SHUTE, MIHALY & WEINBERGER LLP

396 HAYES STREET, SAN FRANCISCO, CA 94102
T: (415) 552-7272 F: (415) 552-5816
www.smwlaw.com

WINTER KING
Attorney
King@smwlaw.com

April 14, 2023

Via E-Mail

City of Pittsburg
Members of the City Council
65 Civic Avenue
Pittsburg, CA 94565
citycouncil@pittsburgca.gov

Re: Faria/Southwest Hills Annexation Project Approvals and Revised and Updated Final Environmental Impact Report

Dear Members of the City Council:

This firm represents Save Mount Diablo in matters related to the Faria/Southwest Hills Annexation Project ("Project"). As you are likely aware, Save Mount Diablo challenged the City's original approval of the Project and prevailed in court, obtaining a ruling that the environmental impact report for the project was flawed in numerous ways. We have reviewed the Revised and Updated Final Environmental Impact Report ("RUFEIR") and supporting documents prepared by the City for the proposed Development Agreement, amendments to the City General Plan, Prezoning Designations, and Master Plan ("Project Approvals") and submit that these documents have not corrected the problems identified by the court.

In fact, the Project as now proposed by Seeno and its affiliates, Discovery Builders, and Faria Land Investors ("Seeno") includes only the most superficial changes to a massive development that is poorly planned and environmentally destructive. The 600-acre Faria Site, which is currently designated for agricultural use by Contra Costa County, is almost entirely steep hillsides, with peaks over 1,000 feet. The Site contains hazards like liquefaction zones and large-scale landslides, including a 2007 slide that caused home evacuations in a neighboring Discovery subdivision. Rather than taking the court's order seriously, by finally analyzing the devastating impacts of the project and changing the project to cause less environmental damage, Seeno's current proposal continues to:

- Gut the General Plan by eliminating long-standing policies that protect hillsides, ridgelines, creeks and drainages.

- Violate City planning law, which requires a detailed Master Plan showing where houses, streets and parks will actually be built.

- Betray the voters who approved Measure P in 2005 and placed the entire Site in the protective hillside zoning. Now Seeno wants to change the zoning to bulldoze the hills for massive subdivisions.

- Violate state environmental law by failing to protect air quality and ensure a viable water supply.

In addition, rather than disclosing the additional environmental impacts of building 150 accessory dwelling units on site, Seeno proposes to eliminate those units in favor of paying an inclusionary housing in-lieu fee at some future date to locate the housing elsewhere. While this is a neat trick to try to avoid providing more information to the public and decisionmakers, it also ignores City laws requiring affordable housing to be built on-site wherever possible.

At its February 14, 2023 meeting, the Planning Commission voted not to recommend approval of this flawed Project. The Planning Commission expressed serious concerns about the Project's failure to include a detailed Master Plan and its deferral of environmental analysis. The commissioners also objected to Seeno's request that the City eliminate or weaken long-standing General Plan policies to move this outdated Project forward. They rightfully noted that Seeno should be changing the Project to fit the City's existing hillside and grading policies, not the other way around.

The City has the opportunity now to adopt a better plan. In response to Save Mount Diablo's successful challenge, Judge Weil of the Contra Costa County Superior Court ordered the City to rescind the 2021 Faria Project approvals. The City complied, and thus has a clean slate for processing Seeno's proposed project. The City claims it is trying to build a greener and more sustainable new future with a focus on alternative transportation, sustainable and clean growth, development that preserves the City's hills and greenspaces, and affordable housing. It now has the opportunity to require modifications to the proposed project to accomplish these goals.

The City should not rush with approvals that lock in Seeno's development rights for a plan that was flawed from the beginning. Instead, the City should demand a new plan that:

- Protects the Site's sensitive ridgelines and hilltops, ensuring no ridgeline or hilltop development
- Minimizes destructive grading
- Conforms to City environmental policies
- Provides on-site affordable housing that is similar to proposed market-rate housing
- Details where housing, roads and parks will be located
- Creates walking path connections from the proposed development to the new Thurgood Marshall Regional Park
- Ensures that the Project is transit, bicycle, and solar friendly

Save Mount Diablo also objects that the RUFEIR has not been circulated for public review as the California Environmental Quality Act ("CEQA") requires. The Superior Court's Ruling that the Faria approvals violated CEQA came out nearly a year ago and the City set aside the approvals last August. But the City released the RUFEIR on January 31, 2023 and scheduled the Planning Commission hearing just two weeks later, on February 14. When the Planning Commission recommended denial, the City proceeded to schedule the City Council hearing, again without circulating the RUFEIR for public review. Furthermore, the City published an updated RUFEIR on March 2, 2023, which substantially changes the EIR's traffic analysis and mitigation measures. This updated RUFEIR failed to include, or provided responses to, the comments submitted on the earlier draft.

This rushed process thwarts public participation in this important decision. And the Staff Report and RUFEIR fail to provide key information about the Project, leaving the public in the dark about important issues like affordable housing, ridgeline protection, and water supply.

Save Mount Diablo recently toured the Faria Site, which made it clear that there are parts of the ridge that are not protected, and has been in conversation with Discovery Builders about ways to improve the Project to make it more environmentally sensitive and better for Pittsburg residents. To allow these conversations to continue and to provide the necessary time for public review, Save Mount Diablo requests that the City

Council delay any consideration of the Project for 45 days. If the City Council does go forward, Save Mount Diablo respectfully requests that it deny the Project.

I. The Project violates City planning law.

A. The Master Plan violates City law.

The purpose of a Master Plan is to ensure "orderly planning." A master plan "*must include* a land use and circulation system concept that is consistent with the goals and policies of the general plan." Pittsburg Municipal Code ("PMC") § 18.72.060.A (emphasis added). Here, the proposed Master Plan contains *no* circulation system. In fact, the Staff Report acknowledges that the "overall traffic circulation pattern for the Site is largely unknown at this time." Staff Report, p. 6.

Master Plan applications are also required to include a "site plan indicating the existing and proposed uses, gross floor area, lot coverage, height, parking and density, and a circulation plan;" an architectural plan with exterior elevations and floor plans; a landscape plan showing the "design of walkways, trails, bicycle paths, [and] recreation areas;" a preliminary development schedule; and topographic maps "showing the relationship of the building to the topography." PMC § 18.72.060(B). The Master Plan omits all of these; it contains no site plan, circulation plan, or landscaping plan, and provides no indication of where roads, housing lots, trails, or parks will be or their relation to topography.

While the trial court found the City could waive its own code requirements in some cases, it also recognized that the City has discretion to require more. Here, a circulation system and land use plan is necessary to determine potential environmental impacts, as well as to consider whether alternative layouts would better protect resources, including ridgelines. Indeed, Contra Costa County's Local Agency Formation Commission ("LAFCO") has previously indicated that this information is essential to their determination as to whether to allow the annexation. As a result, SMD strongly recommends that the City postpone any decision on this "project" until more detail is provided.

B. The Development Agreement violates the City's affordable housing laws.

Given that Seeno is asking the City to hand it a huge gift—development rights to build 1,500 units—Seeno should at least comply with the City's minimum affordable housing requirements. City laws require 15 to 20 percent of new homes to be low- or moderate-income. PMC § 18.86.040(B). Yet, in approving this Project in 2021, the City waived this requirement at the 11th hour. Instead of setting aside a portion of the 1,500 full-sized houses as affordable, the City allowed Seeno to instead build an additional 150 tiny accessory dwelling units ("ADUs").

The Superior Court held that the City could not simply add 150 homes to the Project at the last minute with no environmental review. But rather than analyze the impacts of the new housing, or make a substantial portion of the full-size homes affordable, Seeno is now asking the City to approve a project with **no affordable housing at all.** Instead, "pursuant to PMC section 18.86," Seeno proposes to pay an **entirely unspecified** "in-lieu fee" for future affordable housing at a "location not known at this time." Staff Report, p. 11.

The version of the development agreement released to the public for the upcoming City Council hearing appears incorrect, and thus the public was unable to review the terms of this important document.[1] But the earlier version provided with the Planning Commission materials failed to specify the amount of the fee or the amount of housing it must subsidize and further provided that Seeno shall have **no obligation to provide affordable housing at all** if a future City Council rescinds its existing ordinance. Development Agreement, Section 3.09(b).

City code does not permit a developer to simply replace on-site affordable housing with fees except in rare case. The section cited in the Development Agreement provides that "a developer of a residential project is permitted to pay fees in lieu of constructing affordable units **if the city council finds that the residential project site is not suitable for affordable housing**." PMC § 18.86.080.C (emphasis added). The City cannot conclude this massive Site is not "suitable" for affordable housing given that it *already* found that the Site could accommodate affordable housing in approving the Project in 2021. The City provides no substantial evidence demonstrating that the Site is now unsuitable.

If the City nonetheless grants Seeno's request to pay an in-lieu fee instead of providing on-site affordable housing, it must establish a minimum fee amount, and show how many units that amount would subsidize. Without such a requirement, the

[1] *See* https://onbaseweb.pittsburgca.gov/OnBaseAgendaOnline/Documents/ViewDocument/DA_FARIA_REV%202-2-2023.PDF.pdf?meetingId=1072&documentType=Agenda&itemId=11566&publishId=9784&isSection=false

public will have no way of knowing whether Seeno paid its fair share—or whether the City gave a multi-million dollar gift to a for-profit developer.

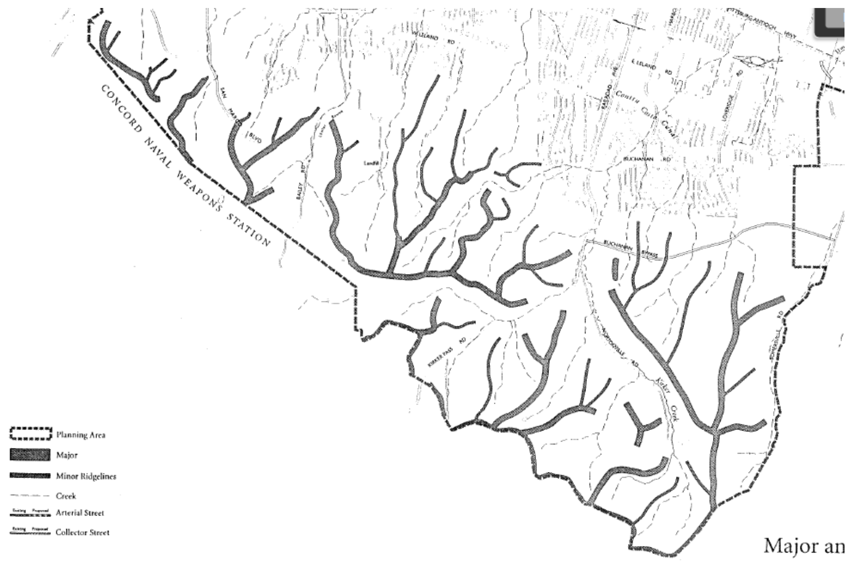
II. The Staff Report and Addendum are misleading and misinform the public about the Site history and approvals.

A. The Staff Report and Addendum ignore the destruction of key ridgelines on the property.

The Staff Report and Addendum perpetuate the Seeno myth that the Faria Project is somehow consistent with the long-term planning for this Site and its hillside protection policies.

The Site is covered with steep hills and ridgelines, as can be seen in the aerial Site photos included in the RUFEIR. *See* pdf 583-91. The ridgelines are also visible on Google terrain maps (*see* Ex. 1 of Exhibits 1-18 attached):

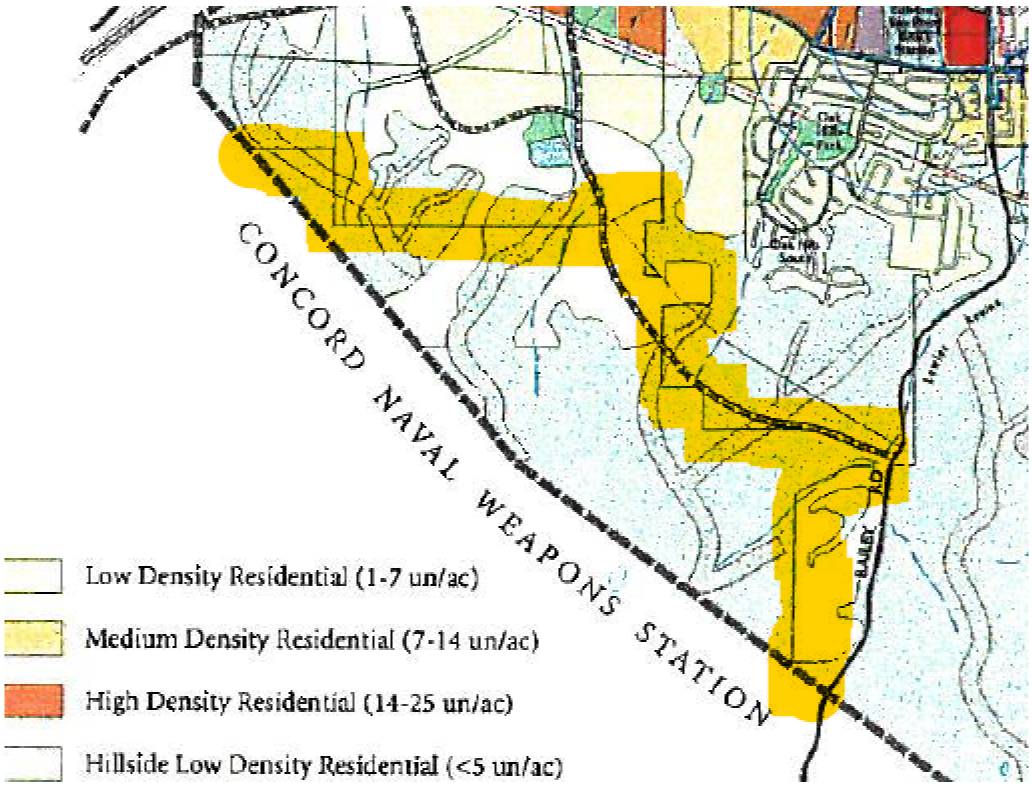
These ridgelines are part of the ridgeline system for the entire area, which the City originally proposed to protect in adopting its 2020 General Plan



2020 General Plan, Draft EIR, Figure 4.2-3 (Ex. 2). But following the release of the final EIR for the General Plan, Seeno appeared at a City hearing and urged the City to remove the ridgeline designations on the Faria Site. Ex. 3. After that meeting, the ridgelines for the Faria Site simply disappear from the final General Plan map:

Pittsburg 2020 General Plan, Figure 4-2

The RUFEIR claims that the "project site area does not contain any designated major or minor ridgelines." RUFEIR, 2-5. But the Site *does* contain major and minor ridgelines:



General Plan, DEIR, Figure 3.4-1 (highlighting of Site boundaries added) (Ex. 2). The designation for these ridgelines was simply removed at Seeno's demand to pave way for the intensive development it has been planning for decades. The RUFEIR, however, contains no map that overlays the proposed development against the Site's actual ridgelines. Instead, the RUFEIR attempts to confuse the issue by focusing solely on the ridgeline between Concord and the Site.

To adequately inform the public and decisionmakers about the true impacts of this Project, the City must prepare a map showing **all** ridgelines on the Site, including those that were originally designated in Figure 4.2-3 in the General Plan DEIR, and revise the CEQA review to show how the development and grading allowed under the Master Plan will impact these ridgelines.

B. The Project is NOT consistent with Measure P, where the voters kept in place the Site's protective Hillside Zoning on the Site.

The Staff Report and Addendum repeatedly suggest that the proposed 1,500-unit Project is consistent with, or even somehow *more* protective, than the land use designations in the 2005 voter-approved ballot initiative Measure P and the Site's longstanding zoning.

For example, the Staff Report states that the proposed land use amendments "would not change the existing maximum development potential" for the Site. Staff Report 1. It further states that the "proposed amendments to the General Plan are in the public interest in that they would be *consistent with the 2005 voter approved Measure P*" and "fulfill the voter initiative (Measure P) … which anticipated the development of the site with residential uses," "thereby effectuating the will of the voters." Staff Report, p. 15-16 (emphasis added). The RUFEIR similarly provides that, under the voter-approved Measure P, "the entire approximately 606-acre project site was prezoned for development." RUFEIR 2-16.

These claims are misleading. Measure P did not prezone the "entire" Site for development, the existing prezoning would *not* have allowed 1,500 units on the Site, and the proposed amendments clearly increase the allowable density.

Measure P, another Seeno-backed strategy, did place the Site within the City's Urban Limit Line ("ULL"). But it prezoned the Site for Hillside Planned Development ("HPD") and Open Space—not for the intensive development Seeno now proposes. The ballot arguments emphasized that Measure P's ULL provisions "can <u>only be changed by a subsequent vote of the people</u>" and that it "<u>preserves and protects agricultural land [and] open space.</u>" Ex. 4 at 3. The fine print, however, permitted future *zoning* amendments by simple City Council vote. Ex. 4 at 2.

What the voters approved was hillside zoning, which would take effect if the Site were annexed and ensure protection of the Site's rolling hills and ridgelines. This hillside zoning provides that future development in the southern foothills must be "compatible with the special sensitivity of the hillside areas," "protect natural topographic features, aesthetic views, vistas and prominent ridgelines," "protect the public health [and] safety," and reduce impacts related to "grading and drainage associated with hillside development." PMC §§ 18.56.020(C)-(D). This HPD zoning contains rigorous permitting requirements, requires that grading "be designed to minimize cuts and fills and to retain the general character of the existing terrain," and limits development on steep slopes:

Slope	Units per acre
30%	1.5
35%	1.0
40%	0.5
Over 40%	0.2

§§ 18.56.090(A)(4), (B);18.56.020(C)-(D).

The new zoning will allow Project allows 1-5 units per acre. Staff Report, p. 6. Since the Site is almost entirely over 30% slope, with substantial portions at 50-70% slope (DEIR 4.2-4) the new zoning will allow density up to **25 times higher** than the HPD zoning for portions of the Site. Yet the RUFEIR fails to disclose this fact when analyzing the Project's consistency with current land use plans.

In addition, Measure P says nothing about allowing 1,500 development units. Ex. 5. While the General Plan permitted a *maximum* of 1,500 units, the HPD zoning would have required far lower densities. *See* Pittsburg 2020 General Plan, 2-15 ("density/intensity standards do not imply that development projects will be approved only at the maximum density"; zoning and "site conditions may reduce development potential").

Therefore the Project is **not** consistent with the City's long-standing hillside development plans for the southwest hills and it is **not** "consistent with the 2005 voter approved Measure P" as the Staff Report and proposed City Council findings suggest. Staff Report, pp. 15-16. To ensure the public and decisionmakers are aware of the consequences of approving this Project, the City must:

- **Prepare an analysis that: (1) maps and calculates the areas of the Site that are 30%, 35%, and 40% slope; and (2) compares maximum development under the existing HPD zoning to the maximum development under the proposed zoning.**

- **Identify the existing City hillside zoning policies—which require that new development protect hillsides, ridgelines, views, and reduces impacts related to grading, drainage and erosion—that will no longer apply to the Site under the proposed rezoning.**

- **Delete the statement in the Staff Report that the proposed zoning and General Plan amendments "would not change the existing maximum development potential" of the Site.**

- **Make clear that the text of Measure P did not approve development of 1,500 units on the Site but anticipated lower-density hillside zoning that Seeno now proposes to change.**

C. Acknowledge that the Project changes the General Plan to allow Seeno to bulldoze the Site's steep hillsides and destroy its creeks and drainages.

The Staff Report also fails to make clear the extent to which the Faria Project is inconsistent with long-standing General Plan policies. It admits that the proposal would necessitate revision and/or deletion of twelve General Plan goals or policies, but suggests that the Project remains consistent with the City's "overarching goals and policies related to hillside development in the southwest hills." Staff Report, pp. 9-11, 17.

However, the General Plan contains only two "Goals" for the "Southwest Hills." One of these is:

> 2-G-33 Maintain the general character of the hill forms.

Pittsburg 2020 General Plan 2-76. Rather than remaining consistent with this Goal, Seeno is demanding that the City **eliminate** it**.** Staff Report, p. 10. Seeno is also asking the City to **eliminate** other long-standing policies for ensuring sensitive hillside development:

> Policy 4-P-10: Minimize grading of the hillsides…
>
> Policy 4-P-12: Encourage terracing in new hillside development to be designed in small incremental steps. Extensive flat pad areas should be limited.
>
> Policy 4-P-14: Preserve natural creeks and drainage courses as close as possible to their natural location and appearance.

Staff Report, p. 10. And Seeno wants to City to change other policies protecting steep slopes so that the exceptions swallow the rule. For example (new text shown with underlined font, and text proposed for deletion is shown with ~~strikethrough font~~):

> Policy 4-P-11: Limit grading of hillside areas over 30 percent slope (see Figure 10-1 [of the General Plan]) to elevations less than 900 feet, foothills, knolls, and ridges not classified as major or minor ridgelines (see Figure 4-2 [of the General Plan]), unless deemed necessary for slope stability remedial grading, or installation of City infrastructure. ~~During review of development plans, ensure that~~

> ~~necessary grading respects significant natural features and visually blends with adjacent properties.~~
>
> Goal 10-G-6: Limit development on slopes greater than 30 percent (as delineated on Figure 10-1 [of the General Plan]) to lower elevations, foothills, and knolls, unless it can be demonstrated that appropriate soil stability techniques can be implemented.

Staff Report, p.10.

The City prepared internal analyses explaining why Seeno's proposed development is incompatible with its long-standing hillside protection policies. It explained, for example, that Seeno's development would violate existing polices because "**the rolling hills would be eliminated by the mass grading**." Ex. 6 at 2-3. But it never released that analysis as part of the CEQA process. The City should not allow one developer to gut critical and long-standing hillside protection policies.

Moveover, the City cannot approve the Master Plan without finding that the Project is consistent with its General Plan. Here, the City cannot make such findings. As the EIR itself admits: "**Policy 2-G-8 is intended to preserve ridgelines and viewsheds.** The **proposed project would involve grading of hillside areas, which would not be consistent with the forementioned City polic[y]**." DEIR 5-12 (emphasis added).

III. The RUFEIR fails to comply with CEQA

The RUFEIR fails to cure the legal defects in the EIR's analysis identified by the by the Superior Court's February 10, 2022 ruling ("Ruling") or to address new information regarding Project impacts since release of the draft EIR.

A. RUFEIR fails to fix the water supply analysis.

First, the revised water analysis simply repeats the flaws in the 2020 EIR. The RUFEIR now purports to rely on the 2020 Urban Water Management Plan ("UWMP"). RUFEIR 1-3. But an EIR may incorporate the UWMP's analysis *only if* the UWMP includes the project. Wat. Code § 10910(c)(2)-(3). As the Superior Court found, the "DEIR states that the 2015 UWMP does not include the Project." Ruling at 26; DEIR 4.11-26.

The 2020 UWMP *also* does not include the Project.[2] Just like the 2015 UWMP, the 2020 UWMP "reports solely on the City's service area" and the "City's water service area is consistent with City limits" and does *not* include the Project area. 2020 UWMP, 2-2, 3-1; maps at Figure 3-1 and 3-2, 7-9 (drought risk assessment "considers an unconstrained demand condition *within the City's service area*"); Wat. Code, § 10635(a) ("water service reliability assessment shall be based upon … data from state, regional, or local agency population projections within the service area of the urban water supplier"). The August 30, 2022 Technical Memorandum suggests that the 2020 UWMP somehow *does* include the Project because it attached a planning map. Technical Memorandum at 2, 4. But this cannot be squared with the text of the UWMP itself. The Project area was shown on a map as being within the City's sphere of influence; but that does not negate the 2020 UWMP's clear statement that it "reports solely on the City's service area" which is "consistent with City limits." UWMP, 2-2, 3-1.

The RUFEIR was therefore required to include a water supply assessment of "whether the public water system's total projected water supplies available during normal, single dry, and multiple dry water years during a 20-year projection will meet the projected water demand associated with the proposed project." Wat. Code § 10910(c)(3). Instead, it relies entirely on the 2020 UWMP's supply and demand projections. *Compare* RUFEIR 1-5 to 2020 UWMP 7-8. But since these projections do not include the Project, the Project will create *additional* water demand and cause *additional* shortages which will further strain the City's water supply, exacerbating the water deficit during dry years. *See* RUFEIR, Appx. E at 5 (showing a deficit of 126 AFY and 863 AFY during multiple dry-year periods). The EIR must fully analyze these impacts and explain how the Project's additional demand will be fully met.

For example, the RUFEIR states that the Project demand is 663 AFY. Technical Memorandum at 4. If this Project demand is added to the water demand in Table 2, there would be *new* water shortfalls in dry Year 3 (51 AFY), as well as *greater* shortfalls in Year 4 (789 AFY) and 5 (1,526 AFY). Because the projected difference between supply and existing demand is less than 663 AFY, there would also be *new* shortfalls in 2025 (Year 4), 2030 (Year 4), and 2035 (Year 4) and 2040 (Year 3), as well as *greater* shortfalls in years that are already in the red (shown before in Table 7-4 of the 2020 UWMP):

[2] Save Mount Diablo is not attaching City documents which are presumably part of the record for this case. The 2020 UWMP is available at: https://www.pittsburgca.gov/home/showpublisheddocument/13176/63763662816105124 7

Table 7-4 Multiple Dry Years Supply and Demand Comparison

		2025 (AF)	2030 (AF)	2035 (AF)	2040 (AF)	2045 (AF)
First year	Supply totals	12,691	13,690	14,620	15,484	16,405
	Demand totals	11,342	12,341	13,271	14,135	15,056
	Difference	1,349	1,349	1,349	1,349	1,349
Second year	Supply totals	12,691	13,690	14,620	15,484	16,405
	Demand totals	11,342	12,341	13,271	14,135	15,056
	Difference	1,349	1,349	1,349	1,349	1,349
Third year	Supply totals	12,139	13,089	13,972	14,793	15,668
	Demand totals	11,342	12,341	13,271	14,135	15,056
	Difference	797	748	701	658	612
Fourth year	Supply totals	11,588	12,487	13,324	14,102	14,931
	Demand totals	11,342	12,341	13,271	14,135	15,056
	Difference	246	146	53	(33)	(126)
Fifth year	Supply totals	11,036	11,886	12,676	13,410	14,193
	Demand totals	11,342	12,341	13,271	14,135	15,056
	Difference	(306)	(456)	(595)	(725)	(863)

The RUFEIR was required to inform the public of these additional shortfalls, analyze their impacts, and propose mitigation to reduce them. It should also make clear that there will *not* be sufficient water supply to meet demand. There is no "surplus" water to serve the Project during (predictable) multiple dry years.

In addition, this analysis addresses only population-based water demand. It contains no discussion at all of how much water the Project will require *during* construction for measures like dust control.

The RUFEIR is also flawed because it does not incorporate any changes to the text of its original water analysis in the DEIR. *See* RUFEIR, ch. 3 ("Revisions to the Draft EIR Text"). Therefore, all of the inadequacies previously identified by Save Mount Diablo and the Court *remain in the EIR*. These include references to outdated data, improper reliance on the 2015 UWMP, failure to show that the water supply analysis actually includes the project, and failure to show how water supply can meet demand in dry years. *See* RUFEIR at 2-88-93 (November 30, 2018 Save Mount Diablo comments on EIR's water supply analysis).

The result is a confusing document that sends mixed messages to the public and decision-makers. Critical environmental analysis must be in the EIR itself, not buried in technical appendices, especially they conflict with the EIR itself.

The Technical Memorandum also fails to discuss any *impacts* of supplying water to the Project. For example, it does not discuss how additional water demand will impact surrounding communities dependent on the same sources. Nor does the Technical Memorandum disclose the cumulative impacts that this and similar development projects in the area will have on the regional water supply. *See Vineyard Area Citizens for Responsible Growth v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 434 ("The ultimate question under CEQA . . . is not whether an EIR establishes a likely source of water, but whether it adequately addresses the reasonably foreseeable *impacts* of supplying water to the project.").

Finally, the water supply analysis contains no mitigation measure to actually reduce water demand to avoid the projected water supply deficits, like recycled or grey water systems, or landscaping requirements. It also fails to address or analyze specific demand reduction measures, like rationing, or evaluate their effectiveness or their impacts on future residents or existing customers.

B. The RUFEIR's proposed air quality and greenhouse gas emission mitigation remains vague and fails to comport with current law.

The Superior Court found that the existing air pollution and greenhouse gas ("GHG") measures were too "vague," that their components were "improperly deferred" and that the EIR failed to analyze the measures' effectiveness and feasibility. Ruling at 30-31. The RUFEIR fails to correct these flaws. In addition, the RUFEIR does not address important regulatory changes as a result of the new Scoping Plan released by the California Air Resources Board ("CARB").

1. There have been substantial regulatory and legal changes impacting the Project since the draft EIR was circulated.

An EIR must show how a project will conform to statewide GHG reduction targets and adopt enforceable mitigation to achieve these goals. *Center for Biological Diversity v. Department of Fish & Wildlife* (2015) 62 Cal.4th 204, 225-26; *League to Save Lake Tahoe v. County of Placer* (2022) 75 Cal.App.5th 63, 121-22.

Here, the State has released new GHG reduction targets since the draft EIR was circulated and the Project was approved, and even since the Ramboll Memorandum was prepared in May 2022. In November 2022, CARB released a new Scoping Plan requiring "aggressive reduction of fossil fuels" and "rapidly moving to zero-emission transportation." Ex. 7 at 1. It "identifies a technologically feasible and cost-effective path to achieve carbon neutrality by 2045." *Id.* at 24. The Plan achieves the AB 1279 target of 85 percent below 1990 levels by 2045 and *identifies a need to accelerate the 2030 target* from 40 to 48 percent below 1990 levels. *Id.* at 71. Finally, Appendix D includes recommendations for prioritizing mitigation, starting with on-site GHG-reducing design features and mitigation measures—methods to reduce VMT and support building decarbonization, access to shared mobility services or transit, and EV charging—and moving to off-site measures like development of a neighborhood green space, investment in street trees, and expansion of transit. Ex. 7 at Appendix D (pdf 298). The RUFEIR must be revised to analyze whether the Project will meet the targets set forth in the Scoping Plan.

2. There is new science demonstrating significant environmental changes.

The RUFEIR should also be revised to reflect current science showing that the "tipping point" for GHG emissions may occur far sooner than previously expected. For example, the World Meteorological Organization's ("WMO") recently reported "atmospheric levels of the three main greenhouse gases - carbon dioxide, methane and nitrous oxide all reached new record highs in 2021," with the "biggest year-on-year jump in methane concentrations in both 2020 and 2021 since systematic measurements began nearly 40 years ago." Ex. 8 at 2 (WMO Greenhouse Gas Bulletin). Likewise, a 2022 report by the Copernicus Climate Change Service revealed that the last eight years have been the eight warmest on record and that global temperatures are reaching a dangerous tipping point much faster than initially anticipated. Ex. 9 (Copernicus, *2022 saw record temperatures in Europe and across the world* (Jan. 9, 2023). And the 2022 Intergovernmental Panel on Climate Change ("IPCC") reported: "Without immediate and deep emissions reductions across all sectors, limiting global warming to 1.5°C (2.7°F) is beyond reach. In the scenarios assessed, limiting warming to around 1.5°C requires global greenhouse gas emissions to peak before 2025 at the latest, and be reduced by 43% by 2030." Ex. 10 at pdf 12 (United Nations Summary of Climate Reports).

The Project involves a massive amount of grading, including leveling steep hills and flattening ridgelines. It will construct 1,500 residential units at a distance from jobs and services with no firm commitment to green transportation. These new reports show that the Project's GHG emissions would have far graver climate change impacts than discussed in the EIR.

3. The EIR Must Consider Feasible New Mitigation Measures to Reduce the Project's Significant Air Pollution and Climate Change Impacts.

Once the RUFEIR is updated to address recent climate change data and the emissions targets in the CARB Scoping Plan, it must evaluate all feasible measures to reduce the Project's significant air quality and greenhouse gas emissions. Under CEQA, and the Court's Ruling, these measures must be feasible and enforceable and anticipated emission reductions must be quantified. The Revised EIR fails to meet this standard.

First, the measures remain "vague." Ruling at 30. The Superior Court noted that the original measures "simply state that the developer will plant shade trees, promote ridesharing, extend transit service into project site, and provide charging stations 'unless the applicant demonstrates that the measures are not feasible'" and that this "does not give even a program-level insight as to the effectiveness of the measures and their feasibility." Ruling at 30-31.

The new measures contain identical, and identically vague, provisions: "[p]lanting shade trees," "[p]romote ridesharing," "[e]xtension of transit service into project site" and "[p]roviding of charging stations." RUFEIR pdf 628, 631-32, 641-42. Again, the analysis contains no specifics about how the Project will "promote" measures like ridesharing, transit, bicycling, and walking for work trips; not does it identify the number of electric vehicle charging stations or shade trees that will be required or explain what vague measures like "[c]ommunity-based traveling" even mean. Similarly, the measures are "presumptively feasible *unless the applicant can demonstrate otherwise*." RUFEIR pdf 632-33 (emphasis added). The measures are thus neither specific nor enforceable measures and do not comply with the Court's Ruling or applicable CEQA law. *See King & Gardiner Farms, LLC v. County of Kern* (2020) 45 Cal.App.5th 814,45 Cal.App.5th at 858 (finding that a mandatory measure modified by the phrase "to the extent feasible" was not a specific, enforceable standard).

Second, the mitigation remains "improperly deferred." Ruling at 31. The original MM 4.3-2 deferred specific mitigation to a future "project-level, detailed air quality analysis" to be developed "in coordination with the BAAQMD." DEIR 4.3-36. The new measure contains identical language. RUFEIR pdf 627-28; MM 4.3-2 & 4.3-5(a)&(b). MM 4.3-2 also allows the applicant to forego some, or all, of the proposed on-site mitigation, either by showing it is not feasible or by using off-site mitigation pursuant to a yet-to-be established BAAQMD program. RUFEIR pdf 629-30. Since these programs apparently do not exist, such mitigation is entirely speculative. *King & Gardiner Farms,* 45 Cal.App.5th at 877-78 (EIR cannot rely on programs that have not been developed as effective mitigation). Because the RUFEIR defers any commitment to specific measures to minimize emissions until after the Project approvals have been granted, it does not comport with CEQA or the Court's Ruling. CEQA Guidelines § 15125(a); *Stanislaus Natural Heritage Project v. County of Stanislaus* (1996) 48 Cal. App. 4th 182, 199.

Instead of essentially restating the same flawed and vague mitigation, the RUFEIR must adopt mandatory mitigation and evaluated the effectiveness of that mitigation in reducing air pollution and GHG emissions. For example, the mitigation should require that a*ll* buildings use zero-COV paints and finishes, use cool roof materials and be wired for electric vehicle charging capacity. It should require Seeno to prepare *prior* to Project approval a water efficiency plan, native/drought-tolerant landscaping plan, bicycle and pedestrian plan, and plan identifying the number and location of shade trees and charging stations. Moreover, because many of its proposed measures are already required under State law, the RUFEIR must explain applicable law and evaluate how the Project is going beyond the "business as usual" model to *reduce* air pollution and GHG emissions.

While the Technical Memorandum attaches a feasibility analysis for some measures (RUFEIR pdf 516), the City does not commit to using it in the future. RUFEIR pdf 6327 (allowing use of "other methods" instead). And the assumptions in that analysis are never incorporated as Project requirements (e.g., "1.5 trees per household" (RUFEIR at pdf 522)).

In addition, the revised analysis must consider additional, feasible measures based on the measures set forth in Appendix D of the CARB Scoping Plan, in the California Air Pollution Control Officers Association 2021 Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity ("CAPCOA 2021 Handbook," Ex. 11), and in the Newhall Ranch Final EIR (Ex. 12). Additional feasible mitigation includes:

- hiring local construction contractors to reduce worker commute trip lengths and associated air pollutant and greenhouse gas emissions;
- use of low-carbon concrete for development of the Project as it becomes available on the market. *See* Ex. 13 ("Major construction firms team up to get the carbon out of concrete");
- use of high efficacy public street lights
- use of reclaimed non-potable water or grey water for all irrigation;
- use of low-flow water fixtures;
- subsidies for purchase of zero energy vehicles and schools buses;
- preparation of vehicle miles traveled (VMT) reduction plans and Transportation Demand Management (TDM) plans;
- shuttles to BART and transit;
- establish a carbon sequestration project on-site;
- carbon offsets issued by an accredited carbon registry;
- a commitment to achieve zero net GHG emissions for the Project.

Finally, the proposed mitigation is focused almost exclusively on operational emissions of the future subdivision and ignores emission related to the massive grading and hilltop removal Seeno proposes. The analysis must clearly identify the air emission and GHG emissions related to the proposed hundreds of acres of grading and identify feasible mitigation to reduce these emissions. Feasible measures include minimizing the grading footprint, reducing construction on steep slopes, and retaining—rather than leveling—hilltops and ridgelines.

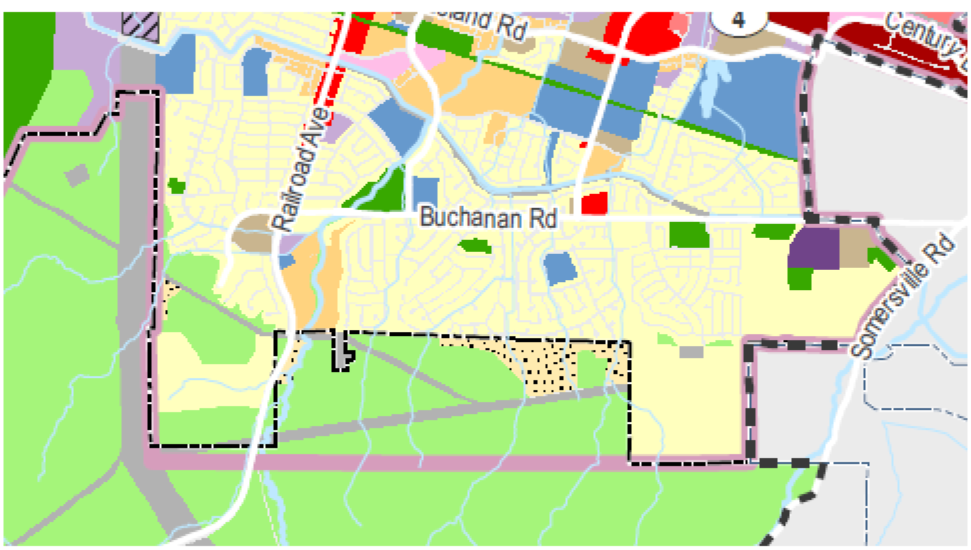
C. The RUFEIR otherwise fails to comply with CEQA.

The RUFEIR also fails to address the other errors identified by the Ruling. While the City performed some additional plant surveys, it did not circulate the new analysis for review by the public and relevant resources agencies. . In addition, while the City has dropped the 150 additional ADUs that the Superior Court found were omitted from the EIR, it has done so in a way that ignores City laws requiring that affordable housing be on-site wherever feasible.

The RUFEIR also ignores new information about City growth that will exacerbate the impact of the Project approvals. The EIR evaluated the General Plan policy amendments—which eliminated critical hillside, creek and drainage protections—*only* with regard to the Project Site. But these policies will also apply to any new projects developed in the City going forward.

Since the draft EIR was circulated the City has moved forward with its proposal to build, and annex the land for, the James Donlon Boulevard extension. On March 22, 2022, the Planning Commission accepted the General Plan Annual Progress Report noting that annexation to the City was "pending" and indicating that the project is "in the design stage with 65% construction drawings complete." Ex. 14 at 2, 10. In June 2022, the City approved a 5-Year Capital Improvement Program which included $6,200,000 in funding for the Project, which will "design and construct an additional east-west connection between East and Central County by adding in a new link between James Donlon Boulevard in Antioch and Kirker Pass Road." Ex. 15.

Moreover, three of the four alternatives in the City's Land use Alternatives and Capacity Report (March 2021) shows new potential development adjacent to the planned James Donlon Boulevard Extension outside the City limits, between Seeno's Montreaux and Sky Ranch II developments. *See* Ex. 16 (Alternative B; *see also* Alternative C (Ex. 16) & D (Ex. 17)).



The RUFEIR must analyze how proposed changes to the City's General Plan deleting protection for hillsides, creeks and drainages will impact these planned and foreseeable developments. Note that some of these policies were explicitly referenced in the EIR for the James Donlon Boulevard Extension.[3]

In addition, the RUFEIR includes new traffic analysis that shows traffic will be worse than previously predicted. *See, e.g.*, RUFEIR pdf 646-49. The revised traffic analysis must updated to comply with current CEQA law requiring an analysis of vehicles miles traveled and circulated for public review. *See* Guidelines § 15064.3.

IV. The RUFEIR fails to include the information required by LAFCO.

The RUFEIR includes LAFCO's November 30, 2018 comments on the DEIR (pdf 43) but fails to include the information requested: a detailed Master Plan that complies with City laws; a description of the open space uses; an analysis of consistency with LAFCO policies protecting agricultural land and discouraging sprawl; an adequate analysis of water, sewer and other public services; and an analysis of cumulative impacts and regional housing needs.

The RUFEIR also fails to address LAFCO's particular questions about the carrying capacity for cattle and the land's qualification as prime agricultural land. In fact, contrary to the City's and Seeno's earlier claims, Appendix D shows that the Site *is* extensively used for cattle grazing: "Nearly all the surface of the Faria Property is annual grassland and nearly all the annual grassland is grazed, primarily by cattle. Cattle were confined to the pastures around the residences during the April surveys but were on the entire site in recent months." RUFEIR pdf 574; *id.* pdf 596 ("Much of the grassland in the middle third of the site is currently heavily grazed due to the concentration of cattle and support facilities (water, supplemental feed, etc.).)"

The City must address each of the LAFCO policies raised in LAFCO's comments on the DEIR, particularly with regard to the carrying capacity of the Site for grazing, and recirculate the RUFEIR.

---

[3] *See, e.g.,* James Donlon Boulevard Extension Draft Environmental Impact Report (April 2013) at 4.3-13-14. The full document is available on the City's website at https://www.pittsburgca.gov/home/showpublisheddocument/5385/637479142624630000.

V. The City Council must modify the Master Plan to protect its ridgelines and comply with its General Plan.

The EIR recognized that any development above 900 feet would be a significant impact because it would directly conflict with Policy 10-P-2 of the General Plan. DEIR 4.9-22. Yet the Mitigation Monitoring and Reporting Program ("MMRP") for the RUFEIR still proposes as mitigation that "the Land Use Map for the proposed project shall be revised to remove development from all areas with elevations in excess of 900 feet" at some future time. Zoning and land use entitlements must be consistent with the General Plan *at the time of approval*; the City cannot approve inconsistent plans with a provision that they be amended to conform later. The Master Plan Land Use Map must be amended now to remove all development from areas with elevations in excess of 900 feet.

As noted above, the Master Plan fails to map or to protect the Site's important ridgelines. It is therefore inconsistent with City policies designed to ensure good land stewardship, particularly:

> Policy 2-G-8: Ensure that hillside development enhances the built environment, improves safety through slope stabilization, is respectful of topography and other natural constraints, and preserves ridgelines and viewsheds.

DEIR 4.2-11. As the EIR itself admits: "**Policy 2-G-8 is intended to preserve ridgelines and viewsheds.** The **proposed project would involve grading of hillside areas, which would not be consistent with the forementioned City polic[y**]." DEIR 5-12 (emphasis added). To eliminate this inconsistency, the Project must be revised to protect *all* ridgelines on the Site, including those that were originally designated in Figure 4.2-3 in the General Plan DEIR.

VI. The City Council must modify the Master Plan to limit grading.

The Master Plan map analyzed in the EIR designates 339.1 acres for residential development, with additional grading of open space shaded gray. DEIR, 3-10. The EIR states that open space grading "would not exceed 72.9 acres, or 27.3 percent of the designated Open Space" and assumes total grading of 412 acres (339.1 + 72.9). EIR, 3-11, 4.3-31. But after the DEIR was released, Seeno sent the City *new* development and grading maps, dated June 23, 2020. Ex. 18 at 1. The development map shows a slightly increased development footprint (341 acres). Ex. 18 at 2. But the updated *grading* map shows that **119.55** acres—45% of the open space—will be graded, with a total grading footprint of **460.6** acres, or three-quarters of the entire Site. Ex. 18 at 3-4.

Nothing in the Project Approvals expressly limits grading to the footprint or to the total of 412 acres identified in the EIR. To ensure that the Project does not have impacts beyond what was analyzed in the EIR, the City must limit grading to the areas set forth in the EIR Map and establish a maximum grading cap of 72.9 acres of open space and 412 acres total. The City must also include a map showing the limits of grading in the Master Plan, as well as a condition in the Master Plan that any increase in grading above this amount will require supplemental CEQA review that will be circulated for public review and comment.

VII. The RUFEIR must be circulated for public review in accordance with CEQA.

CEQA requires that, when preparing a subsequent or supplemental EIR, the lead agency must issue notices of preparation ("NOP") and completion, file them with the State Clearinghouse, provide a 45-day comment period, and consult with public agencies. § 21091(a); Guidelines §§ 15082-88, 15105, 15162(d), 15163(c) (subsequent or supplemental EIR requires "the same kind of notice and public review as is given to a draft EIR").

The City has failed to follow this procedure. Instead it released the RUFEIR with no NOP and with no formal comment period. The failure to provide adequate opportunity for public engagement on the RUFEIR, despite the Superior Court's ruling that the original FEIR was invalid, violates CEQA. *See, e.g., Woodward Park Homeowners Assn., Inc. v. City of Fresno* (2007) 150 Cal.App.4th 683, 690 (where an agency's actions violate CEQA, "it must do the environmental review process over if it wants to approve the project").

While the RUFEIR asserts that no recirculation is required under CEQA Guidelines Section 15088.5(a), this provision is inapplicable. Where a court holds that an EIR is legally inadequate, public review and comment on the revised environmental analysis is mandatory. *See Mountain Lion Coalition v. Fish & Game Com.* (1989) 214 Cal.App.3d 1043, 1052 (deficient analysis could not be "bolstered by a document that was never circulated for public comment"); *Galante Vineyards v. Monterey Peninsula Water Management Dist.* (1997) 60 Cal.App.4th 1109, 1124-25 (where "original EIR is inadequate," the "procedures for addressing postcertification changed circumstances or new information are inappropriate" and the agency must "void its certification of the EIR and [] prepare a supplemental EIR").

In addition, the RUFEIR fails to include, or to respond to, *any* of the comments submitted after those on the partially recirculated draft EIR. For example, it fails to include or respond to extensive comments submitted by Save Mount Diablo, East

Bay Regional Park Districts ("EBRPD"), LAFCO and other public agencies and organizations on the Final EIR, released in July 2020, or prior to the Planning Commission hearing on July 28, 2020 or the City Council hearing on February 22, 2021. All of these comments and attached exhibits are part of the record for the City Council's consideration of the Project, as well as being part of the administrative record for this case. Save Mount Diablo incorporates by reference *all* of these comments and their attachments, including but not limited to its August 21, 2020 comment letter on the FEIR and February 22, 2021 letter to the City Council and EBRPD's August 24, 2020 comments on the FEIR and February 19, 2021 letters to the City Council. The RUFEIR also fails to include, or respond to, the comments submitted to the Planning Commission on the January RUFEIR. The City cannot simply ignore these and other comments, but must prepare meaningful responses to them.

Save Mount Diablo therefore requests that the City issue a new NOP and circulate a revised environmental analysis for a **45-day comment period**, just as it did for the draft EIR to allow the public and resource agencies an adequate time to prepare comments. It also asks the City to postpone the City Council meeting, currently scheduled for April 17, 2023, and continue any City Council decision on the matter until after that comment period has closed and the City has prepared responses to comments. Finally, it asks that the revised analysis respond to the questions and comments set forth in this letter and any other public comments.

VIII. Conclusion

Save Mount Diablo respectfully requests that the City delay any consideration of the Project for 45 days to allow further discussions with Discovery, additional public review, and further consideration of the other issues raised in this letter. If the City Council goes forward, it requests that City Council deny approval of the Faria Project as currently proposed, as recommended by the Planning Commission.

Very truly yours,

SHUTE, MIHALY & WEINBERGER LLP

Winter King

cc: John Funderburg, Assistant Director of Planning (jfunderburg@pittsburgca.gov)

WK:SF

EXHIBIT 1

Faria/Southwest Hills Annexation Project Site.
Google Maps – Terrain, 2/9/2023

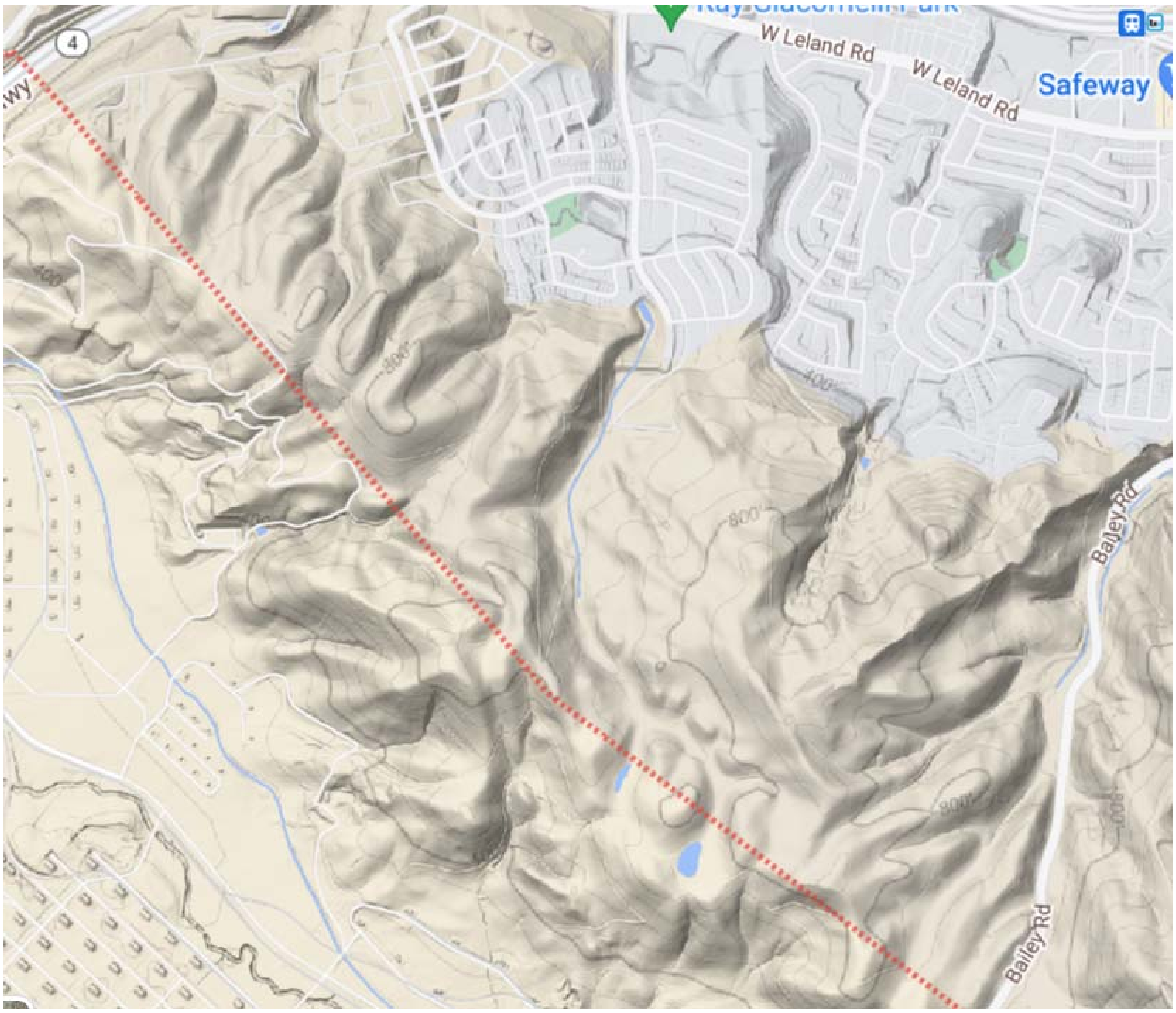


EXHIBIT 2

Pittsburg 2020: A Vision for the 21st Century

CITY OF PITTSBURG GENERAL PLAN

DRAFT ENVIRONMENTAL IMPACT REPORT

SCH NO. 1999072109

January 2001

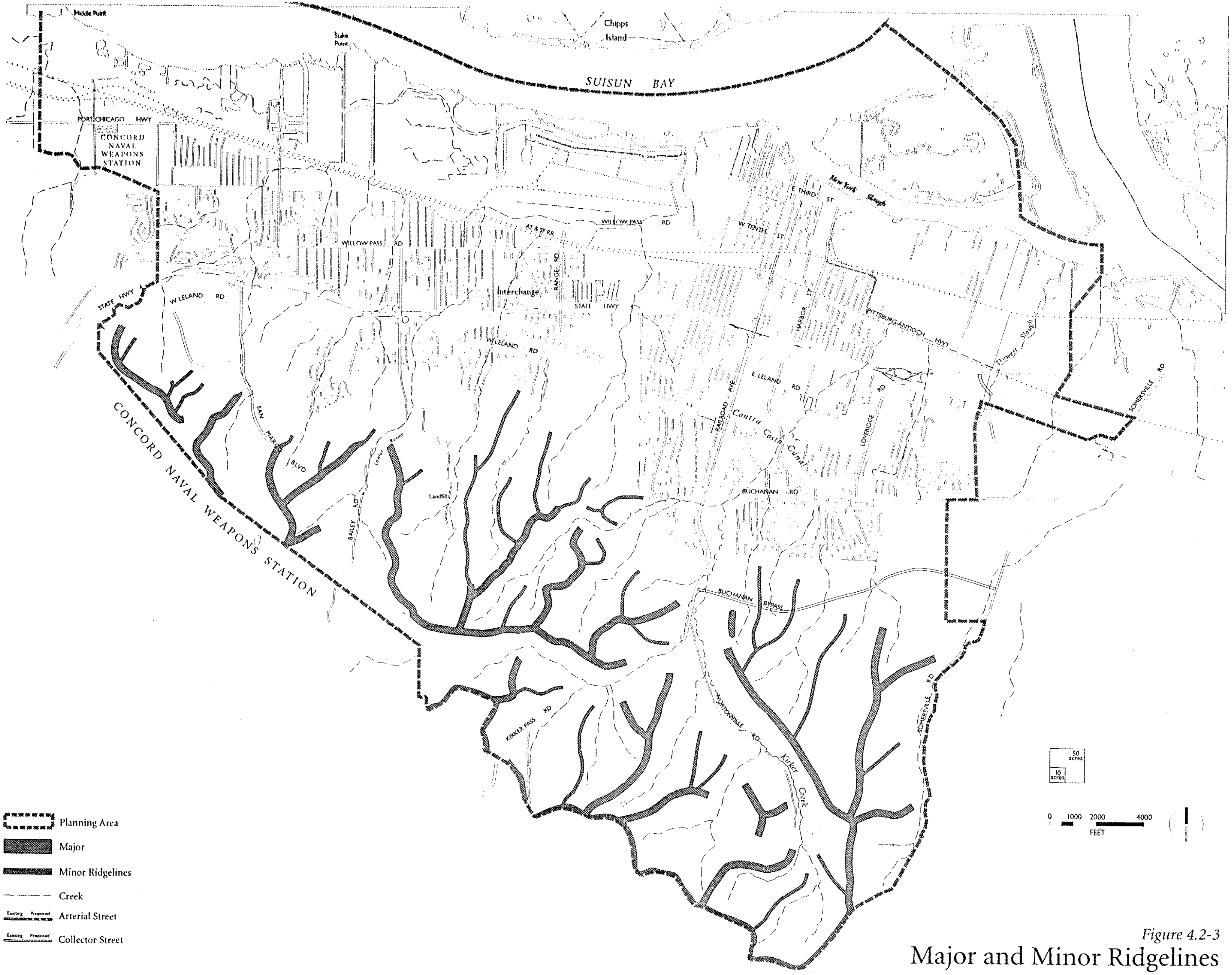


Figure 4.2-3

Major and Minor Ridgelines

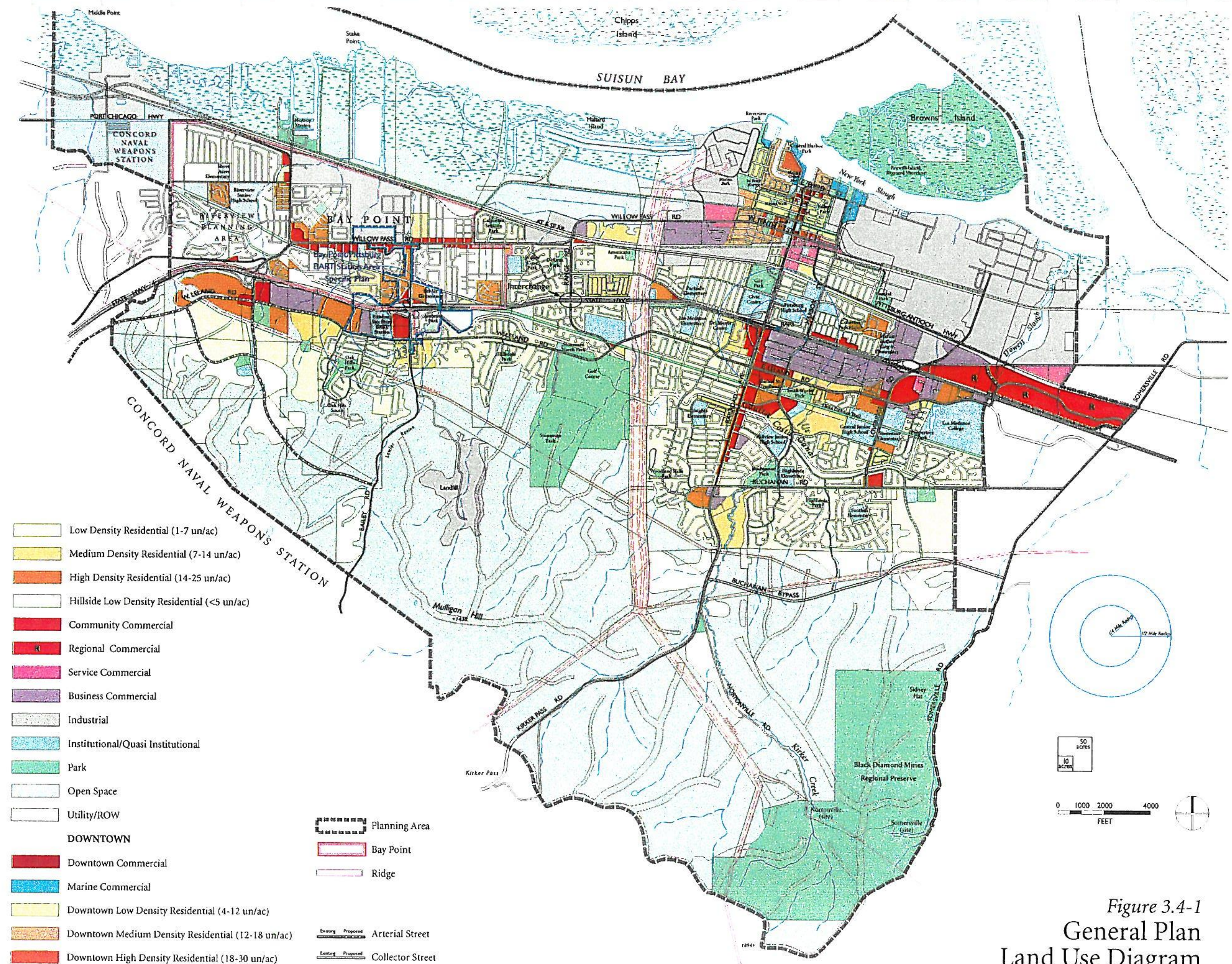


Figure 3.4-1
General Plan
Land Use Diagram

EXHIBIT 3

MINUTES

OF A SPECIAL MEETING
OF THE

PITTSBURG PLANNING COMMISSION

October 2, 2001

A special meeting of the Pittsburg Planning Commission was called to order by Chairperson Holmes at 7:08 P.M. on Tuesday, October 2, 2001, in the City Council Chambers of City Hall at 65 Civic Avenue, Pittsburg, CA.

ROLL CALL:

Present:	Commissioners Garcia, Glynn, Harris, Kelley, Leonard, Valentine, Chairperson Holmes (Commissioners Kelley and Leonard arrived after roll call)
Absent:	None
Staff:	Acting Director, Planning & Building Randy Jerome; Planning Technician Dana Hoggatt; and Administrative Assistant II Fara Bowman

POSTING OF AGENDA:

The agenda had been posted at City Hall on Friday, September 28, 2001.

PLEDGE OF ALLEGIANCE:

Chairperson Holmes led the Pledge of Allegiance.

COMMENTS FROM AUDIENCE:

There were no comments from the audience.

COMMISSION CONSIDERATION:

City of Pittsburg Draft Comprehensive General Plan Update, "Pittsburg 2020: A Vision For The 21st Century." GP-97-01

General Plan entitled, "Pittsburg 2020: A Vision for the 21st Century" (General Plan Update). The City Council referred the Draft General Plan back to the Commission to make further recommendations on various aspects of the draft document.

Randy Jerome, Acting Director Planning & Building, presented the item that had been referred back to the Planning Commission from the City Council. He identified staff concerns that there could be significant change in the General Plan that could require further analysis by the General Plan consultant, which could also impact the Environmental Impact Report (EIR). While some of the changes were considered to be relatively minor, with no significant impact, some of the major changes, if approved, could create months of delays and the extension of the budget, which would have to be reviewed with the General Plan consultant.

Mr. Jerome explained that the current hearing was not a formal public hearing, although the public had been invited and the meeting agenda had been sent to everyone on the General Plan mailing list. He advised that he had also spoken with a member of the Seeno Construction organization, who wished to make a presentation on the hillside issues. He requested direction from the Commission as to how to proceed.

Commissioner Valentine proposed that the Planning Commission ignore the direction from the City Council and proceed with the previously approved Planning Commission Draft General Plan document. He characterized the changes as a selfish and self-centered attempt by a few to impose their will on the majority.

Chairperson Holmes requested that staff identify in detail those items the Council directed the Planning Commission to reconsider.

Commissioner Glynn recommended that those present to give a presentation be allowed to speak prior to the staff presentation.

Commissioner Valentine requested clarification from staff as to whether or not the Planning Commission was to consider new items, since hillside preservation was not one of the items returned by the Council for reconsideration.

Mr. Jerome explained that the Council had requested that various points, as identified in the staff report, be raised with the Planning Commission. He advised that the hillside/ridgeline policies had been placed in the Commission packets since he was aware that such discussion would be raised.

During the meeting of June 24, the Commission had briefly discussed the 194-acre San Marco development proposed by Seecon, which development was located in the southwest rolling hills and which was not consistent with the proposed General Plan. In addition, the 160-acre Sky Ranch development located in the southeast hills and the Buchanan subareas had been discussed. The Commission had decided not to change the designations of any of those properties.

The only property the City Council had specifically discussed had been the St. Vincent de Paul property site where the Pittsburg Family Apartments project had been proposed, had been approved by the Planning Commission and had subsequently been appealed to the City Council. The Council had deliberated on the appeal and had continued it for further studies. Staff had been informed by the City Attorney that whatever action taken by the Planning Commission or the City Council would not affect that application since it had been submitted prior to the consideration of the Draft General Plan.

Mr. Jerome identified the issues the City Council had requested that the Commission reconsider, as delineated in the staff report. He clarified that if new issues were to arise that had not been previously discussed by the Planning Commission, a formal public hearing would be required. He pointed out that the Planning Commission had previously conducted an entire workshop on hillside policies, which had been an issue and which had been resolved by the then Planning Commission.

Commissioner Valentine expressed concern that if a new public hearing was required to address new issues, the process could be extended into 2002. He expressed concern that could be a delaying tactic by the Council to appoint new Commissioners to the Planning Commission.

Mr. Jerome expressed concern that any changes that might result from the discussions that were radically different from the Draft General Plan could involve further study. He otherwise characterized the Council's request for changes as being minor in nature, although some could be major.

In response to the Chair, Mr. Jerome reiterated that a new public hearing notice had not been sent out to the public, although those on the General Plan mailing list had been provided a copy of the meeting agenda, by mail.

PUBLIC COMMENTS:

ALBERT SEENO, III, Seeno Construction, 4021 Port Chicago Highway, Concord, introduced Carl Campos, the Senior Principal for Loving Campos Architects, who was present to make a presentation to the Commission regarding the Southwest Hills. He requested that the Planning Commission consider the comments and be open minded.

CARL CAMPOS, President, Loving & Campos Architects, advised that he had been retained by Seeno Construction to evaluate the Draft General Plan for its final implementation. He identified some areas of the Southwest Hills and requested Commission reconsideration of that area. He highlighted the background of his firm's 30 years in land plan analysis and planning for cities in the Bay Area and western states, with extensive experience in the area of hillside development.

Mr. Campos noted that the City did not have a Housing Element within the General Plan, although provisions had been made in the document. He commented on the number of developments within the international and national communities that had been built on hillsides. He also characterized the Bay Area as hilly, where it was a tradition to have homes on the hillsides to take advantage of the panoramic vistas offered throughout the Bay Area.

Mr. Campos also referenced the City of San Ramon that had a hillside ordinance, which regulated the development of hillside development. He also cited the Cities of Pleasanton, Alamo, and Walnut Creek where hillside development had been approved. He suggested the same should be permitted in the Southwest Hills of San Marco, which would increase the tax benefits to the community.

Mr. Campos offered a slide presentation to identify a number of hillside developments throughout the Bay Area. He commented that the Draft General Plan, as currently proposed, would not allow the local community to have developments that other communities enjoyed and where executive homes on the larger estate lots with views could be developed. He noted that the City currently precluded development in the Southwest Hills above 800 feet where homes were being forced farther down the hillsides with no views. He suggested that the City had some of the most abundant dedicated open space, such as the Keller Canyon Landfill, the East Bay Regional Parks District (EBRPD) properties, and the Southwest Hills, the only area left in the City to design and place executive homes to allow a diversity of housing stock in the community.

Mr. Campos also commented that the Southwest Hills had been a prime site for a prior proposal for a dumpsite by the County. He noted that Seeno Construction had invested heavily in the community having built a number of residential and commercial developments. The developer had purchased that property and had developed the San Marco property preventing the site from becoming a 50-year landfill. He spoke in detail to the views from the hillsides and ridgelines, the types of executive homes that could be built in the Southwest Hills, and the fact that surrounding communities had taken advantage of their hillsides by allowing the development of executive/upscale homes with panoramic and beautiful vistas.

Mr. Campos challenged the View Shed Analysis that had been conducted by the General Plan consultant. He stated that he had prepared a similar analysis, had photographed the regional views of the corridor and had traveled to I-680 in the City of Benicia with views across, and across the Martinez/Benicia Bridge up to the Willow Pass Road summit with views of the water and the approved San Marco project site, as well as views from Railroad Avenue and the City of Antioch.

Mr. Campos spoke in detail to the future development of the San Marco site, which would include several needed components of housing and commercial development.

Mr. Campos requested that the Draft General Plan be revised with the Southwest Hills west of Bailey Road removed from the ridgeline protection area to allow an executive community to be built to consist of larger homes on larger lots with views.

Mr. Campos commented if that were allowed, the City would still be provided with 32.2 miles of ridgelines in the City that would be totally protected in perpetuity. He suggested that such a revision would allow the City the control over what the City would like to see built in that area. He recognized that any development would have to comply with City and environmental regulations.

Mr. Campos also requested that the area be changed to Low Density Residential, which would allow 7 units to the acre consistent with the San Marco development.

Suggesting that the revisions were minor in nature and could be handled by the Planning Commission, Mr. Campos stated that the revisions would provide a move up opportunity for City residents, supporting the economic development goals of the City and encouraging and maintaining a high quality of business in the City. Such a revision would also allow the City to include executive housing, as had other nearby communities, and provide high value residential property significantly increasing the property taxes to the City.

Mr. Campos suggested that the revision would not significantly impact the quality of the City's hillside backdrop, would not reduce potential open space areas, and would not impact sensitive environmental impact areas.

Mr. Campos also presented the Commission with a current proposal by Seeno Construction, currently under review by the County, for a million square feet of office space, high-density housing and mixed-use retail and restaurants on 27 acres at the Pittsburg/Bay Point BART Station.

Commissioner Glynn referenced Figure 2-4-K of the General Plan document regarding the roadways proposed in the Southwest Hills. He inquired how that would relate to the proposal being presented in terms of how the roadways would relate to the ridgelines.

Mr. Campos advised that San Marco Boulevard had been designed to extend from the freeway and West Leland Road all the way through and connect to Bailey Road. San Marco Boulevard would be designed in such a way as to follow the natural contours of the hillside with collector roads off of that roadway to follow the contours up to the areas where development had been proposed in the hillsides. He described the potential development as village clusters with a lot of open spaces.

Mr. Campos noted that there was a current land plan to develop in the Southwest Hills where many of the roadways were single loaded, with streets and houses on only one side and with open space on the other side, to be designed in a cul-de-sac fashion.

Commissioner Glynn requested clarification that the roadways identified in Figure 2-4-K were in alignment with the magnitude of the project that had been outlined in the presentation. He also requested clarification that the roadway, as designed, would offer due consideration for fire and police protection in terms of access. He questioned whether or not the design of the roadway would result in a minimal destruction of existing ridges or a compromise based on the best estimates, or minimal impacts to the existing hills.

Mr. Campos suggested that the roadway alignment appeared about right and with the proper grading they could gain access off of those roads to the community development. He acknowledged that the roadway would have to provide access for emergency access.

As to the potential impacts to the ridgelines, Mr. Campos noted that he had not analyzed the ridgeline to that extent, although with the exception of a ridge near Bailey Road, the alignment fairly followed the areas that could be graded to allow the placement of a roadway.

Commissioner Glynn also referenced the lower portion of the West Leland Road Extension as it related to the Pittsburg/Bay Point BART Station. He inquired whether or not in Mr. Campos' opinion that alignment would be appropriate, to which Mr. Campos noted that as the roadway traveled through the Alves property over to that site, there could be an appropriate road design. The West Leland Road connection to the BART station would be the key to the success of any housing development south of State Route 4.

Mr. Campos advised that the developer currently had plans, including designs and conceptual sketches, for high density apartments, condominiums, and townhomes that would feed through to the BART station, to include pedestrian access. Office development had also been envisioned for that area to allow local employment opportunities while also taking traffic off of the roadways.

Commissioner Valentine expressed concern that developments were being planned and envisioned with no study prepared that the roadways or homes would be breathtaking. He referenced the comments offered by Mr. Campos, among them that everyone wanted to live on hillsides, and he disagreed that was the case. He pointed out that through the entire four-year process, the people of the City had made it perfectly clear their desire to protect the hillsides and the views of those hillsides.

Commissioner Valentine questioned the presentation, which had included views of homes on hillsides in Italy involving a heritage with a 3,000-year history, which did not apply to the local community. He questioned other comments made during the presentation that the developer had purchased the land to keep it from being designated as a dump and he commented that the same developer had purchased an interest in the existing dump in the community.

Commissioner Valentine recommended that the General Plan remain as is consistent with the will of the people, that the developer prepare a plan when ready to proceed, and that the developer present that plan to the City, at which time a request to change the General Plan could then be considered by the Commission.

Mr. Campos clarified his comments and explained his position that those communities he had referenced in his presentation had housing elements and planned for housing and where the City of Pittsburg had the same opportunities, although current regulations precluded such development. While he recognized that was a decision for the City to make, he emphasized the need for vision to allow the development of a viable community.

Mr. Campos described Seeno Construction as a forward thinking company that was planning for the area. He emphasized the need for the City to be able to offer an equal balance of diversity, with not just affordable homes, but where executive homes could be developed in the local community, rather than require interested homebuyers to have to move to communities such as Walnut Creek or Alamo in order to have a home with a view lot.

Mr. Campos advised that the developer did have a plan for the Southwest Hills, which included a land plan, and engineered drawings that had illustrated all of the lotting of the homes and road designs that had been envisioned. He expressed the willingness to return to the Commission at a future date to present the plan.

Commissioner Garcia noted that most City staff lived in the City of Walnut Creek, a community where hillside and ridgeline development had been permitted. He suggested that the Planning Commission consider that the Southwest Hills was the last piece of property for development. He noted that oftentimes people had complained about some of the City's open spaces in terms of potential fire hazards. He questioned whether or not the City wanted to accept responsibility for all of the open space. He agreed that the City had plenty of open space in that there were 360 acres of open space in Camp Stoneman Park adjacent to the golf course. He urged the Commission to have an open mind.

Chairperson Holmes stated that he had attended the Council meeting when the Draft General Plan had been reviewed. In light of the presentation made to the Commission, he stated that the issue of hillside and ridgeline development had not been identified by the Council as one of its original concerns. He understood that it had been added to the discussion since staff was of the opinion the concern would be raised.

Mr. Jerome affirmed the Chair's understanding.

Commissioner Garcia disagreed and suggested it had been stated during the Council meeting that ridgelines were to be considered as one of the items to be sent back to the Commission. While that issue might not have been in the motion made by the Council at that time, he recognized the Mayor in the audience and suggested he be asked if that was one of the items to be reconsidered.

From the audience, Mayor Frank Quesada commented that the Planning Commission had been asked to redefine the policy for the Southwest Hills.

Commissioner Glynn suggested that the reconsideration of the policy for the Southwest Hills would properly fall under the Other Category, whether or not contained in the minutes from the Council meeting, particularly due to the magnitude and the potential build out of the entire area and the major plans that would be affected by the situation. He clarified that he too had attended the City Council meeting where ridgelines had been mentioned.

ALBERT SEENO, III, Seeno Construction Company, recognized that some of their projects had involved some controversy while others had not. He noted that recently the developer had brought Oak Hills Units 5, 6 and 7 before the Planning Commission, at which time Commissioner Valentine had requested reconsideration of some of the design elements, which had been done. He emphasized that the developer was trying to do good for the City, to build a good home and good products. Along with that would be parks and streets to build a city. He stated that soon the City would have no where to turn but to the land of the Southwest Hills and other assorted areas for the buildout population. He requested that the Commission approve their request for reconsideration.

MICHAEL KEE, a resident of Pittsburg, stated that he had attended the Council meeting when the Draft General Plan had been considered and returned to the Planning Commission. He advised that he had a number of concerns, but that he would not speak to the Southwest Hills issues since the Planning Commission had previously reviewed the policies and rejected any revisions in that case.

Mr. Kee noted that the Council had raised a number of concerns with the Draft General Plan. One of the concerns had been that the public did not have adequate time to review and respond to the document. He emphasized that public hearings had been held for over a year. The Council had raised concerns regarding Marine Commercial properties. He suggested that if the properties were changed to Marine Commercial it would require a rezoning of properties that would create non-conforming situations.

Mr. Kee commented that the other issues that had been raised could all have been addressed by the City Council, which could have made all of the changes necessary to the document and which could have approved that document. The Council had chosen to send the document back to the Planning Commission for review. He suggested that represented an insult for those who had worked on the document for some time. He encouraged the Commission to send the General Plan back to the City Council in its current state to allow the Council to be accountable for making their desired changes as opposed to requesting that the Planning Commission make the changes.

WILLIE MIMS, a resident of Pittsburg, referenced the presentation that had been made and a statement that the revised plan would only require minor revisions, although the staff report stated something else entirely, particularly with respect to the designation of downtown residential open space area for the Marine Commercial designations, which would be considered a major revision requiring additional environmental analysis. He requested clarification since that appeared to contradict the comments offered during the presentation.

Mr. Mims also referenced Page 3 of the staff report regarding ridgeline and hillside policies where it had been stated that a modification to some of the policies could be considered major revisions requiring environmental analysis. He also referenced the last page of the staff report, which had indicated that a reanalysis and rewriting of the Draft General Plan and EIR could take months and could cause a significant increase in the budget.

Mr. Mims further commented that some areas of the Southwest Hills where the San Marco property was located were under a Notice of Suspension issued by the California Department of Fish and Game, where nothing could be built unless permitted by that agency. As to the exemptions under the California Environmental Quality Act (CEQA), he questioned the developer obtaining any type of exemption while a Notice of Suspension had been issued, and which he understood involved the possible destruction of a portion of the creek and a threat to endangered species.

Mr. Mims suggested that the plan be returned to the City Council so that the Council would be held accountable for its decisions.

BRUCE OHLSON, a resident of Pittsburg, and a member of the East Bay Bicycle Coalition, advised that he had provided some suggestions regarding bicycle access on City streets. If the document were to be sent back to the Council, he requested consideration that his minor suggestions be incorporated into the document.

Commissioner Garcia stated that through his tenure on the Planning Commission, his position had not changed. He recognized that the City was running out of property and that the only property left to build was the area of the Southwest Hills.

Commissioner Garcia suggested that those ridgelines be allowed to be developed to allow executive homes to be constructed. He supported rezoning the Southwest Hills to Low-Density development.
Commissioner Valentine requested a roll call vote as opposed to a Commission consensus on the requested revisions. He made a motion that the revisions, as directed by the City Council, including the Southwest Hills, be rejected, with the Draft General Plan to be returned to the City Council.

On the discussion, Chairperson Holmes emphasized that the Planning Commission had met on a number of occasions, where each individual who desired to speak to the General Plan and EIR had been given the opportunity to speak. That had been the reason he had supported the Commission's recommendation to refer the document to the City Council for consideration. He noted that during the public hearings, there had been a number of people who had commented on the document, and that staff had received a number of phone calls. In addition, previous Councilmembers had requested that the Commission do what was possible to preserve the City's ridgelines and hillsides.

Chairperson Holmes reiterated that he had attended the Council meeting when the Draft General Plan had been considered. He disagreed that a reconsideration of the Ridgeline and Hillside Policies regarding the Southwest Hills had been included in the Council's direction for Planning Commission reconsideration.

Motion by Commissioner Valentine that the Planning Commission reject the recommended changes, as proposed by the City Council, with those portions of the Draft General Plan to be returned to the City Council, as recommended by the Commission.

Chairperson Holmes recognized that the motion failed due to the lack of a second.

Motion by Commissioner Garcia to revise the Draft General Plan for Ridgeline and Hillside Policies to Low Density Residential. Commissioner Harris seconded the motion.

Mr. Jerome requested clarification on the change or changes to policies that was being recommended by the Commission.

Commissioner Garcia clarified his motion, that in his opinion, building could occur on the ridgelines with the proper design and in his opinion, development should be permitted on the ridgelines of San Marco Meadows where the current General Plan precluded such development.

Mr. Jerome explained that the General Plan had been drafted with designated ridgelines. From the discussion, he understood that the Commission desired to eliminate all of the ridgelines west of Bailey Road as designated ridgelines, to which Commissioner Garcia affirmed that was his recommendation.

Mr. Jerome stated that there were significant open areas in the Southwest Hills. He requested clarification as to the intent of the motion to convert all of that area to Low Density Residential and eliminating all of the Open Space in the Southwest Hills, to which Commissioner Garcia affirmed, that was his recommendation.

Mr. Campos identified the ridgelines under discussion, the City's sphere of influence (SOI) and the City limits, along with the planning area designated as Open Space. He identified the area west of Bailey Road and the Southwest Planning Area, with the Concord Naval Weapons station to the west and the area west of Bailey Road bordered by the Concord Naval Weapons station, which area like San Marco, was designated as Low Density Residential.

Mr. Jerome stated that currently the Southwest Hills Planning Area included Open Space, Ridgelines and Hillside Low Density Residential, less than 5 dwelling units per acre. Low Density Residential would be 1 to 7 dwelling units per acre.

Commissioner Valentine inquired whether or not such a change could be made since it would involve a major change that could require months of further study.

Mr. Jerome explained that what was being proposed, was a recommendation to the City Council, although he acknowledged that he would have to speak to the General Plan consultant to determine how many more units would be allowed and what impacts would occur to visual analysis and traffic impacts, among other concerns.

Mr. Jerome clarified the required action as recommendations from the Planning Commission with the City Council to take final action. He suggested that the Commission could take action on each of the six items for reconsideration, as identified in the staff report. A report of the recommendations from the Planning Commission would be made to the City Council for consideration.

MOTION:

Motion by Commissioner Garcia to Recommend that the City Council convert all of the Open Space areas in the Southwest Hills to Low Density Residential, eliminating all of the Open Space in the Southwest Hills and eliminating all of the ridgelines west of Bailey Road as designated ridgelines. The motion was seconded by Commissioner Harris and carried by the following vote:

Ayes:	Commissioners Garcia, Glynn, Harris, Leonard
Noes:	Commissioners Kelly, Valentine, Holmes
Abstain:	None
Absent:	None

Speaking to the staff report, Mr. Jerome identified the Southwest Quadrant of Central and Solari Avenues and the Council's request to reconsider the area currently zoned for Medium Density Residential to Low Density Residential. He advised that the 4-acre St. Vincent de Paul site had involved an application for a 63-unit Pittsburg Family Apartments project, which had been approved by the Planning Commission and subsequently appealed to the City Council.

The City Council had heard the appeal and sent the project back for further restudy, which was in the process of being completed. Staff had reviewed the area in terms of the possibility of lowering the density to Single Family Low Density under the new General Plan, which would be a higher designation than the existing General Plan.

The existing General Plan would allow a maximum of 5 dwelling units per acre. The Draft General Plan would allow for some of the newer small lot single family residential lots up to 7 units per acre.

The change in density had been presented to the Planning Commission in June 2001 and had ultimately been rejected. The City Council during its evaluation of the General Plan appeared to be in favor of the change, although they had sent the change back to the Planning Commission for reconsideration.

EXHIBIT 4

Contra Costa County, CA November 8, 2005 Election

Measure P
City General Plan and Zoning Map
City of Pittsburg
Majority Approval Required

Pass: 5,577 / **51.75%** **Yes** votes ...... 5,199 / **48.25%** **No** votes

See Also: Index of all Measures

Results as of Nov 23 10:05am, 100.0% of Precincts Reporting (22/22)

Information shown below: Official Information | Impartial Analysis | Arguments | Full Text

Shall the voters of the City of Pittsburg approve a proposal to amend the City General Plan and Zoning Map by: (1) establishing a voter-approved urban limit line, which could only be changed by a vote of the people; (2) prezoning certain lands outside the City limits; (3) adding a new General Plan goal; and (4) modifying other General Plan text and diagrams, as further described in the proposal?

Official Sources of Information

- Official WWW Site

Impartial Analysis from Pittsburg City Attorney

A Proposal to Create a City of Pittsburg Voter-Approved Urban Limit Line and to Prezone Certain Lands Within the Urban Limit Line

The City of Pittsburg ("City") adopted a comprehensive, long-term General Plan for the City's physical development in November 2001. The proposed measure would amend the City's General Plan by creating an urban limit line around the entire City. It is the measure's intent to prohibit urban development beyond that line. Future changes to the urban limit line would require approval by the City's voters.

The General Plan already assigns land use designations to parcels within the proposed urban limit line since the line either corresponds with, or lies within, the City's "planning area" (the area outside the City limits that bears a relationship to the City's planning). This measure would go further by "prezoning" certain lands within the proposed urban limit line, but outside City limits, so these lands could be annexed to the City in the future. The prezoning, along with the General Plan land use designations, will determine how the affected lands may be used and

Official Information

City of Pittsburg's Web Site

News and Analysis

San Francisco Chronicle

- Mount Diablo ranch caught up in politics; Environmentalists say developer links it to Pittsburg vote - October 27, 2005

East Bay Express

- The Space Races Other East Bay land-use votes. - October 19, 2005

Suggest a link related to Measure P

Links to sources outside of Smart Voter are provided for information only and do not imply endorsement.

how densely they may be developed, plus the development standards that will apply upon annexation. The Contra Costa County Local Agency Formation Commission ("LAFCo") must approve the annexation; until LAFCo does, Contra Costa County's General Plan and zoning designations govern the prezoned properties.

The proposed measure's Zoning Map amendments would affect large parcels of land near the urban limit line's southwest, south, and northern boundary. This land would be prezoned to "Hillside Planned District" or "Open Space District." Both districts are consistent with the applicable General Plan land use designations. Five of the City's planning subareas would be affected: Southwest Hills, Northwest River, Buchanan, Black Diamond and Woodlands. Future changes to the Zoning Map amendments would require a vote of the people, or a majority vote of the City Council. Regulations governing the Hillside Planned District and Open Space District are available for review in Pittsburg Municipal Code Chapters 18.56 and 18.58.

Adoption of the City-approved urban limit line is one of two ways the City can obtain its share of Measure J transportation sales tax revenue (also known as the "Contra Costa Transportation Sales Tax Expenditure Plan"). Measure J, approved by County voters in November 2004, requires that a city comply with a new countywide, mutually agreed upon voter-approved urban limit line, or an urban limit line approved by that City's voters, as a prerequisite to receiving Measure J tax revenue. At present, there is no countywide, mutually agreed upon voter-approved urban limit.

In addition to creating an urban limit line and prezoning land outside City boundaries, the measure would add a new General Plan policy, add other General Plan text, and modify several General Plan diagrams to include the proposed urban limit line.

The above statement is an impartial analysis of Measure P. If you desire a copy of the full text of the measure, please call the City Clerk's Office at (925) 252-4870 and a copy will be mailed to you at no cost.

Arguments For Measure P

Who should control the future of Pittsburg + the people who live here, or County officials?

A YES vote on P means <u>taking control of growth</u> in Pittsburg:

- YES on P means that the people of Pittsburg, not County bureaucrats, determine the city's

Arguments Against Measure P

We're not stupid.

Albert Seeno and other developers are spending hundreds of thousands of dollars to get you to believe them. **They're sponsoring initiatives** in Pittsburg, Antioch and Brentwood.

boundaries;
- YES on P draws a voter-approved urban limit line all the way around the city that can only be changed by a subsequent vote of the people;
- YES on P preserves and protects agricultural land, open space, and creates parkland;
- YES on P creates a greenbelt around our city so that no growth can ever occur beyond that line unless the people of Pittsburg vote to change it.

But Measure P is more than just good policy - it guarantees millions of dollars to help solve our traffic congestion.

Measure J, passed by voters last year, states that each city in Contra Costa County must have an urban limit line to control growth, in order to receive funds for local street and road improvements.

Pittsburg is entitled to receive more than $34 million dollars, but only if it passes a voter-approved urban limit line. Pittsburg should draw that line.

A YES vote on P means these funds will help address traffic on our city streets and on Highway 4:

- YES on P will help reduce cut-through traffic on Buchanan Road with the construction of the Buchanan Road Bypass;
- YES on P helps build additional access roads to BART;
- YES on P will allow Pittsburg to improve our local streets and roads.

Say YES to Measure P to put control in the hands of Pittsburg voters, and address our traffic, transportation and road problems.

Please join us and the 6,547 residents who came together to put this measure on the ballot.
Vote YES on P!
s/Mary Erbez,
former Pittsburg Mayor & City Clerk
s/Mary Coniglio,
3rd generation Pittsburg resident
s/Orin T. Allen,
former Pittsburg Unified School District Board past president & member
s/Jess Leber,

They have polled. And they have cleverly calculated. Their consultants have put together an initiative they want you to believe will benefit Pittsburg.

It won't.

Measure P will bring more development, more traffic, more crowded classrooms, longer emergency response times, and a lower quality of life for all of us.

What these developers won't tell you ... if these Measures pass be prepared for:

- **Thousands of new houses,** on top of thousands that have already been approved, but not yet built!
- **Gridlock - more traffic and congestion on Highway 4**, and more air pollution - that's why nurses are opposed.
- **Competition for our limited water supplies -** do you want to ration?
- **Increased crime** and longer response times for police, firefighters and emergency personnel!
- **Lowered property values** - bad traffic, crowded schools and too few local jobs mean lower property values.
- **Huge developments destroy natural lands, working farms and ranches around our cities** - some projects are proposed on scenic hills next to our parks.
- **Overcrowded schools** the day they open.
- **Nurses are concerned about longer waits for ambulances and at Emergency Rooms.**

The developers, who stand to make millions at our expense, are counting on one thing: Us being fooled by this crafty initiative.

We're not stupid. We've figured it out. And we can't be bought-out, or hoodwinked into believing Measure P will be good for Pittsburg.

The only ones who will ultimately benefit are the developers. The rest of us will be stuck in traffic on Highway 4!

retired Pittsburg High School principal
s/Sal Cardinale,
retired superintendent of Pittsburg Unified School District

Rebuttal to Arguments For

Measure P is NOT about local control it's about DEVELOPER control.

Measure P was written and put on the ballot by Albert Seeno not by the City of Pittsburg.

It will mean an expansion of development and the potential for thousands more homes and even more traffic congestion and gridlock.

Measure P will allow our hills to be graded and open space lost forever. It will NOT protect anyone but Albert Seeno.

Pittsburg is already protected by an urban limit line that has worked for years.

You the voters and taxpayers have already agreed to pay more sales tax for traffic improvements WE ARE ALREADY ENTITLED TO RECEIVE OUR MONEY. Measure P will ensure that those improvements will be overcrowded before they are even built.

No on Measure P will continue to protect our open space and ranchlands.

No on Measure P will allow the City NOT Albert Seeno to decide where and how our community will grow.

No on Measure P will let our road improvements catch up with the thousands of homes already approved but not yet built.

No on Measure P will allow our schools to expand to meet an already growing demand.

No on Measure P will ensure that we the people and

Take a closer look. Don't be fooled by the sugar-coated lies. Please vote NO on Measure P.
s/Joe Canciamilla,
State Assemblyman
s/Federal Glover,
County Supervisor
s/Michael Kee,
Pittsburg City Council
s/Elaine Ruiz, RN
Pittsburg, California Nurses Association
s/Ron Brown, Executive Director,
Save Mount Diablo

Rebuttal to Arguments Against

Pittsburg's community must support our future by supporting Measure P.

With Measure P, the community can control how developers build within Pittsburg's voter-approved Urban Limit Line.

By passing Measure P, Pittsburg will have control of its city limits; we will also ensure that we receive Measure J funds needed to repair our local streets and roads.

Approving Measure P ensures Pittsburg's fair share of Measure J funding to control its own destiny.

<u>A YES Vote means:</u>

- Pittsburg's voters can manage their own future.
- Pittsburg can grow and control its growth and boundaries, which can only be changed by a subsequent vote of the people.
- Pittsburg can maintain the proper development for housing. Supply and demand and values will adjust with the market.
- Pittsburg can control land use, natural lands, greenbelts, working farms and ranches within Pittsburg's Sphere of Influence.
- Funding for a Buchanan Road Bypass is ensured and will be built within Pittsburg's boundaries, helping to reduce traffic gridlock.

Pittsburg voters are smart and understand when we are in control, we make the right decisions for our future. A YES vote means we will control our not developers will control our future.

Just ask yourself one simple question, if this is such a good idea why did Albert Seeno have to pay to gather signatures to put this on the ballot?

Please join us in protecting our future by voting NO on Measure P.
s/Laura Canciamilla,
Trustee PUSD

boundaries and all that happens within our city's voter-approved Urban Limit Line.

To ensure Pittsburg is not left behind in East County, please join the 6,547 Pittsburg voters who helped place Measure P on the ballot by voting YES.

Thank You,
s/Ben Johnson,
Pittsburg City Council Member
s/Bill Glynn,
Councilman, City of Pittsburg
s/Mary Erbez,
Former Pittsburg Mayor & City Clerk
s/Sal Cardinale,
Retired Superintendent of Pittsburg Schools
s/Mary Coniglio,
3rd generation Pittsburg resident

Full Text of Measure P

If you desire a copy of the full text of the measure, please call the City Clerk's Office at (925) 252-4870 and a copy will be mailed to you at no cost.

Contra Costa Home Page || Statewide Links || About Smart Voter || Feedback

EXHIBIT 5

A Proposal to
Create a City of Pittsburg Voter-Approved Urban Limit Line and
To Prezone Certain Lands Within That Urban Limit Line

This Proposal would, if adopted, establish an Urban Limit Line for the City of Pittsburg, and prezone certain lands within that Urban Limit Line which are not already within the City's boundaries. The measure would do this by amending both the City of Pittsburg General Plan and the City's Zoning Map, which is part of the City's Zoning Ordinance.

This Proposal would, by amending the City's General Plan: (1) create a City voter-approved urban limit line around the entire City; (2) revise multiple diagrams in the General Plan to reflect the voter-approved urban limit line; and (3) add text about the urban limit line to Chapter 1.2, "Purpose and Requirements of a General Plan," and Chapter 3.1, "Growth and Expansion."

The proposed text amendments to the General Plan state, among other things, that it is the Proposal's intent to comply with Measure J. Measure J, approved by County voters in November 2004, is the Contra Costa Transportation Sales Tax Expenditure Plan which requires that a city in Contra Costa County, as a prerequisite to receiving transportation sales tax revenue, complies either with a new countywide, mutually agreed upon voter-approved urban limit line, or that city's voter-approved urban limit line.

The Proposal would add to the City's General Plan Goal 3-G-2, concerning Growth and Expansion. The new goal states:

> Realize the opportunities afforded by establishment of the Voter Approved Urban Limit Line to allow the City to grow in such a way as to diversify and expand the employment base, develop a range of housing opportunities, increase the depth of municipal fiscal resources, enhance the quality of urban life of all Pittsburg residents and prohibit urban development beyond the Voter Approved Urban Limit Line.

The Proposal would amend the City's existing Zoning Map to prezone specific areas outside the City limits, but within the voter-approved urban limit line. "Prezoning" is a method to establish zoning for unincorporated territory the City desires to annex. The zoning does not take effect until the annexation occurs. Five of the City's planning areas would be affected by the prezoning: Southwest Hills, Northwest River, Buchanan, Black Diamond and Woodlands. The Proposal would prezone certain portions of each area as "Hillside Planned District" or "Open Space District." The City's existing Zoning Ordinance, Chapters 18.56 and 18.58, establish the regulations and development standards for these zoning designations.

The Proposal does not affect existing General Plan land use designations.

The voter-approved urban limit line could only be changed by a vote of the people at a future City general or special election. The Zoning Map amendments that prezone certain lands could be changed by a vote of the people at a City general or special election, or by a majority vote of the City Council.

CITY OF PITTSBURG VOTER APPROVED URBAN LIMIT LINE AND PREZONING ACT

SECTION 1. Title.

This Act shall be known and may be cited as the "City of Pittsburg Voter Approved Urban Limit Line and Prezoning Act."

SECTION 2. Findings and Purposes.

The people of the City of Pittsburg hereby make the following findings and declare that their purpose in enacting this Act is as follows:

(a) The City of Pittsburg must plan for its future. Moderate, managed growth will secure economic prosperity and enhance the quality of life in Pittsburg. With a plan to manage development and the City boundaries, Pittsburg can achieve a diverse and high-quality employment base close to home, create traffic solutions, improve its public schools, and ensure an improved quality of life for all Pittsburg citizens.

(b) To guide future growth and development in the manner consistent with the City's General Plan, the people of Pittsburg must establish the Voter Approved Urban Limit Line.

(c) Establishment of a City of Pittsburg Voter Approved Urban Limit Line complies with the purposes of Measure J (Contra Costa's Transportation Sales Tax Expenditure Plan) to:

(1) Ensure the preservation and protection of identified non-urban land, including agricultural, open space, parkland, and other areas, by establishing a line beyond which urban development is prohibited;

(2) Link land use decisions with the transportation investments in Measure J by channeling future growth to locations more suitable for urban development; and

(3) Ensure that land use policies within the Voter Approved Urban Limit Line effectively promote appropriate development that accommodates the area's projected housing and job needs for the future.

(d) Approval of this Act will qualify the City of Pittsburg to receive the millions of dollars' worth of Measure J "Return to Source" funds to which it is entitled for local street and road improvements. Unless we establish a Voter Approved Urban Limit Line, these funds will be withheld by the Contra Costa Transportation Authority.

(e) The prezoning of certain lands designated by this Act is a necessary first step so that the City of Pittsburg may proceed to annex these lands.

(f) The new urban areas within the Voter Approved Urban limit line would be pre-zoned as Hillside Planned District (HPD) and Open Space District (OS).

(g) Establishment of the Voter Approved Urban Limit Line will allow the City to achieve a goal first identified in the 1980 General Plan: the construction of the Buchanan Road Bypass, relieving the severe congestion on existing Buchanan Road and providing another east-west connector between Kirker Pass Road and Somersville Road to relieve current neighborhood congestion.

(h) The Voter Approved Urban Limit Line and prezoning established by this Act are consistent with the goals and policies of the existing Pittsburg General Plan and zoning ordinances.

(i) The Voter Approved Urban Limit Line may only be changed by a subsequent vote of the voters of the City of Pittsburg at a city election.

(j) Establishment of the Voter Approved Urban Limit Line and the prezoning of certain lands will finally give residents of the City of Pittsburg control over their future. The residents of Pittsburg know what is best for their city, and the residents of other Contra Costa County cities and unincorporated areas should have no control over the future of our City.

SECTION 3. City of Pittsburg General Plan Amendments.

The City of Pittsburg General Plan is amended as follows:

(a) The Cover is hereby amended to show the establishment of a Voter Approved Urban Limit Line as shown on Exhibit 1, attached hereto and incorporated herein by reference.

(b) The paragraph entitled *Growth Management (Chapter 3)* at page 1-7 of the Introduction and Overview section of the General Plan is hereby amended as follows:

Growth Management (Chapter 3)

This element addresses growth and expansion, traffic standards, and public facility standards, pursuant to the Contra Costa County Transportation Improvement and Growth Management Program (Measure C) passed by county voters in 1988. <u>The element also addresses the Voter Approved Urban Limit Line passed by the voters of the City of Pittsburg.</u>

(c) Figure 1-2 (Planning Boundaries and Physical Relief) at page 1-11 is hereby amended to show the establishment of a Voter Approved Urban Limit Line as shown on Exhibit 2, attached hereto and incorporated herein by reference.

(d) Figure 2-2 (General Plan Diagram) at page 2-12 is hereby amended to show the establishment of a Voter Approved Urban Limit Line as shown on Exhibit 3, attached hereto and incorporated herein by reference.

(e) Figure 2-3 (Planning Boundaries) at page 2-26 is hereby amended to show the establishment of a Voter Approved Urban Limit Line as shown on Exhibit 4, attached hereto and incorporated herein by reference.

(f) Part 3.1 (Growth and Expansion), subsection "Growth and Annexation," beginning at page 3-2 is hereby amended as follows:

GROWTH AND ANNEXATION

The Planning Area boundaries of this General Plan largely coincide with those of the City's last General Plan, which was prepared in 1988, and are described in Chapter 1: Introduction. Since the 1988 General Plan was adopted, Pittsburg has witnessed six major expansions of its City boundaries, totaling approximately 2,780 acres:

- Northeast River subarea. In 1990, 1,170 acres were annexed for industrial development;
- West Central subarea. In 1991, 190 acres were annexed for construction of a mobile home park;
- Buchanan subarea. In 1997, 160 acres of Highlands Ranch were annexed for industrial development; and
- Southwest Hills subarea. In 1990, 1,030 acres were annexed for the San Marco project. In 1992, 130 acres were annexed along the western municipal boundary. Then in 1996, 100 acres were annexed south of Oak Hills.

Full implementation of the land uses proposed in this General Plan will require additional annexations in the Woodlands, Buchanan, Southwest Hills, and Northwest River subareas. Policies also consider potential annexation of developable lands outside of the current SOI along the eastern and western edges of the City.

As part of the 1996 Contra Costa County General Plan, the County delineated an Urban Limit Line (ULL) to identify areas appropriate for urban expansion and preserve open space in the southern hills. Recently, in 2000, the County amended its ULL, removing several hundred acres of the southern hills from planned urban growth areas. This General Plan seeks to define appropriate limits for urban growth based on land use considerations and environmental and topographic constraints.

The voters approved the City of Pittsburg Voter Approved Urban Limit Line and Prezoning Act. This Act amended this General Plan to establish a Voter Approved Urban Limit Line that could not be changed without a vote of the voters. The Act also prezoned certain specified lands as a necessary first step in the process of annexing those lands to the City and provided that the prezoning could be changed by a vote of the voters or by a majority vote of the City Council.

The findings and purpose section of the City of Pittsburg Voter Approved Urban Limit Line and Prezoning Act specifically stated its intent to comply with the purposes of Measure J (Contra Costa's Transportation Sales Tax Expenditure Plan) as follows:

a. Ensure the preservation and protection of identified non-urban land, including agricultural, open space, parkland, and other areas, by establishing a line beyond which urban development is prohibited;
b. Link land use decisions with the transportation investments in Measure J by channeling future growth to locations more suitable for urban development; and
c. Ensure that land use policies within the Voter Approved Urban Limit Line effectively promote appropriate development that accommodates the area's projected housing and job needs for the future.

GOALS: GROWTH AND EXPANSION

3-G-1 Manage the City's growth to balance development of housing options and job opportunities, protection of open space and habitat areas, construction of transportation improvements, and preservation of high quality public facilities.

3-G-2 Realize the opportunities afforded by establishment of the Voter Approved Urban Limit Line to allow the City to grow in such a way as to diversify and expand the employment base, develop a range of housing opportunities, increase the depth of municipal fiscal resources, enhance the quality of urban life for all Pittsburg residents and prohibit urban development beyond the Voter Approved Urban Limit Line.

(g) Figure 13-1 (Areas in Need of Repair or Replacement) at page 13-33 is hereby amended to show the establishment of a Voter Approved Urban Limit Line as shown on Exhibit 5, attached hereto and incorporated herein by reference.

(h) Figure 13-2 (Housing Opportunity Sites 2004-2006) at page 13-63 is hereby amended to show the establishment of a Voter Approved Urban Limit Line as shown on Exhibit 6, attached hereto and incorporated herein by reference.

(i) Figure 13-3 (Los Medanos Community Development Project) at page 13-119 is hereby amended to show the establishment of a Voter Approved Urban Limit Line as shown on Exhibit 7, attached hereto and incorporated herein by reference.

SECTION 4. City of Pittsburg Zoning Map Prezoning Amendments.

The Zoning Map of the Zoning Ordinance of the City of Pittsburg, Title 18 of the Municipal Code, Section 18.04.020.C (Ordinance No. 90-979) is amended to prezone lands by applying Chapter 18.56 (Hillside Planned District) and Chapter 18.58 (Open Space District) to certain lands as shown in Exhibit 8 (Prezoning Northwest River), Exhibit 9 (Prezoning Southwest Hills), Exhibit 10 (Prezoning Woodlands) and Exhibit 11 (Prezoning Buchanan), attached hereto and incorporated herein by reference.

SECTION 5. Finding of Consistency.

The Voter Approved Urban Limit Line established by this Act is consistent with the Pittsburg General Plan. The prezoning established by this Act is consistent with the Pittsburg General Plan and Zoning Ordinance.

SECTION 6. Implementation.

Upon the effective date of this Act, the Act shall be deemed inserted in the City of Pittsburg General Plan and the City of Pittsburg Zoning Map as amendments thereof, except that if the four amendments of the mandatory elements of the City of Pittsburg General Plan permitted by state law for any given calendar year have already been utilized prior to the effective date of this Act, the portions of this Act pertaining to the City of Pittsburg General Plan shall be deemed inserted in the City of Pittsburg General Plan on the sixtieth day following the date of certification of the vote approving this Act by the City Clerk.

SECTION 7. Amendments.

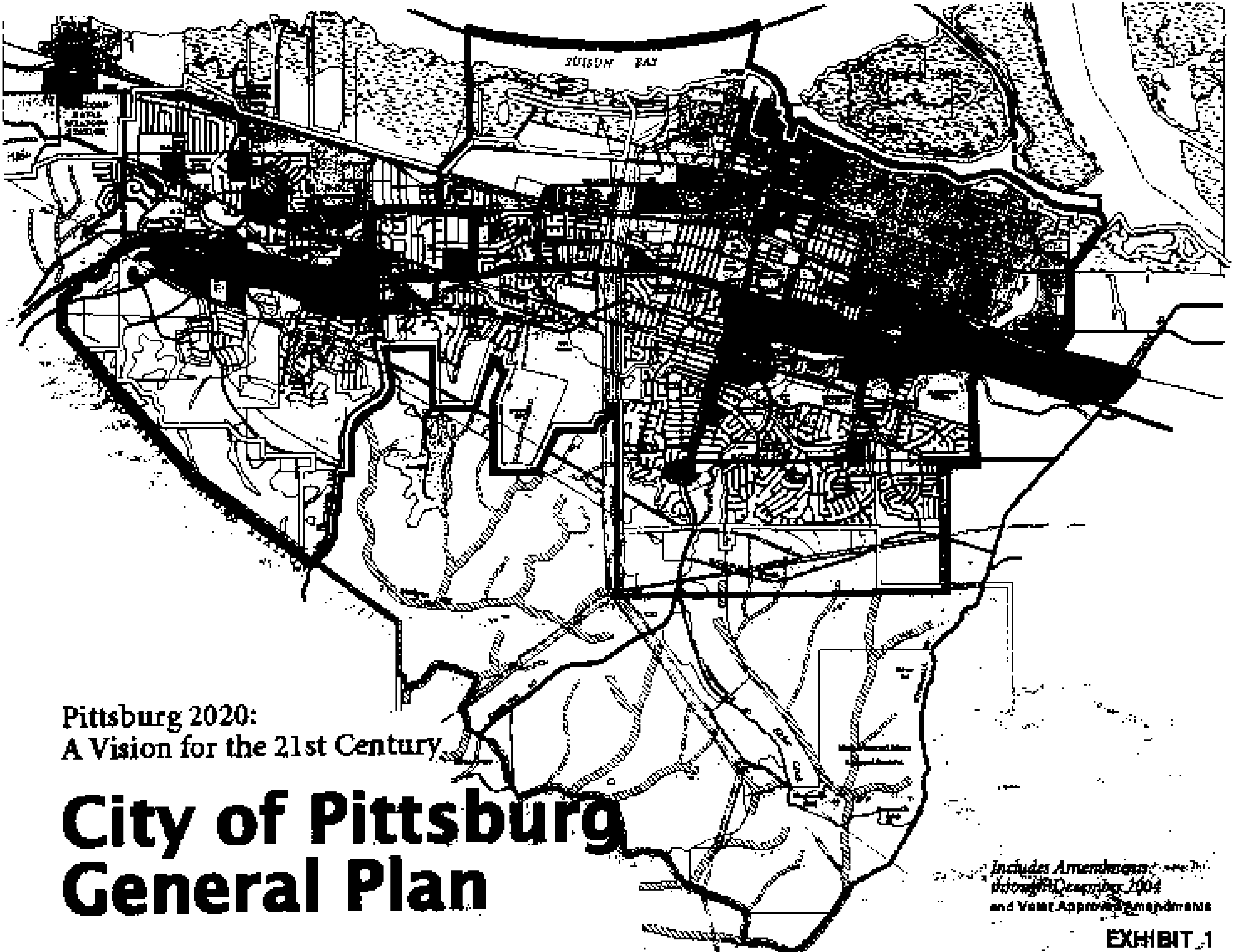
The Voter Approved Urban Limit Line established by this Act may only be changed by a subsequent vote of the voters at a city election. The Prezoning Map amendments contained in Section 4 of this Act may be changed by a subsequent vote of the voters at a city election or by a majority vote of the City Council.

SECTION 8. Effective Date.

The provisions of this Act shall become effective upon the approval of the voters of the City of Pittsburg pursuant to California Elections Code section 9217.

SECTION 9. Severability.

If any provisions of this Act or the application thereof to any person or circumstances is held invalid or unconstitutional, such invalidity or unconstitutionality shall not affect other provisions or applications of this Act, and to this end the provisions of this Act are severable.



Pittsburg 2020:
A Vision for the 21st Century

City of Pittsburg General Plan

Includes Amendments through December 2004
and Voter Approved Amendments

EXHIBIT 1

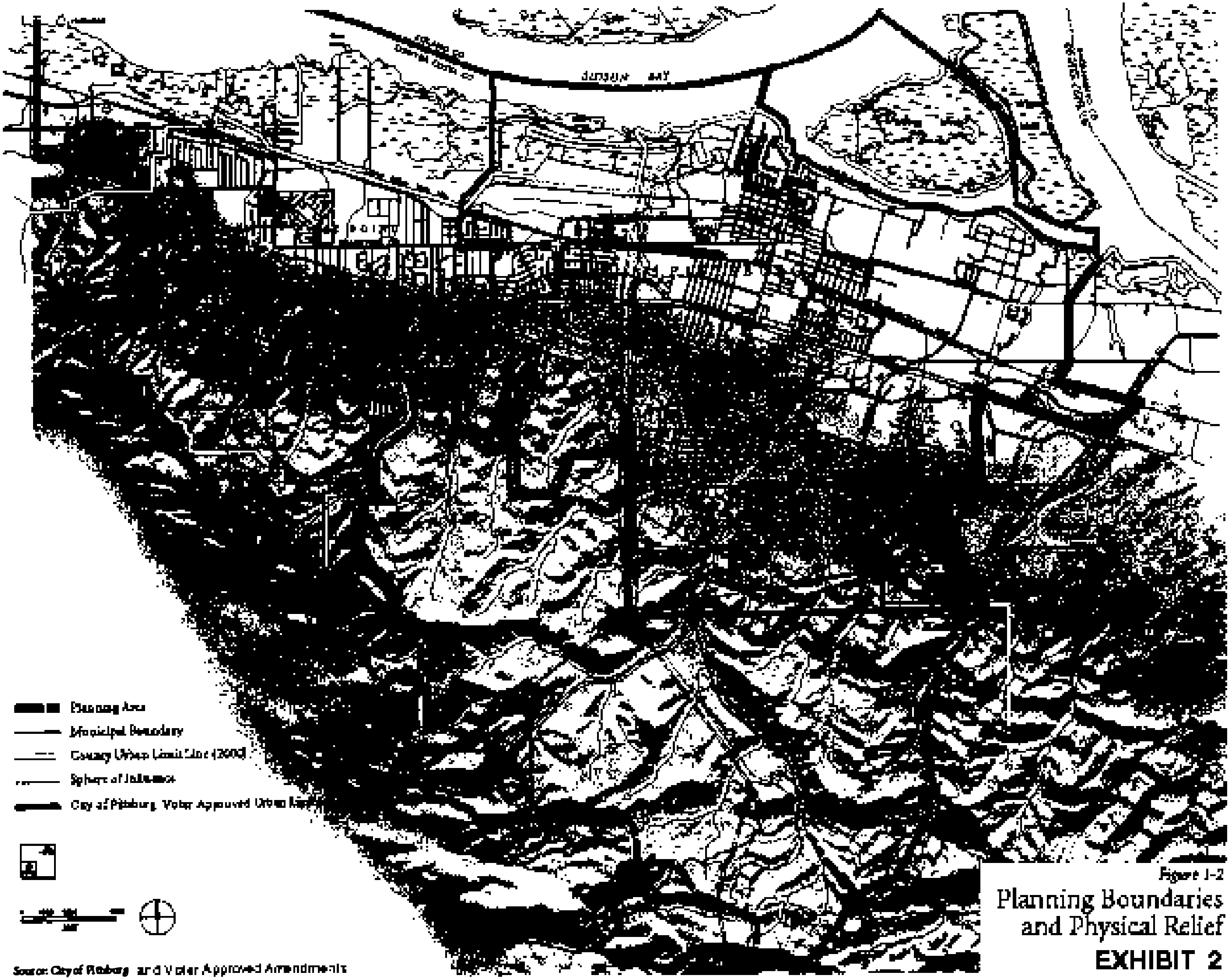


Figure 1-2
Planning Boundaries
and Physical Relief
EXHIBIT 2

Source: City of Pittsburg and Voter Approved Amendments

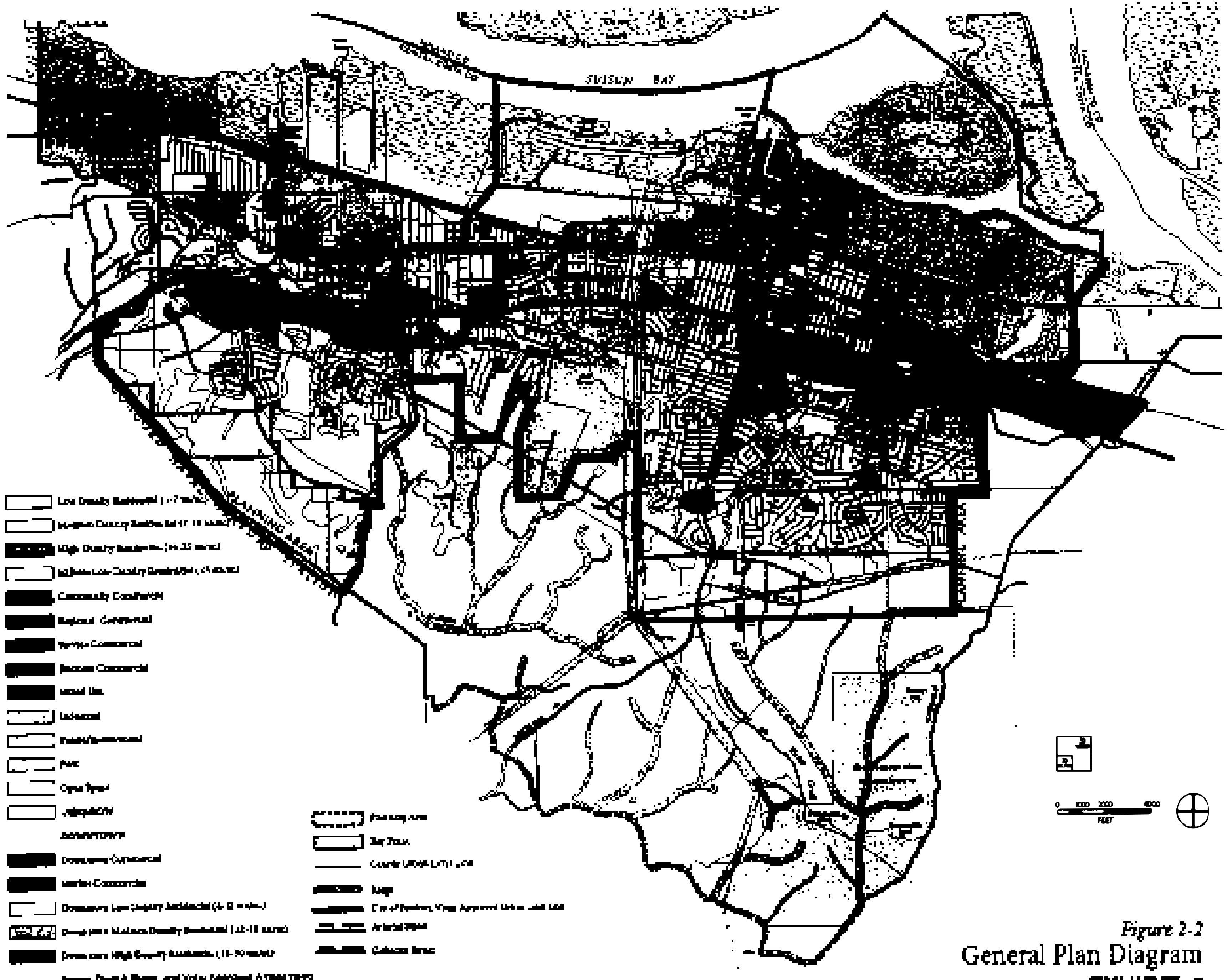


Figure 2-2
General Plan Diagram
EXHIBIT 3

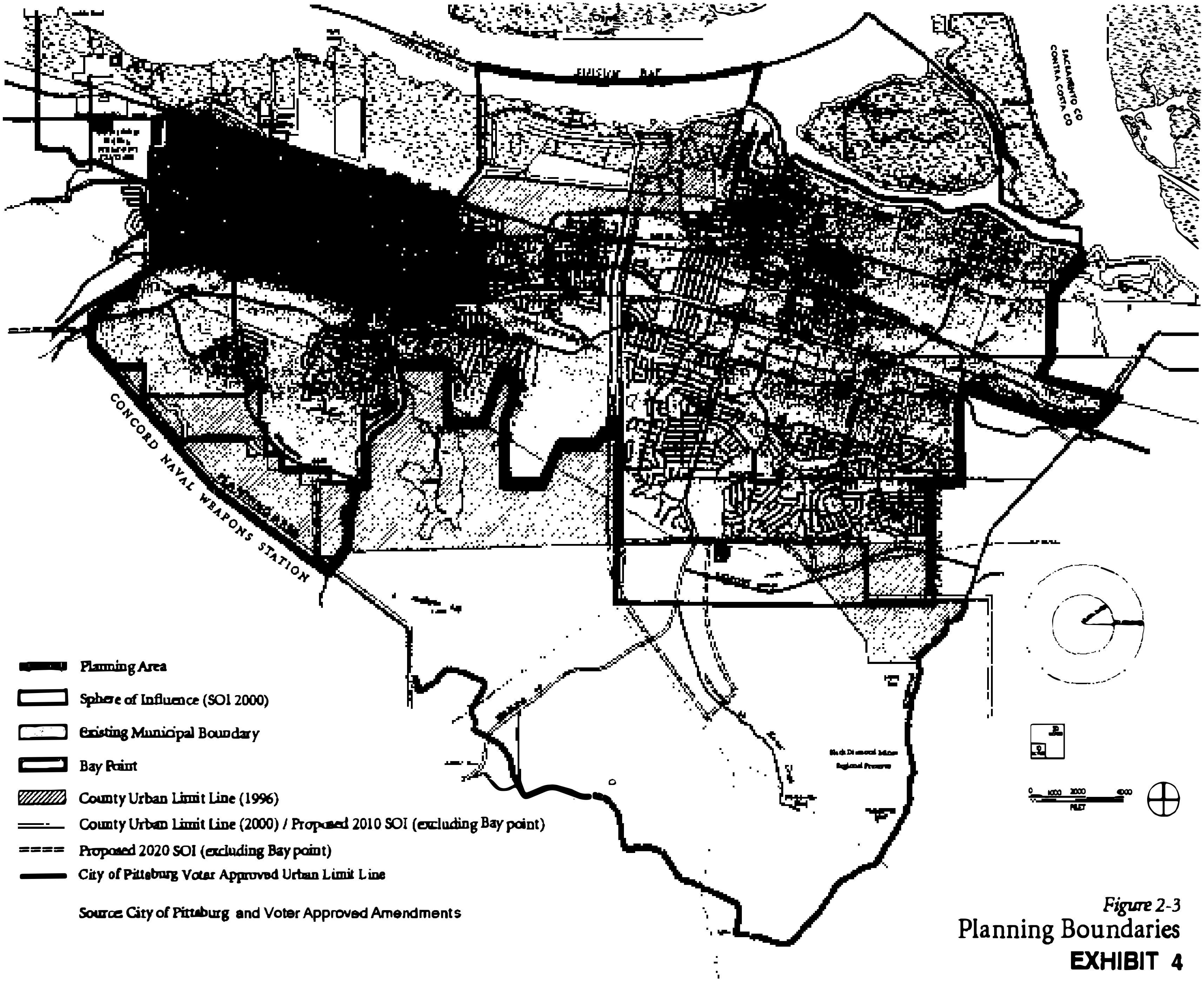


Figure 2-3
Planning Boundaries
EXHIBIT 4

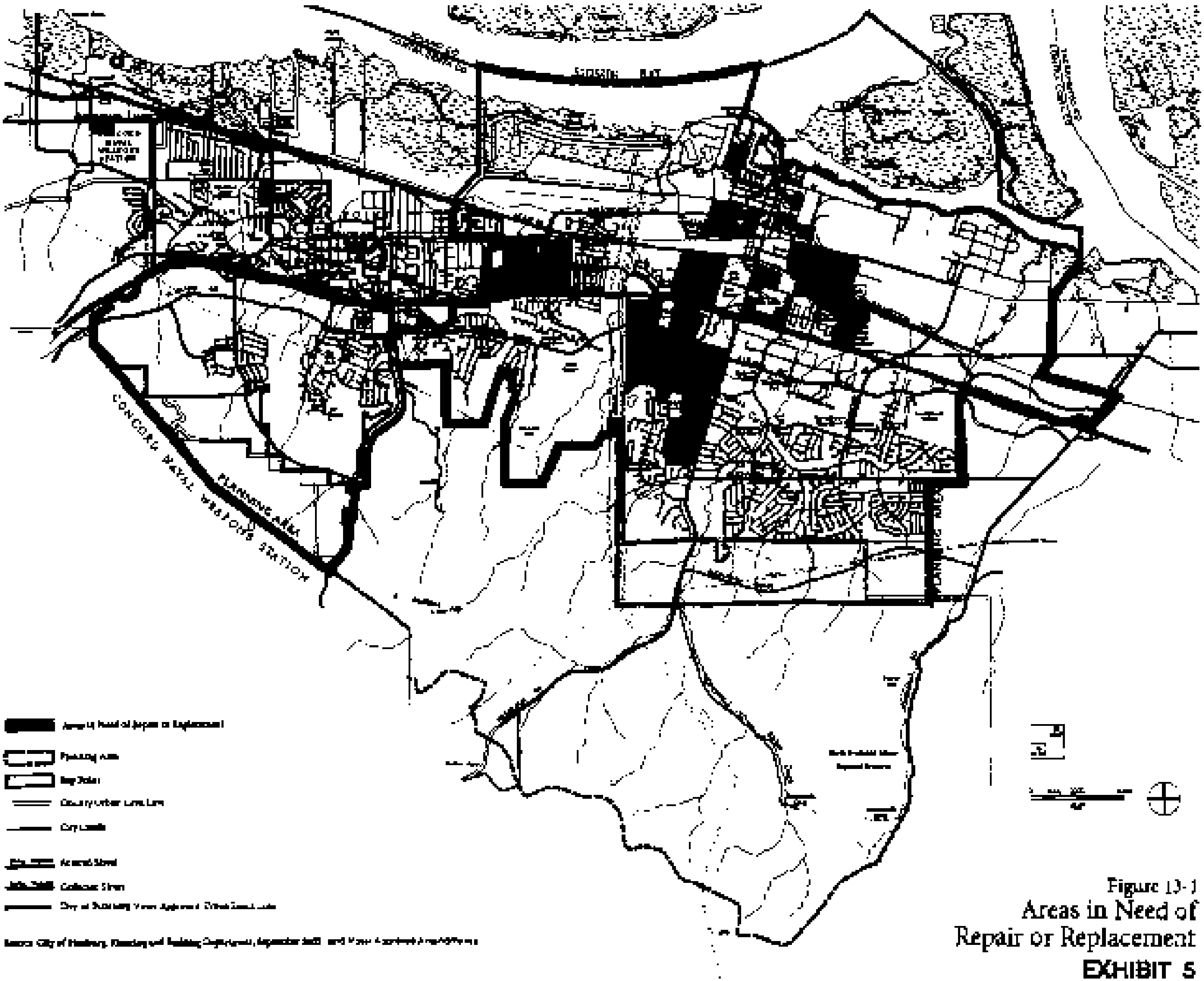
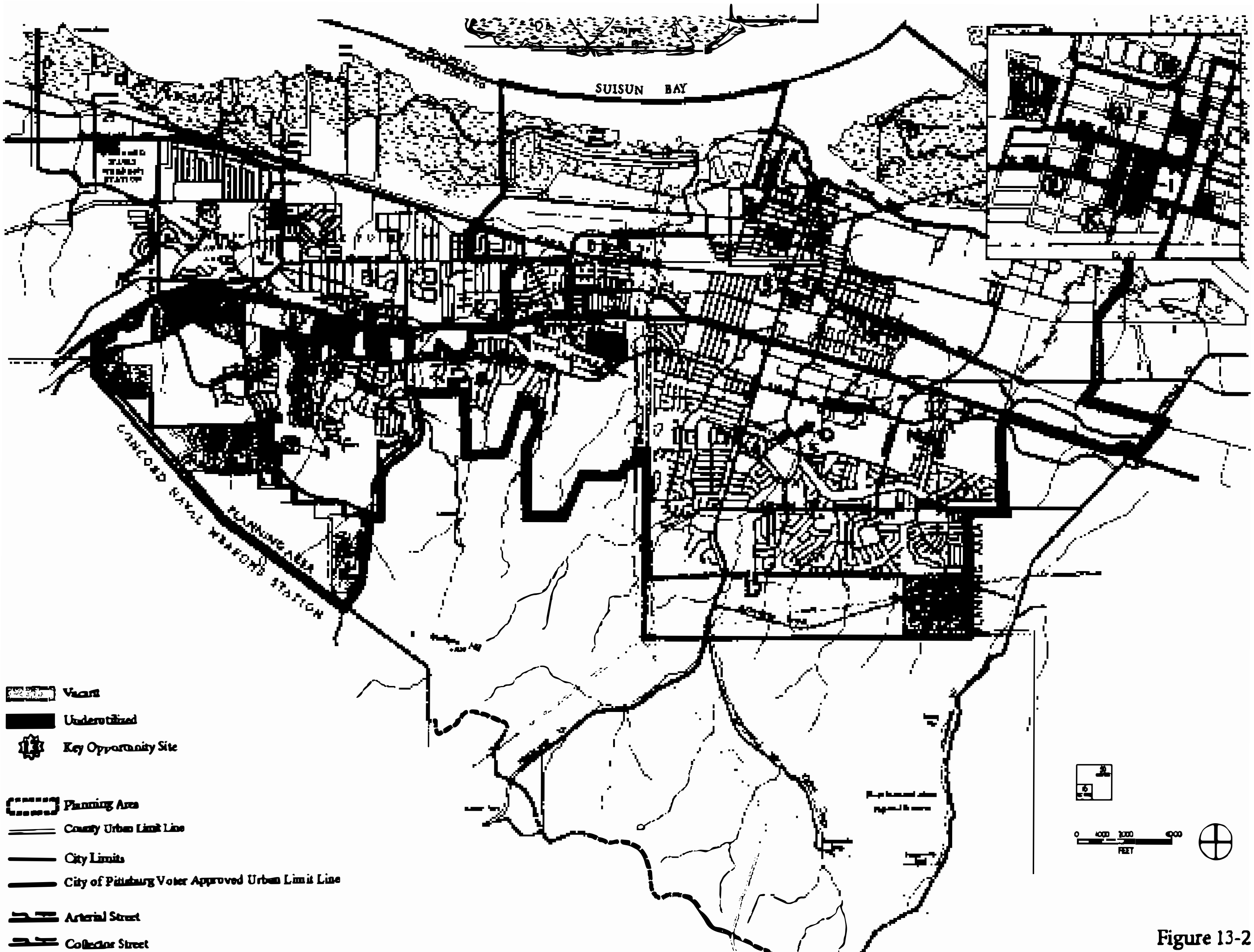


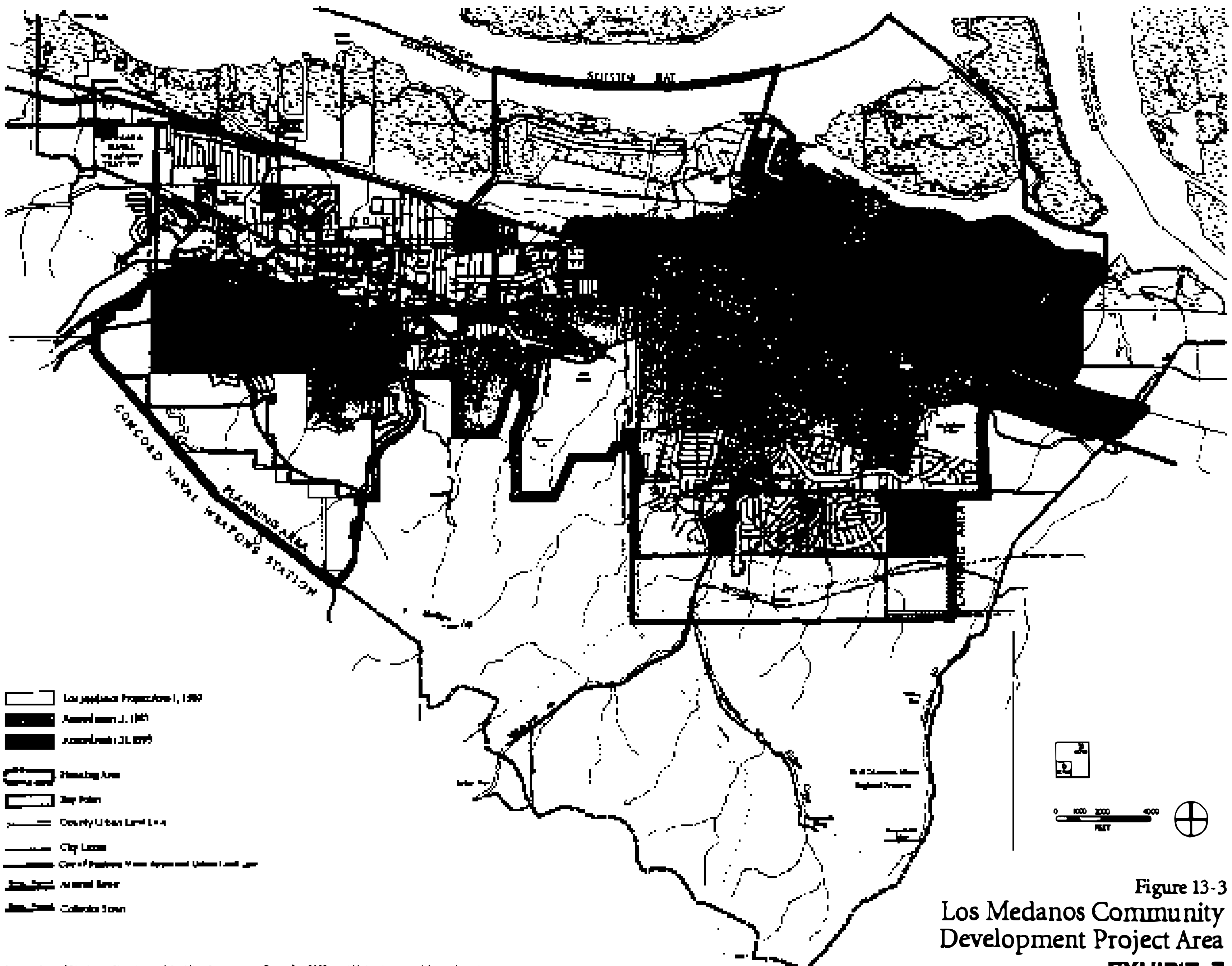
Figure 13-1
Areas in Need of
Repair or Replacement
EXHIBIT 5



Source: City of Pittsburg, Planning and Building Department, May 2004 and Voter Approved Amendments

Figure 13-2
Housing Opportunity
Sites 2004-2006

EXHIBIT 6



Source: City of Pittsburg, Planning and Building Department, December 2003 and Voter Approved Amendments

Figure 13-3
Los Medanos Community Development Project Area
EXHIBIT 7

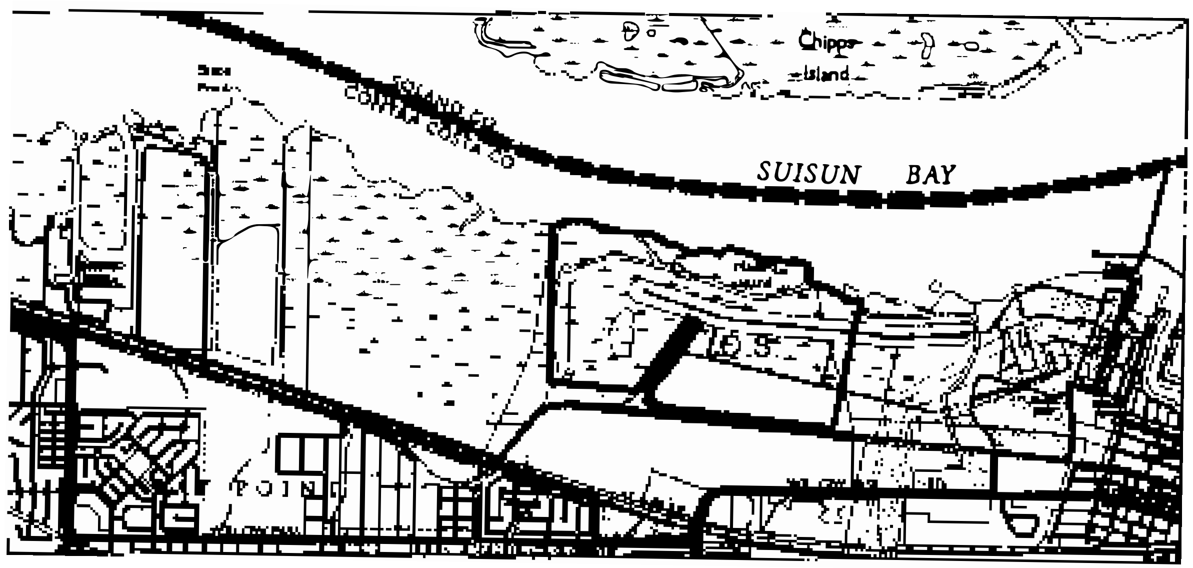
LEGEND

O.S. Open Space District, Ref: Chapter 18.58 of Pittsburg Zoning Ordinance.

Prezoning Boundary

Includes all of Assessor Parcel Numbers 096-100-015, 096-100-017, 096-100-018, and a portion of Assessor Parcel Number 096-100-026.

Amends Zoning Map of the Zoning Ordinance of the City of Pittsburg, Title 18 of the Municipal Code, Section 18.04.020.C; Ord. No. 90-979.



Source: Dyett & Bhatia and Voter Approved Amendments

Prezoning Northwest River

Ref: City of Pittsburg General Plan, Figure 2-4L Northwest River, page 2-70

EXHIBIT 8

LEGEND

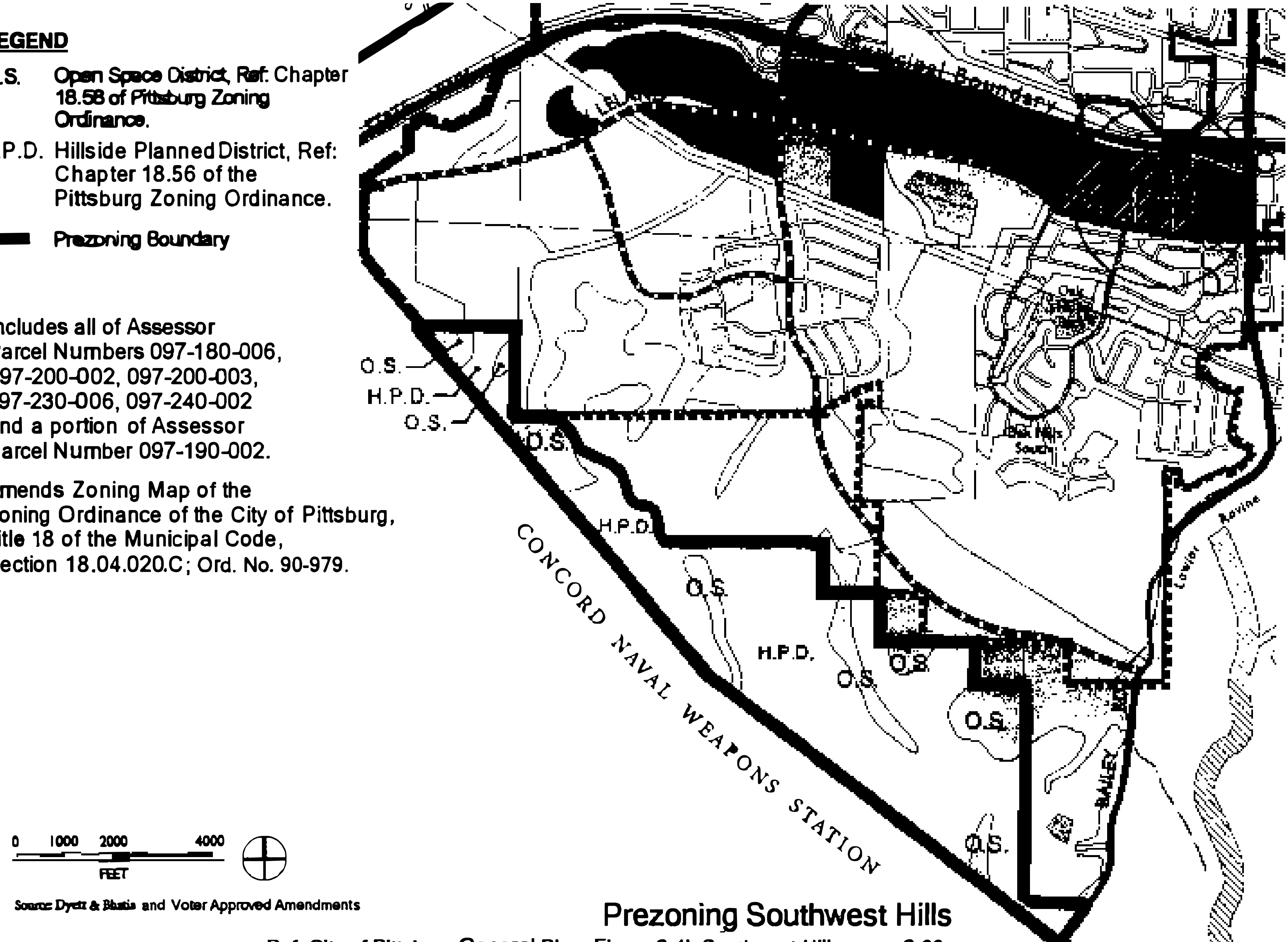
O.S. Open Space District, Ref: Chapter 18.58 of Pittsburg Zoning Ordinance.

H.P.D. Hillside Planned District, Ref: Chapter 18.56 of the Pittsburg Zoning Ordinance.

Prezoning Boundary

Includes all of Assessor Parcel Numbers 097-180-006, 097-200-002, 097-200-003, 097-230-006, 097-240-002 and a portion of Assessor Parcel Number 097-190-002.

Amends Zoning Map of the Zoning Ordinance of the City of Pittsburg, Title 18 of the Municipal Code, Section 18.04.020.C; Ord. No. 90-979.



Source: Dyett & Bhatia and Voter Approved Amendments

Prezoning Southwest Hills

Ref: City of Pittsburg General Plan, Figure 2-4k Southwest Hills, page 2-66

EXHIBIT 9

LEGEND

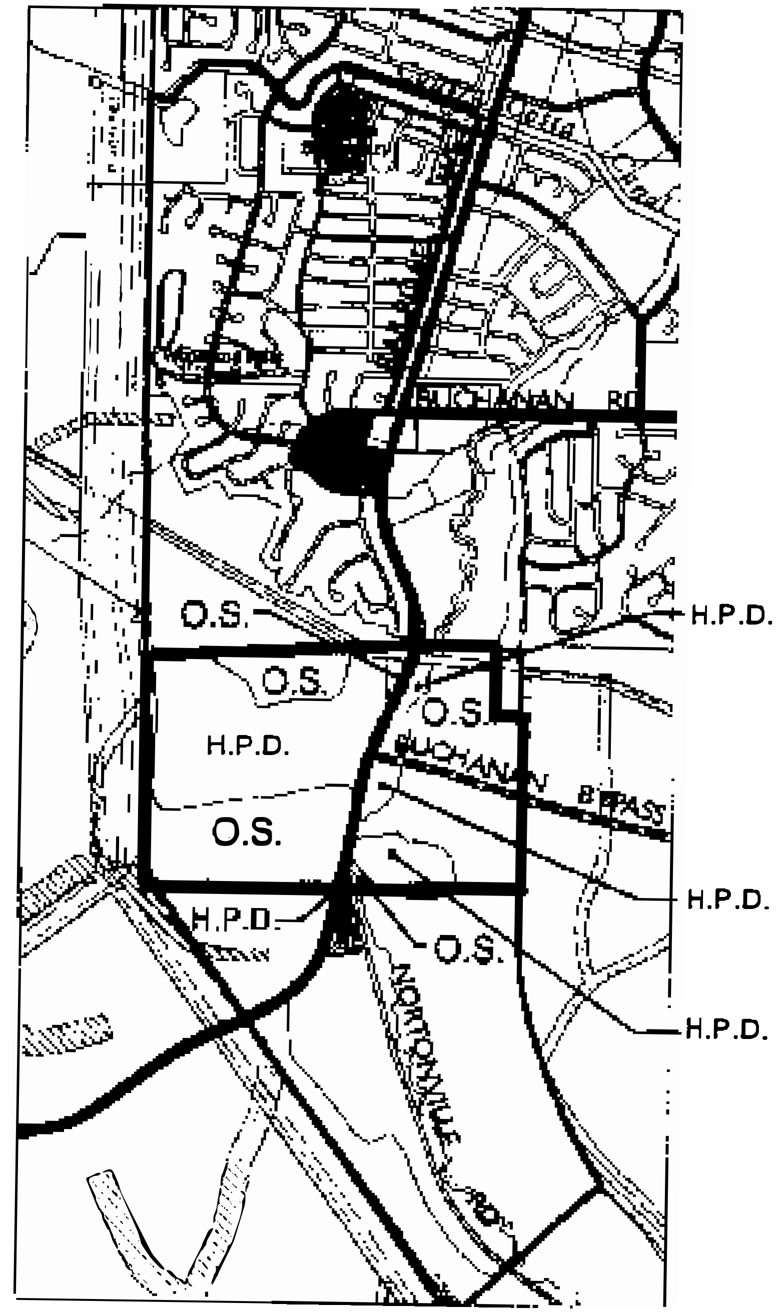
O.S. Open Space District, Ref: Chapter 18.58 of Pittsburg Zoning Ordinance.

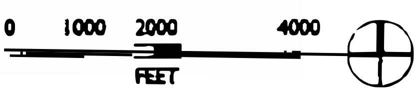
H.P.D. Hillside Planned District, Ref: Chapter 18.56 of the Pittsburg Zoning Ordinance.

▬ Prezoning Boundary

Includes all of Assessor Parcel Numbers 089-020-009, 089-020-010, 089-020-011, 089-020-012 and a portion of Assessor Parcel Number 089-050-056.

Amends Zoning Map of the
Zoning Ordinance of the City of Pittsburg,
Title 18 of the Municipal Code,
Section 18.04.020.C; Ord. No. 90-979.





Source: Dyett & Bhatia and Voter Approved Amendments

Prezoning Woodlands

Ref: City of Pittsburg General Plan, Figure 2-4h Woodlands, page 2-60

EXHIBIT 10

LEGEND

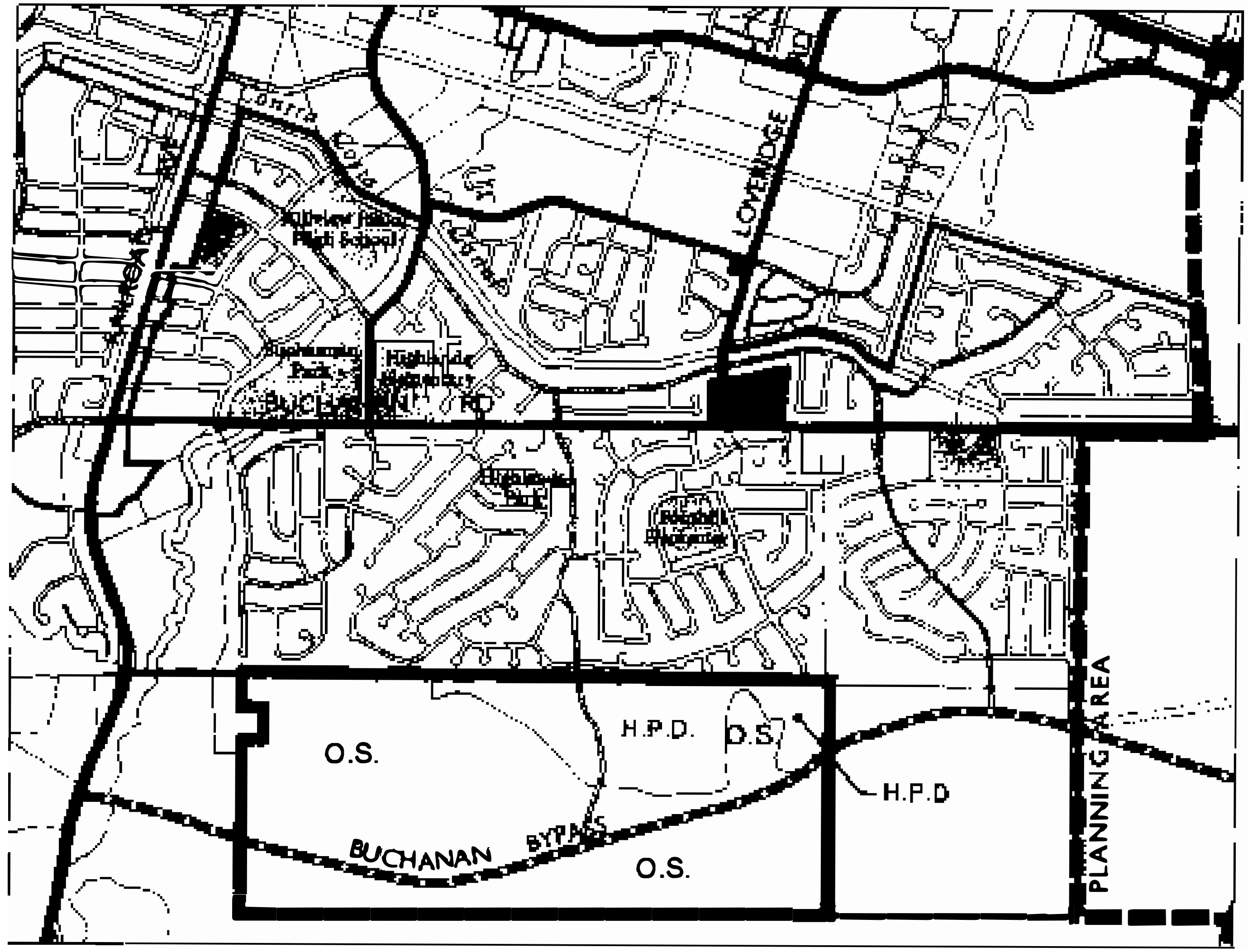
O.S. Open Space District, Ref: Chapter 18.58 of Pittsburg Zoning Ordinance.

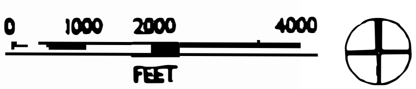
H.P.D. Hillside Planned District, Ref: Section 18.56 of the Pittsburg Zoning Ordinance.

Prezoning Boundary

Includes a portion of Assessor Parcel Number 089-050-056.

Amends Zoning Map of the Zoning Ordinance of the City of Pittsburg, Title 18 of the Municipal Code, Section 18.04.020.C; Ord. No. 90-979.





Source: Dyett & Bhatia and Voter Approved Amendments

Prezoning Buchanan

Ref: City of Pittsburg General Plan, Figure 2-5g Buchanan, page 2-58

EXHIBIT 11

EXHIBIT 6

Faria Annexation
Summary of General Plan Policies Related to Aesthetics

Regulatory Context	Compliance
City of Pittsburg **General Plan**	
Land Use Goal 2-G-8: Ensure that hillside development enhances the built environment, improves safety through slope stabilization, is respectful of topography and other natural constraints, and preserves ridgelines and viewsheds.	**No.** The mitigation measures related to geology address slope stabilization and the overall topography. The project preserves the ridgelines and viewsheds through the 150-foot Ridgeline Buffer on the Master Plan Map. The visual analysis (Figures 4.1-12 through 4.1-20) shows the existing topography and the potential impact of the project. The natural form of the Southwest Hills would be partially preserved. As shown in the figures the project would be dwarfed by the dominant ridges that surround the project site. However there would be extensive mass grading on the project site itself within the areas designated for development in the Master Plan to create level building pads.

***Goal 2-G-33: Maintain the general character of the hill forms. Policy 2-P-91: Ensure as part of the development review process that any future subdivision in the southwest hills that is adjacent to the 2005 Pittsburg voter approved urban limit line, establishes a greenbelt buffer within the City's urban limit line between the proposed development and the urban limit line. The greenbelt buffer shall include all land between the City of Concord border and the first set of **ridges**, including the tops of these same ridges which generally run parallel to the common border. The City will consider, in conjunction with subdivision applications on these properties and related environmental analysis, general plan and/or the transfer of lost development rights as a result of these greenbelts to other portions of these properties, while not increasing the overall number of units permitted on these properties.	**REQUESTED DELETION.** The project would maintain the character of the hills from the General Plan designated viewshed. It is establishing a ridge line buffer to maintain the ridge line topography. .
Goal 4-G-3 Ensure that new residential development in the southern hills provides adequate transition between urban and open space uses on the City's edge.	**Yes.** The proposed density would transition from 3-5 du/acre adjacent to the San Marco development, to 1-3 du/acre as the project extends up the hill. The open space designated on the site plan would also provide the transition between the developed portion of the project site and adjacent open space lands.
Urban Design Element ***Policy 4-P-2: As part of the development review process, require design review of proposed hillside development. Ensure that: • Hillside development is clustered in small valleys and behind minor ridgelines, to preserve more prominent views of the southern hills.	**No.** The proposed grading and development would not comply with the intent of this policy. Within the project site the rolling hills would be eliminated by the

• Hillside streets are designed to allow open views by limiting the building of structures or planting of tall trees along the southern edge or terminus of streets. • Many arterial and collector roadways within the City feature views of rolling, grassy hills. Sensitive layout and design of new and redeveloped sites throughout Pittsburg can retain and enhance views of these tremendous natural features.	mass grading to create level building pads.
***Policy 4-P-3: As part of the development review process, limit building heights and massing where views of the hills from adjacent properties and public spaces could be preserved. Limiting the height and massing of new structures to retain views of ridgelines over the tops of rooflines will ensure that the City's hillside identity is preserved. These building standards should then be used to ensure views before development approval.	**No.** The 150-foot ridgeline buffer would protect the ridgeline and the hills as seen offsite. The policy makes it clear that it refers to view from adjacent properties. However, the visual analysis shows that there will be views of the development from distant viewpoints.
***Policy 4-P-4: Develop and implement use of a "Design Review Checklist" for all new hillside development, to ensure that conservation and site layout policies within the General Plan are considered.	**Yes.** The proposed Master Plan contains Urban Design Guidelines to comply with this intent.
Policy 4-P-6: Ensure that developers of new residential projects in the southern hills plant trees and other vegetation along collector and arterial roadways, in order to maintain the sense of "rural" open space at the City's southern boundary. Although residential developers should restrict planting of trees and landscaping that will block views of the hills from other areas of the City, or views of Suisun Bay from hillside streets, vegetation along new roadways will contribute to the goal of retaining a sense of open space.	**Yes.** The Master Plan contains Urban Design Guidelines to comply with this intent.
Policy 4-P-7: Ensure that design treatment of new development at the City's southern boundary retains a rural feel by:	**Yes.** The current application does not contain the level of detail to

• Discouraging the use of solid walls along these edges (fences must be visually permeable; however, discourage use of chain link in front and side yards); • Using materials and design to promote a rural feeling (for example, wooden or other rustic materials); and • Encouraging development at the outer edge of the City to face outwards toward the rural landscape (preventing a solid wall of residential back yard fences).	evaluate compliance with this policy. However, the design of the project could comply with the intent of these policies.
***Goal 4-G-4: Encourage development that preserves unique natural features, such as topography, rock outcroppings, mature trees, creeks, and ridgelines, in the design of hillside neighborhoods.	**Requested Amendment.** The application requests an amendment to this policy shown below with underlined text that would clarify that the reference to ridgelines refers to those that have been designated in the General Plan as either major or minor ridgelines. Goal 4-G-4 Encourage development that preserves unique natural features, such as topography, rock outcroppings, mature trees, creeks, and <u>designated major and minor</u> ridgelines, in the design of hillside neighborhoods.
Goal 4-G-5: Encourage a sense of rural character in the design and construction of hillside development, including extensive landscaping, rooftop terraces, sloping rooflines, and use of natural materials.	**Yes.** The intent of the Urban Design Guidelines within the proposed

	Master Plan would be to comply with this policy.
***Policy 4-P-9: Encourage new hillside development to preserve unique natural features by mapping all natural features as part of development applications, including landforms, mature tree stands, rock outcroppings, creek ways, and ridgelines. During development and design review, ensure that site layout is sensitive to such mapped features.	**No.** The Master Plan would preserve the ridge line with the 150-foot setback for development from the top of the ridge line. There is a creek running through the central portion of the project site that would be removed by the proposed mass grading for the development. There are no other mapped unique natural features.
***Policy 4-P-10: Minimize grading of the hillsides. Amend the City's Zoning Ordinance to allow density bonuses of 10 percent (maximum) for new hillside development that preserves 40 percent of natural hill contours. Extensive grading of hillsides has the potential to destroy their irregular character and increase risk of geologic and landslide hazards. Encourage developers to grade only building pads, and to blend the graded area with adjacent hillside properties.	**REQUESTED DELETION.** The Master Plan designates acres as open space and acres for development. The developed area would require substantial grading to create level building pads which would destroy the irregular character of the topography noted in the policy.
Policy 4-P-11: Limit grading of hillside areas over 30 percent slope (see Figure 10-1 in Pittsburg General Plan) to elevations less than 900 feet, foothills, knolls, and ridges not classified as major or minor ridgelines (see Figure 4-2 in Pittsburg General Plan).	**Requested Amendment.** The applicant requests an amendment to this policy as shown by the following underlined wording. Limit grading of hillside areas over 30 percent slope (see Figure 10-1 in Pittsburg General Plan) to elevations less than 900 feet, foothills, knolls, and ridges not classified as major or

	minor ridgelines (see Figure 4-2 in Pittsburg General Plan), unless deemed necessary for slope stability. During review of development plans, ensure that necessary grading respects significant natural features and visually blends with adjacent properties.
***Policy 4-P-12: Encourage terracing in new hillside development to be designed in small incremental steps. Extensive flat pad areas should be limited.	**REQUESTED DELETION**. There would be mass grading to create level building pads.
Policy 4-P-13 Revise the City's development permitting requirements to include erosion control and re-vegetation programs as part of grading plans for new hillside development. Where erosion potential exists, hydro-seeding, silt traps, or other engineering solutions may be required. Using re-vegetation as an erosion control measure also contributes to the aesthetic, natural character of a hillside.	**Yes.** This would be required as a mitigation measure.
***Policy 4-P-14: Preserve natural creeks and drainage courses as close as possible to their natural location and appearance. "Man-made" streams (manufactured drainage courses designed to simulate natural creeks) draining into natural creeks are preferable to concrete channels for ensuring adequate surface drainage in new hillside development.	**REQUESTED DELETION.** The mass grading in the central portion of the project site would remove the one natural creek.
***Policy 4-P-15: Minimize the visual prominence of hillside development by taking advantage of existing site features for screening, such as tree clusters, depressions in topography, setback hillside plateau areas, and other natural features.	**NO.** The visual analysis shows that from distant offsite viewpoints, the development would blend into the background. However on the

	project site itself the mass grading would eliminate that natural features to create level building pads.
Policy 4-P-19: Encourage lot configuration such that perimeter walls and fences along arterial corridors within the southern hills are not needed.	**Possible.** This could be accomplished through site design.
***Policy 4-P-20: Discourage lot orientation that fronts onto the cross-slope of street segments on steep grades. ***Policy 4-P-21: Encourage single-loaded streets parallel to steep slopes, with placement of lots on the uphill side of the street, such that homes front down-slope and allow open vistas from the public street.	**REQUESTED DELETION.** It is not the intent of the applicant to create single-loaded streets.
***Policy 4-P-22: Discourage placement of lots that allow the rear of homes to be exposed to lower elevation views.	**REQUESTED DELETION.** We will not be able to determine compliance to this policy until the Tentative Map is filed.
Policy 4-P-24: Building Forms should be "stepped" to conform to site topography. Encourage the use of rooftop decks atop lower stories. Discourage construction of decks on poles over sloped areas; they make buildings seem more massive from downhill lots.	**No.** The applicant is proposing mass grading to create building pads which would not conform to the site topography.
***Policy 4-P-25: During development review, encourage residential rooflines that are oriented in the same direction as the natural hillside slope.	**REQUESTED DELETION.** Given the proposed mass grading of the site to provide level building pads, the project would not retain the natural hillside slopes.
***Policy 4-P-26: Reflect the predominant colors and textures within the surrounding landscape in selection of building materials for hillside development. Roof colors should tend toward darker earth tones, so that they are less visible from adjacent or upslope properties.	**REQUESTED DELETION.** The applicant has indicated that they would not be able to conform to this policy.

Preferred building materials include wood siding, exposed wooden structural elements, and natural-colored stucco. Clustering new residential development will retain open space within the southern hills. During design review, encourage open space pockets within the most visible hillside slopes.	**Yes.** As noted above the visual analysis shows that the views of open space in the southern hills would remain because there are hill forms that screen the interior of this site from distant viewers.
Policy 4-P-27: Maximize water conservation, fire resistance, and erosion control in landscape design through use of sturdy, native species. Use irregular planting on graded slopes to achieve a natural appearance.	**Possible.** This can be incorporated into the project design.
***Policy 4-P-28: Encourage developers to align and construct streets along natural grades. Minimize visibility of streets from other areas within the City (see Figure 4-7 in the Pittsburg General Plan).	**No.** The mass grading on the developed portions of the project site will eliminate the natural grades.
***Policy 4-P-29: Encourage the construction of split roadways on steep hillsides, where appropriate. Split roadways allow the integration of natural features, such as mature trees and rock outcroppings, into the street design. Additionally, landscaping is increased and medians can be used to collect drainage flows.	**No.** The mass grading will level out the steep hillsides such that split roadways would not be built.
Policy 4-P-30: Ensure that all residential developers provide multi-use trails or trailheads connecting to local schools and parks, commercial centers, and regional open spaces.	**Possible.** This can be incorporated into the project when detailed plans are submitted.

Because housing will be clustered in hillside areas, the provision of trails through remaining open space areas will provide connections to employment, shopping, and recreation centers within the City's flatlands.	
Policy 4-P-31: Provide on-street parking along hillside roads in parking bays where topography allows.	**Possible**. This can be incorporated into the project when detailed plans are submitted.
Resource Conservation Element	
Policy 9-P-5: Work with Contra Costa County, the East Bay Regional Park District, and the City of Antioch, to expand the regional open-space system in the southern hills to preserve California annual grasslands habitat.	**Yes.** The proposed open space designation on the Master Plan complies with this intent.
Goal 9-G-2: Guide development in such a way that preserves significant ecological resources.	**Yes.** The project conforms to this Policy because the only significant ecological resource identified is the California Tiger Salamander habitat on the site. This habitat would be protected under the Open Space designation in the Master Plan.
Policy 9-P-7: During the design of hillside residential projects, encourage clustering of housing to preserve large, unbroken blocks of open space, particularly within sensitive habitat areas. Encourage the provision of wildlife corridors to ensure the integrity of habitat linkages.	**Yes.** The Master Plan preserve large unbroken blocks of open space including the sensitive California Tiger Salamander habitat which includes the area designated in the HCP as a wildlife corridor for that species.
Policy 9-P-8: As a condition of approval of new development, ensure re-vegetation of cut-and-fill slopes with native plant species.	**Yes.** This would be included as a condition of approval.

In addition, planting on some existing slopes could contribute to Pittsburg's image and would be a justified public cost.	

EXHIBIT 7

2022 SCOPING PLAN FOR ACHIEVING CARBON NEUTRALITY

NOVEMBER 16, 2022

CALIFORNIA AIR RESOURCES BOARD

Table of Contents

List of Figures

List of Tables

List of Appendices

Abbreviations

°F	Fahrenheit
°C	Celsius
AB	Assembly Bill
AQMD	Air Quality Management District
AR5	IPCC Fifth Assessment Report
BECCS	bioenergy with carbon capture and storage
CAISO	California Independent System Operator
CalEPA	California Environmental Protection Agency
CalGEM	California Geologic Energy Management Division
CalSTA	California State Transportation Agency
CAP	climate action plan
CARB	California Air Resources Board
CCR	California Code of Regulations
CCS	carbon capture and sequestration
CCUS	carbon capture, utilization, and storage
CDFA	California Department of Food and Agriculture
CDPH	California Department of Public Health
CDR	carbon dioxide removal
CE	common era
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CES	CalEnviroScreen
CH_4	methane
CMAQ	Community Multiscale Air Quality
CNRA	California Natural Resources Agency
CO_2	carbon dioxide
COPD	chronic obstructive pulmonary disease

CORE	Clean Off-Road Equipment
CPUC	California Public Utilities Commission
CVM	Climate Vulnerability Metric
DAC	direct air capture
DPR	Department of Pesticide Regulation
Draft EA	Draft Environmental Analysis for this Scoping Plan
EA	Environmental Analysis
ED	emergency department
EIA	U.S. Energy Information Administration
EJ	environmental justice
EJ Advisory Committee	Environmental Justice Advisory Committee
EO	executive order
EV	electric vehicle
F-gas	fluorinated gas
FCEV	fuel cell electric vehicle
GCF	Governors' Climate and Forests Task Force
GDP	gross domestic product
GHG	greenhouse gas
GSP	gross state product
GW	gigawatt
GWh	gigawatt-hour
GWP	global warming potential
HDV	heavy-duty vehicle
HD ZEV	heavy-duty zero-emission vehicle
HFC	hydrofluorocarbon
IBank	Infrastructure and Economic Development Bank
ICE	internal combustion engine
IPCC	Intergovernmental Panel on Climate Change

IPT	incidence-per-ton
IWG	Interagency Working Group
LCFS	low-carbon fuel standard
LDV	light-duty vehicle
MDV	medium-duty vehicle
MMT	million metric tons
$MMTCO_2e$	million metric tons of carbon dioxide equivalent
MOU	memorandum of understanding
MRR	Mandatory Reporting of GHG Emissions
$MTCO_2e$	metric tons of carbon dioxide equivalent
MW	megawatt
N_2O	nitrous oxide
NEMS	National Energy Systems Model
NF_3	nitrogen trifluoride
NOAA	National Oceanic and Atmospheric Administration
NOx	nitrogen oxides
NRDC	National Resources Defense Council
NWL	Natural and Working Lands
OEHHA	Office of Environmental Health Hazard Assessment
OGV	Ocean-Going Vessel
OPR	Governor's Office of Planning and Research
OTC	once-through cooled
PFC	perfluorocarbon
PHMSA	Pipelines and Hazardous Materials Safety Administration
PM	particulate matter
$PM_{2.5}$	fine particulate matter
PPP	public-private partnership
RFS	renewable fuel standard

ROG	reactive organic gases
RPS	Renewables Portfolio Standard
SB	Senate Bill
$SC\text{-}CH_4$	social cost of methane
$SC\text{-}CO_2$	social cost of carbon
SC-GHG	social cost of greenhouse gases
$SC\text{-}N_2O$	social cost of nitrous oxide
SF_6	sulfur hexafluoride
SGIP	Self-Generation Incentive Program
SLCP	short-lived climate pollutant
TSD	Technical Support Document
UC	University of California
UCLA	University of California, Los Angeles
UNFCCC	United Nations Framework Convention on Climate Change
U.S. EPA	United States Environmental Protection Agency
VMT	vehicle miles traveled
WUI	wildland-urban interface
ZEV	zero-emission vehicle

Executive Summary

This Scoping Plan lays out the sector-by-sector roadmap for California, the world's fifth[1] largest economy, to achieve carbon neutrality by 2045 or earlier, outlining a technologically feasible, cost-effective, and equity-focused path to achieve the state's climate target. This is a challenging but necessary goal to minimize the impacts of climate change. There have been three previous Scoping Plans. Previous plans have focused on specific greenhouse gas (GHG) reduction targets for our industrial, energy, and transportation sectors—first to meet 1990 levels by 2020, then to meet the more aggressive target of 40 percent below 1990 levels by 2030. This plan, addressing recent legislation and direction from Governor Newsom, extends and expands upon these earlier plans with a target of reducing anthropogenic emissions to 85 percent below 1990 levels by 2045. This plan also takes the unprecedented step of adding carbon neutrality as a science-based guide and touchstone for California's climate work. The plan outlines how carbon neutrality can be achieved by taking bold steps to reduce GHGs to meet the anthropogenic emissions target and by expanding actions to capture and store carbon through the state's natural and working lands and using a variety of mechanical approaches.

What this means for California is an ambitious and aggressive approach to decarbonize every sector of the economy, setting us on course for a more equitable and sustainable future in the face of humanity's greatest existential threat, and ensuring that those who benefit from this transformation include communities hardest hit by climate impacts and the ongoing pollution from the use of fossil fuels. The combustion of fossil fuels has polluted our air—particularly in low-income communities and communities of color—for far too long and is the root cause of climate change. This Scoping Plan helps us chart the path to a future where race and class are no longer predictors of disproportionate burdens from harmful air pollution and climate impacts.

The major element of this unprecedented transformation is the aggressive reduction of fossil fuels wherever they are currently used in California, building on and accelerating carbon reduction programs that have been in place for a decade and a half. That means rapidly moving to zero-emission transportation; electrifying the cars, buses, trains, and trucks that now constitute California's single largest source of planet-warming pollution. It also means phasing out the use of fossil gas used for heating our homes and buildings. It means clamping down on chemicals and refrigerants that are thousands of times more powerful at trapping heat than carbon dioxide (CO_2). It means providing our communities

[1] In October 2022, California was poised to become the world's fourth largest economy.

with sustainable options for walking, biking, and public transit to reduce reliance on cars and their associated expenses. It means continuing to build out the solar arrays, wind turbine capacity, and other resources that provide clean, renewable energy to displace fossil-fuel fired electrical generation. It also means scaling up new options such as renewable hydrogen for hard-to-electrify end uses and biomethane where needed. Successfully achieving the outcomes called for in this Scoping Plan would reduce demand for liquid petroleum by 94 percent and total fossil fuel by 86 percent in 2045 relative to 2022.[2] Despite these world-leading efforts, some amount of residual emissions will remain from hard-to-abate industries such as cement, internal combustion vehicles still on the road, and other sources of GHGs, including high global warming chemicals used as refrigerants.

The plan addresses these remaining emissions by re-envisioning our natural and working lands—forests, shrublands/chaparral, croplands, wetlands, and other lands—to ensure they play as robust a role as possible in incorporating and storing more carbon in the trees, plants, soil, and wetlands that cover 90 percent of the state's 105 million acres while also thriving as a healthy ecosystem. Modeling indicates that natural and working lands will not, on their own, provide enough sequestration and storage to address the residual emissions. For that reason, it is necessary to research, develop, and deploy additional methods of capturing CO_2 that include pulling it from the smokestacks of facilities, or drawing it out of the atmosphere itself and then safely and permanently utilizing and storing it, as called for in recent legislation. Carbon removal also will be necessary to achieve net negative emissions to address historical GHGs already in the atmosphere.

This is a plan that aims to shatter the carbon status quo and take action to achieve a vision of California with a cleaner, more sustainable environment and thriving economy for our children. This ambitious plan will serve as a model for other partners around the world as they consider how to make their transition. As we have so often in the past, California can continue to serve as a leader in innovation that has produced not only the fifth largest economy on the planet, but ultimately one of the most energy-efficient economies, with a track record of demonstrating the ability to decouple economic growth from carbon pollution. This plan also builds upon current and previous environmental justice efforts to integrate environmental justice directly into the plan, to ensure that all communities can reap the benefits of this transformational plan. Specifically, this plan:

[2] See *https://ww2.arb.ca.gov/sites/default/files/2022-11/2022-sp-PATHWAYS-data-E3.xlsx* for energy demand reductions.

- Identifies a path to keep California on track to meet its SB 32 GHG reduction target of at least 40 percent below 1990 emissions by 2030.
- Identifies a technologically feasible, cost-effective path to achieve carbon neutrality by 2045 and a reduction in anthropogenic emissions by 85 percent below 1990 levels.
- Focuses on strategies for reducing California's dependency on petroleum to provide consumers with clean energy options that address climate change, improve air quality, and support economic growth and clean sector jobs.
- Integrates equity and protecting California's most impacted communities as driving principles throughout the document.
- Incorporates the contribution of natural and working lands (NWL) to the state's GHG emissions, as well as their role in achieving carbon neutrality.
- Relies on the most up-to-date science, including the need to deploy all viable tools to address the existential threat that climate change presents, including carbon capture and sequestration, as well as direct air capture.
- Evaluates the substantial health and economic benefits of taking action.
- Identifies key implementation actions to ensure success.

The path forward is informed by robust science. The recent Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC) summarizes the latest scientific consensus on climate change. It finds that atmospheric concentrations of CO_2 have increased by 50 percent since the industrial revolution and continue to increase at a rate of two parts per million each year.[3] By the 2030s, and no later than 2040, the world will exceed 1.5°C warming unless there is drastic action. While every tenth of a degree matters—every incremental increase in warming brings additional negative impacts—climate-related risks to human health, livelihoods, and biodiversity are projected to increase further under 2°C warming, compared to 1.5°C.[4] For example, at 1.5°C of global warming, we would experience increasing heat waves, longer warm seasons, and shorter cold seasons, but at 2°C of global warming, heat extremes would more often reach critical tolerance thresholds for human health and agriculture.[5] We are already seeing unprecedented climate change impacts, such as continued sea level rise, that are

---

[3] IPCC. 2021. *Climate Change 2021: The Physical Science Basis.* Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press. https://www.ipcc.ch/report/ar6/wg1/.

[4] IPCC. 2018. *Global Warming of 1.5°C.* World Meteorological Organization. Geneva, Switzerland. 32 pp. https://www.ipcc.ch/sr15/.

[5] IPCC. 2021. Climate change widespread, rapid, and intensifying – IPCC. August. *https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/.*

"irreversible" for centuries to millennia, and we are dangerously close to hitting 1.5ºC in the near term.[6] To avoid climate catastrophe and remain below 1.5°C with limited or no overshoot of that threshold, global net anthropogenic CO_2 emissions need to reach net zero by 2050.

It has been 16 years since the Global Warming Solutions Act of 2006 was passed and signed into law. In 2017, the second update to the Assembly Bill (AB) 32 Climate Change Scoping Plan[7] (2017 Scoping Plan) laid out a cost-effective and technologically feasible path to achieve the 2030 GHG reduction target. At the time, many characterized the plan and the AB 32 target as unachievable, citing that it would lead to massive business and job loss, and excessive costs. Those predictions proved to be incorrect as California achieved its AB 32 target years ahead of schedule, all the while growing our economy, with the state distinguishing itself as a hub for green technology investment. This Scoping Plan draws on a decade and a half of proven successes and additional new approaches to provide a balanced and aggressive course of effective actions to achieve carbon neutrality in 2045, if not before, in addition to the 2030 goal.

California's economy is projected to grow vigorously in the coming years and decades. In 2045, under a Reference Scenario, the gross state product would be $5.1 trillion, nearly $2 trillion more than in 2021, and allow growth that would add hundreds of thousands of jobs. Under the Scoping Plan scenario, impacts to economic and job growth would be negligible in both 2035 and 2045, while delivering $199 billion of benefits in the form of reduced hospitalizations, asthma cases, and lost work and school days due to the cleaner air supported by this plan. This should come as no surprise given the tremendous growth of California's economy since the Great Recession of 2007–2009, even as the state has taken drastic measures to lower emissions. As noted, the savings associated with ambitious climate action are extensive, both in terms of avoided climate impacts and health costs. As described in Chapter 1, the health costs of climate and air pollution in the U.S. are well over $800 billion today and will continue to grow in the coming years[8] without robust action. Similarly, the costs of delayed or insufficient climate action could cost the

---

[6] United Nations. 2021. IPCC report: 'Code red' for human driven global heating, warns UN chief. August 9. *https://news.un.org/en/story/2021/08/1097362*.

[7] CARB. 2017. *California's 2017 Climate Change Scoping Plan.* *https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf*.

[8] Alwis, D. D., and V. S. Limaye. No date. *The Costs of Inaction: The Economic Burden of Fossil Fuels and Climate Change on Health in the United States.* NRDC, The Medical Society Consortium on Climate and Health, and WHPCA. https://www.nrdc.org/sites/default/files/costs-inaction-burden-health-report.pdf.

U.S. upwards of $14.5 trillion over the next 50 years.[9] We can either take action now or pay the cost of inaction, both now and later.

We cannot take on this unprecedented challenge alone. Collaboration with the federal government, other U.S. states, and other jurisdictions around the world will continue to be fundamental for California to succeed in achieving its climate targets, especially as the pace of our efforts increases in the coming years. We believe this collaboration and coordination also creates a race to the top, encouraging and enabling other jurisdictions to achieve climate and air quality goals as well, and often providing lessons for national action.

One example of fruitful collaboration is California's longstanding vehicle emissions standards programs, which have repeatedly been freely adopted by other states, consistent with the federal Clean Air Act. California's programs frequently pioneer more rigorous standards or new technologies—such as the now-standard catalytic converter and the rules that led directly to the nation-leading numbers of zero-emission vehicles on our roads today. From initial standards for cars and trucks decades ago to the world-leading Advanced Clean Trucks program currently helping to electrify heavy-duty vehicles, this partnership continues to offer regulatory options and spread innovative technologies. A major example of future work is the Advanced Clean Cars II program, which lays out California's legally binding path to achieving 100 percent zero emission vehicle (ZEV) sales in 2035.[10] The California Air Resources Board (CARB) continues to work closely with many other states that also see zero-emission vehicles as critical to their climate and public health goals and expects many states to choose to adopt this regulation as well. This partnership with other states also creates market certainty for automakers, which in turn helps to ensure that California consumers have access to a variety of ZEVs at multiple price points.

The Scoping Plan Process

Four scenarios were extensively modeled to develop this Scoping Plan, with the objective of informing the most viable path to remain on track to achieve our 2030 GHG reduction target: a reduction in anthropogenic emissions by 85% below 1990 levels and carbon neutrality by 2045. All four have their merits and are informed by stakeholder input. The scenario ultimately chosen as the basis of this Scoping Plan is the alternative that most

---

[9] Deloitte. 2022. *The Turning Point: A New Economic Climate in the United States.* https://www2.deloitte.com/content/dam/Deloitte/us/Documents/about-deloitte/us-the-turning-point-a-new-economic-climate-in-the-united-states-january-2022.pdf?id=us:2el:3dp:wsjspon:awa:WSJSBJ:2021:WSJFY22.

[10] Executive Department. State of California. Executive Order N-79-20. *https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf*.

closely aligns with existing statute and Executive Orders. It was selected because it best achieves the balance of cost-effectiveness, health benefits, and technological feasibility.

For the first time, this Scoping Plan includes modeling and quantification of GHG emissions and carbon sequestration in natural and working lands (NWL). To date, the focus has been only on reducing the emissions of GHGs from our transportation, energy, and industrial sectors. The state's 2020 and 2030 GHG reductions targets only include these sources, as they are the primary drivers of climate change and disproportionate harmful air pollution in our vulnerable communities. This Scoping Plan, through the lens of carbon neutrality, expands the scope to more meaningfully consider how our NWL contribute to our long-term climate goals. For the first time, new and cutting-edge modeling tools allow us to estimate the quantitative ability of our forests and other landscapes to remove and store carbon under different scenarios. These cutting-edge tools were developed through a stakeholder process and in coordination with other agencies for the purpose of this update and will continue to be refined over time and made available to others seeking to do similar work.

As recent data and Scoping Plan modeling shows, our NWL also can act as a source of emissions, principally in the form of wildfires. California's forests are experiencing a deadly combination of drought and heat combined with a century of misguided fire suppression management. Scoping Plan modeling shows that, at this time and until our forests reach a balance through appropriate treatments, California's NWL will act as a net source of emissions, not a sink. As such, the Scoping Plan includes policy direction and actions intended to quickly move the sector toward being a net sink and a more natural state, where wildfires will continue to be an important part of the healthy forest cycle but not at the intensity and frequency observed in recent years.

Development of this Scoping Plan also includes careful consideration of, and coordination with, other state agencies, consistent with Governor Gavin Newsom's whole-of-government approach to tackling climate change. State agency plans and regulations, including the SB 100 Joint Agency Report,[11] State Implementation Plan, Climate Action Plan for Transportation Infrastructure,[12] AB 74 Studies on Vehicle Emissions and Fuel

[11] California Public Utilities Commission (CPUC), California Energy Commission (CEC), and CARB. 2021. *SB 100 Joint Agency Report.* https://www.energy.ca.gov/sb100.

[12] California State Transportation Agency (CalSTA). 2021. Climate Action Plan for Transportation Infrastructure. https://calsta.ca.gov/subject-areas/climate-action-plan.

Demand and Supply,[13,14,15] Short-Lived Climate Pollutant Strategy (SLCP Strategy),[16] CARB's Achieving Carbon Neutrality Report,[17] Climate Smart Lands Strategy,[18] Natural Working Land Implementation Plan,[19] and the California Climate Insurance Report: *Protecting Communities, Preserving Nature, and Building Resiliency,*[20] among others, provided critical inputs and data points for this plan. This Scoping Plan is the product of work by multiple agencies across the Administration, including dozens of public workshops and years of rigorous analysis and economic modeling by California's leading institutions. This cooperation on planning lays the foundation for even closer coordination among and between state agencies to put the plan into effect.

The plan is also the product of tireless efforts of, and recommendations from, the AB 32 Environmental Justice Advisory Committee (EJ Advisory Committee). The EJ Advisory Committee, created by statute, plays a critical role to inform the development of each Scoping Plan and helps to ensure environmental justice is integrated throughout the plan. CARB reconvened the EJ Advisory Committee in early 2021 to advise on the development of this Scoping Plan. In their advisory role, the EJ Advisory Committee has worked together to provide inputs to CARB to inform the development of scenarios and the associated modeling. And in April 2022, the EJ Advisory Committee provided draft preliminary recommendations in advance of the Draft 2022 Scoping Plan to help ensure the draft plan meaningfully addresses environmental justice. The CARB Board and EJ Advisory Committee held a joint board hearing on September 1, 2022, where the EJ Advisory Committee presented their final recommendations on the Scoping Plan. Over five dozen of the recommendations are reflected in the Scoping Plan. Going forward, as this plan is ultimately acted on by the Board, ongoing input from the EJ Advisory

---

[13] California Environmental Protection Agency (CalEPA). 2021. Carbon Neutrality Studies. https://calepa.ca.gov/climate/carbon-neutrality-studies/.

[14] Brown, A. L., et. al. 2021. *Driving California's Transportation Emissions to Zero.* University of California Institute of Transportation Studies. https://escholarship.org/uc/item/3np3p2t0.

[15] Deschenes, O. 2021. *Enhancing equity while eliminating emissions in California's supply of transportation fuels.* University of California Santa Barbara. https://zenodo.org/record/4707966#.YKPiaKhKi73.

[16] CARB. Short-Lived Climate Pollutants. https://ww2.arb.ca.gov/our-work/programs/slcp.

[17] Energy and Environmental Economics, Inc. 2020. *Achieving Carbon Neutrality in California: PATHWAYS Scenarios Developed for the California Air Resources Board*. October. *https://ww2.arb.ca.gov/sites/default/files/2020-10/e3_cn_final_report_oct2020_0.pdf*.

[18] California Natural Resources Agency (CNRA). 2021. Draft Climate Smart Lands Strategy. *https://resources.ca.gov/Initiatives/Expanding-Nature-Based-Solutions.*

[19] CARB. 2019. *Draft California 2030 Natural and Working Lands Climate Change Implementation Plan. https://ww2.arb.ca.gov/resources/documents/nwl-implementation-draft.*

[20] California Department of Insurance. 2021. *Protecting Communities, Preserving Nature, and Building Resiliency. climate-insurance-report.pdf (ca.gov).*

Committee will be essential to address environmental justice and achieve the ambitious vision outlined in the plan throughout its implementation in the coming years.

Importantly, per legislative direction, the Scoping Plan development includes modeling and analyses of emissions, economics, air quality, health, jobs, and public health. This work is important to inform the discussion around trade-offs and how to balance the various legislative direction in identifying a path to achieve the state's climate goals. The technical work serves as a backdrop to what this means to Californian's daily lives—to how they will work, play, and live as we act to eliminate fossil fuel combustion and achieve the many public health and environmental benefits that will result from that action.

Ensuring Equity and Affordability

The state has a long history of public health and environmental protection. However racist and discriminatory practices such as redlining have resulted in low-income communities and communities of color being disproportionately exposed to health hazards and pollution burdens.[21] These communities are often located adjacent to major roadways and large stationary sources that not only emit GHGs, but also harmful localized air pollution. The plan delivers on the promise to transform the way we move, live, and work by nearly eliminating our dependence on fossil fuels. It includes effective actions to move with all possible speed to clean energy, zero-emission cars and trucks, energy-efficient homes, sustainable agriculture, and resilient NWL. And it prioritizes working with the communities most impacted to ensure that these strategies address their needs.

An important part of our equity consideration is ensuring the transition to a zero-emission economy is affordable and accessible, and that it uplifts disadvantaged, low-income communities and communities of color. Some aspects of the transition will have associated costs (e.g., escalating efforts to retrofit existing homes and businesses to support electric appliances and vehicles and increased costs of insurance). The state must ensure that these costs do not disproportionately burden consumers. In addition, the state has an important role to play in providing financial incentives, especially to low-income consumers, to allow for uptake of clean technologies. The Department of Community Services and Development's Low Income Weatherization Program is a prime example of this approach, enabling low-income Californians to be part of the zero-emission transition, all while lowering energy bills. The program provides low-income households with solar photovoltaic systems and energy efficiency upgrades at no cost to residents, helping cushion the impact of climate change on vulnerable communities.

---

[21] CalEPA. 2021. Pollution and Prejudice: Redlining and Environmental Injustice in California. August 16. https://storymaps.arcgis.com/stories/f167b251809c43778a2f9f040f43d2f5.

With this Scoping Plan, the state also adds another tool to help identify and close climate change impact gaps that will emerge over time. As California invests in climate mitigation and adaptation, it is essential to understand the relative impact of climate change across the state's diverse communities. We know not all communities are equally resilient in the face of climate impacts due to persisting health and opportunity gaps. We also know that a global metric such as the Social Cost of Carbon cannot adequately capture the incremental additional impact faced by overly burdened communities. The Climate Vulnerability Metric (CVM) is specifically focused on quantifying the community-level impacts of a warming climate on human welfare.

Energy and Technology Transitions

To support the transformation needed, we must build the clean energy production and distribution infrastructure for a carbon-neutral future. The solution will have to include transitioning existing energy production and transmission infrastructure to produce zero-carbon electricity and hydrogen, and utilizing biogas resulting from wildfire management or landfill and dairy operations, among other substitutes. In almost all sectors, electrification will play an important role. That means that the grid will need to grow at unprecedented rates and ensure reliability, affordability, and resiliency through the next two decades and beyond. It also means we need to keep all options on the table, as it will take time to fully grow the electricity grid to be the backbone for a decarbonized economy. We also know that electrification is not possible in all situations. As such, this plan systematically evaluates and identifies feasible clean energy and technology options that will bring both near-term air quality benefits and deliver on longer-term climate goals.

This transition will not happen overnight. It will take time and planning to ensure a smooth transition of existing energy infrastructure and deployment of new clean technology. And while this Scoping Plan has the longest planning horizon of any Scoping Plan to date, this 25-year horizon is still relatively short in terms of transforming California's economy. We must avoid making choices that will lead to stranded assets and incorporate new technologies that emerge over time. Importantly, given the pace at which we must transition away from fossil fuels, we absolutely must identify and address market and implementation barriers to be successful. The scale of transition includes adding four times the solar and wind capacity by 2045 and about 1,700 times the amount of current hydrogen supply.

As we transition our energy systems, we must also rapidly deploy the clean technologies that rely on a decarbonized grid. As called for in Executive Order N-79-20, all new passenger vehicles sold in California will be zero-emission by 2035, and all other fleets will have transitioned to zero-emission as fully possible by 2045. This means the percentage of fossil fuel combustion vehicles will continue to rapidly decrease, becoming a fading vision of the past. Successful implementation of this Executive Order (EO) and other zero-emission priorities will have to be attractive to consumers. As an example, electric and hydrogen transportation refueling must be readily accessible, and active transportation and clean transit options must be cheaper and more convenient than driving.

Cost-Effective Solutions Available Today

Ultimately, to achieve our climate goals, urgent efforts are needed to slash GHG emissions. Fortunately, cost-effective solutions are available to do so in many cases. In short, this plan relies on existing technologies—it does not require major technological breakthroughs that are highly uncertain.

For example, targeted action to reduce methane emissions can be achieved at low or negative cost, and with significant near-term climate and public health benefits. In many cases, renewable energy and energy storage are cheaper than polluting alternatives, and are already firmly part of our business-as-usual approach; modeling related to the most recent integrated resource planning process at the California Public Utilities Commission (CPUC) has shown that scenarios associated with the best emissions outcomes had the lowest average rates. As another example, research from Energy Innovation shows that the U.S. can achieve 100 percent zero-carbon power by 2035 without increasing customer costs.[22]

The same is either already true, or soon to be true, for zero-emission vehicles as well. Myriad studies show cost parity for light-duty and heavy-duty ZEVs being achieved by mid-decade or shortly thereafter. A carbon neutrality study conducted by the University of California (UC) Institute of Transportation Studies and funded by the California Environmental Protection Agency (CalEPA) shows that achieving carbon neutrality in the transportation sector will *save* Californians $167 billion through 2045.[23] Similar research from the Goldman School of Public Policy at UC Berkeley finds that achieving 100 percent light-duty ZEV sales nationwide would save consumers $2.7 trillion through 2050; equivalent to $1,000 per household, per year, for 30 years.[24]

Many of these outcomes are a direct result of California's vision and policy development to advance clean energy and climate solutions, including through the Renewables Portfolio Standard, Advanced Clean Cars II regulations, SLCP Reduction Strategy, and

---

[22] Phadke, A. et al. 2020. "Illustrative Pathways to 100 Percent Zero Carbon Power by 2035 Without Increasing Customer Costs, Energy Innovation." September. *https://energyinnovation.org/wp-content/uploads/2020/09/Pathways-to-100-Zero-Carbon-Power-by-2035-Without-Increasing-Customer-Costs.pdf*.
[23] Brown, A. L., et al. 2021. *Driving California's Transportation Emissions.* *http://dx.doi.org/10.7922/G2MC8X9X*. Retrieved from https://escholarship.org/uc/item/3np3p2t0.
[24] Goldman School of Public Policy. 2021. *2035: The Report: Transportation.* UC Berkeley. April. *https://www.2035report.com/transportation/*.

others. While the world collectively has not yet fully deployed clean energy and climate solutions at the scale needed to adequately address climate change, California has made tremendous progress—even since the last Scoping Plan update in 2017. Continued ambition, leadership, and climate policy development from California will help the state achieve the scale of emissions reductions needed from technologies and strategies that are already cost-effective or close to it today, and will move additional technologies and strategies to that point in the near future. Achieving those outcomes and reducing costs for the entire array of climate solutions needed to achieve carbon neutrality and then maintain net-negative emissions will prove the true measure of California's success. This will enable California to not just meet our own climate targets, but to ultimately develop the replicable solutions that can scale globally to address global warming.

Continue with a Portfolio Approach

Over the past decade and a half, the state has undertaken a successful three-pronged approach to reducing GHGs: incentives, regulations, and carbon pricing. The 2017 Scoping Plan leveraged existing programs such as the Renewables Portfolio Standard, Advanced Clean Cars, Low Carbon Fuel Standard, Short-lived Climate Pollutant Strategy, mobile source measures to achieve federal air quality targets, and a Cap-and-Trade Program, among others, to lay out a technologically feasible and cost-effective path to achieve the 2030 GHG reduction target. When looking toward the 2045 climate goals and the deeper GHG reductions needed across the AB 32 GHG Inventory sectors, all of the existing programs must be evaluated and, as necessary, strengthened to support the rapid production and deployment of clean technology and energy, as well as the increased pace and scale of actions on our natural and working lands.

The challenge before us requires us to keep all tools on the table. Given the climate mitigation co-benefits, critical actions to deliver near-term air quality benefits, such as those included in the State Implementation Plan to achieve the federal air quality standards, are incorporated into this Scoping Plan, as are new legislative mandates to decarbonize the electricity and cement sectors. And, if additional gaps are identified, new programs and policies must be developed and implemented to ensure all sectors are on track to reduce emissions. Opportunities to leverage these programs to address ongoing air quality disparities must also be considered, along with targeted environmental justice policies such as the AB 617 Community Air Protection Program and the investments made possible through the California Climate Investments Program.

Conclusion

California has never undertaken such a comprehensive, far-reaching, and transformative approach to fighting climate change as that called for in this plan. Once implemented, it will place every aspect of how we live, work, play, and travel in California on a more sustainable footing, with a focus on directly benefitting those communities already most burdened by pollution. This comprehensive approach reflects how climate change is already changing life in California. We have all experienced the impacts of devastating wildfires, extreme heat, and drought. Despite much progress, California still has some of the worst air pollution in the nation, especially in the San Joaquin Valley and the Los Angeles Basin, which is driven by the continued use of fossil fuel-powered trucks and cars.

This Scoping Plan provides a solution; a way forward and a vision of a California where we can and will address those impacts. This plan is fundamentally based on hope. It is a hope grounded in experience and science that we can fundamentally improve the California we leave to future generations. The plan is built on the legacy of effective actions and on the conviction that we can effectively marshal the combined capabilities of California—from state, regional, tribal, and local governments to industry to our research institutions, and most importantly, to the nearly 40 million Californians who will benefit from the actions laid out in the plan. It addresses the challenge of our generation by laying out a pathway and guideposts for action across three decades. But the Scoping Plan is only that: a plan. The hard work—and hopeful work—is putting its recommendations into action. And there is no time to waste.

Post-adoption of the Scoping Plan

As with previous Scoping Plans, CARB Board approval is the beginning of the next phase of climate action. Specifically, approval of this plan catalyzes a number of efforts, including the development of new regulations as well as amendments to strengthen regulations and programs already in place, not just at CARB but across state agencies. The unprecedented rate of transition will also require the identification and removal of market and implementation barriers to the production and deployment of clean technology and energy. All of these actions and more will be needed if we are to achieve our climate goals.

Chapter 1: Introduction

"The debate is over around climate change. Just come to the state of California. Observe it with your own eyes."

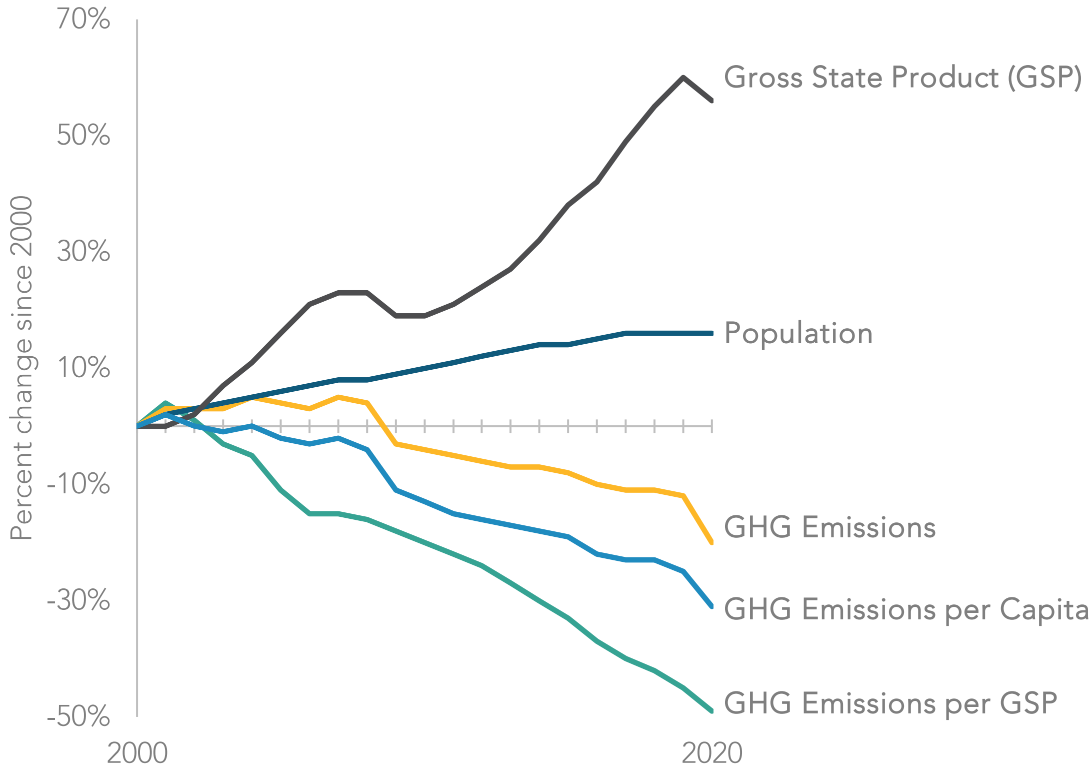
- California Governor Gavin Newsom in September 2020 after surveying the devastation caused by catastrophic wildfires

The impacts of climate change are no longer a distant threat on the horizon—they are right here, right now, with a growing intensity that is adversely affecting our communities and our environment, here in California and across the globe. The science that, decades ago, predicted the impacts we are currently experiencing is even stronger today and unambiguously tells us what we must do to limit irreversible damage: we must act with renewed commitment and focus to do more and do it sooner. That science is indisputable. Unless we increase ambition, we will be faced with more fire, more drought, more temperature extremes, and deadly, choking air pollution. The future of our state—our communities, economy, and ecosystems—is inextricably tied to the way we respond in this decade and the partnerships we forge along the way.

The impacts of climate change fall most heavily on frontline communities that bear the brunt of extreme heat, drought, wildfires, and other effects. Low-income communities and communities of color are also disproportionately impacted by fossil fuel combustion-related air pollution and related health problems. The continued phaseout of fossil fuel combustion will advance both climate and air quality goals and will deliver the greatest health benefits to the most impacted communities.

As it has responded to this climate crisis, California has established itself as a global leader in science-based, public health-focused climate change mitigation and air quality control. The California Legislature has worked with both Republican and Democratic governors to advance action on public health and environmental protections—and California has made progress on addressing climate change during periods of both Republican and Democratic federal administrations. Since the passage of Assembly Bill 32 (AB 32) (Núñez and Pavley, Chapter 488, Statutes of 2006), California has developed bold, creative, and durable policy solutions to protect our environment and public health, all while growing our economy. In fact, California met the target established in AB 32—a return of greenhouse gas (GHG) emissions to 1990 levels by 2020—years ahead of schedule, even as the state established itself as the one of the largest economies in the world. As Figure 1-1 below shows, California's emissions and economic growth have continued to decouple, and California is now the fifth largest economy in the world.

Figure 1-1: California total and per capita GHG emissions[25]



Recognizing both California's early successes in achieving GHG emissions reductions while growing the economy, as well as the worsening impacts of climate change, our governors and legislators have continued to enact ambitious goals. California's unwavering commitment to address climate change is based on indisputable science and data. This commitment is also informed by our collective efforts to address environmental justice and advance racial equity, such that race will no longer be a predictor for disproportionate environmental burdens faced by low-income communities and communities of color. As the Office of Environmental Health Hazard Assessment's

---

[25] Due to the global pandemic, 2020 is an outlier year and should not be considered indicative of a trend; emissions are likely to increase as economies recover from the impacts of the pandemic.

(OEHHA's) recent analysis of race/ethnicity and air pollution vulnerability and CalEnviroScreen 4.0 scores demonstrate, much work remains to be done.[26]

Many of California's environmental policies have served as models for similar policies in other U.S. states, and at national and international levels. Moving forward, California will continue its pursuit of collaborations and advocacy for action to address climate change at all levels of government. While California is responsible for just one percent of global GHG emissions, and we must do our part, we also play an important role in exporting both political will and technical solutions to address the climate crisis globally.

Today, we have a chance to re-envision California's future and set the state on a path to be carbon neutral no later than 2045 while advancing equity, addressing environmental justice, and continuing to grow our economy. This Scoping Plan provides a roadmap outlining key policies we can implement to achieve our climate goals while improving the health and welfare of Californians and addressing disparities in health outcomes to create a more equitable future. It will enable us to turn the corner in our efforts to protect and preserve our critical natural and public resources, all while providing unparalleled opportunities for clean, pollution-free economic growth.

Severity of Climate Change Impacts

With the increasing severity and frequency of drought, wildfire, extreme heat, and other impacts, Californians just have to look out their windows to know that climate change is real and rapidly getting worse. The impacts we thought we would see in the decades to come are happening now. We must act decisively to both reduce our GHG emissions and build resilience to these impacts for ourselves, future generations, and our iconic landscapes.

Wildfires

Of the twenty largest wildfires ever recorded in California, nine occurred in 2020 and 2021. The worst wildfire season in California's recorded history was in 2018, with over 24,226 structures damaged or destroyed and over 100 lives lost. The largest wildfire season ever recorded in state history was in 2020, where more than 4.3 million acres burned, albeit at different intensity and with varying ecological impacts, and over 112 million metric tons of

---

[26] OEHHA and CalEPA. 2021. Analysis of Race/Ethnicity and CalEnviroScreen 4.0 Scores. https://oehha.ca.gov/media/downloads/calenviroscreen/document/calenviroscreen40raceanalysisf2021.pdf.

carbon dioxide (CO_2) emitted into the atmosphere.[27] The economic damage of these fires was estimated to be over $10 billion in property damage and over $2 billion in fire suppression costs.[28] The Camp Fire, which destroyed much of Paradise, California, was the world's costliest natural disaster in 2018, with overall damages of $16.5 billion.[29] It was also the deadliest fire in California history, with 85 civilian fatalities. Wildfires have always been part of California's natural ecology and will continue to be. However, changes to the state's climate and precipitation expands the footprint of wildfire threat, severity, and intensity, with one quarter of California—more than 25 million acres—now classified as being under very high or extreme fire threat.[30]

The impacts of wildfire smoke have been linked to respiratory infections, cardiac arrests, low birth weight, mental health conditions, and exacerbated asthma and chronic obstructive pulmonary disease.[31] In 2020, with all of California covered by wildfire smoke for over 45 days—and 36 counties for at least 90 days—maximum fine particulate ($PM_{2.5}$) levels persisted in the "hazardous" range of the Air Quality Index for weeks in several areas of the state.[32,33]

Catastrophic wildfire damages extend beyond human health and the economy. The Castle Fire in 2020 and the KNP Complex and Windy Fires in 2021 led to the loss of an unprecedented number of giant sequoias: an estimated 13 to 19 percent of the giant

---

[27] CARB. 2020. Public Comment Draft Greenhouse Gas Emissions of Contemporary Wildfire, Prescribed Fire, and Forest Management Activities. https://ww3.arb.ca.gov/cc/inventory/pubs/ca_ghg_wildfire_forestmanagement.pdf.

[28] News18. 2021. San Francisco Bay Area Receives its First Wildfire Warning of 2021, After California Concludes its Driest Year. https://www.news18.com/news/buzz/san-francisco-bay-area-receives-its-first-wildfire-warning-of-2021-after-california-concludes-its-driest-year-3722897.html.

[29] Munich RE. 2019. Extreme Storms, Wildfires and Droughts Cause Heavy Nat Cat Losses In 2018. https://www.munichre.com/en/company/media-relations/media-information-and-corporate-news/media-information/2019/2019-01-08-extreme-storms-wildfires-and-droughts-cause-heavy-nat-cat-losses-in-2018.html#-1808457171.

[30] CARB. No date. Wildfires. https://ww2.arb.ca.gov/our-work/programs/wildfires/about.

[31] Reid, C. E., M. Brauer, F. H. Johnston, M. Jerrett, J. R. Balmes, and C. T. Elliott. 2016. "Critical Review of Health Impacts of Wildfire Smoke Exposure." *Environmental Health Perspectives* http://dx.doi.org/10.1289/ehp.1409277.

[32] Vargo J. A. 2020 (updated in 2021 using the NOAA Hazard Mapping System). "Time Series of Potential US Wildland Fire Smoke Exposures." *Frontiers in Public Health* https://doi.org/10.3389/fpubh.2020.00126.

[33] CalFire. 2020 *Fire Siege Report.* https://www.fire.ca.gov/media/hsviuuv3/cal-fire-2020-fire-siege.pdf.

sequoia population in the Sierra Nevada. An iconic species, giant sequoias are the largest trees on earth, with exceptional longevity outside of climate extremes.[34,35]

It is clear that we must take drastic measures to prepare for future wildfires, which is why California invested $2.7 billion in wildfire resilience from fiscal years 2020 to 2023. The exponential increase in funding launched more than 552 wildfire resilience projects in less than a year, and CAL FIRE met its 2025 goal of treating 100,000 acres a full three years ahead of schedule. Since Fiscal Year 2019–20, treatment work has significantly increased, and CAL FIRE has averaged 100,000 acres treated each fiscal year.

Although we are making progress, we have a lot more work to do in order to achieve our goal of treating one million acres annually by 2025. The Governor's Wildfire and Forest Resilience Strategy details 99 actions needed to address the key drivers of catastrophic wildfires, ramp up the pace and scale of forest management, and make threatened communities more resilient to catastrophic fires. It is also important to note that natural wildfire cycles are a part of a sustainable forest ecosystem and will continue to play a role in a healthy forests' future. We should not expect wildfires to cease, but we must manage our lands to address catastrophic wildfires that result from buildup of carbon stocks due to our interventions to suppress wildfires and from climate change resulting from fossil fuel combustion.

Drought

Drought is a recurring feature of the California climate that has been intensified by increasingly warmer average temperatures. Anthropogenic climate trends have exacerbated drought conditions; human-caused climate change accounts for 19 percent of drought severity and 42 percent of the soil moisture deficit in this region since 2000. The governor declared a drought state of emergency in October 2021, and as of September 2022, 94 percent of California was in severe drought, and 99.8 percent[36] of the state was in at least moderate drought. The first three months of 2022 were the driest January, February, and March on record in California.[37] The harsh drought conditions affecting California are part of a larger megadrought—a drought lasting more than two

---

[34] Shive, K., C. Brigham, T. Caprio, and P. Hardwick. 2021. 2021 Fire Season Impacts to Giant Sequoias. The Nature Conservancy and National Park Service. https://www.nps.gov/articles/000/2021-fire-season-impacts-to-giant-sequoias.htm.

[35] Shive, K. L., A. Wuenschel, L. J. Hardlund, S. Morris, M. D. Meyer, and S. M. Hood. 2022. "Ancient Trees and Modern Wildfires: Declining Resilience to Wildfire in the Highly Fire-adapted Giant Sequoia." *Forest Ecology and Management* 511, 120110. https://doi.org/10.1016/j.foreco.2022.120110.

[36] Drought.gov. California. National Oceanic and Atmospheric Administration (NOAA) and the National Integrated Drought Information System. https://www.drought.gov/states/california.

[37] Drought.ca.gov. September 26, 2022. California Drought Update. https://drought.ca.gov/media/2022/09/Weekly-CA-Drought-Update-09262022-FINAL.pdf.

decades—that has been ongoing in the Southwestern region of North America since 2000. The past 22 years have been the region's driest period since at least 800 CE.[38]

While large urban water districts with diversified sources of water supply have maintained water deliveries to customers through the drought, hundreds of individual well owners and some small water systems have suffered disruption. The state is providing funding for water system consolidation and modernization projects in small communities, emergency repairs and replacements for dry wells, and bottled and hauled water deliveries. A 2021 law requires small suppliers to create drought contingency plans. During the drought of the last three years the state has delivered emergency drinking water assistance to nearly 10,000 households and 150 water systems.

California agriculture is responsible for more than half of all U.S. domestic fruit and vegetable production, and in 2021 drought resulted in the fallowing of nearly 400,000 acres of fields.[39] Direct crop revenue losses were approximately $962 million, and total economic impacts were more than $1.7 billion, with over 14,000 full- and part-time job losses.[40] During the 2011–2017 drought, California's agricultural industry suffered at least $5 billion in losses.[41] The 2022–23 budget includes $100 million to support agricultural water conservation practices, provide on-farm technical assistance, and provide direct relief to small farm operators.

Though native California species are adapted to drought, human engineering has altered most streams and wetlands in the state, making drought increasingly stressful to fish and wildlife. The state has conducted hundreds of fish and amphibian rescues in this drought to move creatures from diminished habitat, upgraded hatcheries, and boosted hatchery production, and has hauled millions of young hatchery salmon to San Francisco Bay to avoid adverse river conditions. State biologists monitor dozens of streams statewide and have negotiated voluntary agreements with landowners and water users to improve stream flows and temperatures.

California has started to implement major policies to build resilience to combat drought—such as the Sustainable Groundwater Management Act of 2014, the governor's Water Resilience Portfolio (2020), the governor's Water and Supply Strategy (August 2022), and

---

[38] Williams, A. P., B. I. Cook, and J. E. Smerdon. 2022. "Rapid Intensification of The Emerging Southwestern North American Megadrought in 2020–2021." *Nature Climate Change* https://doi.org/10.1038/s41558-022-01290-z.

[39] Medellín-Azuara, J. 2022. *Economic Impacts of the 2021 Drought on California Agriculture.* University of California Merced. https://wsm.ucmerced.edu/wp-content/uploads/2022/02/2021-Drought-Impact-Assessment_20210224.pdf.

[40] Medellín-Azuara. *Economic Impacts of the 2021 Drought*.

[41] National Resources Defense Council (NRDC). 2019. Climate Change and Health in California. Issue Brief. https://www.nrdc.org/sites/default/files/climate-change-health-impacts-california-ib.pdf.

new standards for indoor, outdoor, and industrial water use. However, it is crucial that we take further actions to minimize the impacts of drought in the years to come.

Extreme Heat

California's hottest summer on record was 2021.[42] Death Valley recorded the world's highest reliably measured temperature (130°F) in July 2021, breaking its own record (129°F) from summer 2020.[43] Meanwhile, Fresno also broke one of its own records, with 64 days over 100°F in 2021.[44] This is part of a trend: the daily maximum average temperature, an indicator of extreme temperature shifts, is expected to rise 4.4°F–5.8°F by 2050 and 5.6°F–8.8°F by 2100.[45] Heat waves that result in public health impacts are also projected to worsen throughout the state. By 2050, these heat-related health events are projected to last two weeks longer in the Central Valley and occur four to ten times more often in the Northern Sierra region.[46]

Heat ranks among the deadliest of all climate hazards in California, and heat waves in cities are projected to cause two to three times more heat-related deaths by mid-century.[47] Climate vulnerable communities[48] will experience the worst of these effects, as heat risk is associated and correlated with physical, social, political, and economic factors. Aging populations, infants and children, pregnant people, and people with chronic illness are especially sensitive to heat exposure.[49,50] Combining these characteristics and existing health inequities with additional factors such as poverty, linguistic isolation,

---

[42] NOAA. 2022. Climate at a Glance. *https://www.ncdc.noaa.gov/cag/statewide/time-series/4/tavg/3/8/1895-2021?base_prd=true&firstbaseyear=1901&lastbaseyear=2000*.

[43] Masters, J. 2021. Death Valley, California, breaks the all-time world heat record for the second year in a row. Yale Climate Connections. *https://yaleclimateconnections.org/2021/07/death-valley-california-breaks-the-all-time-world-heat-record-for-the-second-year-in-a-row/*.

[44] NOAA. Climate Data Online Search. Accessed on 16 March 2022. *https://www.ncdc.noaa.gov/cdo-web/search*.

[45] Governor's Office of Planning and Research (OPR), CEC, and CNRA. 2018. *California's Fourth Climate Change Assessment*. Page 23. *https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018-013_Statewide_Summary_Report_ADA.pdf*.

[46] OPR, CEC, and CNRA. *California's Fourth Climate Change Assessment - Statewide Summary Report.* *https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018-013_Statewide_Summary_Report_ADA.pdf*.

[47] Ostro, B., S. Rauch, and S. Green. 2011. "Quantifying the health impacts of future changes in temperature in California." National Library of Medicine. *https://pubmed.ncbi.nlm.nih.gov/21975126/*.

[48] CARB. Priority Populations. California Climate Investments. *https://www.caclimateinvestments.ca.gov/priority-populations*.

[49] Basu, R. 2009. "High Ambient Temperature and Mortality: A Review of Epidemiologic Studies from 2001 to 2008." National Library of Medicine. *https://pubmed.ncbi.nlm.nih.gov/19758453/*.

[50] Basu, R., and B. Malig. 2011. "High Ambient Temperature and Mortality in California: Exploring the Roles of Age, Disease, and Mortality Displacement." National Library of Medicine. *https://pubmed.ncbi.nlm.nih.gov/21981982/*.

housing insecurity, and the legacy of racist redlining practices, can put individuals at a disproportionately high risk of heat-related illness and death.[51,52] Rising temperatures will also speed up smog-forming chemical reactions, leading to worse asthma, reduced lung function, cardiac arrest, and cognitive decline. African American, American Indian/Alaskan Native, and Puerto Rican Californians are particularly sensitive to smog, as they are between 28.6 and 132.5 percent more likely to be diagnosed with asthma than white Californians.[53]

In addition to the dangers to public health, California's September 2022 heat wave is particularly illustrative of how more frequent extreme heat strains the state's infrastructure we depend on to adapt to a changing climate. For example, as all-time high temperature records were broken in Sacramento, San Jose, Santa Rosa and Fairfield, electricity demand for air conditioning threatened to overwhelm the state power supply.[54]

California has taken major steps to protect communities from the impacts of extreme heat. Our recent budgets invest $800 million to cool our schools and neighborhoods, including projects to reduce urban overheating. The Extreme Heat Action Plan, released in April 2022, outlines the all-of-government approach California is taking to reduce urgent risks and build long-term resilience to the impacts of extreme heat. In September 2022, Governor Newsom signed multiple bills addressing extreme heat, including AB 2238 (Rivas, Chapter 264, Statutes of 2022), which will create the nation's first extreme heat advance warning and ranking system to better prepare communities ahead of heat waves. The Administration is committed to addressing extreme heat, but we still have a lot of work to do.

Wildfires, drought, and extreme heat are some of the most pronounced climate impacts California is experiencing, but they are not the only ones. Sea level rise, rising ocean temperatures, ocean acidification, and inland flooding are also already having devastating impacts on our communities, ecosystems, and economy, and will continue to do so in the years and decades to come. The decisions and actions that we take today will determine how strongly we will feel the impacts of climate change in the future.

---

[51] Hoffman, J. S., V. Shandas, and N. Pendleton. 2020. "The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas." MDPI. *https://www.mdpi.com/2225-1154/8/1/12/htm*.

[52] U.S. Climate Resilience Toolkit. No date. Heat and Social Inequity in the United States. *https://toolkit.climate.gov/tool/heat-and-social-inequity-united-states*.

[53] NRDC. 2019. Climate Change and Health. Issue Brief. *https://www.nrdc.org/sites/default/files/climate-change-health-impacts-california-ib.pdf*.

[54] Samenow, Jason. 2022. No September on record in the West has seen a heat wave like this. *The Washington Post.* September 9. *https://www.washingtonpost.com/climate-environment/2022/09/08/western-heatwave-records-california-climate/*.

Imperative To Act

Consequences of Further Warming

The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6) found that it will not be possible to keep global warming within the threshold of 1.5°C to avoid the most severe impacts of climate change unless we make immediate and large-scale reductions in GHG emissions. It finds that atmospheric concentrations of CO_2 have increased by 50 percent since the industrial revolution, and that they continue to increase at a rate of two parts per million each year.[55] Without immediate action, the world will exceed 1.5°C (or 2.7°F) warming by the 2030s, and no later than 2040.

While every tenth of a degree matters—every incremental increase in warming brings additional negative impacts—climate-related risks to human health, livelihoods, and biodiversity are projected to increase further under 2°C (or 3.6°F) warming, compared to 1.5°C.[56] To remain below 1.5°C with limited or no overshoot of that threshold, global net anthropogenic CO_2 emissions need to be cut by about half by 2030 and reach net-zero by 2050.

If we fail to make rapid changes, we may not be able to limit global warming to 2°C,[57] and the consequences of inaction would be catastrophic. Our planet is already 1.2°C warmer than pre-industrial times due to human-induced warming, and many impacts we are already experiencing, such as sea level rise, are "irreversible" for centuries to millennia.[58] Californians with the fewest resources, who are disproportionately low-income communities and communities of color, are the most vulnerable to the impacts of climate change. While the human costs associated with health impacts can never be fully monetized, a recent report finds that the health costs of climate and air pollution in the U.S. are well over $800 billion today and will continue to grow in the coming years.[59]

---

[55] IPCC. 2021. *Climate Change 2021: The Physical Science Basis.* https://www.ipcc.ch/report/ar6/wg1/.

[56] IPCC. 2018. *Special Report: Global Warming of 1.5°C.* World Meteorological Organization. https://www.ipcc.ch/sr15/.

[57] IPCC. 2021. Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis.* Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. In Press. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf.

[58] United Nations. 2021. IPCC report: 'Code red.' https://news.un.org/en/story/2021/08/1097362#:~:text=%27Code%20red%20for%20humanity%27&text=We%20are%20at%20imminent%20risk,%2C%20to%20keep%201.5%20alive.%22.

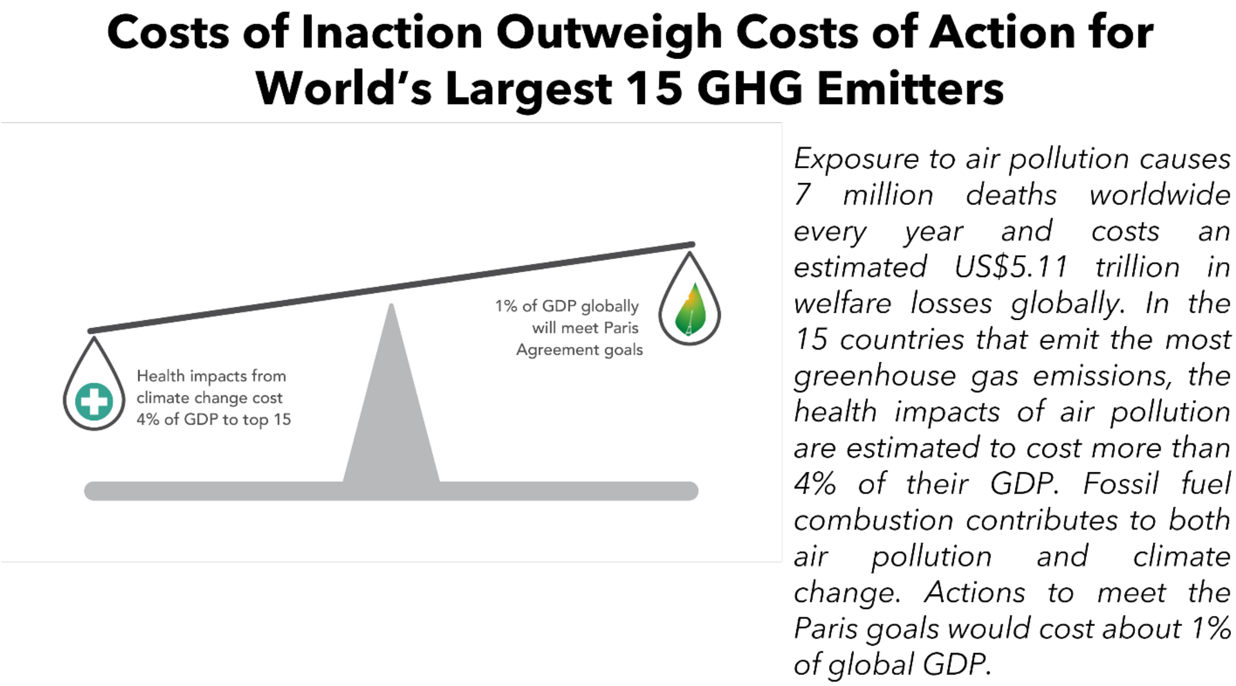
[59] Alwis, D. D., and V. S. Limaye. No date. *The Costs of Inaction*. https://www.nrdc.org/sites/default/files/costs-inaction-burden-health-report.pdf.

Any delays in action or insufficient action are a threat to public health and the environment. The impacts to our economy would be devastating as well. While not specific to California, a 2022 report from Deloitte Economics Institute finds that failing to take sufficient action to reduce emissions could result in economic losses to the U.S. of more than $14.5 trillion over the next 50 years.[60] On a hopeful note, however, the report finds that if the country invests now and in the coming years in a net-zero economy, $3 trillion could be added to the economy over the next 50 years. The U.S. annual gross domestic product (GDP) would be 2.5 percent higher in 2070 in this fast-action scenario than in the delayed action scenario. The lessons for California from these analyses are clear: invest now or pay the price later. As shown in Figure 1-2, inaction can lead to negative consequences for individuals, communities, the economy, and society as a whole. As discussed later, Governor Newsom and the Legislature have accepted this imperative and made significant investments in climate action. This Scoping Plan combined with the historic investments and policy direction from the governor and Legislature, will result in unprecedented action to address the climate crisis.

---

[60] Deloitte. 2022. *The Turning Point.* https://www2.deloitte.com/content/dam/Deloitte/us/Documents/about-deloitte/us-the-turning-point-a-new-economic-climate-in-the-united-states-january-2022.pdf?id=us:2el:3dp:wsjspon:awa:WSJSBJ:2021:WSJFY22.

Figure 1-2: The real costs of inaction[61]



Scoping Plan Overview

Previous Scoping Plans

The Scoping Plan is a strategy the California Air Resources Board (CARB) develops and updates at least one every five years, as required by AB 32. It lays out the transformations needed across our society and economy to reduce emissions and reach our climate targets. This Scoping Plan is the third update to the original plan that was adopted in 2008. The initial Scoping Plan laid out a path to achieve the AB 32 2020 limit of returning to 1990 levels of GHG emissions, a reduction of approximately 15 percent below business as usual.[62] The 2008 Scoping Plan included a mix of incentives, regulations, and carbon pricing, laying out the portfolio approach to addressing climate change and clearly making the case for using multiple tools to meet California's GHG targets. The 2013 Scoping Plan assessed progress toward achieving the 2020 limit and made the case for addressing

---

[61] Katowice, P. 2018. *Health benefits far outweigh the costs of meeting climate change goals.* WHO. https://www.who.int/news/item/05-12-2018-health-benefits-far-outweigh-the-costs-of-meeting-climate-change-goals.
[62] CARB. 2008. *Climate Change Scoping Plan.* https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/document/adopted_scoping_plan.pdf.

short-lived climate pollutants (SLCPs).[63] The most recent update, the 2017 Scoping Plan,[64] also assessed the progress toward achieving the 2020 limit and provided a technologically feasible and cost-effective path to achieving the Senate Bill 32 (SB 32, Pavley, Chapter 249, Statutes of 2016) target of reducing GHGs by at least 40 percent below 1990 levels by 2030.

Overview of this Scoping Plan

It is paramount that we continue to build on California's success by taking effective actions and doubling down on implementation of the strategies outlined here. As such, this Scoping Plan builds on and integrates efforts already underway to reduce the state's GHG, criteria pollutant, and toxic air contaminant emissions by identifying the clean technologies and fuels that should be phased in as the state transitions away from combustion of fossil fuels. By selecting and pursuing a sustainable and clean economic path, the state will continue to successfully execute existing programs, work to eliminate air pollution inequities, demonstrate the coupling of economic growth and environmental progress, and enhance new opportunities for engagement within the state to address and prepare for climate change.

The 2022 Scoping Plan for Achieving Carbon Neutrality (Scoping Plan) is the most comprehensive and far-reaching Scoping Plan developed to date. It identifies a technologically feasible and cost-effective path to achieve carbon neutrality by 2045 while also assessing the progress California is making toward reducing its GHG emissions by at least 40 percent below 1990 levels by 2030, as called for in SB 32 and laid out in the 2017 Scoping Plan.[65] The 2030 target is an interim but important stepping stone along the critical path to the broader goal of deep decarbonization by 2045. Modeling for this Scoping Plan shows that this decade must be one of transformation on a scale never seen before to set us up for success in 2045.

The relatively longer path assessed in this Scoping Plan incorporates, coordinates, and leverages many existing and ongoing efforts to reduce GHGs and air pollution, while identifying new clean technologies and energy. Given the focus on carbon neutrality, this Scoping Plan also includes discussion for the first time of the Natural and Working Lands (NWL) sectors as both sources of emissions and carbon sinks. Chapter 2 of this document

---

[63] CARB. 2014. *First Update to the Climate Change Scoping Plan.* https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf.
[64] CARB. 2017. *California's 2017 Climate Change Scoping Plan.* https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf.
[65] CARB. 2017. *California's 2017 Climate Change Scoping Plan.* https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf.

includes a description of a suite of specific actions to drastically reduce GHGs across all sectors. Chapter 3 provides the air quality and economic evaluations of the actions. Chapter 4 provides a broader description of the many actions needed across all sectors to achieve carbon neutrality. Chapter 5 provides an overview of the next steps and partnerships needed to implement this Scoping Plan. Guided by legislative direction, the actions identified in this Scoping Plan reduce overall GHG emissions in California and deliver policy signals that will continue to drive investment and certainty in a low carbon economy. This Scoping Plan builds upon the successful framework established by the Initial Scoping Plan and subsequent updates while identifying new, technologically feasible, and cost-effective strategies.

Principles That Inform Our Approach to Addressing the Climate Challenge

California has decades of experience addressing the climate challenge. Through this experience, and based on extensive engagement with stakeholders through our regulatory and program development processes, we have developed a set of principles to inform our approach.

Unprecedented Investments in a Sustainable Future

The scale of transformation needed over this decade to avoid the worst impacts of climate change and meet our ambitious climate goals is extraordinary. This is why Governor Newsom and the Legislature invested over $15 billion in climate action through the 2021–2022 California Comeback Plan, and why the 2022–2023 budget marks the beginning of the California Climate Commitment—the governor's multi-year plan to invest $54 billion in climate action. The enacted budgets (Figure 1-3) and the California Climate Commitment represent investments of a historic scale and will advance precisely the type of all-of-government approaches necessary to create the whole-of-society changes described in this Scoping Plan that will enable us to avert the worst impacts of climate change.

Figure 1-3: Comprehensive California climate change investments

The *California Climate Commitment* includes the following game-changing elements:

- $10 billion for zero-emission vehicles (ZEVs), including $1.5 billion for electric school buses to protect students' health and $3 billion to build an accessible charging network. ZEV investments will particularly focus on programs such as heavy-duty vehicle and port electrification that will reduce emissions and protect public health in low-income communities.
- $2.1 billion for clean energy investments, such as long duration storage, offshore wind, green hydrogen,[66] and industrial decarbonization.
- $13.8 billion for programs that reduce emissions from the transportation sector, such as improving public transportation while also funding walking, biking, and adaptation projects.
- Over $720 million for California's higher education institutions and research that will support the next generation of climate innovations.

[66] For the purposes of this Scoping Plan, "renewable hydrogen" and "green hydrogen" are interchangeable and are not limited to only electrolytic hydrogen produced from renewables.

- Nearly $1 billion to build sustainable, affordable housing and over $1 billion to help low-income Californians realize energy cost savings through building decarbonization.
- Nearly $9 billion for wildfire risk reduction, drought mitigation, extreme heat resilience, and nature-based solutions.

These investments are incredibly important in the context of this Scoping Plan in that they accompany and help support implementation of the many policies and regulations that will continue to be necessary to achieve our 2030 and carbon neutrality targets. In addition, these incentive programs jump-start emission reduction strategies for priority sectors, sources, and technologies, leveraging private-sector investment and building sustainable, growing markets for clean and efficient technologies. Many of California's incentive programs work in concert with federal and other state programs to drive emission reductions. As an example, as California pushes to move to 100% sales of new zero emission-vehicles, including plug-in hybrid vehicles, the Newsom Administration continues to invest heavily in incentive programs that allow families, communities, and businesses to choose zero-emission vehicles. This is done while simultaneously working with the federal government, other states, and jurisdictions around the world to align policies, regulations, and incentives, creating market certainty for the automakers that serve our markets.

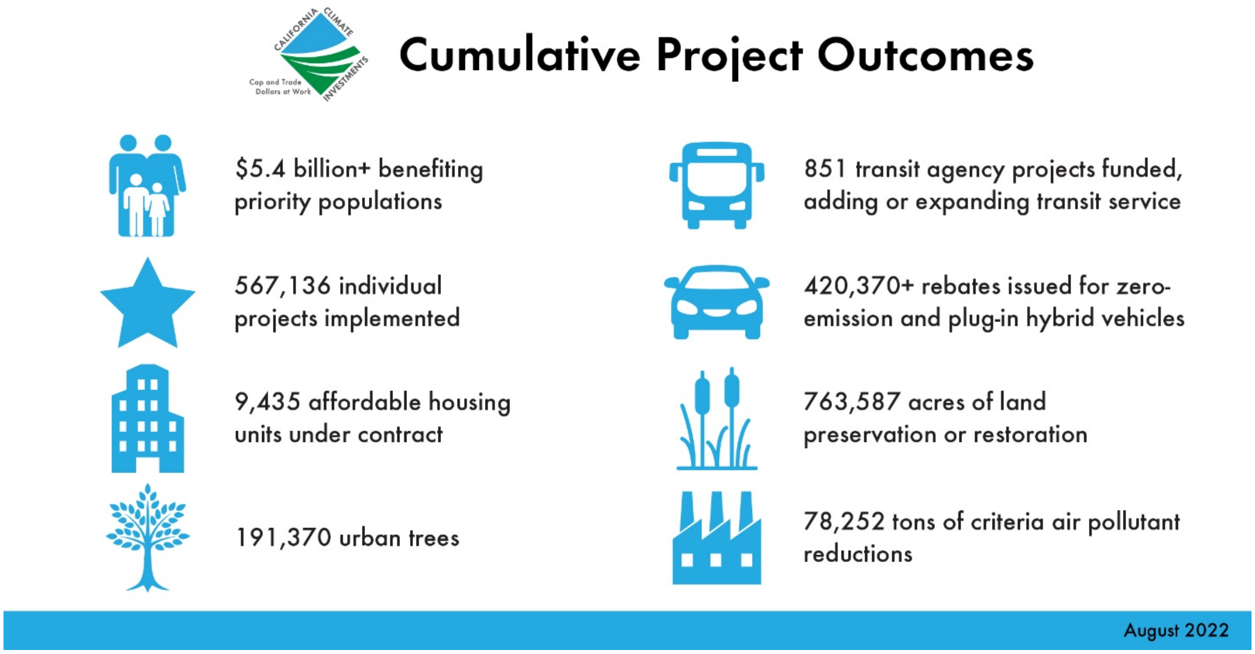
Centering Equity

Prioritizing equity is just as important as the magnitude of the climate investments California is making. Addressing climate change and advancing our equity and economic opportunity goals cannot be decoupled. In line with the governor's Executive Order[67] to take additional actions to embed equity analysis and considerations, this plan works to center equity by addressing disparities for historically underserved and marginalized communities. California strives to ensure that our climate and air research, regulations, investments, and plans include provisions that specifically address and advance equity. This includes reducing and eliminating air pollution disparities, removing barriers that can prevent frontline communities from accessing benefits, lowering costs for low-income Californians, and promoting high-quality jobs. CARB's incentive programs regularly surpass their mandated equity targets, and CARB has incorporated equity-focused provisions in our research, planning, and regulatory efforts. For instance, statute requires that a minimum of 35 percent of California Climate Investments benefit low-income households along with disadvantaged and low-income communities (referred to as *priority*

[67] Executive Department. State of California. 2022. Executive Order N-16-22. GSS_9320_2-20220912152941 (ca.gov).

populations). However, 48 percent—over $5.4 billion—of implemented California Climate Investments project funding is benefiting priority populations, greatly exceeding the statutory minimums (see Figure 1-4). Senate Bill 535 (De León, Chapter 830, Statutes of 2012) and AB 1550 (Gomez, Chapter 369, Statutes of 2016) direct state and local agencies to make significant investments using auction proceeds to assist California's most vulnerable communities. Under these laws, a minimum of 25 percent of the total investments are required to be located within and provide benefits to disadvantaged communities, and at least 10 percent of the total investments must benefit low-income communities and households. Moving forward, the state will continue to devote a greater share of incentive funding to priority populations, with the light-duty vehicle incentive program as just one example. We can simultaneously confront the climate crisis and build a more resilient, just, and equitable future for all communities.

Figure 1-4: California climate investments cumulative outcomes[68,69]



Role of the Environmental Justice Advisory Committee

To inform the development of the Scoping Plan, AB 32 calls for the convening of an Environmental Justice Advisory Committee (EJ Advisory Committee) to advise CARB in developing the Scoping Plan, and any other pertinent matter in implementing AB 32. It requires that the Committee be comprised of representatives from communities with the most significant exposure to air pollution, including communities with minority populations and/or low-income populations. On January 25, 2007, CARB appointed the first

[68] CARB. 2022. California Climate Investments program implements $10.5 billion in greenhouse gas-reducing programs, expected to reduce 76 million metric tons of emissions. April 11. https://ww2.arb.ca.gov/news/california-climate-investments-program-implements-105-billion-greenhouse-gas-reducing-projects.

[69] SB 535 and AB 1550 require investments located in and benefiting low-income communities and households, which are termed *priority populations. Disadvantaged communities* are currently defined by CalEPA as the top 25 percent of communities experiencing disproportionate amounts of pollution, environmental degradation, and socioeconomic and public health conditions according to the Office of Environmental Health Hazard Assessment's *CalEnviroScreen tool,* plus certain additional communities including federally recognized Tribal Lands. Low-income communities and households are defined by statute as those with incomes either at or below 80 percent of the statewide median or below a threshold designated as low-income by the Department of Housing and Community Development.

Environmental Justice Advisory Committee to advise it on the Initial Scoping Plan and other climate change programs.

For this Scoping Plan, CARB reconvened the EJ Advisory Committee in May 2021. The committee is currently comprised of 14 environmental justice and disadvantaged community representatives, including the EJ Advisory Committee's first tribal representative, who was appointed in February 2022. In October 2021, the EJ Advisory Committee formally created eight workgroups. These workgroups are a space for EJ Advisory Committee members to better understand specific sectors of the Scoping Plan and to assist the EJ Advisory Committee in the development of recommendations on this Scoping Plan. In December 2021, the EJ Advisory Committee provided scenario input responses to help shape the modeling for this Scoping Plan. In February 2022, San Joaquin Valley EJ Advisory Committee members hosted their first community workshop, with over 100 attendees. In March 2022, the CARB Board held a joint public meeting with the EJ Advisory Committee to discuss their draft preliminary recommendations for this Scoping Plan. In June 2022, over 165 attendees participated in a statewide community workshop held by EJ Advisory Committee members. The full schedule of EJ Advisory Committee Meetings and meeting materials are available on CARB's website.[70] This Scoping Plan includes references where EJ Advisory Committee Final Recommendations[71] are included in the document. The final recommendations were discussed at a joint CARB and EJ Advisory Committee Hearing on September 1, 2022.

The integration of environmental justice is critical to ensure that certain communities are not left behind. The AB 32 EJ Advisory Committee provided recommendations on September 30 in advance of the final Scoping Plan. There are footnotes to indicate where there is alignment between the AB 32 EJ Advisory Committee's recommendations and this Scoping Plan. While the language in the text may not fully incorporate the specific EJ Advisory Committee's recommendation, the footnotes do acknowledge the places in the text where there is general alignment with the spirit of the EJ Advisory Committee's recommendation.

Partnering with Tribes

[70] CARB. Environmental Justice Advisory Committee Meetings and Events. https://ww2.arb.ca.gov/environmental-justice-advisory-committee-meetings-and-events.

[71] Environmental Justice Advisory Committee. September 30, 2022. 2022 Scoping Plan Recommendations. https://ww2.arb.ca.gov/sites/default/files/barcu/board/books/2022/090122/finalejacrecs.pdf.

There are 109 federally recognized tribes and over 60 non-federally recognized tribes in California. [72] In 2011, Governor Brown issued Executive Order B-10-11, recognizing and reaffirming the inherent right of tribes to exercise sovereign authority over their members and territory and directing state agencies to engage in government-to-government consultation with tribe and to work to develop partnerships and consensus.[73] In 2019, Governor Newsom issued Executive Order N-15-19, which acknowledges and apologizes on behalf of the state for the historical "violence, exploitation, dispossession and the attempted destruction of tribal communities."[74] Establishing partnerships with tribal leaders to incorporate their priorities, traditional expertise, and knowledge will be important to achieving California's climate goals. The Scoping Plan includes actions that tribal partners can voluntarily implement for sources under their jurisdiction (e.g., transitioning to zero emission fleets, installing infrastructure and control technologies, conducting climate smart land management). The Scoping Plan also uplifts the importance of having our tribal partners help guide actions that may impact tribal cultural resources and of benefitting from tribal input.

We also need alignment between state and local partners and tribes on actions related to land-use decisions. This means respecting and reinforcing tribal sovereignty and self-determination. As tribes do not always draw clear lines between the "natural" and "cultural" resources of a place, taking a holistic perspective will result in positive impacts in ability to address the complex issues of land management and regulatory undertakings.

Tribes have an intimate and historical knowledge of places and should be engaged early on to inform planning and future management related to activities that may impact tribal resources and areas including potential funding opportunities, technical assistance, and capacity building, where appropriate. Additionally, tribes should be involved in the identification of their own significant resources and areas of use. As decisions are made related to Scoping Plan undertakings, agencies should recognize and appropriately consider cultural resources and management from the beginning, not as an afterthought; and consider how the project could impact tribes.

---

[72] These numbers are subject to change depending on determinations made by the Bureau of Indian Affairs (BIA) and the Native American Heritage Commission (NAHC). Please consult the most current Federal Register for a list of federally recognized tribes and the NAHC for a list of non-federally recognized tribes in California. As of the date of the Scoping Plan, the current list for federally recognized tribes is located at 87 Fed. Reg. 4636 (Jan. 28, 2022).

[73] Executive Order B-10-11. https://www.ca.gov/archive/gov39/2011/09/19/news17223/index.html#:~:text=EXECUTIVE%20ORDER%20B-10-11%20Published%3A%20Sep%2019%2C%202011%20WHEREAS,and%20affirmed%20in%20state%20and%20federal%20law%3B%20and.

[74] Executive Order N-15-19. https://tribalaffairs.ca.gov/wp-content/uploads/sites/10/2020/02/Executive-Order-N-15-19.pdf.

Finally, to the extent allowed by law, traditional ecological knowledge and culturally sensitive information should be protected, as this is information that may not be common knowledge and may not be known outside the tribe, as each tribe is unique and influenced by its local environment and cultural practices. Protection of this information will help foster productive relationships with tribes and should be included as part of the process. CARB and other agencies should continue to foster relationships with tribal partners.

Maximizing Air Quality and Health Benefits

The state has over 50 years of experience successfully cleaning the air in California by addressing criteria pollutants and toxic air contaminants from mobile and stationary sources. CARB has been a leader in measuring, evaluating, and reducing sources of air pollution that impact public health. Its air pollution programs have been adapted for national programs and emulated in other countries. Significant progress has been made in reducing diesel particulate matter (PM), which is a designated toxic air contaminant, and many other hazardous air pollutants. CARB partners with local air districts to address stationary source emissions and adopts and implements state-level regulations to address sources of criteria and toxic air pollution, including mobile sources. CARB also collaborates with federal agencies to address air pollution from sources primarily under federal jurisdiction. In many instances, actions to reduce fossil fuel combustion and achieve federal air quality standards also help to reduce GHG emissions.

However, air pollution disparities still exist, and more must be done to ensure the most vulnerable populations have safe air to breathe. California must continue to evaluate opportunities to harmonize our climate and air quality programs through innovative policymaking and by building on existing programs like the Low Carbon Fuel Standard (LCFS) and Community Air Protection Program. The LCFS includes a provision that allows electric utilities to opt-in and generate residential electric vehicle (EV) charging credits, where some of the revenues are invested back into rebate programs that address air quality and climate pollution.[75] The Community Air Protection Program[76] is the first of its kind in the country and brings together diverse stakeholders, including CARB, local air districts, and residents of environmental justice communities to increase local air monitoring and develop community-led plans to improve air quality in the communities most impacted by air pollution.

This Scoping Plan identifies actions that will deliver near-term air quality benefits to communities with the highest exposures and provide long-term GHG benefits. Many of the actions in this Scoping Plan are key elements of the 2022 State Strategy for the State

---

[75] CARB. LCFS Utility Rebate Programs. https://ww2.arb.ca.gov/resources/documents/lcfs-utility-rebate-programs.

[76] CARB. Community Air Protection Program. https://ww2.arb.ca.gov/capp.

Implementation Plan to meet federal air quality standards,[77] which has a primary focus of reducing harmful air pollution and achieving federal air quality targets. California's approach of leveraging air quality and GHG policies together has yielded results. A 2022 report by the Office of Environmental Health and Hazard Assessment (OEHHA)[78] that evaluated GHG and harmful air pollution emissions from the heavy-duty vehicle (HDV) and large stationary source sectors found declines in emissions in both sectors, with the greatest declines in disadvantaged communities. Both sectors are subject to state GHG and air quality policies, in addition to federal and local rules on harmful air pollution. Because of historically racist and discriminatory practices such as redlining, both types of sources are disproportionately located adjacent to vulnerable communities, which are predominantly communities of color.[79] The key findings from the OEHHA report are as follows:

- Both HDVs and facilities subject to the Cap-and-Trade Program have reduced emissions of co-pollutants, with HDVs showing a clearer downward trend when compared to stationary sources. These emission reductions have major health benefits, including a reduction in premature pollution-related deaths.
- The greatest beneficiaries of reduced emissions from both HDVs and facilities subject to the Cap-and-Trade Program have been in communities of color and in disadvantaged communities in California, as identified by CalEnviroScreen (CES). This has reduced the emission gap between disadvantaged and non-disadvantaged communities, but a wide gap still remains.
- The transition to zero-emission HDVs will expedite further emissions reductions.
- While the progress observed is encouraging, inequities persist, and federal, state, and local climate and air quality programs must do more to reduce emissions of GHGs and co-pollutants to reduce the burden of emissions on disadvantaged communities and communities of color.

It will take all tools at all levels of government, with robust enforcement, to ensure that vulnerable communities continue to see improvements in air quality until no disparities exist in air pollution across the state.

---

[77] CARB. 2022 State Strategy for the State Implementation Plan. https://ww2.arb.ca.gov/resources/documents/2022-state-strategy-state-implementation-plan-2022-state-sip-strategy.

[78] OEHHA. 2022. *Impacts of Greenhouse Gas Emission Limits within Disadvantaged Communities: Progress Toward Reducing Inequities.* https://oehha.ca.gov/environmental-justice/report/ab32-benefits.

[79] CalEPA. 2021. Pollution and Prejudice. https://storymaps.arcgis.com/stories/f167b251809c43778a2f9f040f43d2f5.

Economic Resilience

The state's efforts to tackle the climate crisis will create economic and workforce development opportunities in the clean energy economy in communities across the state. Transitioning existing skills and expanding workforce training opportunities in climate-related fields are critical for reducing harmful emissions and supporting workers in transitioning to new, high-quality jobs. The Administration's recent budgets acknowledge the challenges facing workers in industries most affected by the state's response to climate change—especially those in the fossil fuel industry. It will invest $1 billion in regional partnerships and economic diversification to create new jobs and support a local tax base and workforce transition and development once opportunities are identified. It also will invest in safety nets to protect, and support impacted communities as part of the transition to a carbon neutral economy. Specifically, the Community Economic Resilience Fund Program[80] (CERF) supports communities and regional groups in producing regional roadmaps for economic recovery and transition that prioritize the creation of accessible, high-quality jobs in sustainable industries. The budget investments create the opportunity to future-proof and increase economic resilience in the face of more frequent climate impacts and shifting economic conditions. For these investments and implementation of the Scoping Plan to be successful in supporting the transition to a carbon neutral economy, workers and affected communities must be included in ongoing dialogue to ensure a high-road transition for regional economies.

That state also recognizes it can play a more direct role in supporting a sustainable work force through its incentive programs. In 2021, Assembly Bill 680 (AB 680) (Burke, Chapter 746, Statutes of 2021) was signed into law, requiring CARB to work with the California Labor and Workforce Development Agency to update the Funding Guidelines to include new workforce standards. CARB's Funding Guidelines currently include requirements for administering agencies to, wherever possible, foster job creation within California, provide employment opportunities or job training tied to employment, and target these opportunities to priority populations. The Funding Guidelines also recommend administering agencies prioritize investments in projects that directly support jobs or a job training and placement program, and that they report the estimated employment benefits and employment outcomes for projects that meet specified criteria. These new requirements apply to agencies administering certain California Climate Investments

[80] Office of Planning and Research. Community Economic Resilience Fund. https://opr.ca.gov/economic-development/cerf/.

programs that receive continuous appropriations from the Greenhouse Gas Reduction Fund and fall into the following six categories of standards:

- fair and responsible employer standards,
- inclusive procurement policies,
- prevailing wage for construction work,
- community workforce agreements for construction projects over one million dollars,
- preference for projects with educational institutions or training programs, and
- creation of high-quality jobs. CARB will be updating the Funding Guidelines through a public process over the next year to operationalize these new requirements.

Partnering Across Government

The Scoping Plan is an actionable plan to identify and align programs and policies to achieve California's climate targets. To realize the outcomes and deliver results in any Scoping Plan, action is critical. For this Scoping Plan, there are also actions that rely on our federal partners to take on sources primarily under their jurisdiction (such as aviation, and federally owned/managed lands) while they also continue to develop national programs for GHG reductions. The federal government is already taking major steps to advance these types of programs. The Inflation Reduction Act of 2022[81] includes $369 billion for domestic energy production and manufacturing and is expected to lead to U.S. GHG emission reductions of roughly 40 percent by 2030. Direct incentives will include those for clean vehicles and ENERGY STAR appliances, as well as improving transportation and clean energy in underserved communities.

We also need our local partners to align on actions related to land-use decisions that support sustainable, resilient, low-carbon communities and permitting for clean energy production facilities and infrastructure; diversion of organics from landfills; and other climate-related projects. State agencies also should use the Scoping Plan to review and update their own programs and policies to support the actions identified in this Scoping Plan. Importantly, the Scoping Plan also can serve as a resource as the Legislature considers new legislative direction and funding to support the state's path to carbon neutrality and continue action to address near-term air pollution disparities.

Partnering with the Private Sector

Government cannot achieve our climate targets alone. The scale of investment needed requires both private-sector investment and partnerships with philanthropies. Public

[81] Pub.L. No. 117-169 (August 16, 2022).

sector dollars, accompanied by strong and steady policy signals, must be a catalyst for deeper and broader investments by the private sector in both reducing emissions and building the resilience of our communities. Governor Newsom is committed to working collaboratively with businesses, including small businesses, to deploy the technologies, capital, and ingenuity that are hallmarks of the private sector.

California structures our climate policies and regulations to create market signals and certainty that spur private sector investment. For example, the Governor's Executive Order on Zero-Emission Vehicles[82] set 2035 as the target year for 100 percent zero-emission vehicle sales, creating a time horizon that allows automakers to scale up zero-emission fleets and sending a clear signal to the companies and utilities that would deploy charging infrastructure. The Executive Order has been followed by development and adoption of the Advanced Clean Cars II regulation. CARB convened auto manufacturers, environmental justice groups, labor organizations, and many other stakeholders to provide input into development of the regulation in a robust and transparent manner; again, with the aim of providing certainty for producers and consumers.

California also pursues public-private partnerships (PPP) as a mechanism to advance our collective climate goals. We know these vehicles can be effective at increasing the impact of public sector dollars and helpful in moving markets in a direction aligned with state policy. A new PPP the Administration is advancing is the Climate Catalyst Revolving Loan Fund, housed at the state's Infrastructure and Economic Development Bank (IBank). The fund offers a range of financial instruments—including flexible credit and credit support—to help bridge financing gaps currently preventing advanced climate solutions from scaling in the marketplace. The Catalyst Fund's initial areas of investment include forest biomass management and utilization (unlocking innovation to reduce wildfire threats), climate-smart agriculture, and clean energy transmission. The fund leverages public sector investments by mobilizing private finance for shovel-ready projects that are stuck in the deployment phase. As such, IBank is ideally positioned as the state's all-purpose "Green Bank," with increasing connection to federal financing programs such as US DOE's Loan Programs Office and the United States Environmental Protection Agency's (U.S. EPA) Greenhouse Gas Reduction Fund.

The Catalyst Fund builds from existing IBank financing programs that are themselves increasingly focused on the climate imperative. The IBank's Infrastructure State Revolving Fund provides supportive capital to climate-aligned projects promoted by local governments and certain nonprofit entities, and will be refining its criteria and market outreach strategies to increase its level of service. IBank's bonds program has supported

---

[82] Executive Department. State of California. Executive Order N-79-20. *https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf*.

multiple large environmental projects, including more than $2 billion in "green bonds," and is poised to help expand access to the state's deep and liquid bond capital market. Within IBank's Small Business Finance Center, the new Climate Tech Loan Guarantee program encourages commercial banks to back climate-focused small businesses, leveraging federal capital to insure a portion of the private bank's loan. And through IBank's Expanding Venture Capital Access Fund program, the state is promoting greater diversity in the venture capital community, including climate equity and climate justice.

All of these financing programs exist to leverage private capital in support of the state's climate goals, and to partner with state policy agencies driving the transition. IBank will also continue to collaborate closely with the State Treasurer's Office in its provision of capital support to climate solutions, ensuring that funding flows to programs best positioned to deliver success. This partnership of public and private capital, responsive to and in communication with the climate policy community, will ensure that California gets the maximum possible benefit from its allocation of scarce resources.

Supporting Innovation

Reaching our ambitious, deep decarbonization goals will require continued technological innovation. Investment in research, development, and deployment of clean technologies has never been more critical. Sending clear and sustained market and policy signals will encourage large and small companies alike to pursue innovation that can be scaled up and deployed here and beyond our borders. The full suite of AB 32 policies[83] has touched nearly every sector of California's economy and spurred technology innovation in the state, including the growth of technology developers, manufacturers, processors, and assemblers in many areas. Specifically, AB 32 policies and programs support both the supply side and the demand side to build new markets in California. On the supply side, AB 32 policies support businesses to demonstrate and refine technologies, and to help establish critical supply chains. On the demand side, AB 32 policies and programs provide outreach, education, and incentives—as well as disincentives—to motivate everyone from consumers to institutional purchasers to utility planners to adopt new, climate smart technologies. Innovations resulting directly from the state's climate policies include the following:

- In the past 10 years, a growing market for heavy-duty zero-emission vehicles (HD ZEVs) was established in California, and this market now represents the largest single share of North American supply and demand for HD ZEVs. Vehicle

[83] CARB. Climate Change Programs. *https://ww2.arb.ca.gov/our-work/topics/climate-change*.

and component manufacturers are making long-term investments to develop and produce HD ZEVs within California.

- Total consumption of renewable diesel in the California LCFS market has skyrocketed from approximately 1.8 million gallons in 2011 to nearly 589 million gallons in 2020. The LCFS is a key driver of market development for renewable diesel and its coproducts. While the federal renewable fuel standard (RFS) and blenders tax credit also benefit producers, an analysis of their respective contributions to market development, and interviews with industry representatives and independent experts, point to LCFS as a more important factor in market development, at least in recent years.
- In the past five years, a market for small-scale energy storage in California was created where none previously existed. As of 2020, 185 megawatts (MW) of small-scale energy storage projects have been interconnected to the grid. The significant increase in deployment in the last five years is a result of the Self-Generation Incentive Program (SGIP), which significantly reduces the upfront costs to purchase and install small-scale energy storage devices, and of growing customer interest in disaster resiliency in the face of increasing risk from wildfire and related utility outages. These systems have already provided disaster resiliency benefits for residential and non-residential customers.

We have seen how quickly market barriers can be overcome in response to strong policy signals, as occurred in the solar panel and electric vehicle battery space. Government-stated priorities have a significant role in guiding private and public research, development, and deployment. This Scoping Plan unequivocally puts the marker down on the need for innovation to continue in non-combustion technologies, clean energy, CO_2 removal options, and alternatives for SLCPs. The five-year update to the Scoping Plan allows for a periodic evaluation of new tools to add to the state's toolkit.

Engagement with Partners to Develop, Coordinate, and Export Policies

California works closely with other states, tribal governments, the federal government, and international jurisdictions to identify the most effective strategies and methods to reduce GHGs, manage GHG control programs, and facilitate the development of integrated and cost-effective regional, national, and international GHG reduction programs. For example, the state's Cap-and-Trade Program has been linked with Québec's since 2014, and CARB staff regularly engage with jurisdictions throughout the world on the design features of our Cap-and-Trade Program through memoranda of understanding (MOUs) and venues such as the International Climate Action

Partnership.[84] Low carbon fuel mandates similar to California's LCFS have been adopted by the U.S. EPA and by other jurisdictions, including Oregon, Washington, British Columbia, the European Union, and the United Kingdom. Many other jurisdictions from Japan to New Zealand, Australia, and the European Commission also continue to seek information and technical experience on our LCFS. California has and will continue to share information and encourage ambitious emissions reductions with interested jurisdictions, with a focus on China, India, Mexico, Canada, and the European Union. California's early action to reduce super-pollutants such as methane and other SLCPs was reaffirmed by the 2021 Global Methane Pledge signed by the U.S. and over 100 other countries at the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC).[85]

In addition, under the Clean Air Act, the federal government is authorized to allow California to set more stringent vehicle emissions regulations than federal standards. California's goals and regulations to transition to 100 percent sales of new zero-emission passenger vehicles by 2035 (including plug-in hybrid vehicles), to drayage trucks by 2035, and other trucks and buses where feasible by 2045 are being emulated by partner states across the U.S. and in jurisdictions around the world. CARB's Advanced Clean Cars II regulation, [86] which codifies these targets, was approved in August 2022, and already at least four other states have announced their plans to adopt this regulation. Earlier in June 2020 CARB adopted the Advanced Clean Truck regulation, which requires truck manufacturers to meet increasing sale targets of zero-emission trucks in California through 2035. Since adoption, at least five other states—20 percent of the U.S. truck market—have adopted this regulation. These kinds of coordinated policies help signal to vehicle manufacturers a widespread and growing demand for zero-emissions technology, which in turn helps scale production and lower costs for consumers.

With the Mexican Secretariat for Environment and Natural Resources (SEMARNAT), California has engaged in a technical exchange on clean vehicle policies and helped to establish Mexico's Emissions Trading System (being piloted in 2022). A 2019 MOU signed between California and Environment and Climate Change Canada enables in-depth collaboration on policies and programs to decarbonize vehicles, engines, and fuels. This partnership has led to tangible emissions reductions, from aligning vehicle emissions targets and policies to collaborating on emissions testing and research critical to enforcing

---

[84] International Carbon Action Partnership (ICAP). Homepage. https://icapcarbonaction.com/en?msclkid=dac30cb7b4f511ec94ccd0f1ae323e98.

[85] Global Methane Pledge. Homepage. https://www.globalmethanepledge.org/.

[86] Cal. Code Regs., tit. 13, §§ 1900,1961.2, 1961.3, 1962.2, 1962.3, 1962.4, 1962.5, 1962.6, 1962.7, 1962.8, 1965, 1968.2, 1969, 1976, 1978, 2037, 2038, 2112, 2139, 2140, 2147, and 2903; and Test Procedures located here: https://ww2.arb.ca.gov/rulemaking/2022/advanced-clean-cars-ii.

emissions limits for vehicle manufactures. At the national level, China has looked to California for cutting-edge requirements for car diagnostics and policies that promote zero-emissions vehicles. At a local level, Beijing has adopted California's vehicle emissions standards and several other progressive environmental regulations. California will continue and renew such efforts across China, including through a 2022 MOU signed with China's Ministry of Ecology and Environment.

Between 2021 and 2023, California also will serve as president of the Transport Decarbonisation Alliance, a global network of countries, regions, cities, and companies that come together to share experiences and technical expertise, and to increase the ambition and accelerate the deployment of targeted transportation decarbonization policies across freight, electric vehicle infrastructure, and active mobility. Throughout its presidency, California will focus its leadership on decarbonizing the cross-jurisdiction network of medium- and heavy-duty vehicles, both to ensure cleaner air in freight-adjacent communities and to stem the effects of climate change.

Over the years, California has also asserted the importance of and supported the ongoing efforts of state and local clean air and climate leadership. Through our participation in the Pacific Coast Collaborative alongside British Columbia, Washington, and Oregon,[87] the Under2 Coalition,[88] the U.S. Climate Alliance,[89] the International ZEV Alliance,[90] the Transportation Decarbonisation Alliance, and many more organizations, California has and will continue to build climate partnerships with state and local governments.

California also recognized the need to address the substantial emissions caused by the deforestation and degradation of tropical and other forests, and continues its work alongside other subnational governments as part of the Governors' Climate and Forests Task Force (GCF).[91] Founded in 2008, there are currently 39 GCF members, including states and provinces in Brazil, Colombia, Ecuador, Indonesia, Ivory Coast, Mexico, Nigeria, Peru, Spain, and the United States—all of whom are considering or operating programs to reduce emissions from deforestation, land-use, and rural development, and to benefit local and indigenous communities. CARB's California Tropical Forest Standard provides a rigorous methodology to assess jurisdiction-scale programs that reduce deforestation and to incentivize responsible action and investment.[92] The standard

---

[87] Pacific Coast Collaborative. Homepage. https://pacificcoastcollaborative.org/.
[88] Under2 Coalition. Homepage. https://www.theclimategroup.org/under2-coalition.
[89] United States Climate Alliance (USCA). Homepage. https://www.usclimatealliance.org/.
[90] ZEV Alliance. Homepage. Accelerating the Adoption of Zero-Emission Vehicles. https://zevalliance.org/.
[91] Governors' Climate and Forests Task Force. University of Colorado Boulder: Colorado Law. https://www.gcftf.org/.
[92] CARB. California Tropical Forest Standard. https://ww2.arb.ca.gov/our-work/programs/california-tropical-forest-standard.

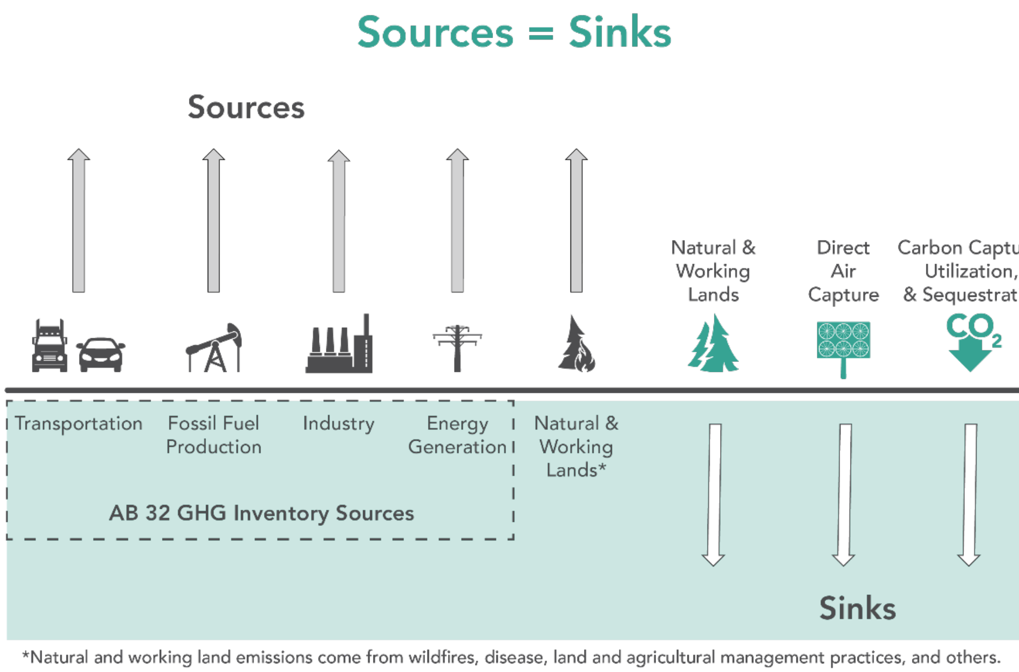
provides a strong signal to value the preservation of tropical forests over continued destructive activities such as oil exploration and extraction and ensures rigorous social and environmental safeguards for indigenous peoples and local communities.

Working Toward Carbon Neutrality

To date, California and many other regions have focused on reducing GHG emissions from the industrial, energy, and transportation sectors. As defined in statute, the state's 2020 and 2030 targets include all in-state sources of GHG emissions—and those emissions associated with imported power that is consumed in the state. By moving to a framework of carbon neutrality, the scope for accounting is expanded to include all sources and sinks. As such, carbon neutrality is achieved when the GHG fluxes are at equilibrium—when sources equal sinks. Figure 1-5 depicts the sources included in the AB 32 GHG Inventory and the new sources and sinks added in this Scoping Plan under the framework of carbon neutrality. Natural and working lands are able to sequester carbon and therefore play an increasingly important role in this framework. However, modeling for this plan shows that carbon sequestration in our natural and working lands alone will be insufficient to achieve carbon neutrality no later than 2045. Therefore, this plan also considers the role of carbon capture and sequestration, as well as biological and mechanical carbon sequestration processes that are included in the IPCC Sixth Assessment Report,[93] as necessary tools for climate change mitigation.

[93] IPCC. 2021. *Climate Change 2021: The Physical Science Basis.* https://www.ipcc.ch/report/ar6/wg1/.

Figure 1-5: Carbon neutrality: Balancing the net flux of GHG emissions from all sources and sinks



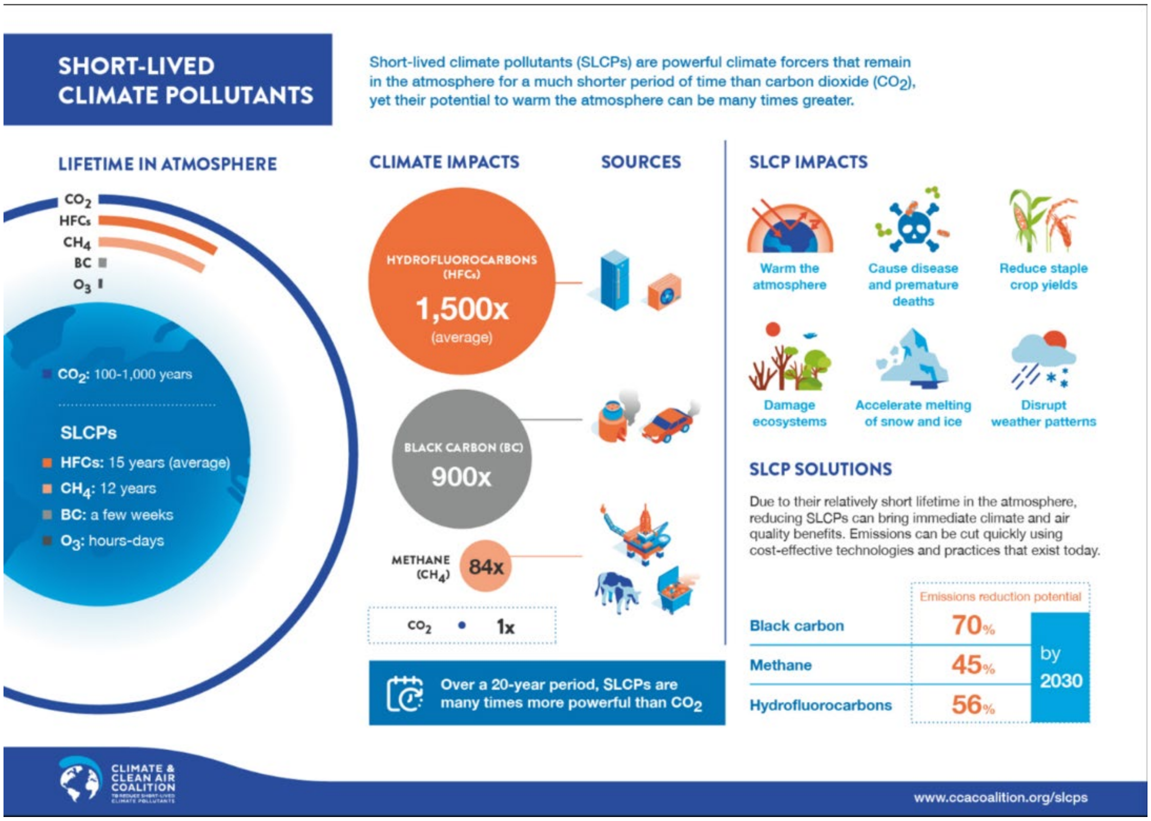
Supporting Healthy and Resilient Lands

Our natural and working lands are an important piece in California's fight to achieve carbon neutrality and build resilience to the impacts of climate change. Healthy land can sequester and store atmospheric carbon dioxide in forests, grasslands, soils, and wetlands. Healthy lands can also reduce emissions of powerful short-lived climate pollutants, limit the release of future GHG emissions, protect people and nature from the impacts of climate change, and build our resilience to future climate risks. Unhealthy lands have the opposite effect—they release more GHGs than they store and are more vulnerable to future climate change impacts. Through climate smart land management that focuses on supporting healthy living systems, we can support our carbon neutrality goals, reduce emissions, advance sequestration, and support healthy and more climate-resilient lands.

Maintaining the Focus on Methane and Short-Lived Climate Pollutants

Given the urgency of climate change, the often-disproportional impacts already being felt by underserved populations across California and the world, and the need to rapidly decarbonize and avoid climate tipping points as identified in the most recent IPCC assessment, efforts to reduce short-lived climate pollutants are especially important. SLCPs include methane (CH_4), black carbon (soot), and fluorinated gases (F-gases, including hydrofluorocarbons, or HFCs), and they are among the most harmful pollutants to both human health and the global climate. SLCPs are more potent than CO_2 in terms of their impact on climate change (and subsequently, global warming) and have a much shorter lifetime in the atmosphere than CO_2 does. That means they have an outsized impact on climate change in the near term—they are responsible for up to 45 percent of current climate forcing. It also means that targeted efforts to reduce short-lived climate pollutant emissions can provide outsized climate and health benefits, within weeks to about a decade (see Figure 1-6).

Figure 1-6: Short-lived climate pollutant impacts[94]



California has been a leader in addressing SLCP emissions. As part of the 2014 Scoping Plan,[95] CARB committed to developing a dedicated strategy to reduce SLCP emissions.

---

[94] Climate and Clean Air Coalition. Short-Lived Climate Pollutants (SLCPs). https://www.ccacoalition.org/en/content/short-lived-climate-pollutants-slcps.

[95] CARB. 2014. *First Update.* https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf.

The resulting SLCP Reduction Strategy,[96] adopted by CARB in 2017, implements targets codified in SB 1383 (Lara, Chapter 395, Statutes of 2016) to reduce methane and HFC emissions by 40 percent by 2030 and anthropogenic black carbon emissions by 50 percent. California worked with several other states through the U.S. Climate Alliance to establish a similar goal to reduce SLCP emissions in line with the requirements of the Paris Agreement,[97] identifying the potential to reduce SCLPs by 40 to 50 percent by 2030 across the U.S. Climate Alliance.[98]

Process for Developing the Scoping Plan

This Scoping Plan was developed in coordination with the Governor's Office and state agencies, in accordance with direction from the Chair and Members of CARB, through engagement with the Legislature, with advice from the EJ Advisory Committee, in consultation with tribes, and with open and transparent opportunities for stakeholders and the public to engage in workshops and other meetings. Appendix A (Public Process) includes details of the public workshops, and Chapter 5 includes details of the EJ Advisory Committee's role in the Scoping Plan update process.

Guidance from the Administration and Legislature

This Scoping Plan reflects existing and recent direction in the Governor's Executive Orders and Statutes. Table 1-1 provides a summary of major climate legislation and executive orders issued since the adoption of the 2017 Scoping Plan.

---

[96] CARB. 2017. *Short-Lived Climate Pollutant Reduction Strategy.* https://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf.

[97] UNFCCC. 2015. Paris Agreement. https://unfccc.int/sites/default/files/english_paris_agreement.pdf.

[98] USCA. 2018. *From SLCP Challenge to Action: A Roadmap for Reducing Short-Lived Climate Pollutants to Meet the Goals of the Paris Agreement.* http://www.usclimatealliance.org/slcp-challenge-to-action.

Table 1-1: Major climate legislation and executive orders enacted since the 2017 Scoping Plan

Bill/Executive Order	Summary
Assembly Bill 1279 (AB 1279) (Muratsuchi, Chapter 337, Statutes of 2022) *The California Climate Crisis Act*	AB 1279 establishes the policy of the state to achieve carbon neutrality as soon as possible, but no later than 2045; to maintain net negative GHG emissions thereafter; and to ensure that by 2045 statewide anthropogenic GHG emissions are reduced at least 85 percent below 1990 levels. The bill requires CARB to ensure that Scoping Plan updates identify and recommend measures to achieve carbon neutrality, and to identify and implement policies and strategies that enable CO_2 removal solutions and carbon capture, utilization, and storage (CCUS) technologies. This bill is reflected directly in this Scoping Plan.
Senate Bill 905 (SB 905) (Caballero, Chapter 359, Statutes of 2022) *Carbon Capture, Removal, Utilization, and Storage Program*	SB 905 requires CARB to create the Carbon Capture, Removal, Utilization, and Storage Program to evaluate, demonstrate, and regulate CCUS and carbon dioxide removal (CDR) projects and technology. The bill requires CARB, on or before January 1, 2025, to adopt regulations creating a unified state permitting application for approval of CCUS and CDR projects. The bill also requires the Secretary of the Natural Resources Agency to publish a framework for governing agreements for two or more tracts of land overlying the same geologic storage reservoir for the purposes of a carbon sequestration project. The Scoping Plan modeling reflects both CCUS and CDR contributions to achieve carbon neutrality.
Senate Bill 846 (SB 846) (Dodd, Chapter 239, Statutes of 2022) *Diablo Canyon Powerplant: Extension of Operations*	SB 846 extends the Diablo Canyon Power Plant's sunset date by up to five additional years for each of its two units and seeks to make the nuclear power plant eligible for federal loans. The bill requires that the California Public Utilities Commission (CPUC) not include and disallow a load-serving entity from including in their adopted resource plan, the energy, capacity, or any attribute from the Diablo Canyon power plant. The Scoping Plan explains the emissions impact of this legislation.
Senate Bill 1020 (SB 1020) (Laird,	SB 1020 adds interim renewable energy and zero carbon energy retail sales of electricity targets to California end-use customers set at 90 percent in 2035 and 95 percent in 2040.

Chapter 361, Statutes of 2022) *Clean Energy, Jobs, and Affordability Act of 2022*	It accelerates the timeline required to have 100 percent renewable energy and zero carbon energy procured to serve state agencies from the original target year of 2045 to 2035. This bill requires each state agency to individually achieve the 100 percent goal by 2035 with specified requirements. This bill requires the CPUC, California Energy Commission (CEC), and CARB, on or before December 1, 2023, and annually thereafter, to issue a joint reliability progress report that reviews system and local reliability. The bill also modifies the requirement for CARB to hold a portion of its Scoping Plan workshops in regions of the state with the most significant exposure to air pollutants by further specifying that this includes communities with minority populations or low-income communities in areas designated as being in extreme federal non-attainment. The Scoping Plan describes the implications of this legislation on emissions.
Senate Bill 1137 (SB 1137) (Gonzales, Chapter 365, Statutes of 2022) *Oil & Gas Operations: Location Restrictions: Notice of Intention: Health protection zone: Sensitive receptors*	SB 1137 prohibits the development of new oil and gas wells or infrastructure in health protection zones, as defined, except for purposes of public health and safety or other limited exceptions. The bill requires operators of existing oil and gas wells or infrastructure within health protection zones to undertake specified monitoring, public notice, and nuisance requirements. The bill requires CARB to consult and concur with the California Geologic Energy Management Division (CalGEM) on leak detection and repair plans for these facilities, adopt regulations as necessary to implement emission detection system standards, and collaborate with CalGEM on public access to emissions detection data.
Senate Bill 1075 (SB 1075) (Skinner, Chapter 363, Statutes of 2022) *Hydrogen: Green Hydrogen: Emissions of Greenhouse Gases*	SB 1075 requires CARB, by June 1, 2024, to prepare an evaluation that includes: policy recommendations regarding the use of hydrogen, and specifically the use of green hydrogen, in California; a description of strategies supporting hydrogen infrastructure, including identifying policies that promote the reduction of GHGs and short-lived climate pollutants; a description of other forms of hydrogen to achieve emission reductions; an analysis of curtailed electricity; an estimate of GHG and emission reductions that could be achieved through deployment of green hydrogen through a variety of scenarios; an analysis of the potential for opportunities to integrate hydrogen production and applications with drinking water supply treatment needs; policy recommendations for regulatory and permitting processes

	associated with transmitting and distributing hydrogen from production sites to end uses; an analysis of the life-cycle GHG emissions from various forms of hydrogen production; and an analysis of air pollution and other environmental impacts from hydrogen distribution and end uses. This bill would inform the production of hydrogen at the scale called for in this Scoping Plan.
Assembly Bill 1757 (AB 1757) (Garcia, Chapter 341, Statutes of 2022) *California Global Warming Solutions Act of 2006: Climate Goal: Natural and Working Lands*	AB 1757 requires the California Natural Resources Agency (CNRA), in collaboration with CARB, other state agencies, and an expert advisory committee, to determine a range of targets for natural carbon sequestration, and for nature-based climate solutions, that reduce GHG emissions in 2030, 2038, and 2045 by January 1, 2024. These targets must support state goals to achieve carbon neutrality and foster climate adaptation and resilience. This bill also requires CARB to develop standard methods for state agencies to consistently track GHG emissions and reductions, carbon sequestration, and additional benefits from natural and working lands over time. These methods will account for GHG emissions reductions of CO_2, methane, and nitrous oxide related to natural and working lands and the potential impacts of climate change on the ability to reduce GHG emissions and sequester carbon from natural and working lands, where feasible. This Scoping Plan describes the next steps and implications of this legislation for the natural and working lands sector.
Senate Bill 1206 (SB 1206) (Skinner, Chapter 884, Statutes of 2022) *Hydrofluorocarbon gases: sale or distribution*	SB 1206 mandates a stepped sales prohibition on newly produced high- global warming potential (GWP) HFCs to transition California's economy toward recycled and reclaimed HFCs for servicing existing HFC-based equipment. Additionally, SB 1206 also requires CARB to develop regulations to increase the adoption of very low-, i.e., GWP < 10, and no-GWP technologies in sectors that currently rely on higher-GWP HFCs.
Senate Bill 27 (SB 27) (Skinner, Chapter 237, Statutes of 2021)	SB 27 requires CNRA, in coordination with other state agencies, to establish the Natural and Working Lands Climate Smart Strategy by July 1, 2023. This bill also requires CARB to establish specified CO_2 removal targets for 2030 and beyond as part of its Scoping Plan. Under SB 27, CNRA is to establish and maintain a registry to identify projects in the state

Carbon Sequestration: State Goals: Natural and Working Lands: Registry of Projects	that drive climate action on natural and working lands and are seeking funding. CNRA also must track carbon removal and GHG emission reduction benefits derived from projects funded through the registry. This bill is reflected directly in this Scoping Plan as CO_2 removal targets for 2030 and 2045 in support of carbon neutrality.
Senate Bill 596 (SB 596) (Becker, Chapter 246, Statutes of 2021) *Greenhouse Gases: Cement Sector: Net-zero Emissions Strategy*	SB 596 requires CARB, by July 1, 2023, to develop a comprehensive strategy for the state's cement sector to achieve net-zero-emissions of GHGs associated with cement used within the state as soon as possible, but no later than December 31, 2045. The bill establishes an interim target of 40 percent below the 2019 average GHG intensity of cement by December 31, 2035. Under SB 596, CARB must: • Define a metric for GHG intensity and establish a baseline from which to measure GHG intensity reductions. • Evaluate the feasibility of the 2035 interim target (40 percent reduction in GHG intensity) by July 1, 2028. • Coordinate and consult with other state agencies. • Prioritize actions that leverage state and federal incentives. • Evaluate measures to support market demand and financial incentives to encourage the production and use of cement with low GHG intensity. The Scoping Plan modeling is designed to achieve these outcomes.
Executive Order N-82-20	Governor Newsom signed Executive Order N-82-20 in October 2020 to combat the climate and biodiversity crises by setting a statewide goal to conserve at least 30 percent of California's land and coastal waters by 2030. The Executive Order also instructed the CNRA, in consultation with other state agencies, to develop a Natural and Working Lands Climate Smart Strategy that serves as a framework to advance the state's carbon neutrality goal and build climate resilience. In addition to setting a statewide conservation goal, the Executive Order directed CARB to update the target for natural and working lands in support of carbon neutrality as part of this Scoping Plan, and to take into consideration the NWL Climate Smart Strategy.

	Executive Order N-82-20 also calls on the CNRA, in consultation with other state agencies, to establish the California Biodiversity Collaborative (Collaborative). The Collaborative shall be made up of governmental partners, California Native American tribes, experts, business and community leaders, and other stakeholders from across the state. State agencies will consult the Collaborative on efforts to: • Establish a baseline assessment of California's biodiversity that builds upon existing data and can be updated over time. • Analyze and project the impact of climate change and other stressors in California's biodiversity. • Inventory current biodiversity efforts across all sectors and highlight opportunities for additional action to preserve and enhance biodiversity. CNRA also is tasked with advancing efforts to conserve biodiversity through various actions, such as streamlining the state's process to approve and facilitate projects related to environmental restoration and land management. The California Department of Food and Agriculture (CDFA) is directed to advance efforts to conserve biodiversity through measures such as reinvigorating populations of pollinator insects, which restore biodiversity and improve agricultural production. The Natural and Working Lands Climate Smart Strategy informs this Scoping Plan.
Executive Order N-79-20	Governor Newsom signed Executive Order N-79-20 in September 2020 to establish targets for the transportation sector to support the state in its goal to achieve carbon neutrality by 2045. The targets established in this Executive Order are: • 100 percent of in-state sales of new passenger cars and trucks will be zero-emission by 2035. • 100 percent of medium- and heavy-duty vehicles will be zero-emission by 2045 for all operations where feasible, and by 2035 for drayage trucks. • 100 percent of off-road vehicles and equipment will be zero-emission by 2035 where feasible. The Executive Order also tasked CARB to develop and propose regulations that require increasing volumes of zero-electric passenger vehicles, medium- and heavy-duty

	vehicles, drayage trucks, and off-road vehicles toward their corresponding targets of 100 percent zero-emission by 2035 or 2045, as listed above. The Scoping Plan modeling reflects achieving these targets.
Executive Order N-19-19	Governor Newsom signed Executive Order N-19-19 in September 2019 to direct state government to redouble its efforts to reduce GHG emissions and mitigate the impacts of climate change while building a sustainable, inclusive economy. This Executive Order instructs the Department of Finance to create a Climate Investment Framework that: • Includes a proactive strategy for the state's pension funds that reflects the increased risks to the economy and physical environment due to climate change. • Provides a timeline and criteria to shift investments to companies and industry sectors with greater growth potential based on their focus of reducing carbon emissions and adapting to the impacts of climate change. • Aligns with the fiduciary responsibilities of the California Public Employees' Retirement System, California State Teachers' Retirement System, and the University of California Retirement Program. Executive Order N-19-19 directs the State Transportation Agency to leverage more than $5 billion in annual state transportation spending to help reverse the trend of increased fuel consumption and reduce GHG emissions associated with the transportation sector. It also calls on the Department of General Services to leverage its management and ownership of the state's 19 million square feet in managed buildings, 51,000 vehicles, and other physical assets and goods to minimize state government's carbon footprint. Finally, it tasks CARB with accelerating progress toward California's goal of five million ZEV sales by 2030 by: • Developing new criteria for clean vehicle incentive programs to encourage manufacturers to produce clean, affordable cars. • Proposing new strategies to increase demand in the primary and secondary markets for ZEVs. • Considering strengthening existing regulations or adopting new ones to achieve the necessary GHG reductions from within the transportation sector.

	The Scoping Plan modeling reflects efforts to accelerate ZEV deployment.
Senate Bill 576 (SB 576) (Umberg, Chapter 374, Statutes of 2019) *Coastal Resources: Climate Ready Program and Coastal Climate Change Adaptation, Infrastructure and Readiness Program*	Sea level rise, combined with storm-driven waves, poses a direct risk to the state's coastal resources, including public and private real property and infrastructure. Rising marine waters threaten sensitive coastal areas, habitats, the survival of threatened and endangered species, beaches, other recreation areas, and urban waterfronts. SB 576 mandates that the Ocean Protection Council develop and implement a coastal climate adaptation, infrastructure, and readiness program to improve the climate change resiliency of California's coastal communities, infrastructure, and habitat. This bill also instructs the State Coastal Conservancy to administer the Climate Ready Program, which addresses the impacts and potential impacts of climate change on resources within the conservancy's jurisdiction.
Assembly Bill 65 (AB 65) (Petrie-Norris, Chapter 347, Statutes of 2019) *Coastal Protection: Climate Adaption: Project Prioritization: Natural Infrastructure: Local General Plans*	This bill requires the State Coastal Conservancy, when it allocates any funding appropriated pursuant to the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access For All Act of 2018, to prioritize projects that use natural infrastructure in coastal communities to help adapt to climate change. The bill requires the conservancy to provide information to the Office of Planning and Research on any projects funded pursuant to the above provision to be considered for inclusion into the clearinghouse for climate adaption information. The bill authorizes the conservancy to provide technical assistance to coastal communities to better assist them with their projects that use natural infrastructure.
Executive Order B-55-18	Governor Brown signed Executive Order B-55-18 in September 2018 to establish a statewide goal to achieve carbon neutrality as soon as possible, and no later than 2045, and to achieve and maintain net negative emissions thereafter. Policies and programs undertaken to achieve this goal shall: • Seek to improve air quality and support the health and economic resiliency of urban and rural communities, particularly low-income and disadvantaged communities. • Be implemented in a manner that supports climate adaptation and biodiversity, including protection of the state's water supply, water quality, and native plants and animals.

	This Executive Order also calls for CARB to: • Develop a framework for implementation and accounting that tracks progress toward this goal. • Ensure future Scoping Plans identify and recommend measures to achieve the carbon neutrality goal. This Scoping Plan is designed to achieve carbon neutrality no later than 2045 and the modeling includes technology and fuel transitions to achieve that outcome.
Senate Bill 100 (SB 100) (De León, Chapter 312, Statutes of 2018) *California Renewables Portfolio Standard Program: emissions of greenhouse gases*	SB 100 mandates that the CPUC, CEC, and CARB plan for 100 percent of total retail sales of electricity in California to come from eligible renewable energy resources and zero-carbon resources by December 31, 2045. This bill also updates the state's Renewables Portfolio Standard (RPS) to include the following interim targets: • 44% of retail sales procured from eligible renewable sources by December 31, 2024. • 52% of retail sales procured from eligible renewable sources by December 31, 2027. • 60% of retail sales procured from eligible renewable sources by December 31, 2030. Under SB 100, the CPUC, CEC, and CARB shall use programs under existing laws to achieve 100 percent clean electricity. The statute requires these agencies to issue a joint policy report on SB 100 every four years. The first of these reports was issued in 2021. This Scoping Plan reflects the SB 100 Core Scenario resource mix with a few minor updates.
Assembly Bill 2127 (AB 2127) (Ting, Chapter 365, Statutes of 2018) *Electric Vehicle Charging Infrastructure: Assessment*	This bill requires the CEC, working with CARB and the CPUC, to prepare and biennially update a statewide assessment of the electric vehicle charging infrastructure needed to support the levels of electric vehicle adoption required for the state to meet its goals of putting at least 5 million zero-emission vehicles on California roads by 2030 and of reducing emissions of GHGs to 40% below 1990 levels by 2030. The bill requires the CEC to regularly seek data and input from stakeholders relating to electric vehicle charging infrastructure. This bill supports the deployment of ZEVs as modeled in this Scoping Plan.

Senate Bill 30 (SB 30) (Lara, Chapter 614, Statutes of 2018) *Insurance: Climate Change*	This bill requires the Insurance Commissioner to convene a working group to identify, assess, and recommend risk transfer market mechanisms that, among other things, promote investment in natural infrastructure to reduce the risks of climate change related to catastrophic events, create incentives for investment in natural infrastructure to reduce risks to communities, and provide mitigation incentives for private investment in natural lands to lessen exposure and reduce climate risks to public safety, property, utilities, and infrastructure. The bill requires the policies recommended to address specified questions.
Assembly Bill 2061 (AB 2061) (Frazier, Chapter 580, Statutes of 2018) *Near-zero-emission and Zero-emission Vehicles*	Existing state and federal law sets specified limits on the total gross weight imposed on the highway by a vehicle with any group of two or more consecutive axles. Under existing federal law, the maximum gross vehicle weight of that vehicle may not exceed 82,000 pounds. AB 2061 authorizes a near-zero-emission vehicle or a zero-emission vehicle to exceed the weight limits on the power unit by up to 2,000 pounds. This bill supports the deployment of cleaner trucks as modeled in this Scoping Plan.

Consideration of Relevant State Plans and Regulations

Development of this Scoping Plan also included careful consideration of, and coordination with, other state agency plans and regulations, including the SB 100 Joint Agency Report,[99] the 2022 State Strategy for the State Implementation Plan,[100] Climate Action Plan for Transportation Infrastructure,[101] AB 74 Studies on Vehicle Emissions and Fuel Demand and Supply,[102,103,104] Short-Lived Climate Pollutant Strategy (SLCP Strategy),[105]

[99] CPUC, CEC, and CARB. 2021. *SB 100 Joint Agency Report.* https://www.energy.ca.gov/sb100.
[100] CARB. January 31, 2022. Draft 2022 State Strategy for the State Implementation Plan. https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf.
[101] CalSTA. 2021. *Climate Action Plan.* https://calsta.ca.gov/subject-areas/climate-action-plan.
[102] CalEPA. 2021. Carbon Neutrality Studies. https://calepa.ca.gov/climate/carbon-neutrality-studies/.
[103] Brown, A. L., et. al. 2021. *Driving California's Transportation Emissions.* https://escholarship.org/uc/item/3np3p2t0.
[104] Deschenes, O. 2021. *Enhancing equity*. https://zenodo.org/record/4707966#.YKPiaKhKi73.
[105] CARB. Short-Lived Climate Pollutants. https://ww2.arb.ca.gov/our-work/programs/slcp.

CARB's Achieving Carbon Neutrality Report,[106] Climate Smart Strategy,[107] and draft Natural and Working Lands Implementation Plan,[108] among others.

Input from Partners and Stakeholders

CARB also collaborated with other state agencies, held consultations with tribes, and solicited comments and feedback from affected stakeholders, including labor organizations and the public. The process to update the Scoping Plan began with kickoff workshops in early June 2021,[109] followed by over a dozen public workshops, including engagement with tribes,[110] and featured a series of EJ Advisory Committee and environmental justice community meetings.[111] The June 2021 workshop and several others were a joint agency effort, as there are many agencies with direct authority or jurisdiction over different sectors of the economy. Consultation with agencies also included bi-weekly, monthly, and weekly meetings.

During the summer of 2022 CARB held three community listening sessions, hosted by the CARB Chair and Board, in communities around the state, along with one virtual community listening session and one tribal listening session specifically for tribes. Many tribes provided written feedback, which was incorporated into this Scoping Plan. In addition, CARB respects tribal sovereignty and also engaged in a consultation campaign with tribes, which resulted in government-to-government consultations, and this Scoping Plan is reflective of this process.[112]

Emissions Data That Inform the Scoping Plan

Greenhouse Gas Emissions

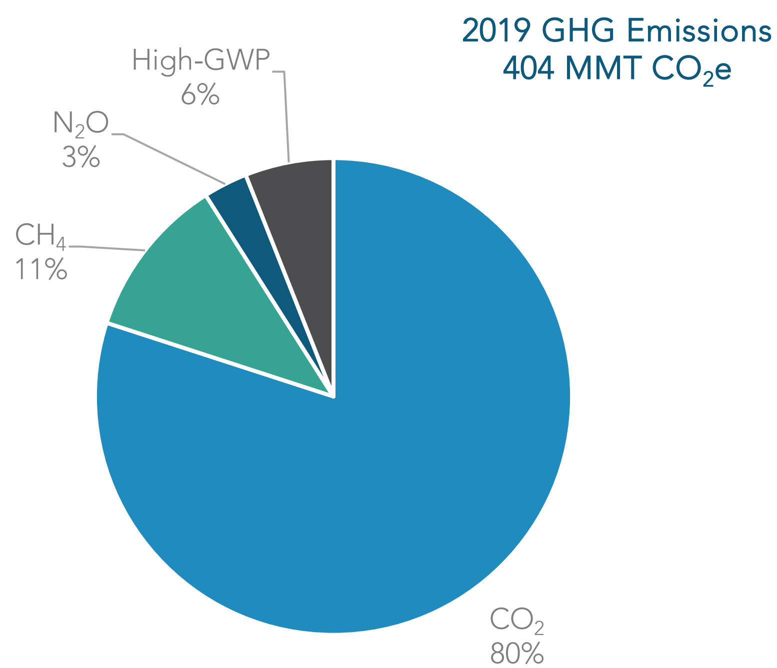
AB 32 includes which GHGs are to be regulated, reduced, and included in the state's targets and goals. That list includes seven GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs),

---

[106] Energy and Environmental Economics, Inc. 2020. *Achieving Carbon Neutrality.* https://ww2.arb.ca.gov/sites/default/files/2020-10/e3_cn_final_report_oct2020_0.pdf.
[107] CNRA. 2022. Natural and Working Lands Climate Smart Strategy. https://resources.ca.gov/Initiatives/Expanding-Nature-Based-Solutions.
[108] CARB. 2019. *Draft California 2030 Natural and Working Lands Climate Change Implementation Plan.* https://ww2.arb.ca.gov/resources/documents/nwl-implementation-draft.
[109] Appendix A (Public Process).
[110] CARB. Scoping Plan Meetings & Workshops. https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/scoping-plan-meetings-workshops.
[111] CARB. Environmental Justice Advisory Committee Meetings and Events. https://ww2.arb.ca.gov/environmental-justice-advisory-committee-meetings-and-events.
[112] CARB. 2018. Tribal Consultation Policy. October. https://www.arb.ca.gov/regact/nonreg/2018/california_air_resources_board_tribal_consultation_policy.pdf.

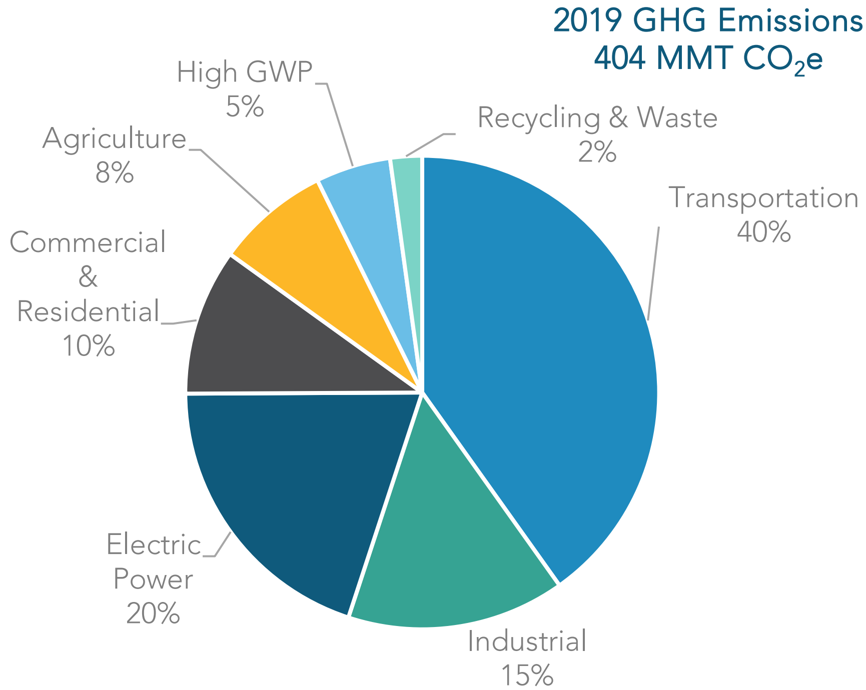
perfluorocarbons (PFCs), and nitrogen trifluoride (NF_3). Carbon dioxide is the primary GHG emitted in California, accounting for 83 percent of the total GHG emissions in 2019, as shown in Figure 1-7 below. Figure 1-8 illustrates that transportation (primarily on-road travel) is the single largest source of CO_2 emissions in the state. Upstream transportation emissions from the refinery and oil and gas sectors are categorized as CO_2 emissions from industrial sources and constitute about 50 percent of the industrial source emissions. When including these emissions, the transportation sector accounts for approximately half of statewide GHG emissions. Other significant sources of CO_2 include electricity production, industrial sources like refineries and cement plants, and residential sources like fossil gas. Figures 1-7 and 1-8 show state GHG emission contributions by GHG and sector based on the 2020 Greenhouse Gas Emission Inventory; GHG emissions for 2019 are shown because 2020 was an outlier due to the global pandemic. Emissions in Figure 1-8 are depicted by Scoping Plan sector, which includes separate categories for high-global warming potential (GWP) and recycling/waste emissions that are otherwise typically included within other economic sectors.

Figure 1-7: 2019 State GHG emission contributions by GHG[113]



[113] CARB. 2022. *California Greenhouse Gas Emissions for 2000 to 2020: Trends of Emissions and Other Indicators.* https://ww2.arb.ca.gov/sites/default/files/classic/cc/inventory/2000-2020_ghg_inventory_trends.pdf.

Figure 1-8: 2019 State GHG emission contributions by Scoping Plan sector[114]



The scope of the AB 32 GHG Inventory encompasses emission sources within the state's borders, as well as imported electricity consumed in the state. This construct for the inventory is consistent with IPCC practices to allow for comparison of statewide GHG emissions with those at the national level and with other international GHG inventories. Statewide GHG emissions calculations use many data sources, including data from other state and federal agencies. However, a significant source of data comes from reports submitted to CARB through the Regulation for the Mandatory Reporting of GHG Emissions (MRR). The MRR requires facilities and entities with more than 10,000 metric tons of carbon dioxide equivalent ($MTCO_2e$) of combustion and process emissions, all facilities belonging to certain industries, and all electric power entities to submit an annual GHG emissions data report directly to CARB. Furthermore, this regulation requires that reports from entities that emit more than 25,000 $MTCO_2e$ be verified by a CARB-

---

[114] The High GWP sector includes high global warming potential gas emissions from releases of ozone depleting substance (ODS) substitutes, SF_6 emissions from the electricity transmission and distribution system, and gases that are emitted in the semiconductor manufacturing process. ODS substitutes, which are primarily HFCs, are used in refrigeration and air conditioning equipment, solvent cleaning, foam production, fire retardants, and aerosols.

accredited third-party verification body. More information on MRR emissions reports can be found at CARB's Mandatory Greenhouse Gas Emissions Reporting website.[115]

All data sources used to develop the GHG Emission Inventory are listed in CARB's inventory supporting documentation.[116]

Natural and Working Lands

For natural and working lands, the 2018 ecosystem carbon inventory (NWL Inventory)[117] shows there are approximately 5,340 million metric tons (MMT) of carbon in the carbon pools[118] (reservoirs of carbon that have the ability to both take in and release carbon) that CARB has quantified (see Figure 1-9). For purposes of comparison, 5,340 MMT of ecosystem carbon stock is equivalent to 19,600 MMT of atmospheric CO_2. Forests and shrublands contain the majority of California's carbon stock because they cover the majority of California's landscape and have the highest carbon density of any land cover type. All other land categories combined comprise over 35 percent of California's total acreage, but only 15 percent of carbon stocks. Roughly half of the 5,340 MMT of carbon resides in soils and half in plant biomass.

---

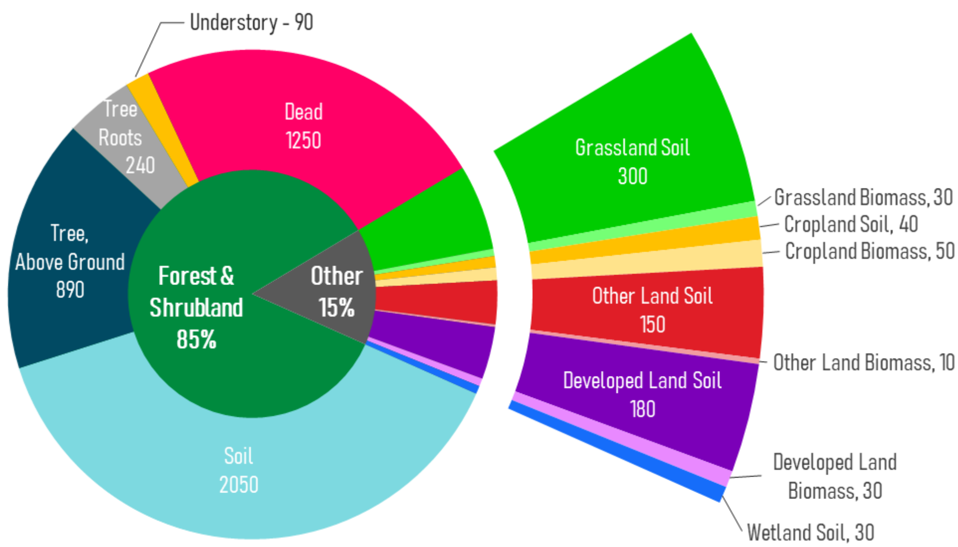
[115] CARB. Mandatory Greenhouse Gas Emissions Reporting. https://ww2.arb.ca.gov/our-work/programs/mandatory-greenhouse-gas-emissions-reporting.

[116] CARB. Current California GHG Emission Inventory Data. www.arb.ca.gov/cc/inventory/data/data.htm.

[117] CARB. 2018. *An Inventory of Ecosystem Carbon in California's Natural and Working Lands.* https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory.pdf.

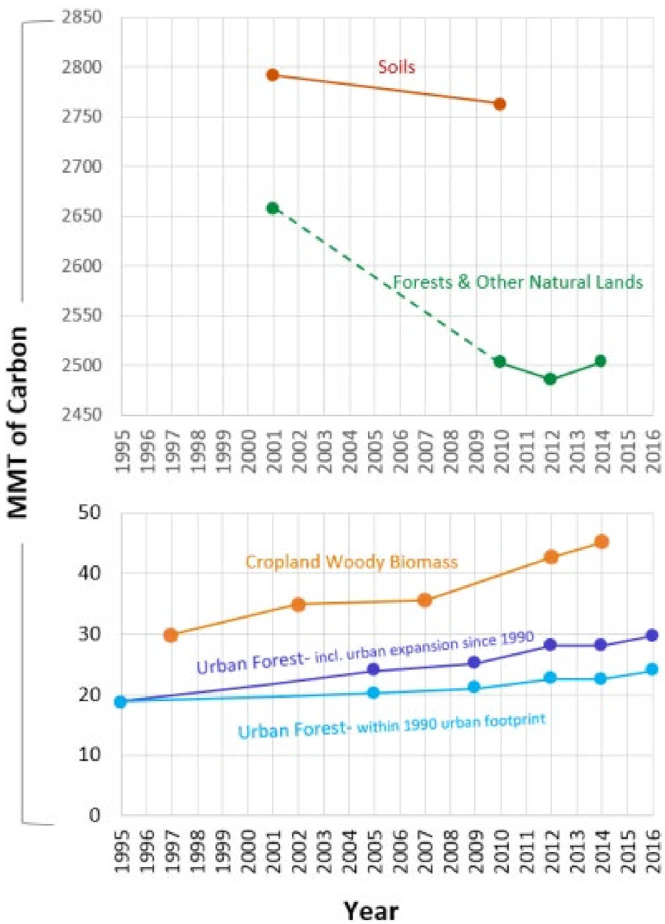
[118] "Carbon pools" are Above-Ground Live Biomass (boles, stems, and foliage in shrubs, trees, grasses, and herbaceous vegetation), Below-Ground Live Biomass (roots in shrubs, trees, grasses, and herbaceous vegetation), Dead Organic Matter (standing or downed dead wood and litter), Harvested Wood Products (all wood and bark material that leaves harvest sites regardless of whether it is eventually incorporated into merchandisable products), and Soil Organic Matter (organic carbon in the top 30 centimeters of soil).

Figure 1-9: Carbon stocks in natural and working lands (MMT carbon)



In addition to providing an estimate of the ecosystem carbon that exists on California's landscape, the NWL Inventory also shows how those carbon stocks are changing (see Figure 1-10). The inventory attributes stock change to human activity, such as land use change, or to disturbances, such as wildfire. CARB's inventory shows these lands were a source of GHG emissions from 2001 to 2011, releasing more carbon than they stored, and then they returned to be a slight carbon sink from 2012 to 2014. These trends highlight the interannual and interdecadal variability of lands and their ability to be both a source and a sink of carbon.

Figure 1-10: Changes in carbon stock by landscape type



For natural and working lands, California's inventory is also based on IPCC methods for tracking ecosystem carbon over time, providing for comparability with other national and subnational inventories and carbon accounting. As such, the NWL Inventory is an important tool for tracking both carbon stock changes in California over time and the impacts that interventions such as those identified in this Scoping Plan, actions identified in the Climate Smart Land Strategy, and others have on NWL carbon stocks.

All data sources used to develop the NWL Inventory are listed in the technical support documentation at CARB's California Natural & Working Lands Inventory website.[119]

[119] CARB. California Natural & Working Lands Inventory. https://ww2.arb.ca.gov/nwl-inventory.

Black Carbon

In addition, CARB has developed a statewide emission inventory for black carbon in support of the SLCP Strategy. The inventory is reported in two categories: non-forestry (anthropogenic) sources and forestry sources.[120] The black carbon inventory is calculated using existing $PM_{2.5}$ emission inventories combined with speciation profiles that define the fraction of $PM_{2.5}$ that is black carbon. The black carbon inventory helps support implementation of the SLCP Strategy, but it is not part of California's GHG Inventory that tracks progress toward the state's climate targets under AB 32 or SB 32. The state's major anthropogenic sources of black carbon include off-road transportation, on-road transportation, residential wood burning, fuel combustion, and industrial processes. CARB estimated 2017 black carbon emissions to be approximately 8 $MTCO_2e$.[121] The majority of anthropogenic sources come from transportation—specifically, heavy-duty vehicles. The share of black carbon emissions from transportation is dropping rapidly and is expected to continue to do so between now and 2030 as a result of California's air quality programs. The remaining black carbon emissions will come largely from woodstoves/fireplaces, off-road applications, and industrial/commercial combustion. The forestry category includes non-agricultural prescribed burning and wildfire emissions.

Tracking Life-Cycle and Out-of-State Emissions

In recent years there has been increased interest in the embedded carbon in products, also known as *life-cycle emissions.* A life-cycle accounting framework refers to all of the GHG emissions generated from the sourcing, production, and transportation of products to an endpoint. In doing such assessments for a product, emissions may be associated with sourced materials and production activity outside a jurisdiction's borders. While life-cycle emissions can provide a more comprehensive picture of the emissions associated with the goods we consume and ongoing demand, life-cycle inventories are inconsistent with IPCC standards, as they would result in double counting of emissions across jurisdictions. Other countries and regions do produce their own inventory reports consistent with IPCC methods and are taking action to reduce emissions within their jurisdictions. In addition, jurisdictions often lack legal authority to regulate sources outside of their borders. Finally, it is difficult to obtain accurate data for sources and production activities outside of a region's border that would impact the accuracy of such an inventory. For these reasons, the inventory used in the Scoping Plan does not use a life-cycle

[120] SB 1383. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB1383.
[121] This is a preliminary estimate developed for this Scoping Plan. Official Black Carbon emissions estimates are provided in the SLCP inventory here: https://ww2.arb.ca.gov/ghg-slcp-inventory.

approach and remains consistent with international accounting standards and consistent with how other countries and regions track emissions within their jurisdictions.

However, GHG mitigation action may cross geographic borders as part of subnational and international collaboration, or as a natural result of implementation of regional policies. In addition to the state's existing GHG inventory, CARB will develop an accounting framework that reflects the benefits of our policies accruing outside of the state. This accounting framework will be important to better understand the true impact of the state's policies on what is emitted into the atmosphere. For example, the LCFS incentivizes GHG reductions along the entire supply chain for the production and delivery of transportation fuel imported for use in the state. However, our inventory only captures the change in emissions from the tailpipe of when that fuel is used in California and does not capture any GHG reductions that occur in the production process if the fuel is produced out of state.

Natural and working lands forestry actions are another example, where California's policies are inspiring forest management actions in other states that result in increased permanent carbon sequestration. California's NWL inventory does not capture the increased carbon stocks resulting from forestry projects happening outside of California, and the CO_2 removals resulting from these projects are not applied in either CARB's NWL inventory or CARB's AB 32 GHG Emissions Inventory. For GHG reductions outside of the state to be attributed to our programs, those reductions must be real, quantifiable, verifiable, and permanent.

It also will be important to avoid any double counting (including claims to those reductions by other jurisdictions) and to transparently indicate whether any extra-jurisdictional emissions reductions might be included in another region's inventory. CARB is collaborating with other jurisdictions to ensure GHG accounting rules are consistent with international best practices, as robust accounting rules instill confidence in the reductions claimed and maintain support for joint action across jurisdictions. The policy goals of consistency and transparency are critical as we work together with other jurisdictions on our parallel paths to achieve our GHG targets with real benefits to the atmosphere.

Tracking Progress

Historically, the AB 32 GHG Inventory has been the primary metric to track progress toward achieving climate targets.[122] However, we must now deploy clean technology at unprecedented rates. The emissions modeling underpinning this Scoping Plan and

---

[122] Starting with the 2022 Edition of the AB 32 GHG inventory, the inventory development now relies more directly on the annually reported and third-party verified emissions from the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions.

targets for clean technology in statute can serve as leading indicators across the economy on how our actions compare to the pace of action needed to be on track to achieve carbon neutrality. The California Climate Dashboard[123] was launched in 2022 and provides high-level metrics for clean energy production and technology deployment. Statistics such as the deployment of zero emission vehicles and clean electricity generation are just some of the examples of metrics across the economy that can be tracked, in addition to GHG emissions, to understand if the state is on track to meet its climate goals. A key indicator to track will be building of new energy infrastructure and deployment of clean technology as evaluated in the uncertainty analysis in Chapter 2. CARB will coordinate with state agencies to establish and make public similar metrics across all economic sectors to help provide transparency on the state's progress in deploying clean technology at the pace and scale needed to achieve carbon neutrality no later than 2045.

[123] CalEPA. California Climate Dashboard. *https://calepa.ca.gov/climate-dashboard/*.

Chapter 2: The Scoping Plan Scenario

This chapter describes the Scoping Plan Scenario, which for the first time includes sources in both the AB 32 GHG Inventory and Natural and Working Lands (NWL). It begins with a short description of the alternatives evaluated. Four scenarios for the AB 32 GHG Inventory and NWL were considered separately and helped to inform the Scoping Plan Scenario. Each of the alternatives were considered in terms of the important criteria and priorities that the state's comprehensive climate action must deliver, including the need for GHG reductions that are not only technologically feasible and cost-effective, but also can deliver health and economic benefits for the state. All the scenarios were set against what is called the *Reference Scenario*—that is, what the GHG emissions would look like if we did nothing at all beyond the existing policies that are required and already in place to achieve the 2030 target of at least 40 percent below 1990 levels, or those expected with no new actions in the NWL sector. For this Scoping Plan, two sets of modeling tools were used to evaluate the AB 32 GHG Inventory and NWL sectors because no single model can assess both AB 32 sectors and NWL together. As a result, two different sets of scenarios were developed for each sector type. While this chapter breaks out discussion separately for the two sector types, the Scoping Plan Scenario reflects the combined actions across both sectors by choosing an alternative from each sector type. The modeling provides point estimates; however, that does not imply precision. As discussed in the uncertainty section, several types of uncertainties are associated with any outcomes projected by the modeling results. There will be ranges of estimates associated with each point that are not shown in the graphs or results.

Scenarios for the AB 32 GHG Inventory Sectors

The Reference Scenario for the AB 32 GHG Inventory sectors shows continuing but modest GHG reductions beyond 2030 that level off toward mid-century. The comprehensive analysis of all four alternatives indicates that the Scoping Plan Scenario is the best choice to achieve California's climate and clean air goals while balancing the legislative direction on prioritizing direct emissions reductions, reducing anthropogenic emissions by at least 85 percent by 2045, being technologically feasible, and being cost-effective. It also protects public health, provides a solid foundation for continued economic growth, and drastically reduces the state's dependence on fossil fuel combustion and does not disproportionately impact disadvantaged communities. Each of the alternative scenarios was the product of a process of development informed by public input, the governor,[124] CARB, legislative direction, and input by the EJ Advisory Committee.[125,126] Future updates to the Scoping Plan may consider new clean technologies and fuels beyond those included in this Scoping Plan.

The four scenarios evaluated shared many similarities. They each embodied the following characteristics:

- Drastic reduction in fossil fuel dependence, with some remaining in-state demand for fossil fuels for aviation, marine, and locomotion applications, and for fossil gas for buildings and industry
- Ambitious deployment of efficient non-combustion technologies such as zero emission vehicles and heat pumps
- Rapid growth in the production and distribution of clean energy such as zero carbon electricity and hydrogen
- Progressive phasedown of fossil fuel production and distribution activities as part of the transition to clean energy
- Remaining emissions of fugitive SLCPs such as refrigerants and fugitive methane
- Strong consumer adoption of clean technology and fuel options
- Removal of remaining CO_2 emissions to achieve carbon neutrality
- Some reliance on carbon capture and sequestration (CCS)

While the four scenarios had a lot in common, they also had some differences:

- Year in which carbon neutrality is achieved (2035 or 2045)
- Rate of deployment of clean technology and production and distribution of zero carbon energy
- Remaining amount of demand for fossil energy in the year carbon neutrality is achieved
- Constraints on technology and fuels deployed in certain sectors
- Consumer adoption rates of clean technologies and fuels
- Degree of reliance on CO_2 removal
- Degree of reliance on CCS

[124] Newsom, Gavin. July 22, 2022. Letter from Governor Newsom to CARB Chair Liane Randolph. Retrieved from *https://www.gov.ca.gov/wp-content/uploads/2022/07/07.22.2022-Governors-Letter-to-CARB.pdf*.
[125] EJ Advisory Committee. December 2, 2021. EJ Advisory Committee Responses for the CARB Scenario Inputs. *https://ww2.arb.ca.gov/sites/default/files/2021-12/EJAC%20Final%20Responses%20to%20CARB%20Scenario%20Inputs_12_2_21.pdf*.
[126] CARB. January 25, 2022. Update on PATHWAYS Scenario Modeling Assumptions. *https://ww2.arb.ca.gov/sites/default/files/2022-01/Scenario%20Slides%20for%20Jan25%20EJAC%20Mtg_01242022.pdf*.

The summary below provides an overview of the alternatives designed and considered for the energy and industrial sectors in this update. Full details of each scenario considered can be found in the *Draft 2022 Scoping Plan Update*

Scoping Plan Scenario (modeling scenario Alternative 3 from the Draft): carbon neutrality by 2045, deploy a broad portfolio of existing and emerging fossil fuel alternatives and clean technologies, and align with statutes, Executive Orders, Board direction, and direction from the governor

Alternative 1: carbon neutrality by 2035, nearly complete phaseout of all combustion, limited reliance on carbon capture and sequestration and engineered carbon removal, and restricted applications for biomass-derived fuels

Alternative 2: carbon neutrality by 2035 and aggressive deployment of a full suite of technology and energy options, including engineered carbon removal

Alternative 4: carbon neutrality by 2045, deployment of a broad portfolio of existing and emerging fossil fuel alternatives, slower deployment and adoption rates than the Scoping Plan Scenario, and a higher reliance on CO_2 removal

Other considerations for the AB 32 GHG Inventory sectors include the following:

- To what extent does an alternative meet the statewide targets and any sector targets, and also deliver clean air benefits (especially in the near term) to address ongoing healthy air disparities, prioritize reductions for mobile and large stationary sources, and emphasize continued investment in disadvantaged communities?
- Does an alternative support California in building on efforts to collaborate with other jurisdictions and include exportable policies based on robust science?
- Does an alternative provide for compliance options and a cost-effective approach to reduce GHG emissions?
- Does the alternative present a realistic and ambitious path forward consistent with statute and science, and support economic opportunities, particularly in anticipated growth sectors?

Scenarios for Natural and Working Lands

For the natural and working lands sector, the Reference Scenario shows that NWL will continue to emit GHGs and lose carbon stocks into the future as the combined effects of past unhealthy management practices and climate change impact our lands. Relative to the Reference Scenario, the four NWL scenarios represent different scales of land management on seven landscapes (forests, shrublands/chaparral, grasslands, croplands, developed lands, wetlands, and sparsely vegetated lands) to support carbon neutrality.

The analysis of the four NWL scenarios shows that the Scoping Plan Scenario is the preferred choice because it prioritizes sustainable land management to sequester carbon over the long term, GHG and air pollution reductions, ecosystem health and resilience, and implementation and technological feasibility and cost-effectiveness. The Scoping Plan Scenario reduces catastrophic wildfire risk to the state; increases the health and resilience of California's forests, shrublands, and grasslands; increases soil health; and protects, restores, and enhances California's natural and working lands for future generations. The Scoping Plan Scenario takes into consideration the priority landscapes and nature-based strategies identified in California's Climate Smart Strategy[127] and reflects the state's priorities to manage lands in ways that support the multiple benefits they provide. The Scoping Plan Scenario, as well as each of the alternative NWL scenarios, were informed by input from other agencies, the public, and the EJ Advisory Committee. Additional landscapes and land management activities will be added and evaluated in future Scoping Plan updates and in response to AB 1757.

Each of the NWL scenarios have several similarities, including the following:

- Prioritizing NWL management actions on forests, shrublands, grasslands, croplands, developed lands, wetlands, and sparsely vegetated lands. These actions can reduce GHG emissions from these lands, protect ecosystems against future climate change, protect communities, and enhance the ecosystem benefits they provide to nature and society.
- Exploring the potential impacts of different levels of NWL management actions that are designed to achieve the objective associated with each scenario.
- Analyzing the carbon impacts of land management actions, climate change, wildfire, and water use on California's diverse natural and working lands through 2045.

There are also differences across the four NWL scenarios. These include:

- The level of NWL management actions taken on each landscape, such as varying the acres of healthy soils practices for croplands.
- The types of NWL management actions taken on each landscape, such as prescribed burning or thinning for forests, grasslands, and shrublands.

---

[127] CNRA. 2022. Natural and Working Lands Climate Smart Strategy. *https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Expanding-Nature-Based-Solutions/CNRA-Report-2022---Final_Accessible_Compressed.pdf*.

The summary below provides an overview of the alternatives designed and considered for the NWL sectors in this Scoping Plan. Full details of each scenario considered can be found in the *Draft 2022 Scoping Plan Update*.

Scoping Plan Scenario (NWL Alternative 3 from the Draft): land management activities that prioritize restoration and enhancement of ecosystem functions to improve resilience to climate change impacts, including more stable carbon stocks

NWL Alternative 1: land management activities that prioritize short term carbon stocks in our forests and through increased climate smart agricultural practices on croplands

NWL Alternative 2: land management activities representative of California's current commitments and plans

NWL Alternative 4: land management activities that prioritize reducing catastrophic wildfires in forests, shrublands, and grasslands

Evaluation of Scoping Plan Alternatives

CARB staff solicited feedback from topical experts, affected stakeholders, and the EJ Advisory Committee, including a tribal representative, at public meetings to assemble input assumptions for four carbon neutrality scenarios to model using PATHWAYS. Revisions to the Draft Scoping Plan were informed by direction in statute, the Governor's Executive Orders, public comments, and the recommendations of the EJ Advisory Committee. The three alternative scenarios were designed to explore the potential speed, magnitude, and impacts of transitioning California's energy demand away from fossil fuels. The modeling assumptions listed below identify the primary fossil fuel alternative that is commercially available and technically feasible for widespread use by 2045 for each sector. CARB assumes that any energy demand that remains after the alternative technology or fuel is applied—such as on-road internal combustion engines, industrial processes, and gas use in existing buildings that have not yet decarbonized—will continue to be met by fossil fuels, resulting in residual GHG emissions.

NWL Scoping Plan Alternatives

For the NWL sectors, staff significantly expanded the scale of the scientific analysis for NWL from previous Scoping Plan efforts. CARB staff utilized modeling tools for this expanded analysis to assess both the carbon and other ecological, public health, and economic outcomes of management actions on forests, shrublands, grasslands, croplands, developed lands, wetlands, and sparsely vegetated lands. CARB staff aligned the scenarios with both the landscape types and actions identified in other efforts called for in Governor Newsom's Executive Order N-82-20 (e.g., California's Climate Smart Strategy and Pathways to 30x30). As part of this Scoping Plan, CARB staff modeled as many of the management actions identified in the Natural and Working Lands Climate

Smart Strategy as were feasible. The management actions that were included in the model were selected because of the State of California's previous work to quantify these actions' impacts. It was not feasible to model every land management strategy for NWL, and so it is possible that larger volumes of sequestration (e.g., in soils or in oceans) could result from additional non-modeled activities. California's Natural and Working Lands Climate Smart Strategy includes a more comprehensive listing of priority nature-based solutions and management actions. It is important to note that the absence of a particular management action or its climate benefit in the modeling is not an indication of its importance or potential contributions toward meeting the target or toward supporting the carbon neutrality target for California.

Forests: Management strategies were modeled for forests: biological/chemical/ herbaceous treatments (e.g., herbicide application), clearcut, various timber harvests (e.g., variable retention, seed tree / shelterwood, selection harvesting), mastication, other mechanical treatments (e.g., piling of dead material, understory thinning), prescribed burning, and thinning. Avoided land conversion to another land use was also included in the modeling. Wildfire was modeled and is responsive to management strategies and climate conditions.

Shrublands and chaparral: Management strategies were modeled for shrublands and chaparral: biological/chemical/herbaceous treatments, prescribed burning, mechanical treatment (e.g., mastication, crushing, mowing, piling), and avoided conversion from shrubland to another land use. Wildfire was modeled and is responsive to management strategies and climate conditions.

Grasslands: Management strategies were modeled for grasslands: biological/chemical/herbaceous treatments, prescribed burning, and avoided land conversion from grasslands to another land use. Wildfire was modeled and is responsive to management strategies and climate conditions.

Croplands: Management strategies were modeled for row crops: cover cropping, no till, reduced till, compost amendment, transition to organic[128] farming, avoided conversion of annual crop agricultural land through easements, establishing riparian forest buffers, alley cropping, establishing windbreaks/shelterbelts, establishing tree and shrubs in croplands, and establishing hedgerows. For perennial crops, windbreaks/shelterbelts, hedgerows, conversion from annual crops to perennial crops, and avoided conversion to other land uses were modeled.

[128] Note: N_2O reductions from decreases in synthetic fertilizer application in organic farming were not modeled.

Developed lands: Management strategies were modeled for developed lands: Increasing tree canopy cover through planting trees and improved management of existing trees, and removing vegetation surrounding structures in accordance with the CAL FIRE Defensible Space PRC 4291.

Wetlands: Management strategies were modeled for wetlands: Restoring wetlands through submerging cultivated land in the Sacramento-San Joaquin Delta and avoided land conversion in the Sacramento-San Joaquin Delta.

Sparsely vegetated lands: Management strategies were modeled for sparsely vegetated lands: Avoided conversion of sparsely vegetated lands to another land use.

Scoping Plan Scenario

The Scoping Plan Scenario achieves GHG emission reductions that exceed the levels expected based on existing policies represented in the Reference Scenario, keeping California on track to achieve the SB 32 GHG reduction target for 2030 and become carbon neutral no later than 2045. Actions that reduce GHG emissions and transition AB 32 GHG Inventory sources away from fossil fuel combustion affect each economic sector. Actions that lead to improved carbon stocks affect each landscape.

AB 32 GHG Inventory Sectors

The AB 32 GHG Inventory Sector Reference scenario is the forecasted statewide GHG emissions through mid-century, with existing policies and programs but without any further action to reduce GHGs beyond those needed to achieve the 2030 limit. The Reference Scenario was developed based on other projections of business-as-usual conditions. Sources of data and policies included are:

- California Energy Demand Forecast[129]
- The two transportation carbon neutrality studies required by AB 74[130]
- The Mobile Source Strategy[131]
- SB 100 60 percent Renewables Portfolio Standard
- A Low Carbon Fuel Standard carbon intensity reduction target of 20 percent

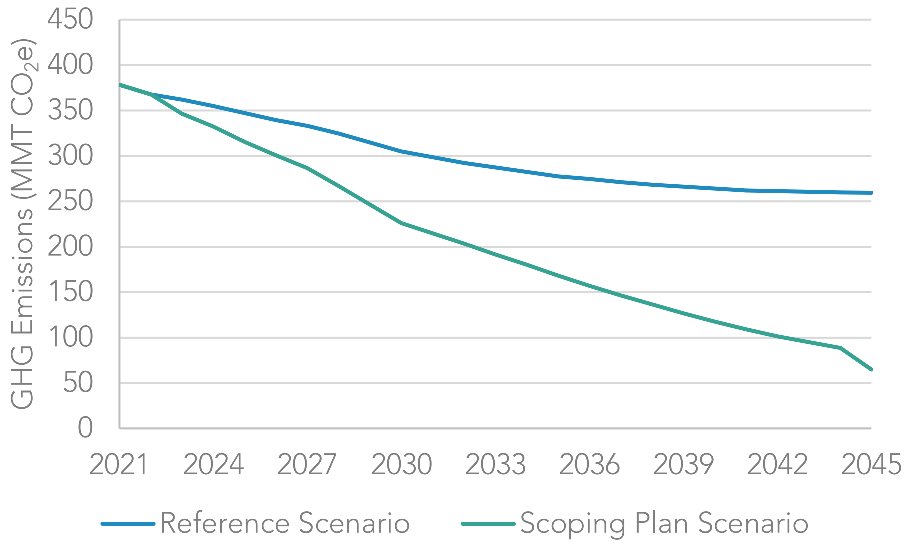
Policies that are under study or design, such the Advanced Clean Fleets regulation, are not included. The Reference Scenario reflects current trends and expected performance of policies identified in the 2017 Scoping Plan—some of which are performing better (such as the RPS and LCFS) and others that may not meet expectations (such as vehicle miles traveled [VMT] reductions and methane capture). Figure 2-1 provides the modeling results for a Reference Scenario for the AB 32 GHG Inventory sectors compared to the Scoping Plan Scenario.

[129] California Energy Commission (CEC). 2020. *2019 Integrated Energy Policy Report.* https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2019-integrated-energy-policy-report.

[130] Brown et al. 2021. *Driving California's Transportation Emissions.* https://escholarship.org/uc/item/3np3p2t0 and Deschenes et al. 2021. *Enhancing equity.* https://zenodo.org/record/4707966#.YI72RNrMKUn.

[131] CARB. 2021. 2020 *Mobile Source Strategy.* https://ww2.arb.ca.gov/sites/default/files/2021-12/2020_Mobile_Source_Strategy.pdf.

Figure 2-1: Reference and Scoping Plan Scenario GHG emissions[132]



The Scoping Plan Scenario is summarized in Table 2-1. The table shows the types of technologies and energy needed to drastically reduce GHG emissions from the AB 32 Inventory sectors. It also includes references to relevant statutes and Executive Orders, although it is not comprehensive of all existing new authorities for directing or supporting the actions described. Each action is expected to both reduce GHGs and help improve air quality, primarily by transitioning away from combustion of fossil fuels. The Scoping Plan Scenario achieves the AB 1279 target of 85 percent below 1990 levels by 2045 and identifies a need to accelerate the 2030 target to 48 percent below 1990 levels.

---

[132] The drop in emissions in 2045 reflects both the need to achieve an 85% reduction below 1990 levels in anthropogenic emissions per AB 1279 and Governor Newsom’s request for a 100 MMT CO2e carbon removal and capture target in 2045. This was modeled by extending CCS to electric sector emissions.

Table 2-1: Actions for the Scoping Plan Scenario: AB 32 GHG Inventory sectors

Sector	Action	Statutes, Executive Orders, Other Direction, Outcome
GHG Emissions Reductions Relative to the SB 32 Target[133]	40% below 1990 levels by 2030	SB 32: Reduce statewide GHG emissions. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory
Smart Growth / Vehicle Miles Traveled (VMT)	VMT per capita reduced 25% below 2019 levels by 2030, and 30% below 2019 levels by 2045	SB 375: Reduce demand for fossil transportation fuels and GHGs, and improve air quality. In response to Board direction and EJ Advisory Committee recommendations
Light-duty Vehicle (LDV) Zero Emission Vehicles (ZEVs)	100% of LDV sales are ZEV by 2035	EO N-79-20: Reduce demand for fossil transportation fuels and GHGs, and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory 2035 target aligns with the EJ Advisory Committee recommendation.

[133] While the SB 32 GHG emissions reduction target is not an Action that is analyzed independently, it is included in this table for reference.

Sector	Action	Statutes, Executive Orders, Other Direction, Outcome
Truck ZEVs	100% of medium-duty (MDV)/HDV sales are ZEV by 2040 (AB 74 University of California Institute of Transportation Studies [ITS] report)	EO N-79-20: Reduce demand for fossil transportation fuels and GHGs, and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory
Aviation	20% of aviation fuel demand is met by electricity (batteries) or hydrogen (fuel cells) in 2045. Sustainable aviation fuel meets most or the rest of the aviation fuel demand that has not already transitioned to hydrogen or batteries.	Reduce demand for petroleum aviation fuel and reduce GHGs. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory In response to Governor Newsom's July 2022 letter to CARB Chair Liane Randolph
Ocean-going Vessels (OGV)	2020 OGV At-Berth regulation fully implemented, with most OGVs utilizing shore power by 2027. 25% of OGVs utilize hydrogen fuel cell electric technology by 2045.	Reduce demand for petroleum fuels and GHGs, and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory
Port Operations	100% of cargo handling equipment is zero-emission by 2037. 100% of drayage trucks are zero emission by 2035.	Executive Order N-79-20: Reduce demand for petroleum fuels and GHGs, and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory

Sector	Action	Statutes, Executive Orders, Other Direction, Outcome
Freight and Passenger Rail	100% of passenger and other locomotive sales are ZEV by 2030. 100% of line haul locomotive sales are ZEV by 2035. Line haul and passenger rail rely primarily on hydrogen fuel cell technology, and others primarily utilize electricity.	Reduce demand for petroleum fuels and GHGs, and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory
Oil and Gas Extraction	Reduce oil and gas extraction operations in line with petroleum demand by 2045.	Reduce GHGs and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory
Petroleum Refining	CCS on majority of operations by 2030, beginning in 2028 Production reduced in line with petroleum demand.	Reduce GHGs and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory

Sector	Action	Statutes, Executive Orders, Other Direction, Outcome
Electricity Generation	Sector GHG target of 38 million metric tons of carbon dioxide equivalent ($MMTCO_2e$) in 2030 and 30 $MMTCO_2e$ in 2035 Retail sales load coverage[134] 20 gigawatts (GW) of offshore wind by 2045 Meet increased demand for electrification without new fossil gas-fired resources.	SB 350 and SB 100: Reduce GHGs and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory In response to Governor Newsom's July 2022 letter, Board direction, and EJ Advisory Committee recommendation
New Residential and Commercial Buildings	All electric appliances beginning 2026 (residential) and 2029 (commercial), contributing to 6 million heat pumps installed statewide by 2030	Reduce demand for fossil gas and GHGs, and improve ambient and indoor air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory In response to Governor Newsom's July 2022 letter

[134] SB 100 speaks only to retail sales and state agency procurement of electricity. The *2021 SB 100 Joint Agency Report* reflects the agency authors' understanding that other loads—wholesale or non-retail sales and losses from storage and transmission and distribution lines—are not subject to the law.

Sector	Action	Statutes, Executive Orders, Other Direction, Outcome
Existing Residential Buildings	80% of appliance sales are electric by 2030 and 100% of appliance sales are electric by 2035. Appliances are replaced at end of life such that by 2030 there are 3 million all-electric and electric-ready homes—and by 2035, 7 million homes—as well as contributing to 6 million heat pumps installed statewide by 2030.	Reduce demand for fossil gas and GHGs, and improve ambient and indoor air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory In response to Governor Newsom's July 2022 letter
Existing Commercial Buildings	80% of appliance sales are electric by 2030, and 100% of appliance sales are electric by 2045. Appliances are replaced at end of life, contributing to 6 million heat pumps installed statewide by 2030.	Reduce demand for fossil gas and GHGs, and improve ambient and indoor air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory In response to Governor Newsom's July 2022 letter
Food Products	7.5% of energy demand electrified directly and/or indirectly by 2030; 75% by 2045	Reduce demand for fossil gas and GHGs, and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory

Sector	Action	Statutes, Executive Orders, Other Direction, Outcome
Construction Equipment	25% of energy demand electrified by 2030 and 75% electrified by 2045	Reduce demand for fossil energy and GHGs, and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory
Chemicals and Allied Products; Pulp and Paper	Electrify 0% of boilers by 2030 and 100% of boilers by 2045. Hydrogen for 25% of process heat by 2035 and 100% by 2045 Electrify 100% of other energy demand by 2045.	Reduce demand for fossil energy and GHGs, and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory
Stone, Clay, Glass, and Cement	CCS on 40% of operations by 2035 and on all facilities by 2045 Process emissions reduced through alternative materials and CCS	SB 596: Reduce demand for fossil energy, process emissions, and GHGs, and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory
Other Industrial Manufacturing	0% energy demand electrified by 2030 and 50% by 2045	Reduce demand for fossil energy and GHGs, and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory

Sector	Action	Statutes, Executive Orders, Other Direction, Outcome
Combined Heat and Power	Facilities retire by 2040.	Reduce demand for fossil energy and GHGs, and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory
Agriculture Energy Use	25% energy demand electrified by 2030 and 75% by 2045	Reduce demand for fossil energy and GHGs, and improve air quality. AB 197: direct emissions reductions
Low Carbon Fuels for Transportation	Biomass supply is used to produce conventional and advanced biofuels, as well as hydrogen.	Reduce demand for petroleum fuel and GHGs, and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory
Low Carbon Fuels for Buildings and Industry	In 2030s biomethane[135] blended in pipeline Renewable hydrogen blended in fossil gas pipeline at 7% energy (~20% by volume), ramping up between 2030 and 2040 In 2030s, dedicated hydrogen pipelines constructed to serve certain industrial clusters	Reduce demand for fossil energy and GHGs, and improve air quality. AB 197: direct emissions reductions for sources covered by the AB 32 Inventory

[135] *Biomethane* is also known as renewable natural gas (RNG).

Sector	Action	Statutes, Executive Orders, Other Direction, Outcome
Non-combustion Methane Emissions	Increase landfill and dairy digester methane capture. Some alternative manure management deployed for smaller dairies Moderate adoption of enteric strategies by 2030 Divert 75% of organic waste from landfills by 2025. Oil and gas fugitive methane emissions reduced 50% by 2030 and further reductions as infrastructure components retire in line with reduced fossil gas demand	SB 1383: Reduce short-lived climate pollutants.
High GWP Potential Emissions	Low GWP refrigerants introduced as building electrification increases, mitigating HFC emissions	SB 1383: Reduce short-lived climate pollutants.

Natural and Working Lands

The Reference Scenario for NWL represents the amount of land management that occurred between 2001 and 2014, and projects the outcomes from maintaining the 2001–2014 levels of land management until 2045. The management and land use practices that occur within the Reference Scenario were derived from empirical data used by staff. For forests, shrublands/chaparral, and grasslands, the Reference Scenario constitutes approximately 250,000 acres of annual statewide treatments. For croplands, the Reference Scenario represents no healthy soil practices because during this period the healthy soil program did not yet exist. For land use change within all land types that consider land use change, historical rates of land conversion from 2001–2014 also were taken from empirical data and modeled into the future for the Reference Scenario.

Table 2-2 summarizes the Scoping Plan Scenario. The table also includes references to relevant statutes and Executive Orders where available.

Table 2-2: Actions for the Scoping Plan Scenario: NWL sectors

Sector	Action	Statutes, Executive Orders, Outcome
Natural and Working Lands	Conserve 30% of the state's NWL and coastal waters by 2030. Implement near- and long-term actions to accelerate natural removal of carbon and build climate resilience in our forests, wetlands, urban greenspaces, agricultural soils, and land conservation activities in ways that serve all communities—and in particular low-income, disadvantaged, and vulnerable communities.	EO N-82-20 and SB 27: CARB to include an NWL target in the Scoping Plan. AB 1757: Establish targets for carbon sequestration and nature-based climate solutions. SB 1386: NWL are an important strategy in meeting GHG reduction goals.

Sector	Action	Statutes, Executive Orders, Outcome
Forests and Shrublands	At least 2.3 million acres[136] treated statewide annually in forests, shrublands/chaparral, and grasslands, comprised of regionally specific management strategies that include prescribed fire, thinning, harvesting, and other management actions. No land conversion of forests, shrublands/chaparral, or grasslands.	Restore health and resilience to overstocked forests and prevent carbon losses from severe wildfire, disease, and pests. Improve air quality and reduce health costs related to wildfire emissions. Improve water quantity and quality and improve rural economies. Provide forest biomass for resource utilization. EO B-52-18: CARB to increase the opportunity for using prescribed fire. AB 1504 (Skinner, Chapter 534, Statutes of 2010): CARB to recognize the role forests play in carbon sequestration and climate mitigation.

[136] The 2.3 million acre target is what the Scoping Plan modeling shows would be needed to realize the carbon stock target called for in this Scoping Plan by 2045.

Sector	Action	Statutes, Executive Orders, Outcome
Grasslands	At least 2.3 million acres[137] treated includes increased management of grasslands interspersed in forests to reduce fuels surrounding communities using management strategies appropriate for grasslands. No land conversion of forests, shrublands/chaparral, or grasslands.	Help to achieve climate targets, improve air quality, and reduce health costs.
Croplands	Implement climate smart practices for annual and perennial crops on ~80,000 acres annually. Land easements/ conservation on annual crops at ~5,500 acres annually. Increase organic agriculture to 20% of all cultivated acres by 2045 (~65,000 acres annually).	Reduce short-lived climate pollutants. Increase soil water holding capacity. Increase organic farming and reduce pesticide use. SB 859: Recognizes the ability of healthy soils practices to reduce GHG emissions from agricultural lands. Target increased in response to Governor Newsom's direction to prioritize sustainable land management.

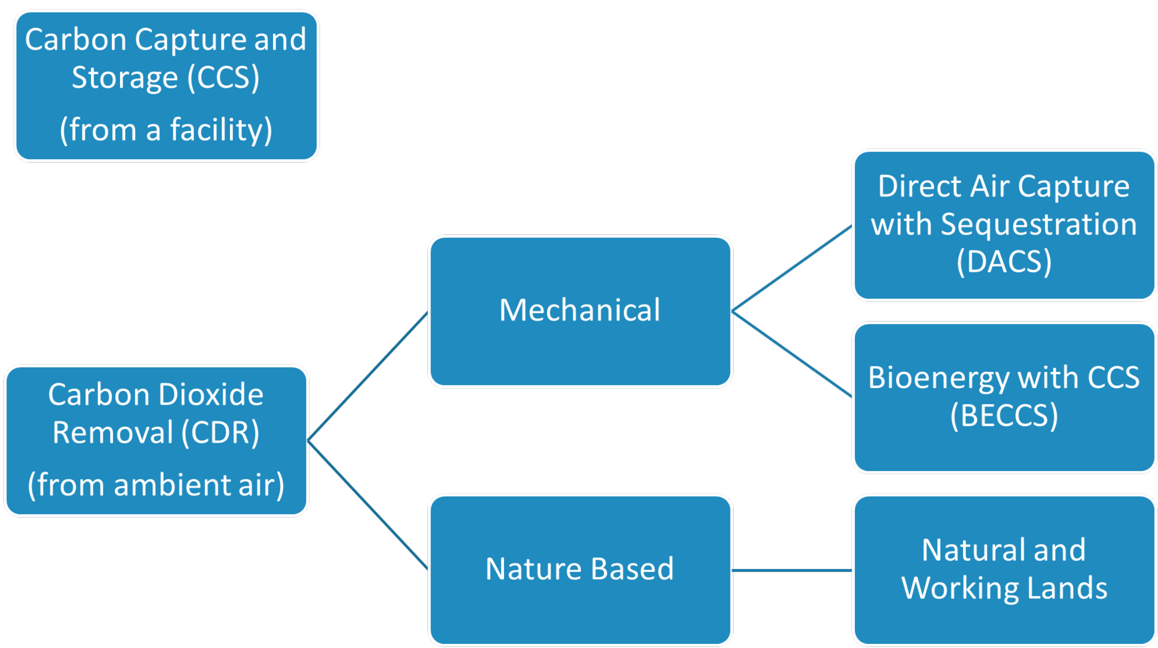
[137] The 2.3 million acre target is what the Scoping Plan modeling shows would be needed to realize the carbon stock target called for in this Scoping Plan by 2045.

Sector	Action	Statutes, Executive Orders, Outcome
Developed Lands	Increase urban forestry investment by 200% above current levels and utilize tree watering that is 30% less sensitive to drought. Establish defensible space that accounts for property boundaries.	Increase urban tree canopy and shade cover. Reduce heat island effects and support water infrastructure. Reduce fire risk via defensible space. AB 2251 (Calderon, Chapter 186, Statutes of 2022): Increase urban tree canopy 10% by 2035. Target increased in response to AB 2251 and Governor Newsom's direction on CO_2 removal targets in his July 2022 letter.
Wetlands	Restore 60,000 acres of Delta wetlands.	Increase carbon sequestration and reduce short-lived climate pollutants. Helps to reverse land subsidence while improving flood protection and providing critical habitat.
Sparsely Vegetated Lands	Land conversion at 50% of the Reference Scenario land conversion rate.	Reduce the rate of land conversion to more GHG-intensive land uses.

Strategies for Carbon Removal and Sequestration

To achieve carbon neutrality, any remaining emissions must be compensated for using carbon removal and sequestration tools. The following discussion presents more detail on the options available to capture and sequester carbon. Carbon removal and sequestration will be an essential tool to achieve carbon neutrality, and the modeling clearly shows there is no path to carbon neutrality without carbon removal and sequestration. Governor Newsom also recognized the importance of CO_2 removal strategies and directed CARB to establish CO_2 removal and carbon capture targets of 20 $MMTCO_2$ and 100 $MMTCO_2$ by 2030 and 2045, respectively, as well as signing 2022 legislation on carbon removal and sequestration, including: AB 1279, SB 905, SB 1137, and AB 1757. Carbon removal and sequestration can take different forms. Figure 2-2 illustrates the types of carbon removal and sequestration included in this Scoping Plan. There are numerous other carbon removal options undergoing research, development, and pilot deployment. As these options mature and new approaches emerge, they can be considered in future Scoping Plan updates.

Figure 2-2: Forms of carbon removal and sequestration considered in this Scoping Plan



The Role of Carbon Capture and Sequestration

Carbon capture and sequestration (CCS) will be a necessary tool to reduce GHG emissions and mitigate climate change while minimizing leakage and minimizing emissions where no technological alternatives may exist. CCS is a process by which large amounts of CO_2 are captured, compressed, transported, and sequestered. CCS projects are paired with a source of emissions, as the CCS project captures CO_2 as it leaves a facility's smokestack. CCS projects are often paired with large GHG-emitting facilities such as energy, manufacturing, or fuel production facilities. The sequestration component of CCS includes CO_2 injection into geologic formations (such as depleted oil and gas reservoirs and saline formations), as well as use in industrial materials (e.g., concrete). CCS is distinct from biological sequestration, which is typically accomplished through NWL management and conservation practices that enhance the storage of carbon or reduce CO_2 emissions with nature-based approaches. CCS is also distinct from mechanical CO_2 removal technologies, where CO_2 is removed directly from the atmosphere using mechanical and/or chemical processes.

CARB adopted a CCS Protocol in 2018 as part of amendments to the Low Carbon Fuel Standard.[138] At this time, no CCS projects have been implemented or have generated any credits under that protocol. However, CCS projects have been implemented elsewhere since the 1970s, largely on coal-fired power plants, with over two dozen projects operational around the world. Over 100 are at the stages of advanced or early development and are expanding beyond coal-fired plants to fossil gas, fuel production, and electricity generation facilities.[139] CCS projects are in development for addressing emissions from fuel, gas, energy production, and chemical production. As of November 2019, more than half of global large-scale CCS facilities (representing approximately 22 $MMTCO_2$/yr in capacity[140]) were in the U.S., mostly as a result of sustained governmental support for these technologies.[141] This support includes the federal 45Q tax credit for CCS[142,143] and research and deployment grants from federal agencies.[144,145] California's deep sedimentary rock formations in the Central Valley represent world-class

[138] CARB. 2022. Carbon Capture & Sequestration. *https://ww2.arb.ca.gov/our-work/programs/carbon-capture-sequestration*.

[139] Global CCS Institute. 2021. *Global Status of CCS 2021. https://www.globalccsinstitute.com/wp-content/uploads/2021/11/Global-Status-of-CCS-2021-Global-CCS-Institute-1121.pdf*.

[140] IHS Markit. August 2021. Carbon Removal Potential: An Overview. *https://ww2.arb.ca.gov/sites/default/files/2021-08/ihsmarkit_presentation_sp_engineeredcarbonremoval_august2021.pdf*.

[141] Beck, Lee. 2019. *Carbon capture and storage in the USA: The role of US innovation leadership in climate-technology commercialization. https://academic.oup.com/ce/article/4/1/2/5686277*.

[142] Congressional Research Service. 2021. Carbon Storage Requirements in the 45Q Tax Credit. IF11639. *https://crsreports.congress.gov/product/pdf/IF/IF11639*.

[143] The Inflation Reduction Act of August 2022 expands and enhances the 45 Q tax credit for CCS. Pub.L. No. 117-169 (August 16, 2022).

[144] U.S. Department of Energy. 2020. U.S. Department of Energy Announces $131 Million for CCUS Technologies. *https://www.energy.gov/articles/us-department-energy-announces-131-million-ccus-technologies*.

[145] U.S. Department of Energy. 2021. Funding Opportunity Announcement 2515, Carbon Capture R&D for Natural Gas and Industrial Point Sources, and Front-End Engineering Design Studies for Carbon Capture Systems at Industrial Facilities and Natural Gas Plants. *https://www.energy.gov/fecm/articles/funding-opportunity-announcement-2515-carbon-capture-rd-natural-gas-and-industrial*.

CO_2 storage sites that would meet the highest standards, with storage capacities of at least 17 billion tons of CO_2.[146, 147]

In this Scoping Plan, CCS is included to address emissions from limited sectors, including electricity generation, cement production facilities, and refineries, to ensure anthropogenic emissions are reduced by at least 85 percent below 1990 levels in 2045, as directed in AB 1279. While the modeling outputs show CCS not being applied to the electricity sector until 2045, CCS could be implemented earlier on the electricity sector with a similar ramp up over time as that for refineries and cement plants. An earlier application of CCS in the electricity sector would yield additional reductions in years prior to 2045. In addition, CCS can support hydrogen production until such time as there is sufficient renewable power for electrolysis and an abundant water source.

Cement plants have emissions associated with combustion and process-related activities. Combustion emissions account for approximately 40 percent of the total emissions at cement plants. The remaining emissions are related to process-related activities. Due to the high heat content needed to produce cement, there is currently no technically feasible alternative to combustion. SB 596 calls for a 40 percent reduction in GHG intensity in cement emissions from 2019 levels by 2035, and then net zero emissions by 2045. To meet in-state demand, the state relies on cement both produced in state and imported. There are seven cement plants operating in California.[148] To minimize emissions leakage and address emissions from cement plants, the Scoping Plan Scenario includes CCS for cement plants. Additional reductions will need to be pursued and considered as part of implementation of SB 596, which calls for CARB to develop a comprehensive strategy by July 1, 2023, for the state's cement sector to achieve net-zero emissions of GHGs associated with cement used within the state as soon as possible, but no later than December 31, 2045. This effort began in the summer of 2022 and included sector specific workshops.

Even with implementation of EO N-79-20, and despite all of the ambitious efforts in the Scoping Plan Scenario, there will remain some demand for petroleum fuels for legacy vehicles on road applications, and in aviation, rail, and marine applications. Petroleum refineries will need to implement technology to decarbonize their operations and reduce their emissions. This Scoping Plan also assumes CCS at petroleum refineries as one of those potential strategies. Currently, there are seventeen petroleum refineries operating

---

[146] For comparison purposes, California's emitted 418.2 million metric tons of CO_2e in 2019.

[147] Lawrence Livermore National Laboratory. 2020. *Getting to Neutral: Options for Negative Carbon Emissions in California.* Revision 1. https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf.

[148] CARB. Mandatory GHG Reporting – Reported Emissions. https://ww2.arb.ca.gov/mrr-data

in the state.[149] On the supply side, the modeling assumes all in-state demand is met through some very limited refining activities in California. Figure 2-3 shows the emissions from the refining sector with and without CCS. If CCS is not deployed, the emissions would be directly emitted into the atmosphere, and CO_2 removal by NWL or direct air capture would need to increase to compensate for the sector's emissions.

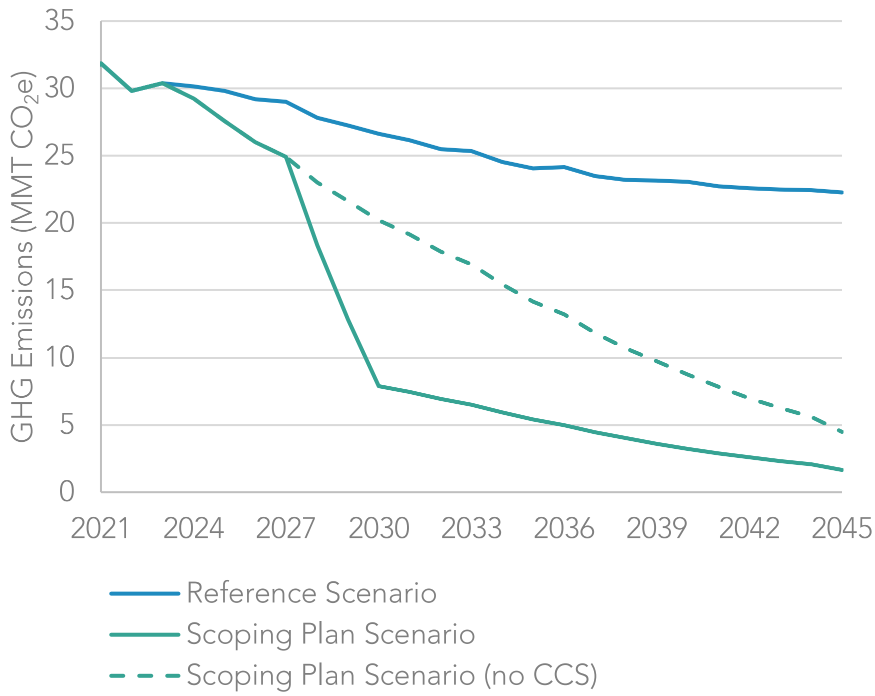
Refineries can have a variety of point sources that emit CO_2—such as steam methane reformers for producing hydrogen, combined heat and power units, and catalytic crackers—that are best suited for CCS. Each configuration of a refinery can be unique to its footprint, onsite operations, and the types of crude oils processed. There are newer technologies with smaller footprints[150] that can be deployed in modular configurations to capture CO_2 in space-constrained and multiple-point-source facilities such as refineries. CCS can provide a path to reducing GHG emissions from these facilities to meet petroleum demand while avoiding leakage and until such time as some refineries can be transitioned to produce clean energy to support the transition away from fossil fuels.

While the Scoping Plan modeled deployment of CCS on refineries and identifies significant emissions reductions that can be achieved, the refineries in California are large and complex. The actual deployment of CCS at these facilities as modeled in the Scoping Plan is uncertain. It will be important to closely monitor the evolution of CCS deployment in the refinery sector and, in the next Scoping Plan update, to evaluate the progress toward use in this sector to determine whether the projected reductions will be achieved.

---

[149] CARB. Mandatory GHG Reporting. *https://ww2.arb.ca.gov/mrr-data*.
[150] Carbon Clean. Modular Carbon Capture Systems for Industry. https://www.carbonclean.com/modular-systems?hsLang=en.

Figure 2-3: Petroleum refining emissions with and without carbon capture and sequestration



This Scoping Plan also calls for accelerating the transition from combustion of fossil fuels to hydrogen. Hydrogen can be produced through electrolysis with renewable electricity or through steam methane reformation of biomethane. There is a high degree of uncertainty around the availability of solar to support both electrification of existing sectors and the production of hydrogen through electrolysis. Producing hydrogen required under the Scoping Plan Scenario with electrolysis would require about 10 gigawatts (GW)[151] of additional solar capacity. If steam methane reformation is paired with CCS, the hydrogen produced could potentially be low carbon. Additionally, the biomethane used to generate hydrogen could be sourced from gasification of forest or agricultural waste resulting from forest management and other NWL management practices, which could also lead to net negative carbon outcomes. Steam methane reformation paired with CCS can thus ensure a rapid transition to hydrogen and increase hydrogen availability until such time as

[151] The Draft Scoping Plan included an estimate for solar capacity (40 GW) to support only electrolysis to produce all hydrogen in the Proposed Scenario. The Scoping Plan now includes steam methane reformation of biomethane and biomass gasification with CCS to produce hydrogen, along with electrolysis from off-grid solar. See Appendix H (AB 32 GHG Inventory Sector Modeling) for additional details.

electrolysis with renewables can meet the ongoing need, assuming there is also sufficient water supply. Additional background and next steps for CCS can be found in Chapter 4.

The EJ Advisory Committee has raised multiple concerns related to the inclusion of CCS and mechanical CDR in the Scoping Plan. Concerns range from potential negative health and air quality impacts in communities from operation of facilities utilizing CCS that continue to emit other emissions, to safety concerns related to potential leaks, to the viability of the current technology. Additionally, the EJ Advisory Committee has policy concerns about the strategy and wants to ensure that engineered carbon removal is not used as a substitute for strategies to achieve emissions reductions onsite and that it does not result in delays in phasing out fossil fuel use. Given these and other concerns and the importance of building public awareness, CARB recognizes the need for a multi-stakeholder process including other state, federal, and local agencies; tribes; independent experts; and community residents to further understand and address community concerns related to CCS. CARB hosted a CCS Symposium with U.S. EPA Region 9 and the Stanford Doerr School of Sustainability to discuss some of these critical issues with community members and other participants. As CARB begins the process of implementing SB 905 in 2023, that will provide an opportunity for further engagement.

In the context of CCS deployment, the Council of Environmental Quality (CEQ) also highlighted the need to further assess and quantify potential impacts on local criteria air pollutants and other emissions resulting from carbon capture retrofits at industrial facilities in response to concerns regarding potential cumulative emissions from single and/or multiple sources.[152] An October 2020 Stanford report[153] discussed how the potential post-combustion capture for CO_2 could also reduce emissions of criteria air pollutant emissions from certain facilities. Exploring these potential outcomes will be important to ensure deployment of CCS does not exacerbate air pollution impacts in communities and maximizes any air pollution benefits. The need for these types of evaluations is also included in SB 905.

The Role of Natural and Working Lands Emissions and Sequestration

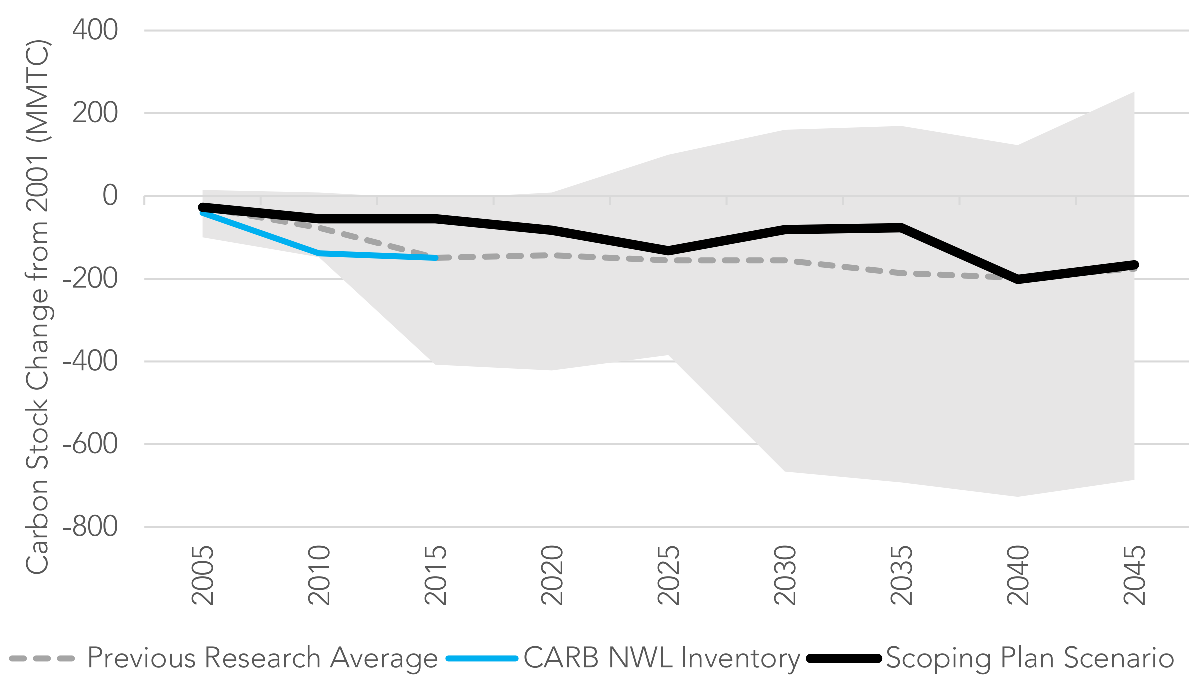
California's NWL assessments highlight the importance of increasing the pace and scale of NWL actions to ensure that our ecosystems are better equipped to withstand future climate change so they continue to provide the benefits that nature and society depend

[152] Carbon Capture, Utilization, and Sequestration Guidance. 87 Fed. Reg. 8808 (Feb. 16, 2022), 2022-03205.pdf (govinfo.gov).

[153] Stanford Center for Carbon Storage. 2020. *An Action Plan for Carbon Capture and Storage in California: Opportunities, Challenges, and Solutions.* October. https://sccs.stanford.edu/ccs-in-ca/full-report-form?msclkid=6f9177f6c57811ecbebc473e75203b21.

upon for survival. As climate change increases the likelihood of extreme wildfires, drought, heat, and other impacts, carbon stocks in California's NWL will face increased risks and impacts. We know from previous climate change and Scoping Plan work[154] that lands can be a net source of GHG emissions or a net sink, and that the magnitude of carbon stock changes and GHG emissions and sequestration from NWL are dependent on the effects of climate change and land management. The expanded modeling conducted for this Scoping Plan shows that NWL are projected to be a net source of emissions through 2045 and indicates a probable decrease of carbon stocks into the future. This projection is further corroborated by previous, independent research that has reached the same conclusion, showing a range of varying levels of carbon stock loss. Figure 2-4 shows the modeling results of the Scoping Plan Scenario overlaid with the NWL inventory and findings from independent research.

Figure 2-4: Comparison of the Scoping Plan Scenario (NWL) with existing research



The modeling indicates that immediate and aggressive climate action can reduce the environmental impacts that would occur in the absence of this action. The results of the modeling demonstrate that regular NWL management over the next two decades can

---

[154] CARB. 2019. January 2019. *Draft California 2030 Natural and Working Lands Climate Change Implementation Plan*. https://ww2.arb.ca.gov/sites/default/files/2020-10/draft-nwl-ip-040419.pdf.

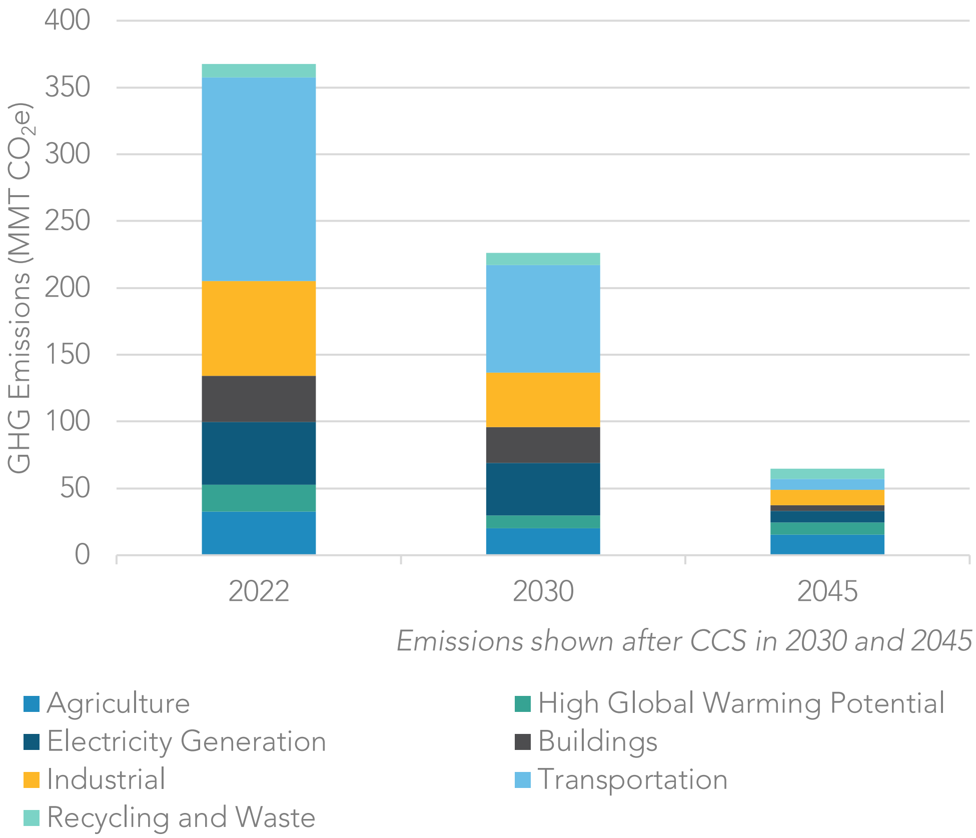
increase carbon stocks from the Reference Scenario trajectory, reduce GHG emissions from lands, and improve ecosystem and public health. This effort is the most comprehensive scientific effort taken by any government to include NWL within its overall climate strategy. Even so, we know that uncertainty exists about future climate and economic forces and the impacts they may have on our ecosystems, so it is important that the state take decisive and aggressive action to improve and diversify ecosystem structures and management.

The effects of climate change, including increased drought, wildfire, and extreme heat, play a significant role in determining the future of California's carbon stocks. And while management actions will help to reduce the impact that climate change will have on California, it is clear from the analysis that NWL sinks and sources are highly variable from year to year, and short time frames do not adequately demonstrate the impact that climate and management are having on ecosystems. For the purposes of climate planning, therefore, it is best to focus on carbon stock changes over longer periods rather than focusing on sequestration or emissions on shorter time frames. The Scoping Plan Scenario is estimated to result in additional NWL emissions of 7 million metric tons of carbon dioxide equivalent ($MMTCO_2e$) annually from 2025–2045. The Reference Scenario is estimated to result in annual emissions of 9 $MMTCO_2e$ over the same time period, and so the Scoping Plan Scenario slows the rate of emissions and provides an approximate 2 $MMTCO_2e$ in additional annual sequestration relative to the Reference Scenario. Because NWL are projected to be a net emissions source, the annual NWL emissions of approximately 7 $MMTCO_2e$ from the Scoping Plan Scenario will need to be compensated by additional CO_2 removal approaches to ensure California can achieve carbon neutrality by 2045.

The Role for Carbon Dioxide Removal (Direct Air Capture)

Even if anthropogenic emissions are reduced to at least 85 percent below 1990 levels by 2045 as called for by AB 1279, there will still be residual emissions in the AB 32 GHG Inventory sectors in 2045 that must be addressed in order to achieve the California's carbon neutrality target. Figure 2-5 includes the emissions by sector for the AB 32 GHG Inventory Sectors in 2022, 2030, and 2045 for the Scoping Plan Scenario.

Figure 2-5: Residual emissions in 2022, 2030, and 2045 for the Scoping Plan Scenario[155]



To achieve carbon neutrality, mechanical CDR will therefore need to be deployed. Because NWL management is not estimated to be a significant carbon removal path in the near term, additional CDR options will be needed. *Mechanical CDR* refers to a range of technologies that capture and concentrate ambient CO_2. Direct air capture (DAC) is one available option that is under development today and could be widely deployed. Note that, unlike CCS, DAC technologies are not designed to be attached to a specific source or smokestack. These technologies include chemical scrubbing processes that capture CO_2 through absorption or adsorption separation processes. Another carbon removal

---

[155] The High GWP sector includes high global warming potential gas emissions from releases of ozone depleting substance (ODS) substitutes, SF_6 emissions from the electricity transmission and distribution system, and gases that are emitted in the semiconductor manufacturing process. ODS substitutes, which are primarily hydrofluorocarbons (HFCs), are used in refrigeration and air conditioning equipment, solvent cleaning, foam production, fire retardants, and aerosols.

option that involves rapid mineralization of CO_2 at the Earth's surface is called *mineral carbonation.*[156] As is the case with CCS, mechanical CDR technologies will need governmental or other incentive support to overcome technology and market barriers. In the United States, the U.S. Department of Energy announced financing specifically for DAC in March 2020[157] and March 2021.[158] Additionally, almost $9 billion in CCS support was included in the $ 1 trillion Infrastructure Investment and Jobs Act of 2021.[159] This includes funding to establish four DAC hubs. The Inflation Reduction Act of 2022[160] increases the value of the 45Q tax credit to USD 85 per metric ton of CO_2 captured and stored in geologic formations from some industrial applications and USD 180 per metric ton for DAC with storage in geologic formations. In 2021, there were approximately 19 DAC facilities globally.[161]

Ultimately, the role for mechanical CDR will depend on the success of reducing emissions directly at the source in the AB 32 GHG Inventory sectors and the ability of the NWL to sequester carbon. However, mechanical CDR also provides an opportunity to not just achieve carbon neutrality, but also remove legacy GHG emissions from the atmosphere. As such, increased deployment of DAC can help achieve net negative emissions. This would further help avoid the most damaging impacts of climate change. While the federal incentives for DAC provide some support for this technology, the only California program that recognizes this technology is the LCFS program. Permitting must also happen across different levels of government and across multiple state agencies. Energy availability must also be addressed if DAC is to be implemented in remote areas. Additional information and next steps on DAC can be found in Chapter 4.

---

[156] The National Academies Press. 2018. Direct Air Capture and Mineral Carbonation Approaches for Carbon Dioxide Removal and Reliable Sequestration: Proceedings of a Workshop–in Brief. *https://nap.nationalacademies.org/catalog/25132/direct-air-capture-and-mineral-carbonation-approaches-for-carbon-dioxide-removal-and-reliable-sequestration#:~:text=National%20Academies%20of%20Sciences%2C%20Engineering%2C%20and%20Medicine%3B%20Division,concentrate%20carbon%20dioxide%20%28CO%202%29%20from%20ambient%20air*.

[157] U.S. Department of Energy. 2020. Department of Energy to Provide $22 Million for Research on Capturing Carbon Dioxide from Air. *https://www.energy.gov/articles/department-energy-provide-22-million-research-capturing-carbon-dioxide-air*.

[158] U.S. Department of Energy. 2021. DOE Invests $24 Million to Advance Transformational Air Pollution Capture. *https://www.energy.gov/articles/doe-invests-24-million-advance-transformational-air-pollution-capture*.

[159] Pub.L. No. 117-58 (November 15, 2021). *https://www.congress.gov/bill/117th-congress/house-bill/3684/text*.

[160] Pub.L. No. 117-169 (August 16, 2022). *https://www.congress.gov/bill/117th-congress/house-bill/5376/text*.

[161] International Energy Agency (IEA). 2022. Direct Air Capture – Analysis. *https://www.iea.org/reports/direct-air-capture*.

Carbon Dioxide Removal and Capture Targets for 2030 and 2045

Recognizing the importance of CO_2 removal, Governor Newsom and the Legislature identified the need for targets to send policy and regulatory signals to pilot, deploy, and scale action for those efforts. Governor Newsom requested that CARB set a CO_2 removal and capture target of 20 MMT for 2030 and 100 MMT for 2045, first prioritizing sequestration in NWL. And while this Scoping Plan prioritizes and recommends significant increased climate-smart action on all NWL to support carbon neutrality and healthy and resilient lands, the modeling indicates that, across all NWL, lands will be a net source of emissions when accounting for both carbon sequestration and GHG (CO_2, CH_4, and N_2O) emissions from lands.

Some landscapes, however, are projected to have a net increase in carbon stocks under the Scoping Plan Scenario between 2025 and 2045 relative to the reference case, indicating that NWL actions can help California achieve Governor Newsom's CO_2 removal targets. Carbon stocks in urban forests and grasslands are projected to increase relative to historical levels from implementation of the 2022 Scoping Plan. To support the governor's CO_2 removal targets, CARB estimates that lands would contribute an average of 1.5 MMT of CO_2 removals each year between 2025 and 2045. Any carbon sequestration contributions from lands need to reflect both long-term storage and an overall net increase in carbon stocks over time to ensure these NWL actions are contributing toward California's achievement and maintenance of carbon neutrality over time.

CARB will work to update and revise these estimates as part of implementation of AB 1757, which was signed by the governor in September 2022 and requires that CARB and the California Natural Resources Agency (CNRA) work with an expert advisory committee to determine an ambitious range of carbon sequestration targets by January 1, 2024, for the years 2030, 2038, and 2045.

For the AB 32 GHG Inventory sectors, the Scoping Plan Scenario modeling indicates that the scenario would meet or exceed the 2030 SB 32 target through GHG reduction policies without the need for CDR. CDR will, however, be necessary to increase ambition for an accelerated 2030 target and in increasing amounts over the following decades to achieve carbon neutrality by 2045.[162] Given the likelihood of NWL to be a net source of emissions, and the need for CDR to compensate for residual emissions to achieve carbon neutrality

[162] The modeled scenarios assume that residual emissions will be compensated using DAC technologies by including the direct cost in terms of dollars per ton CO_2 removed. The energy source for DAC is not modeled, but renewable electricity and/or hydrogen produced from electrolysis are zero carbon options consistent with the carbon neutrality targets in this Scoping Plan.

by 2045, California will need increasing deployment of mechanical CDR over the coming decades. In the immediate future, scaling nature-based CDR approaches also can help to provide some CO_2 removal quickly while mechanical CDR is scaled up between now and 2045. Table 2-3 provides estimates of CO_2 removal and capture needed in 2030[163] and 2045.

[163] As identified in Chapter 1, SB 27 (Skinner, Chapter 237, Statues of 2021) directed CARB to "establish carbon dioxide removal targets for 2030 and beyond" as part of this Scoping Plan. CARB is establishing these targets to satisfy both the requirements of SB 27 and the directive from Governor Newsom to establish CO_2 removal targets for 2030 and 2045.

Table 2-3: GHG emissions and removals needed to achieve carbon neutrality and meet the 20 $MMTCO_2$ removal and capture target in 2030 and the 100 $MMTCO_2$ removal and capture target in 2045.[164]

	2030 ($MMTCO_2e$)	2045 ($MMTCO_2e$)
GHG Emissions	233	72
AB 32 GHG Inventory Sector Emissions	226	65
Net NWL GHG Emissions Across All Landscapes (annual average from 2025–2045)	7	7
Carbon Capture and Sequestration (CCS): Avoided GHG Emissions from Industry and Electric Sectors	(13)	(25)
Carbon Dioxide Removal (CDR) including natural and working lands carbon sequestration,[165] Direct Air Capture, and Bioenergy with CCS (BECCS).	(7)	(75)
Net Emissions (GHG Emissions + CDR)	226	(3)

In 2030, the CO_2 removal and capture target is 20 MMT, but because the SB 32 target only encompasses the AB 32 GHG Inventory sectors, only CCS that reduces GHG emissions on AB 32 sources count toward achieving more ambitious GHG emission reductions in 2030. In 2045, the CO_2 removal and capture must compensate for any residual emissions from the AB 32 Inventory sectors and NWL emissions to support achieving carbon neutrality while also totaling at least 100 MMT. It is important to note that NWL, particularly forests, need a natural wildfire cycle to remain healthy. While the modeling projected wildfires, and implementing the Scoping Plan will result in a reduction in future wildfire emissions, getting to zero wildfires in the sector is not the goal, nor the

[164] Modeled estimates from the Scoping Plan Scenario indicate the relative quantity of emissions and removals to achieve carbon neutrality and meet carbon removal and capture targets. These estimates are not intended to imply precision, as the required policies are yet to be implemented and all models have some uncertainty in their forecasts.

[165] For the purposes of quantifying how to achieve the governor's 20 MMT and 100 MMT CO_2 removal and capture target, CARB included 1.5 $MMTCO_2e$ sequestration from NWL, which is the sequestration from urban forests. This is included as CO_2 removal because it is this sequestration that CARB can consider as having some permanence. Permanence is necessary for incorporating NWL into carbon neutrality. The net NWL emissions of 7 $MMTCO_2e$, identified in the second row of Table 2-3, includes *all* emissions and sinks from all NWL landscapes, which is inclusive of the 1.5 $MMTCO_2e$ sequestration. CARB will develop an accounting framework to accommodate NWL carbon stocks.

right approach to a sustainable forestry sector. In contrast in 2045, the reductions from programs and policies are estimated to reduce emissions by 169 $MMTCO_2e$ from business as usual.

The 2030 target for engineered CDR also provides a near term milestone for California and can serve as an important marker for progress in deploying CDR to support California's carbon neutrality goal. Preliminary estimates indicate that, globally, capacity from already announced projects will range from about 2 million metric tons per year ($MMTCO_2$/y) to 8 $MMTCO_2$/y from bioenergy paired with CCS, and from about 2,000 metric tons per year ($MTCO_2$/y) to 1 $MMTCO_2$/y from DACs by 2027,[166] which indicates that California's 2030 target is an ambitious, but achievable, goal.

Scenario Uncertainty

Greenhouse Gas Emissions Modeling

Several types of uncertainty are important to understand in both forecasting future emissions and estimating the benefits of emission reduction actions. In developing this Scoping Plan we forecasted a reference scenario and estimated the GHG emissions outcome of the AB 32 GHG Inventory sectors using the PATHWAYS[167] model. Inherent in the reference scenario modeling is the expectation that many of the existing programs will continue in their current form, and that the expected drivers for GHG emissions, such as energy demand, population growth, and economic growth, will match our current projections.

However, there is also the expectation that each of the policies included and implemented to achieve the 2030 target in the 2017 Scoping Plan will deliver their exact outcomes. It is unlikely the future will precisely match our projections, and this will lead to uncertainty in the forecast. For example, we never could have foreseen and forecasted economic and emissions impacts related to the extended disruptions from the COVID-19 pandemic. Thus, the single "reference" or "forecast" line should be understood to represent one possible future in a range of possible predictions. For this Scoping Plan, PATHWAYS utilized inputs that reflect technically feasible levels of deployment or adoption of low- or zero-carbon fuels and technologies. Each of the input assumptions provided to PATHWAYS has some uncertainty, which also contributes to uncertainty in the resulting reference scenario.

---

[166] IHS Markit. August 2021. Carbon Removal Potential. https://ww2.arb.ca.gov/sites/default/files/2021-08/ihsmarkit_presentation_sp_engineeredcarbonremoval_august2021.pdf.
[167] See Appendix H (AB 32 GHG Inventory Sector Modeling).

Similarly, for the NWL modeling, CARB used a mix of individual modeling tools[168] to estimate the carbon and other ecological, public health, and economic outcomes. The Reference scenario assumes that the level of land management actions that occurred between 2001 and 2014 for forests, shrublands, grasslands, croplands, developed lands, wetlands, and sparsely vegetated lands continues into the future. Alternative scenarios assessed the effect of increasing levels of management actions from the reference scenario beginning in 2025. There is a great deal of uncertainty about exactly how lands are currently managed, and a larger uncertainty about how they may be managed in the future. For NWL, it is unlikely that the future will precisely match the carbon stock outcomes CARB has projected, particularly given the uncertainties around current and future land management and the effects climate change will have on our lands. For any modeling exercise these uncertainties exist; however, this modeling effort brings together the best available science, data, and models to quantify the impact our actions may have on the landscape under an unknown future.

Implementation

As this Scoping Plan is designed to chart a path to achieving carbon neutrality, additional work will be required to fully design and implement any policies and actions identified in this plan. During the subsequent development of policies, the Legislature, CARB, and other state agencies will learn more about the technologies and their costs, as well as how each industry works, as a more comprehensive evaluation is conducted in coordination with stakeholders, including community engagement. Significant areas of uncertainty include permitting wait times[169] and local ordinances that might limit or slow the build-out of utility scale renewables.[170,171] In another example, times to reach commercial operations for solar projects after securing an interconnection agreement also have increased in recent years, to 3.5 to 5.5 years.[172]

The level of natural and working lands climate action identified in this Scoping Plan is ambitious. Achieving the level of action needed to result in the quantified carbon,

---

[168] See Appendix I (Natural and Working Lands Technical Support Document).
[169] CEC. 2021. *SB 100 Joint Agency Report.* https://www.energy.ca.gov/sb100#anchor_report.
[170] Roth, Sammy. 2019. "California's San Bernardino County slams the brakes on big solar projects." *Los Angeles Times.* https://www.latimes.com/business/la-fi-san-bernardino-solar-renewable-energy-20190228-story.html?fbclid=IwAR2qHGq3bahHme6SFErLsnyFi9UPIfBHIhvnOh3dU3OM7kUTMcEqYfN3pQA.
[171] Chediak, Mark. 2021. "California NIMBYs Threaten Biden's Clean Energy Goals." *BNN Bloomberg.* https://www.bnnbloomberg.ca/california-nimbys-threaten-biden-s-clean-energy-goals-1.1634351?msclkid=668c9ae9c11311ec92e34035ea157ad4.
[172] Rand, Joseph, et al. 2022. Queued Up: Characteristics of Power Plants Seeking Transmission Interconnection as of the End of 2021. Power Point Presentation. Lawrence Berkeley National Laboratory. https://emp.lbl.gov/sites/default/files/queued_up_2021_04-13-2022.pdf.

emissions, health, and economic outcomes within this Scoping Plan requires coordination, investment, and partnerships across all levels of government and sectors of the economy. It is possible that not all of the actions at the identified level will begin in 2025. This uncertainty will result in diminished levels of beneficial outcomes quantified in the Scoping Plan Scenario. The levels of NWL action identified in this Scoping Plan represent CARB's assessment of the pace and scale of action needed to achieve the carbon stock targets and CO_2 removal targets identified in this Scoping Plan.

The Scoping Plan Scenario identifies that 2.3 million acres of forests, shrubland, and grassland management annually would achieve substantial levels of fire emissions reductions and the concomitant health and economics benefits. Currently, 1 million acres of forest treatment annually is the joint federal and state government goal (500,000 acres each). This target of one million acres annually by 2025 is for the purposes of increasing forest health and wildfire resilience in the near term, whereas the 2.3 million acre target is what the Scoping Plan modeling shows would be needed to realize the carbon stock target called for in this Scoping Plan by 2045. By identifying 2.3 million acres of climate action annually in forests, shrublands, and grasslands, this Scoping Plan emphasizes the importance of that 1 million acre annual goal as a milestone on the way to even more action and improved fire and air quality outcomes. The modeling indicates that substantial improvements to statewide fire emissions will occur at levels of action greater than 1 million acres per year. If these levels of action do not occur starting in 2025, the Scoping Plan has quantified climate benefits that will still occur, but to a lesser extent. In terms of fire emissions, compared to the Reference Scenario, 2.3 million acres of forest, shrubland and grassland management will result in a 10% reduction in wildfire emissions. At 1 million acres per year, this decreases to a 2.5% reduction. If 1 million acres per year is also not accomplished, then the emissions and health benefits are even lower.

Climate action in other NWL sectors also generates many co-benefits. Climate action identified in this Scoping Plan is aimed at not only fighting climate change but also improving air quality and public health. The climate action identified in the agricultural sector, for example, should result in decreased pesticide and synthetic fertilizer use. This decrease of synthetic chemical use in agriculture across California also should result in improved public health, especially for communities that work and live in and around agricultural lands. However, as with the forestry sector, the benefits of climate action in agricultural lands and in any other land are dependent on how much implementation takes place. Ramping up increased healthy soils practices and increasing organic agriculture in California will require continued and sustained implementation by private industry and public agencies. For example, achieving the carbon stock outcomes for the annual crops called for in this Scoping Plan would require deployment and maintenance of healthy soils practices on 80,000 additional acres of croplands in California every year between 2025 and 2045. For context, CDFA's Healthy Soils Program, which is an incentive program supporting healthy soils practices, took almost four years of sustained funding to achieve approximately 50,000 acres total under healthy soils practices.[173]

Given the uncertainty around the modeling assumptions, and performance uncertainty as specific policies are fully designed and implemented, estimates associated with the Scoping Plan Scenario are certain to be different than what is ultimately implemented. One way to mitigate for this is to develop policies that can adapt and increase certainty in GHG emissions reductions. Periodic reviews of progress toward achieving the 2030 target and longer term deeper decarbonization, as well as performance of specific policies, also provide opportunities for the state to consider any changes to ensure we remain on course to achieve the 2030 target and carbon neutrality. The need for this periodic review process was anticipated in AB 32, as it calls for updates to the Scoping Plan at least once every five years. For this Scoping Plan, the metrics provided on the rate of deployment of clean fuels and technologies, along with the annual AB 32 GHG Inventory, provide additional information that can be used to assess progress on sectors and aggregate emissions. This is also true of CARB's NWL carbon inventory. An uncertainty analysis for achieving an accelerated 2030 target is provided toward the end of this chapter.

Targeted Evaluations for the Scoping Plan: Oil and Gas Extraction and Refining

To achieve California's air quality and climate goals, we must end our dependence on petroleum. This will not happen overnight. There are about 28 million combustion engine heavy- and light-duty trucks and passenger vehicles in California, and these are almost always replaced at their end of life. The ZEV Executive Order (EO N-79-20) calls for 100 percent new ZEV car sales beginning in 2035 and a 100 percent ZEV medium- and heavy-duty fleet sales by 2045 where feasible. The result is an ongoing, albeit shrinking, pool of vehicles that will continue to require petroleum fuels. To avoid leakage, as called for in AB 32, and to meet that remaining demand for petroleum fuel, a complete phaseout of oil and gas extraction and refining is not possible by 2045. This Scoping Plan assumes a phasedown in both oil and gas extraction as well as petroleum refining in line with the reduction in demand for in-state on-road petroleum fuel demand. Since the transportation sector is the largest source of GHG emissions and harmful local air pollution, we must continue to research and invest in efforts to deploy zero emissions technologies and clean fuels, and to reduce VMT. An assessment of ongoing progress and efforts to reduce

---

[173] California Department of Food and Agriculture. 2021. *Incentives Program 2017–2020 Summary by the Numbers.* https://www.cdfa.ca.gov/oefi/healthysoils/docs/HSP_Incentives_program_level_data_funded_projects.pdf.

demand for petroleum fuels and of opportunities to phase down oil and gas extraction and refining will be included in the next Scoping Plan update.

In addition to supplying in-state demand, California is a net exporter of gasoline, diesel, and jet fuel. California pipelines supply the Nevada and Arizona regions[174] with approximately 87 million barrels gasoline equivalent of refined products annually.[175] California pipelines deliver approximately 85% of Nevada's and 40% of Arizona's refined product. Most finished fuels flowing from California to Nevada and Arizona are currently produced by California refineries. To manage the phasedown of oil and gas extraction and petroleum refining in California, exports of finished fuels must be considered and factored into that process, in addition to the declining in-state demand. The authorities and considerations related to supply and demand of petroleum fuels span federal, state, and local agencies. If supply of fossil fuels is to decline along with demand, a multi-agency discussion is needed to systematically evaluate and plan for the transition to ensure that it is equitable.

This inter-agency work should also consider related topics, such as the following:

- Direct and indirect job and economic impacts
- Demand for other liquid fuel types such as renewable fuels, and expected volumes
- Legal considerations
- Public health benefits
- Demand and supply strategies for petroleum fuels, including how to avoid short term supply constraints that may impact low-income consumers

Some of these topics were also discussed as part of two studies[176] supported by the California Environmental Protection Agency, which can serve as a starting point for a working group to analyze these questions and develop policy recommendations.

Oil and Gas Extraction

On April 23, 2021,[177] Governor Newsom directed CARB to evaluate the phaseout of oil and gas extraction no later than 2045 as part of this Scoping Plan. As noted above, this Scoping Plan still has some California demand for finished fossil fuels (gasoline, diesel,

---

[174] CEC. August 2021. A Primer on California's Pipeline Infrastructure. *Petroleum Watch.* https://www.energy.ca.gov/sites/default/files/2021-08/August_Petroleum_Watch_ADA.pdf.

[175] CEC. March 2020. *Petroleum Watch.* https://www.energy.ca.gov/sites/default/files/2020-03/March_2020_Petroleum_Watch.pdf.

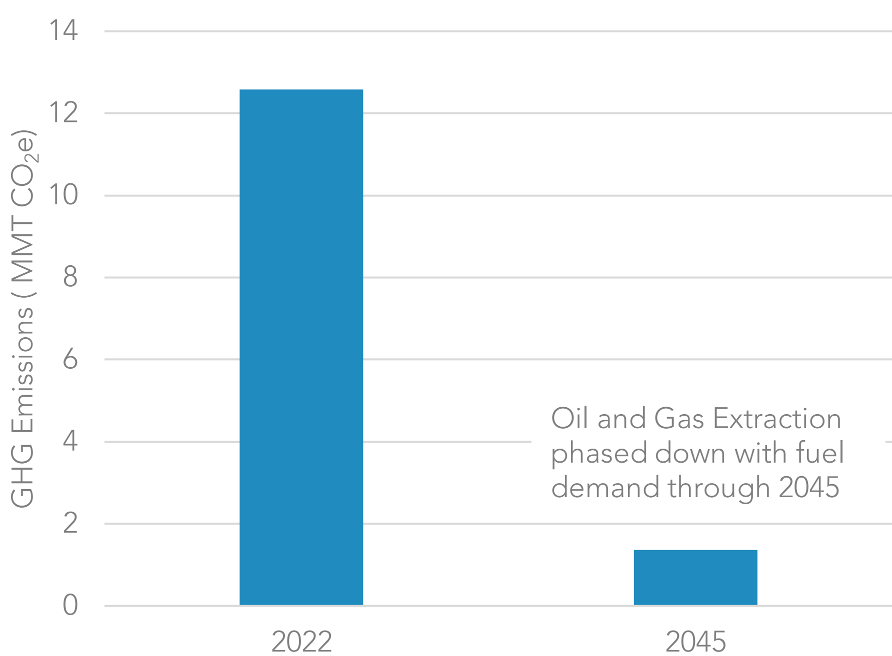
[176] CalEPA. 2021. Carbon Neutrality Studies: https://calepa.ca.gov/climate/carbon-neutrality-studies/.

[177] Governor Newsom. April 23, 2021. Governor Newsom Takes Action to Phase Out Oil Extraction in California. Press Release. https://www.gov.ca.gov/2021/04/23/governor-newsom-takes-action-to-phase-out-oil-extraction-in-california/.

and jet fuel) in 2045. This demand is primarily for transportation, including for sectors that are directly regulated by the state and some that are subject to federal jurisdiction, such as interstate locomotives, marine, and aviation. As discussed more fully below, while significant GHG reductions from oil and gas extraction could be achieved as demand for fossil fuels is reduced due to strategies in this Scoping Plan, it is not feasible to phase out oil and gas production fully by 2045 given this remaining demand.

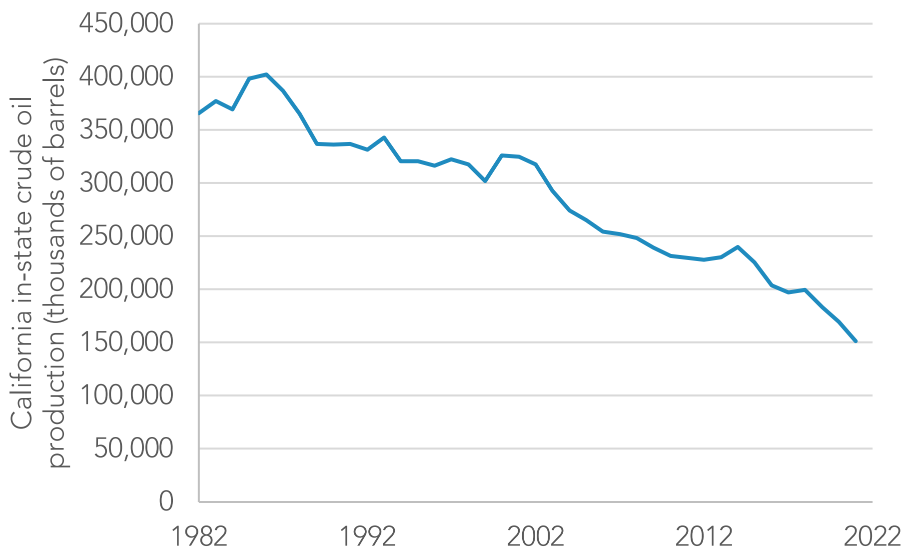
In the Scoping Plan Scenario, with successful deployment of zero carbon fuels and non-combustion technology to phase down petroleum demand, GHG emissions from oil and gas extraction could be reduced by approximately 89 percent in 2045 from 2022 levels if extraction decreases in line with in-state finished fuel demand. If in-state extraction were to be phased out fully, the future petroleum demand by in-state refineries would be met through increased crude imports to the state relative to the Scoping Plan Scenario. AB 32 defines leakage as, “a reduction in emissions in greenhouse gases within the state that is offset by an increase in emissions of greenhouse gases outside the state.” AB 32 also requires any actions undertaken to reduce GHGs to “minimize leakage.” Increases in imported crude could result in increased activity outside California to extract and transport crude into California. Therefore, our analysis indicates that a full phaseout of in-state extraction could result in GHG emissions leakage and in-state impacts to crude oil imported into the state. Figure 2-6 compares the 2022 emissions from this sector with the modeled results when the sector is phased down with in-state petroleum demand.

Figure 2-6: Oil and gas extraction sector GHG emissions in 2022 and 2045 when activity is phased down with in-state fuel demand



According to California Energy Commission (CEC) data used in Figure 2-7, the total oil extracted in California peaked at 402 million barrels in 1986. Since then, California crude oil production has decreased by an average of 6 million barrels per year, to about 200 million barrels in 2020. This steadily decreasing production of crude in California is expected to continue as the state's oil fields deplete.

Figure 2-7: California in-state crude oil production[178]



A UC Santa Barbara report estimated that, under business-as-usual conditions, California oil field production would decrease to 97 million barrels in 2045.[179] The business-as-usual model assumed no additional regulations limiting oil extraction in California.

Any crude oil demand by California refineries not met by California crude oil will be met by marine imports of Alaskan and foreign crude.[180] As shown in Figure 2-8, approximately 99 percent of crude imports into California are delivered by marine transportation. The

---

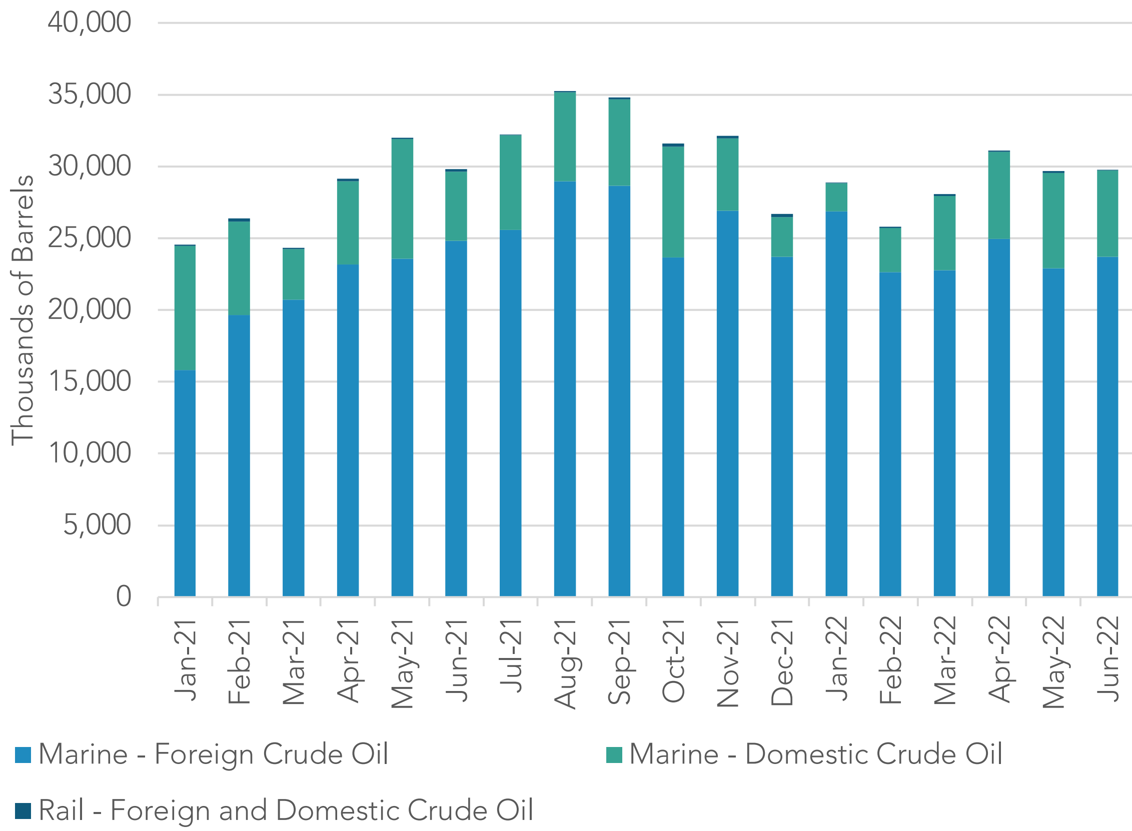
[178] CEC. No date. Oil Supply Sources to California Refineries. Accessed April 21, 2022. https://www.energy.ca.gov/data-reports/energy-almanac/californias-petroleum-market/oil-supply-sources-california-refineries.

[179] University of California, Santa Barbara. 2021. Enhancing Equity While Eliminating Emissions in California's Supply of Transportation Fuels.

[180] CEC. 2020. *Petroleum Watch: How Petroleum Products Move.* March. https://www.energy.ca.gov/sites/default/files/2020-03/March_2020_Petroleum_Watch.pdf, and CEC. 2020. *Petroleum Watch: What Types of Crude Oil Do California Refineries Process?* February. https://www.energy.ca.gov/sites/default/files/2020-02/2020-02_Petroleum_Watch_ADA_0.pdf.

remaining imports occur by rail.[181] There are no pipelines that bring crude oil into California from out of state.[182]

Figure 2-8: Crude oil imports by transportation type[183]



Crude oil delivered by marine tankers is delivered to onshore storage tanks and subsequently to refineries via pipeline. Most crude oil produced in California is delivered to California refineries by pipeline. Using historical trends, any increases in imported crude above historic levels would result in increased deliveries through the marine ports. This increased activity could require more infrastructure to store and move larger volumes of crude to the refineries in state.

---

181 CEC. June 2021. Crude Oil Imports by Transportation Type. Accessed March 16, 2022. https://www.energy.ca.gov/data-reports/energy-almanac/californias-petroleum-market/crude-oil-imports-source.

182 CEC. 2020. *Petroleum Watch: How Petroleum Products Move.* March. https://www.energy.ca.gov/sites/default/files/2020-03/March_2020_Petroleum_Watch.pdf.

183 CEC. June 2021. Crude Oil Imports. https://www.energy.ca.gov/data-reports/energy-almanac/californias-petroleum-market/crude-oil-imports-source.

California refineries import a variety of crude oils to meet refinery needs. California petroleum refineries are generally designed to process relatively heavy crude relative to other U.S. refineries. In 2018, crude inputs to California refineries had an average American Petroleum Institute (API) gravity of 26.18 and an average sulfur content of 1.64 percent. Processing significantly lighter or heavier crude blends would require significant changes to a refinery.[184] Most crude imported from Alaska and the Middle East is relatively light (API gravity > 30) compared to California crude (API gravity < 20).[185] If California crude production is insufficient to meet the demand at California refineries, then California refineries will need access to a similarly heavy source of crude so that the average API gravity of crude remains within their established operating window. South American crude oil imports into California are the heaviest relative to other regions, and therefore they may be the most likely to replace decreased California crude oil supply.[186]

In summary, the modeling indicates that demand for petroleum will persist due to legacy fleets that will not be replaced until end of life. The modeling also shows what the GHG emissions reductions would be if oil and gas extraction activities were phased down in line with the reduction of in-state petroleum demand. Trend data shows that oil and gas extraction already has been on the decline and will continue to decline. It is possible to anticipate the likely regions and types of crude that would be imported to meet in-state petroleum demand if in-state extraction was fully phased out by 2045. Importantly, activity at the ports would increase, and new infrastructure would be needed to store and deliver crude to in-state refineries. And while GHG emissions from this sector would go to zero in our AB 32 GHG Inventory with a full phaseout, emissions related to the production and transport of crude to California might increase elsewhere, resulting in emissions leakage.

As the state continues to reduce demand for petroleum, efforts to protect public health for communities located near oil and gas extraction sites must also continue. In October 2021, Governor Newsom directed action to prevent new oil drilling near communities and

---

[184] CEC. 2020. *Petroleum Watch: What Types of Crude?* February. https://www.energy.ca.gov/sites/default/files/2020-02/2020-02_Petroleum_Watch_ADA_0.pdf.
[185] CEC. 2020. *Petroleum Watch: What Types of Crude?* February. https://www.energy.ca.gov/sites/default/files/2020-02/2020-02_Petroleum_Watch_ADA_0.pdf.
[186] CEC. 2020. *Petroleum Watch: What Types of Crude?* February. https://www.energy.ca.gov/sites/default/files/2020-02/2020-02_Petroleum_Watch_ADA_0.pdf.

expand health protections.[187,188] In 2022, the Legislature passed, and the governor signed, SB 1137 to protect communities from existing and any new oil and gas extraction activities through 3,200 foot setbacks.

Petroleum Refining

In the Scoping Plan Scenario CARB modeled a phasedown of refining activity in line with petroleum demand. Meeting petroleum demand means sufficient availability of finished fuel (gasoline, diesel, and jet fuel). Crude is processed at in-state refineries to produce finished fuel. In response to stakeholder requests,[189] this evaluation focuses on the Scoping Plan Scenario, but with an evaluation of a complete phasedown of refinery operations in state.

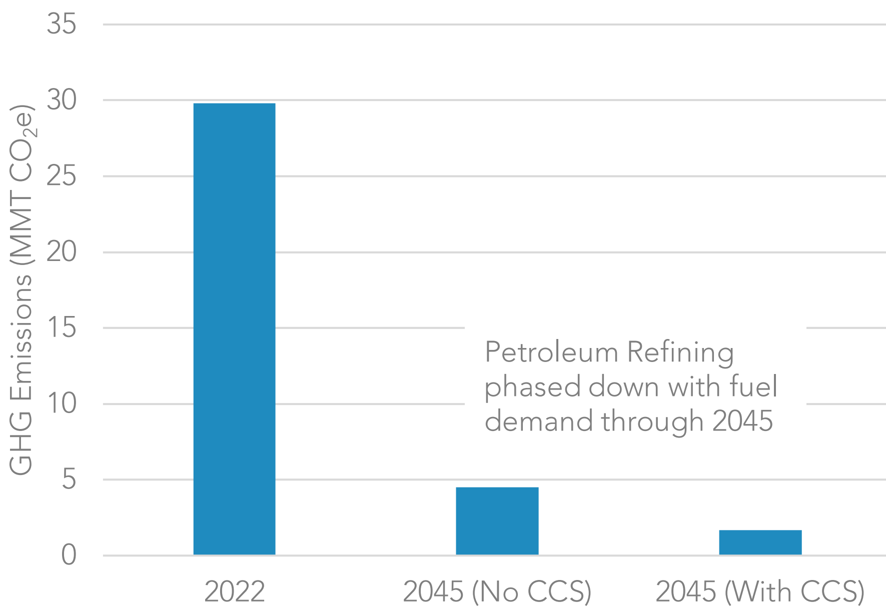
The Scoping Plan Scenario results in California petroleum refining emissions of 4.5 $MMTCO_2e$ in 2045; a reduction of approximately 85 percent relative to 2022 levels, which is in line with the decline in in-state finished fuel demand.[190] Emissions from refining can be reduced further through the application of CCS technology, as shown in Figure 2-9. If in-state refining is phased down to zero and the demand for the finished fuels produced by that refining persists, imported finished fuels may be needed to meet the remaining in-state demand.[191] The current data shows unmet demand for liquid petroleum transportation fuels would most likely be met by marine imports. A CEC report notes, “The only way for California to receive large amounts of crude and refined products is by marine.”[192]

---

[187] Office of Governor Gavin Newsom. 2021. California Moves to Prevent New Oil Drilling Near Communities, Expand Health Protections. https://www.gov.ca.gov/2021/10/21/california-moves-to-prevent-new-oil-drilling-near-communities-expand-health-protections-2/?msclkid=6c0da86bc58e11ecb81cf596d4d8a735.
[188] California Department of Conservation Geologic Energy Management Division. October 2021. Draft Rule for Protection of Communities and Workers from Health and Safety Impacts from Oil and Gas Production Operations. https://www.conservation.ca.gov/calgem/Pages/Public-Health.aspx?msclkid=45660232cf2511ecb1c56119097e3b0c.
[189] California Environmental Justice Alliance. October 22, 2021. Comment on 2022 Scoping Plan Update - Scenario Inputs Technical Workshop. https://www.arb.ca.gov/lists/com-attach/68-sp22-inputs-ws-WzhdPlI5AjACW1Qx.pdf.
[190] This reduction in demand does not assume any need for ongoing operations to support exports to neighboring states.
[191] If demand assumes an ongoing need to support exports to neighboring states, the residual demand would require a five-fold increase in finished fuel imports.
[192] CEC. 2020. *Petroleum Watch: How Petroleum Products Move.* March. https://www.energy.ca.gov/sites/default/files/2020-03/March_2020_Petroleum_Watch.pdf.

There are currently no pipelines capable of bringing refined products to the state, and rail imports of refined products have historically made up less than 1 percent of all imports.[193] Significant increases in marine imports would likely require significant reconfiguring, retrofitting, or replacement of crude pipelines and storage tanks at current marine terminals, and possible reconfiguring of existing finished fuel infrastructure to account for changes in volumes and locations of supply points.

Figure 2-9: Petroleum refining sector GHG emissions in 2022 and 2045 (with and without CCS) when activity is phased down with fuel demand



If California's finished fuel demand is not met by continued refining activity in California, the state would need to import finished fuels to meet the ongoing demand. This would likely result in a two- to five-fold increase in the number of finished fuel ship deliveries to marine terminals. Marine tankers delivering refined products are often much smaller than crude oil tankers, so changes in fuel use and emissions cannot be easily estimated from the change in both the type and the number of ship deliveries.[194]

---

[193] CEC. 2020. *Petroleum Watch: How Petroleum Products Move.* March. https://www.energy.ca.gov/sites/default/files/2020-03/March_2020_Petroleum_Watch.pdf.
[194] Personal communication with CEC staff, March 2022; U.S EIA. 2017. *World Oil Transit Chokepoints*. 3. https://www.eia.gov/beta/international/regions-topics.php?RegionTopicID=WOTC.

If refining ceased in California, the rail and marine deliveries currently needed to support both refining processes and the export of waste products, such as petroleum coke, would cease.

In summary, the modeling indicates that demand for petroleum will persist through 2045. The modeling also shows what the GHG emissions reductions would be if refining activities were phased down in line with the reduction in in-state petroleum demand. CCS can further reduce emissions for this sector. Importantly, activity at the ports would increase, and new infrastructure would be needed to store and deliver finished fuel across the state, if in-state refining were fully phased down by 2045. And while GHG emissions from this sector would go to zero in our AB 32 GHG Inventory with a full phaseout, emissions related to the refining and transport of finished fuel to California might increase elsewhere, resulting in emissions leakage.

Progress Toward Achieving the Accelerated 2030 Target

The 2017 Scoping Plan laid out a path to achieving the SB 32 target of at least a 40 percent reduction of GHG emissions below 1990 levels by 2030 that focused on reducing emissions in the state and was technologically feasible and cost-effective, reflecting statutory direction. Many of the programs to achieve the 2030 target increased in stringency beginning January 1, 2021. However, the 2030 target must be increased to help achieve the deeper reductions needed to meet the state's statutory carbon neutrality target specified in AB 1279 and Executive Order B-55-18.

Starting in 2020 and extending into 2022, the COVID-19 pandemic impacts reverberated across the globe in a multitude of ways, including the devastating loss of millions of lives. The pandemic also had a significant impact on GHG emissions by virtue of its impact on global economies and lifestyle changes for Californians, with extended work and school disruptions. Thus, assessing our progress toward meeting our SB 32 target is confounded by the unprecedented nature of the pandemic. Nevertheless, an assessment of progress toward the 2030 target is critical, in particular the accelerated 2030 target called for in this Scoping Plan, since achieving the accelerated 2030 target would make the state well positioned to achieve its carbon neutrality goals and bring critical near-term air quality benefits to address historical and ongoing disparities in access to healthy air. Because there is only one year of data available for this decade, the analysis takes a prospective look using projected emissions over the remainder of this decade.

Estimating GHG emissions in 2030 requires projecting the effect of policies or measures that are currently deployed and undergoing implementation. Table 2-4 shows three distinct estimates of GHG emissions in 2030 that were created at different times and used different modeling approaches.

Table 2-4: Estimates of 2030 GHG emissions

Scenario Description	2030 GHG Emissions ($MMTCO_2e$)
2017 Scoping Plan: the projected outcome from implementing policies identified in the 2017 Scoping Plan that was approved by the CARB Board in December 2017.	320
Reference Scenario: the assessment of current trends and expected performance of policies identified in the 2017 Scoping Plan, as of February 2022, using the PATHWAYS model (E3).	305
Reference Scenario (Rhodium): the analysis of projected emissions from 2021 to 2030 from state and federal policies implemented as of July 2022, including the estimated impact of the Inflation Reduction Act and Advanced Clean Cars II using RHG-NEMS and other Rhodium Taking Stock 2022 methods (https://rhg.com/wp-content/uploads/2022/07/Taking-Stock-2022_US-Emissions-Outlook.pdf).	324

These three estimates of 2030 GHG emissions differ, which is expected. The estimates reflect different outcomes of the current and future impact of policies and measures. They also vary due to fundamental differences in the way these models work. For example, PATHWAYS is an economy-wide, scenario-based GHG accounting tool that tracks energy demands and supplies in line with scenario assumptions and is benchmarked to historical values. RHG-NEMS optimizes both the supply and demand sides of the energy system while factoring in consumer constraints and dynamic economic and energy systemwide feedback. Importantly, while these point estimates give the appearance of certainty and accuracy, there is significant uncertainty in future emissions projections that is documented thoroughly in each of the three emissions scenarios described above. No model can predict the future given unforeseen factors such as notable economic swings and implementation delays for programs. However, the range of emissions estimates provides a useful indication of possible outcomes from successful implementation of policies and measures.

An important source of uncertainty is the impact of delayed implementation of policy measures and market actions. The successful rate of deployment of clean technology and fuels—including consumer adoption patterns, economic recovery from the pandemic, and the permitting and build-out of necessary new assets and reuse of existing assets to produce and deliver clean energy—is essential to reach GHG emission reduction targets. Any delays will only increase GHG emissions in 2030.

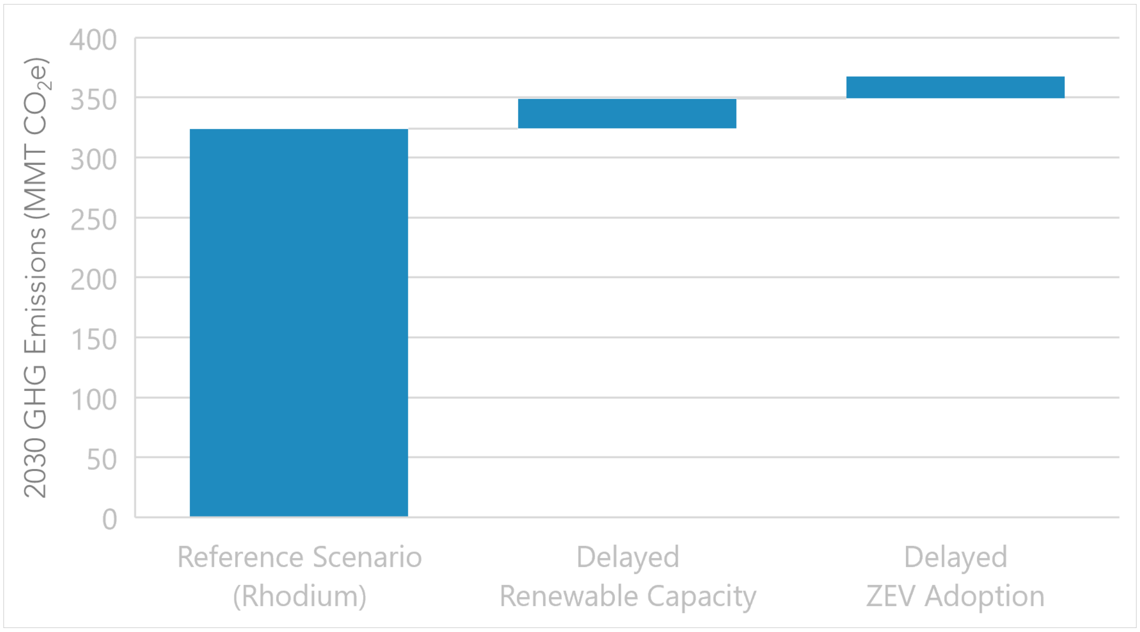
It is important to note that incentives, carbon pricing, and regulations all can result in similar types of responses including, but not limited to:

- Build-out of clean energy and infrastructure
- Deployment of clean technology
- Reduced demand for fossil energy
- Efficiency improvements

As such, the uncertainty analysis discussion focuses on implementation (technology and infrastructure deployment), and not any specific programs or policies. It is successful implementation that must ultimately happen for emissions reductions to be realized.

The uncertainty analysis described in Appendix J (Uncertainty Analysis) quantifies the impact of delayed permitting and building of renewable generation and transmission in the power sector and delayed adoption of ZEVs across all vehicle fleets in the transportation sector. The Reference Scenario (Rhodium) estimates emissions in 2030 to be 324 MMTCO2e. A five-year delay in renewable capacity would increase emissions by 8 percent in 2030 (25 MMTCO2e) relative to the Reference Scenario. If similar delays in clean energy production and deployment occur in other sectors, a larger increase in emissions relative to the reference scenario would be expected, jeopardizing the state’s ability to achieve the 2030 target. Similarly, a delay in consumer adoption of zero emission vehicles (LDV, MDV, HDV) would increase emissions by 6 percent in 2030 (19 MMTCO2e) relative to the Reference Scenario. Delays in transitioning to electric equipment and appliances in homes and businesses would also lead to increased emissions in 2030. Figure 2-10 illustrates the impact on projected emissions in 2030 associated with delayed renewable capacity and delayed transportation vehicle electrification.

Figure 2-10: Impact of delayed implementation on 2030 GHG emissions[195]



Appendix J (Uncertainty Analysis) includes additional details on the assumptions and model used for the uncertainty analysis and the risks to achieve the emissions reductions from 2022 to 2030 that are anticipated in the Scoping Plan Reference Scenario. While the analysis focuses on renewable capacity and transportation, the analysis identifies a common set of themes that can impact emissions reductions across economic sectors, including permitting, technology availability, and consumer adoption. The impact of delayed emissions reductions will vary by sector and by the specific policy at risk of delay.

We give these quantitative examples of the impact implementation delays can have on GHG reductions, but almost every economic sector will have the need for permitting to enable at least a 40 percent reduction below 1990 levels. If we consider the increased ambition of the Scoping Plan Scenario, which identifies an accelerated 2030 target, the same types of uncertainty manifest themselves in successful implementation of the Scoping Plan Scenario, with the added need for CCS and CDR and a need to grow other energy sectors such as hydrogen.

[195] The implementation delay scenarios were modeled separately and do not necessarily reflect the combined impact of delayed renewable capacity and transportation vehicle electrification.

Cap-and-Trade Program Update

Since the adoption of the first Scoping Plan in 2008, carbon pricing in the form of a Cap-and-Trade Program has been part of the portfolio to achieve the state's GHG reduction targets, and it will remain critical as we work toward carbon neutrality. This section provides an update on the program and its role in achieving the 2030 target.

The Cap-and-Trade Program first came into effect in 2012, under AB 32, and included declining allowance caps through 2020. In 2017, AB 398[196] was passed by a supermajority in the Legislature and included prescriptive direction on the design of the program from 2021 through 2030. The AB 398 Cap-and-Trade Program came into effect on January 1, 2021, and it included the following changes:

- Doubling of stringency with an annual cap decline of 4 percent per year from 2021–2030
- AB 398 price ceiling
- AB 398 redesigned allowance price containment reserve with two tiers
- AB 398 100 percent leakage assistance factor for industry
- AB 398 lower offset limits: Usage limit cut from 8 percent to 4 percent, and half of offsets must provide direct benefits to California

The reduction in the role of offsets in the program was in recognition of ongoing concerns raised by environmental justice advocates regarding the ability of companies to use offsets for compliance instead of investing in actions on site to reduce GHG emissions that could also potentially reduce criteria or toxic emissions.[197,198] Note that data show the relationship between facility emissions of GHGs and co-pollutants is highly variable by sector and pollutant.[199] Changes to the allowance price containment reserve and the addition of the price ceiling were included to ensure protections against price spikes in the program, while the changes to the leakage assistance factors were to ensure the maximum protection against leakage in the program. The original design of the program included an auction floor price that increases by 5 percent plus inflation each year, and

---

[196] Assembly Bill 398 (Garcia, Chapter 135, Stats. of 2017). California Global Warming Solutions Act of 2006: market-based compliance mechanisms: fire prevention fees: sales and use tax manufacturing exemption. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB398.

[197] OEHHA. 2022. *Impacts of Greenhouse Gas Emission Limits Within Disadvantaged Communities*. https://oehha.ca.gov/media/downloads/environmental-justice/impactsofghgpoliciesreport020322.pdf.

[198] The OEHHA report also found that companies that use the most offsets often own the facilities that contribute to local $PM_{2.5}$ exposure. However, there was no causal relationship found to indicate that implementation of the Cap-and-Trade Program was contributing to increases in local air pollution. Also see: CARB. FAQ Cap-and-Trade Program. https://ww2.arb.ca.gov/resources/documents/faq-cap-and-trade-program.

[199] OEHHA. 2022. *Impacts of Greenhouse Gas Emission Limits Within Disadvantaged Communities*. https://oehha.ca.gov/media/downloads/environmental-justice/impactsofghgpoliciesreport020322.pdf.

that escalation factor is retained in the post-2020 program and is also applied to the allowance price containment reserve and price ceiling. These features, combined with the self-ratcheting mechanism for unsold allowances at auctions,[200] help to ensure the program is able to handle periods of high and low demand for allowances while continuing to ensure a steadily increasing price signal for regulated entities to invest in GHG reduction technologies.

As a result of achieving the 2020 target several years earlier than mandated by law, there are unused allowances in circulation. CARB estimated the amount to be approximately 310 million allowances after the conclusion of the third compliance period (2018–2020).[201] AB 398 had also called for a similar analysis, which was completed in 2018.[202] This bank represents approximately 5 percent of the total number of vintage 2013–2030 allowances issued within the joint market. This bank of allowances can only remain banked if year-over-year the covered emissions are declining by 14 MMT. If the annual decline in actual emissions is less than 14 MMT, regulated entities will need to use the banked allowances to cover their compliance obligations. It is likely that the existing bank of 310 million allowances will be needed over the early part of this decade and will be exhausted by the end of the decade. During the same period, prices for allowances will continue to increase at least 5 percent plus inflation year-over-year, sending a steadily increasing price signal to spur investment in onsite reductions for covered entities.

With the passage of AB 1279, the state has a statutory target to achieve carbon neutrality no later than 2045. This Scoping Plan demonstrates that planning on a longer time frame for the new carbon neutrality target means we must accelerate our near-term ambition for 2030 in order to be on track to achieve our longer-term target. CARB will use the modeling for this Scoping Plan to assess what changes may be warranted to the Cap-and-Trade or other programs to ensure we are on track to achieve an accelerated 2030 target. Since the original adoption of the Cap-and-Trade regulation, the program has been amended eight times through a robust public process. Moreover, then-California Environmental Protection Agency Secretary Jared Blumenfeld testified at a Senate hearing in 2022 that CARB will report back to the Legislature by the end of 2023 on the status of the allowance supply with any suggestions on legislative changes to ensure the number of allowances

---

[200] The self-ratcheting mechanism temporarily removes unsold allowances from the market until either sufficient demand manifests for two consecutive auctions and they are incrementally reintroduced at future auctions, or they are permanently removed from general circulation if demand remains low.
[201] CARB. 2022. BR 18-51 Cap-and-Trade Allowance Report. Attachment A. https://ww2.arb.ca.gov/sites/default/files/cap-and-trade/Allowance%20Report_Reso18_51.pdf.
[202] CARB. 2018. Staff Report: Initial Statement of Reasons: Proposed Amendments to the Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Regulation. September 4. https://www.arb.ca.gov/regact/2018/capandtrade18/ct18398.pdf?_ga=2.134288305.1735610122.1664813952-1100516233.1657841496.

is appropriate to help the state achieve its 2030 target of at least 40% below 1990 levels. As part of that status update, CARB will also provide information on any potential program changes that may be needed to allowance supply to help achieve an accelerated target for 2030 identified in this Scoping Plan as necessary to achieve carbon neutrality no later than 2045. Engaging in this process in 2023 will allow for the consideration of this Scoping Plan, inclusion of additional data points for the second year of operation of the AB 398-designed program (which only came into force in January 2021), and an opportunity to hold public workshops.

It is also worth noting that the COVID-19 pandemic had significant impacts on economic activity in California and elsewhere.[203] Emissions were significantly lower in 2020 due to the impacts of the global pandemic. There is an expectation that emissions will increase as the economy recovers and behaviors continue to shift from the impacts of the ongoing pandemic. As a result, 2020 should be regarded as an outlier in the emissions trends. This scenario of increasing emissions is similar to what happened in the first compliance period for Cap-and-Trade, where the state economy was recovering from the Great Recession and does not correlate to a problem with the structure of this program or other programs that cover emissions related to the manufacturing or transportation sectors. In any assessment of this and other programs, it is essential to consider external factors such as economic activity and availability of zero carbon energy such as hydropower, among others.

To better understand the role of the Cap-and-Trade Program in achieving the 2030 target, Table 2-5 compares the 2030 GHG emissions estimates from the three reference scenarios described in Table 2-4. The 2017 Scoping Plan projection is from the PATHWAYS model for the Scoping Plan Scenario approved by the Board in late 2017. It excludes the contribution of the Cap-and-Trade Program, without any consideration of uncertainty factors (i.e., a characterization of the uncertainty that a given GHG reduction measure included in the 2017 Scoping Plan will actually achieve the GHG reductions it is projected to deliver). The Reference Scenario represents what GHG emissions would look like if we did nothing beyond the existing policies that are required and already in place to achieve the 2030 target; this scenario is based on the recent PATHWAYS modeling, excluding the contribution of the Cap-and-Trade Program, and without any consideration of uncertainty factors. It indicates that GHG emissions will be lower over this decade than originally projected when the 2017 Scoping Plan was approved. The

---

[203] CARB. November 4, 2021. Mandatory Greenhouse Gas Reporting - 2020 Emissions Year Frequently Asked Questions. *https://www.arb.ca.gov/cc/reporting/ghg-rep/reported-data/2020mrrfaqs.pdf?_ga=2.264251343.1760432228.1650736660-1644197524.1577749754*.

Reference Scenario (Rhodium) which also does not include uncertainty bounds, is the modeling used for the uncertainty analysis above.

Importantly, PATHWAYS is not able to explicitly model a carbon pricing policy, and therefore the Cap-and-Trade Program is not represented in the 2017 Scoping Plan or the Reference Scenario. Carbon pricing is included in RHG-NEMS, which reflects state and federal policies included in the U.S. Energy Information Administration (EIA) Annual Energy Outlook 2022 and the National Energy Systems Model (NEMS), which is the basis for RHG-NEMS.[204]

As detailed in EIA's documentation, California's Cap-and-Trade Program is represented through increased energy prices, which flow across economic sectors.[205] However, many of the emissions covered by the California Cap-and-Trade Program are not energy- and fuel-related emissions. Given that, the energy systems model RHG-NEMS was used to model the impact of California Cap-and-Trade on the energy system. However, RHG-NEMS does not explicitly model the entire program, which includes non-energy related emissions from the industrial, agricultural, waste, and transportation sectors.

---

[204] U.S. EIA. 2022. *Summary of Legislation and Regulations Included in the Annual Energy Outlook 2022.* March. https://www.eia.gov/outlooks/aeo/assumptions/pdf/summary.pdf.
[205] U.S. EIA. 2022. Electricity Market Module. https://www.eia.gov/outlooks/aeo/assumptions/pdf/electricity.pdf.

Table 2-5: Comparison of 2017 Scoping Plan and two Reference Scenarios

	2030 GHG Emissions ($MMTCO_2e$) (2017 Scoping Plan)	2030 GHG Emissions ($MMTCO_2e$) (Reference Scenario)	2030 GHG Emissions ($MMTCO_2e$) (Reference Scenario-Rhodium)
Reference Scenarios	320	305	324
Gap to Accelerated 2030 Target under the Scoping Plan Scenario (226)[206]	94	79	98

Under the Scoping Plan Scenario, in 2030 California emissions are anticipated to be 48% below 1990 levels. This represents an acceleration of the current SB 32 target of a 40% reduction below 1990 levels. Table 2-5 includes the gap between the different reference scenarios and the accelerated 2030 target achieved under the Scoping Plan Scenario. It also shows that depending on the modeling, there are a range of potential emissions levels in 2030 prior to accounting for the full impact of the Cap-and-Trade Program on emissions. That range is from 305 to 324 $MMTCO_2e$ in 2030. That represents a 19 $MMTCO_2e$ spread, or about 8.4 percent of the accelerated 2030 target of 226 $MMTCO_2e$. Importantly, none of these scenarios includes all of the actions identified in the Scoping Plan Scenario for this Scoping Plan; many of those actions, such as SB 596, CCS, and a more stringent LCFS program, will only begin to happen in this decade, and their contributions toward meeting the accelerated 2030 target are therefore not included in the reference scenarios. The actual emissions for the remainder of this decade will therefore likely be lower than in each of the scenarios in Table 2-5 once policies and regulations are in place to support an accelerated 2030 target. However, the degree of this difference between actual and projected emissions will differ across the modeled reference scenarios.

[206] Table 3 from the 2017 Scoping Plan included a range of 34 to 79 $MMTCO_2e$ for reductions needed from the Cap-and-Trade Program to achieve a 2030 target of 40 percent below 1990 levels.

Regardless of the uncertainty and differences in the models, it is clear additional GHG reductions must happen over this decade to achieve an accelerated 2030 target. This will require an evaluation of all major programs to assess the need to increase their stringency between now and 2030. As the actual reductions from non-Cap-and-Trade Program measures increase, California will be less reliant on the Cap-and-Trade Program to “fill the gap” to meet an accelerated 2030 reduction target. For example, CARB is developing a proposal to increase the stringency of the LCFS program for 2030, the recently adopted Advanced Clean Cars II regulation is more stringent than modeled for the 2030 40 percent target in the 2017 Scoping Plan, and SB 596 requires specific reductions in the cement sector over this decade and beyond. However, we also know we are not on track to achieve the VMT reduction called for in the 2017 Scoping Plan and will need to double down to achieve the even more ambitious target called for in the Scoping Plan Scenario. Also, we will need additional actions over the coming years to reduce short-lived climate pollutants to meet the emission reductions called for in SB 1383.

Collectively, any additional legislation or prescriptive policies for sectors, delays in successful implementation of non-Cap-and-Trade programs and policies, increases in incentive program funding, and delays in economic recovery from the pandemic will continue to affect the role the Cap-and-Trade Program will need to play over this decade to meet the state’s GHG reduction obligations. In summary, the Cap-and-Trade Program must continue to be able to scale across a range of possibilities. With passage of AB 1279 and the need to accelerate the 2030 target, CARB will initiate a public process to utilize the modeling results from this Scoping Plan, specifically the Scoping Plan Scenario, to evaluate and potentially propose changes to the design of the Program, including the annual caps. This process will ensure that the Program supports an increased ambition for 2030 while retaining the ability to scale as other factors, such as changing economic conditions and implementation of non Cap-and-Trade programs, impact the actual emissions at the sources covered by the Program. Any changes to the Program must continue to support a well-designed system that continues to send a steadily increasing price signal, minimizes for leakage, reduces emissions in the covered sectors toward the state’s targets, is cost-effective and technologically feasible, and avoids energy rate spikes. Importantly, the Program should support air quality benefits, especially in overly burdened communities, and not exacerbate existing air quality disparities.

Chapter 3: Economic and Health Evaluations

This chapter provides two approaches for quantifying the economic and health outcomes of the Scoping Plan Scenario. One approach is to consider the combined impact of all measures[207] in a scenario. The other approach is required by AB 197, where each measure within a scenario is evaluated independently. In addition to these two evaluation approaches, this chapter also includes a discussion of the Public Health implications for the Scoping Plan Scenario, an overview of the Climate Vulnerability Metric, and the Environmental Analysis conducted in accord with the California Environmental Quality Act (CEQA).

It is important to note that all of the analyses in this chapter use a variety of data sources, but because the modeling is economy-wide at the state level, none of them produce community specific detail outputs. The AB 32 GHG Inventory Sector analysis relies on PATHWAYS data at the state level that is proportionally applied across all regions of the state to translate changes in state level fuel combustion to local level changes. The NWL analysis similarly utilizes a variety of data sources and a suite of models that produce data that are scaled up to the statewide level. All of the models, except the Wildland Urban Interface (WUI) defensible space model, which is conducted at the county level, create aspatial projections that are not applicable at the community level.

Economic Analysis

As part of the process to develop this Scoping Plan, alternative scenarios that transition energy needs away from fossil fuels and achieve carbon neutrality no later than 2045 were developed. Alternative scenarios that assess the impact of different land management strategies on carbon stocks in NWL were also developed. These alternatives are described in Appendix C (AB 197 Measure Analysis). The following sections describe the Scoping Plan Scenario in terms of direct cost, the economy, employment, and health outcomes.[208]

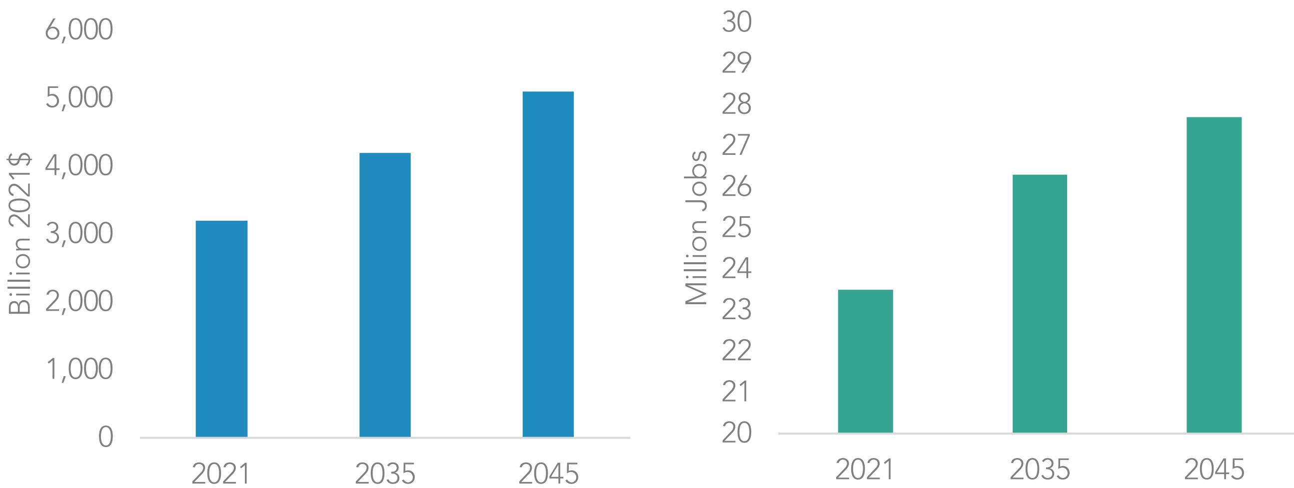
---

[207] AB 197 calls for the evaluation of “measures.” This Scoping Plan treats each action and its variants on stringency as measures for the purposes of this chapter. Appendix C (AB 197 Measure Analysis) lists the measures and corresponding modeling assumptions for each alternative and the Scoping Plan Scenario. The modeling assumptions for the Scoping Plan Scenario are summarized in Table 2-1.

[208] For the Draft 2022 Scoping Plan Update, achieving carbon neutrality in 2035 and 2045 was evaluated. The AB 32 GHG Inventory sector direct cost, the economy, employment, and health outcomes were assessed in those years. Similarly, the Scoping Plan Scenario assessments that are presented in this chapter were made for years 2035 and 2045.

The California economy is growing, and it is projected to continue to grow about 2 percent each year, from $3.2 trillion in 2021 to $5.1 trillion in 2045, as shown in Figure 3-1. Similarly, employment in California is anticipated to grow 0.7 percent per year, from 23.5 million jobs in 2021 to 27.7 million jobs in 2045. It is in this context, termed the *Reference Scenario,* that CARB evaluates the Scoping Plan Scenario in terms of its impact on economic growth and employment. The projections shown in Figure 3-1 were produced by CARB to evaluate the incremental impact of regulations.

Figure 3-1: Projected California gross state product (left) and employment growth (right) from 2021 to 2035 and 2045



Source: California Air Resources Board

Transitioning away from fossil fuels to alternatives and increasing action on NWL will affect employment opportunities, household spending, businesses, and other economic aspects of our lives. Sectors expected to see growth include renewable electricity and hydrogen production, while other sectors may shrink. The deployment of clean technology may require higher upfront costs for things like heat pumps and induction stoves, but those could be offset by energy efficiency savings. Employment and economic development in NWL-related industries and sectors are expected to increase as land management actions increase, especially for the Forestry sector (in which a significant increase is called for under the Scoping Plan Scenario). The net impact of these actions on employment and jobs is presented in this chapter.

Estimated Direct Costs

One key metric is the direct cost, or net investment, reflecting any savings that result from actions. Similar approaches were used to estimate direct costs for the AB 32 GHG Inventory sectors and for the NWL, as described in this section.

AB 32 GHG Inventory Sectors

Transitioning away from fossil fuels requires investment in new equipment and infrastructure throughout the economy. It involves developing the capacity to produce fuels and electricity from renewable sources rather than producing fossil energy. This transition also takes time. One approach is to eliminate combustion of fossil fuels by replacing all equipment in a specified year. Another approach is to establish a future point at which all sales of new equipment rely on alternative energy sources and allow the transition to occur over time as equipment is replaced upon its end of life.

To evaluate the investment required through 2045, the PATHWAYS model was used to represent equipment stock and its turnover to non-fossil fuel alternatives over time. The annualized, incremental cost of infrastructure in excess of the annualized cost of the Reference Scenario[209] was computed for each year from 2022 through 2045. These costs were computed by first taking the absolute cost in each year—which includes both new equipment investment and also expenditures on energy, operations, and maintenance in each year—and then levelizing the costs (in the same way car or house payments are annualized or spread out over time) to arrive at an annualized cost. Fuel savings, and resulting cost savings, associated with changing energy demand—from gasoline to electricity for vehicles, for example—are included as a result of this methodology. Carbon dioxide removal includes DAC technology powered primarily by off-grid solar, BECCS to produce hydrogen or other fuels, and NWL sequestration, as discussed in Chapter 2.[210]

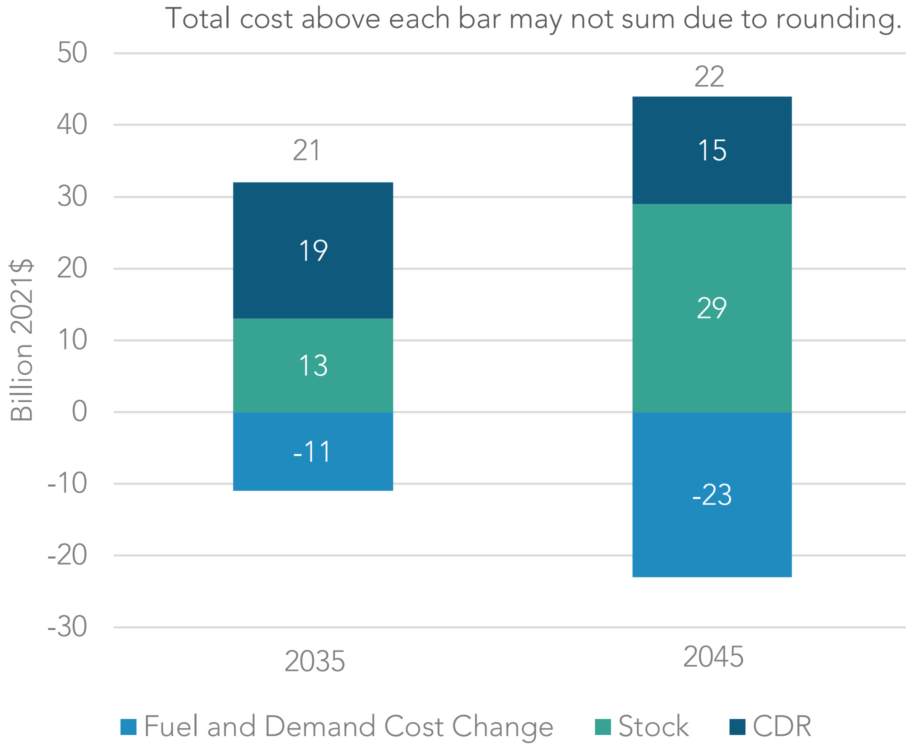
Figure 3-2 shows the stock investment cost, fuel/efficiency savings, and CDR cost. The Scoping Plan Scenario allows end-of-life transition of equipment. The cost of investing in new equipment is partially offset by savings associated with efficiency gains and reduced demand for fuels like gasoline. This is particularly relevant in the transportation sector, which leads to the majority of savings in 2045 in the Scoping Plan Scenario, which models near complete electrification of transport relying only on end-of-life replacement of vehicles. Appendix H (AB 32 GHG Inventory Sector Modeling) includes additional detail on direct costs in each sector and how costs change over time.

---

[209] The Reference Scenario described in Chapter 2 and in Appendix H (AB 32 GHG Inventory Sector Modeling) was the basis for the direct cost comparison.

[210] The energy source for DAC is not modeled, but renewable electricity and/or hydrogen produced from electrolysis are zero-carbon options consistent with the carbon neutrality targets in this Scoping Plan. The economic analysis associated the investment in DAC with the solar industry for consistency with the carbon neutrality targets.

Figure 3-2: Cost and savings relative to the growing California economy for the Scoping Plan Scenario in 2035 and 2045 (AB 32 GHG Inventory sectors)



Natural and Working Lands

For NWL, the direct costs of each management strategy were estimated using available academic literature, monitoring and reporting data, survey data, and cost data from existing subsidy programs on the per acre cost of implementing the management strategy. These cost data, in combination with the acreage of each management strategy under the scenarios, provided estimates of the overall direct cost to either the government or the private sector. The direct costs are independent of the policy lever used to implement the action and do not include many important benefits and externalities of the actions. They are assumed to be constant for each scenario and into the future. Avoided or secondary costs, such as those from reductions in wildfire suppression expenses, are not included. Appendix I (NWL Technical Support Document) includes additional direct cost details.

Table 3-1 includes the direct cost estimates for the Scoping Plan Scenario compared to the Reference Scenario.[211] Direct costs for the NWL sector are expected to be significant due to the ambitious level of action for each land type.

Table 3-1: Cost and savings relative to a growing California economy for the Scoping Plan Scenario (NWL)

Measure	Scoping Plan Scenario: Average Direct Annual Cost, 2025–2045 (millions $/year)
Forests / Shrublands / Grasslands	1,780
Annual Croplands	284
Perennial Croplands	4
Urban Forest	4,230
Wildland Urban Interface (WUI)	114
Wetlands	28
Sparsely Vegetated Lands	4
Totals	6,460
Note: Table values may not add to total due to rounding.	

CARB estimates that all jurisdictions, including private landowners, currently spend approximately $4 billion dollars annually on planting, maintenance, sidewalk repair, tree removal, and other expenses related to urban forests, and that reaching the theoretical maximum tree cover would require increasing that spending by a factor of 20. The cost of the Scoping Plan Scenario is predominantly a mix of urban forests and forests, shrubland, and grasslands spending.

[211] The Reference Scenario described in Chapter 2 and in Appendix I (NWL Technical Support Document) was the basis for the direct cost comparison.

Economy and Employment

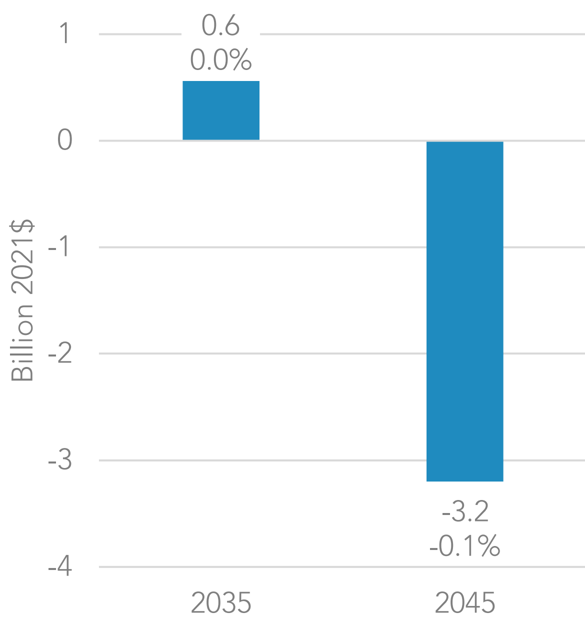
Two different models were used to estimate the overall impact that investing in a transition away from fossil fuels and in our NWL may have on the growing California economy. The transition away from fossil fuels was evaluated using the IMPLAN economic analysis model. The NWL investments were evaluated using the REMI PI+ economic model. These models provide similar outputs relative to the same economic and employment forecasts used to develop a Reference Scenario for use in each model.

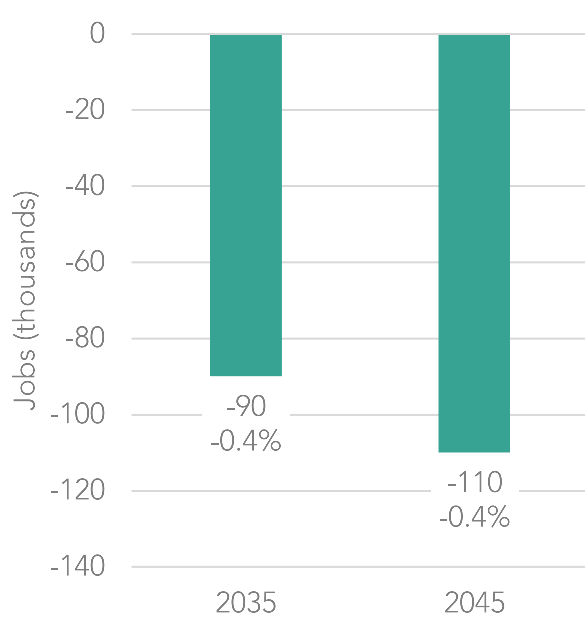
AB 32 GHG Inventory Sectors

To estimate the overall impact that investing in a transition away from fossil fuels may have on the California economy, CARB used the IMPLAN model. Additional detail regarding the model, assumptions, and methodology are included in Appendix H (AB 32 GHG Inventory Sector Modeling). The IMPLAN model is a multisector representation of private industries in the U.S. economy that maps economic relationships across industries, households, and governments. This model translates direct costs and savings associated with transitioning away from fossil fuels with indirect effects such as wages, purchases of goods and services, business tax impacts, and supply chain effects. In addition, the induced effects of household purchases, local and import purchases, wages paid, and household tax impacts are estimated. This comprehensive assessment of the interactions between capital investment in fossil fuel alternatives and household purchases provides an indication of the response of the California economy to the Scoping Plan Scenario.

The Scoping Plan Scenario results in a small impact on the Gross State Product (GSP) and employment relative to the Reference Scenario, as shown in Figure 3-3. Economic growth is largely unaffected by the Scoping Plan Scenario in 2035 and slowed by 0.1 percent in 2045. Employment growth is also slowed a small amount, 0.4 percent in 2035 and in 2045, and employment still grows. Assuming annual growth rates of 0.7 percent means there would be more than 193,000 additional jobs in 2045.

Figure 3-3: Gross state product (left) and employment (right) relative to a growing California economy for the Scoping Plan Scenario in 2035 and 2045 (AB 32 GHG Inventory sectors)





California households will see increased costs from the purchase of new capital stock and savings from reduced spending on fuel, as shown in Figure 3-2. Households also will face increased costs associated with CDR, costs associated with energy efficiency measures, and commercial stock purchases—all of which are assumed to be passed directly to consumers. The impact to California households, however, is not limited to these direct costs, as changes in relative prices, employment, and wages can affect household well-being. Personal income, which captures the direct, indirect, and induced impacts, is a metric commonly used to evaluate the impact of policies on households.

Personal income in California is projected to grow from $2.7 trillion in 2021 to $3.6 trillion in 2035 and $4.4 trillion in 2045. Household projections are based on California Department of Finance population projections, which estimate the state's population to grow an average of 0.3 percent each year from 2021 to 2045.[212] California households are projected to increase from 13.3 million in 2020 to 14.6 million in 2035 and 15.0 million in 2045.

[212] California Department of Finance. Population Projections (Baseline 2019). https://dof.ca.gov/forecasting/demographics/projections/.

While the transition away from combustion of fossil fuels will improve air quality for all Californians (and even, more so in overly burdened communities), the economic impacts of the Scoping Plan Scenario are unlikely to be equal among Californians. Table 3-2 presents the change in income by household income group relative to the Reference Scenario in 2035 and 2045. While in 2035 there is a net decrease in personal income of $600 million, total income for households that make less than $100,000 per year is estimated to decline by $4.1 billion dollars, and the total income for households that make more than $100,000 per year will increase by $3.5 billion under the Scoping Plan Scenario. In 2045, although there is no net change in personal income across all California households, results vary by income level. Total income for households that make less than $100,000 per year are estimated to decline by $5.3 billion dollars, while the total income for households that make more than $100,000 per year will increase by $5.3 billion under the Scoping Plan Scenario.

Table 3-2: Income Impacts by California household income group in 2035 and 2045 for the Scoping Plan Scenario (AB 32 GHG Inventory Sectors)

Household Income Group ($2021)	Percentage of 2021 California Households[213]	Change in Income (Billion $2021)	
		2035	2045
Less than $50,000	30	-2.9	-3.9
$50,000 to $100,000	27	-1.2	-1.4
$100,000 to $200,000	28	2.5	4.0
More than $200,000	15	1.0	1.3
Total	100	-0.6	0.0

[213] U.S. Census Bureau. 2021. Household Income. California. https://data.census.gov/cedsci/table?q=california%20income.

In addition to income level, there is likely to be an impact to California personal income that varies based on race/ethnicity.[214] Table 3-3 shows the percentage of households within each income group based on eight race/ethnicity categories identified in the American Community Survey 2021. As shown in Table 3-2, households in lower income groups are anticipated to see negative impacts, while households in higher income groups are anticipated to see positive impacts from the Scoping Plan Scenario in both 2035 and 2045. Because more than 60% of households in the race/ethnicity categories of Hispanic, Black alone, Native Hawaiian (HI) or Pacific Islander, American Indian or Alaskan Native, Other, and Two or More make less than $100,000 per year, these populations generally are likely to experience reduced income. White and Asian households will generally experience both increased and decreased income because these households are distributed more evenly across all four income groups.

The state recognizes the need to ensure that accessibility to clean technology and energy do not further exacerbate health and opportunity gaps for low-income households and communities of color. The Climate Change Investments program exceeds the statutory minimums to invest in projects to benefit disadvantaged communities.[215] Utilities implement programs for reduced energy bills for qualifying low-income customers.[216] There are also resources for waste and water bills that leverage federal funds.[217] CARB also coordinated with the CPUC to ensure that the Climate Credit[218] funded from the sale of Cap-and-Trade allowances provided to utilities on behalf of ratepayers is credited equally to households and not based on how much energy is used. These are just a few examples of how the state is designing and implementing programs to avoid increasing existing disparities. The state must continue to find ways to relieve economic burdens on low-income households.

---

214 The number of households in each bracket and the race/ethnicity categories are from American Community Survey 2021 results. Population changes through 2035 and 2045 are not forecast. U.S. Census Bureau. 2021. Household Income. California. https://data.census.gov/cedsci/table?q=california%20income.

215 CARB. Priority Populations — California Climate Investments. https://www.caclimateinvestments.ca.gov/priority-populations.

216 CPUC. CARE/FERA Program. https://www.cpuc.ca.gov/lowincomerates/.

217 California Department of Community Services and Development. Low Income Household Water Assistance Program. https:/www.csd.ca.gov/lihwap.

218 CPUC. California Climate Credit - FAQ. https://www.cpuc.ca.gov/industries-and-topics/natural-gas/greenhouse-gas-cap-and-trade-program/california-climate-credit/california-climate-credit---faq.

Table 3-3: Percentage of households in each race/ethnicity category by household income group

Household Income Group ($2021)	Households in Income Group (%)							
	White Not Hispanic	Hispanic	Black Alone	Asian Alone	Native HI or Pacific Islander	American Indian or Alaskan Native	Other	Two or More
Less than $50,000	26	35	45	25	30	35	37	32
$50,000 to $100,000	25	32	27	21	31	33	33	30
$100,000 to $200,000	29	25	21	30	30	26	24	27
More than $200,000	19	7	7	24	9	7	5	11

Natural and Working Lands

The macroeconomic impact of the NWL scenario was evaluated separately in the REMI PI+ model. For the Scoping Plan Scenario, the macroeconomic impact was modeled by assuming that economic activity in the relevant industries grows in proportion to the proposed implementation spending in that industry. All funds for implementing the actions were assumed to be sourced from within the state. For urban forests, the funds were modeled as being sourced from a combination of state government and private property owners in proportion to the current estimated private/public spending ratio. For all other actions, funds were assumed to be sourced from the state government. In each modeled scenario, government spending and income to property owners were reduced relative to the Reference Scenario in proportion to the annual costs of implementation. None of the proposed spending was modeled as being sourced from increased taxes. Additional details on the methodology for evaluating macroeconomic impacts are in Appendix I (NWL Technical Support Document).

While the macroeconomic model does count the increased economic activity in the affected industries as part of GSP, it does not quantify many of the important economic, health, and environmental benefits that would occur if these actions were implemented. While these benefits—like the reduced use of pesticides, value of urban trees, and increased recreational opportunities—would be very significant, they are outside the scope of the macroeconomic model.

The macroeconomic model also makes projections about the total level of employment in the state. The model forecasts that the Scoping Plan Scenario, which greatly increases the level of NWL management actions, channels economic activity toward related industries and would lead to a slight increase in total employment. (Table 3-4). While the model does aim to accurately represent many labor market dynamics, including adjustments of wages and migration rates, it does not account for many costs that might be associated with dramatically scaling up employment in a particular industry, such as the cost of job training.

Table 3-4: Gross state product and employment relative to a growing California economy for the Scoping Plan Scenario in 2035 / 2045 (NWL)

	Scoping Plan Scenario (%)
Gross State Product	0.00 / 0.01
Employment	0.12 / 0.10
Personal Income	-0.04 / -0.04
Personal Income per Capita	-0.04 / -0.14

Health Analysis

Air quality is affected by pollutant emissions from various processes associated with energy systems, including the combustion of fossil fuels, as well as the combustion of vegetation biomass from NWL during wildfires. Pollutants that are important contributors to degraded air quality in California include nitrogen oxides (NO_x), particulate matter (PM), reactive organic gases (ROG), and others. Further, in the atmosphere these pollutants are transported away from the locations of the emissions by wind and other phenomena, and undergo chemical reactions that result in the formation of new pollutants such as ground-level ozone and fine particulate matter ($PM_{2.5}$). Both primary (emitted) and secondary (formed) pollutants are important from a public health standpoint and contribute to the incidence of air pollution-related mortality and disease within California populations. Measures focused on GHGs do not incorporate specific targets to reduce emissions of $PM_{2.5}$ or air toxics like benzene. These co-pollutants, which are emitted from many of the same pollution sources as GHGs, affect local air quality and pose known risks to public health, such as the risk of asthma and cardiovascular disease. Generally, for stationary sources, certain harmful pollutants are regulated via local rules and regulations that are reflected in permits for stationary sources and are enforced by local air districts, with CARB also regulating air toxics contaminants from stationary sources with the air districts.

AB 32 GHG Inventory Sectors

To assess health impacts for the AB 32 GHG Inventory sectors, an integrated modeling approach was used to quantify and value the air pollution-related public health benefits of the Scoping Plan Scenario relative to the Reference Scenario. Additional details about the models, assumptions, and methodology are included in Appendix H (AB 32 GHG Inventory Sector Modeling). Using output from the PATHWAYS model, projections of pollutant emissions to 2045 were developed for stationary, area, and mobile source emissions using a detailed base year CARB pollutant emissions inventory. Further, the emissions are processed, including for where and when they occur in California, using the Sparse Matrix Operator Kernels Emissions (SMOKE) model. For example, on-road vehicle emissions were allocated along existing roadways, and refining emissions were assigned to the locations of existing refineries. It should be noted that the emissions projections represent statewide average reductions associated with high-level assumptions about alternative fuels and technologies. For example, emissions occurring from refineries to produce liquid fuels are reduced in line with petroleum demand. This reduction is applied equally to all refineries in the Scoping Plan Scenario and does not specify individual facility responses to changing demand. Similarly, the Scoping Plan Scenario does not specify which refineries transition to biofuel production or where new electricity generation facilities are built.

Next, emission changes were translated into impacts on atmospheric pollution levels, including ground-level ozone and $PM_{2.5}$, via an advanced photochemical air quality model called the Community Multiscale Air Quality (CMAQ) model, which accounts for atmospheric chemistry and transport. A comprehensive assessment of how pollutant concentrations are impacted throughout the year was achieved by simulating all months in 2035 and 2045 for the Scoping Plan Scenario.[219] Health benefits were estimated using the U.S. EPA's environmental Benefits Mapping and Analysis Program (BenMAP) model to translate pollutant changes into avoided incidence of mortality, hospital admissions, emergency room visits, and other outcomes as a result of reduced exposure to ozone and $PM_{2.5}$. These outcomes are associated with an economic value in order to aggregate health impacts.

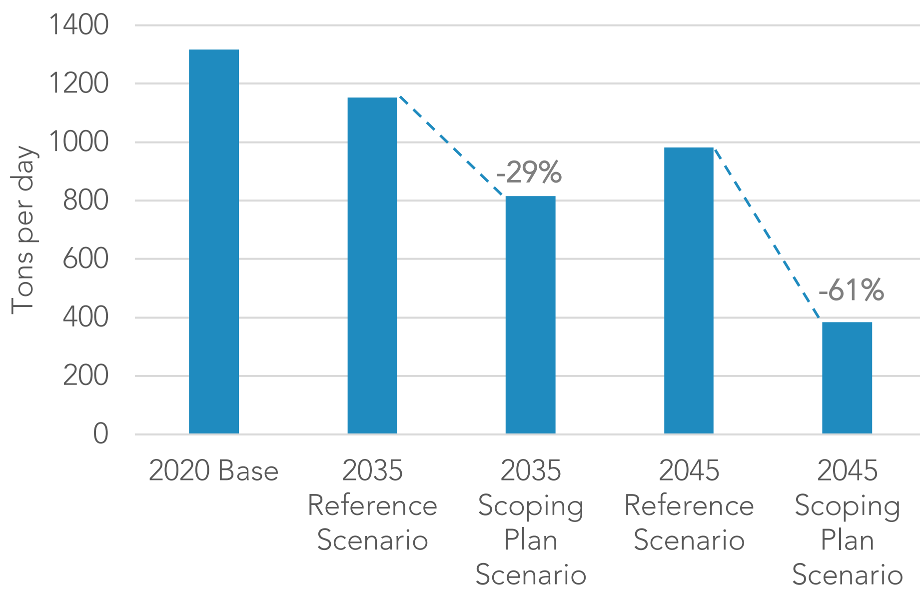
The Scoping Plan Scenario shows a substantial reduction in pollutant emissions relative to the Reference Scenario, including NO_x, $PM_{2.5}$, and ROG. Reductions in NO_x are shown in Figure 3-4. Even under a business-as-usual trajectory, emissions are reduced from present levels by 26 percent in 2045 in the Reference Scenario, demonstrating the impact of current regulations and trends in energy sectors. The Scoping Plan Scenario further reduces NO_x

---

[219] This annual approach differs from the episodic modeling approach applied to the Proposed Scenario and Alternatives in the Draft 2022 Scoping Plan Update. Appendix H (AB 32 GHG Inventory Sector Modeling) describes both approaches.

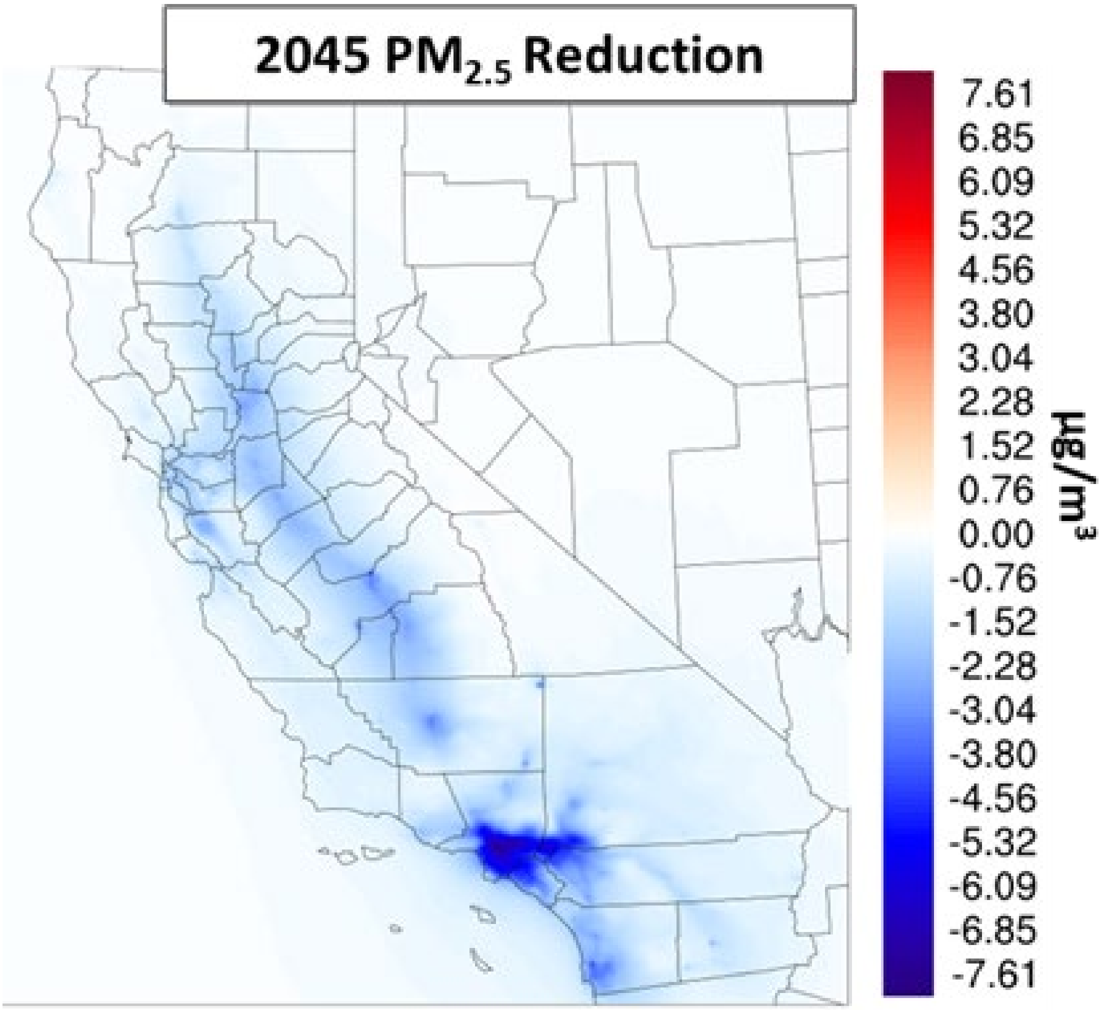
emissions from the Reference Scenario by 29% in 2035 and 61% in 2045. Emission reductions occur throughout the state with particular prominence in urban areas, including the South Coast Air Basin, due to the large presence and activity of emission sources. Appendix H (AB 32 GHG Inventory Sector Modeling) contains additional information about the pollutant emissions modeling and results.

Figure 3-4: Illustration of NOx emission reductions from current levels for the Reference Scenario and the Scoping Plan Scenario (AB 32 GHG Inventory sectors)



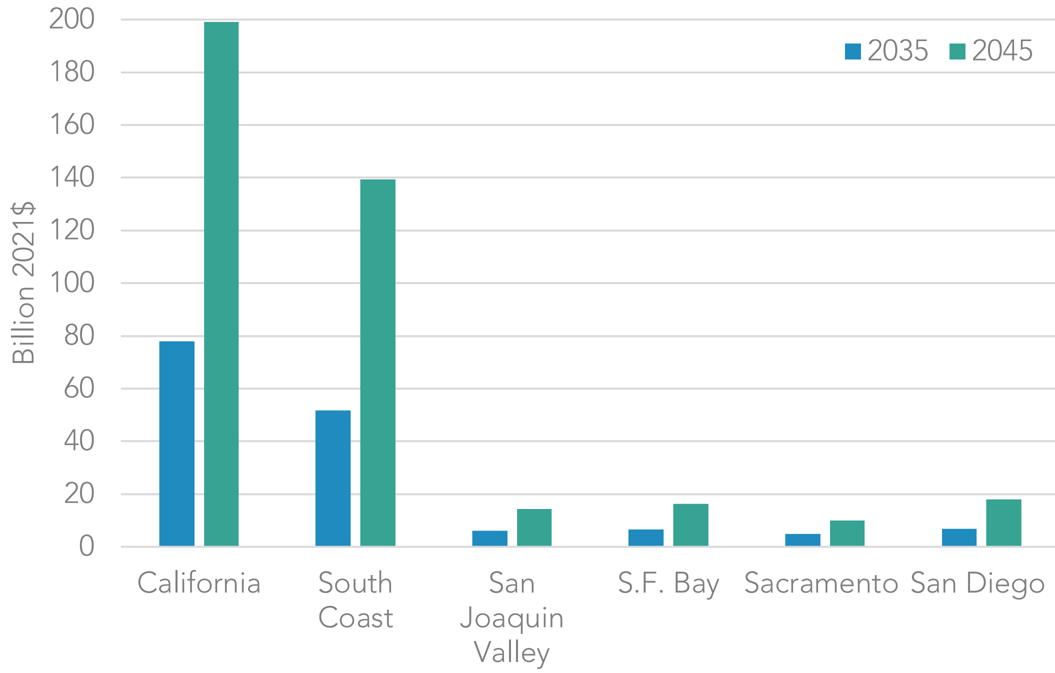
The emission reductions achieve important improvements in air quality throughout California, including reductions in the levels of ozone and $PM_{2.5}$. Reductions in annual $PM_{2.5}$ levels are shown in Figure 3-5. The greatest reductions are evident in Southern California, the San Joaquin Valley, the San Francisco Bay area, and the Greater Sacramento area due to the large presence and activity of emission sources, meteorology, topography, and others. To highlight the extent of the air quality improvements: reductions reach nearly 8 micrograms per cubic meter (μg/m^3) in 2045 and lead to 76% fewer exceedances of the health-based National Ambient Air Quality $PM_{2.5}$ standard of 12 μg/m^3. Similarly, ozone improvements reach 19 parts per billion (ppb) and yield 62% fewer exceedance events. Furthermore, the locations of improvements carry important implications for human health as these areas support large urban populations and generally experience the most degraded ozone and $PM_{2.5}$ pollution. Appendix H (AB 32 GHG Inventory Sector Modeling) provides details regarding the atmospheric modeling and results, including differences in ozone and $PM_{2.5}$.

Figure 3-5: Difference in annual average $PM_{2.5}$ (µg/m^3) in the Scoping Plan scenario relative to the Reference scenario in 2045 (AB 32 GHG Inventory sectors)



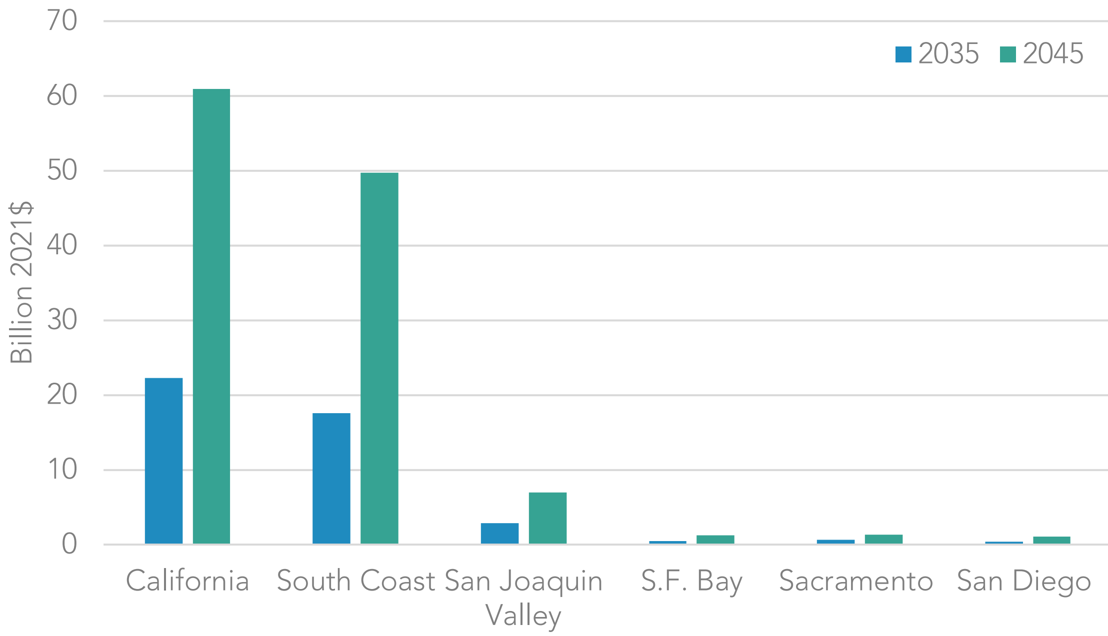
Notable health benefits representing the economic value of the avoided incidence of health effects are associated with the Scoping Plan Scenario. In total, the benefits reach $78 billion in 2035 and $199 billion in 2045, as shown in Figure 3-6. Populations in Southern California benefit the most due to preexisting air quality challenges, significant emission sources and activity, and the presence of a large, dense urban population. Additional details regarding the health impact assessment are provided in Appendix H (AB 32 GHG Inventory Sector Modeling).

Figure 3-6: Total health benefits estimated from air quality improvements in the Scoping Plan Scenario (AB 32 GHG Inventory sectors)



Furthermore, these benefits accrue within socially and economically disadvantaged communities identified by CalEnviroScreen, where they are most needed. Total health benefits within census tracts identified as disadvantaged communities using CalEnviroScreen 4.0 reach $22 billion in 2035 and $61 billion in 2045, as shown in Figure 3-7. Similarly to the statewide health benefits, the largest share of benefits occurs within disadvantaged communities in Southern California. Additional information on the health benefits within disadvantaged communities can be found in Appendix H (AB 32 GHG Inventory Sector Modeling).

Figure 3-7: Disadvantaged community health benefits relative to the Reference Scenario for the Scoping Plan Scenario (AB 32 GHG Inventory sectors)

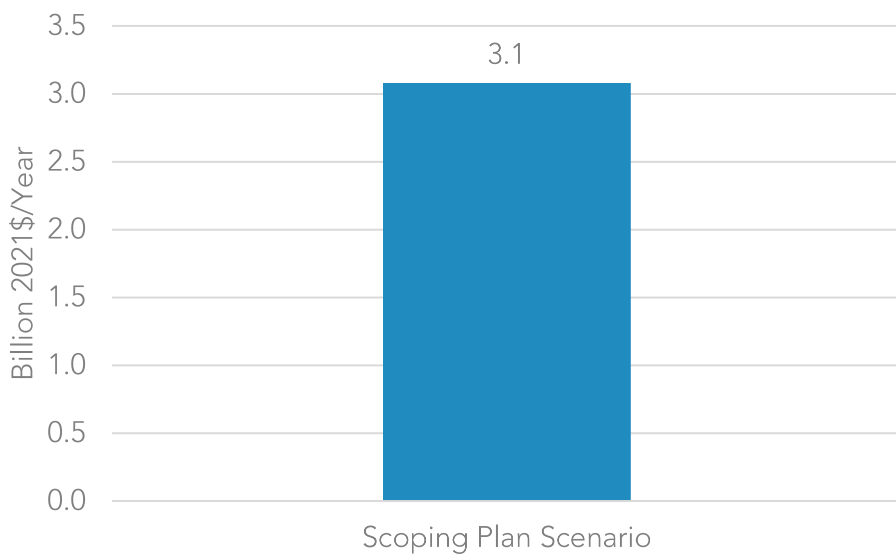


Natural and Working Lands

For NWL, health benefits were evaluated based on projected $PM_{2.5}$ wildfire emissions on forests, shrublands, and grasslands, discussed in the AB 197 Measure Analysis section of the chapter that follows.[220] The health endpoints for the Scoping Plan Scenario and in Appendix I (NWL Technical Support Document) for the alternative scenarios were the basis for the estimated health benefits shown in Figure 3-8. Health benefits were derived from the preliminary University of California, Los Angeles (UCLA) study that estimated annual health impacts and associated costs from California's wildfires from 2008–2018. Additional details are included in Appendix I (NWL Technical Support Document). These costs were applied to the health endpoints discussed in the AB 197 Measure Analysis section of the chapter.

[220] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N11, N14. *finalejacrecs.pdf (arb.ca.gov)*.

Figure 3-8: Total average annual health benefits relative to the Reference Scenario for the Scoping Plan Scenario (NWL)



As health impacts analyzed here are driven by wildfire emissions, the health benefits for the Scoping Plan Scenario are directly related to the amount of forest, shrubland, and grassland management action. These management actions reduce vegetation fuels and, as a result, wildfire activity. The Scoping Plan Scenario increases the amount of these management actions, reducing wildfire emissions and avoiding incidence of emission-related health effects. The health benefits, or economic value of the avoided incidence of health effects, correspondingly increase with an increasing management implementation rate. Additional details are included in Appendix I (NWL Technical Support Document).

Estimated health benefits do not include the direct impact of wildfires on injuries, deaths, or mental health, nor the indirect costs of lost ecosystem benefits to wildfire. Additional direct health costs may result from wildfire that would likely increase the health benefits from increased forest, shrubland, and grassland management to reduce wildfire activity. Nonetheless, the conservative health benefits under the Scoping Plan Scenario are estimated to be $3.1 billion per year relative to the Reference Scenario for all NWL actions identified in the Scoping Plan Scenario.

AB 197 Measure Analysis

This section provides estimates for information associated with GHG emissions reduction measures evaluated in this Scoping Plan.[221] These estimates, which were developed as part of the process for meeting the requirements of AB 197 (E. Garcia, Chapter 250, Statutes of 2016), provide information on the relative impacts of the evaluated measures when compared to each other. To support the design of a suite of policies that result in GHG reductions, air quality co-benefits, and cost-effective measures, it is important to understand if a measure will increase or reduce criteria pollutants or toxic air contaminant emissions, or if increasing stringency at additional costs yields few additional GHG reductions. To this end, AB 197 requires the following for each potential emissions reduction measure evaluated in any Scoping Plan update:

- The range of projected GHG emissions reductions that result from the measure;
- The range of projected criteria pollutant emission reductions that result from the measure; and
- The cost-effectiveness, including avoided social costs, of the measure.

The following sections describe the evaluation of measures for the AB 32 GHG Inventory sectors and NWL. For the purposes of this Scoping Plan, the identified emissions reduction measures for the analysis required by AB 197 are actions grouped by sectors where several policies and programs are expected to overlap. This approach reflects the most granular feasible analysis given the modeling tools available,[222] the overlap and interaction effects among policies and incentive programs, the longer planning horizon used for this Scoping Plan compared to previous efforts, and the scale of transition needed to achieve carbon neutrality. To implement this Scoping Plan, dozens of individual regulations, policies, and incentive programs are anticipated that work together to drive down emissions across all economic sectors and support actions. Every specific policy or incentive program that could contribute to the deployment of clean technology and energy called for in this plan may overlap in ways that make it infeasible to tease out those policies and programs' individual effects with any reasonable degree of certainty. For example, in the transportation sector, deploying ZEVs and reducing driving demand may be achieved through a combination of the implementation of new or existing regulations, fuels programs, incentive programs, and VMT reduction initiatives that can each contribute to reductions in emissions for the sector. It is not feasible to isolate each sub action from each other at this time in terms of the share of contribution to total reductions. The estimated emission

[221] AB 197 calls for the evaluation of "emission reduction measures." This Scoping Plan treats each action and its variants on stringency as emission reduction measures for the purposes of this chapter. Appendix C (AB 197 Measure Analysis) lists the measures and corresponding modeling assumptions for each alternative.
[222] See Appendix H (AB 32 GHG Inventory Sector Modeling and Appendix I (NWL Technical Support Document).

reductions, health endpoints, and costs by measure for the Scoping Plan Scenario are presented in this chapter, and the corresponding estimates for the Proposed Scenario and Alternatives 1, 2, and 4 are included in Appendix C (AB 197 Measure Analysis).

Because many of the measures and underlying assumptions interact with each other, isolating the GHG emission reductions, corresponding changes to fuel combustion, and associated cost of an individual measure is analytically challenging. Each measure is evaluated by examining the change in fuel combustion, cost, and emissions associated with just that measure using the PATHWAYS model. The difference between the Scoping Plan Scenario and the Reference Scenario is estimated for each measure. Starting from the Scoping Plan Scenario, the modeling assumptions for an individual measure are reverted to the Reference Scenario values, resulting in GHG reductions, changes to fuel combustion, and costs (or savings). This approach does not reflect interactions between sectors in PATHWAYS that influence the results for each complete alternative, presented earlier. As such, the values associated with each measure should not be added to obtain an overall scenario estimate.

To arrive at the 2045 target for NWL, CARB modeled the ecological impact that climate smart land-based management strategies (suites of on-the-ground actions, or *treatments,* that are used across the landscape to manipulate an ecosystem) will have on ecosystem carbon; and whenever possible, additional co-benefits from those actions. The Scoping Plan Scenario incorporates a set of land management actions at varying scales of implementation for each land type to achieve the GHG emission reductions. Each land type, and its associated management actions, was considered a measure for this analysis. For modeling individual landscapes and management actions, CARB used a suite of models. The complexity of these models varies by land type, depending on the existing science, data, and availability of existing models to use. Appendix I (NWL Technical Support Document) provides detailed modeling assumptions for each NWL type. The estimated emission reductions, health endpoints, and costs by measure under the Scoping Plan Scenario for each NWL type are presented in this chapter, and the corresponding estimates for the Proposed Scenario and NWL Alternatives 1, 2, and 4 are included in Appendix C (AB 197 Measure Analysis).

Estimated Emissions Reductions

Both GHG emissions reductions and emissions of criteria air pollutants were evaluated for the AB 32 GHG Inventory sectors and for NWL. The methods and results are described in this section.

AB 32 GHG Inventory Sectors

In the absence of having direct modeling results for criteria pollutant estimates from PATHWAYS, CARB estimated criteria pollutant emissions impacts by using changes in fuel combustion in units of exajoules from PATHWAYS and emission factors in units of tons per exajoule to estimate the change in emissions in tons per year. Emission factors from a variety of sources for each sector were utilized, including but not limited to CARB's mobile source emissions models,[223] U.S. EPA's AP 42 Emissions Factors,[224] and the South Coast Air Quality Management District's (AQMD's) District Rules.[225] These emission factors were applied to fuel burn change by fuel type, sector, equipment type, and process, where applicable. Statewide annual average emissions were estimated for three criteria pollutants: NO_x, $PM_{2.5}$, and ROG.

Table 3-5 provides the estimated GHG and criteria pollutant emission reductions for the measures in the Scoping Plan Scenario in 2035 and 2045. The other alternatives are presented in Appendix C (AB 197 Measure Analysis). Based on the estimates below, these measures are expected to provide air quality benefits. The estimates provided in this chapter and Appendix C (AB 197 Measure Analysis) are appropriate for comparing across alternatives considered for the development of this Scoping Plan, but they are not precise estimates.

[223] CARB. MSEI - Modeling Tools. https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/msei-modeling-tools.

[224] U.S EPA. AP-42: Compilation of Air Emissions Factors. https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors.

[225] South Coast AQMD. South Coast AQMD Rule Book. https://www.aqmd.gov/home/rules-compliance/rules/scaqmd-rule-book.

Table 3-5: Estimated GHG and criteria pollutant emission reductions relative to the Reference Scenario for the Scoping Plan Scenario in 2035/2045 (AB 32 GHG Inventory sectors)

Measure	GHG Reductions ($MMTCO_2$)	NOx Reductions (Short Tons/Year)	$PM_{2.5}$ Reductions (Short Tons/ Year)	ROG Reductions (Short Tons/Year)
Deploy ZEVs and reduce driving demand	-46 / -84	-51,620 / -122,806	-2,008 / -6,506	-18,967 / -30,410
Coordinate supply of liquid fossil fuels with declining California fuel demand	-25 / -30	-1,601 / -2,707	-978 / -1,705	-747 / -1,323
Generate clean electricity	-8 / -31	-92 / -1,555	-177 / -1,382	-41 / -425
Measure	**GHG Reductions ($MMTCO_2$)**	**NOx Reductions (Short Tons/Year)**	**$PM_{2.5}$ Reductions (Short Tons/ Year)**	**ROG Reductions (Short Tons/Year)**
Decarbonize industrial energy supply	-9 / -22	-21,172 / -34,876	-1,188 / -2,527	-3,710 / -6,298
Decarbonize buildings	-14 / -35	-8,105 / -94,455	-826 / -6,877	-1,093 / -8,109
Reduce non-combustion emissions[a]	-0.41 / -0.52 ($MMTCH_4$)	N/A	N/A	N/A
Compensate for remaining emissions	-25 / -64	N/A	N/A	N/A

[a] Methane emissions reductions are reported for this measure.

The measures related to reducing non-combustion emissions and compensating for the remaining emissions do not include changes to fuel combustion, and therefore are not associated with changes to air pollutants. Biomethane combustion is captured in measures that reduce combustion of fossil gas, such as decarbonizing industrial energy supply and buildings.

Natural and Working Lands

NWL ecosystems naturally vary between being a source and a sink for carbon over time. The NWL ecosystem carbon stock changes projected through mid-century by the suite of models were used to estimate net emissions or emissions reductions relative to the Reference Scenario. These changes in carbon stocks were affected by projected climate change, the implementation of management actions under the various scenarios, land conversion, and (for forests, shrublands, grasslands) wildfire. Each NWL type was evaluated, and an overview of all NWL is presented in Table 3-6. More detailed results for each NWL type can be found in Appendix C (AB 197 Measure Analysis).

Table 3-6: Estimated average annual GHG and criteria pollutant emission reductions relative to the Reference Scenario for the Scoping Plan Scenario from 2025–2045 (NWL)

Measure	GHG Reductions ($MMTCO_2e$/year)	$PM_{2.5}$ Reductions (MT/Year)
Forests/Shrublands/Grasslands	-0.12	-17,500
Annual Croplands	-0.25	N/A
Perennial Croplands	-0.01	N/A
Urban Forest	-1.29	N/A
Wildland Urban Interface (WUI)	0.75	N/A
Wetlands	-0.43	N/A
Sparsely Vegetated Lands	<-0.01	N/A

Fine particulate wildfire emissions were evaluated for forests, shrublands, and grasslands only. Wildfire emissions decreased under the Scoping Plan Scenario compared to the Reference Scenario. The Scoping Plan Scenario's higher level of management actions that reduce tree or shrub densities, protect large trees, reintroduce fire to the landscape, and diversify species and structures result in greater reductions in wildfire emissions.

Estimated Health Endpoints

Climate change mitigation will result in both environmental and health benefits. This section provides information about the potential health benefits of the Scoping Plan Scenario. Health benefits are primarily the result of reduced $PM_{2.5}$ pollution, both from stationary and mobile sources, as well as wildfire in forests, shrublands, and chaparral.

AB 32 GHG Inventory Sectors

CARB used the criteria pollutant emissions in Table 3-5 to understand potential health impacts. Similar to the air quality estimates, this information should be used to understand the relative health benefits of the various measures and should not be taken as absolute estimates of health outcomes. CARB used the incidence-per-ton (IPT) methodology to quantify the health benefits of emission reductions. The IPT methodology is based on a methodology developed by the U.S.

EPA.[226,227,228,229] Under the IPT methodology, changes in emissions are approximately proportional to the resulting changes in health outcomes. IPT factors are derived by calculating the number of health outcomes associated with exposure to $PM_{2.5}$ for a baseline scenario using measured ambient concentrations and dividing that number by the emissions of $PM_{2.5}$ or a precursor. To estimate the reduction in health outcomes, the emission reductions are multiplied by the IPT factor. For future years, the number of outcomes is adjusted to account for population growth. IPT factors were computed for the two types of $PM_{2.5}$: primary $PM_{2.5}$ and secondary $PM_{2.5}$ of ammonium nitrate aerosol formed from precursors.

For this AB 197 analysis, CARB calculated the health benefits associated with the five key measures that are represented by changes to fuel combustion. The health benefits associated with emission reductions for the Scoping Plan Scenario were estimated for each air basin and then aggregated for the entire state of California. CARB assumed that the statewide emission reductions distribution among the air basins is proportional to the baseline emissions in that air basin.

Calculated health endpoints include premature mortality, cardiovascular emergency department (ED) visits, acute myocardial infarction, respiratory ED visits, lung cancer incidence, asthma onset, asthma symptoms, work loss days, hospitalizations due to cardiopulmonary illnesses, hospitalizations due to respiratory illnesses, hospital admissions for Alzheimer's disease, and hospital admissions for Parkinson's disease.[230,231,232] These health endpoints were calculated using the IPT method for estimated emission reductions. Table 3-7 compares the health benefits of emission reductions associated with each measure for the Scoping Plan Scenario in the year

---

[226] CARB. CARB's Methodology for Estimating the Health Effects of Air Pollution. Retrieved February 9, 2021. https://ww2.arb.ca.gov/resources/documents/carbs-methodology-estimating-health-effects-air-pollution.
[227] Fann, N., C. M. Fulcher, and B. J. Hubbell. 2019. "The influence of location, source, and emission type in estimates of the human health benefits of reducing a ton of air pollution." *Air Quality, Atmosphere & Health* 2:169–176. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2770129/.
[228] Fann, N., K. R. Baker, and C. M. Fulcher. 2012. "Characterizing the $PM_{2.5}$-related health benefits of emission reductions for 17 industrial, area and mobile emission sectors across the U.S." *Environ Int*. 49:141–51. November 15. https://www.sciencedirect.com/science/article/pii/S0160412012001985.
[229] Fann, N., K. Baker, E. Chan, A. Eyth, A. Macpherson, E. Miller, and J. Snyder. 2018. "Assessing Human Health $PM_{2.5}$ and Ozone Impacts from U.S. Oil and Natural Gas Sector Emissions in 2025." *Environ. Sci. Technol.* 52 (15), 8095–8103. https://pubs.acs.org/doi/abs/10.1021/acs.est.8b02050.
[230] CARB. CARB's Methodology. https://ww2.arb.ca.gov/resources/documents/carbs-methodology-estimating-health-effects-air-pollution.
[231] CARB. 2022. Updated Health Endpoints in CARB's Health Benefits Methodology. *Evaluating New Health Endpoints for Use in CARB's Health Analyses*.
[232] Cardio-pulmonary mortality, hospitalizations due to cardiopulmonary illnesses, and hospital admissions due to respiratory illnesses endpoints utilize studies documented in CARB's methodology document. For future assessments, CARB will use more recent studies to estimate cardiovascular hospital admissions and respiratory hospital admissions, as documented in CARB's updated health endpoints memo.

specified (2035 or 2045). The other alternatives are presented in Appendix C (AB 197 Measure Analysis).

Table 3-7: Estimated avoided incidence of mortality, cardiovascular and respiratory disease onset, work loss days and hospital admissions relative to the Reference Scenario for the Scoping Plan Scenario (AB 32 GHG Inventory sectors)

Measure	Mortality	Cardiovascular ED Visits	Acute Myocardial Infarction	Respiratory ED Visits	Lung Cancer Incidence	Asthma Onset	Asthma Symptoms	Work Loss Days	Hospital Admissions, Cardiovascular	Hospital Admissions, Respiratory	Hospital Admissions, Alzheimer's Disease	Hospital Admissions, Parkinson's Disease
Deploy ZEVs and reduce driving demand in 2035	635	170	70	400	45	1,475	128,930	92,510	95	115	245	40
Deploy ZEVs and reduce driving demand in 2045	1,820	475	200	1,115	135	3,995	343,095	255,800	295	350	745	125
Coordinate supply of liquid fossil fuels with declining CA fuel demand in 2035	115	30	15	70	10	275	23,530	16,880	20	20	50	10

Measure	Mortality	Cardiovascular ED Visits	Acute Myocardial Infarction	Respiratory ED Visits	Lung Cancer Incidence	Asthma Onset	Asthma Symptoms	Work Loss Days	Hospital Admissions, Cardiovascular	Hospital Admissions, Respiratory	Hospital Admissions, Alzheimer's Disease	Hospital Admissions, Parkinson's Disease
Coordinate supply of liquid fossil fuels with declining CA fuel demand in 2045	215	55	25	130	15	490	40,860	30,445	35	40	95	15
Generate clean electricity in 2035	20	5	0	10	0	45	3,930	2,820	5	5	10	0
Generate clean electricity in 2045	170	45	20	105	15	385	32,065	23,890	25	30	75	10
Decarbonize industrial energy supply in 2035	300	80	35	190	20	695	60,660	43,520	45	55	115	20
Decarbonize industrial energy supply in 2045	595	155	65	365	45	1,310	111,925	83,435	95	115	245	40

Measure	Mortality	Cardiovascular ED Visits	Acute Myocardial Infarction	Respiratory ED Visits	Lung Cancer Incidence	Asthma Onset	Asthma Symptoms	Work Loss Days	Hospital Admissions, Cardiovascular	Hospital Admissions, Respiratory	Hospital Admissions, Alzheimer's Disease	Hospital Admissions, Parkinson's Disease
Decarbonize buildings in 2035	155	40	15	95	10	360	31,130	22,335	25	30	60	10
Decarbonize buildings in 2045	1,610	420	175	985	120	3,550	303,830	226,500	260	310	665	115
Note: All values are rounded to the nearest 0 or 5.												

The measures related to reducing non-combustion emissions and compensating for remaining emissions do not include changes to fuel combustion and therefore are not associated with changes to air pollutants or health endpoints. Biomethane combustion is captured in measures that reduce combustion of fossil gas, such as decarbonizing industrial energy supply and buildings.

Although the estimated health outcomes presented are based on a well-established methodology, they are subject to uncertainty. For instance, future population estimates are subject to increasing uncertainty as they are projected further into the future, and baseline incidence rates can experience year-to-year variation. Also, the relationship between changes in pollutant concentrations and changes in pollutant or precursor emissions is assumed to be approximately proportional.

In addition, emissions are reported at an air basin level and do not capture local variations. These estimates also do not account for impacts from global climate change, such as temperature rise, and are only based on the scenarios in this Scoping Plan.

The fuel changes for each AB 197 measure are estimated based on the impact of each measure compared to the Reference Scenario for the years 2035 and 2045. Therefore, aggregating the effect of each measure would overestimate the impacts of the Scoping Plan Scenario because the implementation of each measure would affect the level of benefits of the other measures. This measure-by-measure analysis uses a different methodology for calculating health endpoints than does the health analysis for the complete Scoping Plan Scenario provided earlier.

Natural and Working Lands

Implementation of NWL management strategies to mitigate and adapt to climate change will result in both environmental and health benefits. This section provides information about the potential health benefits of measures evaluated for the Scoping Plan Scenario. For this analysis, health benefit estimates were focused on increases or decreases to $PM_{2.5}$ resulting from wildfire emissions on forests, shrublands, and grasslands.[233] Other health benefits resulting from NWL management actions in the Scoping Plan Scenario are not quantified here but are important for all Californians. This includes, but is not limited to, reductions in exposure to synthetic pesticides when switching to organic agricultural systems, improvements in shade availability and mental health with increasing urban forest cover, improved mental health from opportunities for recreation in resilient and healthy environments, and protection from floods and rising sea levels.

[233] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N11, N14. finalejacrecs.pdf (arb.ca.gov).

These examples are by no means exhaustive, as our natural and working lands provide immense health benefits to everyone.

For this analysis, CARB used the $PM_{2.5}$ emissions in Table 3-6 to understand potential health impacts. This information should be used to understand the relative health endpoints of the various measures and should not be taken as absolute estimates of health outcomes of this Scoping Plan statewide or within a specific community. The IPT methodology was used to calculate health endpoints, similar to the AB 32 GHG Inventory Sector analysis. CARB calculated the annual health endpoints associated with the wildfire emissions changes resulting from the implementation of management strategies on forests, shrublands, and grasslands under each alternative. The annual health endpoints associated with emission reductions for the Scoping Plan Scenario were estimated for the entire state. Calculated health endpoints include emissions-caused mortality, hospital admittance, and emergency room visits from asthma; hospital admittance from chronic obstructive pulmonary disease; and emergency room visits from respiratory and cardiovascular outcomes. Table 3-8 compares the average annual health endpoints of wildfire emission reductions associated with the Scoping Plan Scenario over the period 2025–2045. The other alternatives are presented in Appendix C (AB 197 Measure Analysis).

Table 3-8: Estimated average annual avoided incidence of hospital admissions, emergency room visits, and mortality relative to the Reference Scenario for the Scoping Plan Scenario resulting from forest, shrubland, and grassland wildfire emissions (NWL)

Health Endpoints from Forest, Shrubland, and Grassland Wildfire Emissions	Average Annual Avoided Incidence
Hospital admissions from asthma	22
Hospital admissions from chronic obstructive pulmonary disease without asthma	19
Hospital admissions from all respiratory outcomes	63
Emergency room visits from asthma	155
Emergency room visits from all respiratory outcomes	419
Emergency room visits from all cardiovascular outcomes	156
All causes of mortality	394

Estimated Social Cost

Social costs are generally defined as the cost of an action on people, the environment, or society and are widely used to understand the impact of regulatory actions. One tool, the social cost of greenhouse gases (SC-GHG), is an estimate of the present value of the costs associated with the emission of GHGs in future years. It combines climate science and economics to help understand the benefits of reducing GHG emissions. The estimates of the social cost of carbon (SC-CO_2) and social cost of methane (SC-CH_4), two types of SC-GHGs presented here, estimate the value of the net harm to society associated with adding GHGs to the atmosphere in a given year; they do not represent the cost of actions taken to reduce GHG emissions (known as the *cost of abatement*) nor the cost of GHG emissions reductions. In principle, the SC-GHG includes the value of climate change impacts, including but not limited to, changes in net agricultural productivity, human health effects, property damage from increased flood risk and other natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services. It reflects the societal value of reducing emissions of the gas in question by one metric ton.[234] Many of these damages from GHG emissions today will affect economic outcomes throughout the next several centuries.

In 2008, federal agencies began incorporating SC-CO_2 estimates into the analysis of their regulatory actions. U.S. EPA has used various models and discount rates to determine the value of future impacts. Generally, these models begin with assumptions to predict economic activity over time, along with projected GHG emissions. The modeled emissions are input into a model of the global climate system, which then translates into estimates of surface temperature, sea level rise, and other impacts. These outputs are used to estimate economic damages per ton of GHG emitted in a given year in the future. Since the models are calculating the present value of future damages, a discount rate is applied. For example, the SC-CO_2 for the year 2045 represents the value of climate change damages from a release of CO_2 in 2045 discounted back to today. The present value is significantly affected by the discount rate used; a higher discount rate results in a lower present value. For example, in 2021 dollars the SC-CO_2 in 2045 is $31 using a 5 percent discount rate, $88 using a 3 percent discount rate, and $122 using a 2.5 percent discount rate. Additional detail is included in Appendix C (AB 197 Measure Analysis).

The 2017 Scoping Plan utilized SC-CO_2 and SC-CH_4 Obama Administration-era values developed by the Council of Economic Advisors and the Office of Management and Budget-convened Interagency Working Group on the Social Cost of Greenhouse Gases (IWG)[235] to consider the social costs of actions to reduce GHG emissions. The Biden Administration reinstated these values in February 2021,[236] after they had been rescinded and significantly revised by the Trump Administration. The reinstatement was considered an interim step, and the Biden Administration also reconvened the IWG to continue its work to evaluate and incorporate the latest climate science and economic research and

[234] U.S. Government. Interagency Working Group on Social Cost of Greenhouse Gases. February 2021. Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide – Interim Estimates under Executive Order 13990. https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf

[235] Originally titled the "Interagency Working Group on the Social Cost of Carbon," the IWG was renamed in 2016. 82 Fed. Reg. 16093, 16095-96 (Mar. 28, 2017). https://www.govinfo.gov/content/pkg/FR-2017-03-31/pdf/2017-06576.pdf.

[236] Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis, Executive Order 13990 (Jan. 20, 2021), 86 Fed. Reg. 7037 (Jan. 25, 2021). https://www.energy.gov/sites/default/files/2021/02/f83/eo-13990-protecting-public-health-environment-restoring.pdf. IWG, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990 (February 2021), https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf See also, The White House. 2021. A Return to Science: Evidence-Based Estimates of the Benefits of Reducing Climate Pollution. https://www.whitehouse.gov/cea/written-materials/2021/02/26/a-return-to-science-evidence-based-estimates-of-the-benefits-of-reducing-climate-pollution/.

respond to the National Academies' recommendations from 2017 as it develops a more complete revision of the estimates.

It is important to note that the models used to produce SC-GHG estimates do not include all of the important physical, ecological, and economic impacts of climate change recognized in the climate literature. There are additional costs to society, including the costs associated with changes in co-pollutants and costs that cannot be included due to modeling and data limitations. The IWG has stated that the range of the interim SC-GHG estimates likely underestimates societal damages from GHG emissions.[237] The revised estimates were originally slated to be released in early 2022 but were stalled.[238] CARB staff is applying the interim values presented in the IWG February 2021 Technical Support Document (TSD), which reflect the best available science in the estimation of the socioeconomic impacts of GHGs.[239] This Scoping Plan utilizes the TSD standardized range of discount rates, from 2.5 to 5 percent, to represent varying valuation of future damages.

AB 32 GHG Inventory Sectors

Table 3-9 presents the estimated social cost, in terms of avoided economic damages, for each measure of the Scoping Plan Scenario. For each measure, Table 3-9 includes the range of the SC-CO_2 and SC-CH_4 that results from the GHG emissions reductions in 2035 and 2045 at 2.5 and 5 percent discount rates. Additional background on the SC-GHG and methodology for calculating the SC-CO_2 and SC-CH_4 estimates in this Scoping Plan, as well as estimates for the alternatives, are provided in Appendix C (AB 197 Measure Analysis).

---

[237] Interagency Working Group on Social Cost of Greenhouse Gases. 2021. Technical Support Document. https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf

[238] See *Louisiana v. Biden* (W.D. La. 2022) 585 F.Supp.3d 840, stayed pending review (5th Cir. Mar. 16, 2022) 2022 WL 866282. A federal district court ruling issued in early February 2022 had granted a preliminary injunction blocking the Biden Administration from using the interim IWG SC-GHG estimates. However, a federal appeals court overturned the lower court's preliminary injunction in March 2022, which allows the Biden Administration to continue using the policy as legal proceedings continue. CARB will continue to monitor the litigation. However, the federal action does not prohibit CARB from using social cost of carbon and CARB will use the best available science regardless of politics. A separate federal appeals court upheld the Biden administration's use of the IWG SC-GHG estimates in October 2022. *Missouri v. Biden* (8th Cir. 2022) ____ F.4th ____.

[239] Interagency Working Group on Social Cost of Greenhouse Gases. 2021. Technical Support Document. https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf

Table 3-9: Estimated social cost (avoided economic damages) of measures considered in the Scoping Plan Scenario (AB 32 GHG Inventory sectors)

Measure	Social Cost of Carbon in 2035, 5%–2.5% Discount Rate Billion USD (2021 dollars)	Social Cost of Carbon in 2045, 5%–2.5% Discount Rate Billion USD (2021 dollars)
Deploy ZEVs and reduce driving demand	1.12–4.87	2.64–10.23
Coordinate supply of liquid fossil fuels with declining California fuel demand	0.61–2.63	0.95–3.67
Generate clean electricity	0.20-0.88	0.97–3.75
Decarbonize industrial energy supply	0.23–1.01	0.69–2.67
Decarbonize buildings	0.35–1.52	1.11–4.32
Reduce non-combustion emissions	0.51–1.29 (SC-CH_4)	0.86–2.01 (SC-CH_4)
Compensate for remaining emissions	0.61–2.66	2.03–7.84
Scoping Plan Scenario SC-CO_2 **Scoping Plan Scenario SC-CH_4** **Scoping Plan Scenario (Total)**[a]	2.4–10.4 0.51–1.3 2.9–11.7	5.6–21.9 0.86–2.0 6.5–23.9

[a] CARB staff could not precisely separate some CO_2 and CH_4 from other GHGs from PATHWAYS outputs, but the contribution is believed to be small for purposes of calculating the social cost of carbon. The approach used to estimate GHG emissions reductions for individual measures in PATHWAYS does not reflect cross-sector interactions. Therefore, the GHG values for each measure do not sum to the overall scenario total. The total GHG emissions reduction used in this calculation is 97 $MMTCO_2e$ in 2035 and 180 $MMTCO_2e$ in 2045.

Natural and Working Lands

The SC-CO_2 estimates for the NWL measures shown in Table 3-10, in terms of avoided economic damages, reflect 2021 IWG interim values, updated for inflation, similar to the AB 32 GHG Inventory Sector analysis. This analysis utilizes the 2.5 percent and 5 percent discount rate and the average annual emissions reductions from each NWL type from 2025–2045. Estimates for all alternatives are included in Appendix C (AB 197 Measure Analysis).

Table 3-10: Estimated social cost (avoided economic damages) of measures considered in the Scoping Plan Scenario (NWL)

Measure	Social Cost of Carbon in 2035, 5%–2.5% Discount Rate Billion USD (2021 dollars)	Social Cost of Carbon in 2045, 5%–2.5% Discount Rate Billion USD (2021 dollars)
Forests/Shrublands/Grasslands	0.003–0.012	0.004–0.014
Annual Croplands	0.006–0.027	0.008–0.031
Perennial Croplands	<0.001–0.001	0.000–0.001
Urban Forest	0.032–0.138	0.041–0.157
Wildland Urban Interface (WUI)	(0.018) – (0.080)[a]	(0.023) – (0.090)
Wetlands	0.011–0.046	0.014–0.053
Sparsely Vegetated Lands	<0.001	<0.001

[a] Parentheses indicate an increase in estimated social cost, i.e., an increase in economic damages. This is only the case for WUI measures where emissions are increased, shown in Table 3-6. The estimated social cost does not account for the decrease in wildfire risk or decrease in wildfire damages resulting from the WUI measures.

Social Costs of GHGs in Relation to Cost-Effectiveness

AB 32 includes a requirement that rules and regulations "achieve the maximum technologically feasible and cost-effective" greenhouse gas emissions reductions.[240] Under AB 32, *cost-effectiveness* means the relative cost per metric ton of various GHG reduction strategies,[241] which is the traditional cost metric associated with emission control. In contrast, the SC-CO_2, SC-CH_4, and social cost of nitrous oxide (SC-N_2O), because they are estimates of the cost to society of additional GHG emissions, can be used to estimate of the economic benefits of reducing emissions, but do not take into account the cost of the actions that must be taken to achieve those GHG emissions reductions.

There may be technologies or policies that do not appear to be cost-effective when compared to the SC-CO_2, SC-CH_4, and SC-N_2O associated with GHG reductions. However, these technologies or policies may result in other benefits that are not reflected in the IWG social costs. Examples include the evaluation of social diversification of the portfolio of transportation fuels (a goal outlined in the Low Carbon Fuel Standard) and reductions in criteria pollutant emissions from power plants (as in the Renewables Portfolio Standard). Additionally, costs for new technology may be higher early on in a technology's development cycle and may drop over time as use of the technology is scaled up.

Estimated Cost per Metric Ton

AB 197 requires an estimation of the cost-effectiveness of the measures evaluated for this Scoping Plan. The cost (or savings)[242] per metric ton of CO_2e reduced for each measure is one metric for comparing the performance of the measures. Additional factors beyond the cost per metric ton that could be considered include continuity with existing laws and policies, implementation feasibility, contribution to fuel diversity and technology transformation goals, and health and other benefits to California. These considerations are not reflected in the cost per metric ton estimates presented below. It is important to understand the relative cost-effectiveness of individual measures as presented in this section. However, the economic analysis presented earlier in this chapter, in Appendix H

[240] AB 32 Air pollution: greenhouse gases: California Global Warming Solutions Act of 2006. (AB 32, Nuñez, Chapter 488, Statutes of 2006). https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200520060AB32.
[241] Health & Saf. Code § 38505(d).
[242] Similarly, to the direct costs reported earlier, the cost per metric ton of a measure reflects the stock costs and any fuel or efficiency savings associated with a measure divided by the GHG emission reduction achieved by the measure. Costs are reported as positive values, and savings are reported as negative values.

(AB 32 GHG Inventory Sector Modeling), and in Appendix I (NWL Technical Support Document) provides a more comprehensive analysis of how the Scoping Plan Scenario and alternative scenarios affect the state's economy and jobs.

AB 32 GHG Inventory Sectors

The cost per metric ton for the AB 32 GHG Inventory sectors was computed for each measure independently relative to the Reference Scenario using the sensitivity calculations based on PATHWAYS and RESOLVE outputs. The difference in the annualized cost between the Scoping Plan Scenario and the Reference Scenario was computed for each measure in 2035 and in 2045. The incremental cost was divided by the incremental GHG emissions impact to calculate the cost per metric ton in each year. To capture the fuel and GHG impacts of investments made from 2022 through 2035, or from 2022 through 2045, CARB computed an average annual cost per metric ton. The incremental cost in each year was averaged over the period. This value is divided by the corresponding annual, incremental GHG impact averaged over the same period.

The cost metric includes the annualized incremental cost of energy infrastructure, such as zero-emission vehicles, electric appliances, and required revenue to support all electric assets. A residual value for equipment such as vehicles or appliances that are retired early is included. The annual fuel cost or avoided fuel cost that results from efficiency improvements or changes to demand for fuels associated with transitioning to alternative fuels is included. Not included in this cost metric are costs that represent transfers within the state, such as incentive payments for early retirement of equipment.

It is important to note that this cost per metric ton does not represent an expected market price value for carbon mitigation associated with these measures. In addition, the values do not capture fuel savings or GHG reductions associated with the full economic lifetime of measures that have been implemented by the target date of 2035 or 2045 but whose impacts extend beyond the target date.

Table 3-11 includes the cost per metric ton and annual average cost per metric ton estimates for the Scoping Plan Scenario. The other alternatives are presented in Appendix C (AB 197 Measure Analysis). Measures that are relatively less costly in 2035 or 2045 are also less costly over the extended period. As noted earlier, incremental costs of new vehicles are generally offset by gains in efficiency and avoided fuel consumption resulting in negative cost per metric ton.

Table 3-11: Estimated cost per metric ton of reduced CO_2e relative to the Reference Scenario for measures considered in the Scoping Plan Scenario (AB 32 GHG Inventory sectors)

Measure	Annual Cost, 2035 ($/ton)	Average Annual Cost, 2022–2035 ($/ton)	Annual Cost, 2045 ($/ton)	Average Annual Cost, 2022–2045 ($/ton)
Deploy ZEVs and reduce driving demand	-171	-99	-103	-122
Coordinate supply of liquid fossil fuels with declining CA fuel demand	60	109	-50	39
Generate clean electricity[a]	101	156	145	161
Decarbonize industrial energy supply	290	217	257	274
Decarbonize buildings	235	230	112	213
Reduce non-combustion emissions	93	94	106	99
Compensate for remaining emissions	745	823	236	485

[a] Note: The denominator of this calculation (2045) does not include GHG reductions occurring outside of California resulting from SB 100. If these reductions were included, this number would be lower.

Natural and Working Lands

The cost per metric ton for NWL measures were computed for the Scoping Plan Scenario relative to the Reference Scenario using the projected carbon stock/sequestration data from the NWL modeling and the direct cost estimates for each management action, described earlier. Direct costs represent the cost of implementing a certain management action. The projected emissions reductions take into account the loss of carbon that results from the management action, such as fuels reduction treatments in forests, as well as climate change effects on growth. The direct cost for each NWL measure was divided by the average annual emission reductions presented in Table 3-6 to produce the cost per metric ton. The increasing effect of climate change on diminished future growth reduces the ability of the land to sequester or store carbon, driving up the cost per ton.

It is important to note that this cost per metric ton does not represent an expected market price value for carbon mitigation associated with these measures. In addition, emissions benefits of NWL management actions often take longer time periods to accrue, and these values only capture GHG reductions up to 2045.

Table 3-12 includes the average cost per metric ton estimates for the average annual CO_2e reductions from 2025 through 2045 for the Scoping Plan Scenario. The other alternatives are presented in Appendix C (AB 197 Measure Analysis).

Table 3-12: Estimated average cost per metric ton of reduced CO_2e relative to the Reference Scenario for measures considered in the Scoping Plan Scenario (NWL)

Measure	Average Cost per Reduced Ton CO_2e ($/Ton)
Forests/Shrublands/Grasslands	15,500
Annual Croplands	1,100
Perennial Croplands	412
Urban Forest	3,270
Wildland Urban Interface (WUI)	N/A
Wetlands	64
Sparsely Vegetated Lands	451,000

Climate Vulnerability Metric

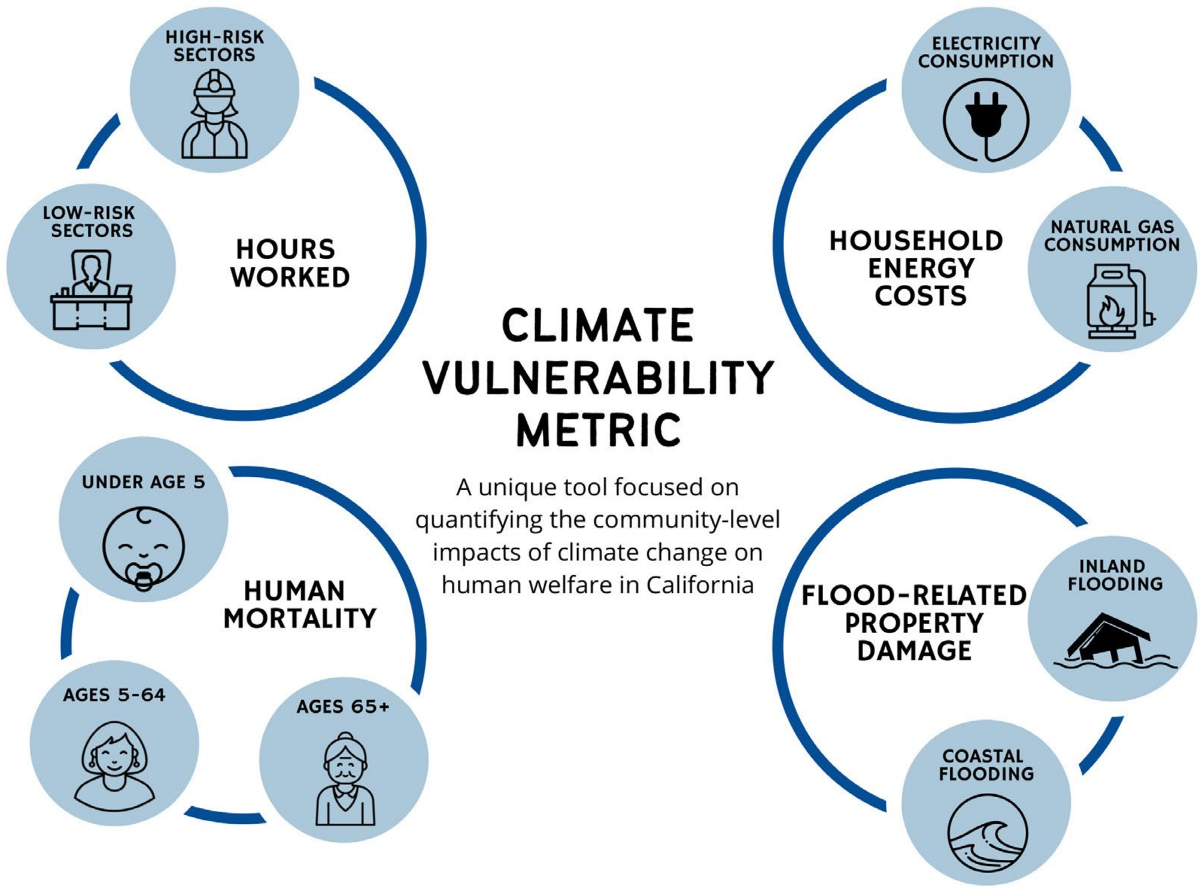
As California invests in climate mitigation and adaptation, it is essential to understand that the relative impact of climate change will vary across the state's communities. Due to persisting health and opportunity gaps, not all communities are equally resilient in the face of climate impacts. A global metric such as the Social Cost of Carbon cannot adequately capture the incremental additional economic impact faced by overly burdened communities. The Climate Vulnerability Metric (CVM) is specifically focused on quantifying the community-level impacts of a warming climate on human welfare and the additional costs. Additional details and results are included in Appendix K (Climate Vulnerability Metric).

The CVM aggregates the impacts of climate change that can be quantified at the census tract level using robust and currently available research. The CVM includes the projected impacts of climate change on human welfare across four categories (hours worked, household energy costs, human mortality, and flood-related property damage) through midcentury. The CVM identifies nine components of the four climate impacts as shown in Figure 3-9 and aggregates the data to generate a total CVM result for each census tract. To ensure that the CVM represents the diversity of California communities, it is reported as the aggregate monetized impact of climate change as a percentage of census tract-specific incomes.[243] For example, a CVM value of 3 implies that by 2050, a census tract is projected to experience human welfare impacts of climate change that amount to 3% of annual income in that tract.

---

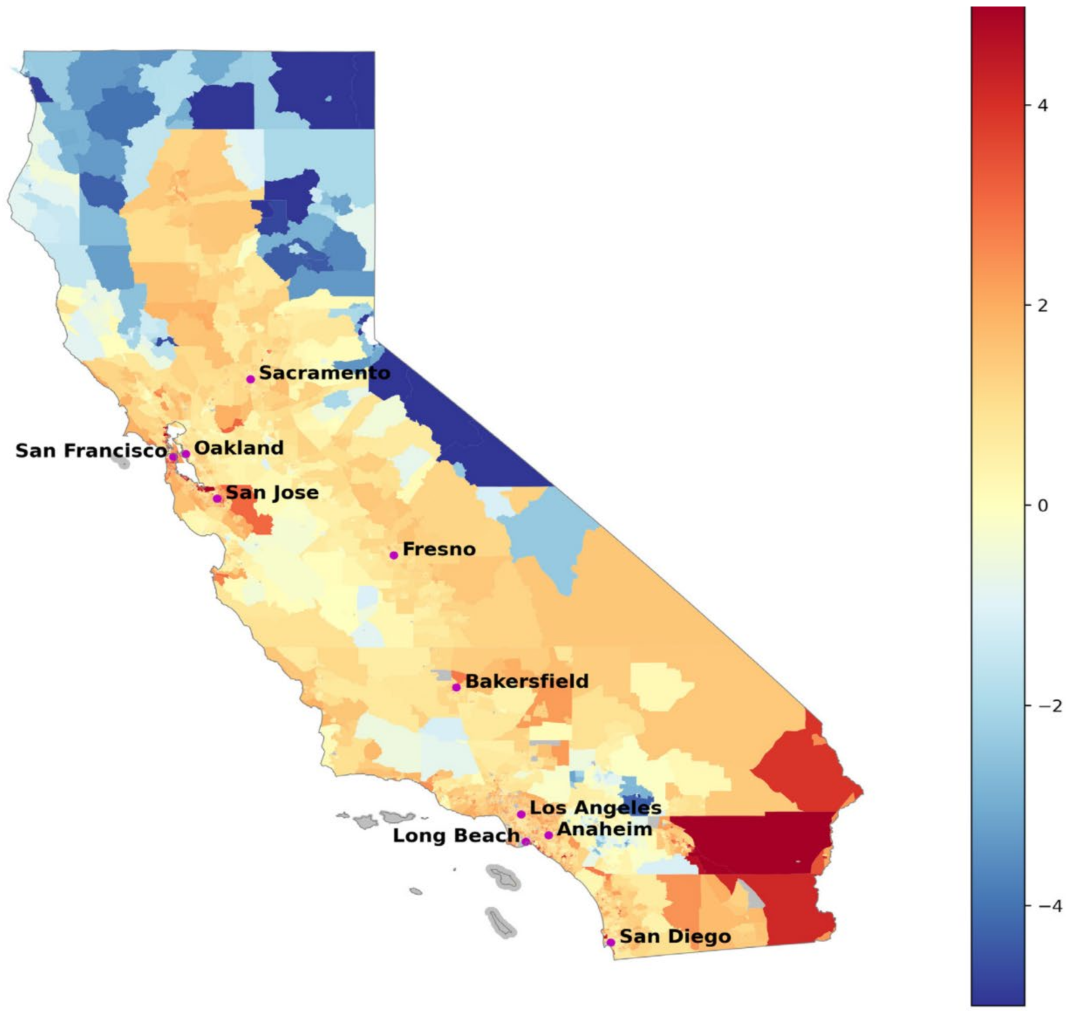
[243] Per capita income in 2019 for census tracts across California ranges from $633 to $176,388, with a median of $32,181 ($2019). Source: American Community Survey.

Figure 3-9: Categories of climate change impacts on human welfare included in the Climate Vulnerability Metric.



The CVM shows that climate change will have highly unequal impacts across California. While some southeastern regions of California are estimated to suffer damages that exceed 5% of annual income, other high-elevation northeastern regions of California are estimated to see benefits of up to 10%. Some low-lying urban areas, such as the San Francisco Bay Area, are estimated to be particularly vulnerable, while much of the Central Valley is estimated to suffer at least moderate economic damages relative to the rest of the state. It is important to note that the CVM does not set a threshold for vulnerability. Instead, it shows relative impacts across census tracts. The CVM is limited to the impacts that can currently be quantified at the census tract level.

Figure 3-10: Combined impacts of climate change in 2050 under a moderate emissions scenario; damages as share of 2019 tract income (%)



The map shows combined impacts of climate change in 2050 under a moderate emissions scenario (RCP 4.5), reported as a share of 2019 census tract income. For example, a CVM value of 3 implies that by 2050, a census tract is projected to experience human welfare impacts of climate change that amount to 3% of annual income. Impacts are combined across the categories shown in Figure 3-9. The higher the CVM for a given census tract, the more damaging the projected impacts of climate change on human welfare. Census tracts with high CVMs are represented by positive percentages in orange and red. A lower CVM is associated with lower projected impacts of climate change, shown in yellow, while a negative CVM value represents a projected beneficial impact of climate change (e.g., through reductions in deaths caused by extremely cold winter weather). Negative CVMs are represented by negative percentages in blue.

By providing information about how climate vulnerability varies across California (Figure 3-10), the CVM results can be used to direct resources to enhance resiliency in the state's most vulnerable communities based on the specific impacts, such as heat or flooding, they are experiencing. The CVM may be used in combination with existing screening tools, such as CalEnviroScreen 4.0, to identify communities that face environmental and health hazards that contribute to disproportionate economic impacts in addition to climate vulnerability. The CVM can become an essential source of information to implement this Scoping Plan and build a more resilient, just, and equitable future for all communities.

Public Health

Health Analysis Overview

This section focuses on a broader evaluation of public health and climate change. Science demonstrates that taking action to address climate change presents one of the most significant opportunities to improve public health outcomes.[244] Transitioning to clean energy and technology and improving land and ecosystem management will lead to a much healthier future. Many actions to reduce GHG emissions also have health co-benefits that can improve the health and well-being of populations across the state, as well as address climate change. This section and the accompanying Appendix G (Public Health) provide a qualitative analysis of health benefits to accompany the quantitative health analysis included in this chapter, in Appendix C (AB 197 Measure Analysis), and in Appendix H (AB 32 GHG Inventory Sector Modeling). Together the qualitative and quantitative analyses of benefits are demonstrating the many ways that climate action and health improvements go hand in hand.

Climate change can lead to a wide range of direct health impacts such as increased heat-related illnesses (i.e., heat exhaustion and heat stroke), and injuries and deaths from extreme weather events or disasters (e.g., severe storms, flooding, wildfires). Indirect impacts include:

- more air pollution-related exacerbations of cardiovascular and respiratory diseases (e.g., due to increased smog, wildfire smoke)
- increased vector-borne and fungal diseases due to changes in the distribution and geographic range of disease-carrying species (e.g., mosquitoes, ticks, fungi in dust)
- negative nutritional consequences related to decreases in agricultural food yields
- stress and mental trauma due to extreme weather-related catastrophes
- anxiety, depression, and other mental health impacts associated with gradual changes in the climate (e.g., prolonged drought or temperature shifts affecting jobs and industries) that result in unemployment and income loss

---

[244] Watts, N., W. N. Adger, P. Agnolucci, et al. 2015. “Health and climate change: Policy responses to protect public health.” *Lancet* 386, 1861–1914.

- residential displacement and home loss (e.g., sea level rise impacting coastal communities)

Wildfires and wildfire smoke are one area where we have already seen and expect to see even further drastic impacts on the health of Californians. According to CalFire, since 1932 the top eight largest wildfires in California have occurred in the past five years (2017–2022), with 151 deaths due directly to fires during that period.[245] Researchers estimate that wildfire smoke during fall 2020 may have led to as many as 3,000 excess deaths, with at least 95% of Californians suffering unhealthy levels of particle pollution due to wildfires in 2020.[246] Continued climate change is projected to further increase smoke exposure from wildfires through the end of the century.[247] Wildfires also create a high-risk environment for outdoor workers, including agricultural workers. While the direct medical and physical health impacts are often most noticeable, the psychological impacts can develop and persist well after the event. Estimates indicate that 20%–65% of survivors of extreme weather events have mental health issues following the event.[248]

Extreme heat, drought, and associated worsened air quality impacts are among the most serious climate-related exposures affecting the health of Californians. Numerous studies find a wide range of adverse health effects accompanying extreme heat, including heat stroke and adverse birth outcomes, and find that extreme heat can harm most body systems. Climate change exacerbates air pollution problems that cause difficulty breathing and can lead to serious illness and death in many parts of California. Increasing temperatures cause increases in ozone and other pollution concentrations, including for California's most polluted regions, and heighten health risks for the vulnerable and marginalized populations living in these areas.[249] In 2020, there were 157 ozone polluted days across Los Angeles, Orange, Riverside, and San Bernardino Counties—the most days since 1997. In addition, particulate matter exposure is a heightened problem during

[245] California Department of Forestry and Fire Protection (CAL FIRE). "Stats and Events." *Cal Fire Department of Forestry and Fire Protection*, https://www.fire.ca.gov/stats-events/.
[246] G-FEED. 2020. Indirect mortality from recent wildfires in CA. http://www.g-feed.com/2020/09/indirect-mortality-from-recent.html.
[247] M. D. Hurteau, A. L. Westerling, C. Wiedinmyer, and B. P. Bryant. 2014. "Projected effects of climate and development on California wildfire emissions through 2100." *Environ. Sci. Technol.* 48, 2298–2304.
[248] American Public Health Association. 2019. Addressing the Impacts of Climate Change on Mental Health and Well-Being. Policy No: 20196. https://www.apha.org/policies-and-advocacy/public-health-policy-statements/policy-database/2020/01/13/addressing-the-impacts-of-climate-change-on-mental-health-and-well-being.
[249] American Lung Association. State of the Air 2021. https://www.lung.org/research/sota.

droughts, which are expected to increase over this century.[250,251] Worse air quality leads to illnesses, emergency room visits, and hospitalizations for chronic health conditions, including chronic obstructive pulmonary disease (COPD), asthma, chronic bronchitis, and other respiratory and cardiovascular conditions, as well as increased risk for respiratory infections, which all result in greater health costs to the state.[252,253,254] These and other climate-related health impacts are discussed in more detail in Appendix G (Public Health).

Health Analysis Components

This Scoping Plan health analysis focuses on the contrast between a California that is still dependent on a fossil fuel-based economy and a California that is transitioned to a carbon-neutral, clean energy future. This qualitative analysis evaluates and demonstrates the broad range of benefits of a dramatic reduction in fossil fuels by 2045 combined with healthier ecosystem management, comparing health outcomes for a "no-action" scenario (Reference) to a "take-action" decarbonization scenario. As this is a qualitative analysis, it looks more broadly at the public health benefits of a drastic reduction in fossil fuel combustion. While this analysis provides scientific evidence for Scoping Plan benefits based on achieving carbon neutrality by 2045, it does not analyze a specific scenario.

The key areas of focus for the analysis are: heat impacts, children's health and development, economic security, food security, mobility and physical activity, urban greening, wildfires and smoke impacts, and housing affordability. For each area of focus, the analysis covers the scientific evidence and compares expected health effects between the Reference and decarbonization scenarios. This analysis looks at the major health outcomes, provides directional effects for each health outcome, and where possible provides information on the strength and scale of health impacts. Some areas include quantitative information where tools are available to measure health outcomes. While the analysis is focused on health outcomes statewide, it also includes discussion

---

[250] Cvijanovic, I., B. D. Santer, C. Bonfils, et al. 2017. "Future Loss of Arctic Sea-ice Cover Could Drive a Substantial Decrease in California's Rainfall." 8 *Nat. Commun.* 1947. https://doi.org/10.1038/s41467-017-01907-4.

[251] Williams, A. P., R. Seager, J. T. Abatzoglou, B. I. Cook, J. E. Smerdon, and E. R. Cook. 2015. "Contribution of anthropogenic warming to California drought during 2012–2014." *Geophysical Research Letters* 42(16), 6819–6828.

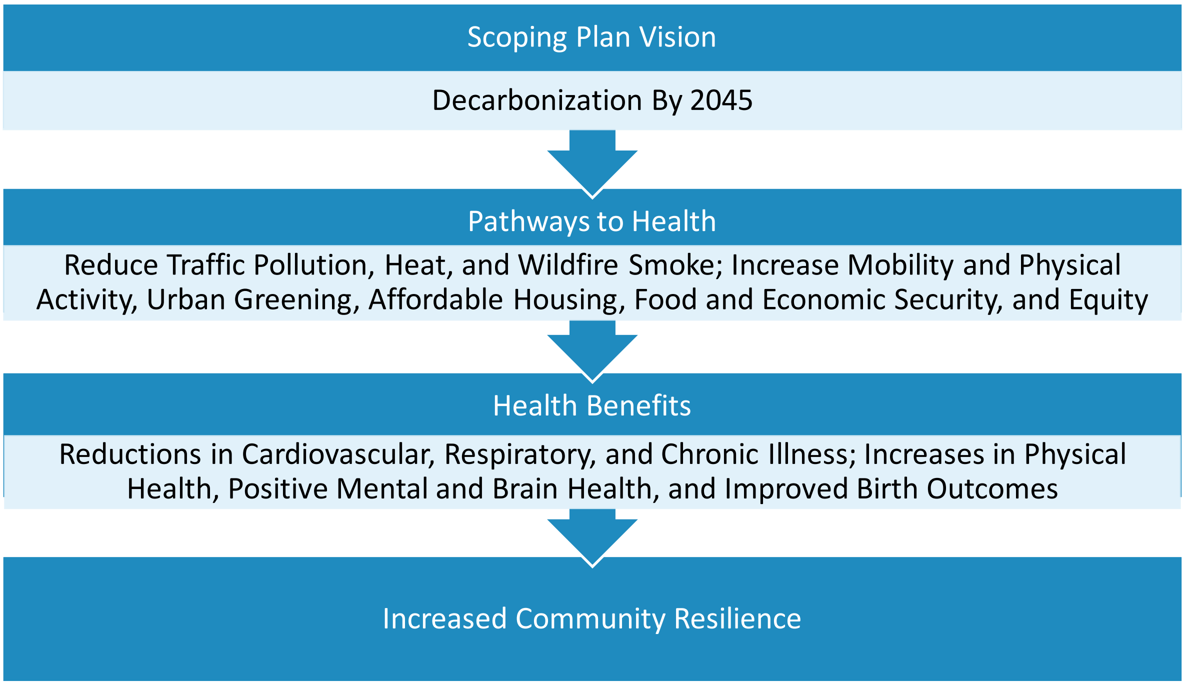
[252] Romley, J. A., A. Hackbarth, and D. P. Goldman. 2010. Cost and Health Consequences of Air Pollution in California. Santa Monica, California. RAND Corp. https://www.rand.org/pubs/research_briefs/RB9501.html.

[253] Wang, M., C. P. Aaron, J. Madrigano, E. A. Hoffman, E. Angelini, J. Yang, A. Laine, et al. 2019. "Association between long-term exposure to ambient air pollution and change in quantitatively assessed emphysema and lung function." *JAMA* 322(6), 546–556.

[254] Inserro, A. 2018. "Air Pollution Linked to Lung Infections, Especially in Young Children." *Am. J. Managed Care* (May 6). https://www.ajmc.com/view/air-pollution-linked-to-lung-infections-especially-in-young-children.

of benefits to community health and climate resilience, as well as potential inequities experienced at a community level. Figure 3-11 shows the co-benefit areas covered in this Scoping Plan and the path to health improvements and increased community resilience.

Figure 3-11: Scoping Plan outcome and the path to health improvements



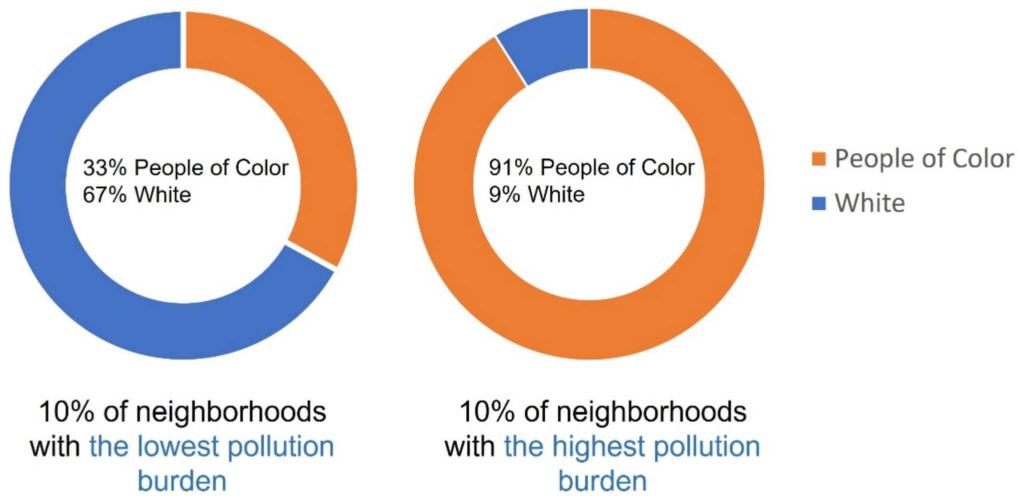
Social and Environmental Determinants of Health Inequities

Communities across the state do not experience exposure to pollution sources and the resulting effects equally. Low-income communities and communities of color (including Black, Latino and Indigenous communities) consistently experience significantly higher rates of pollution and adverse health conditions than others due to factors including historic marginalization rooted in systemic racism. As shown in Figure 3-12, the most impacted neighborhoods according to CalEnviroScreen (CES) are home to very high percentages of people of color while the least impacted neighborhoods are predominantly white. Recent findings show that Black Californians have 19% higher $PM_{2.5}$ exposure from vehicle emissions than the state average, and the census tracts with the highest $PM_{2.5}$ pollution burden from vehicle emissions have a high proportion of people of color.[255] Air pollutant emissions from mobile sources have disproportionate impacts on low-income communities and communities of color due to their proximity.[256] Diesel-fueled vehicles traveling on California's freeways and major roads expose nearby residents to pollution that is linked to lung cancer, hospitalizations and emergency department visits for chronic heart and lung disease, and premature death.[257,258] A combination of historical and social inequities are evident in communities of color disproportionately living close to freeways and other major sources of vehicle pollution. Environmental exposures and contaminants are one component of a broader set of social, economic, and environmental factors that can amplify health conditions, and the combination of all these factors can compound the health effects of individual exposures. This broader set of community factors can be referred to as "cumulative impacts." In addition, specific populations are more sensitive to pollution and face greater susceptibility. This includes young children, older adults, and individuals with existing health conditions.

---

[255] Reichmuth, D. 2019. *Inequitable exposure to air pollution from vehicles in California.* https://www.ucsusa.org/resources/inequitable-exposure-air-pollution-vehicles-california-2019.
[256] CARB. 2017. *California's 2017 climate change scoping plan.* https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf.
[257] CARB. 2020. Overview: Diesel exhaust & health. https://ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health.
[258] Kagawa, J. 2002. "Health effects of diesel exhaust emissions—a mixture of air pollutants of worldwide concern." *Toxicology* 181–182:349–353.

Figure 3-12: Least and most impacted neighborhoods from CalEnviroScreen[259]



Social Determinants of Health Inequities

The physical and mental health of individuals and communities is shaped, to a great extent, by the social, economic, and environmental circumstances in which people live, work, play, and learn. According to the World Health Organization, these same circumstances—or social determinants of health—are "mostly responsible for health inequities: the unfair and avoidable differences in health status seen within and between countries." In fact, a strong body of research demonstrates that more than 50 percent of long-term health outcomes are the result of social determinants affecting an individual.[260] Race/ethnicity and socioeconomic status, for example, have been found to amplify impacts from long- and short-term environmental exposures for several health outcomes,

[259] The figure represents the top and bottom decile scoring of CalEnviroScreen census tracts for pollution burden. This chart is modified from Figure 2. Race in the Least and Most Impacted Census Tracts of CalEnviroScreen 4.0 in the Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. Analysis of Race/Ethnicity and CalEnviroScreen 4.0 Scores. 2021. https://oehha.ca.gov/media/downloads/calenviroscreen/document/calenviroscreen40raceanalysisf2021.pdf.

[260] California Department of Public Health (CDPH). 2015. *The Portrait of Promise: The California Statewide Plan to Promote Health and Mental Health Equity.* A Report to the Legislature and the People of California by the Office of Health Equity. Sacramento, California. California Department of Public Health, Office of Health Equity.

such as mortality and birth outcomes.[261,262,263,264] Social factors combine in low-income communities and communities of color to create levels of toxic chronic stress and limit opportunities for healthy food and healthy lifestyles. Social factors also can cause health disparities through psychosocial pathways such as discrimination and social exclusion.[265] While the importance of social determinants is well known, measuring the specific and cumulative impacts of social determinants is challenging.

There are several important tools to evaluate and map cumulative impacts and factors contributing to the results of historical practices such as redlining, and these tools have been used for air quality and climate planning, community protection, and investments. CalEnviroScreen is a tool that maps cumulative pollution burdens and vulnerabilities on a statewide basis and ranks census tracts based on environmental, exposure, population, and socioeconomic indicators. An analysis using CES shows a direct, persistent relationship between exposure to environmental burdens and socioeconomic and health vulnerabilities affecting communities of color and historical redlining practices. OEHHA has evaluated health impacts of certain climate change policies on disadvantaged communities and communities of color utilizing CES rankings.[266] The Healthy Places Index (HPI) maps indicators that affect life expectancy on a statewide basis. In the future, these and other tools can be helpful to prioritizing investments and informing implementation efforts for GHG emission reductions policies.

Environmental Determinants of Health Inequities

Communities with large percentages of Black and other socially vulnerable and marginalized groups are disproportionately located near pollution sources, such as traffic

---

[261] O'Neill, M. S., M. Jerrett, I. Kawachi, J. I. Levy, A. J. Cohen, N. Gouveia, et al. 2003. "Health, wealth, and air pollution: Advancing theory and methods." *Environ Health Perspect.* 111 (16): 1861–70.
[262] Ponce, N. A., K. J. Hoggatt, M. Wilhelm, and B. Ritz. 2005. "Preterm birth: The interaction of traffic-related air pollution with economic hardship in Los Angeles neighborhoods." *Am J Epidemiol.* 162 (2): 140–8.
[263] Morello-Frosch, R., B. Jesdale, J. Sadd, and M. Pastor. 2010. "Ambient air pollution exposure and full-term birth weight in California." *Environ Health.* 9: 44.
[264] Finkelstein, M. M., M. Jerrett, P. DeLuca, N. Finkelstein, D. K. Verma, K. Chapman, et al. 2003. "Relation between income, air pollution, and mortality: A cohort study." *CMAJ.* 169 (5): 397–402.
[265] Clougherty, J., and L. Kubzansky. 2009. "A framework for examining social stress and susceptibility in air pollution and respiratory health." *Environ Health Perspect.* 117 (9): 1351–8.
[266] OEHHA. 2022. *Impacts of Greenhouse Gas Emission Limits Within Disadvantaged Communities.* https://oehha.ca.gov/media/downloads/environmental-justice//impactsofghgpoliciesreport020322.pdf.

and freight facilities, industrial facilities, and hazardous waste sites.[267,268,269,270] Research shows large disparities in exposure to pollution between white and non-white populations in California, and between low-income and communities of color (Figure 3-13). The research also shows Black and Latino populations experience significantly greater air pollution impacts than white populations in California.[271] Additionally, Native Americans are disproportionately impacted by air pollution with high rates of exposure to industrial, diesel, and residential pollution sources and higher rates of diseases linked to air pollution.[272, 273]

[267] Mohai. P., P. M. Lanz, J. Morenoff, J. S. House, and R. P. Mero. 2009. "Racial and socioeconomic disparities in residential proximity to polluting industrial facilities: Evidence from the Americans' Changing Lives Study." *Am J Public Health.* 99 (Suppl 3): S649–56.

[268] Mohai, P., and R. Saha. 2007. "Racial inequality in the distribution of hazardous waste: A national-level reassessment." *Soc Probl.* 54 (3): 343–70.

[269] Morello-Frosch, R., M. Pastor, C. Porras, and J. Sadd. 2002. "Environmental justice and regional inequality in southern California: Implications for future research." *Environ Health Perspect.* 110 (Suppl 2): 149–54.

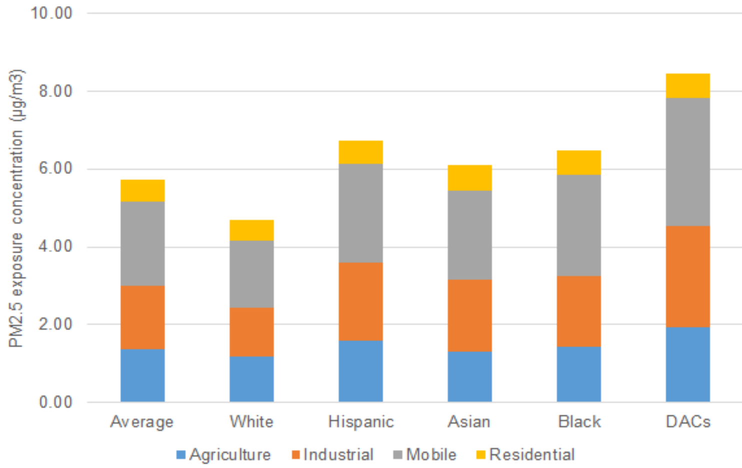
[270] Gunier, R. B., A. Hertz, J. von Behren, and P. Reynolds. 2003. "Traffic density in California: Socioeconomic and ethnic differences among potentially exposed children. *J Expo Anal Environ Epidemiol.* 13 (3): 240–6.

[271] Apte, J. S., S. E. Chambliss, C. W. Tessum, and J. D. Marshall. 2019. *A Method to Prioritize Sources for Reducing High $PM_{2.5}$ Exposures in Environmental Justice Communities in California.* CARB Research Contract Number 17RD006.

[272] Indigenous People and Air Pollution in the United States. A Report from the National Tribal Air Association and Moms Clean Air Force. 2021. https://7vv611.a2cdn1.secureserver.net/wp-content/uploads/2021/04/indigenousairpollution_041421.pdf

[273] National Tribal Air Association. 2022. Status of Tribal Air Report. Pg. 66. https://7vv611.a2cdn1.secureserver.net/wp-content/uploads/2022/10/2022-NTAA-Status-of-Tribal-Air-Report.pdf.

Figure 3-13: Top sources of $PM_{2.5}$ and their contribution to $PM_{2.5}$ exposures by race and in disadvantaged communities



These disparities in exposure to pollution sources generate health inequities. Communities located near major roadways are at increased risk of asthma attacks and other respiratory and cardiac effects. Studies consistently show that mobile source pollution exposure near major roadways or freight sources contributes to and exacerbates asthma, impairs lung function, and increases cardiovascular mortality.[274] The exposure to mixtures of gaseous and particulate pollutants in mobile sources (including PM, NO_x, and benzene) is associated with higher rates of heart attacks, strokes, lung cancer, autism, and dementia.[275]

Environmental hazards found in communities also can include exposures to toxic substances and emissions, as well as occupational exposures. Due to historical inequities, under-resourced communities and communities of color are often located close to sources of toxic pollution, including chrome platers; metal recycling facilities; oil and gas operations; agricultural burning; railyards; facilities transporting, managing, or disposing of hazardous waste; and areas impacted by pesticides, among others. Some populations may be at increased risk of exposure to pollutants, both at work and home.

Children are more susceptible to environmental pollutants for many reasons, including the ongoing development of their nervous, immune, digestive, and other bodily systems. Moreover, children eat more food, drink more fluids, and breathe more air relative to their

---

[274] U.S. Environmental Protection Agency website. How Mobile Source Pollution Effects Your Health. https://www.epa.gov/mobile-source-pollution/how-mobile-source-pollution-affects-your-health.
[275] USC Environmental Health Centers. 2018. Living Near Busy Roads or Traffic Pollution. https://envhealthcenters.usc.edu/wp-content/uploads/2016/10/living-near-bus_19696172.pdf.

body weight, as compared to adults.[276] Exposure to high levels of air pollutants, including indoor air pollutants, increases the risk of respiratory infections, heart disease, and asthma.[277] Children living in low-income communities near industrial operations, rail yards, and heavily trafficked freeways and streets in urban areas are at especially high risk of chronic respiratory conditions. Black children are four times more likely to be hospitalized for asthma compared with white children, and urban Black and Latino children are two to six times more likely to die from asthma than white children.[278] Native American children also experience more impacts from asthma and Native American children, along with Black children, have the highest prevalence of asthma.[279]

For older adults, increased vulnerability is linked to respiratory, cardiovascular, and immune systems weakened by aging.[280] Preexisting health conditions interact with environmental pollutants to enhance risks of adverse health outcomes.[281,282] The recent COVID-19 pandemic has highlighted the heightened vulnerability of older adults as well as communities of color to respiratory disease, as hospital admissions and mortality data linked to COVID-19 cases for these groups have been higher than other groups. Research has also underscored the important link between COVID-19 mortality and morbidity and air pollution, demonstrating significantly higher mortality and morbidity for COVID-19 in areas of elevated $PM_{2.5}$ pollution.

Climate Vulnerabilities

Climate change is expected to exacerbate the existing disparities of health conditions and worsen climate vulnerability, which is the degree to which natural systems and people or

---

[276] Blaisdell, R. J. Air Toxics Hot Spots Program Risk Assessment Guidelines. 2012. Technical Support Document for Exposure Assessment and Stochastic Analysis. Oakland, California: California Environmental Protection Agency, Office of Environmental Health Hazard Assessment. August.
[277] Woodruff, T. J., D. A. Axelrad, A. D. Kyle, O. Nweke, and G. G. Miller. 2003. *America's Children and the Environment: Measures of Contaminants, Body Burdens, and Illness.* 2nd ed. Washington, D.C.: United States Environmental Protection Agency. February.
[278] California Department of Public Health. Asthma Inequities in California Children. 2021. https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHIB/CPE/CDPH%20Document%20Library/CA_Asthma_Inequities_Children_2021-Infographic.pdf.
[279] Meng, Y., S. H. Babey, T. A. Hastert, and E. Brown. 2007. California's Racial and Ethnic Minorities More Adversely Affected by Asthma. UCLA: Center for Health Policy Research. Retrieved from https://escholarship.org/uc/item/4k45v3xt.
[280] Sandström, T., A. J. Frew, M. Svartengren, and G. Viegi. 2003. "The need for a focus on air pollution research in the elderly." *Eur Respir J Suppl.* 40: 92s–5s.
[281] Zanobetti, A., and J. Schwartz. 2001. "Are diabetics more susceptible to the health effects of airborne particles?" *Am J Respir Crit Care Med.* 164 (5): 831–3. https://www.atsjournals.org/doi/pdf/10.1164/ajrccm.164.5.2012039.
[282] Zanobetti, A., J. Schwartz, and D. Gold. 2000. "Are there sensitive subgroups for the effects of airborne particles?" *Environ Health Perspect.* 108 (9): 841–5.

communities are at risk of experiencing the negative impacts of climate change.[283] A report from the California Climate Change Center warned that the impacts of climate change will likely create especially heavy burdens on low-income and other vulnerable populations: "*Without proactive policies to address these equity concerns, climate change will likely reinforce and amplify current as well as future socioeconomic disparities, leaving low-income, minority, and politically marginalized groups with fewer economic opportunities and more environmental and health burdens*."[284]

In the U.S. Environmental Protection Agency's "Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts,"[285] investigators analyzed risks of six primary climate change impacts disproportionately affecting communities across income, educational attainment, race/ethnicity, and age groups. Four socially vulnerable populations—low income, communities of color, no high school diploma, and age 65 and older—were identified as having a higher likelihood of experiencing the greatest impacts of a changing climate (according to the projected 2°C of global warming or 50 centimeters of global sea level rise). Disproportionate impacts were projected for climate events, including air quality, extreme temperature, coastal flooding, and other impacts, leading to increased risk of health and other adverse outcomes. The study projected significant health impacts for low-income communities, certain racial and ethnic subgroups, and those with lower educational attainment.

Several climate vulnerability tools have been developed or are under development to better understand and map areas at higher risk of climate impacts. The Climate Change and Health Vulnerability Indicators (CCHVIs) for California helps state and local health officials prepare for and reduce adverse health impacts due to a changing climate.[286] For example, Los Angeles County shows higher than state average climate vulnerability overall, particularly for those who are linguistically isolated (more than twice the state average).

In summary, there are many environmental, social, individual, and economic factors affecting health and equity in California and contributing to worsening health outcomes from climate change impacts. This section and Appendix G (Public Health) reference a substantial and growing body of research documenting the different social and

---

[283] OPR. 2018. Defining Vulnerable Communities in the Context of Climate Adaptation. https://opr.ca.gov/docs/20180723-Vulnerable_Communities.pdf.

[284] Shonkoff, S., R. Morello-Frosch, M. Pastor, and J. Sadd. 2011. "The climate gap: environmental health and equity implications of climate change and mitigation policies in California—A review of the literature." *Climatic Change* 109 (Suppl 1): S485–S503.

[285] U.S. EPA. 2021. Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. U.S. Environmental Protection Agency. EPA 430-R-21-003.

[286] CDPH. 2022. Climate Change and Health Vulnerability Indicators for California. California Department of Public Health. https://www.cdph.ca.gov/Programs/OHE/Pages/CC-Health-Vulnerability-Indicators.aspx.

environmental factors affecting health outcomes and the many groups that are vulnerable to increased effects or that experience health inequities in California (see Table 3-13).

Table 3-13: Examples of vulnerable groups due to socioeconomic, environmental, developmental, and climate change factors

Examples of Vulnerable Groups Due to Socioeconomic, Environmental, Developmental, and Climate Change Factors		
Older People	People with Existing Chronic Illness	People Impacted Due to Working Conditions
Tribal Groups	Infants and Children	Low-Income People
People with Disabilities	People Experiencing Homelessness	Pregnant People
Communities of Color	Marginalized People	Immigrants/Refugees
People with Less Educational Options	Linguistically Isolated Households	People Impacted Due to Poor Housing Conditions

Summary of the Qualitative Health Analysis

CARB has developed a detailed health analysis that covers eight social and environmental co-benefit areas that impact public health (listed below). These co-benefit areas were selected due to ongoing research in these areas as well as discussion in a public workshop on climate change and health impacts held in summer 2018. For each social and environmental area, the analysis includes:

- a discussion of health impacts and disparities,
- key health metrics or epidemiological research on this topic,
- a discussion of how these areas would be affected by “no-action” (i.e., Reference) scenario compared to a “take-action” (i.e., Scoping Plan) scenario
- a discussion of where there are actions to consider for further success, and
- the types of mitigation actions that can help reduce or eliminate disparities and promote greater health equity and resilience.

All co-benefit areas are interconnected, and pursuing benefits in all areas has the potential to multiply positive results and further support building community resilience. *Community resilience* is the ability of a community to reduce harm and maintain an acceptable quality of life in the face of climate-induced stresses, which vary depending on that community’s circumstances and location. Below is a brief description of the areas evaluated for public health co-benefits. The specific health outcomes impacted by each area, as well as the directional health benefits, are included in the Summary of Health Benefits section of the chapter and covered in more detail in Appendix G (Public Health).

Heat Impacts

Globally, increased GHG concentrations in the atmosphere are causing a continuing increase of the planet's average temperature. California temperatures have risen since records began in 1895, and the rate of increase is accelerating. Recent heat waves have broken heat records and caused serious illness across the state, and these events are becoming more frequent. Heat waves have a particularly high impact in Southern California, where they have become more intense and longer lasting. In the past two years, Los Angeles recorded 121°F, and the Coachella Valley had its hottest year ever, with temperatures reaching 123°F. Heat island effects in urbanized areas can elevate heat effects and disproportionately affect low-income communities and communities of color. Heat events exacerbate respiratory and cardiac illness and cause emergency room visits to soar. Strategies that reduce the impacts of heat exposure promote improved health outcomes.

Wildfires and Smoke

California's NWL cover more than 90 percent of California and include rangeland, forests, woodlands, grasslands, and urban green space. They provide biodiversity and ecosystem benefits, including their ability to sequester carbon from the atmosphere. Protecting and managing California's forests and other natural lands and maintaining their ecosystem health are key practices for maximizing GHG benefits and minimizing negative climate change impacts. Vegetation plays an important role in storing carbon; however, it can also release CO_2 back into the atmosphere when it dies or is burned by fires. California's wildfires are getting worse with increased fire risks, higher frequency of occurrence, larger burn areas, more costly damage, and a longer fire season due to climate change. Strategies that promote healthy ecosystem management of natural and working lands and increased urban greening promote improved health outcomes. Healthy ecosystems provide many health and environmental benefits and can maximize carbon sequestration.

Children's Health and Development

There are a wide range of interconnected environmental, social, biological, and community factors associated with climate change that are adversely affecting children's health. This section focuses on air pollution and near-roadway or traffic pollution as environmental impacts that have a profound effect on children's health. Children's bodies and lungs are still developing, and they take in more air per body weight than adults do. Many low-income communities and communities of color in California experience disproportionately high levels of air pollution, as well as high levels of traffic and freight that impact children. This excess exposure harms children's development and predisposes them to increased risk of illness throughout their lives. Strategies that reduce air pollution and traffic emissions promote improved health outcomes for children.

Economic Security

Climate change is expected to result in serious adverse socioeconomic effects across many sectors. Economic factors, such as income inequality (among geographic regions), poverty, wealth, debt, unemployment rate, and job security are among the strongest determinants of health. Along the entire income spectrum, higher income is associated with increased life expectancy and improved health outcomes in the United States. Additionally, economic insecurity and negative health impacts are more pronounced in low-income communities and communities of color. Economic strategies, such as the promotion of clean energy and other green jobs and investments in low-income communities and communities of color, and promoting a transition to high road jobs in economic sectors tied to the current fossil fuel economy, can promote improved health outcomes.[287]

Food Security

The food system is under pressure from numerous factors, and climate change is a key concern. Climate change can affect food production and agricultural yield, impact culturally significant plants and animals for Native American tribes, and exacerbate factors that limit food availability, such as supply chain disruption. Food security is defined as stable access to affordable, sufficient food for an active, healthy life. Many Californians routinely experience food insecurity, and while that impacts Californians of all races and groups, low-income communities and communities of color and children are disproportionately affected by food insecurity. Many Native Americans depend on resources from the land, such as animals and plants for consumption and cultural practices. Strategies that promote sustainable agriculture, access to healthy foods, and reduced organic food waste promote improved health outcomes.

Mobility and Physical Activity

Physical activity is one of the most important factors for a healthy lifestyle, and lack of activity increases the risk of chronic illness and premature death. Research shows that regular physical activity improves health in people of all ages by improving heart and lung

---

[287] According to the California Labor and Workforce Development Agency's High Road Training Partnership program, high road jobs are considered "Quality jobs [that] provide family-sustaining wages, health benefits, a pension, worker advancement opportunities, and collective worker input and are stable, predictable, safe and free of discrimination." *https://cwdb.ca.gov/wp-content/uploads/sites/43/2020/08/OneSheet_Job-Quality_ACCESSIBLE.pdf*.

function, muscle fitness, mental health and brain function, and sleep quality. A sedentary lifestyle contributes to chronic illnesses, including obesity, heart disease, and Type 2 diabetes among other chronic illnesses. Promoting community design that supports sustainable patterns of land use and transportation enables active transportation choices like walking, biking, and public transit over driving, and can significantly increase physical activity, leading to many valuable health benefits.

Affordable Housing

Housing is an important social determinant of health. The stability of housing, housing quality, conditions inside and outside the home, the cost of housing, and the environmental and social characteristics of the places people live all affect health (including energy efficiency and insulation, cooler building material, tree canopy, home size). Housing affordability is a key factor, and this section highlights how housing affordability supports not only improved health but also more sustainable land use and transportation patterns. A lack of affordable housing is increasing commute distances for low-income renters and creating health burdens. Strategies that support sustainable transportation and housing patterns, together with increased housing affordability, promote improved health outcomes.

Urban Greening

Urban Greening is well recognized as an important amenity, but the inherent health benefits are not always well understood. Under-resourced and vulnerable areas consistently show a lack of urban greening and higher percentages of concrete, asphalt, and impervious surfaces. Under-resourced communities have a greater proportion of concrete and heat-trapping surfaces and a lower amount of tree cover in the neighborhoods in which they live. Areas with reduced urban greening have the potential to create areas of higher temperatures as heat is reflected from pavements and buildings. By contrast, increasing urban greening can provide air pollution buffers and promote physical activity. Strategies that preserve and create urban parks, green space, natural infrastructure, and sustainable agricultural practices support improved physical and mental health outcomes.

No Action Scenario (Reference)

In a no-action scenario, California would remain dependent on fossil fuels and other GHG emitting technologies. Fossil-fuel powered mobile sources including cars, trucks, trains, tractors, and a myriad of other on-road and off-road vehicles and equipment are the largest source of criteria pollutants and toxic air contaminants that directly affect community health and contribute the largest portion of GHG emissions.[288] Other key GHG emission sources include buildings, natural and working lands, and power production and industry. The no-action scenario reflects a continued reliance on fossil fuels in mobile and stationary sectors, including buildings. The continued production and use of fossil fuels; ongoing dependence on gasoline and diesel cars, trucks, buses, and equipment; continued releases of short-lived climate pollutants; and decreased emphasis on forest and ecosystem health will impact communities by reducing climate resilience and health benefits. Green space will likely remain at the same levels or degrade, and urban heat islands will likely increase. With continued growth of vehicle miles traveled, physical activity and the accompanying health benefits will not increase.

Exposure to wildfire smoke will increase, and air quality is expected to worsen as rising temperatures will increase levels of harmful air pollution. Jobs and economic security will be affected by the continuing potential for price spikes in fossil fuels, impacts to the economy from climate change, and fewer job opportunities in green technologies such as solar and electric vehicles. Food security in California will decrease due to the effects of accelerating climate impacts to agriculture; and without increased recovery of organic waste, including food products, food security will continue to decline under a no action scenario. All these impacts can be linked to worse health outcomes. Adverse health impacts are often most felt by Black, Latino, Native American, and other people of color and in low-income communities. These groups are affected more intensely by the physical stress of environmental pollution, social inequities, and the psychological stress of extreme weather events and food and economic insecurity.

Take Action Scenario

In the Take Action scenario, California will drastically reduce reliance on fossil fuels for motor vehicles, freight, buildings, electricity, or other sectors. This scenario is not a specific scenario within this Scoping Plan but examines the broad outcomes of actions to achieve carbon neutrality in 2045. Implementation of this Scoping Plan would achieve a transition to ZEVs, with 100% sales of light-duty ZEVs by 2035 and 100% sales of zero emission trucks by 2040, along with 30% VMT reductions below 2019 levels by 2045. State and local action that supports sustainable land use and transportation patterns and enables more transit and active transportation will lead to substantial health benefits from physical activity, including reduced illness and deaths.

[288] CARB. 2022. *California Greenhouse Gas Emissions for 2000 to 2020.* https://ww2.arb.ca.gov/sites/default/files/classic/cc/inventory/2000-2020_ghg_inventory_trends.pdf.

The economic benefits of improved health through active transportation can be modeled using the Healthy Mobility Options Tool (HMOT).[289] In order to demonstrate the important health and economic benefits of VMT reduction, CARB and CDPH used the HMOT to analyze an illustrative trip reduction scenario for 2050 from the California Transportation Plan (CTP). The CTP has a goal of increasing active modes of travel and transit from the current level of 13 percent to a level of 23 percent of all travel trips. While the CTP goal of 23 percent for active modes of travel is not a VMT reduction target, the scenario increases active transportation through a mix of changes in land use planning for increased transportation options, including increases in biking, walking, and transit use, and it helps to show the health benefits of increased active transportation. By achieving the CTP 2050 goals, nearly 8,000 deaths would be avoided in 2050 alone (see Figure 3-14), along with significant reductions in chronic diseases. Achieving this would rank among the top public health accomplishments (see Appendix G [Public Health] for additional modeling results and detailed discussion).

The dramatic reduction in fossil fuel combustion, combined with reductions in VMT and freight and traffic emissions projected in this Scoping Plan will significantly reduce air pollution and its associated health impacts on a statewide basis and in communities near freight sources. Coordinated action strategies will emphasize natural and working lands management changes, including healthy forests, increased vegetative cover, and increased organic farming. Wildfire smoke exposure will reduce significantly with healthy ecosystem management strategies. Since many communities in California are disproportionately impacted by high levels of traffic pollution, the reduction in petroleum fueled vehicles will reduce the additional impacts of living or going to school near historically highly polluting sources. Indoor air quality is also likely to improve through a shift to non-fossil fuel appliances. Concerted state and local action to support sustainable land use and transportation patterns can enable more active transportation with health benefits from physical activity.

[289] ITHIM California. 2020. Transportation Planning for Health, Equity, and Climate Change. https://skylab.cdph.ca.gov/HealthyMobilityOptionTool-ITHIM/.

Figure 3-14: Quantified health benefits of active transportation from increased physical activity

*Calculated by the Healthy Mobility Options Tool, active transportation (including walking, rolling, cycling, and taking public transit) from the California Transportation Plan 2050 compared to business as usual for 2050.

Overall community resilience is expected to increase as physical activity and green space increases—potentially decreasing urban heat islands. Efforts to support VMT reduction will include coordination across state agencies on affordable housing measures. Reduced fossil fuel dependence will reduce economic pressure from wildfires, droughts, and price spikes in fossil fuels, especially as more jurisdictions implement plans with similar actions. Investment in sustainable agriculture, healthy forests, urban greening, and clean energy technologies will add sustainable jobs and further promote economic security. More sustainable agriculture and food recovery efforts will add to food security. All these impacts can be linked to wide ranging health benefits, including positive respiratory and cardiovascular effects, healthier birth and brain outcomes, improved mental health indicators, improved life expectancy, reductions in chronic illness and cancers, improved children's health and development, reduced depression, and other benefits. The magnitude of the possible co-benefits is extremely large, especially in areas that are currently the most affected.

Summary of Health Benefits

Below, Tables 3-14 and 3-15 show overall summaries of the directional benefits by co-benefit area estimated for this Scoping Plan. The supporting epidemiological studies used for qualitative or quantitative analysis of each co-benefit area are included in Appendix G (Public Health). Another section of Chapter 3, together with Appendix C (AB 197 Measure Analysis) and Appendix H (AB 32 GHG Inventory Sector Modeling), also includes the quantitative analysis of air pollution related health impacts, including recently added health endpoints for CARB's ongoing analysis.

Table 3-14: Scoping Plan directional benefits for health co-benefit areas (heat, affordable housing, food security, economic security, and urban greening)

	Health Co-benefit Areas*				
Quantitative vs. Qualitative	**Reduced Heat Impacts**	**Increased Affordable Housing**	**Increased Food Security**	**Increased Economic Security**	**Increased Urban Greening**
Research was used for Qualitative Analysis	↓ Mortality ↓ Emergency Room Visits for cardiovascular and respiratory causes and intestinal infections ↓Hospitalization for cardiovascular, respiratory causes ↓ Preterm Birth ↓ Mental Illness	↓ Infectious Disease ↓ Chronic Illness ↓ Asthma ↓ Injuries ↓ Mental Illness ↑ Children's Performance in Schools ↑ Children's Health ↓ Children's Behavioral Problems	↓ Mental Illness ↓ Iron Deficiency ↓ Chronic Diseases ↑ Life Expectancy ↓ Children's Mental Illness ↓ Children's Cognitive Problems ↓ Children's Behavioral Health Problems ↓ Children's Iron Deficiency ↓ Children's Oral Health Problems	↑ Life Expectancy ↑ Health Status ↑ Mental Health	↓ Mortality ↓ Asthma Prevalence ↓ Depression ↓ Adverse Birth Outcomes including low birth weight and small for gestational age ↑ Life Expectancy

*See Appendix G (Public Health) for a table with references to research for each health outcome listed.

Table 3-15: Scoping Plan directional benefits for health co-benefit areas (traffic pollution, wildfire, and active transportation)

Health Co-benefit Areas*			
Quantitative vs. Qualitative	**Reduced Traffic Pollution**	**Reduced Wildfire Smoke**	**Increased Active Transportation**
Research was used for Quantitative Analysis	↓ Children's Respiratory Outcomes, Hospital Admissions ↓ Children's Respiratory Outcomes, Emergency Room Visits ↓ Children's Asthma Onset ↓ Children's Asthma Symptoms	↓ All-Cause Mortality ↓ Asthma, Hospital Admissions ↓ COPD, Hospital Admissions ↓ All Respiratory Outcomes, Hospital Admissions ↓ Asthma, Emergency Room Visits ↓ All Respiratory Outcomes, Emergency Room Visits ↓ All Cardiac Outcomes, Emergency Room Visits	↓ Cardiovascular Diseases ↓ Colon Cancer ↓ Breast Cancer ↓ Diabetes ↓ Dementia ↓ Lung Cancer ↓ Respiratory Disease ↓ Depression ↑ Traffic Accidents
Research was used for Qualitative Analysis	↑ Children's Lung Function Growth ↓ Children's Bronchitic Symptoms ↓ Children's Impaired Cognitive Development ↓ Children's Adverse Birth Outcomes, including low birth weight and preterm birth		

*See Appendix G (Public Health) for a table with references to research for each health outcome listed.

In summary, the qualitative health analysis of the No-Action versus Take-Action scenarios for this Scoping Plan shows an overwhelming benefit for the state by taking action to move forward to carbon neutrality while continuing efforts to increase health equity and resilience in individual communities. Taking action can improve physical and mental health for adults and children, reduce a range of chronic illnesses, and promote improvements in life expectancy. Development and implementation of actions to achieve the outcomes called for in this Scoping Plan should consider how to engage affected communities in implementation, address the existing health and opportunity gaps, and pursue equitable implementation statewide and locally. This Scoping Plan deployment of clean technology and fuels, together with improved land management, will reduce GHGs and air pollution and create more resilient communities that are better able to prepare for and recover from extreme climate events.

Environmental Analysis

In May 2022, CARB, as the lead agency for the Scoping Plan, released for public review the Draft Environmental Analysis (Draft EA) for this Scoping Plan; it assessed the potential environmental impacts of implementing the Scoping Plan. CARB circulated the Draft EA for public review and comment for a period of 45 days that began on May 10, 2022, and ended on June 24, 2022. CARB held a public hearing on June 23, 2022 to provide the opportunity for public comment. During the review period, written and oral comments were received on the Draft EA. CARB reviewed the comments to identify environmental topics and began preparation of responses to those comments.

After the end of the Draft EA public review period, CARB identified potential revisions to certain aspects of this Scoping Plan that merit revisions to the project description. This new information results from, among other things, revisions to the project description regarding energy sector goals (including offshore wind), revised carbon removal targets, and additional strategies for natural and working lands. CARB released a Recirculated Draft EA for a written public comment period that started September 9, 2022, and ended on October 24, 2022. See Chapter 2 of the Recirculated Draft EA[290] for further information regarding the changes. The Recirculated Draft EA assesses the potential for significant adverse and beneficial environmental impacts associated with all proposed actions in this Scoping Plan, and provides a programmatic environmental analysis of the reasonably foreseeable compliance responses that could result from implementation of the Scoping

---

[290] CARB. 2022. Recirculated Draft EA. *https://ww2.arb.ca.gov/sites/default/files/2022-09/2022-draft-sp-appendix-b-draft-ea-recirc.pdf*.

Plan.[291] The Recirculated Draft EA concluded implementation of this Scoping Plan could result in the following:

- Beneficial impacts to: air quality (long-term operational-related) and GHG emissions (short-term construction-related and long-term operational-related)
- Less than significant impacts to: energy demand, mineral resources, population and housing, public services, recreation (short-term construction-related), and wildfire (short-term construction-related)
- Potentially significant and unavoidable adverse impacts to: aesthetics, agriculture and forest resources, air quality (construction-related and operational odors), biological resources, cultural resources, geology and soils, hazards and hazardous materials, hydrology and water quality, land use and planning, noise, recreation (long-term operational-related), transportation and traffic, tribal cultural resources, utilities and service systems, and wildfire (long-term operational-related

Before the public meeting at which the Board will consider this Scoping Plan Update, CARB will publish the Final EA as Appendix B (Final Environmental Analysis) to this Scoping Plan, along with written responses to timely submitted comments raising significant environmental issues received on the Draft EA and the Recirculated Draft EA, which will be presented to the Board for consideration.

[291] The Recirculated Draft EA is available at *https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents*.

Chapter 4: Key Sectors

Chapter 4 provides an overview of the major energy sources and technology in use today, and of alternative clean technology and fuels to support decarbonization based on the latest information available. Every sector of the economy will need to begin to transition in this decade to meet our GHG reduction goals and achieve carbon neutrality no later than 2045. AB 32 requires climate change mitigation policies to be considered in the context of the sector's contribution to the state's total GHG emissions. The transportation, electricity (in-state and imported), and industrial sectors are the largest contributors of GHGs in the state and present the largest opportunities for GHG reductions. Actions to reduce fossil fuel combustion in these sectors also can provide critical air pollution reductions in low-income communities and communities of color, which are often located adjacent to these sources. A carbon neutrality framework also elevates the role of CO_2 removal through natural and working lands and mechanical capture and storage. Actions that support energy efficiency, reduced VMT, alternative fuels, and renewable power also can provide benefits by reducing both criteria and toxic air pollutants.

What sets this plan apart from previous Scoping Plans is the focus on the accelerated rate of deployment of clean technology and energy within every sector. As a result, specific actions, including accelerated rates of deployment of clean technology and fuels identified within this Scoping Plan, will need to be translated into both new and amended regulations, policies, and incentive programs. State agencies will need to evaluate current authority to align existing policies or develop new ones to achieve outcomes called for in this Scoping Plan. Legislative support may be needed in some cases to ensure authority and funding is sufficient to ensure this Scoping Plan is translatable to action on the ground. Most regulations, or change to existing regulations, ultimately considered by the Board or other state agencies for adoption will be subject to administrative procedure requirements. Accordingly, they must rely on specific subsequent supporting analysis and extensive public processes and consultations with interested tribes to develop and identify appropriate proposals for effective implementation. For example, any proposal to strengthen the LCFS regulations through amendments increasing the stringency of the carbon intensity (CI) targets would be considered on the basis of a public process, including workshops, and focused environmental, economic, and public health analyses.

Policies that ensure economy-wide investment or program decisions that incorporate consideration of GHG emissions are particularly important. As we pursue GHG reduction targets, we must acknowledge the manner in which built and natural environments are connected, how changes in one may impact the other, and how policy choices in one sector can and do impact other sectors. For example, fostering more compact, transportation-efficient development in infill areas and increasing transportation choices with the goal of reducing VMT not only reduces demand for transportation fuel but also requires less energy for buildings and helps to conserve natural and working lands that sequester carbon. Therefore, the multiple and often interwoven actions that reduce VMT both reduce emissions from the transportation sector and support reductions needed in other sectors.

Legislation, such as SB 350[292] (De León and Leno, Chapter 457, Statutes of 2015), has recognized the need for CARB, the CEC, and the CPUC to work together to ensure the state's energy and climate goals are integrated in procurement decisions by load serving entities as part of Integrated Resource Plans. Moving forward, it is especially critical that similar approaches are adopted to break down silos across state agencies to ensure policies and programs are aligned with multiple state priorities outlined in this plan. Finally, supportive legislative direction, such as SB 905 that requires CARB to create the Carbon Capture, Removal, Utilization, and Storage Program, may also benefit emerging areas of policy to provide express agency authority and roles for these nascent efforts, including streamlining of permitting, while ensuring that protections for communities are in place.

Unlike previous Scoping Plans that separated out individual economic sectors, this Scoping Plan approaches decarbonization from two perspectives: (1) managing a phasedown of existing energy sources and technology and (2) ramping up, developing, and deploying alternative clean energy sources and technology over time. This approach supports a more comprehensive consideration of our energy infrastructure, the ability to repurpose existing assets, and the need to build new assets. It also provides multiple metrics beyond just the annual AB 32 GHG Inventory to better enable tracking progress. For example, it clearly demonstrates the production and distribution rates of specific types of clean energy, such as adding 4.3 GW of utility solar and 2.5 GW of storage year-over-year between now and 2035 to be on track to achieve carbon neutrality no later than 2045, and does the same for technology deployment, such as 11 million ZEVs in 2035.

The sections below include key actions to support success in the necessary transition away from fossil combustion, which is an overriding goal of this plan. The wide array of complementary and supporting actions being contemplated or to be undertaken across state government are detailed here. The broad view of actions described in this chapter thus provides context for the specific deployment of clean technology and fuels identified in the Scoping Plan Scenario described in Chapter 2. Actions identified in this Scoping Plan are based on currently known options and the latest science. As part of future Scoping Plan updates, additional clean technology and fuels may be identified and added to the mix of needed tools to continue to reduce the state's GHG emissions, support air quality co-benefits, and remove carbon from the atmosphere.

---

[292] California Air Resources Board. SB 350 Electricity Sector Greenhouse Gas Planning Targets. https://ww2.arb.ca.gov/our-work/programs/sb350.

Transportation Sustainability

The transportation sector has long relied on liquid petroleum fuels as the primary energy source for internal combustion engine (ICE) vehicles, including cars, trucks, locomotives, marine equipment, and aircraft. Combustion of fossil fuels in vehicles emits significant amounts of GHGs, criteria pollutants, and toxic air contaminants. In 2019,[293] the transportation sector accounted for approximately 50 percent of statewide GHG emissions[294] and thus was by far the single largest source of carbon pollution in the state. In addition, the transportation sector accounted for over 80 percent of statewide NOx emissions and 30% of fine particulate matter emissions, including toxic diesel particulate matter.[295]

Communities adjacent to congested roadways, including ports and distribution centers, are exposed to the highest concentration of toxic pollutants from vehicles and equipment consuming fossil fuels, leading to a number of demonstrated health impacts such as respiratory illnesses, higher likelihood of cancer development, and premature death. In addition, communities located near oil extraction operations or crude oil refineries often experience higher exposure to poor air quality. While CARB's programs, along with local action, have made substantial progress over the past few decades, it is clear that California must transition away from fossil fuels to zero-emission technologies with all possible speed and pursue policies that result in less driving, in order to meet our GHG and air quality targets.

The transportation sector can be divided into three general categories: Technology, Fuels, and Vehicle Miles Traveled.

- *Technology* refers to the vehicles themselves, as well as the associated refueling infrastructure for those vehicles.
- *Fuels* refers to the energy source used to power vehicles and the facilities that produce them.
- Vehicle travel is measured as *vehicle miles traveled* (VMT), and is a product of development patterns and available transportation options.

---

[293] In 2020 the state experienced shelter-in-place orders in response to the COVID-19 pandemic. The orders, and the effects of the pandemic, led to a significant year-over-year decline in transportation emissions in 2020. This means 2019 is likely a more representative year for overall transportation emissions and 2020 a likely outlier in the historical transportation emissions trend data.

[294] CARB. 2022. *California Greenhouse Gas Emissions for 2000 to 2020.* https://ww2.arb.ca.gov/sites/default/files/classic/cc/inventory/2000-2020_ghg_inventory_trends.pdf. This includes upstream oil extraction and refining emissions.

[295] CARB. California Greenhouse Gas Emission Inventory Program. https://ww2.arb.ca.gov/our-work/programs/ghg-inventory-program.

Sector Transition

Technology

Vehicles must transition to zero emission technology to decarbonize the transportation sector. Executive Order N-79-20[296] reflects the urgency of transitioning to zero emission vehicles (ZEVs) by establishing target dates for reaching 100 percent ZEV sales or fleet transitions to ZEV technology. The primary ZEV technologies available today are battery-electric and hydrogen fuel cell electric vehicles (FCEVs), both of which emit zero tailpipe GHGs, criteria pollutants, and toxic air contaminants, as they do not burn fuel. These vehicles are rapidly growing in performance, affordability, and popularity.[297] Plug-in hybrid electric vehicles also offer a limited but increasing range of zero emission operation and will play a role in the transition to ZEVs.

Light-duty passenger vehicles consume the majority of gasoline in the state—12.9 billion gallons in 2019[298]—and are well-suited for transitioning to ZEVs. EO N-79-20 calls for 100 percent ZEV sales of new light-duty vehicles by 2035, and this target is reflected in this Scoping Plan.[299] The Advanced Clean Cars II regulation fulfills the goal in the Executive Order and serves as the primary mechanism to help deploy ZEVs. A number of existing incentive programs also support this transition, including the Clean Cars 4 All Program.[300] Heavy-duty trucks are the largest source of diesel particulate matter, a toxic air contaminant that is directly linked to a number of adverse health impacts, and EO N-79-20 also sets targets for transitioning the medium- and heavy-duty fleet to zero emissions: by 2035 for drayage trucks and by 2045 for buses and heavy-duty long-haul trucks where feasible. Replacing heavy-duty vehicles with ZEV technology will significantly reduce GHG emissions and diesel PM emissions in low-income communities and communities of color adjacent to ports, distribution centers, and highways. The existing Advanced Clean Trucks regulation, paired with the proposed Advanced Clean Fleets regulation, are designed to transition a significant amount of the

---

[296] Executive Department. State of California. Executive Order N-79-20. https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf.

[297] CARB. 2021. Public Workshop for Advanced Clean Cars II. May 6. https://ww2.arb.ca.gov/sites/default/files/2021-05/acc2_workshop_slides_may062021_ac.pdf.

[298] CARB. 2022. *Fuel Activity for California's Greenhouse Gas Inventory by Sector and Activity.* https://ww2.arb.ca.gov/sites/default/files/classic/cc/inventory/fuel_activity_inventory_by_sector_all_00-20.xlsx.

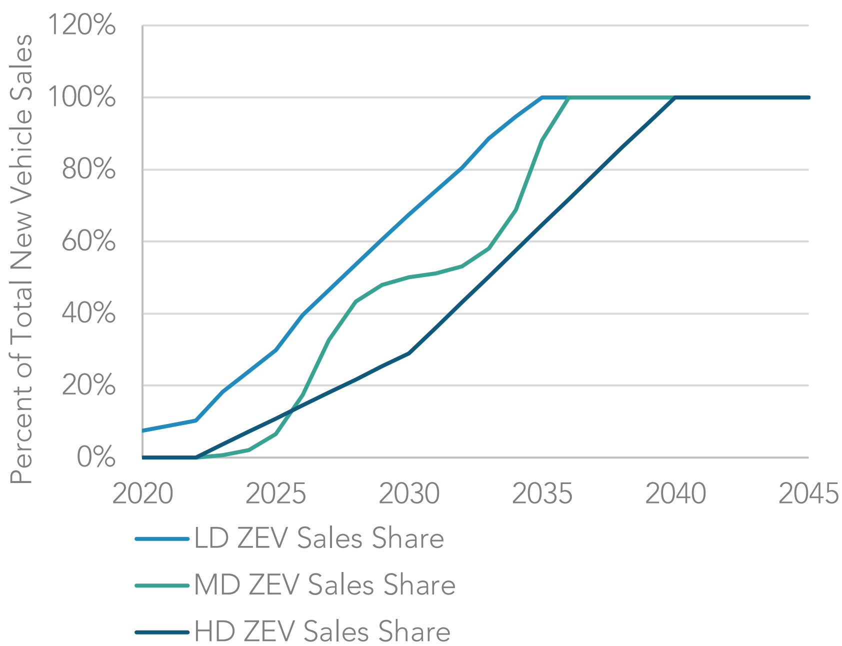
[299] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F1A, with reference to the date at which all new vehicle sales are ZEVs. finalejacrecs.pdf (arb.ca.gov).

[300] CARB. Clean Cars 4 All. https://ww2.arb.ca.gov/our-work/programs/clean-cars-4-all. The Clean Vehicle Rebate Project (CVRP) also supports the transition to ZEVs. https://cleanvehiclerebate.org/en.

California truck fleet to ZEV technology. As with the LDV sector, a number of incentive programs support this transition, such as the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP).[301]

Figure 4-1 below illustrates the pace of transition in vehicle technology needed to drastically reduce GHG emissions from vehicles. All vehicle classes reach 100 percent ZEV sales before 2045, with some achieving this well before. The ZEV technology across the vehicle classes is assumed to be primarily battery electric and hydrogen fuel cell (reflecting the primary ZEV technologies available today).[302]

Figure 4-1: Transition of on-road vehicle sales to ZEV technology in the Scoping Plan Scenario



Today, off-road vehicles also rely heavily on ICE technology. Executive Order N-79-20 sets an off-road equipment target of transitioning the entire fleet to ZEV technology by 2035, where feasible. There is a great need for both investment and innovation in the off-road space in order to develop and commercialize zero emission equipment types that meet or exceed the performance of existing equipment. A number of funding sources currently support this transition, including programs such as FARMER, Carl Moyer, and

[301] California HVIP. Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project. https://californiahvip.org/?msclkid=efaf65f2c26f11eca6bdd08ecc323864.

[302] The light-duty fleet includes more than 11 million battery electric and hydrogen fuel cell vehicles in 2035 and over 23 million battery electric and hydrogen fuel cell vehicles in 2045.

the Community Air Protection Incentives—as well as Low Carbon Transportation Incentives, including the Clean Off-Road Equipment (CORE) program. In addition, the 2021–22 California budget provided record-high allocations for funding ZEVs, including off-road equipment, and the 2022–23 budget is similarly ambitious.[303] Several regulations focused on transitioning to zero emission off-road equipment have recently been adopted or are in the works, and apply to locomotives,[304] forklifts, ocean-going vessels at berth,[305] commercial harbor craft,[306] small off-road engines,[307] and more.

Intrastate aviation relies on ICE technology today, but battery-electric and hydrogen fuel cell aviation applications are in development, along with sustainable aviation fuel. The Scoping Plan Scenario includes a transition of 20% of aviation fuel demand to ZEV technologies by 2045 and sustainable aviation fuel for the rest.

Refueling infrastructure is a crucial component of transforming transportation technology. Electric vehicle chargers and hydrogen refueling stations must become easily accessible for all drivers to support a wholesale transition to ZEV technology. Deployment of ZEV refueling infrastructure is currently supported by a number of existing local and state public funding mechanisms, the new National Electric Vehicle Infrastructure (NEVI) federal funding mechanism, California's electric utilities, the Electrify America initiative that was established in response the Volkswagen ZEV commitment, and by numerous companies, such as EVgo, ChargePoint, Tesla, Ford, FirstElement Fuel, Chevron, Shell, and Iwatani, who are investing substantial private resources into developing these networks. Private investment in reliable, affordable and ubiquitous refueling infrastructure must drive the transition as the business case for ZEVs continues to strengthen.

Strategies for Achieving Success

- Achieve 100 percent ZEV sales of light-duty vehicles by 2035[308] and medium-heavy-duty vehicles by 2040.
- Achieve a 20% zero emission target for the aviation sector.

---

[303] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F1C. CARB and the Administration are committed to increasing focus on transportation equity investment as was reflected in the governor's 2022–23 budget. *finalejacrecs.pdf (arb.ca.gov)*.

[304] CARB. Reducing Rail Emissions in California. *https://ww2.arb.ca.gov/our-work/programs/reducing-rail-emissions-california*.

[305] CARB. Ocean-Going Vessels At Berth Regulation. *https://ww2.arb.ca.gov/our-work/programs/ocean-going-vessels-berth-regulation*.

[306] CARB. CARB passes amendments to commercial harbor craft regulation. *https://ww2.arb.ca.gov/news/carb-passes-amendments-commercial-harbor-craft-regulation*.

[307] CARB. Small Off-Road Engines (SORE). *https://ww2.arb.ca.gov/our-work/programs/small-off-road-engines-sore*.

[308] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F1A. *finalejacrecs.pdf (arb.ca.gov)*.

- Develop a rapid and robust network of ZEV refueling infrastructure to support the needed transition to ZEVs.
- Ensure that the transition to ZEV technology is affordable for low-income households and communities of color, and meets the needs of communities and small businesses.[309]
- Prioritize incentive funding for heavy-duty ZEV technology deployment in regions of the state with the highest concentrations of harmful criteria and toxic air contaminant emissions.[310]
- Promote private investment in the transition to ZEV technology, undergirded by regulatory certainty such as infrastructure credits in the Low Carbon Fuel Standard for hydrogen and electricity[311] and hydrogen station grants from the CEC's Clean Transportation Program[312] pursuant to Executive Order B-48-18.[313]
- Evaluate and continue to offer incentives similar to those through FARMER,[314] Carl Moyer,[315] the Clean Fuel Reward Program,[316] the Community Air Protection Program,[317] and Low Carbon Transportation,[318] including CORE.[319] Where feasible, prioritize and increase funding for clean transportation equity programs.[320]
- Continue and accelerate funding support for zero emission vehicles and refueling infrastructure through 2030 to ensure the rapid transformation of the transportation sector.

---

[309] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF6, in the context of communities. *finalejacrecs.pdf (arb.ca.gov)*.
[310] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF7. *finalejacrecs.pdf (arb.ca.gov)*.
[311] CARB. LCFS ZEV Infrastructure Crediting. *https://ww2.arb.ca.gov/resources/documents/lcfs-zev-infrastructure-crediting*.
[312] CEC. Clean Transportation Program. *https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program*.
[313] EO B-48-18 calls for 200 hydrogen refueling stations by 2025. *https://www.library.ca.gov/wp-content/uploads/GovernmentPublications/executive-order-proclamation/39-B-48-18.pdf*.
[314] CARB. FARMER program. *https://ww2.arb.ca.gov/our-work/programs/farmer-program*.
[315] CARB. Carl Moyer program. *https://ww2.arb.ca.gov/our-work/programs/carl-moyer-memorial-air-quality-standards-attainment-program*.
[316] California Clean Fuel Reward Program. *https://cleanfuelreward.com/*.
[317] CARB. Community Air Protection Program. *https://ww2.arb.ca.gov/capp*.
[318] CARB. Low Carbon Transportation Investments and Air Quality Improvement Program. *https://ww2.arb.ca.gov/our-work/programs/low-carbon-transportation-investments-and-air-quality-improvement-program*.
[319] Clean Off-Road Equipment (CORE) Voucher Incentive Program. *https://californiacore.org/*.
[320] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F1C. *finalejacrecs.pdf (arb.ca.gov)*.

- Evaluate and align with this Scoping Plan relevant CARB policies such as Advanced Clean Cars II,[321] Innovative Clean Transit,[322] Zero Emission Airport Shuttle,[323] California Phase 2 GHG Standards,[324] Advanced Clean Trucks, Advanced Clean Fleets, Zero Emission Forklifts,[325] In-use Locomotives,[326] the Off-Road Zero-Emission Targeted Manufacturer rule, Clean Off-Road Fleet Recognition Program, In-use Off-Road Diesel-Fueled Fleets Regulation,[327] Commercial Harbor Craft,[328] Off-Road Zero-Emission Targeted Manufacturer rule, Clean Off-Road Fleet Recognition Program, Amendments to the In-use Off-Road Diesel-Fueled Fleets Regulation,[329] carbon pricing through the Cap-and-Trade Program,[330] and the Low Carbon Fuel Standard.[331]
- Identify and address permitting and market barriers to successful rapid ZEV technology deployment while protecting public health and the environment.

Fuels

Transitioning away from conventional ICE vehicles is part of the solution, but we must ensure that an adequate supply of zero-carbon alternative fuel and distribution is available to power these vehicles. Electricity and hydrogen are currently the primary fuels for ZEVs,

---

321 CARB. Advanced Clean Cars Program. https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program. Cal. Code Regs., tit. 13, §§ 1900, 1961.2, 1961.3, 1961.4, 1962.2, 1962.3, 1962.4, 1962.5, 1962.6, 1962.7, 1962.8, 1965, 1968.2, 1969, 1976, 1978, 2037, 2038, 2112, 2139, 2140, 2147, 2317, 2903.

322 CARB. Innovative Clean Transit. https://ww2.arb.ca.gov/our-work/programs/innovative-clean-transit. Cal. Code Regs., tit. 13, §§ 2023—2023.11.

323 CARB. Zero-Emission Airport Shuttle. https://ww2.arb.ca.gov/our-work/programs/zero-emission-airport-shuttle. Cal. Code Regs., tit. 17, §§ 95690.1—95690.8.

324 CARB. California Phase 2 Greenhouse Gas Standards. https://ww2.arb.ca.gov/our-work/programs/greenhouse-gas-standards-medium-and-heavy-duty-engines-and-vehicles/phase2. Cal. Code Regs., tit. 13, §§ 1956.8 and 2036; and Cal. Code Regs., tit. 17, §§ 95301, 95302, 95303, and 95663.

325 CARB. Zero-Emission Forklifts. https://ww2.arb.ca.gov/our-work/programs/zero-emission-forklifts. Cal. Code Regs., tit. 17, §§ 95690.1—95690.8.

326 CARB. Reducing Rail Emissions. https://ww2.arb.ca.gov/our-work/programs/reducing-rail-emissions-california. Proposed Cal. Code Regs., tit. 13, §§ 2478—2478.16.

327 CARB. In-use Off-Road Diesel-Fueled Fleets Regulation. https://ww2.arb.ca.gov/our-work/programs/use-road-diesel-fueled-fleets-regulation. Cal. Code Regs., tit. 13, §§ 2449, 2449.1, 2449.2.

328 CARB. Commercial Harbor Craft. https://ww2.arb.ca.gov/our-work/programs/commercial-harbor-craft. Cal. Code Regs., tit. 13, § 2299.5.

329 CARB. In-use Off-Road Diesel-Fueled Fleets Regulation. https://ww2.arb.ca.gov/our-work/programs/use-road-diesel-fueled-fleets-regulation.

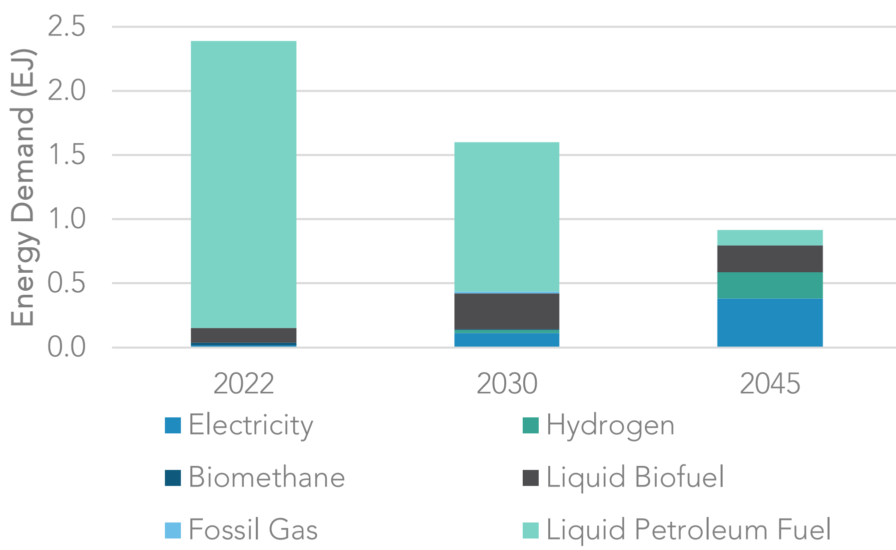
330 CARB. Cap-and-Trade Program. https://ww2.arb.ca.gov/our-work/programs/cap-and-trade-program. Cal. Code Regs., tit. 17, §§ 95801 et seq.

331 CARB. Low Carbon Fuel Standard. https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard. Cal. Code Regs., tit. 17, §§ 95480 et seq.

and both fuels must be produced using low-carbon technology and feedstocks to minimize upstream emissions.

The transition to complete ZEV technology will not happen overnight. Conventional ICE vehicles from legacy fleets will remain on the road for some time, even after all new vehicle sales have transitioned to ZEV technology. In addition, some equipment types are only now in the initial stages of development of ZEV technology for propulsion, such as commercial aircraft or ocean-going vessels. In addition to building the production and distribution infrastructure for zero-carbon fuels, the state must continue to support low-carbon liquid fuels during this period of transition and for much harder sectors for ZEV technology such as aviation, locomotives, and marine applications. Biomethane currently displaces fossil fuels in transportation and will largely be needed for hard-to-decarbonize sectors but will likely continue to play a targeted role in some fleets while the transportation sector transitions to ZEVs. Figure 4-2 provides the detail on fuels used in 2020 and the fuel mix under the Scoping Plan Scenario for 2035 and 2045.

Figure 4-2: Transportation fuel mix in 2022, 2030, and 2045 in the Scoping Plan Scenario[332]



Private investment in alternative fuels will play a key role in diversifying the transportation fuel supply away from fossil fuels. The Low Carbon Fuel Standard is the primary mechanism for transforming California's transportation fuel pool with low-carbon

[332] See https://ww2.arb.ca.gov/sites/default/files/2022-11/2022-sp-PATHWAYS-data-E3.xlsx for transportation fuels by year.

alternatives and has fostered a growing alternative fuel market. Partially as a result of the powerful market signals from the LCFS, fuels like renewable diesel, sustainable aviation fuel, biomethane, and electricity have all gained significant market shares and continue to displace gasoline and diesel in both on- and off-road vehicles. In addition, Executive Order N-79-20 calls on state agencies to support the transition of existing fuel production facilities away from fossil fuels and directs that this transition also protect and support workers, public health, safety, and the environment. In line with this direction, existing refineries could be repurposed to produce sustainable aviation fuel, renewable diesel, and hydrogen. This trend has already begun, and continuing to develop fuel production capacity in-state to support the energy transition while making the most efficient use of existing assets is critical to avoiding emissions leakage. If fuel demand persists after fuel production facilities have ceased operations, fuel demand will have to be met through imports.

As we transition or build new energy production facilities and infrastructure, it will be important to ensure low-income communities, tribes, and communities of color do not experience increases in existing air pollution disparities and continue to experience a reduction in the air pollution disparities that exist today. California must use the best available science to ensure that raw materials used to produce transportation fuels do not incentivize feedstocks with little to no GHG reductions from a life cycle perspective. A dramatic increase in alternative fuel production must not come at the expense of global deforestation, unsustainable land conversion, or adverse food supply impacts, to name a few examples. CARB will continue to monitor scientific findings on these topics to ensure that California policies, such as the LCFS, send the appropriate market signals and do not result in unintended consequences.[333]

Strategies for Achieving Success

- Accelerate the reduction and replacement of fossil fuel production and consumption in California.[334]
- Incentivize private investment in new zero-carbon fuel production in California.
- Incentivize the transition of existing fuel production and distribution assets to support deployment of low- and zero-carbon fuels while protecting public health and the environment.
- Invest in the infrastructure to support reliable refueling for transportation such as electricity and hydrogen refueling.

---

[333] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F1E. finalejacrecs.pdf (arb.ca.gov).

[334] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F3. finalejacrecs.pdf (arb.ca.gov).

- Evaluate and propose, as needed, changes to strengthen the Cap-and-Trade Program.
- Initiate a public process focused on options to increase the stringency and scope of the LCFS:
    - Evaluate and propose accelerated carbon intensity targets pre-2030 for LCFS.
    - Evaluate and propose further declines in LCFS post-2030 carbon intensity targets to align with this 2022 Scoping Plan.
    - Consider integrating opt-in sectors into the program.
    - Provide capacity credits for hydrogen and electricity for heavy-duty fueling.
- Monitor for and ensure that raw materials used to produce low-carbon fuels or technologies do not result in unintended consequences.[335]

Vehicle Miles Traveled

Transforming the transportation sector goes beyond phasing out combustion technology and producing cleaner fuels. Managing total demand for transportation energy by reducing the miles people need to drive on a daily basis is also critical as the state aims for a sustainable transportation sector in a carbon neutral economy. Though GHG emissions are declining due to cleaner vehicles and fuels, rising VMT can offset the effective benefits of adopted regulations.

Even under full implementation of Executive Order N-79-20 and CARB's Advanced Clean Cars II Regulations, with 100 percent ZEV sales in the light-duty vehicle sector by 2035, a significant portion of passenger vehicles will still rely on ICE technology, as demonstrated in Figure 4-2 above. Accordingly, VMT reductions will play an indispensable role in reducing overall transportation energy demand and achieving the state's climate, air quality, and equity goals. After a significant pandemic-induced reduction in VMT during 2020, passenger VMT has steadily climbed back up and is now closing in on pre-pandemic levels.[336] Driving alone with no passengers remains the primary mode of travel in California, amounting to 75 percent of the mode share for daily commute trips. Conversely, the transit industry, which was significantly impacted during

---

[335] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F1E. finalejacrecs.pdf (arb.ca.gov).

[336] U.S. Department of Transportation. 2021. December 2021 Traffic Volume Trends. Figure 3 - Seasonally Adjusted Vehicle Miles Traveled by Month. https://www.fhwa.dot.gov/policyinformation/travel_monitoring/21dectvt/figure3.cfm.

the lockdown months, and has struggled to recover; ridership only averages two-thirds of pre-pandemic levels,[337] [338] and service levels also lag behind.

Sustained VMT reductions have been difficult to achieve for much of the past decade, in large part due to entrenched transportation, land use, and housing policies and practices. Specifically, historic decision-making favoring single-occupancy vehicle travel has shaped development patterns and transportation policy, generating further growth in driving (and making transit, biking and walking less viable alternatives). These policies have also reinforced long-standing racial and economic injustices that leave people with little choice but to spend significant time and money commuting long distances, placing a disproportionate burden on low-income Californians, who pay the highest proportion of their wages on housing and transportation. While CARB has included VMT reduction targets and strategies in the Scoping Plan and appendices, these targets are not regulatory requirements, but would inform future planning processes. CARB is not setting regulatory limits on VMT in the 2022 Scoping Plan; the authority to reduce VMT largely lies with state, regional, and local transportation, land use, and housing agencies, along with the Legislature and its budgeting choices.

Appendix E (Sustainable and Equitable Communities) elaborates on reasons for reducing VMT and identifies a series of policies that, if implemented by various responsible authorities, could help to achieve the recommended VMT reduction trajectory included in this Scoping Plan (and related mode share increases for transit and active transportation). These policies aim to advance four strategic objectives:

1. Align current and future funding for transportation infrastructure with the state's climate goals, preventing new state-funded projects from inducing significant VMT growth and supporting an ambitious expansion of transit service and other multimodal alternatives.
2. Move funding for transportation beyond the gasoline and diesel taxes and implement fuel-agnostic pricing strategies that accomplish more productive uses of the roadway network and generate revenues to further improve transit and other multimodal alternatives.
3. Deploy autonomous vehicles, ride-hailing services, and other new mobility options toward high passenger-occupancy and low VMT-impact service models that complement transit and ensure equitable access for priority populations.
4. Encourage future housing production and multi-use development in infill locations and other areas in ways that make future trip origins and destinations

[337] U.S. Government Accountability Office. January 25, 2022. During COVID-19, Road Fatalities Increased and Transit Ridership Dipped. https://www.gao.gov/blog/during-covid-19-road-fatalities-increased-and-transit-ridership-dipped.
[338] American Public Transportation Association. APTA - Ridership Trends. https://transitapp.com/APTA.

closer together and create more viable environments for transit, walking, and biking.

The pace of change to reduce VMT must be accelerated. Certainly, structural reform will be challenging, but California has demonstrated time and again that it possesses the collective leadership and commitment to break away from ideas that no longer represent Californians' values and their aspirations for the many generations to come.

Strategies for Achieving Success

- Achieve a per capita VMT reduction of at least 25 percent below 2019 levels by 2030 and 30 percent below 2019 levels by 2045. [339]
- Reimagine new roadway projects that decrease VMT in a way that meets community needs and reduces the need to drive.
- Invest in making public transit a viable alternative to driving by increasing affordability, reliability, coverage, service frequency, and consumer experience.[340]
- Implement equitable roadway pricing strategies based on local context and need, reallocating revenues to improve transit, bicycling, and other sustainable transportation choices.[341]
- Expand and complete planned networks of high-quality active transportation infrastructure.[342]
- Channel the deployment of autonomous vehicles, ride-hailing services, and other new mobility options toward high passenger-occupancy and low VMT-impact service models that complement transit and ensure equitable access for priority populations.
- Streamline access to public transportation through programs such as the California Integrated Travel Project.
- Ensure alignment of land use, housing, transportation, and conservation planning in adopted regional plans, such as regional transportation plans (RTP)/ sustainable communities strategies (SCS), regional housing needs assessments (RHNA), and local plans (e.g., general plans, zoning, and local transportation plans), and develop tools to support implementation of these plans.

---

[339] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F1D. *finalejacrecs.pdf (arb.ca.gov)*.
[340] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F1D. *finalejacrecs.pdf (arb.ca.gov)*.
[341] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F1D. *finalejacrecs.pdf (arb.ca.gov)*.
[342] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F1F. *finalejacrecs.pdf (arb.ca.gov)*.

- Accelerate infill development and housing production at all affordability levels in transportation-efficient places, with a focus on housing for lower-income residents.

Clean Electricity Grid

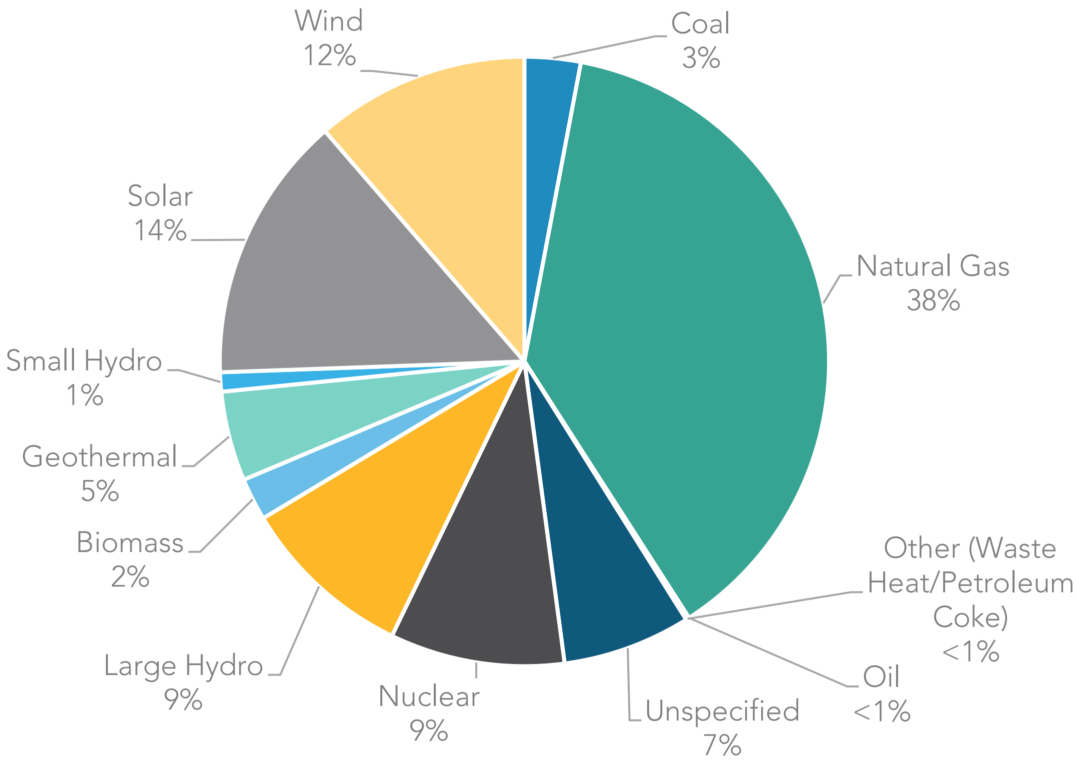
Much of the state's success to date in reducing GHGs is due to decarbonization of the electricity sector as a result of the RPS, SB 100 implementation, and the Cap-and-Trade Program. Moving forward, a clean, affordable, and reliable electricity grid will serve as a backbone to support deep decarbonization across California's economy. Under this Scoping Plan, the role of electricity in powering the economy will grow in almost every sector.

In 2021, 70 percent of California electricity demand was served by in-state power plants totaling about 82 GW, with the rest coming from out-of-state imports.[343] Additionally, approximately 8 GW of customer solar photovoltaic capacity has been installed to date to help with in-state demand.[344] Figure 4-3 shows the breakdown of in-state and imported sources of electricity.

[343] CEC. 2021. Electric Generation Capacity and Energy. Data available at: https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/electric-generation-capacity-and-energy and CEC. 2021. Total System Electric Generation. Data available at: https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2021-total-system-electric-generation. Capacity values are nameplate capacity from sources 1 MW and larger.

[344] CEC. 2021. *SB 100 Joint Agency Report Summary: Achieving 100% Clean Electricity in California, An Initial Assessment.* 10. https://www.energy.ca.gov/publications/2021/2021-sb-100-joint-agency-report-achieving-100-percent-clean-electricity.

Figure 4-3: 2021 total system electric generation (based on GWh)[345]



Note: Imports contributing to total system generation are comprised of 58% zero-carbon energy and 42% non-renewable and unspecified energy. Percentages do not add to exactly 100 due to rounding.

In 2021, about 48 percent of electricity generation serving California came from non-renewable and unspecified[346] resources, while 52 percent came from renewable and zero-carbon resources. The state's Strategic Reliability Reserve, established in AB 205 to provide additional reliability insurance during extreme events, may make three of the fossil gas-fired OTC plants planned for retirement available to support the grid on a limited basis after 2023. The state also adopted legislation to facilitate extension of the Diablo Canyon Nuclear Power Plant for five years beyond its 2025 planned closure.[347] At the

---

[345] *Total system generation* is the sum of all utility-scale, in-state generation, plus net electricity imports. CEC. 2021 Total System Electricity Generation. https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2021-total-system-electric-generation.

[346] *Unspecified power* refers to electricity that is not traceable to a specific generating facility, such as electricity traded through open market transactions. It typically consists of a mix of resources and may include renewables.

[347] In accordance with SB 846 (Dodd, Chapter 239, Statutes of 2022).

same time, the state continues to rapidly expand deployment of clean energy generation and storage resources and plan for increased electrification.[348] This is critical to reducing GHG emissions and addressing the long-term impacts of climate change.

Climate change is causing unprecedented stress on California's energy system—driving high demand and constraining supply. Heat, drought, and wildfires can both reduce electricity supply from reductions in hydropower generation and impacts on generation and transmission performance, and increase demand, especially in the evening hours when solar generation is declining.

California has experienced three straight years of energy reliability challenges, including a multi-day extreme heat event across the western United States with temperatures up to 20 degrees above normal in California, resulting in rotating outages in August 2020. In 2021, heat waves in June prompted a Grid Warning and the onset of emergency conditions, and the Bootleg Fire caused the loss of one transmission line, reducing import capability by 3,000 megawatts into the California Independent System Operator (CAISO) balancing authority area. And from August 31–September 9, 2022, a 10-day extreme heat event resulted in an unprecedented, sustained period of high peak loads in the CAISO system, averaging 47,000 MW and maxing at an all-time record of over 52,000 MW on September 6. The Western region also hit its record peak load on September 6, at 167.5 GW.

Reliable electricity service was maintained throughout the 10-day September 2022 heat wave in spite of the record breaking load levels. Factors that contributed to this outcome include the installation of over 3,500 MW of lithium-ion battery storage since summer 2020, enhanced coordination and communication within and outside of California, engagement with customer groups and other stakeholders, state actions to reduce load during critical times, and the additional capacity provided through the Strategic Reliability Reserve and other new state programs authorized in the 2022 Budget to provide load reduction and support the grid in extreme events. CEC, CPUC, CAISO, and the California Department of Water Resources will continue to build out strategies to enhance reliability in light of the increasing and compounding impacts of climate change on the electricity system.

---

[348] In June 2021, the CPUC adopted D.21-06-035 directing procurement of 11,500 MW of new capacity between 2023 and 2026 to ensure systemwide electric reliability as Diablo Canyon and several OTC facilities retire. It requires that, out of the 11,500 MW, 2,500 MW must be from zero-emission resources. Additionally, 2,000 MW must be long lead-time resources, with at least 1,000 MW of long-duration storage and 1,000 MW of firm capacity with zero on-site emissions or that qualifies under the RPS eligibility requirements.

While the electricity sector is using less fossil fuel due to increasing amounts of renewables,[349] existing fossil gas generation will continue to play a critical role in grid reliability until other clean, dispatchable alternatives can be deployed at scale. The integration of greater amounts of variable renewable generation resources[350] is changing power system planning and operations, and system operators need resources with flexible attributes to balance shifting supply and demand.

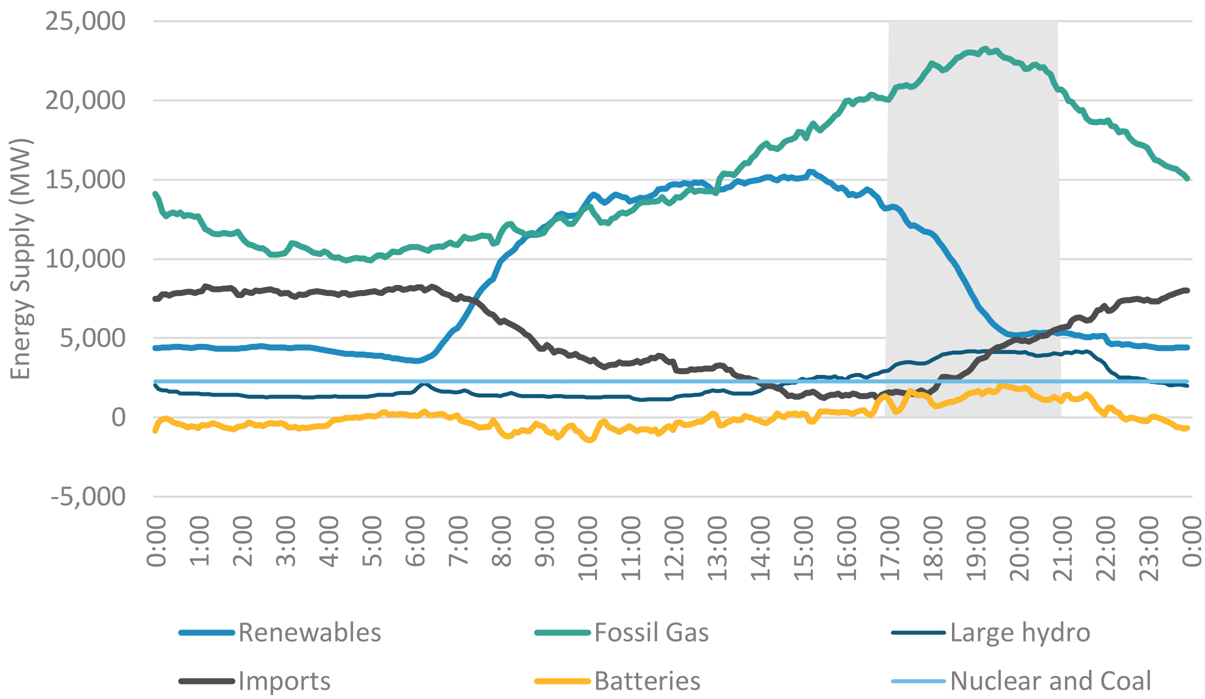
High levels of solar generation can lead to instances of oversupply during the middle of the day, when the sun is brightest.[351] In the evening hours, as the sun is setting, solar generation declines to zero and customers with solar generation shift back to the electric grid. In hot weather, customer demand remains high well into the summer evening period to power air conditioning, which can lead to reliability challenges.[352]

Figure 4-4 shows the energy sources used throughout one summer day in July. Renewable energy is consistent during the middle of the day, but it cannot meet all of the evening demand in the gray area. As illustrated in the figure, fossil gas generation is currently a resource that is typically ramped up to meet this evening demand as solar production begins to drop and electrical loads increase To help address this challenge, resource installations that pair solar with batteries, as well as a greater amount of battery build-out, are coming online currently and over the next five years. Nevertheless, the state's electricity grid is expected to be stressed further in the coming years by heat waves, drought, wildfires, and the growing intermittent power supply from renewables. California must accelerate deployment of diverse clean energy resources to maintain reliability and affordability in the face of climate change.

---

[349] CARB. 2022. *California Greenhouse Gas Emissions for 2000 to 2020.* https://ww2.arb.ca.gov/sites/default/files/classic/cc/inventory/2000-2020_ghg_inventory_trends.pdf.
[350] A *variable renewable generation resource* is a renewable source of electricity that is non-dispatchable due to its fluctuating nature and only produces electricity when weather conditions are right, such as when the sun is shining or the wind is blowing. Renewable resources that can be controlled and are dispatchable include geothermal, biomass, and dam-based hydroelectric power.
[351] *Brightness* is used colloquially here; solar energy depends on insolation (e.g., sun-hours), which is the measurement of cumulative solar energy that reaches an area over a period of time.
[352] CAISO, CPUC, and CEC. 2021. *Final Root Cause Analysis: Mid-August 2020 Extreme Heat Wave.* http://www.caiso.com/Documents/Final-Root-Cause-Analysis-Mid-August-2020-Extreme-Heat-Wave.pdf.

Figure 4-4: Electricity supply trend by resource for a California summer day, July 2022



Sector Transition

Decarbonizing the electricity sector is a crucial pillar of this Scoping Plan. It depends on both using energy more efficiently and replacing fossil-fueled generation with renewable and zero carbon resources, including solar, wind, energy storage,[353] geothermal, biomass, and hydroelectric power. The RPS Program[354] and the Cap-and-Trade Program continue to incentivize dispatch of renewables over fossil generation to serve state demand. SB 100 increased RPS stringency to require 60 percent renewables by 2030 and for California to provide 100 percent of its retail sales[355] of electricity from renewable and zero-carbon resources by 2045. Furthermore, SB 1020 has added interim targets to

---

[353] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF1, NF2. finalejacrecs.pdf (arb.ca.gov).

[354] The CEC estimates that 36 percent of California's 2019 retail electricity sales was served by RPS-eligible renewable resources (see CPUC. 2021. CPUC Perspectives on Electric Sector Decarbonization. https://ww2.arb.ca.gov/sites/default/files/2021-11/CPUC-sp22-electricity-ws-11-02-21.pdf).

[355] SB 100 speaks only to retail sales and state agency procurement of electricity. The *2021 SB 100 Joint Agency Report* interprets this to mean that other loads—wholesale or non-retail sales and losses from storage and transmission and distribution lines—are not subject to the law.

SB 100's policy framework to require renewable and zero-carbon resources to supply 90 percent of all retail electricity sales by 2035 and 95 percent of all electricity retail sales by 2040; the governor has asked the CEC to establish a planning goal of at least 20 GW of offshore wind by 2045; and the governor directed that state agencies plan for an energy transition that avoids the need for new fossil gas capacity to meet California's long-term energy goals.[356] In addition to grid-level resources, state efforts have supported rapid growth of the distributed solar industry through key actions like the California Solar Initiative (SB 1, Murray, Chapter 132, Statues of 2006).[357] Steps to commercialize microgrids powered by clean resources[358] are also being examined as part of SB 1339 (Stern, Chapter 566, Statutes of 2018).[359]

California also continues to advance its appliance and building energy efficiency standards to reduce growth in electricity consumption and meet the SB 350 goal to double statewide energy efficiency savings in electricity and fossil gas end uses[360] by 2030. In 2018, the CEC adopted a building energy efficiency code requiring most new homes to have solar photovoltaic systems[361] (or be powered by a solar array nearby) starting January 1, 2020. In 2019, California reached the milestone of 1 million solar rooftop installations.

Increased transportation and building electrification and continued policy commitment to behind-the-meter solar and storage will continue to drive growth of microgrids and other distributed energy resources (DER).[362] The CPUC's High-DER proceeding is examining how to prepare the electric grid for a high DER future by determining how to integrate

---

[356] Newsom, Gavin. July 22, 2022. Letter from Governor Newsom to CARB Chair Liane Randolph. *https://www.gov.ca.gov/wp-content/uploads/2022/07/07.22.2022-Governors-Letter-to-CARB.pdf*.

[357] More information on the program, which closed in 2016, can be found on the CPUC website, including annual program assessment reports, at: *https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/california-solar-initiative*.

[358] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, In part (NF2, NF13). *finalejacrecs.pdf (arb.ca.gov)*.

[359] CPUC. Resiliency and Microgrids. *https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/resiliency-and-microgrids*.

[360] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF1, ES1. *finalejacrecs.pdf (arb.ca.gov)*.

[361] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF2. *finalejacrecs.pdf (arb.ca.gov)*.

[362] Distributed energy resources include rooftop solar and other distributed renewable generation resources, energy storage, electric vehicles, time variant and dynamic electric rates, flexible load management, demand response, and energy efficiency technologies.

millions of DERs within the distribution grid to maximize societal and ratepayer benefits from DERs while ensuring grid reliability and affordable rates.[363]

SB 350 also aims to connect long-term planning for electricity needs with the state's climate targets. This is primarily accomplished through CARB's establishment of 2030 GHG emissions targets for the electricity sector in general and for each electricity provider, which inform the CPUC and publicly owned utilities' integrated resource planning. A GHG planning target range of 30 to 53 $MMTCO_2e$—informed by the 2017 Scoping Plan—was originally developed and adopted by CARB in 2018. In its 2021 IRP planning cycle, the CPUC adopted a 38 MMT GHG target for the electricity sector in 2030, which drops to 35 MMT in 2032.[364]

The Scoping Plan Scenario incorporates SB 350's energy efficiency doubling goal, aligns with the CPUC's IRP 2030 GHG target and latest GHG emissions benchmarks through 2035,[365] the governor's 20 GW offshore wind and no new gas generation[366] goals, and SB 100's 2030 RPS and 2045 zero-carbon retail sales targets to reduce dependence on fossil fuels in the electricity sector by transitioning substantial energy demand to renewable and zero-carbon resources.[367] As described in Chapter 2, CCS is applied in limited sectors, including on 16.7 MMT of CO_2 from existing fossil gas electricity generation in 2045, to ensure the state achieves the 85 percent reduction in anthropogenic emissions required by AB 1279. Continued transition to renewable and

[363] The High-DER proceeding is one of four "anchor" proceedings in the CPUC's DER Action Plan 2.0 and is within the Action Plan's infrastructure track. Information on the High-DER proceeding is available at: https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/distribution-planning. The Action Plan can be accessed at: https://www.cpuc.ca.gov/about-cpuc/divisions/energy-division/der-action-plan.

[364] The February 10, 2022, Decision 22-02-004 by the CPUC adopts the 2021 Preferred System Plan, completing the 2019–21 IRP cycle. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M451/K412/451412947.PDF. The Decision requires load serving entities to submit plans in the next IRP cycle detailing how they will meet their proportionate share of a 30 MMT electric sector target, as well as a 38 MMT GHG target.

[365] June 15, 2022, Administrative Law Judge's Ruling for 2022 integrated resource plan filings specifies the need for GHG targets to plan for in 2035 to continue progress toward the 2045 goal. The ruling proposes a straight-line projection from the GHG planning target for 2030. Corresponding to the adopted Preferred System Plan in D.22-02-004, 38 MMT in 2030 leads to a target of 30 MMT in 2035. https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M485/K625/485625915.PDF.

[366] The governor's July 22, 2022, letter specifies no new gas generation but does not place any constraints on existing gas resources. Therefore, for purposes of RESOLVE electricity sector modeling, existing gas capacity is an available resource that is able to be reduced over time based on announced retirements or if selected for retirement by the model.

[367] CARB. 2021. PATHWAYS Scenario Modeling: 2022 Scoping Plan Update – Attachment B: Generation Technologies to be included in Modeling. https://ww2.arb.ca.gov/sites/default/files/2021-12/Revised_2022SP_ScenarioAssumptions_15Dec.pdf.

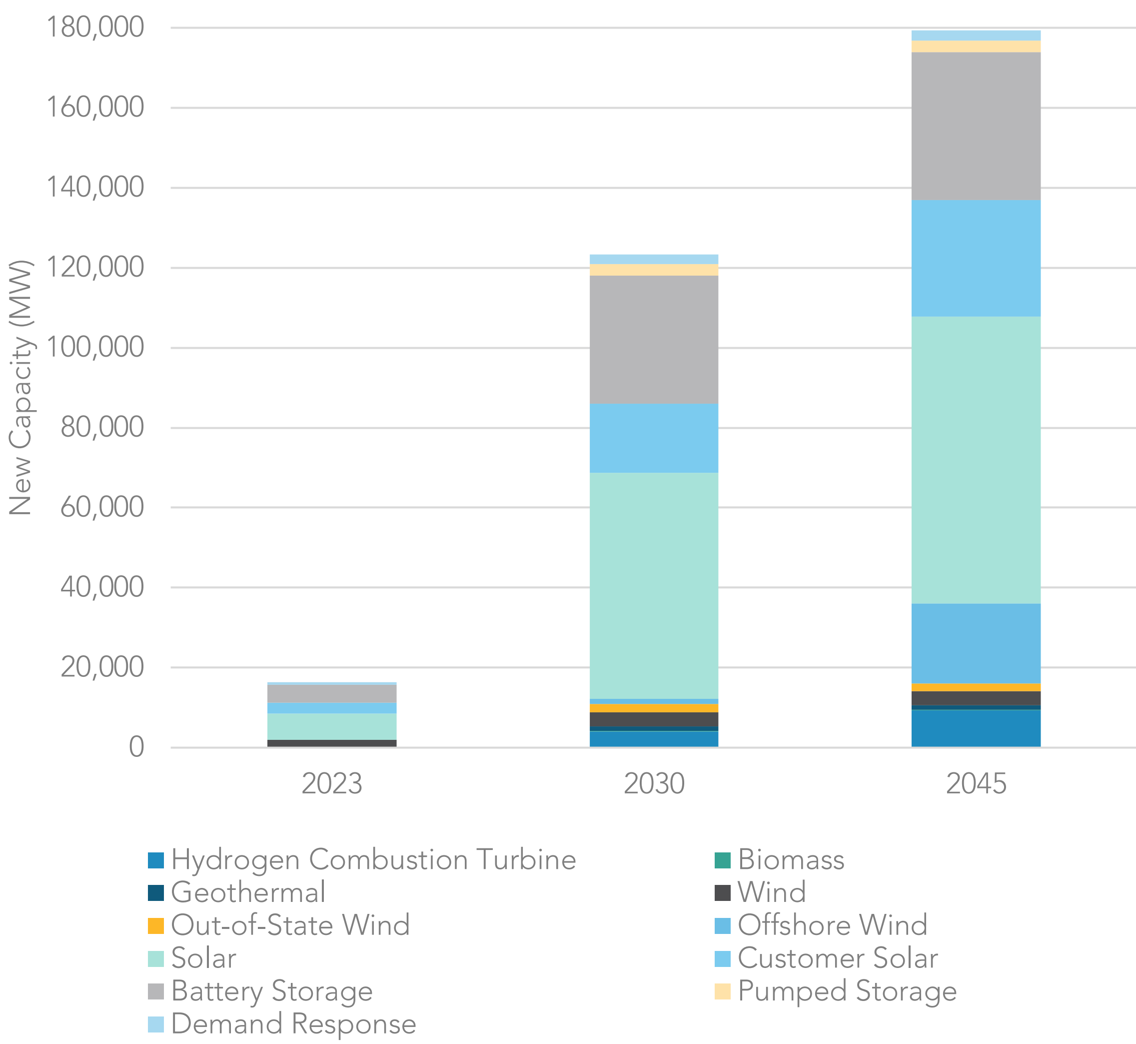
zero-carbon electricity resources will enable electricity to become a zero-carbon substitute for fossil fuels across the economy.

Figure 4-5 shows the modeled resource capacity to meet the SB 100 retail sales target.[368] Energy efficiency moderates some of the need for additional electricity generation. However, that is quickly surpassed by growing electricity demand of 26 percent by 2030 and 76 percent by 2045 compared to today (2022) from increased population and electrification of other sectors, as shown in Figure 4-6. The estimated resource build needed to meet this level of demand amounts to approximately 72 GW of utility solar[369] and 37 GW of battery storage by 2045. Annual build rates (over the 2022–2035 period) for the Scoping Plan Scenario will need to increase by about 60 percent and over 700 percent for utility solar and battery storage, respectively, compared to historic maximum rates.[370] To reach the 2045 target, the state will need to quadruple its current level of wind and solar capacity. This does not include capacity associated with hydrogen production nor mechanical CDR, which was modeled off-grid; assuming hydrogen production via electrolysis, this would roughly be equivalent to an additional 10 GW[371] of solar generation needed in 2045, and an additional 64 GW of solar generation for direct air capture in 2045. The scale of solar and battery build rates needed could be reduced through the commercialization of new zero-carbon technologies.

---

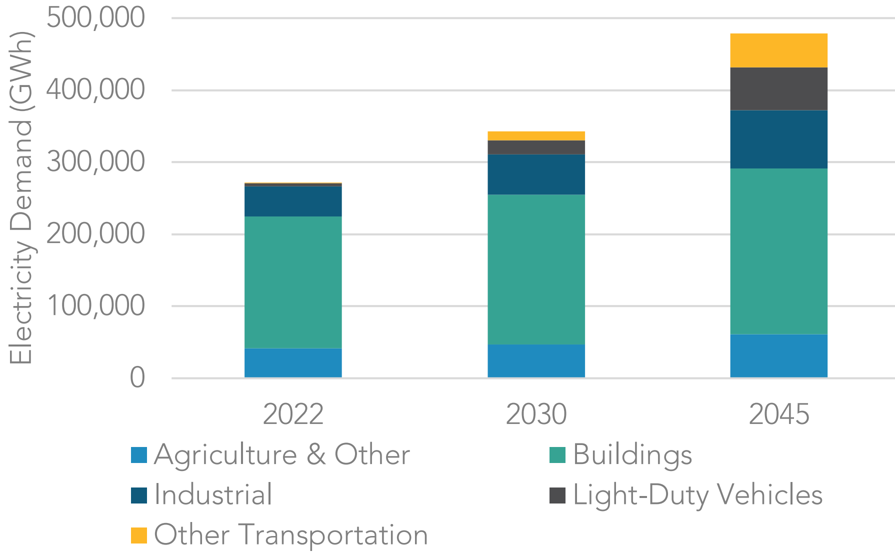
[368] SB 846 requires that load-serving entities exclude energy, capacity, or any attribute from the Diablo Canyon power plant in their resource plans. The Scoping Plan Scenario excludes energy, capacity, or any attribute from the Diablo Canyon power plant after the prior planned retirement date of 2025.
[369] The amount of additional customer solar included in the Scoping Plan Scenario is 29,208 MW by 2045.
[370] E3. 2022. CARB Scoping Plan: AB32 Source Emissions Final Modeling Results. PowerPoint. *https://ww2.arb.ca.gov/sites/default/files/2022-11/SP22-MODELING-RESULTS-E3-PPT.pdf*. Build rates are from EIA data historical builds in the 2011–2021 time frame.
[371] The estimate does not include hydrogen production assumed to be produced with bioenergy with carbon capture and storage (BECCS) and steam methane reforming (SMR).

Figure 4-5: Projected new electricity resources needed by 2045 in the Scoping Plan Scenario[372]



[372] See https://ww2.arb.ca.gov/sites/default/files/2022-11/2022-sp-PATHWAYS-data-E3.xlsx for the capacity build-out by resource type.

Figure 4-6: Electric loads in 2022, 2030 and 2045 for the Scoping Plan Scenario[373]



This transformation will drive investments in a large fleet of generation and storage resources but will also require significant transmission to accommodate these new capacity additions. Transmission needs include high-voltage lines to access out-of-state resources and major in-state generation pockets. In consideration of typical 8- to 10-year lead times for many projects, the CAISO published its first 20-Year Transmission Outlook to inform transmission planning focused on meeting the needs identified through the 2021 SB 100 Joint Agency Report process. The outlook calls for significant transmission development to access offshore wind and out-of-state wind and reinforce the existing CAISO footprint at an estimated cost of $30.5 billion.[374]

Presently, fossil gas power plants provide about 75 percent of the flexible capacity for grid reliability as more renewable power enters the system. Moving forward, other resources such as storage and demand-side management are essential to maintain reliability with high concentrations of renewables. Hydrogen produced from renewable resources and renewable feedstocks can serve a dual role as a low-carbon fuel for existing combustion turbines or fuel cells, and as energy storage for later use. Reliability

---

[373] *Other Transportation* includes all non-light-duty vehicles and reflects electrification of modes like passenger and freight rail, aviation, and ocean-going vessels.
[374] CAISO. 2022. *20 Year Transmission Outlook.* http://www.caiso.com/InitiativeDocuments/20-YearTransmissionOutlook-May2022.pdf.

also can be supported through increased coordination and markets in the interconnected western power grid; this is already helping to better integrate renewables.[375]

Strategies for Achieving Success

- Use long-term planning processes (Integrated Energy Policy Report, IRP, CAISO Transmission Planning Process, AB 32 Climate Change Scoping Plan) to support grid reliability and expansion of renewable and zero-carbon resource and infrastructure deployment.
- Complete systemwide and local reliability assessments across CAISO and other balancing authority areas, using realistic assumptions for land use, build rates, statewide and distribution system level constraints, and energy needs. Such assessments should be completed before state agencies update their electricity sector GHG targets.
- Prioritize actions to mitigate impacts to electricity reliability and affordability and provide sufficient flexibility in the state's decarbonization roadmap for adjustments as may be needed.
- Facilitate long lead-time resource development through the IRP and the SB 100 interagency process and through technology development and demonstration funding[376] that includes resources such as long-duration energy storage and hydrogen production.
- Continue coordination between energy agencies and energy proceedings to maximize opportunities for demand response.
- Continue to explore the benefits of regional markets to enhance decarbonization, reliability, and affordability.
- Address resource build-out challenges, including permitting, interconnection, and transmission network upgrades.
- Explore new financing mechanisms and rate designs to address affordability.[377]
- Per SB 350, double statewide energy efficiency savings in electricity and fossil gas end uses by 2030, through a combination of energy efficiency and fuel substitution actions.[378]
- Per SB 100 and SB 1020, achieve 90 percent, 95 percent, and 100 percent

---

[375] CEC. 2021. *2021 SB 100 Joint Agency Report – Achieving 100 Percent Clean Electricity in California: An Initial Assessment.* Publication Number: CEC-200-2021-001.

[376] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, ES2. The committee recommendation speaks specifically to offshore wind production. *finalejacrecs.pdf (arb.ca.gov)*.

[377] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF30. *finalejacrecs.pdf (arb.ca.gov)*.

[378] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF1, NF2. *finalejacrecs.pdf (arb.ca.gov)*.

renewable and zero-carbon retail sales by 2035, 2040, and 2045, respectively.

- Evaluate and propose, as needed, changes to strengthen the Cap-and-Trade Program.
- Target programs and incentives to support and improve access to renewable and zero-carbon energy projects (e.g., rooftop solar, community owned or controlled solar or wind, battery storage, and microgrids) for communities most at need, including frontline, low-income, rural, and indigenous communities.[379]
- Prioritize public investments in zero-carbon energy projects to first benefit the most overly burdened communities affected by pollution, climate impacts, and poverty.[380]

Sustainable Manufacturing and Buildings

Fossil gas is the primary gaseous fossil fuel used to produce heat at industrial facilities, as well as in residential and commercial buildings. In buildings, space and water heating, cooking, and clothes drying all rely on gaseous fuels today. Industrial processes that require heat for conventional boilers and other processes also rely on gaseous fuels. Refineries rely on fossil gas and other gaseous fossil fuels, like liquefied petroleum gas and refinery fuel gas, and fossil gas is also used to generate electricity, as discussed earlier.

Gaseous fossil fuel use can be displaced by four primary alternatives: zero-carbon electricity, solar thermal heat, hydrogen, and biogas/biomethane. Displacing gaseous fossil fuel use can yield indoor air quality benefits, protect public health and property from unexpected fossil gas leaks, and reduce short-lived climate pollutants, which are many times more potent in affecting climate change than CO_2. The Scoping Plan Scenario reduces dependence on fossil gas in the industrial and building sectors by transitioning substantial energy demand to alternative fuels. Reducing fossil gas combustion also will help toward achieving our air quality and equity goals by reducing pollution in neighboring areas and communities. In addition, reduced dependence on gasoline and diesel in the transportation sector diminishes the need for gaseous fossil fuels to support oil and gas production and petroleum refining operations as those are phased down relative to the demand.

---

[379] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF2, NF9, NF11, NF12, NF13. *finalejacrecs.pdf (arb.ca.gov)*.
[380] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF14. *finalejacrecs.pdf (arb.ca.gov)*.

Sector Transition

Industry

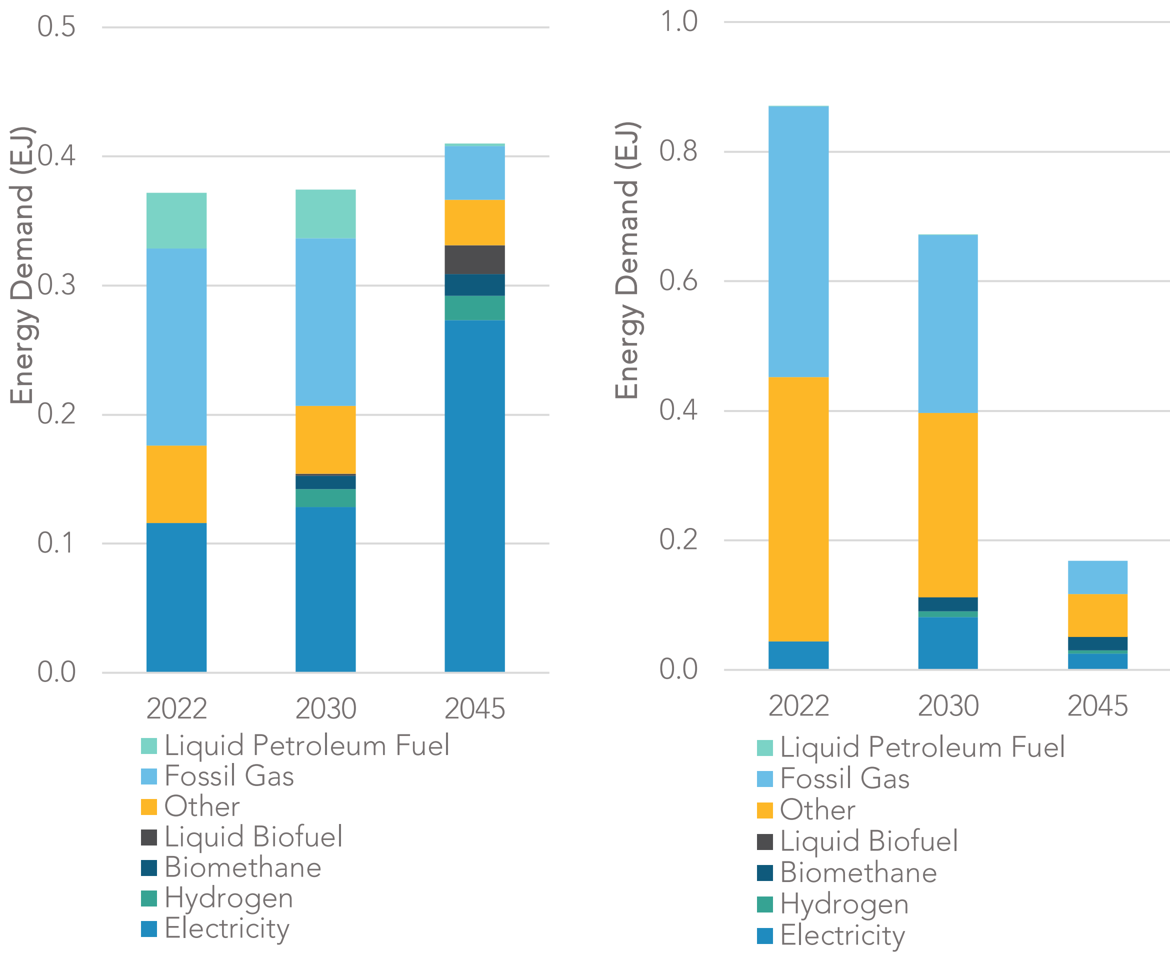
California's industrial sector contributes significantly to the state's economy, with a total output from manufacturing in 2019 of $324 billion (10.4 percent of the state total)[381] and employment of 1,222,000 manufacturing jobs (7.6 percent of the total state workforce).[382] California industry includes a diverse range of facilities, including cement plants, refineries, glass manufacturers, oil and gas producers, paper manufacturers, mining operations, metal processors, and food processors. Combustion of fossil gas, other gaseous fossil fuels, and solid fossil fuels provide energy to meet three broad industry needs: electricity, steam, and process heat. Non-combustion emissions result from fugitive emissions and from the chemical transformations inherent to some manufacturing processes. About 20 percent of the GHG emissions from the industrial sector are non-combustion emissions.

Decarbonizing industrial facilities depends upon displacing fossil fuel use with a mix of electrification, solar thermal heat, biomethane, low- or zero-carbon hydrogen, and other low-carbon fuels to provide energy for heat and reduce combustion emissions. Emissions also can be reduced by implementing energy efficiency measures and using substitute raw materials that can reduce energy demand and some process emissions. Some remaining combustion emissions and some non-combustion CO_2 emissions can be captured and sequestered. The strategy employed will depend on the industrial subsector and the specific processes utilized in production. The left side of Figure 4-7 illustrates the fuels used to meet industrial manufacturing energy demand in 2020. Industrial manufacturing energy demand needs to transition to the fuel mix shown for 2035 and 2045. The right side of Figure 4-7 illustrates the fuel mix needed to meet the energy demand of oil and gas extraction and petroleum refining operations for the same years. Energy demand in this portion of the industrial sector declines along with decreased demand for gasoline and diesel in the transportation sector. In both figures there is a continuing demand for fossil gas due to lack of non-combustion technologically feasible or cost-effective alternatives for certain industrial sectors. Policies that support decarbonization strategies like electrification, use of renewable energy, and transition to alternative fuels are needed.

---

[381] National Association of Manufacturers (NAM). 2021 California Manufacturing Facts. https://www.nam.org/state-manufacturing-data/2021-california-manufacturing-facts/.
[382] NAM. 2021 California Manufacturing Facts. https://www.nam.org/state-manufacturing-data/2021-california-manufacturing-facts/.

Figure 4-7: Final energy demand in industrial manufacturing (left) and in oil and gas extraction and petroleum refining (right) in 2022, 2030, and 2045 in the Scoping Plan Scenario[383]



Electrification and solar thermal heat are best-suited to industrial processes that have relatively low heat requirements, such as food processors, paper mills, and industries that use low-pressure steam in their processes. Approaches could include replacing fossil gas boilers with electric boilers, process heaters with industrial electric heat pumps, steel forging furnaces with induction heaters, and implementing other sector-specific process electrification. Under current rate structures for industrial electricity and fossil gas in

[383] *Other* fuel in the industrial manufacturing sector is primarily coke and coal for cement production. *Other* fuel in the petroleum refining sector is primarily fossil gas associated with refining petroleum products.

California, most projects to electrify a fossil gas-powered industrial process will face operating cost barriers and potential reliability concerns. Microgrids powered by renewable resources and with battery storage are emerging as a key enabler of electrification and decarbonization at industrial facilities.

There are fewer commercially available and economically viable electrification options to replace industrial processes that require higher-temperature heat. For these processes, onsite combustion may continue to be needed, and decarbonization will require fuel substitution to hydrogen,[384] biomethane, or other low-carbon fuels. Fuel substitution and continued combustion will require monitoring and mitigation of any potential air quality impacts, especially in low-income and communities of color which already face disproportionate air pollution burdens. Industries in California with high heat needs include steel forging, glass manufacturing, and industries with calcination processes, such as manufacturing lime and cement.

Onsite emissions from cement manufacturing derive from two main sources: (1) fuel combustion to heat the kiln to a very high temperature and (2) process CO_2 emissions from the chemical transformation of limestone. Over 60 percent of emissions from the sector are process emissions unrelated to fuel use, and most emissions related to fuel use are from coal and petroleum coke combustion. Process emissions from cement manufacturing are significant and will continue even if the sector were to operate using only zero-carbon fuels; thus carbon capture and use/sequestration will be a likely component of any strategy to fully decarbonize cement manufacturing. There are additional opportunities to reduce GHG emissions from cement manufacturing via the combination of fuel-switching to low-carbon fuels (e.g., biomethane, municipal solid waste, biochar), increased blending of non-clinker materials, and efficiency improvements. High technological and economic barriers exist to electrifying kiln process heat at cement plants, as clinker production requires temperatures in excess of 1,500°C. There are potential decarbonization opportunities throughout the value chain of cement use, including in cement manufacturing, concrete mixing, and construction practices.[385] SB 596 (Becker, Chapter 246, Statutes of 2021), which was signed by Governor Newsom in September 2021, requires CARB to develop a comprehensive strategy for cement use in California to achieve a GHG intensity 40 percent below 2019 levels by 2035, and net-zero emissions by 2045.

---

[384] Griffiths, Steve, Benjamin K. Sovacool, Jinsoo Kim, Morgan Bazilian, and Joao M. Uratani. 2021. "Industrial decarbonization via hydrogen: A critical and systematic review of developments, socio-technical systems and policy options." *Energy Research & Social Science* 80. 102208, ISSN 2214-6296. https://doi.org/10.1016/j.erss.2021.102208.

[385] California Nevada Cement Association. Achieving Carbon Neutrality in the California Cement Industry. https://cncement.org/attaining-carbon-neutrality.

Oil and gas extraction and refining make up over half of California's industrial GHG emissions. Reduced demand for transportation fossil fuels corresponds to reduced supply of fossil gas and other gaseous fossil fuels for refineries to produce these fuels. Some refining operations will continue to operate to produce fossil fuel for the remaining transportation energy demands, along with renewable diesel and sustainable aviation fuel, as discussed in the Transportation Sustainability section of this chapter.

Across industrial subsectors and processes, California facilities also could realize significant reductions in GHG emissions and energy-related costs by implementing advanced energy efficiency projects and tools.[386] While enhanced operation and maintenance practices are typical at industrial facilities, additional strategic energy management practices offer greater efficiency gains by focusing on setting goals, tracking progress, and reporting results.

Strategies for Achieving Success

- Maximize air quality benefits using the best available control technologies for stationary sources in communities most in need, including frontline, low-income, disadvantaged, rural, and tribal communities.[387]
- Prioritize alternative fuel transitions first in communities most in need, including frontline, low-income, disadvantaged, rural, and tribal communities.[388]
- Invest in research and development and pilot projects to identify options to reduce materials and process emissions along with energy emissions in California's industrial manufacturing facilities, leveraging programs like the CEC's Electric Program Investment Charge (EPIC).[389]
- Evaluate and propose, as needed, changes to strengthen the Cap-and-Trade Program.
- Support electrification with changes to industrial rate structures.
- Develop infrastructure for CCS and hydrogen production to reduce GHG emissions where cost-effective and technologically feasible non-combustion alternatives are not available.
- Implement SB 905.

---

[386] Therkelsen, Peter, Aimee McKane, Ridah Sabouini, and Tracy Evans. 2013. *Assessing the Costs and Benefits of the Superior Energy Performance Program.* U.S Department of Energy. https://www.osti.gov/servlets/purl/1165470.

[387] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, JT14. finalejacrecs.pdf (arb.ca.gov).

[388] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, JT15. finalejacrecs.pdf (arb.ca.gov).

[389] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, M20. finalejacrecs.pdf (arb.ca.gov).

- Establish markets for low-carbon products and recycled materials using Buy Clean California Act and other mechanisms relying on robust data
- Develop a net-zero cement strategy to meet SB 596 targets for the GHG intensity of cement use in California.
- Continue to leverage energy-efficiency programs, including the U.S. DOE's ENERGY STAR program,[390] U.S. DOE's Superior Energy Performance program,[391] and ISO 50001.[392]
- Evaluate and continue to offer incentives to install energy efficiency and renewable energy technologies through programs such as CPUC decisions as part of rulemaking R.19-09-009[393] and the CEC's Food Production Investment Program (FPIP) and EPIC programs.[394]
- Leverage low-carbon hydrogen programs, including the Bipartisan Infrastructure Law, for regional hydrogen hubs, hydrogen electrolysis, and hydrogen manufacturing and recycling.
- Evaluate the role of hydrogen in meeting GHG emission reductions, including policy recommendations regarding the use of hydrogen in California as required by SB 1075.
- Address cost barriers to promote low-carbon fuels for hard-to-electrify industrial applications.

Buildings

Buildings have cross-sector interactions that influence our public health and well-being and affect land use and transportation patterns, energy use, water use, and indoor and outdoor environments.[395] There are about 14 million existing homes and over 7.5 billion square feet of existing commercial buildings[396] in California. Fossil gas supplies about half of the energy consumed by end uses in these buildings. In addition to GHG emissions, fossil gas usage in buildings also produces CO_2, NOx, $PM_{2.5}$, and

---

[390] ENERGY STAR. ENERGY STAR Guidelines for Energy Management. https://www.energystar.gov/buildings/tools-and-resources/energy-star-guidelines-energy-management.

[391] Energy.gov. Superior Energy Performance 50001. https://www.energy.gov/eere/amo/superior-energy-performance.

[392] ISO. ISO 50001 Energy Management. https://www.iso.org/iso-50001-energy-management.html.

[393] CPUC. January 14, 2021. CPUC Adopts Strategies to Help Facilitate Commercialization of Microgrids Statewide. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M360/K370/360370887.PDF.

[394] Bailey, Stephanie, David Erne, and Michael Gravely. 2021. *Final 2020 Integrated Energy Policy Report Update, Volume II: The Role of Microgrids in California's Clean and Resilient Energy Future, Lessons Learned From the California Energy Commission's Research.* California Energy Commission. Publication Number: CEC-100-2020-001-V2-CMF.

[395] See Appendix F (Building Decarbonization).

[396] CEC. 2021. California Building Decarbonization Assessment. https://efiling.energy.ca.gov/GetDocument.aspx?tn=239311&DocumentContentId=72767.

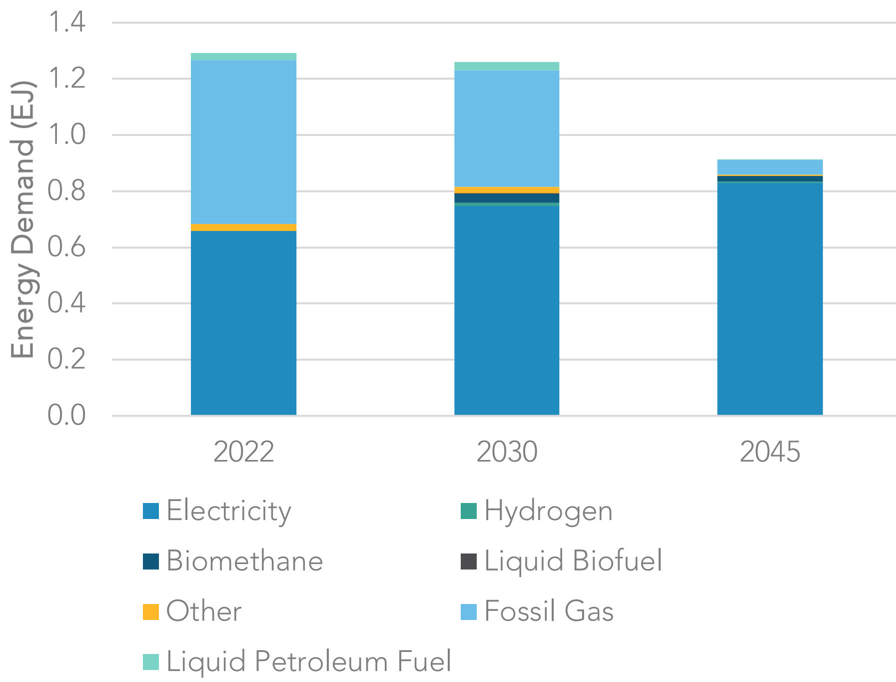
formaldehyde.[397] Each year, about 120,000 new homes[398] and more than 100 million-square feet[399] of commercial buildings are newly constructed across California. These new buildings will represent between a third to half of the total building stock by mid-century.

Achieving carbon neutrality must include transitioning away from fossil gas in residential and commercial buildings, and will rely primarily on advancing energy efficiency while replacing gas appliances with non-combustion alternatives. This transition must include the goal of trimming back the existing gas infrastructure so pockets of gas-fueled residential and commercial buildings do not require ongoing maintenance of the entire limb for gas delivery. Blending low-carbon fuels such as hydrogen and biomethane into the pipeline further displaces fossil gas. Pipeline safety and reliability must be evaluated to accommodate low-carbon fuels. Figure 4-8 illustrates the energy Californians use in buildings at present compared with the Scoping Plan Scenario, which introduces alternatives to fossil gas. In that scenario almost 90 percent of energy demand is electrified by 2045, and the remaining energy demand is met with combustion of hydrogen, biomethane, and fossil gas.

---

[397] Zhu, Yifang, et al. 2020. *Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California.* UCLA Fielding School of Public Health Department of Environmental Health Sciences.
[398] Construction Industry Research Board. 2018. Annual Building Permit Summary. http://www.cirbreport.org.
[399] Delforge, Pierre. August 11, 2021. California Forging Ahead on Zero Emission Buildings. Blog. NRDC. https://www.nrdc.org/experts/pierre-delforge/california-forging-ahead-zero-emission-buildings.

Figure 4-8: Final energy demand in buildings in 2022, 2030, and 2045 in the Scoping Plan Scenario[400]

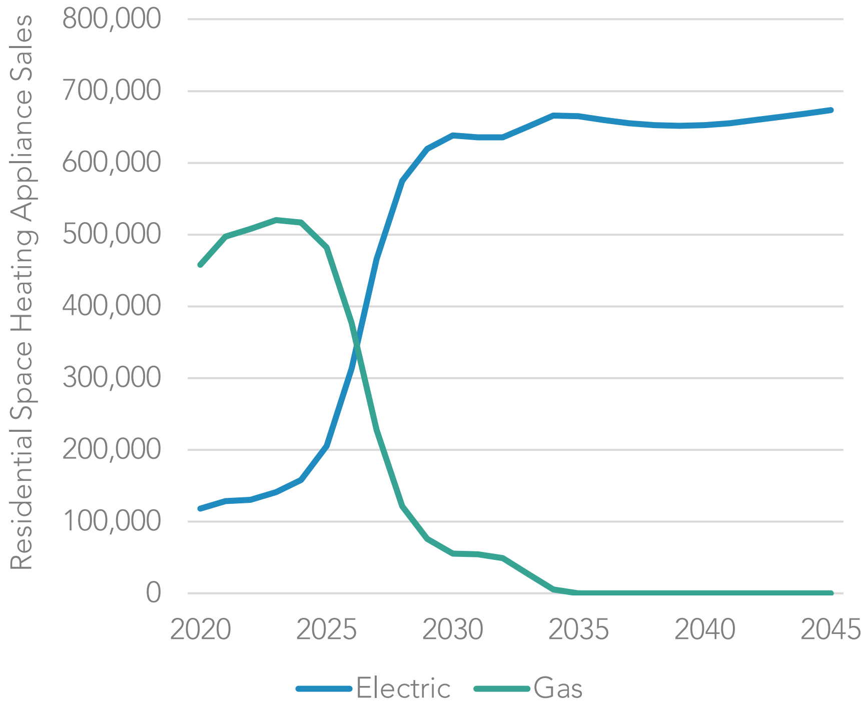


This transition is achieved when all new buildings constructed include non-combustion appliances, and appliances in existing buildings are replaced at the end of their useful life with non-combustion alternatives. Currently, electric alternatives, combined with the decarbonizing of California's grid, are the most effective alternatives, and the Scoping Plan Scenario modeled these alternatives. The Scoping Plan Scenario assumes three million all-electric and electric-ready homes by 2030 and seven million by 2035. Figure 4-9 illustrates the pace at which electric space heating appliance sales increase and gas space heating appliance sales decrease in residences in the Scoping Plan Scenario, such that by 2035 100 percent of residential home appliance sales are electric. By 2030 over six million electric heat pumps are installed statewide. The residential electric space heating appliance sales increases rapidly in the near term as new all-electric buildings are constructed and as existing buildings are renovated to utilize electric appliances. A similar transition is envisioned for other home appliances. Commercial buildings also will undergo a transition away from gas appliances to electric appliances, achieving 80 percent sales of all-electric appliances by 2035 and 100 percent by 2045. Appendix F (Building Decarbonization) describes a holistic policy approach to rapidly grow the

[400] *Other* fuel in the buildings sector is primarily liquid petroleum gas and waste heat.

number of zero emission appliances and buildings, to surmount the market barriers, and to prioritize an equitable transition for vulnerable communities.

Figure 4-9: Residential space heating appliance sales in the Scoping Plan Scenario



Strategies for Achieving Success

- Prioritize California's most vulnerable residents with the majority of funds in the new $922 million Equitable Building Decarbonization program, created through the 2022–2023 state budget. This would include residents in frontline, low-income, disadvantaged, rural, and tribal communities. This program is dedicated to a statewide direct-install building retrofit program for low-income households to replace fossil fuel appliances with electric appliances, energy-efficient lighting, and building insulation and sealing while also coordinating reductions in gas infrastructure in specific geographic areas.
- Achieve three million all-electric and electric-ready homes by 2030 and seven million by 2035 with six million heat pumps installed statewide by 2030.
- Expand incentive programs to support the holistic retrofit of existing buildings, especially for vulnerable communities.
- Ensure that incentive programs prioritize energy affordability and tenant protections, promote affordable and low-income household retrofits that improve habitability and reduce expenses, protect and empower small landlords and homeowners, address overlooked consumer groups, and pair decarbonization

with other critically needed renovation efforts to ensure that buildings support human health and are climate- and weather-resistant.[401]

- End fossil gas infrastructure expansion for newly constructed buildings.[402]
- Evaluate and propose, as needed, changes to strengthen the Cap-and-Trade Program.
- Strengthen California's building standards to support zero-emission new construction.
- Develop building performance standards for existing buildings.
- Adopt a zero-emission standard for new space and water heaters sold in California beginning in 2030, as specified in the 2022 State Strategy for the State Implementation Plan.
- Expand use of low-GWP refrigerants within buildings.
- Support electrification with changes to utility rate structures and by promoting load management programs.
- Increase funding for incentive programs and expand financing assistance programs focused on existing buildings and appliance replacements.
- Expand consumer education efforts to raise awareness and stimulate the adoption of decarbonized buildings and appliances, especially in vulnerable communities.
- Implement biomethane procurement targets for investor-owned utilities as specified in SB 1440 (Hueso, Chapter 739, Statutes of 2018) to reduce GHG emissions in remaining pipeline gas and reduce methane emissions from organic waste.

---

[401] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF23, NF24, NF25, NF26, NF28. *finalejacrecs.pdf (arb.ca.gov)*.

[402] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF22. *finalejacrecs.pdf (arb.ca.gov)*.

Carbon Dioxide Removal and Capture

Climate Change 2022: Mitigation of Climate Change,[403] a report by the IPCC released in early 2022, states "The deployment of CDR to counterbalance hard-to-abate residual emissions is unavoidable if net zero CO_2 or GHG emissions are to be achieved. The scale and timing of deployment will depend on the trajectories of gross emission reductions in different sectors. Upscaling the deployment of CDR depends on developing effective approaches to address feasibility and sustainability constraints especially at large scales." In line with that report, this Scoping Plan considers CDR as a complement to technologically feasible and cost-effective GHG emissions mitigation, and the size of its role will depend on the degree of success in reducing GHG emissions at the source across the economy.[404] The modeling shows that emissions from the AB 32 GHG Inventory sources will continue to persist even if all fossil related combustion emissions are phased out. These residual emissions must be compensated for to achieve carbon neutrality. Options for CDR include both sequestration in natural and working lands and mechanical approaches like direct air capture. Chapter 2 provides estimates on how much CO_2 removal is possible by our natural and working lands and how much must be removed by mechanical CDR.

CCS, which is carbon capture from anthropogenic point sources, is described in Chapter 2 and involves capturing carbon from a smokestack of an emitting facility. Direct air capture, on the other hand, captures carbon directly from the atmosphere. Direct air capture technologies, unlike CCS, are not associated with any particular point source.

For this section, *carbon management* refers to the capture, movement, and sequestration of CO_2 through mechanical solutions for both capture at point sources and direct removal from the atmosphere through direct air capture.[405] Enabling policies and regulations across each of these steps are necessary for individual projects, and on a broader scale, for delivering reductions in support of the state's carbon neutrality and long-term carbon-negative goals. Figure 4-10 provides a graphic of the typical carbon management infrastructure.

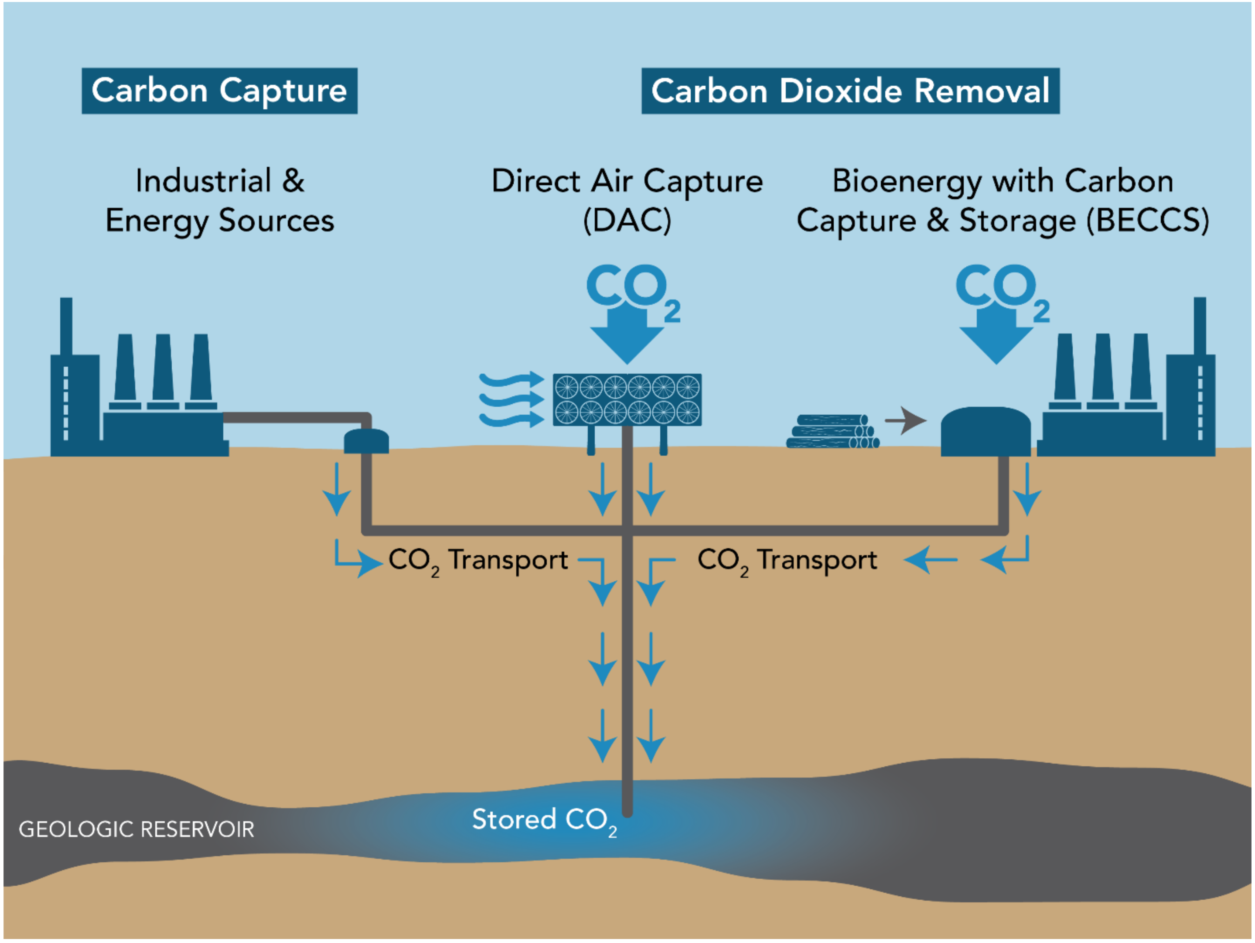
---

[403] IPCC. 2022. *Climate Change 2022: Mitigation of Climate Change.* https://www.ipcc.ch/report/sixth-assessment-report-working-group-3/.

[404] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F4.7. finalejacrecs.pdf (arb.ca.gov).

[405] CDR through natural and working lands is discussed in Chapter 2 and later in this chapter.

Figure 4-10: Carbon management infrastructure



Carbon dioxide removal directly from the atmosphere itself refers to a suite of carbon negative technologies that can be used to draw down ongoing and historical carbon emissions already in the atmosphere. Some CO_2 removal technologies leverage the abilities of both natural photosynthesis and mechanical removal by using biomass wastes as inputs to make low- or zero-carbon energy or fuels, all while capturing and storing produced CO_2.

Captured CO_2 from point sources or from the atmosphere is permanently stored in specialized geologic formations, typically half a mile or more underground. A recent Stanford University study estimated the state's commercial storage potential is nearly 70,000 million metric tons of CO_2, even when excluding oil and gas reservoirs.[406] California is well-positioned because few other places on the West Coast are suitable for

[406] Stanford Center for Carbon Storage. Opportunities and Challenges for CCS in California. https://sccs.stanford.edu/california-projects/opportunities-and-challenges-for-CCS-in-California.

geologic storage at scale. To inform discussion around CO_2 removal, CARB held two full-day workshops exploring the types of options for carbon capture and geologic storage and utilization in products.[407,408,409]

The modeling results provided in Chapter 2 demonstrate the targeted need for CCS on large facilities such as refineries and cement. The CCS numbers do not include the potential additional applications for producing hydrogen with biomethane, other manufacturing, electricity, or other bioenergy. If CCS is not deployed, those emissions would be released directly into the atmosphere and instead need to be addressed through CDR to achieve carbon neutrality. Although a study finds California has 76 existing electricity and industrial facilities that are suitable candidates for CCS retrofit,[410] this Scoping Plan proposes a targeted role for this technology such that it would only be used to address sectors where non-combustion options are not technologically feasible or cost-effective at this time, to the extent needed to achieve the 85 percent reduction in anthropogenic emissions as called for in AB 1279. In future updates to the Scoping Plan, there may be additional options for technologically feasible or cost-effective technologies that may be deployed, which would further reduce the need for CCS and CDR except in situations to address historical GHG emissions.

Recognizing the need for carbon capture and utilization sequestration and removal, the Legislature passed, and the governor signed, SB 905. It includes several key requirements in the development of the state's Carbon Capture Removal, Utilization, and Storage Program. The following is a summary of the work to be completed to establish and administer this program. Many of these steps will address the need to evaluate the safety and efficacy of actions to support carbon removal, sequestration, and transfer via pipelines. Note that not all of these actions are under CARB's authority.

- Review technology to evaluate efficacy, safety, viability of CCUS/CDR methodologies.
- Develop monitoring and reporting requirements and schedules.
- Develop a unified permit application.
- Develop financial responsibility requirements.
- Develop a centralized public database for project status.

---

[407] CARB. December 11, 2019. Carbon Neutrality Meetings & Workshops. *https://ww2.arb.ca.gov/our-work/programs/carbon-neutrality/carbon-neutrality-meetings-workshops*.
[408] CARB. August 2, 2021 Scoping Plan Meetings & Workshops. *https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/scoping-plan-meetings-workshops*.
[409] *Carbon utilization* refers to the use of captured carbon to produce products such as plastics and concrete.
[410] Glenwright, Kara. 2020. *Roadmap for carbon capture and storage in California.* Precourt Institute for Energy. *https://earth.stanford.edu/news/roadmap-carbon-capture-and-storage-california#gs.ysj78q.*

- Consult with CNRA on pore space requirements as CNRA develops a framework for pore space governing agreements.
- Establish a Geologic Carbon Sequestration Group to identify suitable injection well locations, subsurface monitoring, and potential hazards that may require suspension of injection.

SB 905 also has requirements for project developers such as to develop monitoring plans and to avoid any adverse health and environmental impacts at the carbon capture location—or mitigation of unavoidable impacts as required under existing requirements. For the site of injection, there are requirements for site stability, monitoring, and reporting plans. SB 905 also bans CCS with enhanced oil recovery in California and prohibits the transfer of CO_2 via pipeline until the U.S. Department of Transportation's Pipelines and Hazardous Materials Safety Administration (PHMSA) completes its current rulemaking to update existing CO_2 pipeline safety requirements.

An often-cited example of pipeline concerns involves a CO_2 pipeline in Mississippi. On February 22, 2020, a CO_2 pipeline operated by Denbury Gulf Coast Pipelines LLC (Denbury) ruptured in proximity to the community of Satartia, Mississippi. The rupture followed heavy rains that resulted in a landslide, creating excessive axial strain on a pipeline weld (DOT 2022). The combination of weather and topography resulted in a slower dissipation of the gas. The pipeline was also carrying hydrogen sulfide, a flammable and toxic gas. The pipeline failed on a steep embankment, which had recently subsided. Heavy rains are believed to have led to a landslide, which created axial strain on the pipeline and resulted in a full circumferential girth weld failure. The PHMSA investigation also revealed several contributing factors to the accident, including but not limited to: Denbury not addressing the risks of geohazards in its plans and procedures, underestimating the potential affected areas that could be impacted by a release in its CO_2 dispersion model, and not notifying local responders to advise them of a potential failure.

As the Satartia example highlights, appropriate pipeline safety and environmental standards in California are critical to minimize any risks from CO_2 transport in the future. As such, SB 905 also tasks CNRA, in consultation with the Public Utilities Commission, to, no later than February 1, 2023, provide a proposal to the Legislature to establish a state framework and standards for the design, operation, siting, and maintenance of intrastate pipelines carrying CO_2 fluids of varying composition and phase to minimize the risk posed to public and environmental health and safety. The recommended framework shall be designed to minimize risk to public health and environmental health and safety, to the extent feasible. Because SB 905 prohibits the transfer of CO_2 via pipeline until the PHMSA completes its current rulemaking to update existing CO_2 pipeline safety requirements, CCS or CDR projects that would require a pipeline to transfer CO_2 are not feasible at this time within California.

Ultimately, and in accordance with SB 905, the merits of each CCS or CDR project must be evaluated on a case-by-case basis.[411] Deployment of CCS and CDR could support skilled jobs and workforces, including those in traditional fossil energy communities. Other co-benefits could include criteria air pollutant reductions and water production. It will be important to design projects that do not exacerbate community health impacts, include early and ongoing community engagement, and are in compliance with local, state, and federal public health and environmental protection laws. It also should be noted that, as these types of projects are an emerging area of governance, additional coordination and discussion will be needed among the various levels of authorities involved. SB 905 has already initiated this process by assigning specific agencies with tasks related to their expertise and authority.

Chapter 2 includes a more detailed discussion about the proposed role of CO_2 removal in this Scoping Plan.

Sector Transition

State,[412] national,[413,414] and global decarbonization analyses[415] indicate a significant role for carbon management infrastructure, yet relatively few projects are operational. Around the world, about two dozen large CCS projects are capturing tens of millions of metric tons of CO_2 each year, with about a dozen operating in the United States.[416] The vast majority of capacity is at industrial facilities, such as ethanol and fertilizer plants, that would otherwise vent nearly pure CO_2 into the atmosphere as a by-product of normal, non-combustion processes. Future research, development, and demonstration projects must refine and commercialize capture systems for more complex applications, especially

[411] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F4.5. finalejacrecs.pdf (arb.ca.gov).

[412] E3. October 2020. Achieving Carbon Neutrality in California Report: Final Presentation. https://ww2.arb.ca.gov/sites/default/files/2020-10/e3_cn_final_presentation_oct2020_2.pdf.

[413] World Resources Institute. January 31, 2020. CarbonShot: Federal Policy Options for Carbon Removal in the United States. Working paper. https://www.wri.org/research/carbonshot-federal-policy-options-carbon-removal-united-states.

[414] C2ES. No date. Getting to Zero: A U.S. Climate Agenda — Center for Climate and Energy Solutions. https://www.c2es.org/getting-to-zero-a-u-s-climate-agenda-report/.

[415] IPCC. Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development. Chapter 2. https://www.ipcc.ch/sr15/chapter/chapter-2/. All analyzed pathways limiting warming to 1.5°C with no or limited overshoot use CDR to some extent to neutralize emissions from sources for which no mitigation measures have been identified and, in most cases, also to achieve net negative emissions to return global warming to 1.5°C following a peak (high confidence). The longer the delay in reducing CO_2 emissions toward zero, the larger the likelihood of exceeding 1.5°C, and the heavier the implied reliance on net negative emissions after mid-century to return warming to 1.5°C (high confidence).

[416] Congressional Research Service. 2021. Carbon Capture and Sequestration (CCS) in the United States. R44902. https://crsreports.congress.gov/product/pdf/R/R44902?msclkid=e45e0012c25911ec8085ca575cb61e82.

for those with limited decarbonization options. It has only been in the last few years that attention has seriously turned to mechanical CDR. As new information and modeling on climate change have been made available, the science has become clearer that avoiding the most catastrophic impacts of climate change requires both reducing emissions and deploying mechanical CDR.

California is paving a path forward on a science-based carbon management infrastructure policy that can serve as an example for other jurisdictions. The LCFS, which reduces the carbon intensity of transportation fuels, includes a protocol for select carbon management projects to become certified and generate LCFS credits.[417] CCS is not a new concept or technology. Twenty years of CCS testing show it is a safe and reliable tool.[418] As mentioned in Chapter 2, while no new CCS projects have been implemented or generated any credits under the CARB CCS protocol, CCS projects have been implemented elsewhere since the 1970s. Moreover, there has been a U.S. Department of Energy CCS research program underway for more than two decades. These all form a foundation of information for future efforts. Certified projects must successfully demonstrate adherence to rigorous pre-construction, operational, and site closure standards designed to strengthen environmental performance, as described in CARB's CCS Protocol. The protocol is designed to layer on top of existing federal carbon sequestration regulations designed to protect the environment. The protocol would need to be reevaluated if CCS were to be more broadly applied across sectors beyond transportation fuel production.

Direct air capture and carbon mineralization have high potential capacity for removing carbon, but direct air capture is currently limited by high cost. Carbon mineralization may also have high potential for removing carbon from the atmosphere, but understanding of the technology is still limited.[419] Direct air capture could also be deployed at higher rates to remove legacy GHG emissions from the atmosphere. Chapter 2 contains additional information on the current status of CCS and mechanical CDR projects globally, as well as federal support of such technologies.

Strategies for Achieving Success

- Implement SB 905.

---

[417] CARB. 2018. Carbon Capture and Sequestration Protocol under the Low Carbon Fuel Standard. August 13. https://ww2.arb.ca.gov/sites/default/files/2020-03/CCS_Protocol_Under_LCFS_8-13-18_ada.pdf.
[418] National Energy Technology Laboratory. Permanence and Safety of CCS. https://netl.doe.gov/coal/carbon-storage/faqs/permanence-safety.
[419] Aines, Roger. No date. Options for Removing CO_2 from California's Air. Lawrence Livermore National Laboratory. https://ww2.arb.ca.gov/sites/default/files/2021-08/llnl_presentation_sp_engineeredcarbonremoval_august2021.pdf.

- Convene a multi-agency Carbon Capture and Sequestration Group comprised of federal, state, and local agencies to engage with environmental justice advocates, tribes, academics, researchers, and community representatives to identify the current status, concerns, and outstanding questions concerning CCS, and develop a process to engage with communities to understand specific concerns and consider guardrails to ensure safe and effective deployment of CCS.[420]
- Iteratively update the CARB CCS Protocol with the best available science and implementation experience.
- Incorporate CCS into other sectors and programs beyond transportation where cost-effective and technologically feasible options are not currently available and to achieve the 85 percent reduction in anthropogenic sources below 1990 levels as called for in AB 1279.
- Evaluate and propose, as appropriate, financing mechanisms and incentives to address market barriers for CCS and CDR.
- Evaluate and propose, as appropriate, the role for CCS in cement decarbonization (SB 596) and as part of hydrogen production pathways (SB 1075).
- Support carbon management infrastructure projects through core CEC research, development, and demonstration (RD&D) programs.
- Continue to explore carbon capture applications for producing or leveraging zero-carbon power for reliability needs as part of SB 100.
- Consider carbon capture infrastructure when developing hydrogen roadmaps and strategy, especially for non-electrolysis hydrogen production.
- Evaluate and streamline permitting barriers to project implementation while protecting public health and the environment.
- Explore options for how local air quality benefits can be achieved when CCS is deployed.
- Explore opportunities for CCS and CDR developers to leverage existing infrastructure, including subsurface infrastructure.
- Explore permitting options to allow for scaling the number of sources at carbon sequestration hubs.

Short-Lived Climate Pollutants (Non-Combustion Gases)

Short-lived climate pollutants (SLCPs) include black carbon (soot), methane (CH_4), and fluorinated gases (F-gases, including hydrofluorocarbons [HFCs]). They are powerful climate forcers and harmful air pollutants that have an outsized impact on climate change

[420] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F4.9. finalejacrecs.pdf (arb.ca.gov).

in the near term, compared to longer-lived GHGs, such as CO_2. According to the IPCC's *Climate Change 2021: The Physical Science Basis,* in the near-term (i.e., 10- to 20-year time scale) the warming influence of all SLCPs combined will be at least as large as that of CO_2.[421] The United Nations Environment Programme's Global Methane Assessment[422] advises that achieving the least-cost pathways to limit warming to 1.5°C requires global methane emission reductions of 40–45 percent by 2030 alongside substantial simultaneous reductions of all climate forcers, including CO_2 and SLCPs. Action to reduce these powerful emissions sources today will provide immediate benefits—both to human health locally and to reduce warming globally—as the effects of our policies to transition to low carbon energy systems and achieve carbon neutrality further unfold.

In 2017, the Board approved the comprehensive Short-Lived Climate Pollutant Reduction Strategy (Strategy).[423] This strategy explained how the state would meet the following SB 1383-established targets:

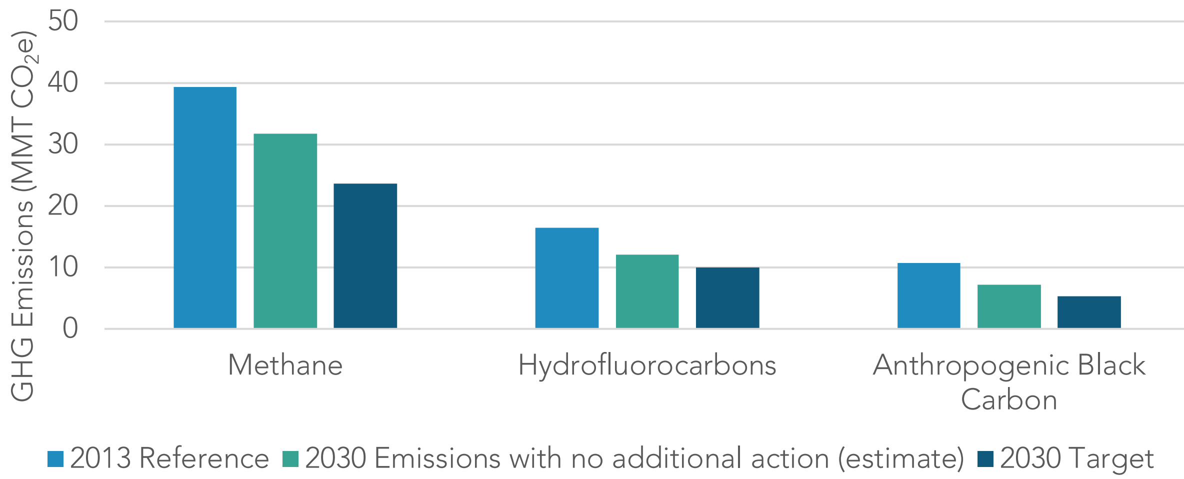
- 40 percent reduction in total methane emissions[424] (including a separate 40 percent reduction in dairy and livestock emissions)
- 40 percent reduction in hydrofluorocarbon gas emissions
- 50 percent reduction in anthropogenic black carbon emissions
- 50 percent reduction of organic waste disposal from 2014 levels by 2020, and 75 percent by 2025, including recovery of at least 20 percent of edible food for human consumption

The state is expected to achieve roughly half of the SB 1383 targeted emissions reductions by 2030 through strategies currently in place (See Figure 4-11). As directed by the Legislature under SB 1383, state agencies focused on voluntary, incentive-based mechanisms to reduce SLCP emissions in the early years of implementation to overcome technical and market barriers. Under this "carrot-then-stick" strategy, incentives are replaced with requirements as the solutions become increasingly feasible and cost-effective. To meet legislated targets, more aggressive action is needed.

---

421 IPCC. 2021. *Climate Change 2021:The Physical Science Basis.* https://www.ipcc.ch/report/ar6/wg1/.
422 United Nations. Global Methane Assessment. Summary for Policymakers. https://wedocs.unep.org/bitstream/handle/20.500.11822/35917/GMA_ES.pdf.
423 CARB. 2017. Short-Lived Climate Pollution Reduction Strategy. https://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf.
424 All SB 1383 emissions reductions are mandated to be realized by 2030 and are relative to 2013 levels.

Figure 4-11: Expected progress toward SB 1383 targeted emissions reductions by 2030 through strategies currently in place



While the state's overall GHG emissions have declined by 9 percent over the past decade, SLCP emissions reductions have not kept pace with broader progress toward decarbonization. After growing steadily in the preceding decade, methane emissions have remained relatively flat since 2013.

HFCs are the fastest growing source of GHG emissions, primarily driven by their use to replace ozone-depleting substances and an increased demand for cooling and refrigeration.[425] Since 2005, statewide HFC emissions have more than doubled. While the rate of increase has slowed in recent years due to the state's measures, HFC emissions are still on the rise in California, and have grown by over 50 percent since 2010.[426] Globally, as temperatures rise, adoption of cooling technologies (and refrigerants) is increasing rapidly. If no measures are taken, it is estimated that HFCs will account for 9 to 19 percent of the total global GHG emissions by 2050.[427]

---

[425] CARB. 2022. *California Greenhouse Gas Emissions for 2000 to 2020: Trends of Emissions and Other Indicators.* https://ww2.arb.ca.gov/sites/default/files/classic/cc/inventory/2000-2020_ghg_inventory_trends.pdf.

[426] CARB. 2022. *California Greenhouse Gas Emissions for 2000 to 2020.* https://ww2.arb.ca.gov/sites/default/files/classic/cc/inventory/2000-2020_ghg_inventory_trends.pdf.

[427] Velders, G. J., D. W. Fahey, J. S. Daniel, M. McFarland, and S. O. Andersen. 2009. "The large contribution of projected HFC emissions to future climate forcing." *Proceedings of the National Academy of Sciences* 106(27), 10949–10954.

Methane

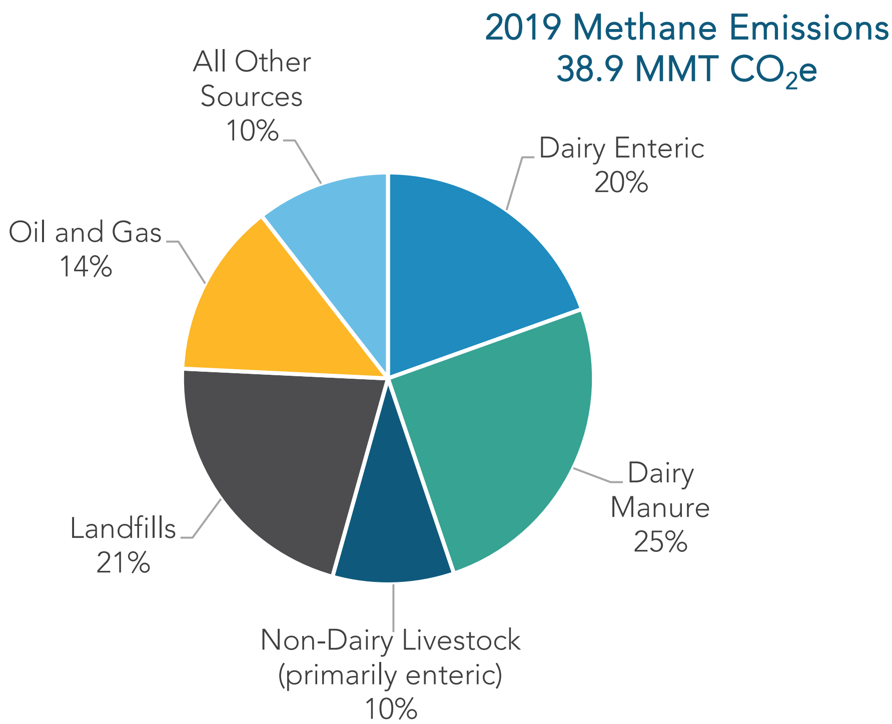
Human sources of methane emissions are estimated to be responsible for up to 25 percent of current warming.[428] Fortunately, methane's short atmospheric lifetime of ~12 years[429] means that emissions reductions will rapidly reduce concentrations in the atmosphere, slowing the pace of temperature rise in this decade. Further, a substantial portion of the targeted reductions can be achieved at low cost and will provide significant human health benefits. For example, the UN's *Global Methane Assessment* (2021)[430] found that over half of the available targeted measures have mitigation costs below \$21/MTCO_2e, and that each million metric tons of methane reduced would prevent 1,430 premature deaths annually due to ozone pollution caused by methane.

Following the Twenty Sixth Conference of Parties (COP26) (the United Nations Convention on Climate Change in 2021), over 110 nations have signed onto the Global Methane Pledge (Pledge)[431] to limit methane emissions by 30 percent relative to 2020 levels. The Pledge covers countries that emit nearly half of all methane and make up 70 percent of global GDP. The UN's Global Methane Assessment[432] shows that human-caused methane emissions can be reduced by up to 45 percent this decade, which would avoid nearly 0.3°C of global warming by 2045.

As shown in Figure 4-12, the three largest sources of California's methane emissions are the dairy and livestock industry, landfills, and oil and gas systems.

[428] IPCC. 2021. *Climate Change 2021:The Physical Science Basis.* https://www.ipcc.ch/report/ar6/wg1/.
[429] In contrast, the lifetime of CO_2 is hundreds of years. The IPCC Third Assessment Report concluded that no single lifetime can be defined for CO_2 because of the different rates of uptake by different removal processes. According to IPCC Fourth Assessment Report, the majority of an increase in CO_2 will be removed from the atmosphere within decades to a few centuries, while the remaining 20 percent may stay in the atmosphere for many thousands of years.
[430] United Nations. 2021. Global Methane Assessment. https://wedocs.unep.org/bitstream/handle/20.500.11822/35917/GMA_ES.pdf.
[431] Global Methane Pledge. https://www.globalmethanepledge.org/.
[432] United Nations Environment Programme. 2021. Global Methane Assessment: Benefits and Costs of Mitigating Methane Emissions. https://www.unep.org/resources/report/global-methane-assessment-benefits-and-costs-mitigating-methane-emissions?msclkid=00661370c85811eca078eb8fdbd603d1.

Figure 4-12: Sources of California methane emissions (2019)



Emissions from dairy and livestock operations come from two main sources: (1) enteric fermentation and (2) manure management operations, especially at dairies that employ open anaerobic lagoons that allow methane to escape into the atmosphere. Landfills, the second largest source of methane emissions, produce methane from the decomposition of organic waste. Although approximately 95 percent of all the waste that has been disposed of in the state has been deposited in a landfill that is equipped with a gas collection and control system, as required by California's Landfill Methane Regulation,[433] a portion of the methane still escapes into the atmosphere. Fugitive methane emissions can be intermittent and highly variable, both seasonally and spatially, particularly at landfills. Research has shown that landfills are complex systems and a wide range of conditions (e.g., atmospheric, operational, biological, chemical, and physical) may contribute to variability in rates of organic waste degradation, methane generation, and capture efficiency, so reducing the amount of organics deposited in landfills is critical to reducing overall landfill methane emissions. And despite the variability in individual landfill emissions, landfill gas collection and control systems remain the most effective strategy

[433] CARB. Landfill Methane Regulation. https://ww2.arb.ca.gov/our-work/programs/landfill-methane-regulation.

for reducing methane emissions from waste once it is placed in a landfill. Non-combustion methane emissions from the oil and gas sector are the third largest source of methane emissions in California. Almost three-quarters of the methane emissions from this sector come from leaks and venting from fossil gas transmission and distribution pipelines and equipment.

Hydrofluorocarbons

HFCs are synthetic GHGs that are powerful climate forcers. They are used mainly as refrigerants or heat transfer fluids in refrigeration, space conditioning, and heat pump equipment. Refrigerants are ubiquitous and are used everywhere from supermarkets, convenience stores, cold storage warehouses and wineries, to vending machines and residential and motor vehicle air-conditioners. Additionally, HFCs are also used as foam-blowing agents, solvents, aerosol-propellants, and fire suppressants. While HFCs remain in the atmosphere for a much shorter time than CO_2, the relative global warming potential (GWP) values of HFCs can be hundreds to thousands of times greater than CO_2. The mix of HFCs currently in use in California, weighted by usage (tonnage), have an average 100-year GWP of 1,700.[434] The average atmospheric lifetime of the mix of HFCs in use is 15 years.[435] Given the short average lifetimes, rapid reductions in HFC emissions can translate into near-term reductions in climate change effects.

As the global temperatures increase, the demand for cooling and refrigerants will continue to grow, as will the use of electric heat pumps to replace conventional fossil gas heating options. Unless addressed, continued use of high-GWP HFCs will perpetuate a feedback loop, where the cooling agents themselves cause additional warming.

In 2016, representatives from 197 nations signed the Kigali Amendment, which amended the existing Montreal Protocol (to reduce ozone-depleting substance production and consumption) to include a global phasedown in the production and consumption of HFCs beginning in 2019.[436] As of September 2022, 137 nations have either accepted, approved, or ratified the Kigali Amendment. On September 21, 2022, the U.S. Senate approved ratification of the Kigali Amendment, and it is expected that the United States

---

[434] CARB. 2020. *Initial Statement of Reasons: Public Hearing to Consider the Proposed Amendments to the Prohibitions on Use of Certain Hydrofluorocarbons in Stationary Refrigeration, Chillers, Aerosols-Propellants, and Foam End-Uses Regulation.* October 20. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hfc2020/isor.pdf?_ga=2.164659835.592460318.1646664679-912670513.1542398285.

[435] Zhongming, Z., et al. 2011. *HFCs: A Critical Link in Protecting Climate and the Ozone Layer: A UNEP Synthesis Report.*

[436] United Nations Treaty Collection. Chapter XXVII, Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer. https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XXVII-2-f&chapter=27&clang=_en.

will soon join the 137 nations that have already ratified.[437] In the United States, Congress enacted the federal *American Innovation and Manufacturing (AIM) Act* in December 2020.[438] The AIM Act authorizes the U.S. EPA to address HFCs in several ways, including a national HFC phasedown that nearly mirrors the schedule of the global phasedown under the Kigali amendment.[439]

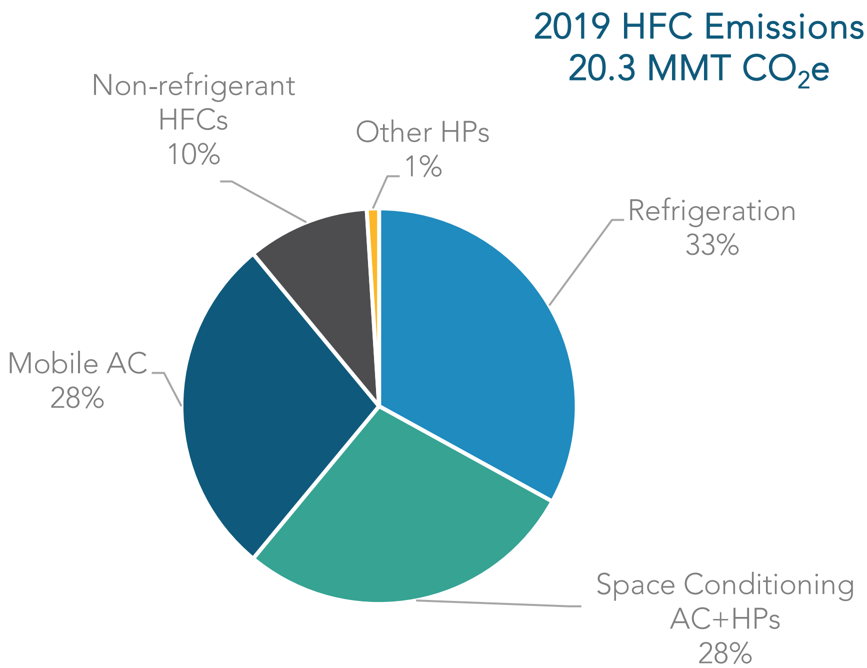
Nearly 90 percent of HFC emissions in California come from their use as refrigerants in the commercial, industrial, residential, and transportation sectors. The timescales over which the HFC emissions occur vary, depending on the type of application. Thus, strategies to reduce HFC emissions must be tailored by equipment type. CARB has several measures in place to tackle HFC emissions from the various sources shown in Figure 4-13 below. This includes the Refrigerant Management Program[440] that tracks and manages emissions from large commercial, industrial, and cold storage refrigeration facilities in the state. CARB has adopted regulations to reduce HFC emissions from consumer product aerosol propellants, semiconductor manufacturing, and small cans of automotive refrigerant.[441]

In 2018, California adopted HFC prohibitions via regulation and legislation for several sectors, including stationary refrigeration and foam end uses to backstop the partially vacated federal Significant New Alternatives Policy (SNAP) program.[442] Most recently, in 2020, CARB adopted additional measures that place GWP limits on refrigerants used in refrigeration and air conditioning equipment, which are the largest sources of HFC emissions, and are commonly used in residential, commercial, and industrial buildings. Additionally, CARB adopted a unique pilot program requiring the use of reclaimed refrigerant: the Refrigerant Recovery, Reclaim, and Reuse (R4) Program. The newly adopted HFC rules for the refrigeration and air conditioning sectors are the first of their kind in the nation.

---

[437] U.S. Ratification of the Kigali Amendment - United States Department of State. https://www.state.gov/u-s-ratification-of-the-kigali-amendment/.
[438] 42 U.S.C § 7675, Pub. L. 116-260, § 103. https://www.epa.gov/sites/default/files/2021-03/documents/aim_act_section_103_of_h.r._133_consolidated_appropriations_act_2021.pdf.
[439] 42 U.S.C § 7675, Pub. L. 116-260, § 103.
[440] Cal. Code of Regs., tit. 17, §§ 95380, et seq.
[441] Contained in various sections, commencing with Cal. Code of Regs., tit. 13, §§ 1900 et seq.
[442] Cal. Code of Regs., tit. 17, §§ 95371, et seq.; California Cooling Act, Senate Bill 1013 (Lara, Stats. of 2018, Ch. 375, Health & Saf. Code § 39764).

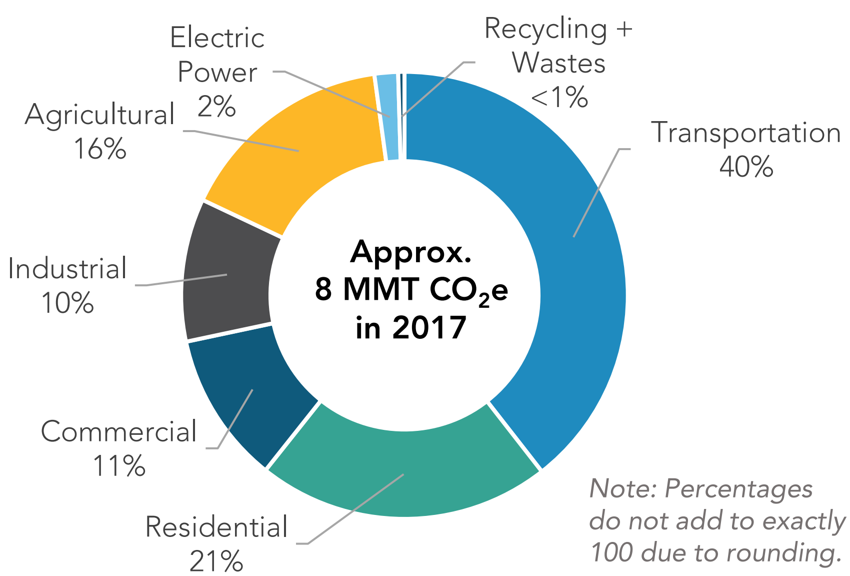
Figure 4-13: Sources of hydrofluorocarbon (HFC) emissions (2019)



Anthropogenic Black Carbon

Black carbon is not included in AB 32 or the state's AB 32 GHG inventory that tracks progress toward the state's climate targets; however, it has been identified as a powerful climate forcer and is included California's Short-Lived Climate Pollutant Reduction Strategy. The majority of anthropogenic black carbon emissions come from transportation, specifically heavy-duty vehicles, and they have decreased since 2013 due to engine certification standards and in-use rules for on-road and off-road fleets, along with clean fuel requirements and incentives, including California Climate Investments and LCFS credits. Additionally, fuel combustion for residential, commercial, and industrial applications contribute significantly to overall black carbon emissions. Approximately 95 percent of residential black carbon emissions are due to wood combustion; these emissions are being reduced through programs like the Woodsmoke Reduction Program established by SB 563 (Lara, Chapter 671, Statutes of 2017). Alternatives to agricultural burning and policies that phase out agricultural burning will also result in agricultural black carbon emissions reductions. In 2021 CARB provided a preliminary estimate of 2017 black carbon emissions (Figure 4-14).[443] This estimate will be finalized as part of a future update to the Short-Lived Climate Pollutant Inventory.

Figure 4-14: Sources of anthropogenic black carbon (preliminary 2017 estimates; AR5 100-yr GWP 900)



Sector Transition

California has long recognized the importance of mitigating non-combustion SLCPs and took several early action measures as part of a comprehensive, ongoing program to reduce in-state GHG emissions under AB 32. The early action measures included CARB's Landfill Methane Regulation,[444] Refrigerant Management Program,[445] and Oil and Gas Methane Regulation.[446]

Methane

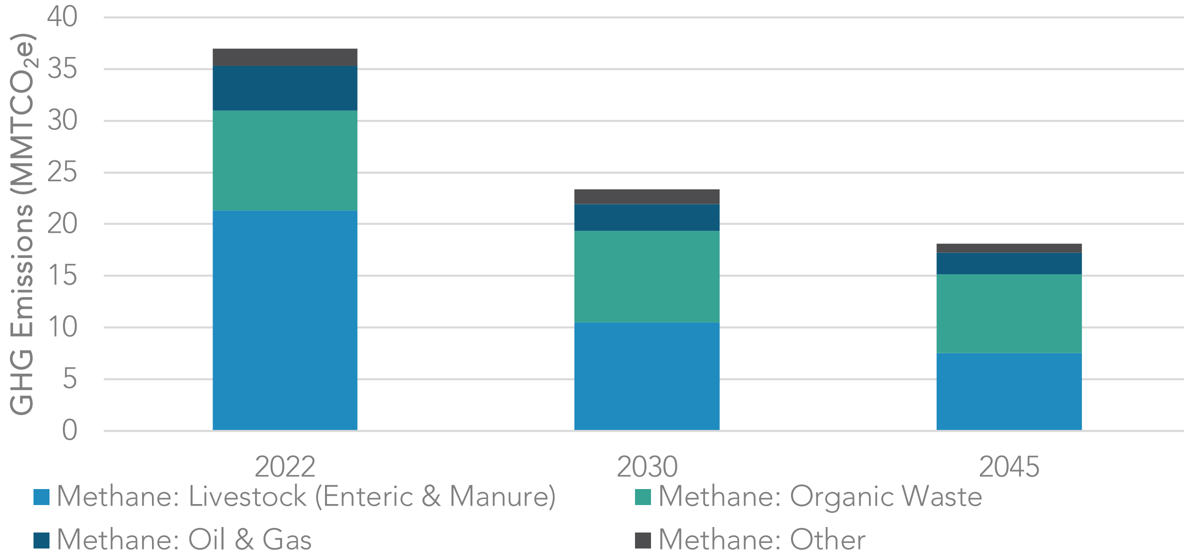
The methane abatement strategies currently in place are projected to achieve half of the methane emissions needed to meet the overall methane reduction target of SB 1383 (40 percent reduction by 2030). The reduction target translates to a limit of less than 24 MMTCO_2e in 2030 (Figure 4-15). It is anticipated that, since some sectors have fewer

---

[443] CARB. 2021. 2022 Scoping Plan Update – Short-Lived Climate Pollutants Workshop Presentation, September 8. https://ww2.arb.ca.gov/sites/default/files/2021-09/carb_presentation_sp_slcp_september2021_1.pdf.
[444] Cal. Code of Regs., tit. 17, §§ 95460, et seq.
[445] Cal. Code of Regs., tit. 17, §§ 95380, et seq.
[446] Cal. Code of Regs., tit. 17, §§ 95665–77.

strategies that can be implemented to reduce methane in the near-term, other sectors will need to go beyond the 40 percent reduction to meet the target.

Figure 4-15: Methane emissions in 2022, 2030, and 2045 in the Scoping Plan Scenario[447]



Dairy and Livestock Methane

California is the largest dairy-producing state, home to one in five U.S. dairy cows. To date, methane emissions reductions from the dairy and livestock sector have mainly been driven by a decreasing animal population and the growing adoption of manure management strategies, including anaerobic digesters and conversion to dry manure systems and pasture systems. CARB recently completed a detailed analysis of the emission reductions expected by 2030 and the estimated additional investment needed to reach the dairy and livestock sector methane reduction target. [448]

Assuming no adoption of additional manure management and enteric mitigations strategies beyond the projects that have committed funding, and a continued annual animal population decrease of 0.5 percent per year through 2030, further reductions of approximately 4.4 $MMTCO_2e$ will be needed to achieve the 2030 methane emissions reduction target for the sector set by SB 1383. If the remaining reductions are met through

---

[447] The *Organic Waste* category includes methane from landfills, wastewater treatment, and compost facilities.

[448] CARB. 2021. Analysis of Progress toward Achieving the 2030 Dairy and Livestock Sector Methane Emissions Target. June. https://ww2.arb.ca.gov/sites/default/files/2021-06/draft-2030-dairy-livestock-ch4-analysis.pdf.

a mix of dairy projects in which half are dairy digesters and half are alternative manure management projects, then it is estimated that at least 420 additional projects will be necessary. Additional emissions reductions beyond this level will likely be necessary to ensure that the overall state methane emissions reduction targets are met.

Despite the considerable methane emissions mitigation potential of enteric strategies like feed additives, little progress has been made, as few products with proven mitigation potential have become commercially available, and unlike manure management strategies, there is a lack of financial incentives for their adoption.

Market conditions favoring farm consolidation and improved production efficiencies have driven reductions in the California and U.S. dairy population over the past decade. [449] These efficiency gains have allowed California to maintain production levels despite the decreasing population. If demand for dairy and beef products remains steady or increases, continued improvements in production efficiency and adoption of effective manure management and enteric mitigation strategies will be important to support dairy and livestock methane emission reductions.

Strategies for Achieving Success

- Install state of the art anaerobic digesters that maximize air and water quality protection, maximize biomethane capture, and direct biomethane to sectors that are hard to decarbonize or as a feedstock for energy.
- Increase alternative manure management projects, including but not limited to conversion to “solid,” “dry,” or “scrape” manure management; installation of a compost-bedded pack barn; an increase in the time animals spend on pasture; and implementation of solid-liquid separation technology into flush manure management systems.
- Implement enteric fermentation strategies that are cost-effective, scientifically proven, safe for animal and human health, and acceptable to consumers, and that do not impact animal productivity. Provide financial incentives for these strategies as needed.
- Accelerate demand for dairy and livestock product substitutes such as plant-based or cell-cultured dairy and livestock products to achieve reductions in animal populations.
- In consideration of pace of deployment of methane mitigation strategies and the scale of complimentary incentives, consider regulation development to ensure that the 2030 target is achieved, assuming the conditions outlined in SB 1383 are met.

[449] MacDonald, James M., Jonathan Law, and Roberto Mosheim. 2020. *Consolidation in U.S. Dairy Farming.* ERR-274. July. https://www.ers.usda.gov/webdocs/publications/98901/err-274.pdf.

Landfill Methane

Achieving the 75 percent organic waste disposal reduction target[450] of SB 1383, and maintaining that level of disposal in subsequent years, would bring annual landfill emissions in 2030 to just below the 2013 baseline. Annual methane emissions will be higher through 2030 than originally anticipated by the SLCP Strategy because the state did not achieve the anticipated reductions in organic waste disposal of 50 percent below 2014 levels by 2020. SB 1383 prohibited the organic disposal regulations from taking effect until 2022,[451] and, as a result, emissions have continued to increase.

Due to the multidecadal time frame required to break down landfilled organic material, the emissions reductions from diverting organic material in one year are realized over the course of several decades. For example, one year of waste diversion in 2030 is expected to avoid 8 $MMTCO_2e$ of landfill emissions, cumulatively, over the lifetime of that waste's decomposition.[452] Near-term diversion efforts are critical to avoid locking in future landfill methane emissions.

CalRecycle's 2020 report, *Analysis of the Progress Toward the SB 1383 Waste Reduction Goals,*[453] estimated that 8 million short tons of composting and anerobic digestion capacity will be needed to manage organic wastes, above the existing and new capacity expected to be available by 2025. The 2019 report, *Co-Digestion Capacity in California,*[454] from the State Water Resources Control Board estimated that at least 2.4 million tons of digester capacity is available at urban wastewater treatment plants if sufficient incentives or funding for collection, receiving, and processing operations are provided to enable utilization of this capacity. The CPUC approved a decision in February 2022 implementing the biomethane procurement program, which will require investor-owned utilities by 2025 to procure 17.6 billion cubic feet (BCF) of biomethane produced from organic wastes to support the landfill disposal reduction and SLCP target and reduce fossil gas reliance for

---

[450] The target is from 2014 levels by 2025.

Public Resources Code, § 42652.5. CalRecycle approved the SLCP: Organic Waste Reductions regulations (*https://calrecycle.ca.gov/organics/slcp/*) in 2020 and began implementing them in January 2022. These regulations are designed to achieve the 2025 disposal reduction and edible food recovery targets.

[452] The life cycle emissions reduction is based on anticipated diversion of 27 million short tons of organic waste from CalRecycle (2020) Analysis of the Progress Toward the SB 1383 Organic Waste Reduction Goals (*https://www2.calrecycle.ca.gov/Publications/Details/1693*). Under CalRecycle's SLCP regulations, an alternative to landfill disposal must achieve a life cycle GHG reduction of 0.3 $MTCO_2e$ per short ton of waste diverted.

[453] CalRecycle. 2020. *Analysis of the Progress Toward the SB 1383 Waste Reduction Goals.* *https://www2.calrecycle.ca.gov/Publications/Details/1693*.

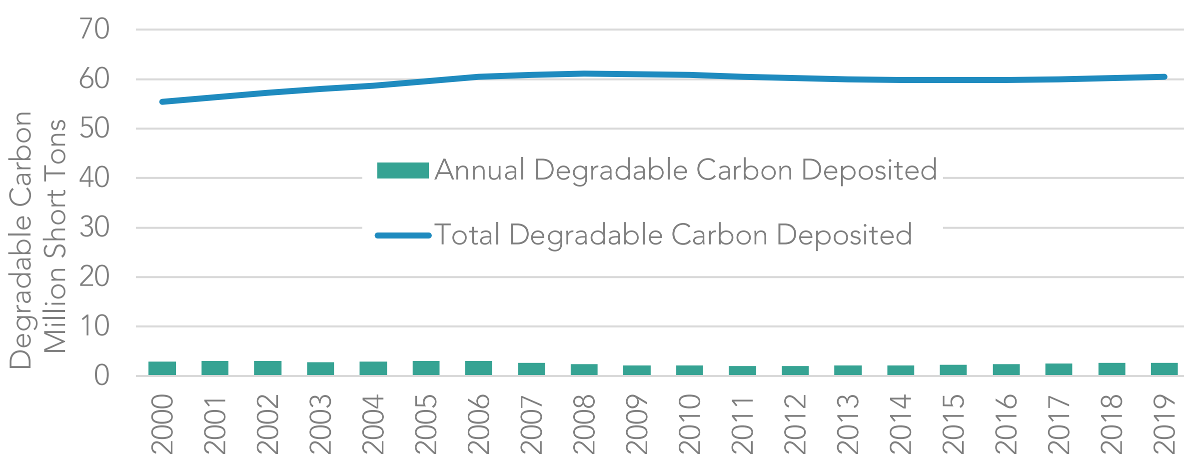
[454] State Water Resources Control Board. 2019. *Co-Digestion Capacity in California.* *https://www.waterboards.ca.gov/water_issues/programs/climate/docs/co_digestion/final_co_digestion_capacity_in_california_report_only.pdf*.

residential and commercial customers.[455] Additionally, the organic waste stream includes more than one million tons of edible food that could be recovered before it enters the waste stream through food rescue programs that combat hunger in communities throughout California.

While reducing organic waste disposal is the most effective means of achieving reductions in waste sector methane, strategies to reduce emissions from waste already in place in landfills also will play a role in achieving near-term reductions. As Figure 4-16 shows, the total degradable carbon (a measure of the amount of waste with potential to generate methane) that is accumulated from waste deposited in previous years is over 20 times greater than the amount added each year. This illustrates that even if we were able to entirely phase out landfilling of organic waste today, the existing waste in place at landfills would continue to generate methane for decades into the future.

Through a combination of improvements in operational practices, use of lower permeability covers, advanced landfill gas collection systems, and increased monitoring to detect and repair leaks, it is estimated that a direct emission reduction of 10 percent is achievable across the state's landfills by 2030. Technologies to utilize landfill gas efficiently can contribute further emission reductions in the energy sector.

Figure 4-16: Degradable carbon deposited in landfills



Strategies for Achieving Success

- Maximize existing infrastructure and expand it to reduce landfill disposal, with strategies including composting, anaerobic digestion, co-digestion at wastewater treatment plants, and other non-combustion conversion technologies.

455 CPUC. 2022. Decision 22-02-025.

- Expand markets for products made from organic waste, including through recognition of the co-benefits of compost, biochar, and other products.[456]
- Recover edible food to combat food insecurity.
- Invest in the infrastructure needed to support growth in organic recycling capacity.
- Utilize existing digesters at wastewater treatment facilities to rapidly expand food waste digestion capacity.
- Direct biomethane captured from landfills and organic waste digesters to sectors that are hard to decarbonize.
- Implement improved technologies and best management practices at composting and digestion operations.
- Reduce emissions from landfills through improvements in operational practices, lower permeability covers, advanced collection systems, and technologies to utilize landfill gas.
- Leverage advances in remote sensing capabilities to quickly pinpoint large methane sources and mitigate leaks, improve understanding of the factors that lead to better capture efficiency, and explore new technologies and practices that can reliably improve methane control at landfills.

Upstream Oil and Gas Methane Reduction

For oil and gas production, processing, and storage, California is currently on track to achieve a 41 percent reduction in methane emissions by 2025 relative to 2013. The additional reductions needed to meet the 2030 target may be achieved by implementing additional regulatory requirements to further reduce intentional venting of fossil gas from equipment. If necessary, additional reductions from transmission and distribution facilities may be achieved by requiring the utilities to increase inspection and repair activities or further reduce emissions from pipeline blowdowns by implementing methods such as using portable compressors, using plugs to isolate sections of pipelines, flaring vented gas, routing gas to fuel gas systems, and installing static seals on compressor rods. Advances in methane detection technologies (e.g., satellites equipped to detect large methane sources) may also help to identify and mitigate methane emissions quickly across the oil and gas sector.

As California transitions away from fossil fuels, in-state oil and gas production will likely decline. This could result in an increase over time in the number of long-term idle and orphan wells (idle wells lacking a financially solvent, responsible owner) in the state. While California has regulations aimed at helping ensure operators manage their idle wells,

---

[456] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F4.4. finalejacrecs.pdf (arb.ca.gov).

there could likely be an increase in California's orphan well population. Plugging all orphan wells, of which there are currently over 5,000, could take decades due to the limited resources California has for orphan well plugging. The benefits from plugging wells include methane emission reductions and job creation; employment gains from well plugging and site remediation activities could help temporarily offset job losses from the oil and gas industry. The California Council on Science and Technology's 2018 report on orphan wells, *Orphan Wells in California: An Initial Assessment of the State's Potential Liabilities to Plug and Decommission Orphan Oil and Gas Wells,*[457] found that the potential cost to the state of plugging current orphan wells could be approximately $500 million, and the cost of plugging all active and idle wells could total over $9.1 billion. As oil and gas production in California declines due to reduced demand for fossil fuels, additional funding will likely be needed to cover the costs of plugging wells that have no viable operator.

Strategies for Achieving Success

- Mitigate emissions from leaks by regular leak detection and repair (LDAR) surveys at all facilities.
- Replace high emitting equipment with zero emission alternatives wherever feasible.[458]
- Have CARB and CalGEM lead a Task Force to identify and address methane leaks from oil infrastructure near communities.
- Pursuant to SB 1137, develop leak detection and repair plans for facilities in health protection zones, implement emission detection system standards, and provide public access to emissions data.
- Minimize emissions from equipment that must vent fossil gas by design (e.g., fossil gas powered compressors).
- Install vapor collection systems on high emitting equipment.
- Phase out venting and routine flaring of associated gas (gas produced as a by-product during oil production).
- Continuous ambient monitoring at fossil gas underground storage facilities to quickly detect large methane sources.
- Reduce pipeline and compressor blowdown emissions.

---

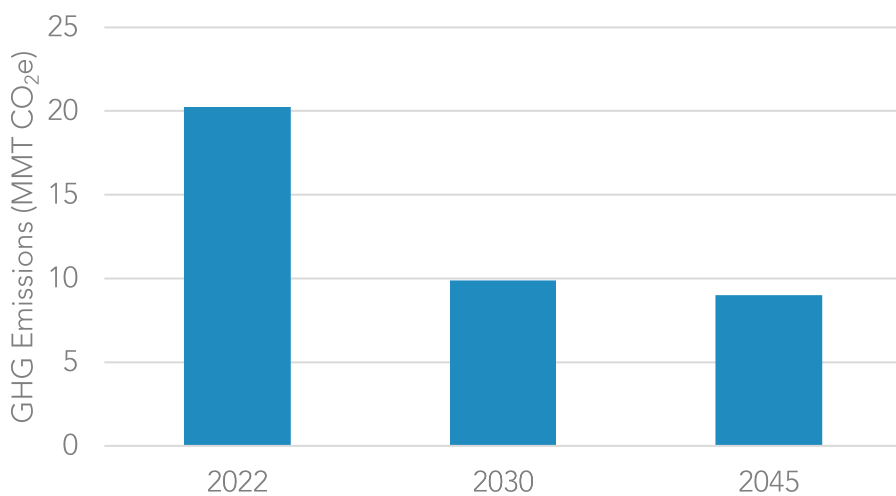
[457] The California Council on Science and Technology. 2018. *Orphan Wells in California: An Initial Assessment of the State's Potential Liabilities to Plug and Decommission Orphan Oil and Gas Wells.* https://ccst.us/wp-content/uploads/CCST-Orphan-Wells-in-California-An-Initial-Assessment.pdf.
[458] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, P5. finalejacrecs.pdf (arb.ca.gov).

- Leverage advances in remote sensing capabilities to quickly pinpoint large methane sources and mitigate leaks.[459]

Hydrofluorocarbons

In California, all the HFC measures currently in place will help achieve more than 70 percent of the reductions needed to achieve the 2030 HFC goal and provide very significant emissions reductions by 2045 and beyond. However, new targeted measures will be needed to maintain the pace of reductions, as demand for technologies that currently predominantly use high-GWP refrigerants is anticipated to grow. Despite decarbonization efforts, high-GWP HFCs are expected to be among the last remaining persistent GHG emission sources, as shown in Figure 4-17.[460]

Figure 4-17: Hydrofluorocarbon emissions in 2022, 2030, and 2045 in the Scoping Plan Scenario



HFC emissions from new and existing sources should be addressed in tandem with building decarbonization efforts to maximize reductions.[461] As buildings are electrified in an effort to decarbonize them, the use of heat pumps for space conditioning, water heaters, and clothes dryers is expected to increase significantly. Heat pumps, while using

---

[459] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, CC17. finalejacrecs.pdf (arb.ca.gov).

[460] Energy and Environmental Economics, Inc. 2020. *Achieving Carbon Neutrality.* https://ww2.arb.ca.gov/sites/default/files/2020-10/e3_cn_final_report_oct2020_0.pdf.

[461] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF26. finalejacrecs.pdf (arb.ca.gov).

electricity, not fossil gas, currently rely predominantly on high-GWP refrigerants. Very low- or no-GWP technologies and solutions are either available or emerging for various heat pump technologies, and likely to develop further as international efforts to mitigate HFCs continue. However, most of these technologies are still nascent in the United States. In addition, some of the alternatives cannot be used until California building codes are updated, which is currently expected at the earliest in mid-2024 for some technologies based on the recently adopted provisions in AB 209[462] requiring the California Building Standards Commission to adopt the latest safety standards for refrigerant containing equipment into California's building codes. The current updates to the building codes will allow the use of many refrigerants with lower GWPs than HFCs currently in use. However, additional building code updates are needed to expand the choices of ultra-low-GWP alternatives, and that will need to happen in the next few years. The adoption of low-GWP refrigerants must occur in parallel with building decarbonization efforts; without such efforts, the vast GHG benefits of the latter will be partially offset, and the proportion of HFC emissions from buildings will continue to grow.

Leaks from existing air conditioning and refrigeration equipment are a major source of statewide and global HFC emissions. Once installed, refrigeration and air conditioning equipment can stay in place for decades, while leaking refrigerants into the atmosphere. This makes it very important that new installed equipment use refrigerants with a GWP as low as possible. The refrigerants inside existing equipment are sometimes collectively referred to as the *installed base* or *banks* of potential HFC emissions. If released spontaneously, the existing HFC banks would equal 60 percent of all annual statewide GHG emissions in California, as illustrated in Figure 4-18.[463]

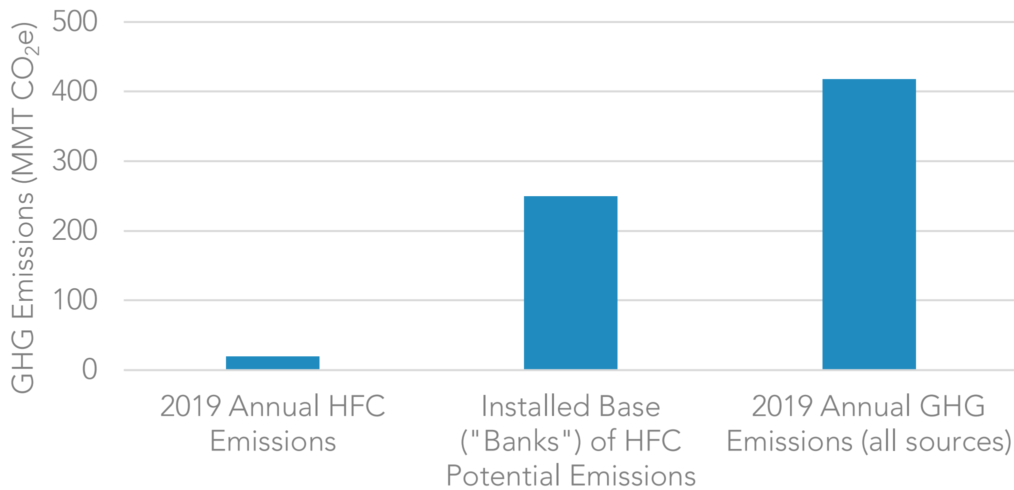
The sales prohibitions on newly produced refrigerants set forth in SB 1206 (2022) and the national/international HFC phasedown will help in reducing HFC emissions from existing equipment by restricting the supply of and increasing the value of existing high-GWP HFCs, thus enabling a circular economy. In the 2022–2023 state budget, CARB received $45 million in incentive funding for climate-friendly refrigerant technologies; this funding will be critical in shifting the market toward the best available refrigerant technologies in various sectors.

---

[462] AB 209: Energy and climate change. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220AB209.

[463] CARB. 2021. 2022 Scoping Plan Update – Short-Lived Climate Pollutants Workshop Presentation. September 8. https://ww2.arb.ca.gov/sites/default/files/2021-09/carb_presentation_sp_slcp_september2021_1.pdf.

Figure 4-18: Potential emissions from refrigerants in existing equipment



Strategies for Achieving Success

- Expand the use of very low- or no-GWP technologies in all HFC end-use sectors, including emerging sectors, like heat pumps for applications other than space conditioning, to maximize the benefits of building decarbonization.[464]
- Convert large HFC emitters such as existing refrigeration systems to the lowest practical GWP technologies.[465]
- Prioritize small-scale and independent grocers serving priority populations in addressing existing "banks" of high-GWP refrigerants.[466]
- Improve recovery, reclamation, and reuse of refrigerants by limiting sales of new or virgin high-GWP refrigerants and requiring the use of reclaimed refrigerants where appropriate.[467]
- Assist low-income and disadvantaged communities in obtaining low-GWP space conditioning units to protect vulnerable communities from heat stress and wildfire smoke.[468]

---

[464] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF26. *finalejacrecs.pdf (arb.ca.gov)*.
[465] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF22. *finalejacrecs.pdf (arb.ca.gov)*.
[466] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, JT5 and JT6. *finalejacrecs.pdf (arb.ca.gov)*.
[467] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, JT1. *finalejacrecs.pdf (arb.ca.gov)*.
[468] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, NF28, JT5, and JT6. *finalejacrecs.pdf (arb.ca.gov)*.

- Accelerate technology transitions in California and the U.S. overall by collaborating with international partners committed to taking action on HFCs under the Kigali Amendment to the Montreal Protocol; this includes addressing barriers to adoption of very low- or no-GWP refrigerant technologies such as high upfront costs, shortage of trained technicians, and lag in updating safety standards and building codes.

Anthropogenic Black Carbon

Significant progress has been made since 2013 to reduce anthropogenic black carbon emissions, primarily from decreased combustion of distillate fuels in the agricultural sector, as well as improvements to provide cleaner, on-road combustion technologies. Under current strategies, anthropogenic black carbon from transportation is expected to be reduced by over 60 percent in 2030. Continued reductions in combustion emissions across all sectors from both the state's climate and air quality programs will also help reduce anthropogenic black carbon emissions going forward.

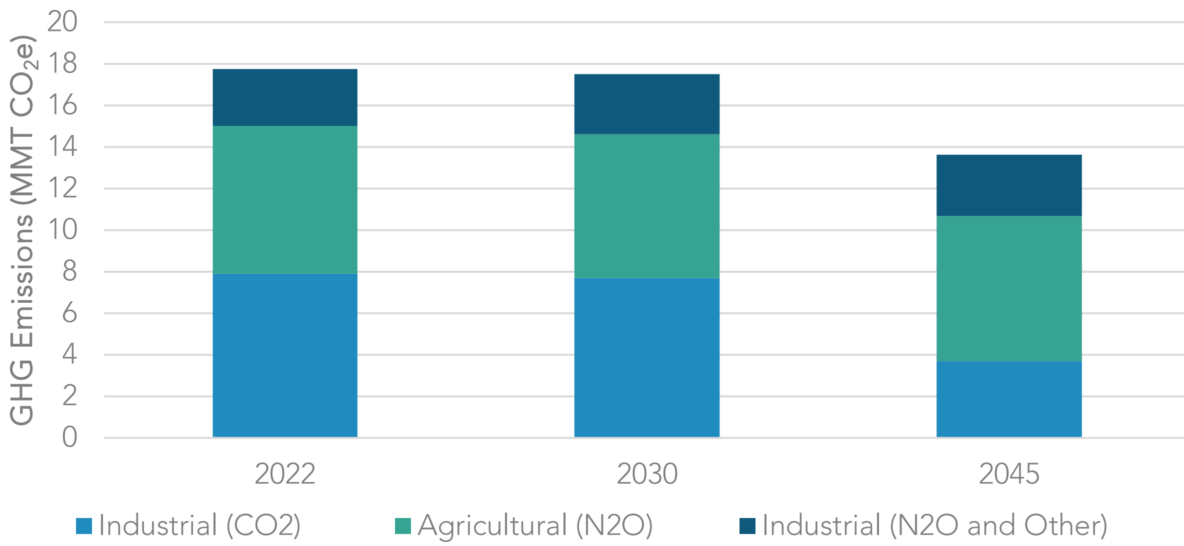
Strategies for Achieving Success

- Reduce fuel combustion commensurate with state's climate and air quality programs, particularly from reductions in transportation emissions and agricultural equipment emissions.[469]
- Invest in residential woodsmoke reduction.

In addition to SLCP emissions, some remaining non-combustion emissions are anticipated to persist in the coming decades, as shown in Figure 4-19. These include CO_2 from industrial processes such as cement manufacturing, oil and gas extraction, and geothermal electric power; N_2O from wastewater treatment, fertilizers, and livestock manure applied to agricultural soils; and other industrial, non-HFC GHG emissions.

[469] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, F1A and Appendix A (Table Summary of Direct Emission Reduction Strategies). "Emissions reductions from energy consumed by California's agricultural sector, including post-harvest processing, use of tractors and other farm equipment, and water import and irrigation." *finalejacrecs.pdf (arb.ca.gov)*.

Figure 4-19: Remaining non-combustion emissions in 2022, 2030, and 2045 in the Scoping Plan Scenario



Natural and Working Lands

California's natural and working lands (NWL) cover approximately 90 percent of the state's 105 million acres,[470] and include forests, grasslands, shrublands and chaparral, croplands, wetlands, sparsely vegetated lands, and the green spaces in urban and built environments. These lands include California Native American tribes' ancestral and cultural lands, parks and green spaces in our cities and communities, and the waters and the iconic landscapes we know and love. The diverse landscapes and biodiversity found throughout California's NWL provide a multitude of benefits to the people of California, including clean water, clean air, biodiversity, food, economic prosperity, recreational opportunities, continuation of traditional tribal ways of life, mental health benefits, and many others.

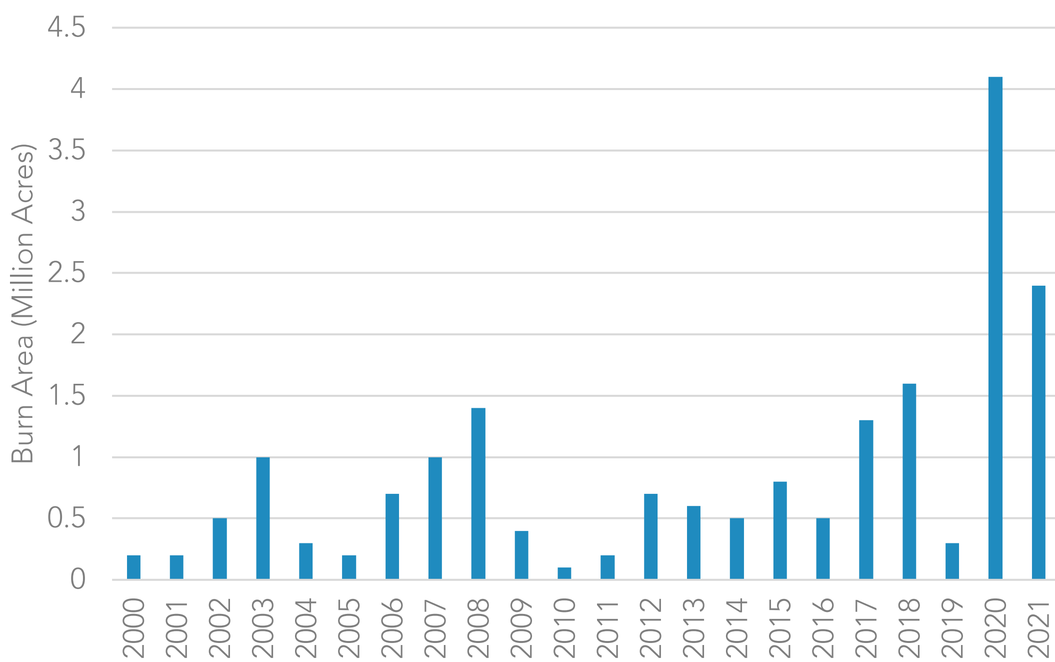
Our lands are a critical sector in California's fight to achieve carbon neutrality and build resilience to the impacts of climate change. Healthy land can sequester and store atmospheric CO_2. Healthy lands also can reduce emissions of powerful SLCPs, limit the release of future GHG emissions, protect people and nature from the impacts of climate change, and build our resilience to future climate risks. Creation of healthy lands through

[470] CNRA. 2022. Natural and Working Lands Climate Smart Strategy. https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Expanding-Nature-Based-Solutions/CNRA-Report-2022---Final_Accessible_Compressed.pdf.

multi-benefit and mitigation measures can also support tribal and local traditional lifeways. Unhealthy lands have the opposite effect—they release more GHGs than they store and are more vulnerable to future climate change impacts.

Climate change impacts have become more apparent in recent years and are having significant effects on communities throughout the state. One of these impacts is the much more frequent occurrence of unusually large, high-severity wildfires, which are being driven by climate change and by a recent history of fire-exclusion and land management practices that have resulted in forests with high levels of biomass. These recent large and high-severity wildfires have resulted in a significant amount of burned acreage and emissions in California (Figure 4-20).[471]

Figure 4-20: Acreage of burned wildland vegetation area



These wildfires deviate from the lower-severity fires that previously occurred at frequent intervals, around which California's forests evolved. As climate change accelerates, these large, uncharacteristic wildfires are likely to become more common and impact more of our landscapes. Climate change is also expected to have other significant effects on our lands, including more extreme droughts, floods, extreme heat, and the spread of invasive aquatic and terrestrial species, pests, diseases, and parasites. These impacts can lead

---

[471] CARB. 2022. Wildfire Emission Estimates for 2021. https://ww2.arb.ca.gov/sites/default/files/classic/cc/inventory/Wildfire%20Emission%20Estimates%202000-2021.pdf.

to negative feedback loops on human and ecological health; for example, increasing the spread of invasive species can lead to increases in pesticide use, if not managed through regulation or mitigation, which can pose risks to human health and the environment.

California's approach to climate action in the NWL sector is not solely focused on maximizing carbon stocks but instead on supporting carbon management that holistically fosters ecosystem health, resilience, provision of overall climate function, and other co-benefits.

Natural systems operate on a longer timescale than the energy and industrial sectors, and benefits from climate action on our lands can take decades to accrue. Scaling climate smart land management in California requires taking action now and playing the "long game" by establishing and maintaining consistent, patient approaches and programs.

Landscapes

For the first time, this Scoping Plan includes modeling for the NWL sector. The focus of the initial modeling is limited to seven land types that align with the those in the NWL Climate Smart Strategy.[472] Work will continue to incorporate more landscapes and management practices into the modeling over time. The initial landscapes included in the modeling for this Scoping Plan are:

- Forests
- Shrublands and Chapparal
- Grasslands
- Croplands
- Wetlands
- Developed Lands
- Sparsely Vegetated Lands

Each of these land types are a key component to the state's approach to increasing climate action in the NWL sector, as called for in Executive Order N-82-20 and AB 1757.[473] The Executive Order directs CARB to update the target for this sector in support of carbon neutrality by 2045 as part of this Scoping Plan, and to take into consideration the NWL Climate Smart Strategy. AB 1757 calls for the development of an

---

[472] CNRA. 2022. *Natural and Working Lands Climate Smart Strategy. Appendix B.* *https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Expanding-Nature-Based-Solutions/Appendix-B_04132022_ada.pdf*.

[473] AB 1757 California Global Warming Solutions Act of 2006: Climate Goal: Natural and Working Lands. *https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220AB1757*.

ambitious range of targets for the NWL sector to be integrated into the Scoping Plan and other state policies. It directs CARB and CNRA to work closely together to update the NWL Climate Smart Strategy, and establish an expert advisory committee to inform and advise on NWL modeling, targets, and implementation strategies.[474] Additionally, in 2021, the governor signed SB 27[475] (Skinner, Chapter 237, Statutes of 2021) into law. It directed CARB to establish CO_2 removal targets for 2030 and beyond and take into consideration the NWL Climate Smart Strategy. The governor's Executive Order, AB 1757, and SB 27 go beyond previous direction from the Legislature and past administrations. These directives emphasize the importance of quantifying land-based carbon both statewide,[476] and in programs and policies,[477] setting targets[478] for NWL to support the state's climate objectives, and advancing land management actions[479] that support the health and resiliency of these lands.

Blue carbon (also known as carbon captured and held in coastal vegetation and soils, such as seagrasses, seaweeds, and wetlands)—is also important to consider as we look at long-term climate goals. While this landscape is not currently covered by IPCC inventory guidelines or included in California's NWL Inventory, the United States was the first nation to include blue carbon in its national GHG emissions inventory. California's Ocean Protection Council and San Francisco Estuary Institute are partnering to create a new coastal wetlands, beaches, and watersheds inventory. CARB staff will utilize information from this effort and assess other available data to evaluate how this landscape may be integrated into our efforts in the future as more data become available.[480]

---

[474] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N20. *finalejacrecs.pdf (arb.ca.gov)*.
[475] SB 27 Carbon sequestration: state goals: natural and working lands: registry of projects. *https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220SB27*.
[476] SB 859 Public resources: greenhouse gas emissions and biomass (SB 859, Committee on Budget and Fiscal Review, Chapter 368, Statutes of 2016). *https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB859*.
[477] SB 1386. Resource conservation: working and natural lands. (SB 1386, Chapter 545, Statutes of 2016). *https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB1386*.
[478] CARB. 2017. 2017 Climate Change Scoping Plan Update. Board Resolution 17-46. *https://ww2.arb.ca.gov/sites/default/files/barcu/board/res/2017/res17-46.pdf*.
[479] Executive Department. State of California. EO B-52-18. *https://www.ca.gov/archive/gov39/wp-content/uploads/2018/05/5.10.18-Forest-EO.pdf*.
[480] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N2. *finalejacrecs.pdf (arb.ca.gov)*.

Trends of Carbon on Landscapes

CARB currently tracks the carbon stock changes though the Inventory of Ecosystem Carbon in California's Lands[481] (NWL Inventory), which is summarized in Chapter 1. The NWL Inventory is a key tool for tracking changes in carbon stocks across the state, and it will serve as the inventory of record for this sector, tracking sector-wide progress toward the target. The NWL Inventory provides a retrospective snapshot of the status of California's lands, and captures the gains or losses of carbon stocks that occur over time. In addition to tracking carbon stock changes, the NWL Inventory is an important tool for understanding the impacts of our efforts to increase climate action in this sector (such as those identified in this Scoping Plan and the NWL Climate Smart Strategy) on NWL carbon stocks. The inventory is also used as the foundation for Scoping Plan scenario modeling and target setting.

CARB's inventory shows that carbon stocks decreased in NWL lands from 2001 to 2011, releasing more carbon than they were storing, and then increased slightly from 2012 to 2014.[482] These trends highlight the interannual and interdecadal variability of lands and their ability to be both a source and a sink of carbon, and the importance of looking at NWL data and trends over multiyear and multidecadal time periods, as opposed to looking only at annual changes. This movement is part of the Earth's carbon cycle, where carbon transfers between the land, ocean, and atmosphere. As part of the carbon cycle, over decades or centuries, fire and plant respiration and decomposition move carbon from the land to the atmosphere, while plant growth and other processes move carbon from the atmosphere to the land. Emissions from fossil-fuel combustion are contributing to putting this cycle out of balance.

Additionally, some historic land management practices that have resulted in the loss of carbon from the soil are also contributing to the atmospheric rise of CO_2 while simultaneously exacerbating the imbalance of the water cycle, which is influenced by and linked to the carbon cycle. These emissions are also contributing to a feedback loop for California's lands: as CO_2 emissions accumulate in the atmosphere—and California experiences more warming, extreme heat events, and droughts—the risk and intensity of carbon losses also increases, which in turn transfers more carbon from the land to the atmosphere. And because forests and shrublands comprise approximately 85 percent of the carbon stocks in California, management strategies and disturbances in forest and

---

[481] CARB. *An Inventory of Ecosystem Carbon in California's Natural & Working Lands.* 2018 Edition. *nwl_inventory.pdf (ca.gov)*. Accessed 3/2/2022.
[482] These trends are consistent estimates in the most recent AB 1504 reporting period.

shrubland carbon play an important role in determining whether California's lands are providing either net carbon sequestration or net emissions on an annual basis.

The gains and losses of carbon on our lands will fluctuate in the future; what is important is to restore carbon in places where it has been lost and reduce large carbon losses on our NWL through active, attentive, and adaptive management. For additional details on the nexus between NWL and GHGs, see pages 5–6 of the NWL Climate Smart Strategy.

Goals and Accelerating Nature-Based Solutions

The state's climate mitigation targets are traditionally identified by individual years, (i.e., tons of GHG emissions in 2020 or 2030). However, because NWL processes fluctuate year to year and because it can sometimes take decades for climate action to fully impact carbon in NWL, it is important to consider the statewide, long-term trends of carbon stock change when identifying how this sector contributes to California's pathway to achieving carbon neutrality. Tracking carbon stock change over a multi-decadal period is the best way to assess the full direct impact climate action has on carbon storage. Such an approach filters out fluctuations from year-to-year weather variations and multi-year natural climate cycles, such as El Niño patterns.

Current data sources and methods allow us to track only certain carbon stocks that exist on NWL. For target tracking to be successful, each carbon pool must be inventoried using a methodology that can detect changes due to management and climate change. Certain carbon pools lack the scientific data and methodologies necessary for target-setting and tracking. For example, soils in forests, shrublands, and grasslands are not included in the Scoping Plan carbon stock target because, currently, there is no way to track statewide soil carbon through time in a way that would capture the effects of increased climate action and climate change.

When considering how NWL contribute to the state's goal of carbon neutrality, all lands' carbon stock gains and losses must be considered, and the Scoping Plan target is set in these terms. It is not sufficient to aggregate climate benefits only within areas where projects, management, or climate action occur. Much of the state does not receive active or quantifiable management, but these areas still contribute to the state's overall carbon stock change and GHG emissions. To incorporate the entire carbon balance toward true carbon neutrality, the Scoping Plan target is set in terms of carbon stock change across the entire state. This incorporates all lands that both receive and do not receive active management, and includes the end result of all sequestration, emissions, and other changes to carbon on the landscape.

However, carbon stock change is not equivalent to emissions. Currently, the data and emission quantification science is not sufficient to enable inventories to comprehensively track all NWL emissions in a way that would enable us to set an NWL target in terms of statewide emissions and sequestration. There is a great need, across the entire NWL sector statewide, for more empirical data, science, and tools to track all carbon stocks across each carbon pool, and to begin to track emission and sequestration rates. As California implements AB 1757, there is an opportunity to update the data, science, and tools to enable this level of tracking and target setting in the future.

As outlined in Chapter 2, California is projected to lose carbon stocks over the coming decades, but this Scoping Plan analysis also shows that increasing the pace and scale of climate smart land management in California will reduce the carbon stock losses and GHG emissions from the NWL sector. In response to EO N-82-20 and AB 1757, the proposed target for NWL is shown in Table 4-1.

Table 4-1: Scoping Plan modeled target for NWL, based on increasing action on NWL

	Total Carbon Stock % Change from 2014
2045	-4

Achieving this target will require significant expansion of the pace and scale of climate action on California's NWL, including the following:

- Increasing climate smart forest, shrubland, and grassland management to at least 2.3 million acres a year—an approximate 10x increase in management from current levels.
- Increasing climate smart agricultural practices by at least 78,000 acres adopted a year, annually conserving at least 8,000 acres a year of croplands, and increasing organic agriculture to comprise at least 20 percent of cultivated acres in California by 2045—an approximate 7.5x increase in healthy soils practices from previous levels and a 2x increase in total acres of organic agriculture.
- Increasing annual investment in urban trees in developed lands by at least 200 percent above historic levels and establishing defensible space on all parcels by 2045.
- Restoring at least 60,000 acres, or approximately 15 percent of all Sacramento–San Joaquin River Delta (Delta) wetlands, by 2045.
- Cutting land conversion of deserts and sparsely vegetated landscapes by at least 50 percent annually from current levels, starting in 2025.

If the carbon stock target above is met, and the management actions above are implemented, the modeling for NWL indicates that California's lands will be a net source of emissions, producing approximately 7 $MMTCO_2e$ of average annual emissions.

Additional climate smart management practices and additional landscapes, such as those included in the Climate Smart Strategy and discussed below in Additional Management Strategies, have the potential to increase carbon stocks and reduce GHG emissions from NWL beyond the levels modeled for this Scoping Plan.

The purpose of the NWL target and the above estimated outcomes is to provide a numerical guide that can support the state's efforts to accelerate both near-term and long-term climate action on California's lands, prioritizing durable solutions that deliver multiple outcomes. Taking these actions over the coming decades will reduce the potential carbon losses from NWL, reduce GHG emissions from some landscape types (such as croplands and Delta wetlands), and support sequestration of GHGs from NWL between 2025 and 2045. These actions will also deliver significant benefits to Californians beyond advancing our climate goals, such as reducing wildfire emissions and their associated health impacts, increasing habitat for biodiversity, reducing urban heat island effects, reducing harmful pesticide exposure, expanding economic opportunities, and others. Additional information on several economic and health outcomes from the Scoping Plan Scenario is included in Chapters 2 and 3.

Statewide planning and target setting for the NWL sector will only create meaningful change if followed by effective on-the-ground implementation. State government cannot accomplish this implementation alone. Effective large scale climate action is dependent on partnerships among tribal, federal, state, regional, and local partners, and across governmental, private, nonprofit, and commercial sectors. The NWL sector of the Scoping Plan sets a carbon target with climate action recommendations that can be used to achieve the quantified carbon, health, and economic outcomes. Implementation of these actions must be led by local or regional partnerships that plan and execute projects appropriate to the specific conditions. The technical expertise and local knowledge of land managers and stewards in all sectors must be elevated to ensure relevant, efficient, and effective climate action.

Implementation of climate action should contribute to state targets, maximize local benefits, and alleviate environmental injustices and other social inequities. On-the-ground action is largely executed and managed by local and regional actors, but state government agencies must support communities across the state in implementing nature-based climate solutions that address statewide objectives, such as the Scoping Plan carbon target. This includes providing resources and developing frameworks, while greatly increasing capacity and technical assistance to assist and empower local partners. Examples of how this can be done are the Regional Forest and Fire Capacity Program within the forestry sector, the UC Cooperative Extension in the agricultural and forestry sectors—as well as the work of the state's 10 regional Conservancies. These programs provide strong examples to emulate as they facilitate statewide coordination, and information and resource transfer from the state to the regional and local levels. The Regional Forest and Fire Capacity Program provides funding for local and regional groups to build their organizational capacity to plan and implement wildfire and forest management projects that are informed by their own local expertise. The UC Cooperative Extension is an example of how the state provides technical assistance to local landowners and community organizations, helping them apply the latest science-based management strategies to their lands. California's regional Conservancies play a pivotal role in implementing regional conservation, restoration, and land management efforts through activities such as grant funding, science generation, and planning assistance.

The state also has identified the need to incorporate and elevate traditional indigenous knowledge into climate action on the regional and local scales. Accomplishing this requires close partnerships with tribes for mutual knowledge and resource sharing, while protecting culturally sensitive knowledge and resources. As Tribes are sovereign nations with specialized cultural knowledge and experience in managing lands, climate action on these lands that contribute to the State of California's climate targets can only be accomplished with the full participation and under the leadership of the Tribes that govern those lands.

Strategies for Achieving Success: Crosscutting Items for all NWL

- Implement AB 1757 and SB 27.
- Implement the Climate Smart Strategy.
- Accelerate the pace and scale of climate smart action, consistent with the management levels identified above, as part of a collective effort between federal, state, private, nonprofit, and individual land managers.
- Prioritize and practice equity, including through meaningful community engagement and prioritizing implementation of nature-based solutions that benefit the communities most vulnerable to climate change.[483]
- Advance multi-benefit, collaborative, landscape-level approaches that engage communities and landowners, and incorporate adaptive managements.
- Consult and partner with California Native American tribes to increase co-management and tribal management authority; restore, protect, and enhance natural cultural resources, traditional foods, and cultural landscapes; respect tribal sovereignty; and support tribes' implementation of tribal expertise and Traditional Ecological Knowledge and cultural easements.[484]

---

[483] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N8. *finalejacrecs.pdf (arb.ca.gov)*.

[484] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N1, N6, N16, N17, N18. *finalejacrecs.pdf (arb.ca.gov)*.

- Leverage existing innovative financial and market mechanisms, and explore new ones, between the public, private, and philanthropic sectors to secure funding of climate smart land management.
- In partnership with communities, tribes, and the private sector, expand and develop new infrastructure for manufacturing and processing of climate smart agricultural and biomass products.
- Leverage and support technical assistance providers: such as the UC Cooperative Extension and California's 98 Resource Conservation Districts, that have track records of providing technical assistance to local landowners and implementing agriculture, forestry, natural resource management, and restoration projects across the state.
- Establish and expand mechanisms that ensure NWL are protected from land conversion and parcelization (e.g., conservation easements or Williamson Act), in line with the strategies outlined in CNRA's Pathways to 30x30 California.[485,486] Pair land conservation projects with management plans that increase carbon sequestration, where feasible.
- Increase opportunities for private and philanthropic investments in nature-based climate solutions, utilizing existing voluntary and compliance carbon markets, existing state and local programs, and the California Carbon Sequestration and Climate Resiliency Project Registry established pursuant to SB 27.
- Expand monitoring and tracking of management actions and outcomes consistent with the tracking and monitoring recommendations of the Climate Smart Strategy.

Forests, Shrublands, and Chaparral

At roughly 29 million acres, forests cover 27 percent of California. Shrublands and chaparral cover 31 percent of the state; roughly 33 million acres. Both types are distinct, with their own ecological dynamics and management strategies, and are modeled within a single model that is calibrated to treat them uniquely.

Together, forests, shrublands, and chaparral support a high biodiversity of plants and animals, in addition to high levels of carbon stocks. They provide important air and water quality benefits to all Californians, as well as recreational opportunities and, for forests, harvested wood products for the state. These landscapes are fire-adapted, and historical tribal management of these lands has fostered ecosystem health and resilience. Over the past century, these lands have been impacted severely by fire exclusion, including

---

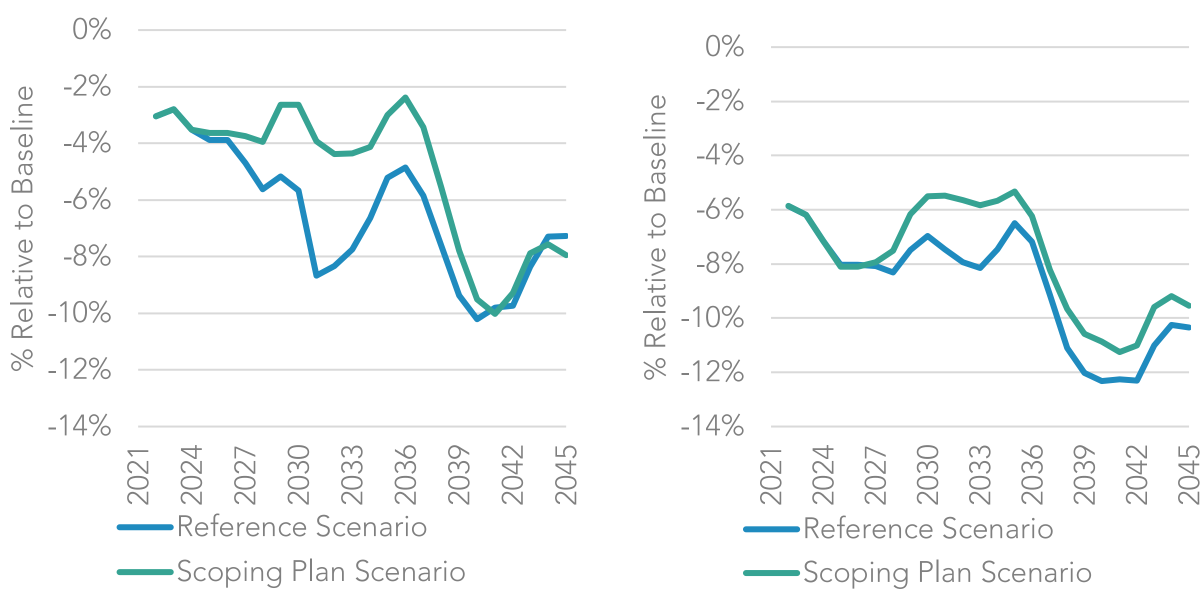
485 AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N5, N26, N27. finalejacrecs.pdf (arb.ca.gov).

486 CNRA. 2022. *Pathways to 30x30 California*. https://www.californianature.ca.gov/pages/30x30.

exclusion of indigenous people's management and past management practices, which has resulted in less resilient ecosystems and communities and more destructive wildfires today. This, along with drought induced stress and mortality, has changed these landscapes from a carbon sink to a carbon source. Climate smart management can help make forests more resilient to climate change and less prone to catastrophic wildfire. Climate-smart management in shrublands and chaparral face additional challenges and uncertainty, but can still provide protection for threatened communities and natural resources. This management, if conducted on a regular basis to maintain forest health, can help reduce emissions from forests, shrublands, and chaparral, and help strengthen and maintain the co-benefits that Californians experience from them.

Under all management levels, forests and shrublands are expected to lose carbon over the next two decades due to climate change and wildfire (Figure 4-21).

Figure 4-21: Forest (left) and shrubland (right) carbon stocks by 2045[487,488]



While this decrease in carbon stocks may be inevitable, forest management under the Scoping Plan Scenario can help direct where and how carbon loss occurs. By proactively managing forests and shrublands, the loss of carbon from wildfire can be lessened as the risk of high severity fire is decreased, with the removed biomass going toward a more

[487] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N13. [finalejacrecs.pdf (arb.ca.gov)](finalejacrecs.pdf).
[488] This analysis is the aggregation of all forests and shrublands from all ownerships across the entire state of California.

useful purpose such as harvested wood products, bioenergy, and engineered carbon removal. Managing for a diverse and resilient forest landscape also can help forests recover more quickly so that when climate change and wildfire impacts occur, forests will be less affected and can continue to thrive and sequester carbon. Additional details on the climate benefit potential of forests and shrublands/chapparal can be found in Section 2 of the NWL Climate Smart Strategy.

Strategies for Achieving Success

- Accelerate the pace and scale of climate smart forest management to at least 2.3 million acres annually by 2025, in line with the climate smart management strategies identified in this Scoping Plan, the NWL Climate Smart Strategy, and the Wildfire and Forest Resilience Action Plan.[489]
- Establish and expand mechanisms that ensure forests, shrublands, and grasslands are protected from land conversion and that support ongoing, rather than one-time, management actions.
- In collaboration with state and local agencies, accelerate the deployment of long-term carbon storage from waste woody biomass residues resulting from climate smart management, including storage in durable wood products, underground reservoirs, soil amendments, and other mediums.
- Expand infrastructure to facilitate processing of biomass resulting from climate smart management.
- Expand permit streamlining in collaboration with state and local agencies to accelerate implementation of climate smart forest management while protecting natural resources.

Grasslands

Grasslands cover 9 percent of California, roughly 10 million acres, and are found throughout the state in various landscapes, with concentrations in the foothills surrounding the Sacramento and San Joaquin Valleys. In addition to carbon storage (primarily in the soil), grasslands provide open space, wild habitat, grazing land, and important water filtration and recharge benefits. The protection of grasslands provides an opportunity to reduce sprawl and complement VMT reduction strategies. As grasslands are susceptible to invasive species, climate smart strategies can increase grassland

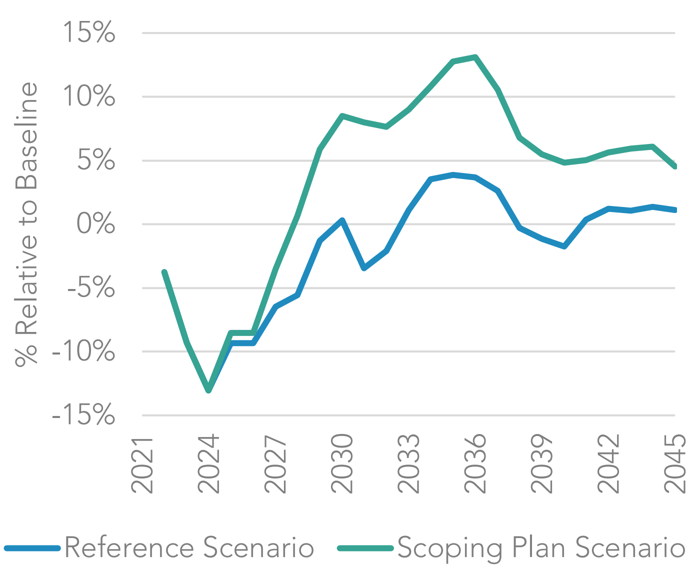
---

[489] Forest Management Task Force. 2021. *California's Wildfire and Forest Resilience Action Plan: Recommendations of the Governor's Forest Management Task Force.* https://www.fire.ca.gov/media/ps4p2vck/californiawildfireandforestresilienceactionplan.pdf.

resilience to climate change by improving species diversity and maintaining or increasing soil carbon stocks.

Modeling results show that increased fuels treatments and avoided land conversion can increase carbon stocks on grasslands by 2045, but sequestration rates fluctuate annually. Grasslands are capable of high carbon sequestration rates but are susceptible to carbon losses from wildfire and land conversion. Soil carbon is the major carbon pool on these lands, and continued future improvement of the monitoring and modeling of soil carbon is needed. Similar to forests and shrubland/chaparral, modeling alternatives that include fuels treatments resulted in greater carbon stocks compared to no management, and had lower wildfire emissions. Unlike forests and shrubland/chaparral, which have a general declining carbon stocks trend, the modeling results (Figure 4-22) show grasslands can maintain or increase carbon stocks with active management. Details on the climate benefit potential of grasslands can be found in Section 2 of the NWL Climate Smart Strategy.

Figure 4-22: Grassland carbon stocks by 2045



Strategies for Achieving Success

- Establish and expand mechanisms that ensure grasslands are protected from land conversion/parcelization and that support ongoing, rather than one-time, management actions that improve carbon sequestration.
- Deploy grassland management strategies, like prescribed grazing, compost application, and other regenerative practices, to support soil carbon sequestration, biodiversity, and other ecological improvements.

- Increase adoption of compost production on farms and application of compost in appropriate grassland settings for improved vegetation and carbon storage, and to deliver waste diversion goals through nature-based solutions.

Croplands

Croplands cover 9 percent of the state, roughly 9.5 million acres. This land is some of the most productive agricultural land in the world, and enables California to be a global leader in agriculture. Aside from developed lands, croplands are the most intensively managed landscapes in the state, and are closely tied to society through the food they produce and the constant, direct contact that people have with croplands through the course of management. In addition to food security, croplands provide considerable carbon storage in the soil and, in perennial croplands, in aboveground biomass. Climate smart practices can improve public health; for example, by reducing synthetic fertilizer and pesticide use. They also help to maintain or increase the climate resilience of cropland productivity through improved soil conditions and increased pollinator habitat.

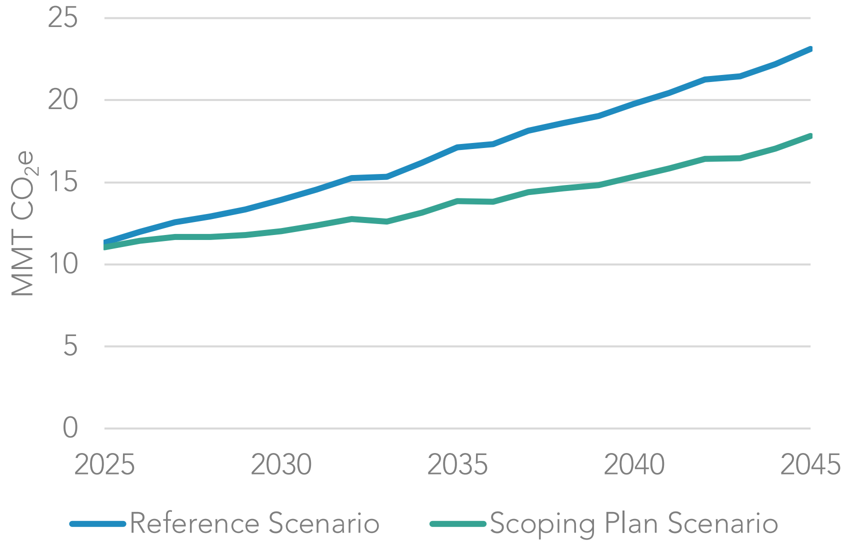
There is also significant potential to transform this sector to increase soil carbon storage, reduce GHG emissions (Figure 4-23), and reduce pesticide exposure and health impacts. Moving to an agricultural system that improves soil health and water holding capacity reduces over-application of nitrogen, reduces the use of pesticides and fumigants, and increases biodiversity and pollinator habitat, supporting California's pathway to carbon neutrality while simultaneously improving the lives of those who live and work in the agricultural community. Croplands are intricately tied to people, communities, and their health, and through climate smart practices and cropland conservation, these lands have the potential to contribute more to society than just food.[490] The implementation of climate smart agricultural practices and diversified organic agriculture can help California achieve social and environmental benefits, like improving water use efficiency, increasing pollinator habitat, and reducing synthetic fertilizer and pesticide use.[491] Additional details on the climate benefit potential of croplands can be found in Section 2 of the NWL Climate Smart Strategy.

---

[490] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations In-part (N3, N4, N22), N5, N21. finalejacrecs.pdf (arb.ca.gov).

[491] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N11. finalejacrecs.pdf (arb.ca.gov).

Figure 4-23: Cumulative CO_2e emissions from annual croplands in 2045[492]



CARB recognizes the complex nature of croplands, cross-sector relationships, and the need to build on this analysis to further our understanding of cropland dynamics. Many more aspects of cropland management need to be explored for potential climate benefits, such as water and nutrient use management, pest control methods, crop rotations, and other management practices. The impacts of climate change on water availability, annual/perennial crop growth, and future carbon sequestration trends are uncertain, and recent policies such as the Sustainable Groundwater Management Act may also influence cropland management in unforeseen ways. Nonetheless, it is clear that greater climate smart practice implementation can prepare California for the future and yield tangible benefits for the state.

Strategies for Achieving Success

- Accelerate the pace and scale of healthy soils practices to 80,000 acres annually by 2025, conserve at least 8,000 acres of annual crops annually, and increase organic agriculture to 20 percent of all cultivated acres by 2045.

---

[492] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N11. *finalejacrecs.pdf (arb.ca.gov)*.

- Utilize the recommendations included in CDFA's Farmer and Rancher-Led Climate Change Solutions[493] report to accelerate deployment of healthy soils practices, organic farming, and climate smart agriculture practices.
- Establish or expand financial mechanisms that support ongoing deployment of healthy soils practices and organic agriculture.[494]
- Support strategies that achieve co-benefits of safer, more sustainable pest management practices and the health and preservation of ecosystems, such as implementing the California Department of Pesticide Regulation's (DPR's) Sustainable Pest Management Work Group recommendations.[495]
- Conduct research on the intersection of pesticides, soil health, GHGs, and pest resiliency via a multi-agency effort with DPR, CDFA, and CARB.[496]
- Conduct outreach and education to develop and facilitate the increased adoption of safer, more sustainable pest management practices and tools; reduce the use of harmful pesticides; promote healthy soils; improve water and air quality; and reduce public health impacts.
- In collaboration with state and local agencies, accelerate the deployment of alternatives to agricultural burning that increase long-term carbon storage from waste agricultural biomass, including storage in durable wood products, underground reservoirs, soil amendments, and other mediums.
- Work across state agencies to reduce regulatory and permitting barriers around some healthy soils practices (e.g., composting), where appropriate.
- Utilize innovative agriculture energy use and carbon monitoring and planning tools to reduce on-farm GHG emissions from energy and fertilizer application or to increase carbon storage, as well as to promote on-farm energy production opportunities.

---

[493] California Department of Food and Agriculture. 2021. Farmer and Rancher Led Climate Change Solutions. https://www.cdfa.ca.gov/oefi/climate/docs/cdfa_farmer_and_rancher-led_climate_solutions_meetings_summary.pdf.

[494] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N5, N7. finalejacrecs.pdf (arb.ca.gov).

[495] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations N3, N4, N5, N7, N22. finalejacrecs.pdf (arb.ca.gov).

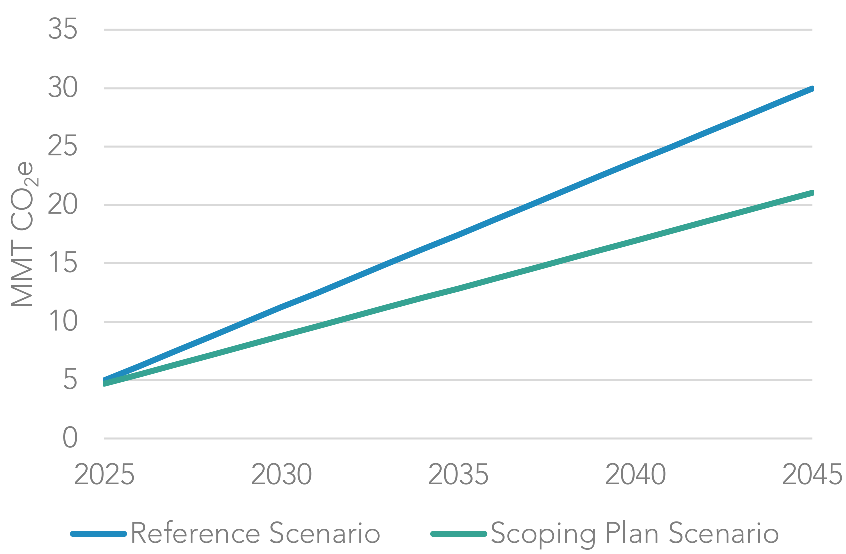
[496] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N11. finalejacrecs.pdf (arb.ca.gov).

Wetlands

Wetlands cover 2 percent of the state (roughly 1.7 million acres) and include inland and coastal wetlands, such as vernal pools, peatlands, mountain meadows, salt marshes, and mudflats. These lands are essential to California's communities as they serve as hotspots for biodiversity, contain considerable carbon in the soil, are critical to the state's water supply, and protect upland areas from flooding due to sea level rise and storms. Wetlands have been severely degraded through reclamation, diking, draining, and dredging practices in the past, resulting in the emissions of the carbon stored in the soils and the loss of ecosystem benefits. Climate smart strategies to restore and protect all the types of wetlands can reduce emissions while simultaneously improving the climate resilience of surrounding areas and improving the water quality and yield for the state. Restored wetlands also can reduce pressure on California's aging water infrastructure. These benefits beyond emissions reductions will help in the future, as climate change is predicted to negatively affect water supply.

Avoided conversion and restoration of Delta wetlands reduces CO_2 and methane emissions from wetlands, with GHG reductions scaling with implementation rates (Figure 4-24). Expansion of conservation and restoration efforts will generate benefits such as the conservation of biodiversity, improved water quality and supply, and reduced flood risk. Additional details on the climate benefit potential of wetlands can be found in Section 2 of the NWL Climate Smart Strategy.

Figure 4-24: Cumulative CO_2e emissions from Delta wetlands by 2045



Strategies for Achieving Success

- Restore 60,000 acres of Delta wetlands annually by 2045 to reduce methane emissions from wetlands and reverse the resulting subsidence.

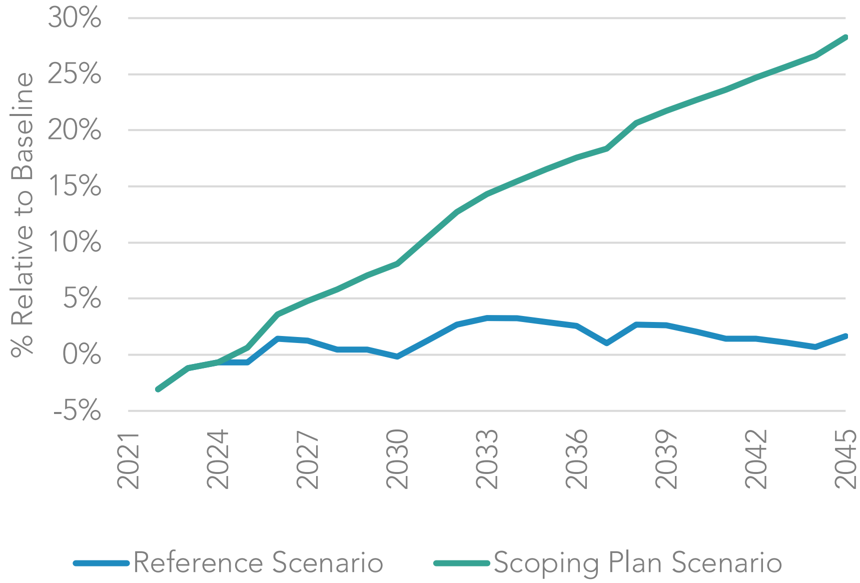
- Identify and prioritize wetland restoration efforts around climate vulnerable communities.
- Leverage other funding and institutions to support wetland restoration projects, including land trusts, local funding (e.g., San Francisco Measure AA), federal funding, and private and philanthropic funding to support wetlands restoration projects.
- Work across state agencies to reduce regulatory and permitting barriers around wetland restoration projects, where appropriate.

Developed Lands

Developed lands cover 6 percent of the state (roughly 6.8 million acres) and include urban, suburban, and rural areas, as well as transportation and supporting infrastructure throughout California. This area encapsulates the land on which the vast majority of Californians reside and call home. The vegetation within cities and communities, and along infrastructure, are all part of developed lands. This vegetation provides numerous benefits to surrounding areas, including carbon storage, air and water filtration, reduced urban heat island effect, and access to nature, aesthetics, and mental health, among others. These areas are susceptible to climate change as well, and climate smart strategies to protect and expand the urban forests, landscaping, green spaces, parks, and associated vegetation can increase their climate resilience and the benefits Californians derive from them. These strategies also have a significant opportunity to benefit disadvantaged communities, who may not have equitable access to these practices or the benefits they provide. Additional details on the climate and equity benefit potential of developed lands can be found in Section 2 and the Introduction of the NWL Climate Smart Strategy.

Urban forests have a significant potential to sequester carbon (Figure 4-25). They are vastly different from wildland forests, as they require investments to maintain and irrigate. This results in the need for a significant increase in investment to increase urban forest carbon. As urban forests become denser and management difficulty increases, the carbon stock returns on investment diminish, making it expensive to maximize carbon in urban forests. Water availability and irrigation efficiency are also an important consideration for increasing urban forest cover. As water becomes scarcer, the prioritization of irrigating trees over lawns or gardens may be required to achieve increases in urban forest carbon.

Figure 4-25: Carbon stocks in urban forests by 2045



Within wildland-urban interface (WUI) areas, defensible space can protect urban and rural communities from wildfire. Analysis results show that 48 percent of parcels are currently fully compliant with defensible space requirements. This highlights how much work needs to be done to protect communities and homes. Defensible space results in a decrease in carbon stocks, as expected when reducing fuels for wildfire.

Strategies for Achieving Success

- Increase urban forestry investment annually by 200 percent, relative to business as usual.
- Increase public awareness of urban forest benefits and, where appropriate, prioritizing irrigation of trees over lawns.
- Provide technical assistance and resources to disadvantaged communities to implement community urban greening projects to provide equitable access to the benefits of urban greening projects.[497]
- Work with state and local agencies to expand technical assistance for and enforcement of the defensible space requirements of PRC 4291 to reduce wildfire risk to homes and structures.

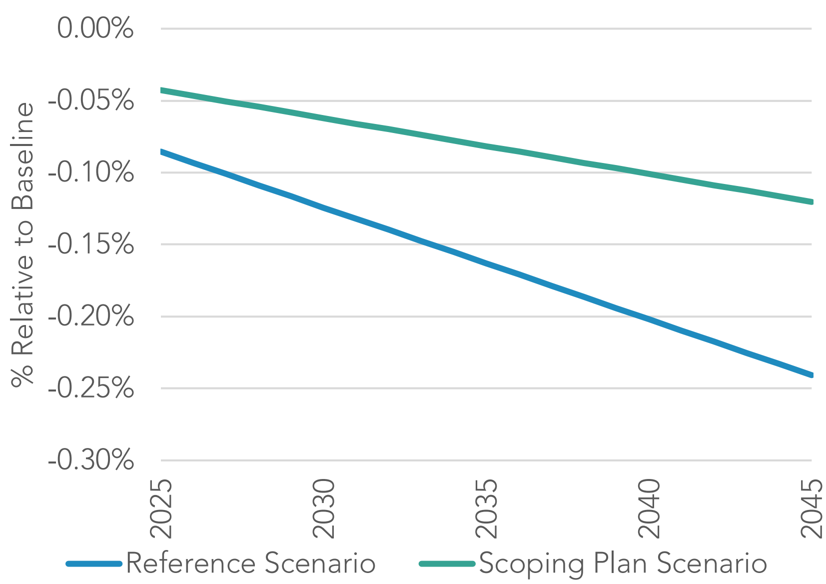
[497] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N8. *finalejacrecs.pdf (arb.ca.gov)*.

Sparsely Vegetated Lands

Sparsely vegetated lands cover 10 percent of the state, roughly 10.2 million acres, primarily in the east and southern parts of California. These lands include deserts, beaches, dunes, bare rock, and areas covered in ice and snow (e.g., higher mountain elevations). The limited carbon storage of these lands varies from bare rock and mineral soil to more vegetated areas, though severe climate limits the amount of biomass. Nonetheless, sparsely vegetated lands are important for open space and provide rare and unique habitats for endemic species and a diversity of wildlife. These lands present important recreational opportunities for Californians and serve as important protective buffers in coastal and low-lying areas. Land use change threatens these lands, and conservation efforts are important for protecting these unique areas of California.[498]

Avoided conversion of sparsely vegetated lands reduces the organic carbon lost from the soil, which is the major carbon pool in this land type (Figure 4-26). In identifying the outcomes for sparsely vegetated lands, CARB modeled avoided land conversion to another land use.

Figure 4-26: Carbon stocks in sparsely vegetated lands by 2045



Strategies for Achieving Success

- Establish and expand mechanisms that ensure sparsely vegetated lands are

[498] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N26. finalejacrecs.pdf (arb.ca.gov).

protected from land conversion, prioritizing those areas most vulnerable to climate change and loss.

Additional Management Strategies

Additional nature-based climate solutions beyond those management strategies modeled for this Scoping Plan are available for implementation, but either cannot currently be modeled and/or affect carbon and the landscape in ways that cannot currently be tracked. Nevertheless, it is important to take action even where these technical gaps exist. Some of these actions, such as cultural burning and indigenous farming practices, have been used on large scales for decades or even centuries, while others are relatively new concepts. The state nevertheless recommends implementing the additional solutions listed here to achieve potential additional climate benefits, as well as other co-benefits. These additional solutions were drawn from the NWL Climate Smart Strategy and stakeholder, tribal government, and interagency feedback.[499]

Considerations

Although these practices are recommended, because of the lack of in-depth modeling and analysis available, several considerations must be addressed when implementing them. These considerations also apply to the management strategies included in the Scoping Plan Scenario.

- Future climate change impacts are uncertain: The negative impact that climate change can have on the ability of these practices to maintain expected climate benefits is uncertain and may significantly change in the future. Climate change is expected to further diminish the already constricting growing conditions in California, with increasing droughts, more extreme weather events, and expanding disturbances from fire, insects, and disease. It is estimated that suitable habitat for many native plant and animal species could shift, creating novel ecosystems without historical precedent. Close monitoring of all practices, including no management, across our NWL will be critical to understand if and how future climate change affects outcomes and how to adapt management to meet the needs of the system under climate change.[500]

---

[499] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N24. *finalejacrecs.pdf (arb.ca.gov)*.

[500] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N15. *finalejacrecs.pdf (arb.ca.gov)*.

- Local conditions: Not every practice is applicable, feasible, or even desirable in every location across California. Implementation of these practices should account for local conditions and needs that may affect the appropriateness of that practice.
- Long-term carbon storage: The ability to sequester additional carbon into NWL is only beneficial to the climate if that carbon stays out of the atmosphere. Many of the additional practices listed here may require continual incentives or interventions to ensure permanence of carbon storage in the soil and biomass. For example, in croplands, it is difficult to estimate how much of the carbon stored by no-tillage can be released by a single subsequent tillage, but a return to conventional tillage would usually be expected to erase most gains.[501,502]
- Scaling actions: There are uncertainties on how these practices may impact both the environment and communities when significantly expanded. For this reason, it is best to take a cautious and measured approach to ramping up actions to a larger scale.
- Infrastructure and operational needs: Scaling up the implementation of some of these practices demands transformational change in the supporting infrastructure and operational frameworks. For example, increasing forest management to the degree included in the Scoping Plan Scenario will require significant changes to wood-processing infrastructure, workforce capacity, permitting processes, technical assistance, and other operational constraints. The increased application of compost to croplands, and potentially to rangelands, will require a significant increase in organic waste and dairy manure collection to increase compost supply, in line with SB 1383. This will also require additional compost production facilities as well as compost/organic waste transportation and application methods.
- Co-benefits: Many co-benefits from these practices exist beyond the climate benefits. These co-benefits include improved public and worker health; improved microbial, insect, and wildlife habitat; enhanced biodiversity; greater labor demand in the nature-based economy; and improved climate resilience.
- Labor and Economics: Many of these practices require additional labor, and an evaluation of how many more jobs are needed to carry out many of these practices

[501] Muñoz-Romero, V., R. J. Lopez-Bellido, P. Fernandez-Garcia, R. Redondo, S. Murillo, and L. Lopez-Bellido. 2017. "Effects of tillage, crop rotation and N application rate on labile and recalcitrant soil carbon in a Mediterranean Vertisol." *Soil Tillage Res.* 169, 118–123.
[502] Mitchell, J. P., A. Shrestha, W. R. Horwath, R. J. Southard, N. Madden, J. Veenstra, and D. S. Munk. 2015. "Tillage and cover cropping affect crop yields and soil carbon in the San Joaquin Valley." *California. Agron. J.* 107, 588–596.

is currently unknown. There will also be the need to explore the costs and economic benefits of implementing these additional practices.

- Retreatments: All of these practices have limits on how long they can enhance carbon sequestration. Many of these practices need to be periodically repeated, followed by complementary practices, or maintained through time. This increases costs and requires diligence and long-term stewardship.

Additional NWL Actions and Strategies

Below is a set of additional actions that should be taken on California's natural and working lands. Again, these practices were not modeled for this Scoping Plan, and all of the considerations listed above should be taken into account before implementing the following actions.

- Conservation of all NWL types (in line with the NWL Climate Smart Strategy and CNRA's Pathways to 30x30 California) is critical to ensuring continued carbon sequestration and provision of co-benefits from these lands for all Californians.[503]
- Reforestation following disturbance, using appropriate species, is an impactful practice that can help prevent conversion away from forestland and establish new trees to sequester carbon. The number of acres that may need reforestation following high severity wildfires is estimated to continue to increase into the future.
- Restoration of shrublands, chaparral, riparian zones, and oak woodlands across California includes a variety of practices to alter their structure and return endemic species to the areas. These unique habitats provide multiple co-benefits to the state, such as clean water, reduced wildfire risk, and biodiverse habitats for flora and fauna.
- Conservation and restoration of wetlands, beyond the Delta wetlands included in the NWL modeling, can protect these unique habitats and the climate benefits they provide. These wetland types can include but are not limited to coastal wetlands, mountain meadows, vernal pool complexes, alkali sinks and meadows, and floodplains.
- Conservation and restoration of seagrasses and seaweeds provide a number of benefits, including carbon storage and sequestration, habitat provision for many culturally and commercially important species of fishes and invertebrates, shoreline protection, and tourism opportunities.[504]

---

[503] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N26, N27. finalejacrecs.pdf (arb.ca.gov).

[504] AB 32 EJ Advisory Committee. 2022 Scoping Plan Recommendations, N2. finalejacrecs.pdf (arb.ca.gov).

- Prescribed herbivory utilizes various livestock to consume vegetation to reduce fuel loads across an area. This fuel management practice can be used in forests, grasslands, and shrublands as an effective alternative to herbicide use, and should be considered wherever local conditions allow.
- Urban and community greening efforts such as green schoolyards, urban farms, rain gardens, community gardens, community composting, and many more provide numerous health benefits to communities.
- Additional Healthy Soils Program practices on annual croplands such as conservation cover and crop rotation, biomass planting for borders, wind barriers, riparian areas, and improved nutrient management can improve soil health, water retention, and increase carbon stocks.
- Healthy Soils Program practices on perennial croplands and rangelands, such as compost application and alley cropping/cover cropping to improve soil health, water retention, erosion control, and biomass growth.[505]
- Stacking of these Healthy Soils Program practices, where appropriate, in perennial and annual systems, can synergistically improve soil health and provide multiple benefits.
- Mulching adds high carbon materials to croplands or fallowed lands to reduce competing vegetation and retain moisture. This practice can support other benefits such as reduced water use and reduced synthetic pesticide and fertilizer use, as well as provide a use for suitable forest and agricultural waste biomass.
- Reductions in the use of synthetic fertilizers in cropland management, generally supported by the implementation of new management tools or technologies, can lead to reductions in GHG emissions from the production and application of fertilizers. This benefit is in addition to the co-benefits of reduced chemical runoff into waterways and reduced exposure of human populations to their harmful effects.

[505] Various types of organic amendments are being researched for application to particular landscape types. For example, compost application to rangelands is a relatively new practice that has been shown to improve soil health and increase carbon sequestration in the short term, though the science on the long-term impacts of this practice is still developing and the supply of available compost may be limiting.

Chapter 5: Challenge Accepted

This chapter provides an overview of the next steps and partnerships that will be needed to successfully implement this Scoping Plan. The path forward is not dependent on one agency, one state, or even one country. It will take action on a global level to address the threat climate change poses. But, the work begins at home.[506] The state can lead by engaging Californians and demonstrating how action at the state, regional, and local levels of government, as well as action at community and individual levels, can contribute to addressing the challenge before us. We must build partnerships with academic institutions, private industry, and others to support and accelerate the transition to carbon neutrality. Ultimately, the success of this Scoping Plan will be measured by our ability to implement the actions modeled in the Scoping Plan Scenario at all levels of government and society. This will depend on a mix of legislative action, regulatory program development, incentives, institutional support, workforce and business development, education and outreach, community engagement, and research and development and deployment. Optimizing this mix will help to ensure that clean energy and other climate mitigation strategies are clear, winning alternatives in the marketplace and in communities—to promote equity, drive innovation, and encourage consumer adoption. Bold institutional action will catalyze continued research and push private investment to create jobs and bring innovative ideas to reality.

State-level Action

Achieving the targets described in this Scoping Plan will require continued commitment to and successful implementation of existing policies and programs and identification of new policy tools and technical solutions to go further, faster. California's Legislature and state agencies will continue to collaborate to achieve the state's climate, clean air, equity, and broader economic and environmental protection goals. It will be necessary to maintain and strengthen this collaborative effort, and to draw upon the assistance of the federal government, regional and local governments, tribes, communities, academic institutions, and the private sector to achieve the state's near-term and longer-term emission reduction goals and a more equitable future for all Californians.

---

[506] This "polycentric" approach to climate challenges, engaging many levels of government, was articulated in leading papers by Nobel laureate Elinor Ostrom. See, for example, Ostrom, E. 2014. "A Polycentric Approach to Coping with Climate Change." *Annals of Economics and Finance* 15-1, 97–134.

Regulations and Programmatic Development

Meeting the AB 32 2020 GHG emissions reduction target several years earlier than mandated demonstrated that developing mitigation strategies through a public process, where all stakeholders have a voice, leads to effective actions that address climate change and yields a series of additional economic and environmental co-benefits to the state. Following adoption of this Scoping Plan, state agencies will continue to update and implement new and existing programs to align with the outcomes in the plan. Community, tribal, and stakeholder engagement will be a critical part of this work. Several state agencies, including CARB, the CEC, the California State Transportation Agency (CalSTA), the CPUC, and others will need to be part of various subsequent rulemaking processes. Each of these agencies' leadership and technical staff will engage with the public through public meetings, written and oral comment, and other methods of engagement. This work will be informed by evaluations of the health, air quality, environmental, equity, and economic benefits and impacts of regulations, including an assessment of the societal cost of carbon, as required under AB 197.

Incentive Programs

As described in Chapter 1, incentive programs are one of the most important tools the state has in advancing our low carbon future, especially for climate vulnerable communities. The programs ensure clean technology and energy are accessible and are critical to closing ongoing opportunity gaps. These programs also leverage private-sector investment and build sustainable, growing markets for clean and efficient technologies, and they are particularly necessary to support GHG emission reduction strategies for priority sectors, sources, and technologies. Clean technologies are often already the best and lowest cost option over their lifetimes but incentive funding is critical to ensure that they are broadly available, especially in climate vulnerable communities. Incentives also build on California's long track record of driving innovative technology developments, and creating new industries, with targeted investment. The Inflation Reduction Act also provides a new source of funding and tax incentives that must be leveraged to help achieve the state's climate goals.

Many state funding programs are designed to achieve multiple objectives simultaneously: reduce emissions from GHGs, criteria pollutants, and toxic air contaminants; manage natural and working lands for carbon sequestration; and address health and opportunity gaps in disadvantaged communities. California's incentive programs focused on jump-starting the transition to a zero emission transportation future are a good example of this "stacked" approach. The state is investing billions of dollars through programs such as the On-Road Heavy-Duty Voucher Incentive Program and Clean Cars 4 All in order to replace the light- and heavy-duty vehicles most responsible for the state's GHG emissions and poor air quality, all while bolstering the nascent ZEV market. Further strategies aid in developing new technologies, in ramping up access for all, and in shifting to cleaner modes of transport; for instance, by supporting investments in walkable, bikeable communities and transit, as well as in vehicles. This funding strategy is, of course, paired with the regulatory approach described above.

Local Action

Local action by cities can support and amplify efforts to reduce GHGs. For example, the City of Oakland requires all new construction to be all-electric and is currently working on electrifying existing buildings.[507] In addition, starting in 2023, the City of Sacramento will require all new buildings under three stories to be all-electric, and it extends the mandate to all new construction by 2026 with some limited exemptions. The City of Sacramento also requires levels of EV charging infrastructure in new construction starting in 2023, higher than the minimum state requirements, and provides parking incentives for zero-emission carsharing and EV charging.[508] Local governments asserting this type of leadership are critical partners in supporting state-level measures to contain the growth of GHG emissions associated with the transportation system and the built environment.

California must accommodate population and economic growth in a far more sustainable and equitable manner than in the past. Good climate policy can and should create affordable and pleasant places to live, with effective transport and clean air for all—a future in which local governments and communities are central partners. Local governments have the primary authority to plan, zone, approve, and permit how and where land is developed to accommodate population growth, economic growth, and the changing needs of their jurisdictions. They also make critical decisions on how and when to deploy transportation infrastructure, and can choose to support transit, walking, bicycling, and neighborhoods that do not force people into cars. Local governments also have the option to adopt building ordinances that exceed statewide building code requirements, and play a critical role in facilitating the rollout of ZEV infrastructure. As a result, local government decisions play a critical role in supporting state-level measures to contain the growth of GHG emissions associated with the transportation system and the built environment—the two largest GHG emissions sectors over which local governments have authority.

Local governments are also frequently the source of innovative and practical climate solutions that can be replicated in other areas. Their efforts to reduce GHG emissions within their jurisdictions are vital to achieving the state's near-term air quality and long-term climate goals. Local governments must continue to take action that affirmatively

[507] City of Oakland. Building Electrification. https://www.oaklandca.gov/projects/building-electrification.
[508] City of Sacramento. Electrification of New Construction. http://www.cityofsacramento.org/SacElectrificationOrdinance.

builds the projects and expend the funds needed to further the state's collective path toward equitable emissions reductions. As such, aligning local jurisdiction action with state-level priorities to tackle climate change and the outcomes called for in this Scoping Plan is critical to achieving the statutory targets for 2030 and 2045. Local governments can implement climate strategies that can effectively engage residents by addressing local conditions and issues that also deliver local economic benefits.

Local Climate Action Planning and Permitting

California encourages local jurisdictions to take ambitious, coordinated climate action at the community scale; action that is consistent with and supportive of the state's climate goals.[509] As discussed in more detail in Appendix D (Local Actions), local jurisdictions can do much to enable statewide priorities, such as taking local action to help the state develop the housing, transport systems, and other tools we all need. Indeed, state tools—such as the Cap-and-Trade Program or zero-emission vehicle programs—do not substitute for these local efforts. Multiple legal tools are open to local jurisdictions to support this approach, including development of a climate action plan (CAP), sustainability plan, or inclusion of a plan for reduction of GHG emissions and climate actions within a jurisdiction's general plan. Any of these can help to align zoning, permitting, and other local tools with climate action.

Once adopted, the GHG emissions reductions plans detailed in CAPs can provide local governments with a valuable tool for coordinated climate planning in their community. When a local CAP complies with CEQA requirements, individual projects that comply with the CAP are allowed to streamline the project-specific GHG analysis.[510,511] Effectively, local governments that adopt a CEQA-compliant CAP enable project developers to use this streamlined approach. This saves time and resources and provides more consistent expectations for how GHG reduction measures are applied across projects in the jurisdiction. While the state encourages local governments to follow this approach, we acknowledge not all jurisdictions have the resources to develop a CAP that meets the CEQA requirements.

In addition to being required for a local CAP to comply with CEQA, local GHG reduction targets have long been recommended as part of the process of developing a climate

[509] This plan provides more detailed guidance and tools to local governments in Appendix D (Local Actions).

[510] Cal. Code of Regs., tit. 14, § 15183.5.

[511] California Governor's Office of Planning and Research. n.d. "General Plan Guidelines - Chapter 8 Climate Change."

action plan.[512] One challenge local jurisdictions have faced is how to evaluate and adopt quantitative, locally appropriate goals that align with statewide goals. An effective response to this challenge is to focus on goals that can help implement overall state priorities—enabling the key transformations California needs.

There are many ways that local governments can make key contributions to this transformation, depending on the characteristics of their jurisdiction and community. For example, some jurisdictions will inherently have more land capacity to remove and store carbon, whether through natural and working lands or by other means. Other jurisdictions will be host to GHG-emitting facilities that serve necessary functions and will take time to transition to clean technology (e.g., municipal wastewater treatment plants, landfills, and energy generation and transmission facilities). It is important to recognize that we will need to build new energy production and distribution infrastructure, and repurpose existing ones, for clean technology and energy before we are able to phase down existing fossil sources. There also will be a need to handle the significant amount of biomass resulting from sustainable forest management for catastrophic wildfire prevention, agricultural waste, and landfill diversion.

Regional efforts can support change too: energy and transportation systems that serve Californians do not stop at jurisdictional boundaries, and some local decisions can have ramifications for other communities. For instance, Metropolitan Planning Organizations (MPOs) can help to integrate local efforts by planning consistent with the Scoping Plan and Climate Action Plan for Transportation Infrastructure, including by removing polluting roadway capacity expansions from project pipelines and instead focusing on climate-friendly solutions. These varied capabilities and needs should be taken into account in setting targets for local climate plans. For instance, although net zero targets can often be valuable and achievable, and mitigation is important, targets should be considered in the larger context of these goals. This all means any GHG targets on a local scale should take into consideration the actions and outcomes included in this Scoping Plan. Jurisdictions considering "net zero" targets should carefully consider the implications such targets may have on emissions in neighboring communities and the ability of the state to meet our collective targets.

Jurisdictions without formal CAPs also have important opportunities within this context. These jurisdictions can still take actions that effectively translate key state plans, goals, and targets, including those articulated in this Scoping Plan for local action. For instance, state ZEV targets can advance local efforts to promote broad and equitable access to charging and fueling. Similarly, local jurisdictions can enable reduced dependence on

---

[512] Climate Smart Communities. 2014. Climate Action Planning Guide. https://cdrpc.org/wp-content/uploads/2015/05/CAP-Guide_MAR-2014_FINAL.pdf.

single-occupancy vehicles by supporting dense infill housing and transit, among other actions. Such actions can be reflected in particular project plans, in general plans, or through other local policies. Regional partnerships among these jurisdictions can also help tap resources and provide for more effective overall action.

Unlocking CEQA Mitigation for Local Success

The California Environmental Quality Act also provides important tools for lead agencies to support the achievement of the state's GHG and VMT reduction goals. Although many climate-friendly local government actions already fall into categories that may not require a full CEQA analysis, thanks to streamlining or other tools, and although certain product types (such as affordable infill housing) are generally clearly consistent with state climate goals, CEQA analyses may still sometimes be required. CEQA can be a powerful and useful tool to engage the public, identify additional opportunities to support climate efforts, and localize change. It is important that lead agencies look for ways to use CEQA to support these core purposes, ensuring that these processes do not become sources of delay but instead unlock more opportunities. The uncertainty analysis in Chapter 2 evaluates how project implementation delays can lead to missed state climate targets and continued dependence on fossil energy. Mitigation measures applied in the communities affected by projects subject to CEQA have the added benefit of improving health, social, and economic resiliency as climate impacts worsen.

Appendix D (Local Actions) explores the role of local government action and CEQA in detail. As discussed there, an important CEQA-related tool is mitigation—which can be used to further drive local action consistent with state climate goals. When a lead agency determines that a proposed project would result in potentially significant GHG impacts due to its GHG emissions or a conflict with state climate goals, the lead agency must impose feasible mitigation measures to minimize the impact. Appendix D (Local Actions) provides suggestions for prioritizing the various types of mitigation, starting with on-site GHG-reducing design features[513] and mitigation measures, such as methods to reduce VMT and support building decarbonization, access to shared mobility services or transit, and EV charging. After exhausting all the on-site GHG mitigation measures, CARB recommends prioritizing local, off-site GHG mitigation measures, including both direct investment and voluntary GHG reduction or sequestration projects, in the neighborhoods impacted by the project. This could include, for example, development of a neighborhood green space, investment in street trees, or expansion of transit services. Implementing GHG mitigation measures in the project's vicinity would allow the project proponent and the lead agency to work directly with the affected community to identify and prioritize the

[513] Cal. Code of Regs., tit. 14, § 15126.4(c)(2) and (3).

mitigation measures that meet their needs while minimizing multiple environmental and societal impacts.

Once all potential on-site and local off-site GHG mitigation measures have been incorporated to the extent feasible, Appendix D (Local Actions) provides further suggestions for prioritizing other mitigation types, including non-local off-site mitigation, and voluntary offsets issued by a recognized and reputable voluntary carbon registry (as listed on CARB's website[514]) may be appropriate. Additional in-state mitigation also may be available in the upcoming SB 27[515] (Skinner, Chapter 237, Statues of 2021) registry, which will serve as a database of projects in the state that drive climate action on natural and working lands. Lead agencies should use substantial evidence to demonstrate that the project proponent explored and prioritized investments in feasible, local mitigation prior to moving mitigation to a geography located farther away from the project.

Communities and Environmental Justice

As noted in Board Resolution 20-33,[516] it is incumbent on CARB to function as an agent of responsible social change, especially when it is clear that environmental injustices continue to persist for low-income communities, tribes, and communities of color.

State law defines *environmental justice* as the fair treatment of all people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies.[517] Government Alliance for Race and Equity (GARE)[518] defines *racial equity* as when race can no longer be used to predict life outcomes and outcomes for all groups are improved.

For this Scoping Plan to be successful, it must address environmental justice and advance racial equity. Implementation of the plan needs to address the needs of those communities that are disproportionately burdened by climate impacts and continue to face significant health and opportunity gaps. Now, we need to ensure our actions allow these communities to not only have a seat at the table, but also inform and shape the policies

---

[514] CARB. 2022. Offset Project Registries. https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program/offset-project-registries.

[515] SB 27. Carbon sequestration: state goals: natural and working lands: registry of projects. (SB 27, Skinner, Chapter 237, Statutes of 2021). https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220SB27.

[516] CARB. 2020. Resolution 20-33: A Commitment to Racial Equity and Social Justice. October 22. https://ww2.arb.ca.gov/sites/default/files/barcu/board/res/2020/res20-33.pdf.

[517] Gov. Code, § 65040.12, subd. (e).

[518] Local and Regional Government Alliance on Race and Equity. 2015. *Advancing Racial Equity and Transforming Government: A Resource Guide to Put Ideas into Action.* Page 9. https://racialequityalliance.org/wp-content/uploads/2015/02/GARE-Resource_Guide.pdf.

to ensure their communities thrive. With this Scoping Plan, the state also adds a new tool to identify which communities will be the least resilient in the face of selected climate impacts and will see disproportionate economic impacts as a result. As described in Chapter 3, the CVM will enable the state to target programs and policies to build resiliency in the specific regions that will feel climate impacts more acutely due to existing health and opportunity disparities leading to disproportionate economic impacts. This tool will be critical in the state's efforts to address climate impacts while accounting for environmental injustices and racial inequities. CARB will incorporate the CVM into its work as it moves forward and will share this new tool with other agencies to align our efforts. The goal is to keep expanding the CVM to incorporate additional climate impacts to better identify disproportionate economic impacts as community level data becomes available.

AB 617 is another important tool for both Air Districts and CARB to bring resources to communities that have long been disproportionately burdened by poor air quality. While AB 617 does not require local agencies to participate in the Community Air Protection Program, several AB 617 communities are finding ways to bring local land use agencies to the table to respond to community priorities. We look forward to more opportunities to foster relationships with local authorities and continued collaboration between state and air district programs.

In alignment with AB 32, and to ensure environmental justice and racial equity were integrated into this Scoping Plan, CARB reconvened the AB 32 Environmental Justice Advisory Committee (EJ Advisory Committee) to advise CARB on the development of this Scoping Plan. Since reconvening in May 2021, the EJ Advisory Committee has engaged in the following activities:

- In October 2021, the EJ Advisory Committee sent a letter to the governor requesting a timeline extension for the Scoping Plan process. In response to the EJ Advisory Committee's letter, CARB modified this Scoping Plan process[519] and committed to an active engagement with the EJ Advisory Committee following the approval of this Scoping Plan. The EJ Advisory Committee also presented to the CARB Board[520] at its October 2021 Board meeting, reiterating its request for a timeline extension, as well as sharing additional concerns about process.

---

[519] Randolph, L. M. 2021. LMR October 19 response to Environmental Justice Advisory Committee Letter. https://ww2.arb.ca.gov/sites/default/files/2021-10/LMR%20October%2019%20response%20to%20EJAC%20Letter%20Final.pdf.

[520] Argüello, M. D., K. Hamilton, S. Taylor, and P. Torres. 2021. EJ Advisory Committee Co-Chair Informational Presentation to CARB Board. October 28. https://ww2.arb.ca.gov/sites/default/files/barcu/board/books/2021/102821/21-11-4pres.pdf.

- In December 2021, the EJ Advisory Committee shared its responses to Scenario Input Questions,[521] as well as a narrative document outlining their concerns[522] around the process, the need for evaluation, and the need for a tribal representative. In response to the EJ Advisory Committee Scenario Input Questions, CARB incorporated the EJ Advisory Committee responses into the Scenario Assumptions document,[523] and modeled results from PATHWAYS.[524] In response to the EJ Advisory Committee's concerns, CARB worked diligently to appoint a tribal representative[525] in February 2022, and to outline additional opportunities for the EJ Advisory Committee to engage in the Scoping Plan process.[526]
- In March 2022, the EJ Advisory Committee presented at the joint EJ Advisory Committee / CARB Board meeting[527] and walked through their preliminary draft recommendations to inform this Scoping Plan. In April, the EJ Advisory Committee shared its revised preliminary draft recommendations[528] to inform this Scoping Plan.
- In September 2022, the EJ Advisory Committee presented at the joint EJ Advisory Committee / CARB Board meeting[529] and engaged in discussion about priority items as they relate to incorporating environmental justice into the Scoping Plan. By the end of September, the EJ Advisory Committee shared its final

---

[521] EJ Advisory Committee. 2021. EJ Advisory Committee Final Responses to CARB Scenario Inputs. December 2. *https://ww2.arb.ca.gov/sites/default/files/2021-12/EJAC%20Final%20Responses%20to%20CARB%20Scenario%20Inputs_12_2_21.pdf*.

[522] EJ Advisory Committee. 2021. EJ Advisory Committee Responses to Scenario Input Questions. EJ Advisory Committee narrative document regarding scenario input recommendations. December 1. *https://ww2.arb.ca.gov/sites/default/files/2021-12/EJAC%20Narrative%20Document%20re%20Scenario%20Input%20Recommendations%2012_1_2021.pdf*.

[523] CARB. 2021. PATHWAYS Scenario Modeling. *https://ww2.arb.ca.gov/sites/default/files/2021-12/Revised_2022SP_ScenarioAssumptions_15Dec.pdf*.

[524] E3. 2022. CARB Draft Scoping Plan AB32 Source Emissions Initial Modeling Results. March 15. *https://ww2.arb.ca.gov/sites/default/files/2022-03/SP22-Model-Results-E3-ppt.pdf*.

[525] CARB. AB32 EJ Advisory Committee Meeting, February 28, 2022 CARB Update. *https://ww2.arb.ca.gov/sites/default/files/2022-02/CARB%20EJAC022822presentation.pdf*.

[526] Fletcher, C. 2021. CARB Response to EJ Advisory Committee Narrative. CARB. December 15. *https://ww2.arb.ca.gov/sites/default/files/2021-12/CARB%20response%20to%20EJAC%20Narrative.pdf*.

[527] EJ Advisory Committee. 2022. EJ Advisory Committee Presentation: Preliminary Draft Recommendations. March 10. *https://ww2.arb.ca.gov/sites/default/files/barcu/board/books/2022/031022/ejacpres.pdf*.

[528] AB 32 EJ Advisory Committee. Draft Recommendations. *https://ww2.arb.ca.gov/sites/default/files/barcu/board/books/2022/031022/ejacrecsrevised.pdf*.

[529] EJ Advisory Committee. 2022. EJAC Presentation. September 1. *https://ww2.arb.ca.gov/sites/default/files/barcu/board/books/2022/090122/ejacpres.pdf*

recommendations[530] to inform this Scoping Plan. To the extent possible, CARB has incorporated and cited these recommendations through this Scoping Plan.

In addition to the activities listed above, Central Valley EJ Advisory Committee members hosted a successful community engagement workshop[531] in San Joaquin Valley in February 2022 with over 100 attendees. Members of EJ Advisory Committee hosted a statewide community engagement workshop[532] in June 2022 with more than 165 attendees. Throughout the EJ Advisory Committee's process, members of the Committee continued to work with their communities to ground truth their recommendations to inform the development of the Scoping Plan. The EJ Advisory Committee worked hard to ensure the voices of those communities most burdened by climate impacts were reflected in the plan. The EJ Advisory Committee will continue to play an ongoing role in the implementation of this Scoping Plan to ensure environmental justice and racial equity are prioritized in our effort to address the climate challenge before us.

To the extent possible, the EJ Advisory Committee's recommendations were integrated throughout the plan. This plan directly cites instances where there is alignment between the plan and the EJ Advisory Committee recommendations. This approach seeks to ensure there is more transparency and identify consensus that exists, as well as relevant ways equity and environmental justice are addressed in this plan and in the planning for future related implementation activities. CARB is dedicated to its efforts to ensure this plan does not leave communities behind.

As this Scoping Plan moves into the implementation phase, there will be a need to better understand how to address EJ Advisory Committee recommendations on the following topics:

- Actions under the jurisdiction of other agencies: there are certain EJ Advisory Committee recommendations that are outside of CARB's jurisdiction. As the EJ Advisory Committee continues to convene, it would be helpful to understand the

[530] EJ Advisory Committee. 2022. EJAC 2022 Scoping Plan Recommendations. September 30. https://ww2.arb.ca.gov/sites/default/files/barcu/board/books/2022/090122/finalejacrecs.pdf

[531] San Joaquin Valley Climate Justice & the Scoping Plan. 2022. https://ww2.arb.ca.gov/sites/default/files/2022-07/SJV%20Climate%20Justice%20%26%20the%20Scoping%20Plan%20Workshop%20Report%20out%20%26%20Recommendations_5.2022.pdf

[532] EJAC. 2022. *EJAC/Community Engagement Synthesis Report '22.* https://ww2.arb.ca.gov/sites/default/files/2022-07/EJAC-CommunityEngagement-SynthesisReport-2022-English%26Spanish.pdf.

role that CARB can play as it relates to the EJ Advisory Committee's recommendations for actions outside CARB's jurisdiction and coordinates with sister agencies.

- Actions that require legislative direction: there are certain EJ Advisory Committee recommendations that would require legislative action. As the EJ Advisory Committee continues to convene, it will be helpful to understand how CARB can work with the EJ Advisory Committee to share these recommendations with the appropriate members of the Legislature.
- Actions directly tied to implementation activities: This Scoping Plan is not an implementation document; it is a plan to chart a course to continue to reduce GHG emissions and achieve carbon neutrality. Once the Scoping Plan is approved, there will be follow-up action at CARB, as well as at other agencies. In these follow-up efforts, there will be a role for ongoing EJ Advisory Committee engagement.
- Actions to implement recent legislation, such as SB 905.

CARB proposes to continue to work with the EJ Advisory Committee to better understand how to move forward on EJ Advisory Committee recommendations that fall into the topics listed above and any other recommendations that were not included in this plan. It is also important to note that there are numerous recommendations where CARB shares the goals of the EJ Advisory Committee and can assist in implementation steps. Examples include the following:

- CARB shares the goal of prioritizing non-fossil energy generation and supports non-fossil projects and opportunities to locate behind-the-meter clean resources in communities of concern in programs such as the Solar on Multifamily Affordable Housing program.
- CARB will engage with agencies and academic institutions to further workforce development.
- Many other recommendations related to financial support for various energy projects, such as microgrids, are within the purview of the CPUC or local publicly owned utilities. Similarly, utility scale projects are within the jurisdiction of other agencies. However, CARB supports strategies identified in the recommendations such as offshore wind to reduce the reliance on fossil fuel generation.
- CARB is supportive of rooftop solar, although it is not within CARB's jurisdiction to determine how incentives for those projects are structured.
- CARB is supportive of strong energy decarbonization goals, recognizing that increased reliance on electrification in transportation and other sectors will create significant demand for electricity, and therefore ensuring reliability of a decarbonized grid is a critical need for the state.
- In the transportation sector, CARB is supportive of the EJ Advisory Committee's recommendations to maintain aggressive zero emission vehicle goals consistent

with its statutory mandate to ensure regulations are technologically feasible and in alignment with Governor Newsom's ZEV Executive Order (EO N-79-20). CARB looks forward to continued engagement on rulemakings that will implement these goals.

- As noted elsewhere in this plan, CARB is supportive of the Caltrans California Transportation Plan 2050 and the California Climate Action Plan for Transportation Infrastructure.
- CARB is supportive of additional public support for transit. CARB is supportive of locating EV charging in low-income communities and communities of color.
- CARB is supportive of prioritizing funding incentives for transit and heavy- and medium-duty vehicles, although CARB does believe there is an important role for incentives that support adoption of light-duty vehicles for the time being. CARB will also be opening a rulemaking on the Low Carbon Fuel Standard to ensure it continues to support clean fuels that will displace petroleum fuels and will consider the EJ Advisory Committee recommendations on this program.
- In the industrial sector, in addition to the strategies discussed more fully in this Scoping Plan, CARB continues to work with the Legislature, local agencies, and air districts to support, implement, and enforce effective reductions in emissions of GHGs and air pollutants in stationary sources. The air districts have the authority to directly issue permits addressing a facility's criteria pollutant and toxics emissions levels. These levels are set after careful permit review, under district regulation and statute. However, AB 617 directs and authorizes CARB to take several actions to improve data reporting from facilities, air quality monitoring, and pollution reduction planning for communities affected by a high cumulative exposure burden. CARB will continue to implement AB 617 and look for ways to strengthen the Community Air Protection Program.
- Considerations around the phaseout of oil and gas extraction and refining, and the role of carbon capture are discussed more thoroughly in Chapter 2.

As CARB continues to engage with the EJ Advisory Committee—in addition to the EJ Advisory recommendations that have been integrated throughout this plan—below are the following commitments that CARB is making to ensure that environmental justice is integrated in this plan and its implementation:

- Building decarbonization is a pillar of this Scoping Plan and CARB commits to working closely with state and local agencies to implement the EJ Advisory Committee recommendations that call for prioritization for residents in low-income communities and communities of color in this transition.
- CARB commits to sharing the EJ Advisory Committee's recommendations with the CEC, CPUC, and other agencies administering funds to support building

decarbonization, and to work closely with those agencies as they engage in public processes to further building decarbonization.

- CARB has committed to review the Cap-and-Trade program and determine what potential legislative or regulatory amendments could be necessary to ensure the program continues to deliver GHG reductions needed to achieve the statutory climate goals. In that process, CARB will consider the recommendations of the EJ Advisory Committee[533] and Independent Emissions Market Advisory Committee,[534] as well as others.

Critically, the EJ Advisory Committee makes numerous recommendations centered around tracking progress of the various strategies in this Scoping Plan. Currently, progress is tracked and reported in numerous ways, including the annual GHG inventory and reports to the Legislature. Part of the ongoing work of implementation, however, will include consideration of ways to provide more data and information to the public, such as rates of deployment of clean energy and technology as described in Chapter 1. CARB will also continue to collaborate with CDPH and OEHHA on health metrics to track cumulative benefits of air pollution and climate programs, especially in low-income communities and communities of color.

As noted earlier in this document, the EJ Advisory Committee will continue to play a vital role in the Scoping Plan and its implementation to ensure environmental justice and racial equity are prioritized in our effort to address the climate challenge before us. This includes ongoing EJ Advisory Committee engagement to advise CARB on the development of the Scoping Plan and any other pertinent matters in implementing AB 32. The ongoing EJ Advisory Committee will help to ensure integration of environmental justice in implementation efforts as it relates to AB 32, and also help CARB as we work toward a future where race is no longer a predictor for life outcomes.

Academic Institutions and the Private Sector

Academic institutions produce and present the latest science on both the impacts of, and actions to reduce, climate change damages. They are also leading the way by

[533] California Legislative Information. Bill Text – AB 32. Air pollution: greenhouse gases: California Global Warming Solutions Act of 2006. (AB 32, Nuñez, Chapter 488, Statutes of 2006). https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200520060AB32.

[534] California Legislative Information. Bill Text – AB 398. California Global Warming Solutions Act of 2006: market-based compliance mechanisms: fire prevention fees: sales and use tax manufacturing exemption. (AB 398). https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB398.

establishing their own climate goals and GHG emissions reductions targets.[535, 536, 537] They are incubators for innovation and knowledge in clean energy and technology and play an important role in adding to the wealth of robust information to inform policies and programs. Academic institutions have the ability to fill knowledge gaps and push us toward new frontiers. As we move forward, we will continue to see these institutions as partners and resources that can help CARB look for ways to accelerate and introduce actions to reduce GHG emissions and remove and store carbon.

As such, it will be important to maintain and enhance relationships with academic institutions, including community colleges. Community colleges are more likely to have a large proportion of first generation students or students that come from low-income communities or communities of color. The perspective of this diverse student body will be critical to inform discussions on climate change damages and mitigation efforts. This student body is also a future workforce, and courses to teach the skills for a sustainable economy are a chance to close historical opportunity gaps. Importantly, many of the students at community colleges are local residents and community members. This engagement provides another way to invest in communities across our state. The Foundation for California Community Colleges is already leading the way through innovate programs such as their Good Jobs Challenge - California Resilient Careers in Forestry.[538] These types of programs could be replicated across other sectors. CARB will evaluate how to leverage the requirements in AB 680 on workforce development in the California Climate Investments programs with the work at the Foundation for California Community Colleges.

As noted in Chapter 1, public and private partnerships will be important as we move forward in the great energy transition. But the private sector is also important in the context of research and development and deployment. Many of these companies have the resources and expertise to build and produce the clean technology and energy we will need. It was through the efforts of several private companies (Bell, Exxon, Telecom

---

[535] University of California. Our Commitment. https://www.universityofcalifornia.edu/initiative/carbon-neutrality-initiative/our-commitment.

[536] California State University. Energy, Sustainability, & Transportation. https://www.calstate.edu/csu-system/doing-business-with-the-csu/capital-planning-design-construction/operations-center/Pages/energy-sustainability.aspx.

[537] California Community Colleges Chancellor's Office. Climate Action and Sustainability. https://www.cccco.edu/About-Us/Chancellors-Office/Divisions/College-Finance-and-Facilities-Planning/Facilities-Planning/Climate-Action-and-Sustainability?msclkid=4a72350ec4f511ecaf292c6b14ac9a4f.

[538] Foundation for California Community Colleges. 2022. Good Jobs Challenge. Developing Resilient Careers in Forestry for Californians. https://foundationccc.org/What-We-Do/Workforce-Development/Good-Jobs-Challenge.

Australia) that the photovoltaic solar panels in use today were developed.[539] Similarly, it was companies such as General Electric and Texas Instruments that contributed to the development of hydrogen fuel cells.[540] This Scoping Plan includes the known and emerging clean technologies and fuels available today. The private sector spirit of invention, improvement, and innovation must continue to deliver new tools in the fight against climate change.

Individuals

This Scoping Plan not only projects ambitious availability of clean technology and energy, but also includes aggressive assumptions about consumer adoption of ZEVs, heat pumps, and other energy efficiency practices, among others. When it comes to climate change mitigation, the sum of the parts matters. Only when we add up the impacts of the choices we make do we understand the true impact on GHG emissions. Today, many Californians have opportunities to choose between driving a car, taking a bus, biking, or walking. Many can choose to install a heat pump or buy an electric cooktop. Together, we can increase these opportunities and pick the future we want. We can start or transform businesses that create clean jobs, innovate new technologies, or introduce new systems. We can engage with fellow workers to support durable paths for labor in a clean economy. And we can choose to engage with our community, tribes, and our governments to advocate for change, call out challenges, and propose solutions. Our choices will help determine California's climate future. Down one path is a future of climate impacts that will continue to worsen and further increase disparities across communities. Down the other is a future that avoids the worst impacts of climate change, improves air quality—especially for the most burdened communities—and fosters new economic and job opportunities to support a sustainable economy.

Importantly, we must acknowledge that historical decisions have resulted in health and opportunity gaps for residents in low-income communities and communities of color. Not everyone has the resources or access to make these choices—to buy a ZEV, install a heat pump, or use public transit to get to work. It is here that government can help. Government, at multiple levels, can fund programs and structure policies to provide consumers with more choice and to support them in adopting cleaner technology options. Whether through affordable energy rates or assistance in purchasing zero emission vehicles and appliances, we can use the transition to a carbon neutral economy as an opportunity to close some of these persisting opportunity gaps. By acting now, we can

---

[539] Californiasolarcenter.org. Passive Solar History. *http://californiasolarcenter.org/old-pages-with-inbound-links/history-pv/*.
[540] Fuel Cell Store. History of Fuel Cells. *https://www.fuelcellstore.com/blog-section/history-of-fuel-cells?msclkid=04a19450c50211ec8d20f2afff4039fe*.

change our planet’s fate and build a more resilient, healthier, and equitable future for all Californians.

APPENDIX D
LOCAL ACTIONS

This Page Intentionally Left Blank

1. Local Government Actions are Crucial for Supporting Attainment of the State's Climate Goals

Local government efforts to reduce greenhouse gas (GHG) emissions within their jurisdiction are critical to achieving the State's long-term climate goals, and can also provide important co-benefits, such as improved air quality, local economic benefits, healthier and more sustainable communities, and improved quality of life. Indeed, a substantial portion of California's GHG reduction potential comes from activities over which local governments have authority or influence.[1] Since the enactment of Assembly Bill (AB) 32 (Nuñez and Pavley, Chapter 488, Statutes of 2006), many local jurisdictions have sought to identify their role in implementing State-level decarbonization efforts. With increasing severity and occurrence of droughts, wildfires, extreme heat, and other conditions, the need for action is urgent.

Local governments have responsibility and authority over the built environment, transportation networks, and provision of local services. For example, local governments have primary authority to plan, zone, approve, and permit how and where land is developed to accommodate population and employment growth and the changing needs of their jurisdictions. They make decisions on how and when to deploy transportation infrastructure and can promote residential and commercial development that supports transit, bicycling, and walking. Local governments have the authority to adopt building ordinances that exceed statewide building code requirements and facilitate the implementation of zero-emission vehicle (ZEV) infrastructure.

Many jurisdictions have demonstrated bold climate leadership, yet meeting the challenge of climate change requires bolder actions from local governments across the state. For example, the City of Oakland requires all new construction to be all-electric and is currently working on electrifying existing buildings.[2] Starting in 2023, the City of Sacramento will require all new buildings under three stories to be all-electric. By 2026 the city will extend this requirement to all new construction, regardless of height, with some limited exemptions. The City of Sacramento also provides parking incentives for zero-emission carsharing and electric vehicle (EV) charging and will require higher than minimum State-required levels of EV charging infrastructure in new construction starting in 2023.[3] This type of leadership by local governments is critical to implementing State-level measures to address GHG emissions associated with transportation and the built environment.

---

[1] Wheeler, S. M., Jones, C. M., & Kammen, D. M. 2018. Carbon Footprint Planning: Quantifying Local and State Mitigation Opportunities for 700 California Cities. *Urban Planning, 3(2), 35-51.* Available at: *https://www.cogitatiopress.com/urbanplanning/article/view/1218*.

[2] City of Oakland. *Building Electrification*. Available at: *https://www.oaklandca.gov/projects/building-electrification* .

[3] City of Sacramento. *Electrification of New Construction.* Available at: *http://www.cityofsacramento.org/SacElectrificationOrdinance.*

This appendix includes recommendations intended to build momentum for local government actions that align with the State's climate goals, with a focus on local GHG reduction strategies (commonly referred to as climate action planning) and approval of new land use development projects, including through environmental review under the California Environmental Quality Act (CEQA). This appendix is not regulatory but is instead intended to provide clarification on specific topics requested by planners, CEQA practitioners, and community groups in response to challenges local jurisdictions face when implementing GHG reduction strategies or approving much-needed housing projects. It is not exhaustive and does not include everything local governments can implement to support the State's climate goals. It focuses primarily on climate action plans (CAPs) and local authority over new residential development. It does not address other land use types (e.g., industrial) or air permitting.

Recommendations in this appendix are meant to be used in combination with other planning and CEQA guidance documents including Chapter 8 of the General Plan Guidelines published by the Governor's Office of Planning and Research (OPR),[4] the State CEQA Guidelines,[5] OPR's CEQA Technical Advisories,[6] as well as guidance from local air districts and the California Air Pollution Control Officers Association (CAPCOA).[7]

The following sections discuss the implications for sustainable development on equity and environmental justice as part of a strategy to combat climate change and provide recommendations to local governments for:

- Developing local CAPs and strategies consistent with the State's GHG emission reduction goals;
- Incorporating State-level GHG priorities into their processes for approving land use plans and individual projects;
- Implementing CEQA mitigation, as needed, to reduce GHG emissions associated with new land use development projects; and
- Leveraging opportunities for regional collaboration.

1.1 Centering Equity in Local Government Action is Key to Addressing the Climate Crisis

Local government action to reduce GHG emissions is not only essential for meeting the State's climate goals; it can build better places for everyone in ways that begin to address the

---

[4] OPR. *General Plan Guidelines - Chapter 8 Climate Change.* Available at: *https://opr.ca.gov/planning/general-plan/guidelines.html.*

[5] Cal. Code Regs., tit. 14, §§ 15000 et seq.

[6] OPR. *Technical Advisories.* Available at: *https://opr.ca.gov/ceqa/technical-advisories.html.*

[7] CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emissions Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity: Designed for Local Governments, Communities, and Project Developers. Available at: *https://caleemod.com/handbook/index.html*.

entrenched inequities experienced by the most overburdened Californians (e.g., Black, Indigenous, People of Color [BIPOC] and low-income communities). Local policies that make it easier for people to afford homes in places with good access to jobs, services, open space, and education, as well as a variety of transportation options that reduce the need to drive, advance equity and reduce GHG emissions.

Ensuring that vulnerable communities benefit from efforts to reduce GHG emissions is crucial to the State's climate strategy. For example, Senate Bill (SB) 32 (Pavley, Chapter 249, Statutes of 2016) recognized that efforts to meet the State's climate goals must be done in an equitable manner by directing CARB to achieve more stringent GHG emission reductions in a way that benefits disadvantaged communities, who often bear the burden of climate impacts. AB 32 also directs that CARB "ensure that the greenhouse gas emission reduction rules, regulations, programs, mechanisms, and incentives under its jurisdiction, where applicable and to the extent feasible, direct public and private investment toward the most disadvantaged communities in California and provide an opportunity for small businesses, schools, affordable housing associations, and other community institutions to participate in and benefit from statewide efforts to reduce greenhouse gas emissions."[8] To address the State goals for housing affordability, social equity, and climate simultaneously, local government institutions are well-positioned to take on a portfolio of integrated strategies such that housing policies are designed to address climate goals and climate policies are designed to meet the State's housing needs. In many cases, land use strategies that support more compact development in infill areas, particularly those already displaying efficient resident travel patterns, have the greatest potential to reduce emissions while also reducing combined housing and transportation costs for Californians and infrastructure costs for local governments due to avoided new roads, public schools, and other sprawl supporting infrastructure. Infill housing development alleviates pressure to develop on the urban periphery, preserving natural and working lands and areas often at risk of wildfire.

The issues that shape where development goes are complex, but the location and type of new housing that is developed matters for climate, health, and equity. Accelerating housing production to meet the extraordinary need for more homes can help reduce vehicle miles traveled (VMT) and GHG emissions and advance health and equity objectives when new housing is developed in types and locations that align with these goals, and particularly when accompanied by complementary policies and investments to create sustainable communities and prevent displacement of existing residents. See Appendix E, Sustainable and Equitable Communities, for strategies to foster sustainable development.

Fostering transportation-efficient, resource-rich, accessible, and inclusive communities is a key strategy for climate, equity, health, and affordability. Climate-smart locations include neighborhoods, commercial corridors, town centers, downtowns, and other areas where

[8] Health & Saf. Code, § 38565.

residents have access to a broad range of mobility options in addition to private automobiles (such as transit, walking, and biking), as well as where residents have access to housing, jobs, and other key destinations. Such communities make it possible for residents to live, work, and recreate without dependence on a personal car. For trips where driving is required, car trips can be relatively short and public infrastructure should support the use of zero-emission vehicles. The predominant historical land use development paradigm that centers on mobility (how far you can go in a given amount of time) over accessibility (how many key destinations, including jobs, housing, and other services, you can reach in that time) has not resulted in equitable outcomes for BIPOC and low-income households, and, in fact, has exacerbated barriers to access and upward economic progress. Increasing housing opportunities in transportation-efficient locations is a necessary paradigm shift and is part of the State's GHG emission reduction strategy.

However, ensuring that the households that would benefit most from living in more accessible areas are not displaced by new investments requires that State, regional, and local governments proactively anticipate and avoid potential unintended equity and social consequences, including gentrification and displacement of historically underserved and disadvantaged communities. The most recent wave of displacement stems from a variety of factors and policies: exclusionary zoning, job growth and reinvestment, changing housing preferences among higher-income households, local policies and local opposition to new housing development proposals, lack of funding for new affordable housing, increased costs of building new housing, and a dearth of policies to preserve existing affordable housing and protect tenants.[9] These variables interact to drive up housing prices and rents for all households—particularly low-income and BIPOC households—increasing displacement pressures in established neighborhoods and forcing people to live in car-dependent neighborhoods away from community support systems and economic opportunities and increase households' combined housing and transportation costs.[10] Policies to facilitate both market rate and subsidized affordable housing production in infill neighborhoods should, over time, stabilize housing costs, minimize displacement, and create new housing opportunities in transportation-efficient locations.

Communities and local jurisdictions have a range of tools and strategies that they can utilize to proactively avoid displacement while facilitating much-needed new infill housing development. The State encourages local jurisdictions and communities to cooperatively develop strategic anti-displacement and neighborhood stabilization plans. Some California jurisdictions have developed these strategic plans (e.g., the City of Oakland's Roadmap to Promote Housing

[9] See resources posted at the Urban Displacement Project: *https://www.urbandisplacement.org/about/what-are-gentrification-and-displacement/*.
[10] Ewing, R., & Hamidi, S. 2017. *Costs of Sprawl.* Taylor & Francis.

Equity[11] and the City of San Jose's Citywide Anti-Displacement Strategy[12]). Jurisdictions and communities that have not implemented localized anti-displacement strategies can review lessons from other jurisdictions and refer to a 2021 literature review funded by CARB that examines the real-world effectiveness of various strategies to curb displacement.[13] In addition to documenting the efficacy of different strategies, the literature review also examines the potential of each strategy to prevent displacement, the type of regional housing market where the strategy is most effective, the most appropriate scale to implement different strategies, and the timeframe for preventing displacement.

The Department of Housing and Community Development's (HCD) recently established Prohousing Designation Program also recognizes local jurisdictions that take actions to accelerate housing production while promoting holistic land use planning that reflects the State's climate goals and helps to reduce VMT.[14] Local governments that earn the prohousing designation are effective at simultaneously promoting multiple objectives, including: increasing housing supply, affirmatively furthering fair housing, preserving existing affordable housing, and supporting VMT reduction. Communities that earn the prohousing designation can receive additional points or preference in the scoring of competitive State housing, community development, and infrastructure funding programs.

2. The Role of Local Climate Action Planning in Supporting the State's Climate Goals

Local governments across the state have developed different types of plans to tackle climate change, including CAPs, sustainability plans, or GHG reduction plans incorporated into a general plan.[15] While CAPs have become an important avenue for climate action at the local level, 47 percent of California cities and counties have no known CAP.[16] Many jurisdictions find that performing or hiring consultants to perform a GHG inventory and developing a CAP is

---

[11] City of Oakland. 2015. *A Roadmap Toward Equity: Housing Solutions for Oakland, California.* Available at: *https://www.policylink.org/sites/default/files/pl-report-oak-housing-070715.pdf.*

[12] City of San Jose. 2019. *Community Strategy to End Displacement.* Available at: *https://www.sanjoseca.gov/your-government/departments-offices/housing/resource-library/housing-policy-plans-and-reports/citywide-anti-displacement-strategy*.

[13] Karen Chapple & Anastasia Loukaitou-Sideris. 2021. White Paper on Anti-Displacement Strategy Effectiveness. CARB Research Contract Number 19RD018. Available at: *https://ww3.arb.ca.gov/research/single-project.php?row_id=68795*.

[14] Department of Housing and Community Development. 2022. *Prohousing Designation Program*. Available at: *https://www.hcd.ca.gov/planning-and-community-development/prohousing-designation-program*.

[15] CARB's Climate Action Portal Map compiles information about local GHG reduction plans and strategies throughout the state. Available at: *https://webmaps.arb.ca.gov/capmap/*.

[16] Boswell et al. 2019. 2019 Report on the State of Climate Action Plans in California. CARB Research Contract Number 17RD033. Available at: *https://ww2.arb.ca.gov/sites/default/files/2020-03/17RD033.pdf*.

costly and time-consuming, regardless of their desire to take action on climate.[17] This section seeks to identify the most effective GHG reduction actions at the local level and other barriers to local climate action to help ensure that local climate efforts align with the State's climate goals.

For purposes of this appendix, a CAP that has been adopted through the CEQA review process and meets the criteria specified in CEQA Guidelines section 15183.5(b) for a "plan for the reduction of greenhouse gas emissions" will be referred to as a "CEQA-qualified CAP." These CEQA-qualified CAPs allow eligible projects to streamline their determination of significance for GHG emissions. Pursuant to CEQA Guidelines section 15183.5(b), CEQA-qualified plans must:

(A) Quantify greenhouse gas emissions, both existing and projected over a specified period, resulting from activities within a defined geographic area;
(B) Establish a level, based on substantial evidence, below which the contribution to greenhouse gas emissions from activities covered by the plan would not be cumulatively considerable;
(C) Identify and analyze the greenhouse gas emissions resulting from specific actions or categories of actions anticipated within the geographic area;
(D) Specify measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level;
(E) Establish a mechanism to monitor the plan's progress toward achieving the level and to require amendment if the plan is not achieving specified levels;
(F) Be adopted in a public process following environmental review.

Once adopted, CEQA-qualified CAPs provide local governments with a valuable tool for 1) coordinated climate planning in their community and 2) streamlining the CEQA GHG analysis for projects consistent with a CEQA-qualified CAP. When jurisdictions have a CEQA-qualified CAP, an individual project that complies with the strategies and actions within a CEQA-qualified CAP can tier and streamline its project-specific CEQA GHG analysis to make a determination "that a project's incremental contribution to a cumulative [GHG] effect is not cumulatively considerable" (CEQA Guidelines Sections 15064.4 (b)(3) and 15183.5).[18, 19] Guidance for preparing a CEQA-qualified CAP and using it to tier and streamline CEQA GHG

---

[17] Deborah Salon, Sinott Murphy & Gian-Claudia Sciara. 2014. Local climate action: motives, enabling factors and barriers. *Carbon Management, 5:1,67-79, DOI 10.4155/cmt.13.81.* Available at: *https://www.tandfonline.com/doi/full/10.4155/cmt.13.81*.

[18] The guidelines implementing CEQA (or "CEQA Guidelines") were amended in 2009 to include criteria for the analysis and mitigation of GHG emissions. The CEQA Guidelines acknowledge the use of plans to reduce GHG emissions in a cumulative impacts analysis. (CEQA Guidelines Section 15183.5(b)).

[19] Cal. Code Regs., tit. 14, § 15183.5.

analysis for future projects can be found in Section 15183.5(b)(2) of the CEQA Guidelines, as well as Chapter 8 of OPR's General Plan Guidelines.[20] Typically, this tiering and streamlining evaluates whether the proposed project would demonstrate consistency with 1) the adopted plans, as well as the growth and land use assumptions that underlie the CEQA-qualified CAP, and 2) all applicable GHG reduction measures identified in the CAP. This includes determining whether the growth associated with the proposed project was accounted for in the CAP's projects and whether the project's GHG reduction measures were identified to help meet the CAP target.

To assist with using a CEQA-qualified CAP for future CEQA streamlining, some jurisdictions have prepared CAP compliance checklists that future projects may use to identify and document the CAP measures that are applicable to the proposed project and how the project is consistent with the CAP measures.[21] The CAP compliance checklists are then included as part of the proposed project's CEQA analysis documenting the project's consistency with the CEQA-qualified CAP. The use of the CEQA-qualified CAP also provides greater clarity in the environmental analysis and more consistent expectations for how GHG reduction measures are applied across projects in the jurisdiction.

Because CEQA-qualified CAPs are voluntary and not subject to any legislative criteria nor requirements, the CEQA Guidelines provide that a plan should include the measures or a group of measures that would collectively achieve the plan's emissions reduction target (Section 15183.5(b)(1)(D)). As the CEQA Guidelines are silent on what measures or groups of measures a CEQA-qualified CAP should contain, this appendix identifies three priority areas that address the State's largest sources of emissions that local governments have authority or influence over. Local jurisdictions should focus on these three priority areas when preparing a CEQA-qualified CAP:

1. Transportation electrification
2. VMT reduction
3. Building decarbonization

By prioritizing climate action in these three priority areas, local governments can address the largest sources of GHGs within their jurisdiction. Local governments that prepare CEQA-

---

[20] OPR. *General Plan Guidelines - Chapter 8 Climate Change.* Available at: *https://opr.ca.gov/planning/general-plan/guidelines.html.*

[21] Examples of CEQA-qualified CAPs include San Francisco's GHG compliance checklists for private development and municipal projects. These checklists are available at: *https://sfplanning.org/permit/environmental-consultant-pools-guidelines-and-resources*.

qualified CAPs that include strategies in these areas are contributing to alignment between local climate action and the State’s climate goals.

The State encourages local governments to follow this approach and adopt a CEQA-qualified CAP addressing the three priority areas. However, as not all jurisdictions have sufficient resources (e.g., political capital, staffing, funding) to do so, jurisdictions that wish to take meaningful climate action (such as preparing a non-CEQA-qualified CAP or as individual measures) aligned with the State’s climate goals in the absence of a CEQA-qualified CAP should also look to the three priority areas when developing local climate plans, measures, policies, and actions.

To assist local jurisdictions with developing local climate plans, measures, policies, and actions aligned with the State’s climate goals, Table 1 presents a non-exhaustive list of impactful GHG reduction strategies that can be implemented by local governments. The strategies in Table 1 are not applicable to all local jurisdictions, nor are they the only strategies that local governments can adopt, but they represent the core strategies that most jurisdictions in California can implement to reduce GHG emissions regardless of whether they have developed a CEQA-qualified CAP. Reaching the outcomes of these priority GHG reduction strategies requires a locally appropriate, comprehensive adoption of policies in support of these objectives. When developing local climate plans, measures, policies, and actions, local jurisdictions should incorporate the recommendations described in Table 1 to the extent appropriate to ensure alignment with State climate goals.

Table 1 – Priority[22] GHG Reduction Strategies

Priority Areas	Priority GHG Reduction Strategies
Transportation Electrification	Convert local government fleets to ZEVs and provide EV charging at public sites
	Create a jurisdiction-specific ZEV ecosystem to support deployment of ZEVs statewide (such as building standards that exceed state building codes, permit streamlining, infrastructure siting, consumer education, preferential parking policies, and ZEV readiness plans)
VMT Reduction	Reduce or eliminate minimum parking standards[23]
	Implement Complete Streets policies and investments, consistent with general plan circulation element requirements[24,25]
	Increase access to public transit by increasing density of development near transit, improving transit service by increasing service frequency, creating bus priority lanes, reducing or eliminating fares, microtransit, etc.
	Increase public access to clean mobility options by planning for and investing in electric shuttles, bike share, car share, and walking
	Implement parking pricing or transportation demand management pricing strategies

[22] These areas and strategies are designated as "priority" because they are the GHG reduction opportunities over which local governments have the most authority and that have the highest GHG reduction potential.
[23] AB 2097, adopted by the Legislature and signed by the Governor in September 2022 eliminates parking requirements for residential and commercial development within a half-mile of transit. Government Code, § 65863.2. "Residential, commercial, or other development types: parking requirements." Available at: *https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220AB2097*
[24] U.S. Department of Transportation. *Complete Streets.* Available at: *https://www.transportation.gov/mission/health/complete-streets.*
[25] OPR. *General Plan Guidelines - Chapter 4 Circulation Element.* Available at: *https://opr.ca.gov/planning/general-plan/guidelines.html.*

Priority Areas	Priority GHG Reduction Strategies
	Amend zoning or development codes to enable mixed-use, walkable, transit-oriented, and compact infill development (such as increasing the allowable density of a neighborhood)[26]
	Preserve natural and working lands by implementing land use policies that guide development toward infill areas and do not convert “greenfield” land to urban uses (e.g., green belts, strategic conservation easements)
Building Decarbonization	Adopt all-electric new construction reach codes for residential and commercial uses[27]
	Adopt policies and incentive programs to implement energy efficiency retrofits for existing buildings, such as weatherization, lighting upgrades, and replacing energy-intensive appliances and equipment with more efficient systems (such as Energy Star-rated equipment and equipment controllers)
	Adopt policies and incentive programs to electrify all appliances and equipment in existing buildings such as appliance rebates, existing building reach codes, or time of sale electrification ordinances
	Facilitate deployment of renewable energy production and distribution and energy storage on privately owned land uses (e.g., permit streamlining, information sharing)
	Deploy renewable energy production and energy storage directly in new public projects and on existing public facilities (e.g., solar photovoltaic systems on rooftops of municipal buildings and on canopies in public parking lots, battery storage systems in municipal buildings)

[26] AB 2011, adopted by the Legislature and signed by the Governor in September 2022 streamlines multifamily housing development that meet affordability, labor, and other objective standards in parcels zoned for office, retail, or parking uses. Government Code, § 65912.100. “Affordable Housing and High Road Jobs Act of 2022.” Available at: *https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220AB2011*

[27] California Energy Commission. Local Ordinance Exceeding the 2019 Energy Code. Available at: *https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2019-building-energy-efficiency-3.*

2.1 Setting Local GHG Targets

Historically, local climate action planning by California cities and counties has primarily focused on adopting supportive measures, such as replacing incandescent traffic lights with LED traffic lights, for reaching the State GHG emission reduction targets mandated by law. Initially, targets were based on consistency with meeting AB 32's 2020 GHG reduction target. More recently, local jurisdictions have looked to consistency with the longer-term targets in following the adoption of SB 32 and issuance of various executive orders (e.g., EO B-30-15 and EO B-55-18) to look beyond 2020 (e.g., 2030, 2045, 2050, etc.), when setting longer-term targets. In September 2022, Governor Newsom signed AB 1279 (Muratsuchi and Garcia, Chapter 337, Statutes of 2022), which codifies a statewide target to achieve carbon neutrality by no later than 2045. The State's climate strategy and the role of local governments continue to evolve as climate goals become more refined and ambitious, and as we advance our understanding of GHG emission sources. To be consistent with science-based statewide targets, local GHG reduction targets should evolve as well. In addition to being required for a local CAP to comply with CEQA, local targets have long been recommended as part of the process of developing, monitoring, and updating a CAP regardless of whether it is CEQA-qualified.[28]

The agency preparing a local GHG reduction target is responsible for determining the precise method for doing so. This appendix is not intended to limit or to provide an exhaustive list of options for setting a local GHG reduction target. Any target should be supported by substantial evidence and meet the criteria in CEQA Guidelines Section 15183.5. Ultimately, a jurisdiction's GHG reduction efforts and target(s) should help to better inform decision-makers and the public about the sources of GHG emissions under a jurisdiction's control (also known as a GHG emissions "inventory") that would be affected by a proposed project and provide a basis for identifying ways to avoid or reduce potentially significant GHG emission impacts. It can be challenging to localize and sub-allocate an individual jurisdiction's share of the GHG reductions needed to curb a global crisis. Developing a localized GHG reduction target requires an adequate local GHG inventory from which to calculate a target, which most jurisdictions have not developed. The 2017 Scoping Plan Update suggested some non-binding options for setting GHG reduction targets.[29] In recognition of different sources of, and opportunities to reduce, GHG emissions, this appendix recognizes the complexities involved in local GHG target-setting and, as a result, does not recommend a specific GHG target or target-setting method for local governments. However, the appendix presents some considerations for various target-setting approaches below.

---

[28] Climate Smart Communities. 2014. Climate Action Planning Guide. Available at: *https://cdrpc.org/wp-content/uploads/2015/05/CAP-Guide_MAR-2014_FINAL.pdf.*

[29] In the 2017 Scoping Plan, CARB recommended per capita, plan-level GHG targets of 6 MTCO2e per capita in 2030 and 2 MTCO2e per capita in 2050. Because the State is now pursuing carbon neutrality no later than 2045, CARB recommends that jurisdictions focus on developing locally appropriate, plan-level targets that align with the trajectory to carbon neutrality instead of focusing on a per capita 2050 target.

GHG reduction targets should typically be estimated for specific years aligned with the State's long-term climate targets established through existing laws or policy guidance. Various target years that are often, but not always, used in climate action planning include 2020 (for AB 32, SB 375, and EO S-3-05 consistency), 2030 (for SB 32 and EO B-30-15 consistency), 2035 (for SB 375 consistency), 2045 (for EO B-55-18 consistency, and there is now a statutory 2045 target in AB 1279), and 2050 (for EO S-3-05 and EO B-30-15 consistency),[30] as well as horizon years of local planning documents, such as general plans.

When establishing GHG reduction targets, jurisdictions should consider their respective share of the statewide reductions necessary to achieve the State's long-term climate target for each target year, and how they can best support those overall goals. Jurisdictions should also evaluate their specific inventory profile when establishing targets consistent with the State's long-term climate targets and should tailor their specific inventory profile to ensure the sectors included in the State's targets align with those included in the local jurisdiction's inventory and target, recognizing each region's distinctive sources and profile. For example, as the State's long-term climate targets address all emissions sectors within the state, a jurisdiction without an airport or port should "factor out" and remove these sectors from the State's long-term climate target when establishing local reduction targets. In essence, local governments should focus on sources and actions within their control, and set targets that support overall state goals.

Generally, a city or county that periodically examines their long-term GHG reduction trajectory is in a better position to determine whether GHG emission levels contemplated in their CAP are sustainable. This type of long-term approach benefits from interim reduction targets rather than a single target. Local governments that choose to adopt a single target year or opt to use a different method (e.g., project-by-project analysis, adopted significance thresholds, specific regional emissions targets, other State-related climate programs, etc.) should explain why their approach reflects sensible long-range planning horizons and should provide substantial evidence to support a conclusion that GHG emissions would decline along a trajectory consistent with the State's climate goals.

One approach to setting targets is to align local GHG-reducing strategies and actions with the respective State policies that will deliver GHG emission reductions, if successfully implemented and supported at the local level.[31] The CAP target-setting process should

---

[30] AB 32 calls for California to reduce GHG emission to 1990 levels by 2020; SB 375 requires CARB to develop and set regional targets, indexed to years 2020 and 2035, for emission reductions from passenger vehicles; EO S-3-05 established a statewide interim target to reduce GHG emissions to 1990 levels by 2020 and 80 percent below 1990 levels by 2050; SB 32 requires the state to reduce statewide GHG emissions to 40% below 1990 levels by 2030; EO B-55-18 and AB 1279 call for carbon neutrality as soon as possible, but no later than 2045; and EO B-30-15 established a statewide interim GHG reduction target of 40 percent below 1990 levels by 2030 and 80 percent below 1990 levels by 2050.

[31] OPR. *General Plan Guidelines - Chapter 8 Climate Change.* Available at: *https://opr.ca.gov/planning/general-plan/guidelines.html.*

account for projected GHG emission reductions from State policies, programs, and strategies implemented over time. However, when using statewide data, local governments should avoid double-counting GHG emission reductions that are achieved through State-level efforts and should ensure that their target focuses on GHG emission reductions within the scope of the CAP. Local jurisdictions should refer to Table 2-2 in Chapter 2 of the 2022 Scoping Plan Update, which summarizes the key State actions (as well as supportive statutes, executive orders, and outcomes) under the Scoping Plan Scenario and identifies approaches to help guide setting targets that align with the State's GHG-reducing strategies. [32]

A number of these key State actions are directly relevant to the priority strategies described in this appendix and should be accounted for in local target-setting, including zero-emission light-duty vehicles (relevant to transportation electrification); smart growth/VMT reduction (relevant to vehicle miles traveled reduction); and new and existing residential and commercial buildings (relevant to building decarbonization). Table 2 summarizes these actions with milestones and benchmarks.[33] Local jurisdictions should consider these recommendations as a starting point when contextualizing the State's climate goals, GHG emissions inventory sectors, and actions for a CAP target-setting process to help align local targets with the State's climate goals.

[32] The Proposed Scenario is the Scoping Plan alternative that most closely aligns with existing statute and Executive Orders and assumes carbon neutrality by 2045 the deployment a broad portfolio of existing and emerging fossil fuel alternatives and clean technologies.

[33] The information in this table should be viewed as a general reference and may serve multiple uses, including providing resources that act as an aid to local governments when developing localized GHG targets for CAPs. The applicability of data, actions, and recommendations may vary across regions and should not be viewed or interpreted as official guidance, as thresholds of significance, or as dictating requirements for GHG target-setting processes. This is not considered an exhaustive list and does not represent the complete list of data resources and tools available. Not every recommendation provided will be relevant to, or appropriate for, a given area or plan.

Table 2 –Summary of Priority Key Actions[34] and Recommendations for CAP Target-Setting Processes

Priority Areas	Related Actions in the Proposed Scenario	Recommendations for Local CAP Target-Setting
Transportation Electrification	100 percent of light-duty vehicle sales are ZEVs by 2035	Potential data sources and tools to localize this for target-setting include EMFAC *Fleet Database* (by county) and *Scenario Analysis Tool* and *Department of Motor Vehicles Database* (by fuel type and registration)
VMT Reduction	VMT per capita reduced 25 percent below 2019 levels by 2030 and 30 percent below 2019 levels by 2045	Potential data sources to localize this for target-setting include VMT modeling outputs prepared for, or consistent with, the travel outcomes associated with the adopted SCS or other applicable regional plan
Building Decarbonization	All electric appliances in new construction beginning 2026 (residential) and 2029 (commercial)	Potential data sources to localize these for target-setting include: *Commercial Building Energy Consumption Survey*

[34] These areas and strategies are designated as "priority" because they are the GHG reduction opportunities over which local governments have the most authority and that have the highest GHG reduction potential.

Priority Areas	Related Actions in the Proposed Scenario	Recommendations for Local CAP Target-Setting
	For existing residential buildings, 80 percent of appliance sales are electric by 2030 and 100 percent of appliance sales are electric by 2035 (appliances replaced at end of life) For existing commercial buildings, 80 percent of appliance sales are electric by 2030 and 100 percent of appliance sales are electric by 2045 (appliances replaced at end of life)	*California Commercial End Use Survey* *Residential Appliance Saturation Survey*

California’s overall state goal of achieving carbon neutrality no later than 2045 can also inform GHG reduction targets at individual community levels, and some communities or regions may be able to reach neutrality themselves. However, it is important to design targets in ways that support overall state goals, recognizing that each region has distinctive sources and systems. For instance, energy and transportation systems that serve Californians do not stop at jurisdictional boundaries, and some decisions can have ramifications for other communities (e.g., by inadvertently exporting emissions from a jurisdiction with a net-zero target to another jurisdiction with less stringent or no target). Jurisdictions considering a net-zero target should carefully consider the implications it may have on emissions in neighboring communities and beyond. Jurisdictions should also avoid creating targets that are impossible to meet as a basis to determine significance. For example, a net-zero target may imply that the GHG emissions of any project that are not reduced or offset to zero would be considered potentially significant. This may lead to undue burdens and frustrate project approval processes, which may be particularly problematic for residential development in climate-smart, infill areas. In addition, some jurisdictions have more land capacity to remove and store carbon, while others host GHG-emitting facilities that serve necessary functions and will take time to transition to new technology (e.g., municipal wastewater treatment plants, landfills, energy generation facilities). In those cases, jurisdictions that work together on a regional framework to rapidly decarbonize together may have better success in maximizing both emission reductions and other co-benefits. Ultimately, a net-zero target that makes it more difficult to achieve statewide goals by prohibiting or complicating projects that are needed to support the State’s climate goals, like infill development or solar arrays, is not consistent with the State’s goals. The scale of GHG reductions needed across all communities will be substantial. Local governments have the discretion to adopt targets that apply to their jurisdictions and may utilize the streamlining functions afforded in CEQA[35] so long as those targets are supported by substantial evidence.

3. The Role of Land Use Plans and Development Projects in Supporting the State’s Climate Goals

3.1 Housing Demand and GHG Efficiency

Local governments are responsible for adopting and updating land use plans and related implementing ordinances, such as zoning and other development codes, as well as evaluating and making decisions regarding a development project’s impact on the environment. The adoption of, or update to, local plans, as well as local discretionary approvals for new development, are subject to environmental review under CEQA, which requires public agencies, including local governments, to evaluate and disclose potential environmental effects from their discretionary decisions and actions and implement feasible mitigation. This environmental review process must address whether GHG emissions from a proposed project,

[35] Cal. Code Regs., tit. 14, § 15183.5.

as defined in Section 15378 of the CEQA Guidelines, would result in a cumulatively considerable contribution to climate change. As part of this review, lead agencies must consider whether a proposed project or plan would be consistent with, and supportive of, the State's climate goals.[36] Section 15064.4(b)(3) of the CEQA Guidelines states that lead agencies should evaluate whether a proposed project would "[c]onflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases." Moreover, CEQA Guidelines Section 15125(d) requires a discussion "of any inconsistencies between the proposed project and applicable general plans, specific plans, and regional plans…regional transportation plans …[and]…plans for the reduction of greenhouse gas emissions," among others.

However, the discretionary processes through which local jurisdictions permit land use development projects vary widely across California and are sometimes not uniformly applied within the same jurisdiction.[37] O'Neill et al. (2022) found that restrictive local zoning and development approval processes are the chief regulatory contributors to California's housing crisis. Local governments have a clear opportunity to eliminate these barriers by reforming their local laws to facilitate dense development in infill areas, particularly those in high-resource and/or low-VMT communities. Local jurisdictions can also choose to adopt ministerial entitlement processes[38] for housing instead of imposing discretionary review processes (some jurisdictions currently even impose multiple layers of discretionary review) that provide project opponents opportunities to slow or stop projects, sometimes without advancing legitimate environmental goals.

The literature review conducted by O'Neill et al. (2022) does not find a consensus among CEQA experts on the impact of litigation (or the threat thereof) on new housing construction. The report finds that litigation rates among entitled housing projects in the jurisdictions studied were low (less than three percent overall). Of the relatively small percentage of projects that were litigated, approximately two-thirds were challenged based on claimed deficiencies in their GHG or VMT analysis. (Note, however, that this statistic in itself is not particularly revealing, since attorneys frequently include in their lawsuits a range of claims regarding various CEQA resource areas to maximize chances of prevailing.) Thus, among other bases for CEQA challenges, CEQA GHG impact analyses and mitigation measures can to be sources of

---

[36] See, e.g., *Cleveland Nat'l Forest Found. v. San Diego Assn. of Governments* (2017) 3 Cal. 5th 497, 519 (holding that CEQA requires planning agencies to ensure their CEQA GHG analysis stays in step with evolving scientific knowledge and state regulatory schemes).

[37] O'Neill et al. 2022. "Final Report: Examining Entitlement in California to Inform Policy and Process: Advancing Social Equity in Housing Development Patterns." Available at: *https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3956250.*

[38] CEQA environmental review requirements only apply to discretionary project approvals; ministerial approvals are not subject to CEQA review. (Cal. Code Regs., tit. 14, § 15002(i).)

litigation and delay for projects, especially for housing projects in high-resource areas.[39] While the State has long been clear that urban infill projects, particularly in high-resource and low-VMT areas, would be generally supportive of the State's climate and regional air quality goals, such claims can persist. Although CEQA litigation can present additional complexity for housing development, restrictive local zoning and development approval processes are clearly the primary hurdles for housing development in California. Local jurisdictions have clear discretion to remove these barriers.

California continues to experience a severe housing shortage. The State must plan for more than 2.5 million residential units over the next eight years, and no less than one million of those residential units must be affordable to lower-income households.[40] This represents more than double the housing planned for during the last eight years.[41] The housing crisis and the climate crisis must be confronted simultaneously, and it is possible to address the housing crisis in a manner that supports the State's climate and regional air quality goals.[42] The following section includes recommendations to make doing so easier.

3.2 Evaluating Plan-Level and Project-Level Alignment with the State's Climate Goals in CEQA GHG Analyses

CEQA requires lead agencies to analyze the potential GHG-related impacts from their proposed projects.[43] As part of these analyses, agencies consider the extent to which their projects are consistent with the State's climate goals and requirements.[44] Land use plans (e.g., general plans, specific plans, area plans) and development projects have long operational lifespans, potentially locking in GHG emissions for decades. Some agencies have improperly attempted to use compliance with statewide regulatory programs to determine that their projects' GHG impacts are mitigated or are otherwise consistent with the Scoping Plan. While CARB has developed programs such as the State vehicle emissions standards (e.g., Advanced Clean Cars), the Low Carbon Fuel Standard, and the Cap-and-Trade program to reduce sector-wide GHG emissions, these programs were not designed to directly mitigate individual land use development project emissions from a CEQA perspective. Therefore, claimed consistency with these programs should not be used to conclude that motor vehicle

---

[39] O'Neill et al. 2022. Final Report: Examining Entitlement in California to Inform Policy and Process: Advancing Social Equity in Housing Development Patterns. CARB Research Contract 19STC005. Available at: *https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3956250*.

[40] California Department of Housing and Community Development. 2022. *Statewide Housing Plan.* Available at: *https://www.hcd.ca.gov/docs/statewide-housing-plan.pdf*.

[41] Ibid.

[42] Elkind, E. N., Galante, C., Decker, N., Chapple, K., Martin, A., & Hanson, M. 2017. Right Type, Right Place: Assessing the Environmental and Economic Impacts of Infill Residential Development through 2030. Available at: *https://ternercenter.berkeley.edu/research-and-policy/right-type-right-place/*.

[43] Cal. Code Regs., tit. 14, § 15064.4.

[44] Cal. Code Regs., tit. 14, § 15064.4(b)(3).

emissions from a land use development project are fully mitigated or that such projects are definitively consistent with the Scoping Plan—particularly where the project at issue is not itself directly regulated by these programs.[45]

This section outlines three distinct approaches that lead agencies may consider for evaluating alignment of proposed plans and residential and mixed-use[46] development projects with the State's climate goals and, therefore, may have a less-than-significant impact on GHG emissions. These approaches are recommendations only and are not requirements. They do not supplant lead agencies' discretion to develop their own evidence-based approaches for determining whether a project would have a potentially significant impact on GHG emissions.[47]

The recommendations outlined in this section apply only to residential and mixed-use development project types. California currently faces both a housing crisis and a climate crisis, which necessitates prioritizing recommendations for residential projects to address the housing crisis in a manner that simultaneously supports the State's GHG and regional air quality goals. CARB plans to continue to explore new approaches for other land use types in the future.

3.2.1 Project Attributes for Residential and Mixed-Use Projects to Qualitatively Determine Consistency with the Scoping Plan

Absent consistency with an adequate, geographically specific GHG reduction plan such as a CEQA-qualified CAP, as described in Section 2, the first approach the State recommends for determining whether a proposed residential or mixed-use residential development would align with the State's climate goals is to examine whether the project includes key project attributes that reduce operational GHG emissions while simultaneously advancing fair housing. Consistent with the Priority Strategies shown in Table 1, empirical research shows that the following project attributes result in reduced GHG emissions from residential and mixed-use development. Residential and mixed-use projects that have all of the key project attributes in Table 3 should accommodate growth in a manner consistent with State GHG reduction and equity prioritization goals.

[45] CEQA Guidelines section 15064.4(b)(3) allows compliance with "regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of greenhouse gas emissions" as an approach for the determination of significance for GHG emissions.

[46] Mixed use residential is defined as development including both residential and nonresidential uses with at least two-thirds of the square footage designated for residential use per Cal. Gov. Code., tit. 7, § 65589.5(h)(2)(B)).

[47] Cal. Code Regs., tit. 14, § 15064.4.

Table 3 – Key Residential and Mixed-Use Project Attributes that Reduce GHGs

Priority Areas	Key Project Attribute
Transportation Electrification	Provides EV charging infrastructure that, at minimum, meets the most ambitious voluntary standard in the California Green Building Standards Code at the time of project approval[48]
VMT Reduction	Is located on infill sites that are surrounded by existing urban uses and reuses or redevelops previously undeveloped or underutilized land that is presently served by existing utilities and essential public services (e.g., transit, streets, water, sewer)[49]
	Does not result in the loss or conversion of natural and working lands
	Consists of transit-supportive densities (minimum of 20 residential dwelling units per acre),[50] or Is in proximity to existing transit stops (within a half mile),[51] or Satisfies more detailed and stringent criteria specified in the region's SCS[52]
	Reduces parking requirements[53] by: Eliminating parking requirements or including maximum allowable parking ratios (i.e., the ratio of parking spaces to residential units or square feet); or Providing residential parking supply at a ratio of less than one parking space per dwelling unit; or

[48] Cal. Code Regs., tit. 24, Part 11.

[49] Government Code, § 65041.1. "Statewide Environmental Goals and Policy Report." Available at: *https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=GOV&sectionNum=65041.1*.

[50] Federal Transit Administration. 2014. *Planning for Transit-Supportive Development: A Practitioner's Guide.* Available at: *https://www.transit.dot.gov/funding/funding-finance-resources/transit-oriented-development/planning-transit-supportive*.

[51] Washington Department of Transportation. 2013. *Tools for Estimating VMT Reductions from Built Environment Changes.* Available at: *https://www.wsdot.wa.gov/research/reports/fullreports/806.3.pdf.*

[52] One example of an evaluation of consistency with the region's SCS is from the 2013 draft EIR for The Cannery in Davis, p. 3.7-26. Available at: *https://www.cityofdavis.org/home/showpublisheddocument/650/635607772224000000.*

[53] CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emissions Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity: Designed for Local Governments, Communities, and Project Developers. Available at: *https://caleemod.com/handbook/index.html*.

Priority Areas	Key Project Attribute
	For multifamily residential development, requiring parking costs to be unbundled from costs to rent or own a residential unit.[54]
	At least 20 percent of units included are affordable to lower-income residents[55, 56]
	Results in no net loss of existing affordable units
Building Decarbonization	Uses all-electric appliances without any natural gas connections and does not use propane or other fossil fuels for space heating, water heating, or indoor cooking[57, 58]

These project attributes are intended as a guide to help local jurisdictions qualitatively identify those residential and mixed-use projects that are ***clearly*** consistent with the State's climate goals, since these attributes address the largest sources of operational emissions for residential projects. In general, residential and mixed-use development projects that incorporate ***all*** of these key project attributes are aligned with the State's priority GHG reduction strategies for local climate action as shown in Table 1 and with the State's climate and housing goals. As such, they are considered to be consistent with the Scoping Plan or other plans, policies, or regulations adopted for the purposes of reducing GHGs; therefore, the GHG emissions associated with such projects may result in a less-than-significant GHG impact under CEQA. Lead agencies may determine, with adequate additional supporting evidence,

[54] AB 2097, adopted by the Legislature and signed by the Governor in September 2022 eliminates parking requirements for residential and commercial development within a half-mile of transit. Government Code, § 65863.2. "Residential, commercial, or other development types: parking requirements." Available at: *https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220AB2097*

[55] Newmark, G. and Haas, P. 2015. Income, Location Efficiency, and VMT: Affordable Housing as a Climate Strategy. Available at: *https://chpc.net/wp-content/uploads/2016/05/CNT-Working-Paper-revised-2015-12-18.pdf*.

[56] California Housing Partnership Corporation and TransForm. 2014. Why Creating and Preserving Affordable Homes Near Transit is a Highly Effective Climate Protection Strategy. Available at: *https://1p08d91kd0c03rlxhmhtydpr-wpengine.netdna-ssl.com/wp-content/uploads/2015/11/4-AffordableTODResearchUpdate070114.pdf*.

[57] Energy and Environmental Economics. 2019. Residential Building Electrification in California: Consumer economics, greenhouse gases and grid impacts. Available at: *https://www.ethree.com/wp-content/uploads/2019/04/E3_Residential_Building_Electrification_in_California_April_2019.pdf*.

[58] Energy and Environmental Economics. 2021. Achieving Carbon Neutrality in California: PATHWAYS Scenarios Developed for CARB. Available at: *https://ww2.arb.ca.gov/sites/default/files/2020-10/e3_cn_final_report_oct2020_0.pdf.*

that projects that incorporate some, but not all, of the key project attributes are consistent with the State's climate goals.

This qualitative approach to determining the significance of GHG impacts is only intended for residential and mixed-use development projects. CARB will continue to explore this qualitative approach for evaluating the significance of GHG impacts for other types of land uses and encourages CEQA practitioners and lead agencies to do the same. The following two sections describe additional approaches lead agencies may employ in CEQA analyses.

3.2.2 Net-Zero Threshold of Significance

Absent consistency with an adequate, geographically specific GHG reduction plan, as described in Section 2 or consistency with the project attributes approach identified in Table 3 for residential and mixed-use development project types, lead agencies can make a significance determination, consistent with Section 4 below, based on whether the project would result in net-zero GHG emissions. (Note that lead agencies can also use other valid significance thresholds, as described in subsection 3.2.3 below.) Although achieving net-zero GHG emissions may be an appropriate overall objective, it should be noted this approach may not be feasible or appropriate for every project. Furthermore, in determining a project's net GHG impacts, agencies should carefully consider how to view the GHG emissions implications of changes to existing land uses at the project site, particularly where such uses may simply relocate to another location. Lead agencies should consider whether there is substantial evidence that the GHG emissions generated by existing uses of the project site will cease to exist as a direct result of the proposed project and will not merely occur at a different location after the proposed project is developed. If substantial evidence demonstrates that emissions from existing sources currently operating or generating emissions at the project site would continue elsewhere, lead agencies should account for those emissions when calculating the net change in emissions associated with the proposed project.

However, there are recent examples of land use development projects in California that have demonstrated that it is feasible to design projects of nearly any scale that achieve net-zero GHG emissions. Several projects have received certification from the Governor under AB 900, the Jobs and Economic Improvement through Environmental Leadership Act (Buchanan, Chapter 354, Statutes of 2011) and a similar program authorized under SB 7 (Atkins, Chapter 19, Statutes of 2021), demonstrating an ability to design economically viable projects that create jobs while contributing net-zero GHG emissions.[59] These projects have included mixed-use housing and commercial developments, large-scale residential projects, sports arenas, a medical center, and business campuses.

As discussed in Section 3.2.1, "Project Attributes for Residential Projects to Qualitatively Determine Consistency with the Scoping Plan," development in infill and transit-oriented areas

[59] OPR. 2021. *Judicial Streamlining*. Available at: *https://www.opr.ca.gov/ceqa/judicial-streamlining/*.

helps to reduce or avoid increasing GHG emissions. Although, while land use development patterns in California have become, in general, more compact than in the past, new low-density, auto-oriented development is still being planned for and built.[60] Despite this continuing challenge, several large and mixed-use projects within California have ultimately committed to achieving net-zero GHG emissions. For example, as part of the Downtown West Mixed Use Plan,[61] the applicant, Google LLC, ultimately committed to achieving net-zero GHG emissions for an approximately 80-acre mixed-use property, including almost 6,000 residential units, as well as retail, office, and other land uses, located in downtown San Jose, California. This commitment will be achieved through a combination of on-site measures and the purchase and retirement of carbon offset credits from CARB-approved registries in the voluntary market. Similarly, the Oakland Athletics, the applicant for the Oakland Waterfront Ballpark District Project located in Oakland, California, also committed its development to result in no net increase of GHG emissions through a combination of on-site and local mitigation measures and the purchase and retirement of carbon offset credits from CARB-approved registries in the voluntary market.[62] Design and local reduction measures[63] were employed by the developers to reduce 54 percent of total non-residential emissions, while 49 percent of operational emissions were reduced via carbon offset credits from the voluntary market.

Even California's largest, most sprawl-intensive housing developments have ultimately committed to achieving net-zero GHG emissions, even if only after intense legal battles. For example, under the Newhall Ranch Resource Management and Development Plan and Spineflower Conservation Plan,[64] the applicant, Newhall Land and Farming Company, ultimately committed to achieving net-zero GHG emissions for an almost 12,000-acre plan area in the Santa Clarita Valley. This commitment will be achieved through a combination of on-site and local mitigation measures and the purchase and retirement of carbon offset credits from the voluntary market. Similarly, as a result of a recent settlement agreement, Tejon Ranch Company, the developer for the Centennial Specific Plan located in northern Los

---

[60] CARB. 2022. Draft 2022 Progress Report California's Sustainable Communities and Climate Protection Act. P. 22-25. Available at: *https://ww2.arb.ca.gov/sites/default/files/2022-07/2022_SB_150_Main_Report_Draft_ADA.pdf*.

[61] OPR. 2022. *Judicial Streamlining: Archived Applications*. Available at: *https://opr.ca.gov/ceqa/judicial-streamlining/archive.html*.

[62] Ibid.

[63] Local reduction measures include measures to reduce VMT and trips (including reduced parking and transportation network surcharges), installing EV chargers at 10 percent of onsite parking spaces, electrification (i.e., prohibition of non-electric energy, such as natural gas) of 50 percent of residential units, and either converting an existing jet-fueled peaker plant to battery storage or installing 1,013 EV charging stations in the community.

[64] California Department of Fish and Wildlife. 2021. Newhall Ranch Resource Management and Development Plan and Spineflower Conservation Plan: Final EIS/EIR Documents. Available at: (*https://nrm.dfg.ca.gov/documents/ContextDocs.aspx?cat=NewhallRanchFinal*).

Angeles County,[65] also committed its development to result in no net increase of GHG emissions.[66] Mitigation measures employed by these developers include the prohibition of natural gas in residential and commercial properties; the requirement of on-site solar photovoltaic energy systems on residential and commercial properties; the installation of almost 30,000 EV chargers within and outside the plan area; funding incentives for the purchase of 10,500 passenger EVs and electric school buses and trucks; and procuring and retiring carbon offset credits from the voluntary market.

Although the projects in San Jose and Oakland may not meet all of the key project attributes for qualitatively determining project consistency with statewide GHG goals, as shown in Table 3, and the Newhall and Tejon Ranch projects do not necessarily represent the type of development that California most needs to simultaneously tackle the housing and climate crises, they do demonstrate the feasibility of a net-zero approach for other large and complex residential development projects.

3.2.3 Recommended Thresholds of Significance

Lead agencies may also analyze the GHG impact of proposed projects by employing a threshold of significance recommended by the applicable air district[67] or other lead agencies.[68] As stated in CEQA Guidelines section 15064.7(b), "a lead agency may consider thresholds of significance previously adopted or recommended by other public agencies or recommended by experts, provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence." However, thresholds for analyzing a project's GHG emissions can become outdated if they are not aligned with the State's most recent GHG reduction goals.[69] To be defensible, CEQA significance thresholds must be supported by substantial evidence.[70] Mitigating GHG emissions below an applicable GHG threshold of significance is one way lead agencies may demonstrate that a project's GHG emissions would have a less-than-significant impact on the environment. For lead agencies that pursue this approach, CAPCOA, which

---

[65] Los Angeles County Department of Regional Planning. 2019. *Specific Plan No. 02-232 / Centennial Specific Plan.* Available at: https://planning.lacounty.gov/case/view/specific_plan_no_02_232_centennial_specific_plan.

[66] Tejon Ranch. 2021. *Settlement Agreement Reached in Centennial lawsuit.* Available at: https://tejonranch.com/settlement-agreement-reached-in-centennial-lawsuit/.

[67] CARB research indicates that less than 20 percent of California's population is located in an area with CEQA GHG thresholds of significance addressing SB 32 reduction goals adopted by an air district (Bay Area Air Quality Management District and Sacramento Metropolitan Air Quality Management District).

[68] As with all CEQA significance thresholds, GHG significance thresholds must be supported by substantial evidence. Some lead agencies, such as the City of San Luis Obispo and County of Santa Barbara, have adopted CEQA GHG thresholds of significance due to the absence of a local air district-adopted threshold or because a local CEQA-qualified CAP used to tier and streamline its project-specific CEQA GHG analysis (per CEQA Guidelines Sections 15064.4 (b)(3) and 15183.5) may not be available or applicable.

[69] CEQA GHG analyses (including significance determinations) "must reasonably reflect evolving scientific knowledge and state regulatory schemes." (Cal. Code Regs., tit. 14, §§ 15064.4(b))

[70] Cal. Code Regs., tit. 14, § 15064.7(b).

provides a forum for the sharing of knowledge, experience, and information between air districts throughout the state, has developed tools and guidance for CEQA practitioners, such as the California Emissions Estimator Model[71] (CalEEMod) and guidance for developing and quantifying project-level GHG mitigation measures.[72]

4. Mitigating Greenhouse Gas Emissions Pursuant to CEQA

If a lead agency determines that a proposed project's GHG emissions would result in a significant impact and a cumulatively considerable contribution to climate change, the lead agency must impose feasible mitigation measures to reduce the project's GHG impact to a less-than-significant level.[73] According to the CEQA Guidelines, mitigation measures must be feasible, roughly proportional, not inappropriately deferred, capable of being monitored or reported, fully enforceable, and based on substantial evidence. They must also have a nexus to a legitimate governmental interest.[74] Any GHG offsets used as CEQA mitigation must not be otherwise required (e.g., by regulation or by existing permitted CEQA projects).[75] Lead agencies should present substantial evidence to document that a given mitigation measure would actually serve to mitigate the proposed project's GHG emissions.[76]

CAPCOA has developed tools and guidance for CEQA practitioners for developing and quantifying project-level GHG mitigation measures. These include CAPCOA's Handbook,[77] which it published in 2021 along with the mitigation module in CalEEMod.[78]

As the severe impacts of climate change become better understood and the State's climate goals become more stringent over time, local, off-site CEQA GHG mitigation measures will become increasingly necessary. However, several factors often hinder the adoption of local, off-site GHG mitigation under CEQA, including confusion about CEQA's requirements for GHG mitigation, a focus on carbon offset credits and lack of awareness of local GHG mitigation

---

[71] CAPCOA. 2022. *California Emissions Estimator Model.* Available at: www.caleemod.com.

[72] CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emissions Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity: Designed for Local Governments, Communities, and Project Developers. Available at: *https://caleemod.com/handbook/index.html*.

[73] Cal. Code Regs., tit. 14, § 15126.4(c).

[74] Cal. Code Regs., tit. 14, § 15126.4(a)(4)(A).

[75] Cal. Code Regs., tit. 14, § 15126.4(c)(3)).

[76] Cal. Code Regs., tit. 14, § 15126.4(c)).

[77] CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emissions Reductions. Assessing Climate Vulnerabilities and Advancing Health and Equity: Designed for Local Governments, Communities, and Project Developers. Available at: *https://caleemod.com/handbook/index.html*.

[78] CAPCOA. 2022. *California Emissions Estimator Model.* Available at: www.caleemod.com.

opportunities, and a perception of high costs (e.g., mitigation costs for project sponsors, administrative costs for lead and responsible agencies).

This section seeks to assist in overcoming barriers to GHG mitigation under CEQA and reduce the use of statements of overriding considerations by lead agencies by establishing a hierarchy of mitigation opportunities that reflect the State's priorities for mitigation. In doing so, this section encourages project applicants and local governments to use local and non-local off-site GHG mitigation approaches (including carbon offset credits) consistent with CEQA's requirements. This section also seeks to clarify how CEQA's mitigation requirements apply to GHG mitigation (including carbon offset credits).

While this section identifies ways to overcome some common barriers to local CEQA GHG mitigation, other barriers may take longer to remove and may even require legislative or other State-level action. Through appropriate application of local GHG mitigation under CEQA, lead agencies have an opportunity to benefit their communities while addressing the climate crisis. Local, off-site mitigation measures implemented in the communities in which project impacts occur have the added potential co-benefit of reducing emissions of toxic air contaminants and criteria air pollutants, which will improve health and social and economic resiliency to climate-related impacts. Verification of local mitigation can also be more straightforward than verification of mitigation that is outside of the jurisdictional boundaries of the lead agency.

4.1 GHG Mitigation Hierarchy

CEQA requires lead agencies to impose all feasible mitigation measures necessary to avoid or reduce GHG emissions to a less-than-significant level prior to certifying an Environmental Impact Report (EIR) or mitigated negative declaration. CEQA does not require mitigation measures that are infeasible for specific legal, economic, technological, or other reasons. If there are not sufficient mitigation measures that the lead agency determines are feasible for avoiding GHGs or reducing GHGs to a less-than-significant level, before approving a project, the lead agency must adopt all measures that are feasible and adopt a statement of overriding considerations (or significance "override") that explains why additional mitigation is infeasible.[79] The statement of overriding considerations must be supported by substantial evidence in the record.

A wide array of CEQA GHG mitigation that can help avoid the need to adopt statements of overriding considerations is discussed in Section 4.1.2 below. The hierarchy outlined below may provide a helpful reference for lead agencies and project sponsors on how to approach mitigation in a way that maximizes benefits to communities surrounding projects, with a particular emphasis on benefitting historically underserved and disadvantaged communities.

[79] Cal. Code Regs., tit. 14, § 15093(b).

The State recommends prioritizing CEQA GHG mitigation according to a geographic hierarchy as follows:

1. On-site design measures;
2. Off-site GHG mitigation:
    a. Funding or implementing local, off-site GHG reduction projects (within the communities or neighborhoods in the vicinity of the project);
    b. Funding or implementing non-local, off-site GHG reduction projects;
3. Purchasing and retiring carbon offset credits:
    a. That originate in the same air basin as the project;
    b. That originate elsewhere in California;
    c. That originate outside of California.

This geographical hierarchy is consistent with SB 7, in which the Legislature mandated a similar hierarchy for land use development projects seeking to be designated as "environmental leadership development projects" and granted certain streamlining provisions. Under this hierarchy, the community in which the project is located is prioritized to receive the environmental and economic co-benefits of the mitigation, especially the reductions in emissions of criteria air pollutants and toxic air contaminants that accompany many GHG reduction measures. Similar prioritization was included in the Oakland Waterfront Ballpark District Project, which required that a minimum of 50 percent of the GHG emission reductions from non-residential land uses result from local, direct measures, and stipulated that no more than 50 percent of reductions may result from offset credits.[80]

The following sections discuss each level of mitigation in the suggested hierarchy of mitigation.

4.1.1 On-site GHG Mitigation

Lead agencies should prioritize on-site design features within the project site that minimize GHG emissions. On-site GHG mitigation includes the implementation of project features, project design, or other measures, including but not limited to energy efficiency measures, installation of renewable energy electricity generation, all-electric building design, EV charging connections, and features that reduce VMT, such as a transportation demand management plan or the provision of shared mobility options (such as facilitating carpooling, providing active transportation and transit vouchers, and implementing telecommuting and alternate work schedules). Chapter 3 of CAPCOA's 2021 *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity*,[81] includes

---

[80] Bonta, Chapter 959, Statutes of 2018. California Environmental Quality Act: Oakland Sports and Mixed-Use Project. Available at: *https://leginfo.legislature.ca.gov/faces/billPdf.xhtml?bill_id=201720180AB734&version=20170AB73492CHP*.

[81] CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emissions Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity: Designed for Local Governments, Communities, and Project Developers. Available at: *https://caleemod.com/handbook/index.html*.

many on-site GHG reduction measures for a variety of project and plan types for lead agencies to consider. Many on-site GHG mitigation measures also result in a reduction in emissions of criteria air pollutants and toxic air contaminants in the air basin in which the project is located, as well as emissions of toxic air contaminants on or near the project site, consistent with legislative direction from SB 32 to "achieve the state's more stringent greenhouse gas emission reductions in a manner that benefits the state's most disadvantaged communities."

4.1.2 Off-site GHG Mitigation

If implementation of all feasible on-site GHG reduction measures is insufficient to reduce a project's impact to a less-than-significant level, the State recommends that the lead agency next explore options to fund or implement ***local***, off-site direct GHG reduction strategies.

Funding or implementing GHG mitigation measures in the project's vicinity may allow the project proponent and the lead agency to work directly with the impacted community to identify and prioritize the mitigation measures that meet its needs while minimizing multiple environmental and societal impacts. Direct, local investments help build relationships for future mutually beneficial development and mitigation opportunities in that community and may also provide a multitude of other co-benefits to the neighborhood's residents. To help remove barriers to employing these types of mitigation, lead agencies may wish to consider developing a local mitigation bank[82] that enables project applicants to fund such projects in exchange for being credited with the resulting GHG reductions in their CEQA analyses. The lead agency should also provide substantial evidence to show that the mitigation would actually serve to mitigate the proposed project's GHG emissions (i.e., a project cannot take credit for unrelated off-site measures that would occur independently of the proposed project). Examples of local investments and their co-benefits include:

- **Local urban forestry** programs that increase the number of trees and other plants in urban areas can sequester carbon, reduce air pollution and ambient temperatures, help manage stormwater and improve water quality, provide shade to reduce energy demand for cooling buildings (and the associated cost and GHG emissions of that energy), improve aesthetics, foster mental health, and encourage physical activity of residents and employees, among many other benefits.
- **Local building retrofit programs** targeting existing residential and commercial buildings in the project's vicinity can fund installation of cool roofs, solar panels, solar or heat pump water heaters, smart meters, and energy efficient lighting and appliances; replacement of fossil fuel-powered appliances with electric models; installation of energy efficient windows, insulation, and other building envelope measures; and

[82] As discussed in Section 5, below, the Regional GHG Collaborative Group along the Central Coast are working to educate and provide avenues for offset projects to help meet current and future local GHG reduction targets and CEQA GHG reduction needs.

implementation of water conservation measures. These investments can improve comfort, reduce utility bills, and help manage the demand for electricity while reducing GHG emissions.

- **Off-site EV chargers** can increase access to EV charging throughout a community. Some examples could include EV chargers in multi-unit dwellings in disadvantaged or low-income areas, public locations (schools, libraries, city centers), workplaces, key destinations (e.g., parks, recreation areas, sports arenas).
- **Public transit subsidies** can increase access to transit and to daily activities served by transit and can encourage less reliance on driving and increased reliance on other modes of transportation (e.g., transit and active transportation), which provides air quality and cost savings co-benefits to residents.

Like many on-site GHG mitigation measures, implementation of most local, off-site GHG reduction strategies also results in reductions of toxic air contaminants and criteria air pollutants and their precursors in the same air basin in which the project is located. The State recommends that lead agencies prioritize GHG mitigation that also increases a community's social and economic resilience to adverse impacts exacerbated by climate change. Applying a local lens to GHG mitigation and allowing for community-led decision-making helps prioritize the mitigation measures that address community-identified needs and can also fill gaps in the existing local approach to climate action.

If a project needs further GHG reductions after adoption of all feasible local, off-site mitigation options, applicants should next consider non-local, off-site mitigation. There has been concern that GHG emission reductions from off-site GHG mitigation measures (including carbon offset credits) may double count GHG emission reductions from California's Cap-and-Trade program. However, off-site mitigation measures, such as EV charging or building efficiency retrofits, are viable options for mitigation under CEQA and would not be double counted, provided they are not otherwise required by law or regulation and would not have happened but for the mitigation requirements of the project. If the mitigation would have been implemented or required through another statute, regulation, existing local program, or requirement other than the project it is mitigating, then the project being mitigated may not also claim credit for the reductions.

4.1.3 Conditions Applicable to Carbon Offset Credits

If implementation of all feasible on-site GHG reduction measures and all feasible off-site GHG reduction measures are insufficient to reduce a project's impact to a less-than-significant level, then the lead agency or project applicant should consider purchasing and retiring carbon offset credits. The State recommends that carbon offset credits retired as CEQA mitigation be registered with a recognized and reputable carbon registry on the voluntary market. For example, while CARB does not review or authorize voluntary-market offset registries or protocols for use as CEQA mitigation, CARB notes that the registries approved by CARB for the Cap-and-Trade Program also serve as voluntary market credit registries, with voluntary market offsets available for CEQA mitigation purposes.[83]

In addition, starting in 2023, the California Carbon Sequestration and Climate Resiliency Project Registry[84] will be maintained by the California Natural Resources Agency for the purposes of identifying and listing projects in the state that drive climate action on the state's natural and working lands. The Registry is seeking funding from State agencies and private entities and may provide additional carbon offset credits. Note that compliance offsets for the Cap-and-Trade Program (a state market-based carbon program unaffiliated with CEQA) cannot be used for any purpose other than Cap-and-Trade compliance by covered entities and therefore cannot be purchased for use as CEQA mitigation.[85] As with other types of off-site mitigation, the State recommends pursuing carbon offset credits that are as close to the project site as possible in the following order of priority: (1) carbon offset credits that originate in the same air basin as the project, (2) carbon offset credits that originate elsewhere in California, (3) carbon offset credits that originate outside of California.

4.2 Clarifying CEQA's Requirements for GHG Mitigation

Over the years, agencies and courts have provided direction and guidance regarding GHG mitigation. Given the variety of potential projects and mitigation scenarios, some uncertainty and misconceptions persist. For example, when lead agencies consider off-site GHG mitigation (including carbon offset credits), they may sometimes conflate the requirements for compliance-grade offsets in California's Cap-and-Trade regulation with the requirements for GHG mitigation measures under CEQA. The Cap-and-Trade regulation requires that compliance offsets used in the Cap-and-Trade Program meet certain regulatory criteria, including that they be real, additional, quantifiable, permanent, verifiable, and enforceable. In general, the State's Cap-and-Trade Program restricts compliance offsets from being used for any purpose other than Cap-and-Trade compliance, including being used as mitigation under CEQA.

When designing GHG mitigation measures (whether local, off-site mitigation or carbon offset credits), the State recommends that lead agencies focus on applying the requirements specified in the CEQA statute, Guidelines, and case law – e.g., not otherwise required (see CEQA Guidelines section 15126.4(c)(3)); enforceable (see CEQA Guidelines section 15126.4(a)(2)); supported by substantial evidence; etc. – rather than strictly importing all of the regulatory requirements used for compliance offsets within California's Cap-and-Trade

---

[83] CARB. 2022. *Offset Project Registries.* Available at: *https://ww2.arb.ca.gov/our- work/programs/compliance-offset-program/offset-project-registries*.

[84] Skinner, Chapter 237, Statutes of 2021. Carbon sequestration: state goals: natural and working lands: registry of projects. Available at: *https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220SB27*.

[85] Cal. Code Regs., tit. 14, Chapter 3, §§ 15000 et seq.

program. It may be appropriate for lead agencies to require CEQA mitigation that helps localities meet targets or commitments set in local planning documents, including CAPs, lacking sufficient funding and are not otherwise explicitly required by regulation. Lead agencies should use substantial evidence to document that a specific off-site mitigation measure is not otherwise required and would not have occurred at that time ***but for*** the requirement to mitigate a project's GHG impacts. Examples of off-site GHG mitigation that would not have occurred but for the requirement to mitigate a project's GHG impacts and could therefore be not otherwise required are included in Section 4.1.2, Off-site GHG Mitigation.

5. Importance of Regional Collaboration

While local jurisdictions have considerable authority to act individually, it is important to consider the many benefits of regional collaboration. Transportation, land use, housing, climate, and energy issues are often interconnected. Local governments can benefit from collaborating with neighboring jurisdictions and regional agencies as they seek to reduce GHG emissions from these sectors. For example, CAPs that consider regional travel patterns, job and housing availability, and regional opportunities to mitigate GHG emissions can be more effective. In collaboration with other regional entities, local jurisdictions can leverage investments, data, best practices, and opportunities for GHG emission reductions in an equitable manner.

Regional collaboration and partnership across levels of government can bring together community leaders, agencies, academia, industry, community-based organizations, and other stakeholders from multiple jurisdictions within a region to share expertise, information, lessons learned, and strategies to promote mutually defined goals. Regional collaboration may include leveraging existing collaboratives and partnerships or establishing new ones. There are many excellent examples of regional collaboration in California that support the intersection of transportation, housing, and land use in tackling climate change. Local jurisdictions can leverage the work of these collaboratives and build on existing efforts to support equitable implementation of priority strategies and GHG mitigation. Examples of existing regional collaboratives include Community Choice Aggregators (CCAs), Regional Energy Networks (RENs), Regional Climate Collaboratives, Regional Housing Collaboratives, and Plug-in Electric Vehicle Collaboratives. The Integrated Climate Adaptation and Resiliency Program (ICARP)[86] offers funding, case studies, and tools for forming regional climate coordination entities.

Regional collaboration has tremendous potential to address barriers and expand opportunities for successful local GHG mitigation. It can help increase local opportunities for feasible GHG mitigation under CEQA that also benefit the communities impacted by the development. It can

[86] Governor's Office of Planning and Research. 2022. *Integrated Climate Adaptation and Resiliency Program (ICARP)*. Available at: *https://opr.ca.gov/climate/icarp/*.

help overcome barriers, such as project and administrative costs. It can help increase awareness of local mitigation opportunities for project applicants and lead agencies, improve connections with existing programs that offer mitigation opportunities, and identify sites for off-site mitigation opportunities, all in an effort to support a local voluntary mitigation market. And it can help site owners aggregate smaller mitigation projects to potentially reduce costs, increase the efficiency of mitigation projects, and leverage expertise on mitigation strategies and quantification methodologies.

Regional collaboration can also lend support to lead agencies and air districts as they seek opportunities for local GHG mitigation. San Luis Obispo County Air Pollution Control District, County of Santa Barbara, County of Ventura, City of Santa Barbara, City of San Luis Obispo, and Community Environmental Council formed a tactical Regional GHG Collaborative Group to understand and identify opportunities for local carbon sequestration and GHG reduction projects.

Developing a local voluntary mitigation market will help a city or region capture mitigation dollars and provide local benefits that are not realized by the purchase of distant, out-of-state carbon offset credits, while providing greater transparency and enforceability. Keeping GHG mitigation dollars within communities or regions can also be a strategy to address community needs and inequities from historic and ongoing underinvestment in vulnerable and disadvantaged communities.

Creating, sustaining, and expanding regional collaboratives takes time, resources, and expertise that are not always available to local jurisdictions. There may be a role for the State to ensure that all regions have access to mitigation opportunities. One potential avenue to accomplish this would be through the creation of a statewide GHG mitigation bank designed for CEQA mitigation purposes.

6. Conclusion

Local governments are essential partners in California’s efforts to reduce GHGs. Their unique expertise and respective authorities allow them to shape growth and development patterns within their jurisdiction, and as a result, local actions remain critical for reducing GHG emissions from the built environment and transportation. Indeed, the Scoping Plan proposes transformative reductions in GHG emissions from the building and transportation sectors. These critical emission reductions rely on significant electrification of the state’s vehicle fleet and building stock, but also require a significant shift in the transportation choices for Californians favoring active mobility, shorter trips, and robust public transit rather than sprawl and automobile dependence. Local governments have a critical role to play in this transition through their land use policies, transportation investments, and partnerships with neighboring jurisdictions, community organizations, business and labor groups, and the State.

Local leadership and regional collaboration are paving the way for reducing emissions in these sectors, and this appendix seeks to inform jurisdictions about opportunities to promote transportation electrification, VMT reduction, and building decarbonization through:

- Developing local CAPs and strategies consistent with the framework described in Section 2: “The Role of Local Climate Action Planning in Supporting the State’s Climate Goals;”
- Localizing State-level GHG priorities when approving individual land use plans and projects as described in Section 3: “The Role of Land Use Development Projects in Supporting the State’s Climate Goals;”
- Implementing mitigation to reduce GHG emissions associated with CEQA projects, consistent with Section 4: “Mitigating Greenhouse Gas Emissions Pursuant to CEQA;” and
- Leveraging regional collaboration to enhance the effectiveness of local climate action and overcome barriers to CEQA GHG mitigation as highlighted in section 5: “Importance of Regional Collaboration.”

California must accommodate population and economic growth in a far more sustainable and equitable manner than in the past. California’s climate trajectory relies on local efforts that align with and help implement the State’s priorities. The recommendations provided in this appendix are non-binding and should not be interpreted as a directive to local governments, but rather as evidence-based analytical tools to assist local governments with their role as essential partners in achieving California’s climate goals.

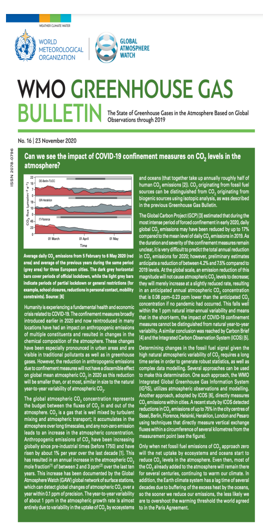
Search

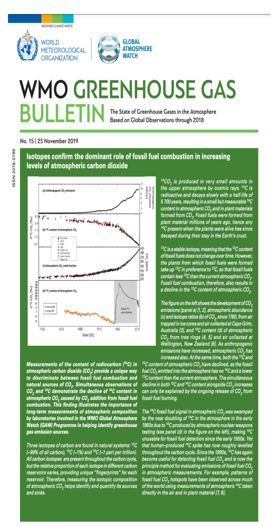
Home Greenhouse Gas Bulletin

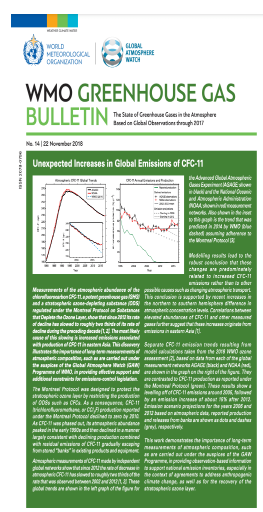
Greenhouse Gas Bulletin

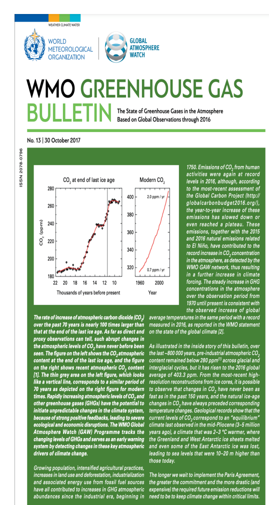
The Greenhouse Gas Bulletin represents the latest analysis of observations from the WMO GAW Programme. It shows globally averaged surface mole fractions for carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) and compares them with the mole fractions during the previous year and with the preindustrial levels. It also provides insights on the change in radiative forcing by long-lived GHGs (LLGHGs) and the contribution of individual gases to this increase.

PREVIOUS REPORTS









In yet another ominous warning for the future of our planet, atmospheric levels of the three main greenhouse gases - carbon dioxide, methane and nitrous oxide all reached new record highs in 2021, according to a new report from the World Meteorological Organization (WMO).

Read the report

WMO's Greenhouse Gas Bulletin reported the biggest year-on-year jump in methane concentrations in both 2020 and 2021 since systematic measurements began nearly 40 years ago. The reason for this exceptional increase is not clear, but seems to be a result of both biological and human-induced processes.

Carbon dioxide (CO_2)

Atmospheric carbon dioxide reached 149% of the pre-industrial level in 2021, primarily because of emissions from the combustion of fossil fuels and cement production. Global emissions have rebounded since the COVID-related lockdowns in 2020. Of the total emissions from human activities during the 2011–2020 period, about 48% accumulated in the atmosphere, 26% in the ocean and 29% on land.

There is concern that the ability of land ecosystems and oceans to act as "sinks" may become less effective in future, thus reducing their ability to absorb carbon dioxide and act as a buffer against larger temperature increase. In some parts of the world the transition of the land sink into CO_2 source is already happening.

Methane (CH_4)

Atmospheric methane is the second largest contributor to climate change and consists of a diverse mix of overlapping sources and sinks, so it is difficult to quantify emissions by source type.

Since 2007, globally-averaged atmospheric methane concentration has been increasing at an accelerating rate. The annual increases in 2020 and 2021 (15 and 18 ppb respectively) are the largest since the systematic record began in 1983.

Causes are still being investigated by the global greenhouse gas science community. Analysis indicates that the largest contribution to the renewed increase in methane since 2007 comes from biogenic sources, such as wetlands or rice paddies. It is not yet possible to say if the extreme increases in 2020 and 2021 represent a climate feedback – if it gets warmer, the organic material decomposes faster. If it decomposes in the water (without oxygen) this leads to methane emissions. Thus, if tropical wetlands become wetter and warmer, more emissions are possible.

The dramatic increase might also be because of natural interannual variability. The years 2020 and 2021 saw La Niña events which are associated with increased precipitation in the tropics.

Watch the highlights

Nitrous oxide (N_2O)

Nitrous oxide is the third most important greenhouse gas. It is emitted into the atmosphere from both natural sources (approximately 57%) and anthropogenic sources (approximately 43%), including oceans, soils, biomass burning, fertilizer use, and various industrial processes. The increase from 2020 to 2021 was slightly higher than that observed from 2019 to 2020 and higher than the average annual growth rate over the past 10 years

News & Press Release

Follow WMO

Discover

Events | News | Bookstore | Projects | Bulletin | MeteoWorld

Learn

Visit the Library | Youth Corner

WMO

Governance | Partnerships | Contact us | Procurement | Privacy policy | Report fraud, corruption or abuse

About us Disclaimer Copyright Sitemap

EXHIBIT 9

Implemented by as part of

Climate Change Service

GLOBAL CLIMATE HIGHLIGHTS 2022

2022 saw record temperatures in Europe and across the world

Home / News

9th January 2023

Summary

1. Europe’s warmest summer
2. Record temperatures in polar regions and tropics
3. Highest CO2 levels in 2 million years

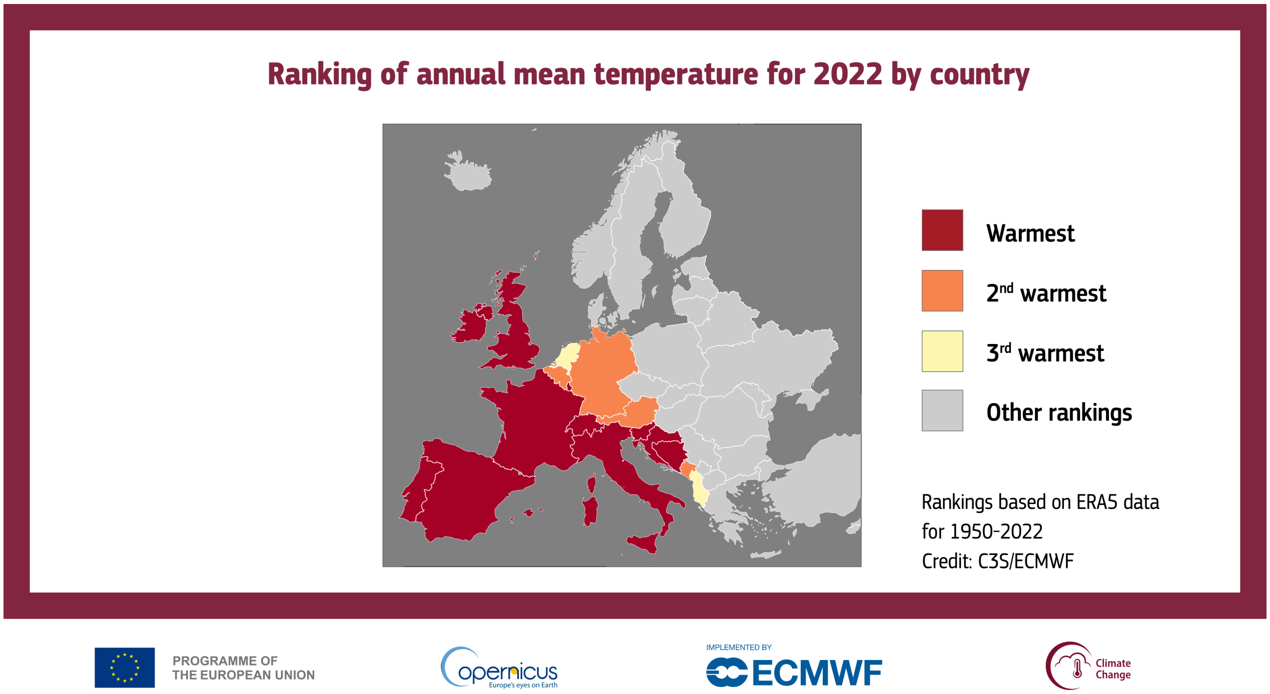
*The Copernicus Climate Change Service (*C3S) has published its 2022 Global Climate Highlights, which show 2022 to have been a year of extremes, with many temperature records broken and a continued rise in greenhouse gas concentrations in the atmosphere. Summer 2022 was the hottest on record for Europe and, overall, last year was the second warmest year on record for Europe, while globally it was the fifth warmest.*

The **2022 Global Climate Highlights,** which summarise the past year's temperatures, greenhouse gas concentrations and significant climate and weather events, show that several temperature records were broken both in Europe and across the world, while other extreme events such as drought and flooding affected large regions.

Europe's warmest summer

Europe saw its hottest summer ever recorded (the previous hottest summer was in 2021) and several prolonged and intense heatwaves affected parts of western and northern Europe. Autumn was the third warmest on record, only beaten by 2020 and 2006, while winter temperatures were around 1°C above average. Conversely, spring temperatures for Europe as a whole were just below the average of the 1991-2020 reference period. In terms of monthly averages, nine months were above average, while three (March, April and September) were below average. The continent experienced its second warmest June ever recorded at about 1.6°C above average and its warmest October, with temperatures nearly 2°C above average.

Temperatures in Europe across the year were the second warmest on record, exceeded only by 2020, which was 0.3°C warmer than last year. All of Europe, with the exception of Iceland saw annual temperatures above the 1991-2020 average. Temperatures were most above average in the western part of the continent where several countries saw their warmest year on record, while most others saw annual temperatures in the top three rankings.

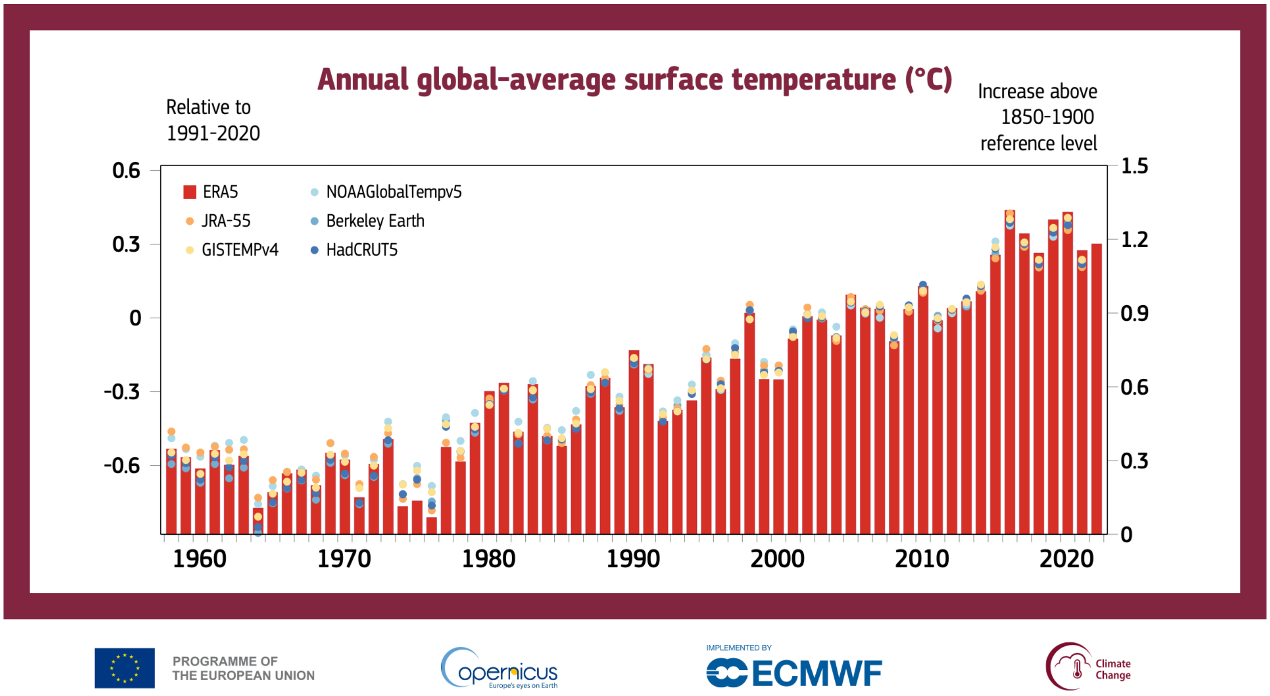


Ranking of 2022 surface air temperatures by country over the period since 1950. Data source: ERA5. Credit: Copernicus Climate Change Service/ECMWF.

The unusual warmth in late spring and summer in Europe combined with a lack of rain, clear skies and dry soils, brought drought conditions especially to the southern and central parts of the continent. Many countries reported impacts on agriculture, river transport and energy management. Extremely dry conditions also led to increased fire danger resulting in unusually high fire activity in southwestern Europe, especially France and Spain.

"2022 was yet another year of climate extremes across Europe and globally. These events highlight that we are already experiencing the devastating consequences of our warming world. The latest 2022 Climate Highlights from C3S provide clear evidence that avoiding the worst consequences will require society to both urgently reduce carbon emissions and swiftly adapt to the changing climate," said C3S Deputy Director Samantha Burgess.

Globally, during 2022, the world experienced its fifth warmest year on record, according to the C3S ERA5 dataset. So far, the hottest years on record globally are 2016, 2020, 2019 and 2017 respectively. According to ERA5, the annual average temperature was 0.3°C above the reference period of 1991-2020, which equates to approximately 1.2°C higher than the period 1850-1900, typically used as a proxy for the pre-industrial era. This makes 2022 the eighth year in a row with temperatures more than 1°C above the pre-industrial level.



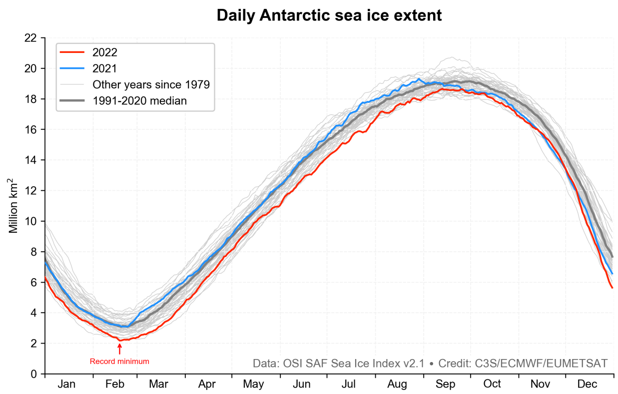
Annual averages of the estimated global surface temperature increase above the 1991–2020 (left-hand axis) and 1850–1900 (right-hand axis) reference levels. 2022 is according to ERA5 only, all other years according to six different datasets. Data sources: ERA5 (C3S/ECMWF), JRA-55 (JMA), GISTEMPv4 (NASA), HadCRUT5 (Met Office Hadley Centre), NOAAGlobalTempv5 (NOAA) and Berkeley Earth. Credit: Copernicus Climate Change Service/ECMWF.

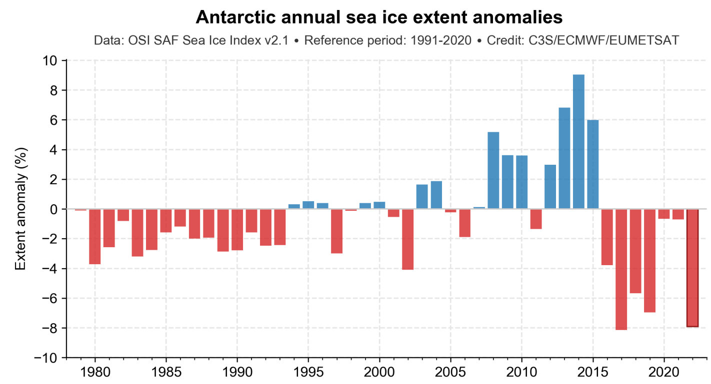
For 2022, temperatures were more than 2°C above the 1991–2020 average over parts of northern central Siberia and along the Antarctic Peninsula. The regions that saw the warmest year on record include large parts of western Europe, the Middle East, Central Asia and China, South Korea, New Zealand, north-western Africa and the Horn of Africa.

Record temperatures in polar regions and tropics

Both polar regions saw episodes of record temperatures during 2022. March saw the Antarctic experience an intense warm period with temperatures well above average. At the Vostok station, in the interior of East Antarctica, for example, the reported temperature reached -17.7°C, the warmest ever measured in its 65-year record. During September, temperatures over Greenland were 8°C higher than average with C3S data showing that almost all of the country experienced average temperatures higher than in any September since at least 1979, associated with prevailing winds from the south and southwest that were warmer than normal.

The Antarctic saw unusually low sea ice conditions throughout the year, with six months seeing record or near-record low Antarctic Sea ice extents for the corresponding month. During the latter half of February, Antarctic daily sea ice extent reached a new record low, bypassing the previous minimum reached in 2017. The low sea ice extents came primarily from below-average sea ice conditions in the Weddell Sea throughout most of the year, in the Ross and Amundsen Seas until April, and in the Bellingshausen Sea from April onward.





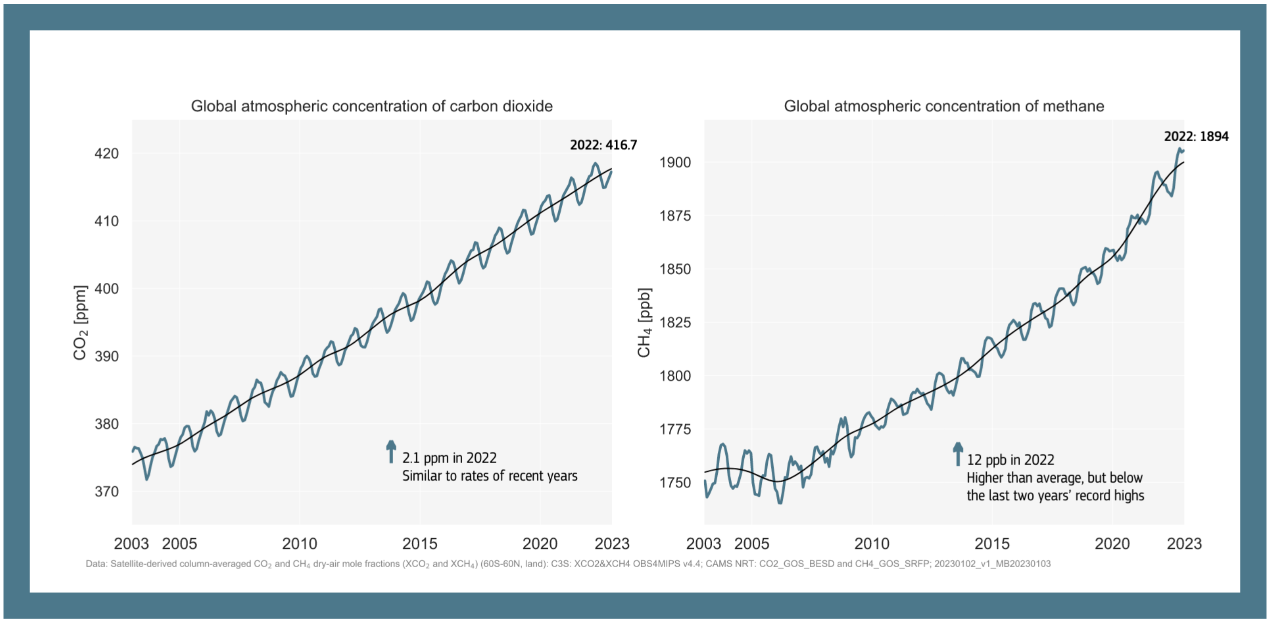
Left: Time series of Antarctic daily sea ice extent for 2022 (red), 2021 (blue) and all other years since 1979 (grey) and the daily median during 1991-2020 (dark grey). Right: Time series of annual mean Antarctic sea ice extent anomalies for all years from 1979 to 2022. The anomalies are expressed as a percentage of the average for the period 1991-2020. Data source: EUMETSAT OSI SAF Sea Ice Index v2.1. Credit: C3S/ECMWF/EUMETSAT.

In the tropical and subtropical regions, extremely high pre-monsoon temperatures in Pakistan and northern India resulted in prolonged spring heatwave conditions and record-breaking maximum and minimum temperatures. Central and eastern China experienced long-lived heatwave conditions with subsequent drought during the summer.

In July and August, Pakistan saw record-breaking rainfall leading to large-scale flooding over large parts of the country causing widespread destruction and loss of life. Australia also experienced below average temperatures, with unusually wet conditions throughout much of the year, especially in the east of the continent, with several episodes of widespread flooding, a situation typically associated with persisting La Niña conditions and likely accentuated by saturated soils.

Highest CO2 levels in 2 million years

Together with the Copernicus Atmosphere Monitoring Service (*CAMS), C3S reveals that atmospheric greenhouse gases continued to increase in 2022. Preliminary analysis of satellite data averaged over the whole atmospheric column shows that carbon dioxide concentrations rose by approximately 2.1 ppm, while methane rose by around 12 ppb. This resulted in an annual average for 2022 of approximately 417 ppm for carbon dioxide and 1894 ppb for methane. For both gases this is the highest concentrations from the satellite record, and by including other records, the highest levels for over 2 million years for carbon dioxide and over 800 000 years for methane.



PROGRAMME OF THE EUROPEAN UNION | opernicus | IMPLEMENTED BY ECMWF | Climate Change | Atmosphere Monitoring

Monthly global mean atmospheric CO2 (left) and CH4 (right) column-averaged concentration from satellites for 2003-2022 (red curve) and 12-months average (black curve). Data source: C3S/Obs4MIPs (v4.4) consolidated (2003–2021) and CAMS preliminary near real-time data (2022) GOSAT records. Spatial range: 60S - 60N over land. Credit: C3S/CAMS/ECMWF/University of Bremen/SRON.

Annual global total emissions from vegetation fires continue to decline in relation to land use changes and declining savannah fires in the tropics. However, scientists from CAMS monitored significantly increased fire emissions in some regions of Europe where hotter and drier conditions contributed to increased flammability and fire danger. As a result, the total estimated summer (June-August) emissions from wildfires in the European Union and United Kingdom were the highest since 2007. France, Spain, Germany, and Slovenia experienced their highest summer wildfire emissions for at least the last 20 years, contributing to degraded air quality locally.

"Greenhouse gases, including carbon dioxide and methane, are the main drivers of climate change and we can see from our monitoring activities that atmospheric concentrations are continuing to rise each year with no signs of slowing," said CAMS Director Vincent-Henri Peuch. "Our ongoing efforts towards an operational verification capacity of CO2 and CH4 will provide immensely useful tools to objectively assess the effectiveness of climate change mitigation measures."

You can access the 2022 Global Climate Highlights here. C3S will comprehensively review various 2022 climate events in Europe in its annual European State of the Climate, due to be published in April 2023. Previous editions can be found here.

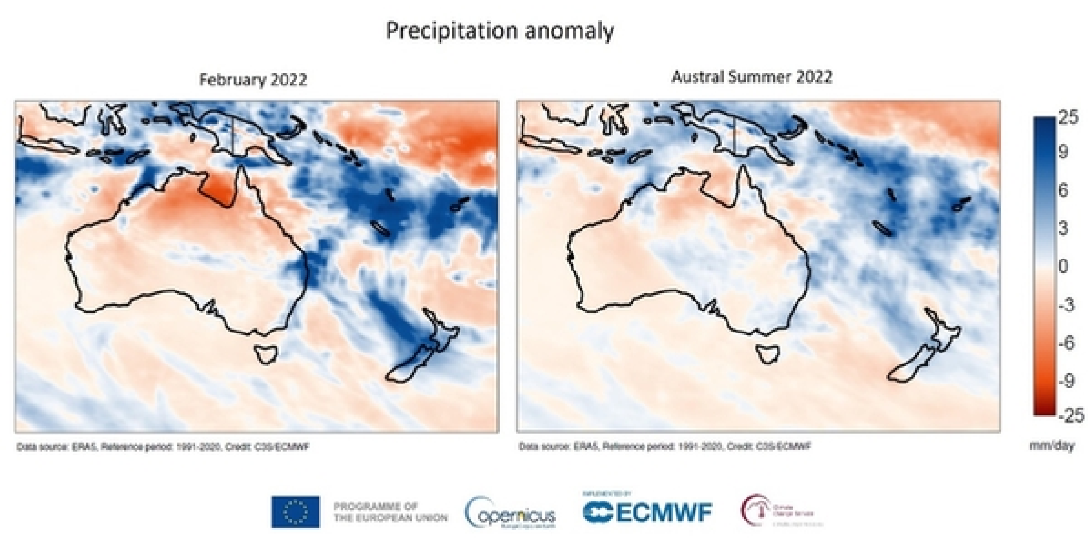
*C3S and CAMS are implemented by the European Centre for Medium-Range Weather Forecasts (ECMWF) on behalf of the European Commission.

Back to top

RELATED CONTENT

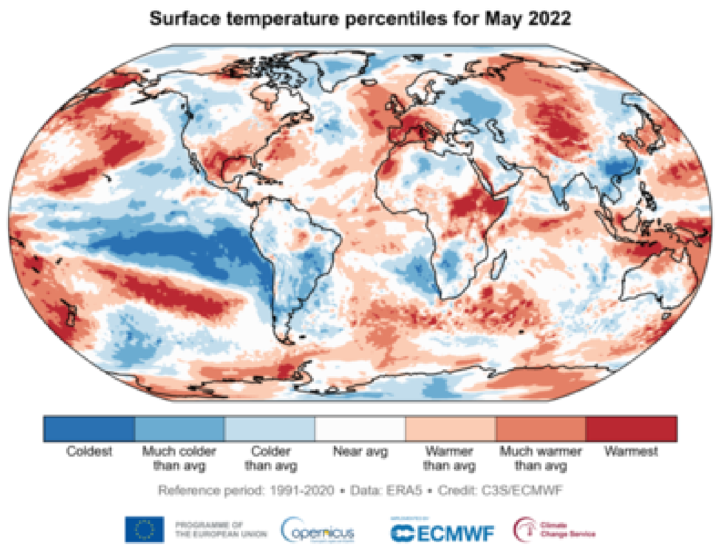
- Global Climate Highlights 2022
- Globe in 2022
- Press Resources
- Press Conference Livestream
- Press Release

FURTHER READING



A tale of two extremes: C3S tracks developments in Iberia and Australia

At opposite ends of the planet, two extreme weather events have been playing out recently, both remarkable for their exceptional nature – with record-breaking floods causing devastation in Australia and sustained dry conditions bringing the Iberian Peninsula to the brink of drought.

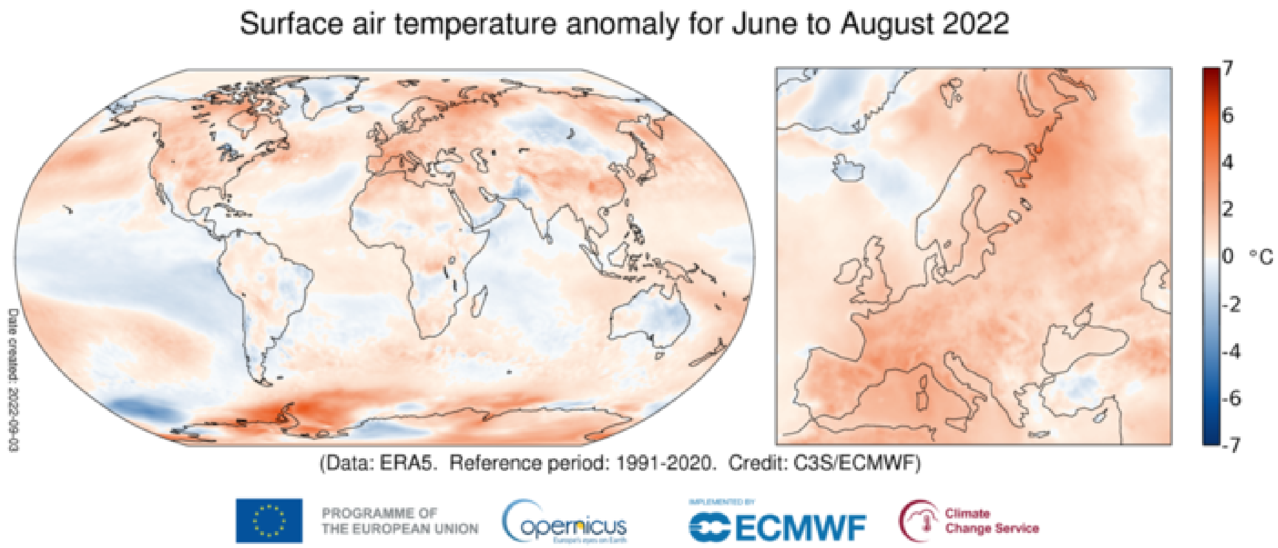


Heatwaves grip parts of Europe, Asia and North America in the first half of 2022

The climate for 2022 has been remarkable for a series of early heatwaves around the globe. This review focuses on three areas which experienced much warmer-than-average conditions in March, April and May 2022: northern India, Afghanistan and Pakistan, southwestern Europe, and North America.

Europe continued to swelter in July

Following two months of intense heat in May and June, Europe continued to swelter in July with an intense and prolonged heatwave that started in Spain and Portugal before spreading further north and east, towards France, the United Kingdom, central Europe and Scandinavia.



C3S Climate Bulletin shows summer 2022 was Europe's warmest on record

C3S Climate Bulletin shows summer 2022 was Europe's warmest on record

Pakistan devastated by August floods

Pakistan has experienced severe monsoon weather since June 2022, according to information from the Pakistan Meteorological Department.

Seasonal review: Europe’s record-breaking summer

In addition to surface temperature, the Copernicus Climate Change Service (C3S*) has been monitoring other essential climate variables, such as precipitation, soil moisture and river discharge.

Copernicus
Europe’s eyes on Earth

IMPLEMENTED BY
ECMWF

Copernicus Services:

Atmosphere

Marine

Land

Security

Climate Change

Emergency

Subscribe to the newsletter:

Subscribe

By subscribing to this newsletter you agree to the privacy policy.

FOLLOW US

Take our feedback survey

Copernicus

Copernicus is the European Union's Earth Observation Programme, looking at our planet and its environment for the ultimate benefit of all European citizens.

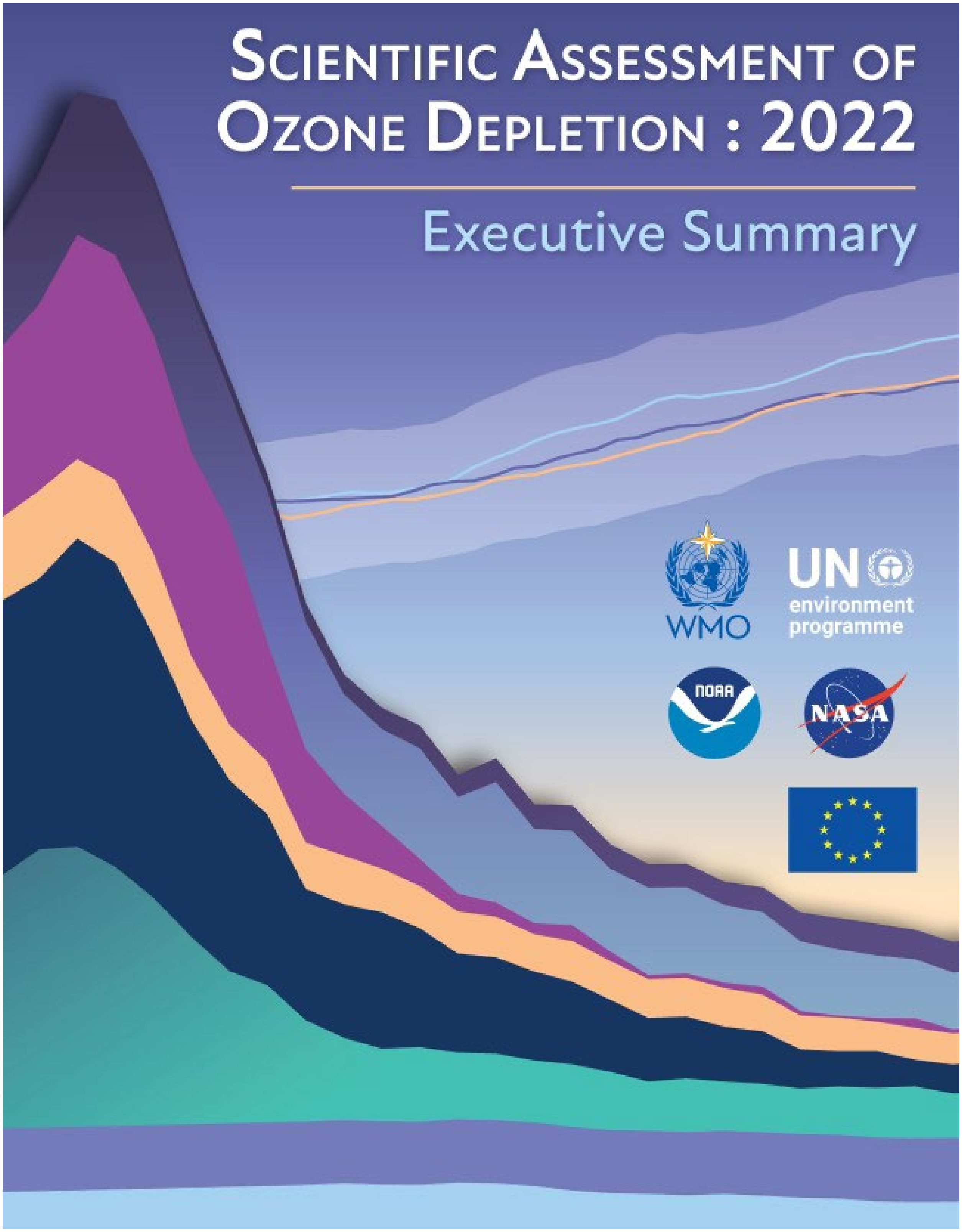
About us
Contact us
Privacy
Sitemap

EXHIBIT 10

Climate Reports

Key reports on climate impacts and solutions from around the United Nations.

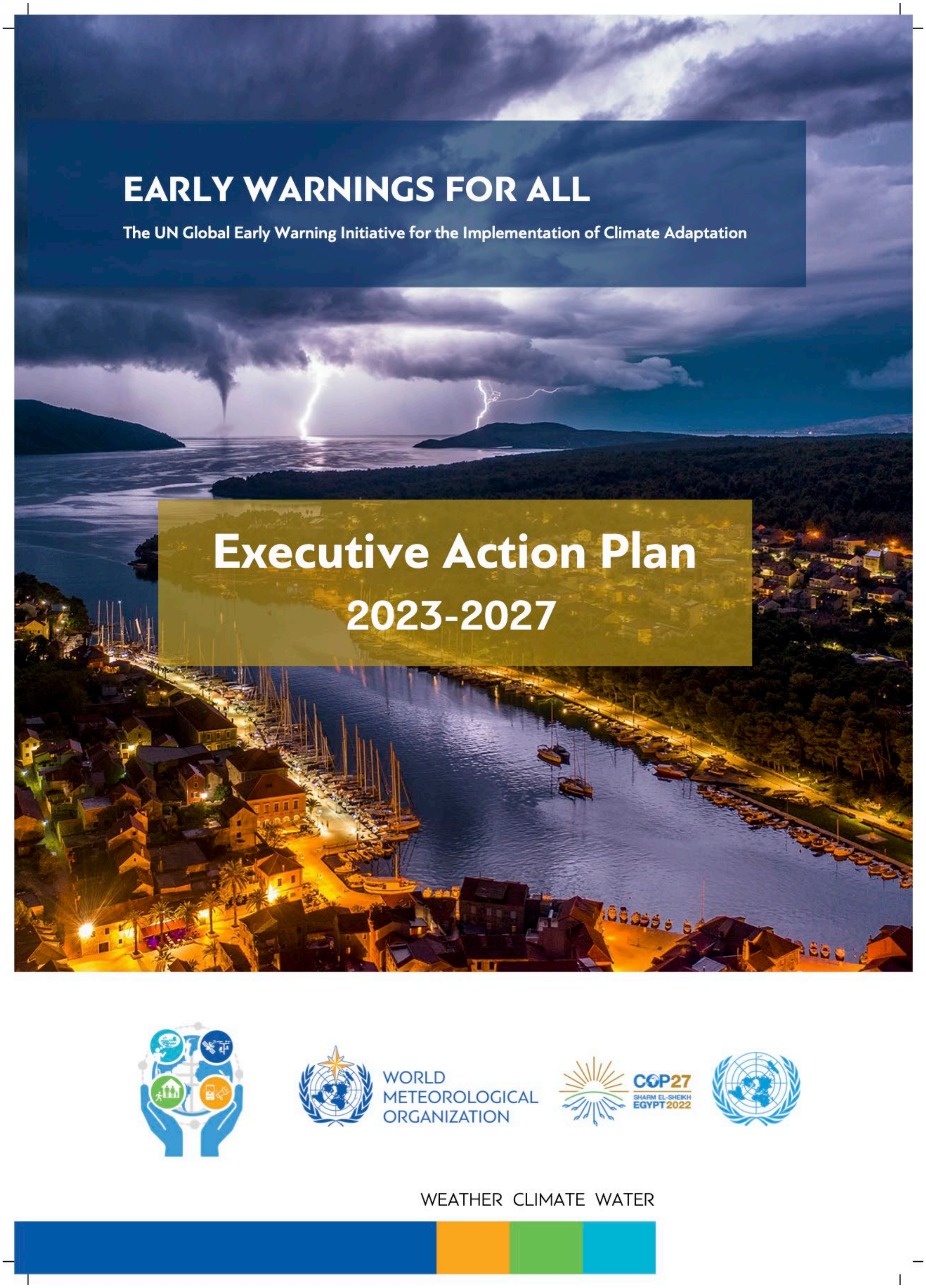
What's New



UNEP & WMO | Scientific Assessment of Ozone Depletion

The successful global phase-out of ozone-depleting chemicals is allowing the ozone layer to recover and is also helping to mitigate climate change.

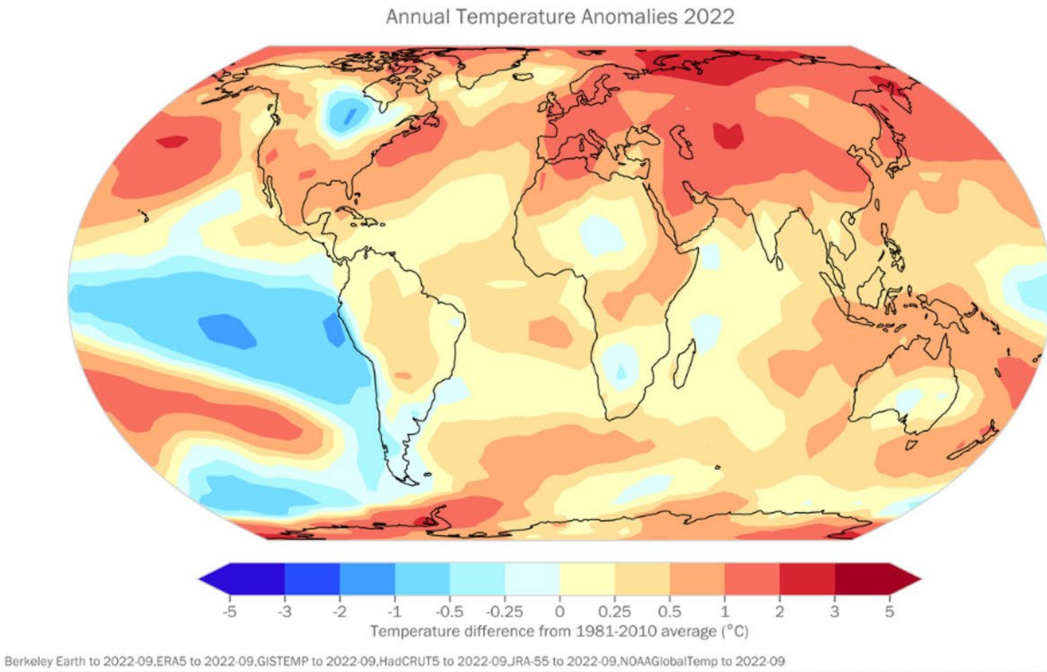
Read the report



WMO | Executive Action Plan for the Early Warnings for All

The Executive Action Plan for the Early Warnings for All initiative calls for initial new targeted investments between 2023 and 2027 of US$3.1 billion – a sum which would be dwarfed by the benefits.

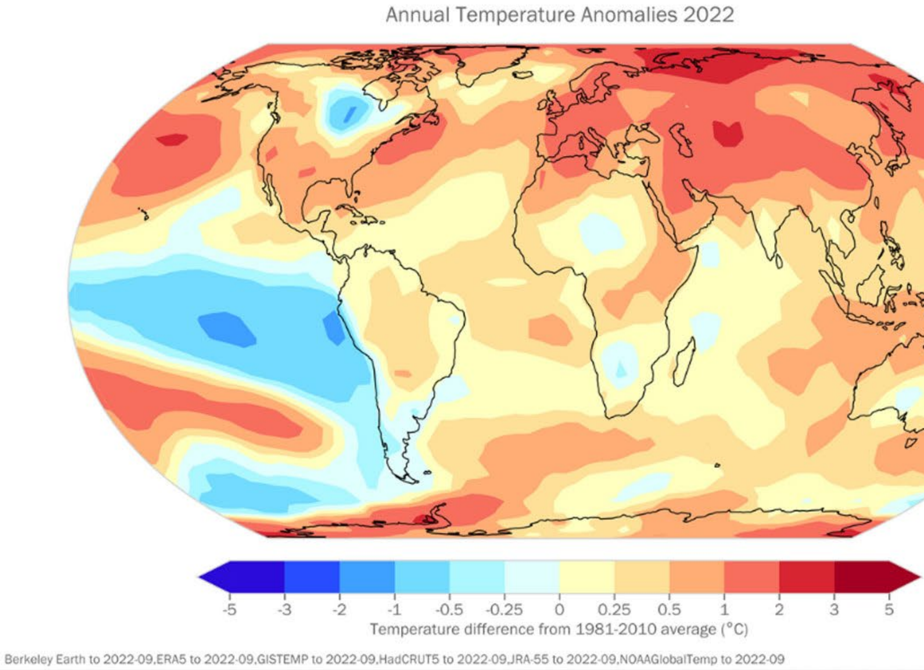
[Read the report]



WMO | Provisional State of the Global Climate 2022

The past eight years are on track to be the eight warmest on record, and the telltale signs and impacts of climate change are becoming more dramatic, warns a new report.

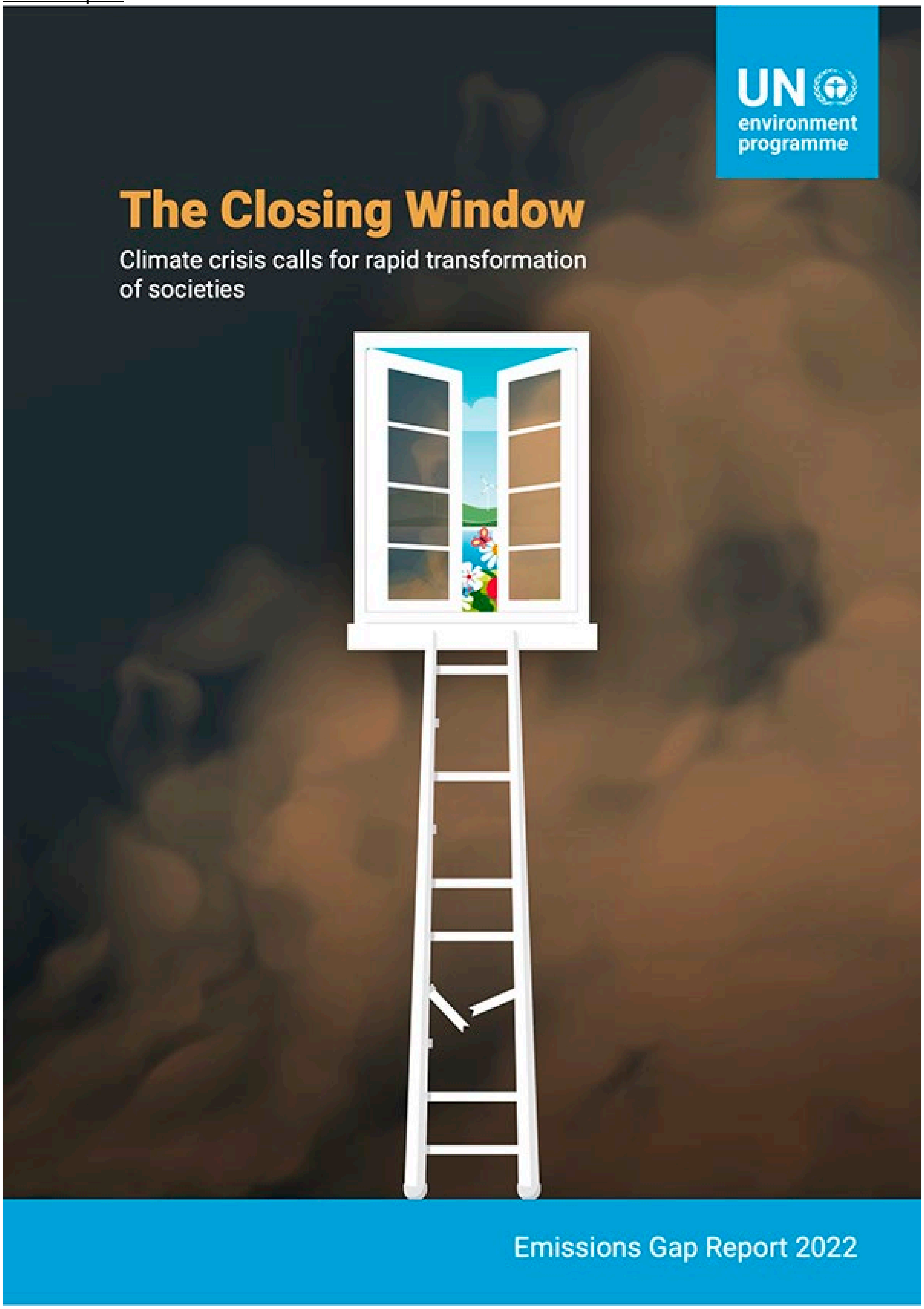
Read the report



WMO | Provisional State of the Global Climate 2022

The past eight years are on track to be the eight warmest on record, fueled by ever rising greenhouse gas concentrations and accumulated heat. Extreme heatwaves, drought and devastating flooding have affected millions and cost billions this year, warns the Provisional State of the Global Climate report.

WMO Report



UNEP | Emissions Gap Report 2022: The Closing Window

Inadequate progress on climate action calls for urgent sector and system-wide transformations – in the electricity supply, industry, transport and buildings sectors, and the food and financial systems – as current climate pledges leave the world on track for a temperature rise of 2.4-2.6°C by the end of this century.

UNEP Report

WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION | GLOBAL ATMOSPHERE WATCH

WMO GREENHOUSE GAS BULLETIN

The State of Greenhouse Gases in the Atmosphere Based on Global Observations through 2021

No. 18 | 26 October 2022

ISSN 2078-0796

In 2020 and 2021, the global network of the WMO Global Atmosphere Watch (GAW) Programme detected the largest within-year increases(1) (15 and 18 ppb,(2) respectively) of atmospheric methane (CH_4) since systematic measurements began in the early 1980s (Figure 1). The causes of these exceptional increases are still being investigated by the global greenhouse gas science community. Analyses of measurements of the abundances of atmospheric CH_4 and its stable carbon isotope ratio $^{13}C/^{12}C$ (reported as $\delta^{13}C(CH_4)$) (Figure 2) indicate that the increase in CH_4 since 2007 is associated with biogenic processes, but the relative contributions of anthropogenic and natural sources to this increase are unclear. While all conceivable efforts to reduce CH_4 emissions should be employed, this is not a substitute for reducing CO_2 emissions, whose impact on climate will continue for millennia.

Atmospheric CH_4 is the second largest contributor to climate change. Its effective direct radiative forcing (EDRF)(3) was 0.55 W m^{-2} in 2021 and over the past decade, it has been increasing by an average of 0.003 W m^{-2} yr^{-1}. In addition, because as CH_4 decays, it leads to the formation of tropospheric O_3 and stratospheric H_2O, in 2021, CH_4 led to an indirect radiative forcing of approximately 0.3 W m^{-2}. (For comparison, the EDRF from CO_2 was 2.22 W m^{-2} in 2021 and over the past decade, it has been increasing by an average of 0.03 W m^{-2} yr^{-1}.) The budget of CH_4 consists of a diverse mix of sources and sinks, with many sources overlapping spatially, so it is difficult to quantify emissions

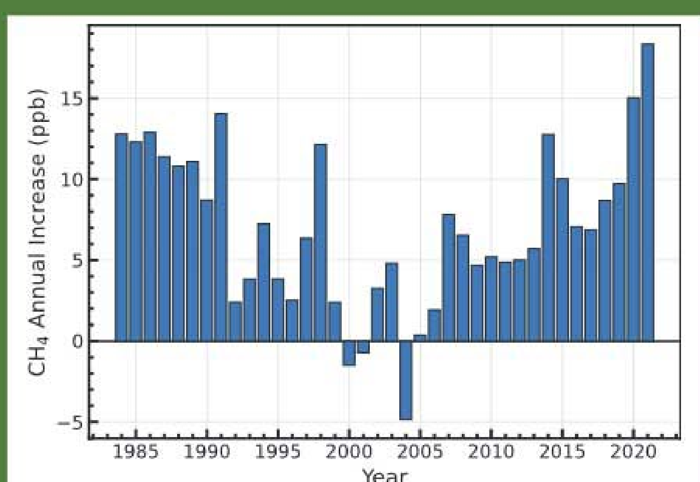
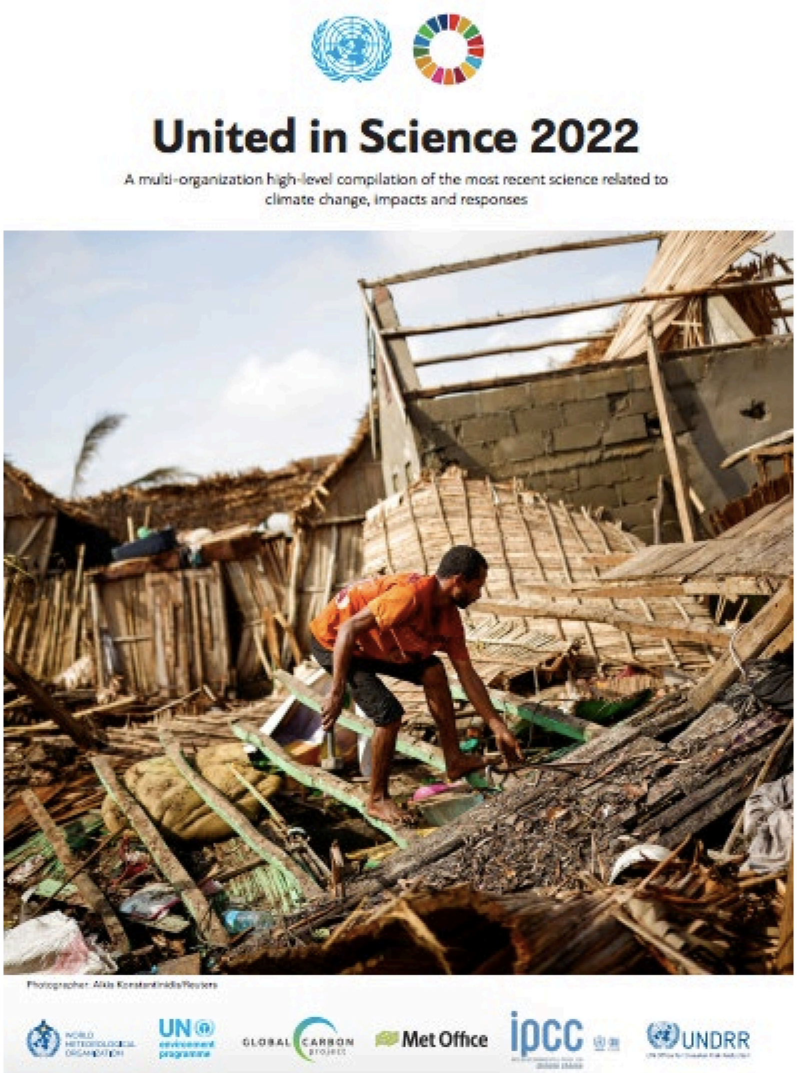


Figure 1. Within-year increases(1) of global average atmospheric CH_4 measured by the WMO GAW network over the period 1983–2021

WMO | Greenhouse Gas Bulletin 2022

The latest report warns that atmospheric levels of the three main greenhouse gases - carbon dioxide, methane, and nitrous oxide - reached new record highs in 2021, showing the biggest year-on-year jump in methane concentrations since systematic measurements began nearly 40 years ago. Moreover, the increase in carbon dioxide levels from 2020 to 2021 was larger than the average annual growth rate over the last decade.

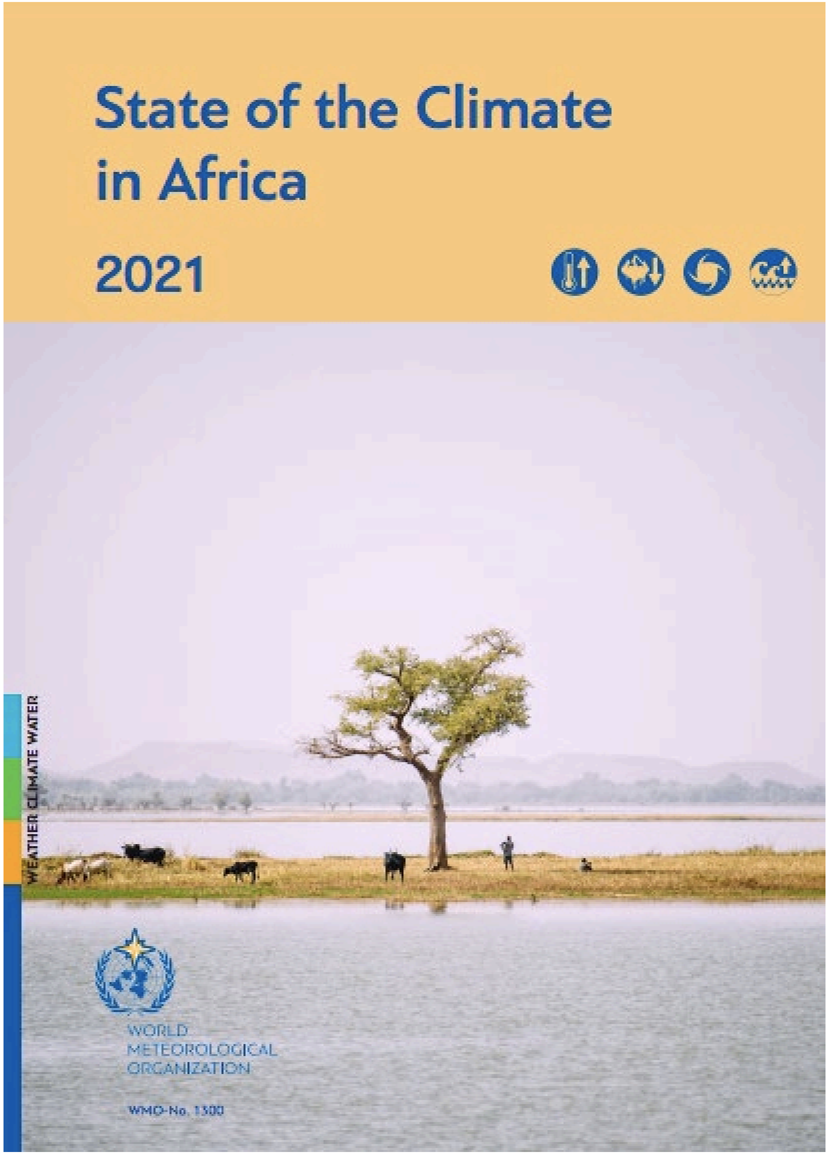
WMO Report



WMO | United in Science 2022

As global warming increases, “tipping points” in the climate system cannot be ruled out and the ambition of emissions reduction pledges for 2030 needs to be seven times higher to be in line with the 1.5 °C goal of the Paris Agreement.

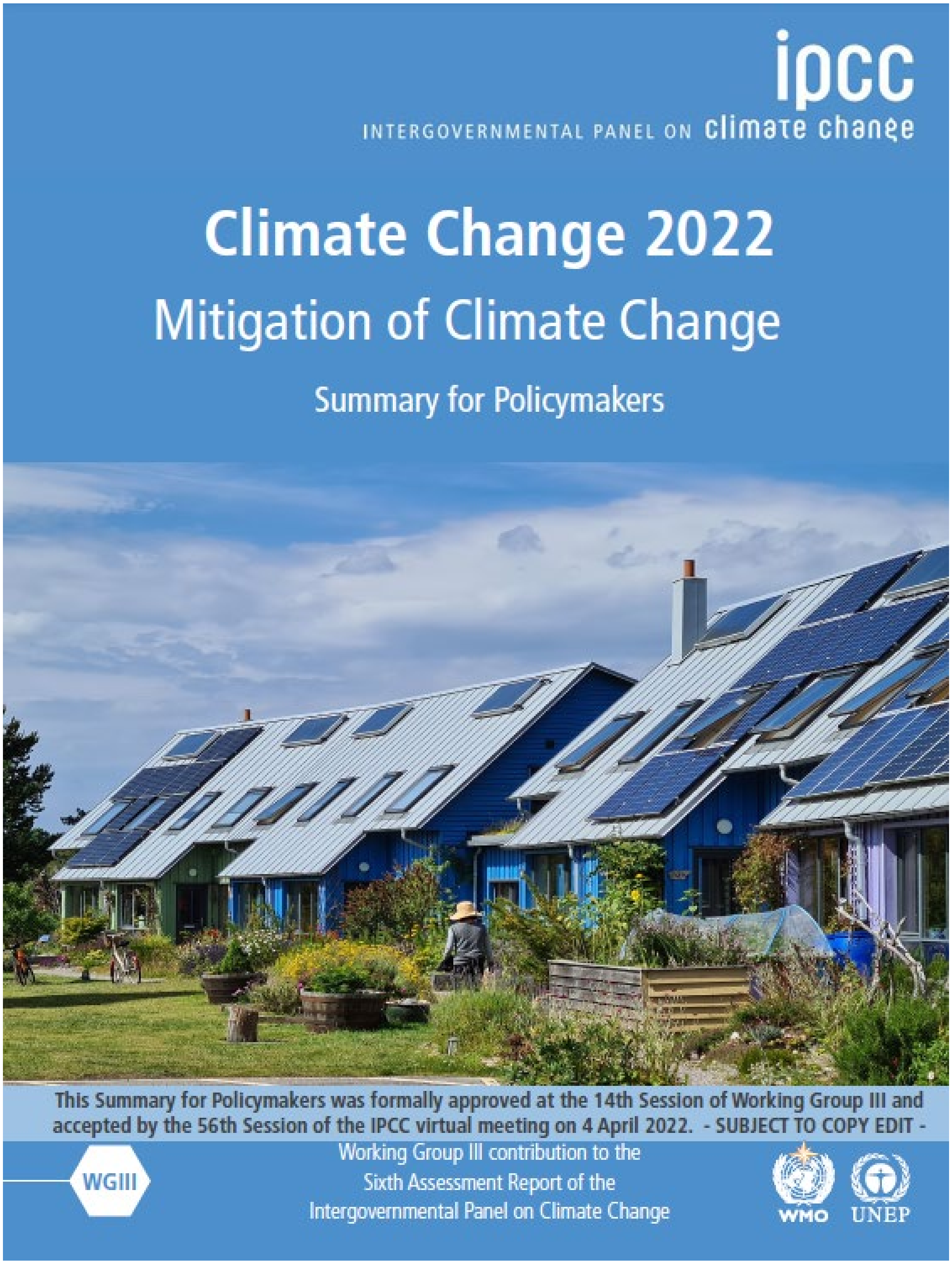
WMO Report



WMO | State of the Climate in Africa

Water stress and hazards like withering droughts and devastating floods are hitting African communities, economies, and ecosystems hard. Rising water demand combined with limited and unpredictable supplies threatens to aggravate conflict and displacement.

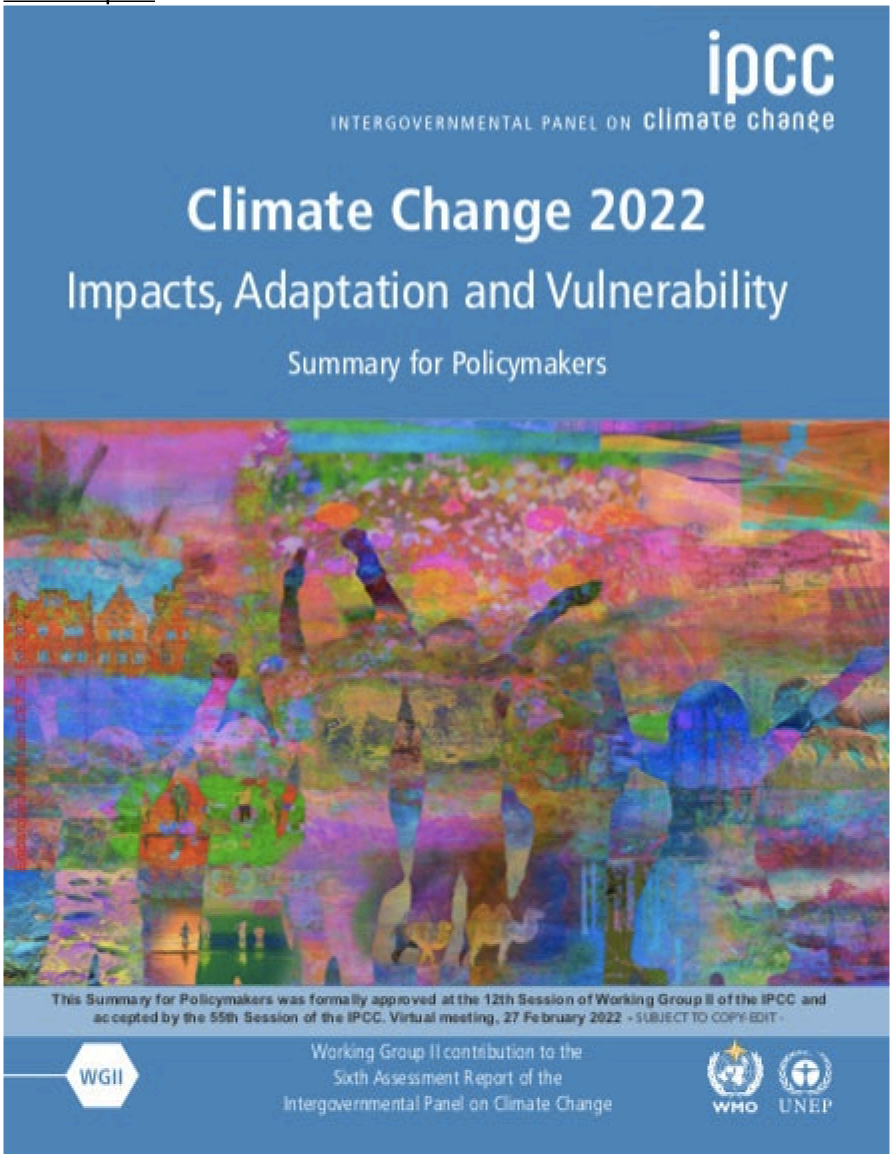
WMO Report



IPCC | Climate Change 2022: Mitigation of Climate Change

Without immediate and deep emissions reductions across all sectors, limiting global warming to 1.5°C (2.7°F) is beyond reach. In the scenarios assessed, limiting warming to around 1.5°C requires global greenhouse gas emissions to peak before 2025 at the latest, and be reduced by 43% by 2030; at the same time, methane would also need to be reduced by about a third. According to the report, there is increasing evidence of climate action. In 2010-2019, average annual global greenhouse gas emissions were at their highest levels in human history, but the rate of growth has slowed. An increasing range of policies and laws have enhanced energy efficiency, reduced rates of deforestation and accelerated the deployment of renewable energy.

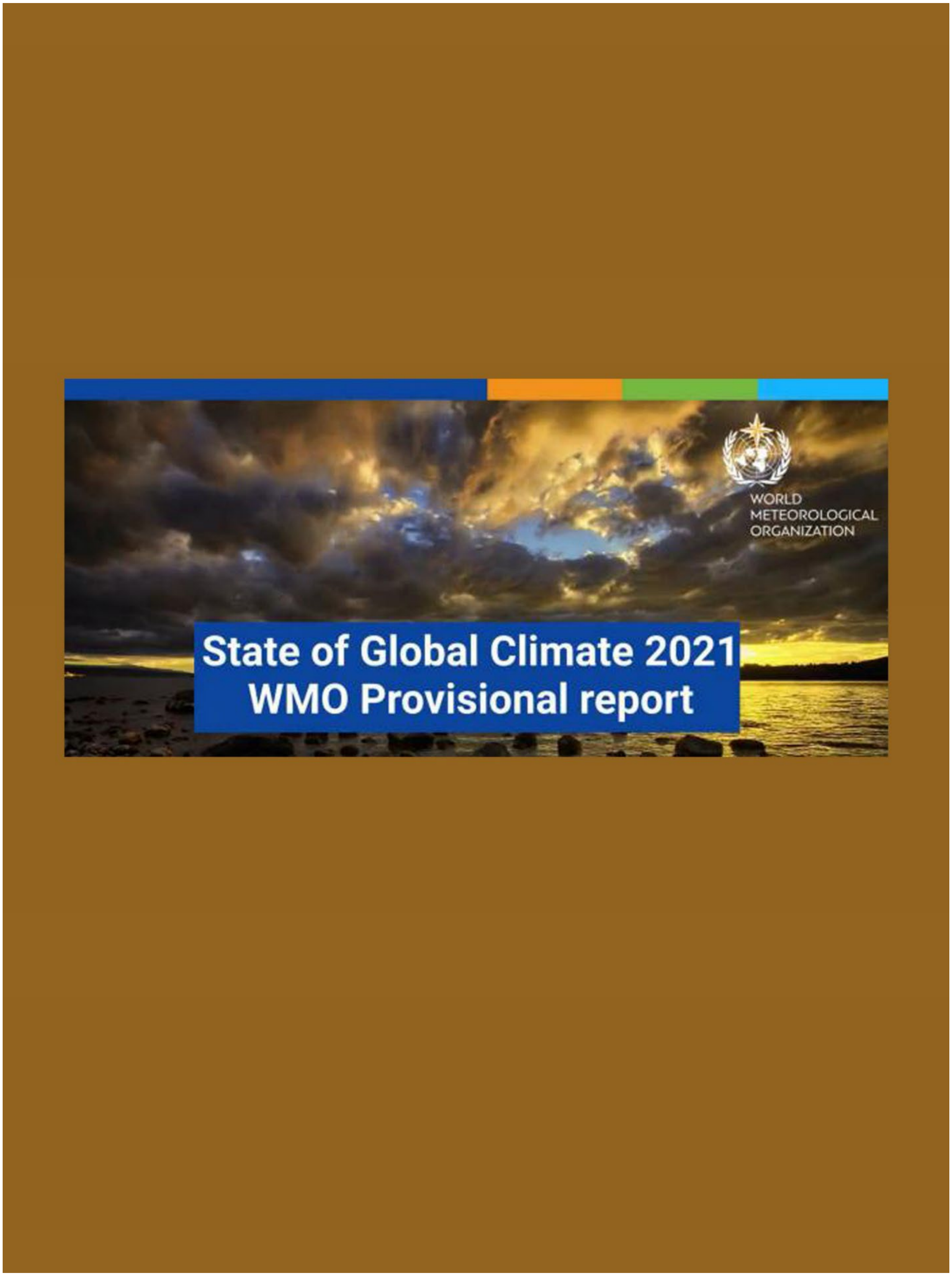
IPCC Report



IPCC | Climate Change 2022: Impacts, Adaptation, Vulnerability

Human-induced climate change is causing dangerous and widespread disruption in nature and is affecting the lives of billions of people around the world, says this Intergovernmental Panel on Climate Change (IPCC) report. People and ecosystems least able to cope are being hardest hit. Increased heatwaves, droughts and floods are already exceeding plants and animals' tolerance thresholds, driving mass mortalities in species such as trees and corals. These weather extremes are occurring simultaneously, causing cascading impacts that are increasingly difficult to manage. They have exposed millions of people to acute food and water insecurity, especially in Africa, Asia, Central and South America, on small islands and in the Arctic. To avoid mounting loss of life, biodiversity and infrastructure, urgent, ambitious, and accelerated action is required to adapt to climate change, at the same time as making rapid, deep cuts in greenhouse gas emissions.

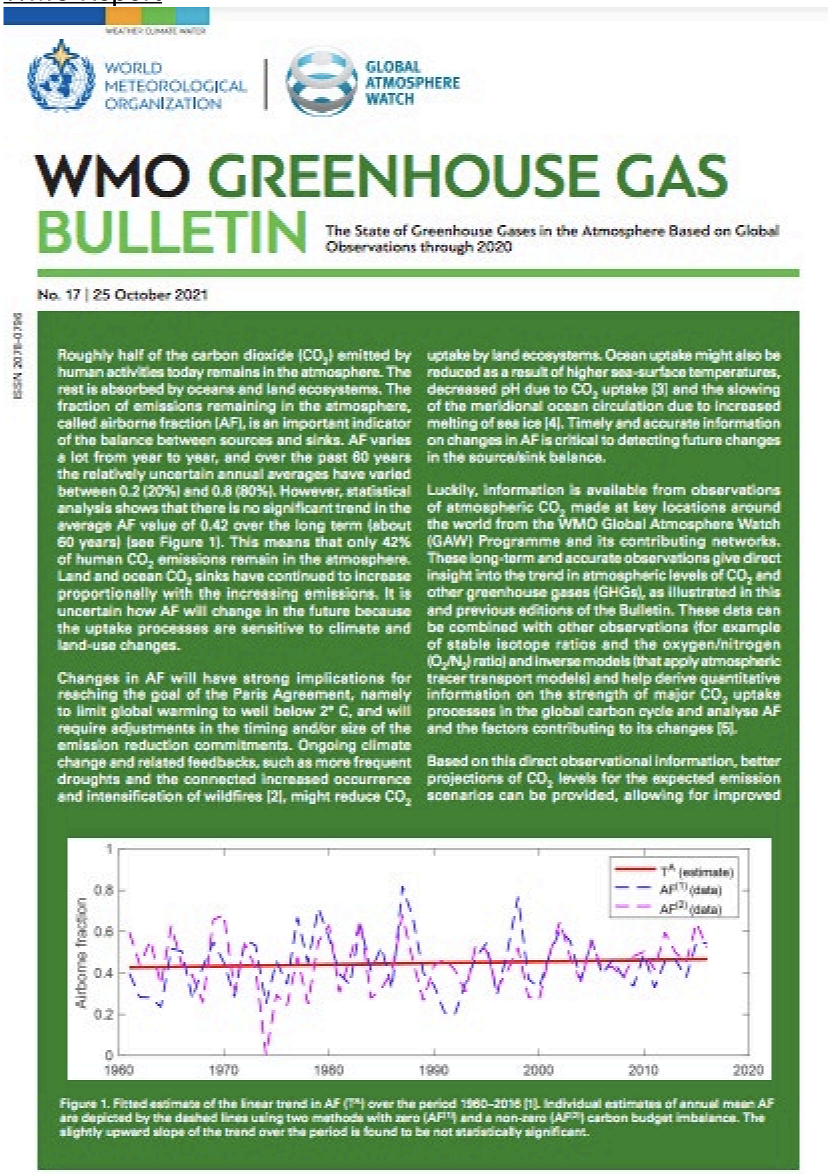
IPCC Report



WMO | State of Global Climate 2021

Record atmospheric greenhouse gas concentrations and associated accumulated heat have propelled the planet into uncharted territory, with far-reaching repercussions for current and future generations. This report finds the past seven years are on track to be the seven warmest on record, based on data for the first nine months of 2021. A temporary cooling “La Niña” event early in the year means that 2021 is expected to be “only” the fifth to seventh warmest year on record. But this does not negate or reverse the long-term trend of rising temperatures. Global sea level rise accelerated since 2013 to a new high in 2021, with continued ocean warming and ocean acidification. The report combines input from multiple United Nations agencies, national meteorological and hydrological services and scientific experts. It highlights impacts on food security and population displacement, harming crucial ecosystems and undermining progress towards the Sustainable Development Goals.

WMO Report


WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION | GLOBAL ATMOSPHERE WATCH

WMO GREENHOUSE GAS BULLETIN

The State of Greenhouse Gases in the Atmosphere Based on Global Observations through 2020

No. 17 | 25 October 2021

ISSN 2078-0796

Roughly half of the carbon dioxide (CO_2) emitted by human activities today remains in the atmosphere. The rest is absorbed by oceans and land ecosystems. The fraction of emissions remaining in the atmosphere, called airborne fraction (AF), is an important indicator of the balance between sources and sinks. AF varies a lot from year to year, and over the past 60 years the relatively uncertain annual averages have varied between 0.2 (20%) and 0.8 (80%). However, statistical analysis shows that there is no significant trend in the average AF value of 0.42 over the long term (about 60 years) (see Figure 1). This means that only 42% of human CO_2 emissions remain in the atmosphere. Land and ocean CO_2 sinks have continued to increase proportionally with the increasing emissions. It is uncertain how AF will change in the future because the uptake processes are sensitive to climate and land-use changes.

Changes in AF will have strong implications for reaching the goal of the Paris Agreement, namely to limit global warming to well below 2° C, and will require adjustments in the timing and/or size of the emission reduction commitments. Ongoing climate change and related feedbacks, such as more frequent droughts and the connected increased occurrence and intensification of wildfires [2], might reduce CO_2 uptake by land ecosystems. Ocean uptake might also be reduced as a result of higher sea-surface temperatures, decreased pH due to CO_2 uptake [3] and the slowing of the meridional ocean circulation due to increased melting of sea ice [4]. Timely and accurate information on changes in AF is critical to detecting future changes in the source/sink balance.

Luckily, information is available from observations of atmospheric CO_2 made at key locations around the world from the WMO Global Atmosphere Watch (GAW) Programme and its contributing networks. These long-term and accurate observations give direct insight into the trend in atmospheric levels of CO_2 and other greenhouse gases (GHGs), as illustrated in this and previous editions of the Bulletin. These data can be combined with other observations (for example of stable isotope ratios and the oxygen/nitrogen (O_2/N_2) ratio) and inverse models (that apply atmospheric tracer transport models) and help derive quantitative information on the strength of major CO_2 uptake processes in the global carbon cycle and analyse AF and the factors contributing to its changes [5].

Based on this direct observational information, better projections of CO_2 levels for the expected emission scenarios can be provided, allowing for improved

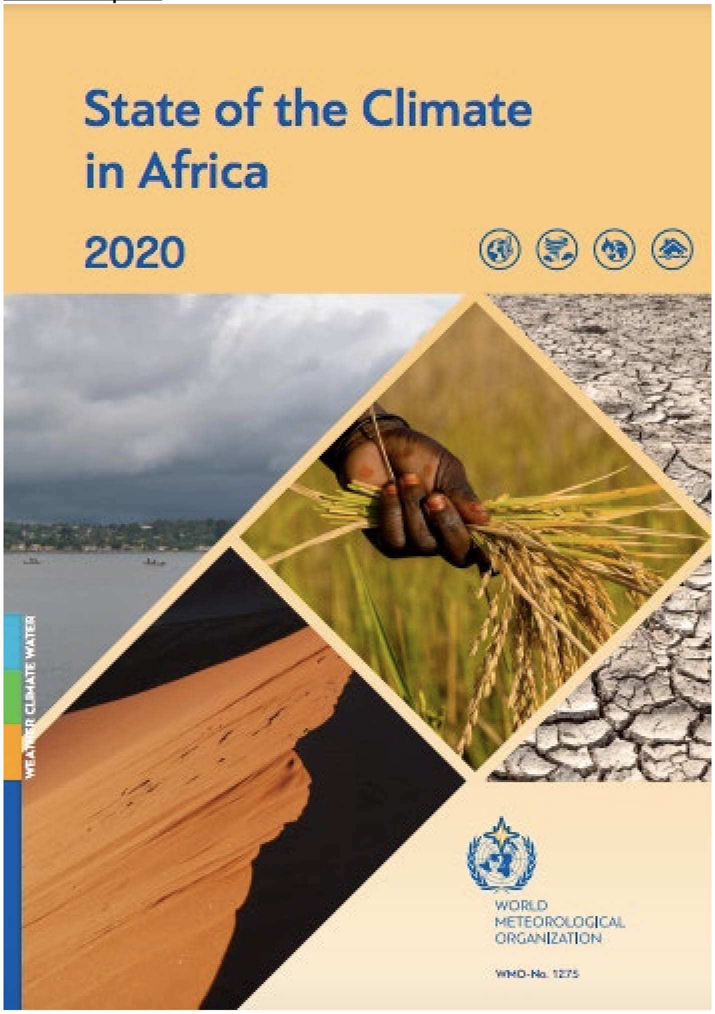
Figure 1. Fitted estimate of the linear trend in AF (T^A) over the period 1960–2016 [1]. Individual estimates of annual mean AF are depicted by the dashed lines using two methods with zero ($AF^{(1)}$) and a non-zero ($AF^{(2)}$) carbon budget imbalance. The slightly upward slope of the trend over the period is found to be not statistically significant.

World Meteorological Organization | Greenhouse Gas Bulletin

The abundance of heat-trapping greenhouse gases in the atmosphere once again reached a new record in 2020, with the annual rate of increase above the 2011-2020 average. That trend has continued in 2021, according to the latest Greenhouse Gas Bulletin. Concentration of carbon dioxide, the most important greenhouse gas, reached 413.2 parts per million in 2020 and is 149 per cent of the pre-industrial level. Methane is 262 per cent of the level in 1750 when human activities started disrupting the Earth’s natural equilibrium. The economic slowdown from COVID-19 did not have any discernible impact on atmospheric levels of greenhouse gases and their growth rates, although there was a temporary decline in new emissions. Roughly half of carbon dioxide emitted by human activities today remains in the atmosphere.

The other half is taken up by oceans and land ecosystems, but their ability to act as "sinks" may become less effective in the future.

WMO Report



WMO and others | The State of the Climate in Africa 2020

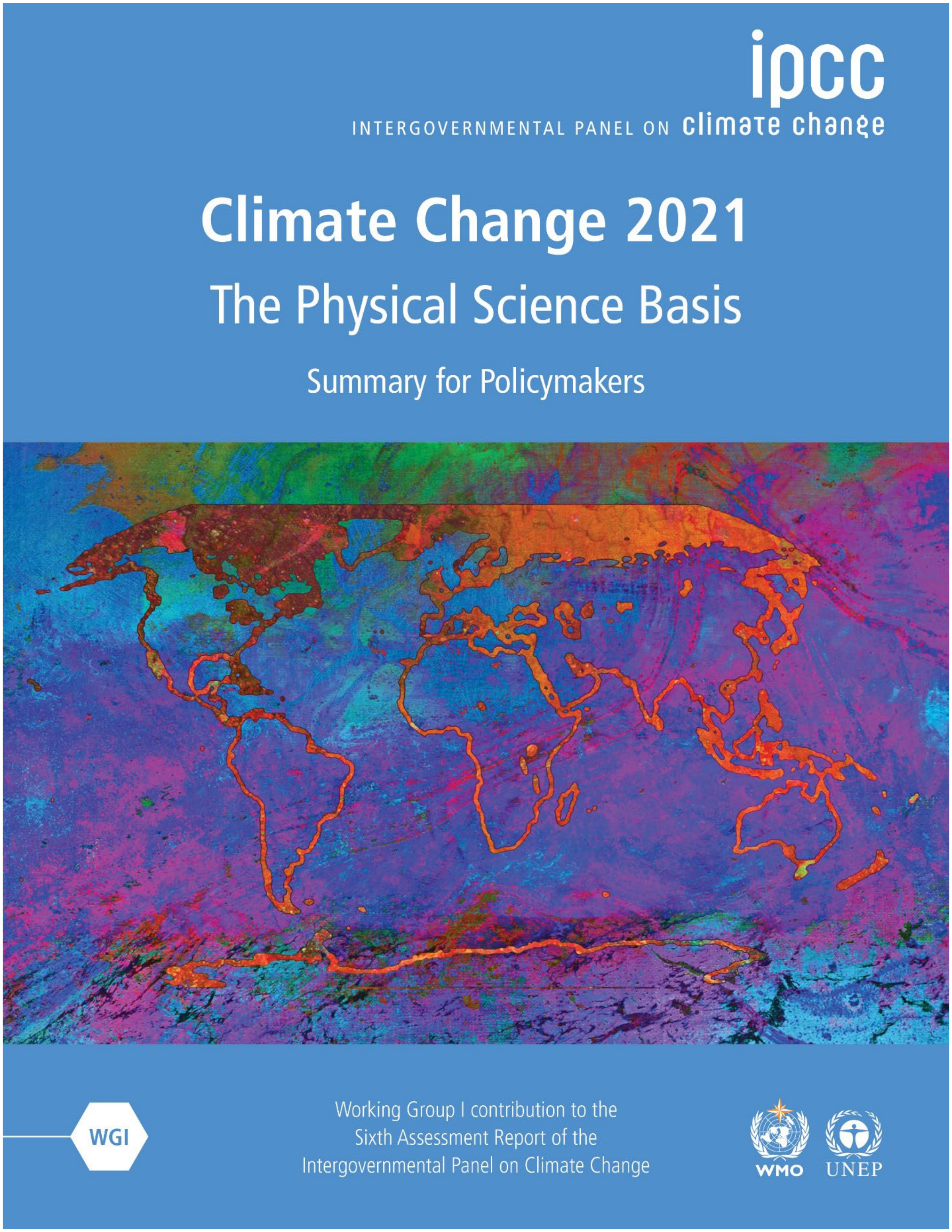
This report provides a snapshot of climate change trends and impacts in Africa, including sea level rise and the melting of the continent's iconic glaciers. It highlights the region's disproportionate vulnerability and shows how the potential benefits of investments in climate adaptation, weather and climate services and early warning systems far outweigh the costs. The report adds to the scientific evidence underlining the urgency of cutting global greenhouse gas emissions, stepping up climate ambition and increasing financing for adaptation. Greater weather and climate variability mean that up to 118 million extremely poor people in Africa may face drought, floods and extreme heat by 2030. Without response measures, poverty alleviation efforts will slow and gross domestic product could fall by up to 3 percent by 2050.

WMO Report

UN | United in Science 2021

COVID-19 paused but did not slow the relentless advance of climate change. Record levels of greenhouse gases in the atmosphere commit the planet to dangerous future warming, according to a new report that links the latest findings from across the United Nations. Rising global temperatures are fuelling extreme weather throughout the world, impacting economies and societies. The average global temperature for the past five years was among the highest on record, and the scale of recent changes across the global climate system is unprecedented over many centuries to many thousands of years. Even with ambitious action to slow greenhouse gas emissions, sea levels will continue to rise and threaten low-lying islands and coastal populations throughout the world. The findings reinforce critical momentum behind climate action to avoid the worst impacts of climate change.

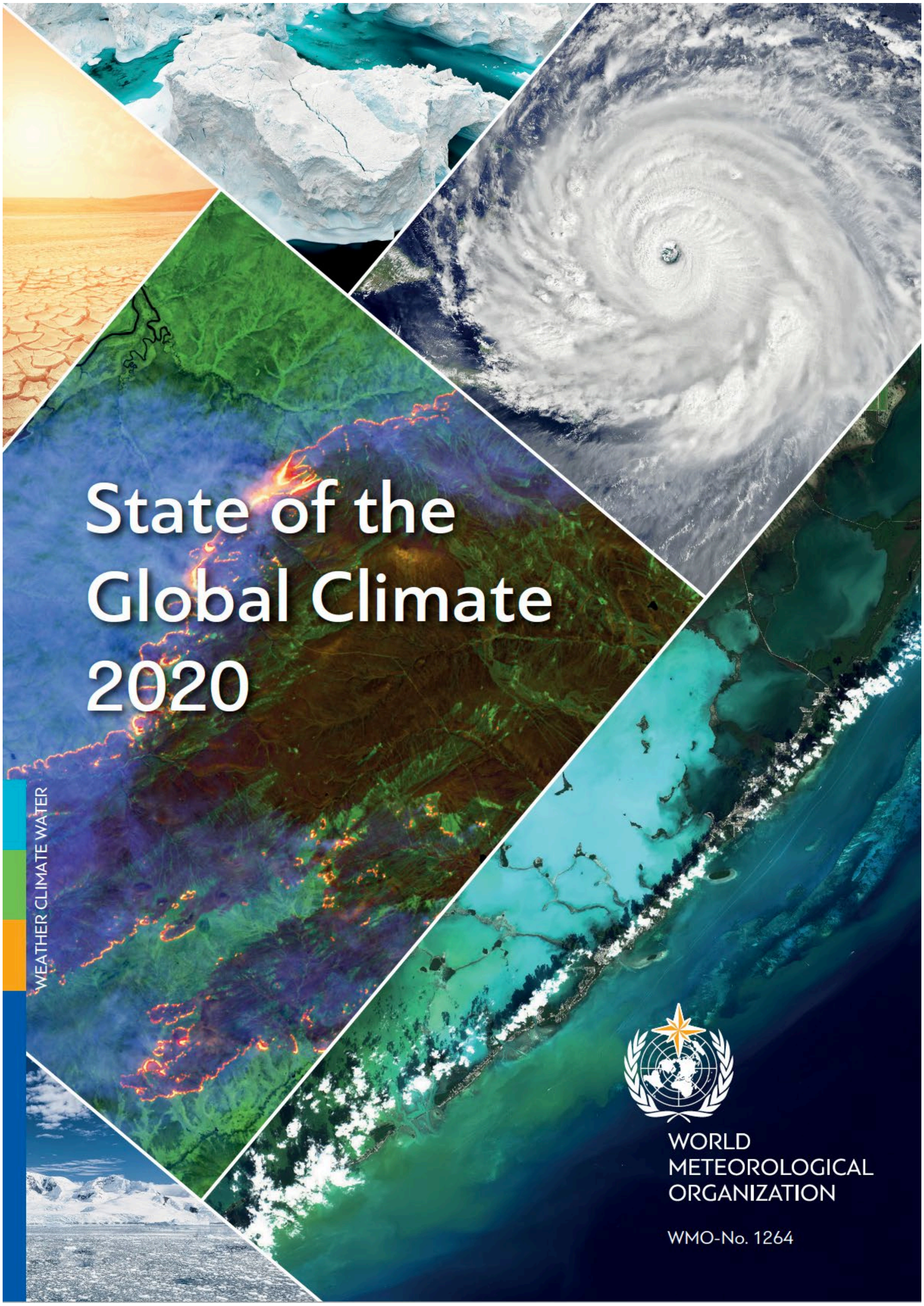
UN Report



IPCC | Climate Change 2021: The Physical Science Basis

Climate change is widespread, rapid and intensifying. That is the key finding of the latest scientific report from the Intergovernmental Panel on Climate Change. It finds changes in the Earth's climate in every region and across the whole climate system. Many changes are unprecedented in thousands, if not hundreds of thousands of years. Some, such as continued sea-level rise, are irreversible over hundreds to thousands of years. The report points to strong and sustained reductions in emissions of carbon dioxide and other greenhouse gases to limit climate change. Benefits for air quality would come quickly, while global temperatures would take 20-30 years to stabilize. The report, issued by the IPCC's Working Group I and approved by 195 member governments, is the first in a series leading up to the 2022 IPCC Sixth Assessment Report. It includes a closer look at the regional dimensions of climate change and builds on advances in attributing specific weather and climate events to climate change.

IPCC Report



WMO | State of the Global Climate 2020

The State of the Global Climate 2020 finds the year was one of the three warmest on record, despite a cooling La Niña event. The global average temperature was about 1.2° Celsius above the pre-industrial

(1850-1900) level. The six years since 2015 have been the warmest on record, with 2011-2020 the warmest decade on record. The report documents indicators of the climate system, including greenhouse gas concentrations, increasing land and ocean temperatures, sea level rise, melting ice and glacier retreat and extreme weather. It also highlights impacts on socioeconomic development, migration and displacement, food security and land and marine ecosystems.

WMO Report

WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION | GLOBAL ATMOSPHERE WATCH

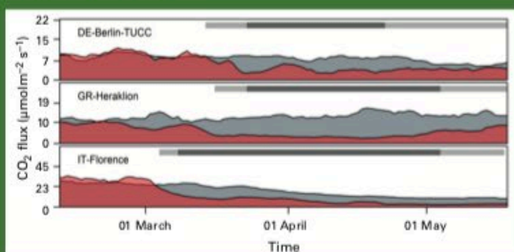
WMO GREENHOUSE GAS BULLETIN

The State of Greenhouse Gases in the Atmosphere Based on Global Observations through 2019

No. 16 | 23 November 2020

ISSN 2078-0796

Can we see the impact of COVID-19 confinement measures on CO_2 levels in the atmosphere?



Average daily CO_2 emissions from 5 February to 6 May 2020 (red area) and average of the previous years during the same period (grey area) for three European cities. The dark grey horizontal bars cover periods of official lockdown, while the light grey bars indicate periods of partial lockdown or general restrictions (for example, school closures, reductions in personal contact, mobility constraints). Source: [6]

Humanity is experiencing a fundamental health and economic crisis related to COVID-19. The confinement measures broadly introduced earlier in 2020 and now reintroduced in many locations have had an impact on anthropogenic emissions of multiple constituents and resulted in changes in the chemical composition of the atmosphere. These changes have been especially pronounced in urban areas and are visible in traditional pollutants as well as in greenhouse gases. However, the reduction in anthropogenic emissions due to confinement measures will not have a discernible effect on global mean atmospheric CO_2 in 2020 as this reduction will be smaller than, or at most, similar in size to the natural year-to-year variability of atmospheric CO_2.

The global atmospheric CO_2 concentration represents the budget between the fluxes of CO_2 in and out of the atmosphere. CO_2 is a gas that is well mixed by turbulent mixing and atmospheric transport; it accumulates in the atmosphere over long timescales, and any non-zero emission leads to an increase in the atmospheric concentration. Anthropogenic emissions of CO_2 have been increasing globally since pre-industrial times (before 1750) and have risen by about 1% per year over the last decade [1]. This has resulted in an annual increase in the atmospheric CO_2 mole fraction(1) of between 2 and 3 ppm(2) over the last ten years. This increase has been documented by the Global Atmosphere Watch (GAW) global network of surface stations, which can detect global changes of atmospheric CO_2 over a year within 0.1 ppm of precision. The year-to-year variability of about 1 ppm in the atmospheric growth rate is almost entirely due to variability in the uptake of CO_2 by ecosystems and oceans (that together take up annually roughly half of human CO_2 emissions [2]). CO_2 originating from fossil fuel sources can be distinguished from CO_2 originating from biogenic sources using isotopic analysis, as was described in the previous Greenhouse Gas Bulletin.

The Global Carbon Project (GCP) [3] estimated that during the most intense period of forced confinement in early 2020, daily global CO_2 emissions may have been reduced by up to 17% compared to the mean level of daily CO_2 emissions in 2019. As the duration and severity of the confinement measures remain unclear, it is very difficult to predict the total annual reduction in CO_2 emissions for 2020; however, preliminary estimates anticipate a reduction of between 4.2% and 7.5% compared to 2019 levels. At the global scale, an emission reduction of this magnitude will not cause atmospheric CO_2 levels to decrease; they will merely increase at a slightly reduced rate, resulting in an anticipated annual atmospheric CO_2 concentration that is 0.08 ppm–0.23 ppm lower than the anticipated CO_2 concentration if no pandemic had occurred. This falls well within the 1 ppm natural inter-annual variability and means that in the short-term, the impact of COVID-19 confinement measures cannot be distinguished from natural year-to-year variability. A similar conclusion was reached by Carbon Brief [4] and the Integrated Carbon Observation System (ICOS) [5].

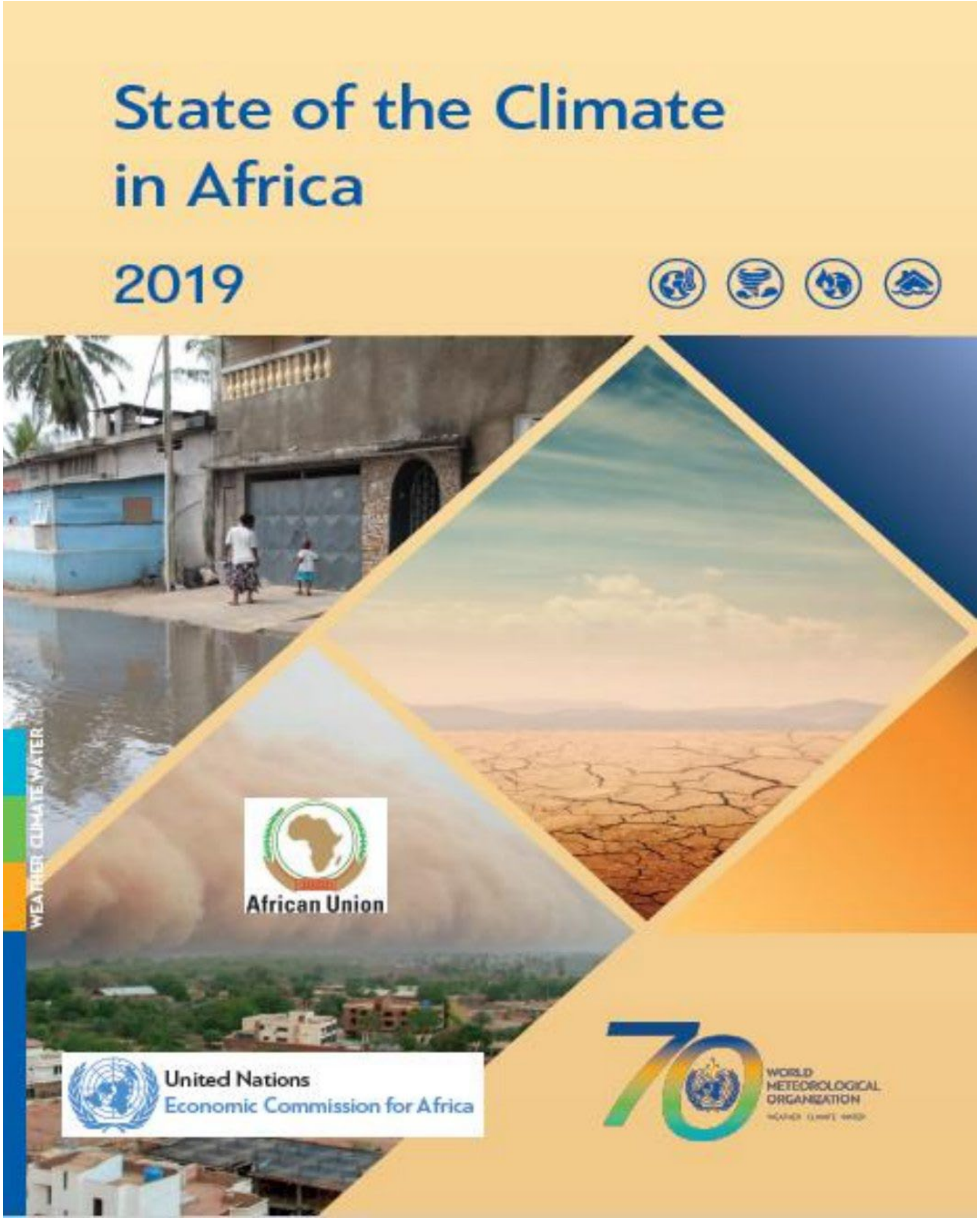
Determining changes in the fossil fuel signal given the high natural atmospheric variability of CO_2 requires a long time series in order to generate robust statistics, as well as complex data modelling. Several approaches can be used to make this determination. One such approach, the WMO Integrated Global Greenhouse Gas Information System (IG^3IS), utilizes atmospheric observations and modelling. Another approach, adopted by ICOS [6], directly measures CO_2 emissions within cities. A recent study by ICOS detected reductions in CO_2 emissions of up to 75% in the city centres of Basel, Berlin, Florence, Helsinki, Heraklion, London and Pesaro using techniques that directly measure vertical exchange fluxes within a circumference of several kilometres from the measurement point (see the figure).

Only when net fossil fuel emissions of CO_2 approach zero will the net uptake by ecosystems and oceans start to reduce CO_2 levels in the atmosphere. Even then, most of the CO_2 already added to the atmosphere will remain there for several centuries, continuing to warm our climate. In addition, the Earth climate system has a lag time of several decades due to buffering of the excess heat by the oceans, so the sooner we reduce our emissions, the less likely we are to overshoot the warming threshold the world agreed to in the Paris Agreement.

WMO | Greenhouse Gas Bulletin

The global slowdown from the COVID-19 pandemic has not curbed rising levels of greenhouse gases, said the World Meteorological Organization in releasing its latest WMO Greenhouse Gas Bulletin. Carbon dioxide levels have pushed past another record threshold, after rising in 2019 at a rate faster than the average for the last 10 years.

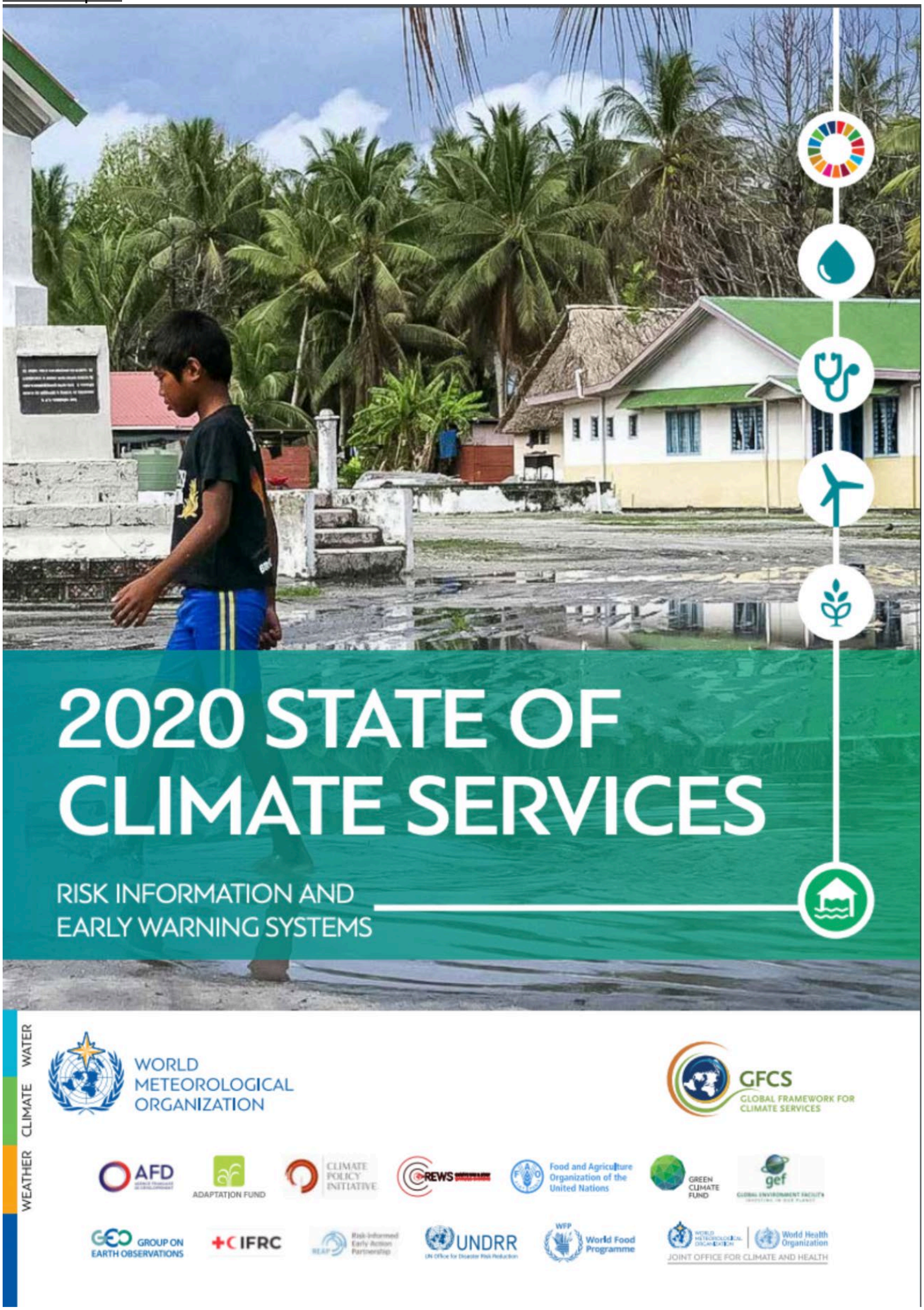
WMO Report



WMO | The State of the Climate in Africa (2019)

Increasing temperatures and sea levels, changing precipitation patterns and more extreme weather are threatening human health and safety, food and water security and socio-economic development in Africa, according to the State of the Climate in Africa Report devoted exclusively to the continent. The report provides a snapshot of current and future climate trends and associated impacts on the economy and sensitive sectors like agriculture. It highlights lessons for climate action in Africa and identifies pathways for addressing critical gaps and challenges.

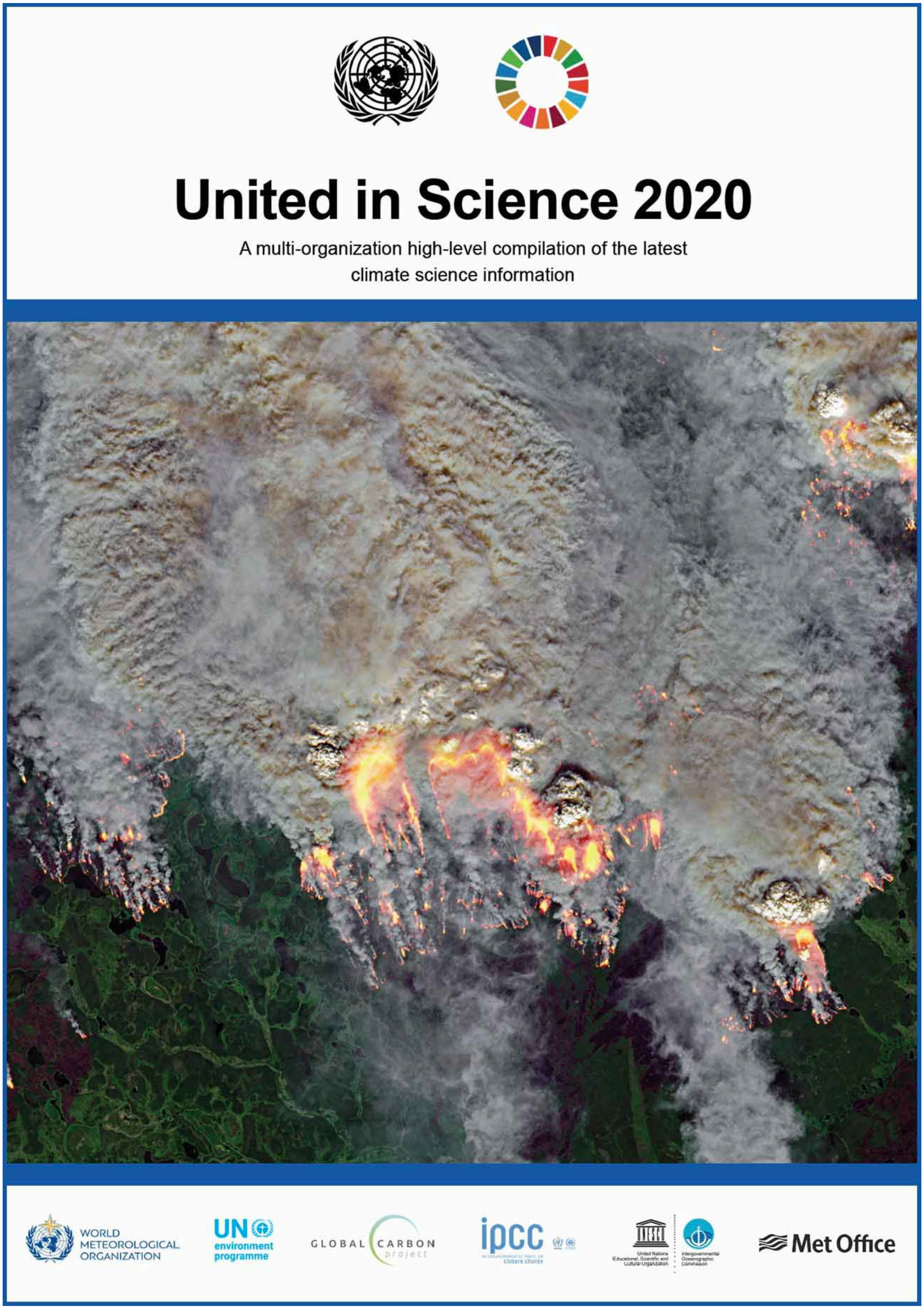
WMO Report



WMO | State of Climate Services (2020)

Between 1970 and 2019, 79% of disasters worldwide involved weather, water, and climate-related hazards. These disasters accounted for 56% of deaths and 75% of economic losses from disasters associated with natural hazards reported during that period. As climate change continues to threaten human lives, ecosystems and economies, risk information and early warning systems (EWS) are increasingly seen as key for reducing these impacts. This latest WMO report highlights progress made in EWS capacity – and identifies where and how governments can invest in effective EWS to strengthen countries' resilience to multiple weather, water and climate-related hazards.

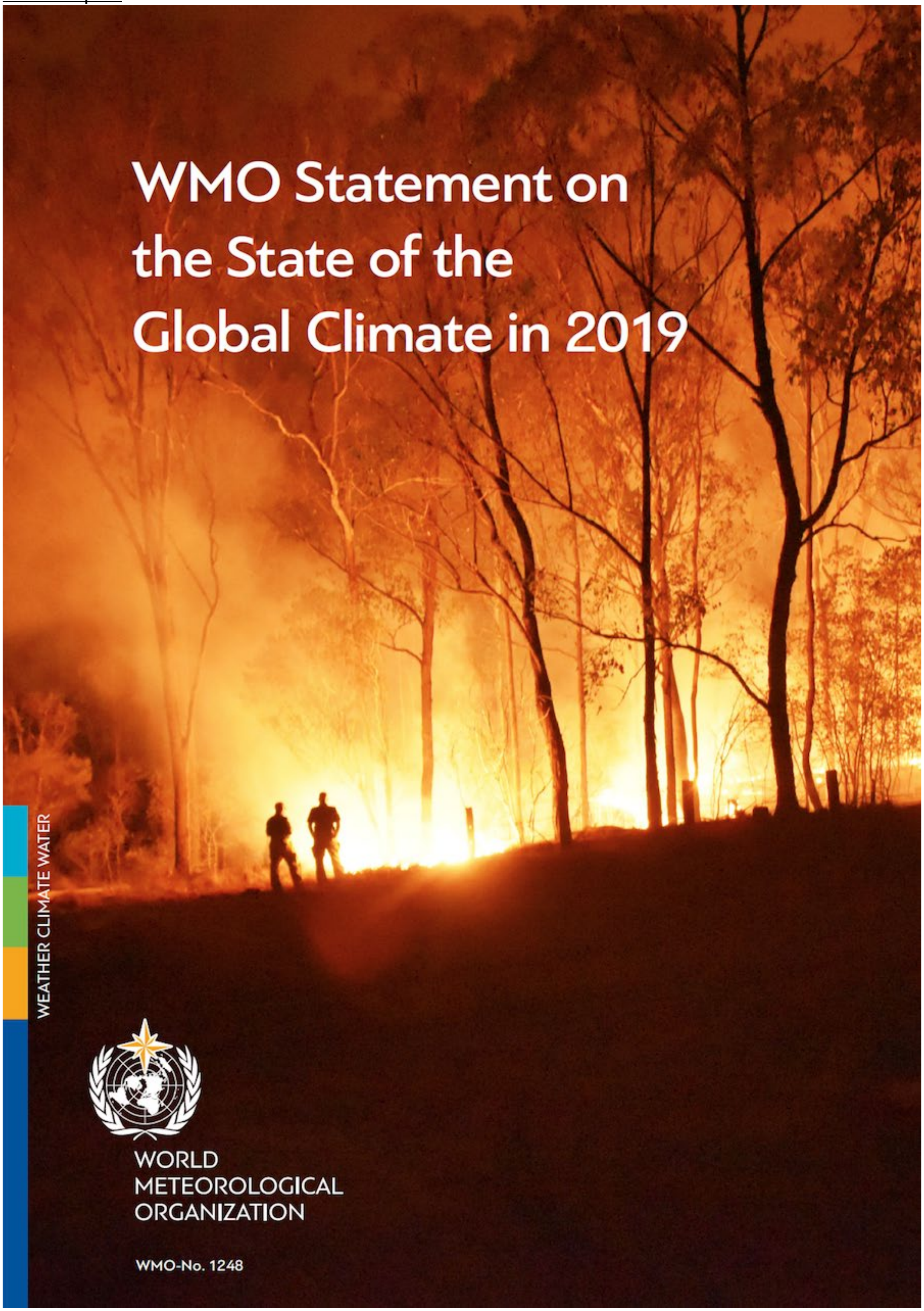
WMO Report



WMO | United in Science (2020)

Climate change has not stopped for COVID19. United in Science 2020, a new multi-agency report from leading science organizations, highlights the increasing and irreversible impacts of climate change, which affects glaciers, oceans, nature, economies and human living conditions and is often felt through water-related hazards like drought or flooding. It also documents how COVID-19 has impeded our ability to monitor these changes through the global observing system.

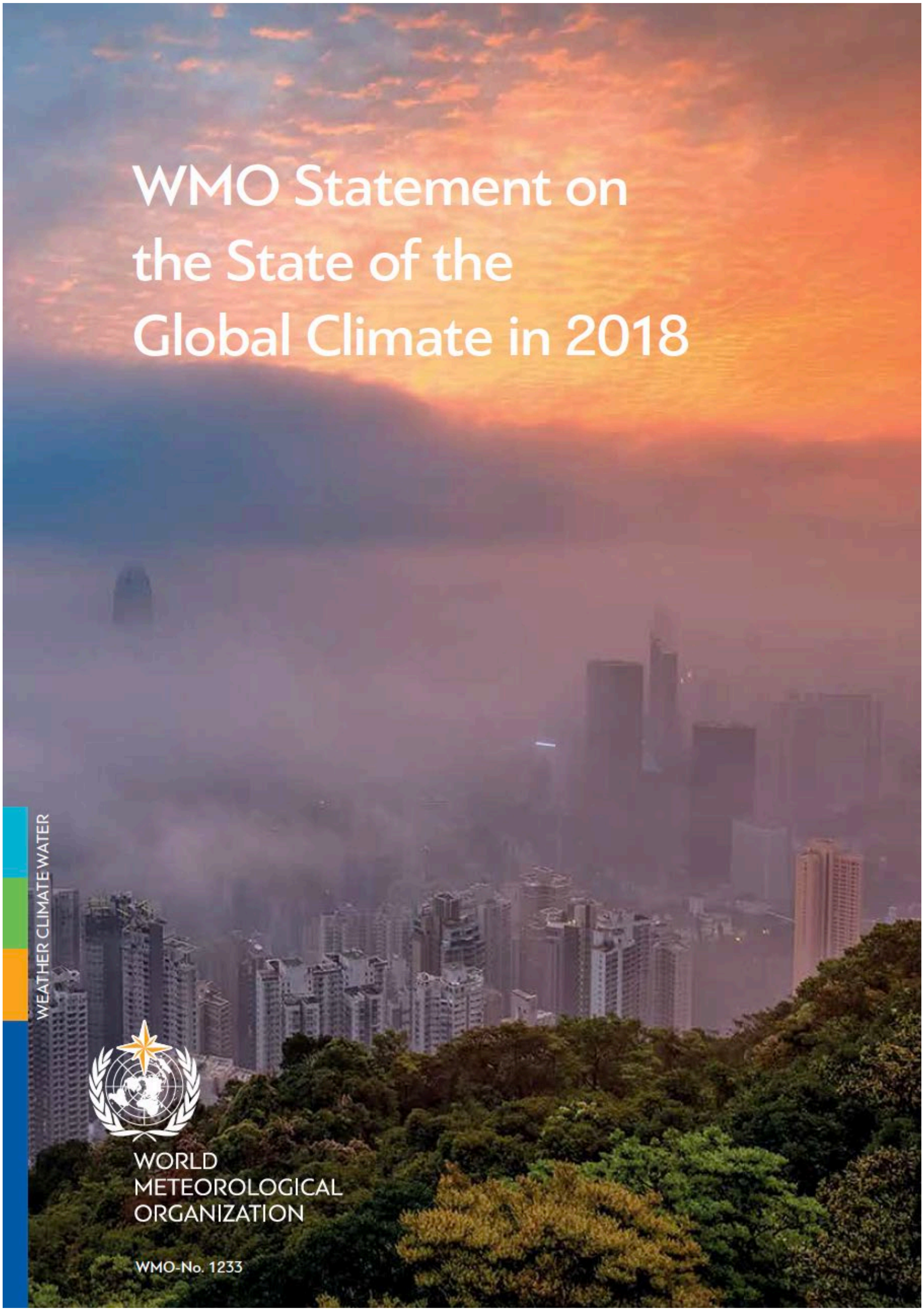
WMO Report



WMO | State of the Global Climate (2019)

The tell-tale physical signs of climate change, such as increasing land and ocean heat, accelerating sea level rise and melting ice, contributed to making 2019 the second warmest year on record according to a new report compiled by a network led by the World Meteorological Organization. The report documents the increasing impacts of weather and climate events on socio-economic development, human health, migration and displacement, food security and land and marine ecosystems.

WMO Report

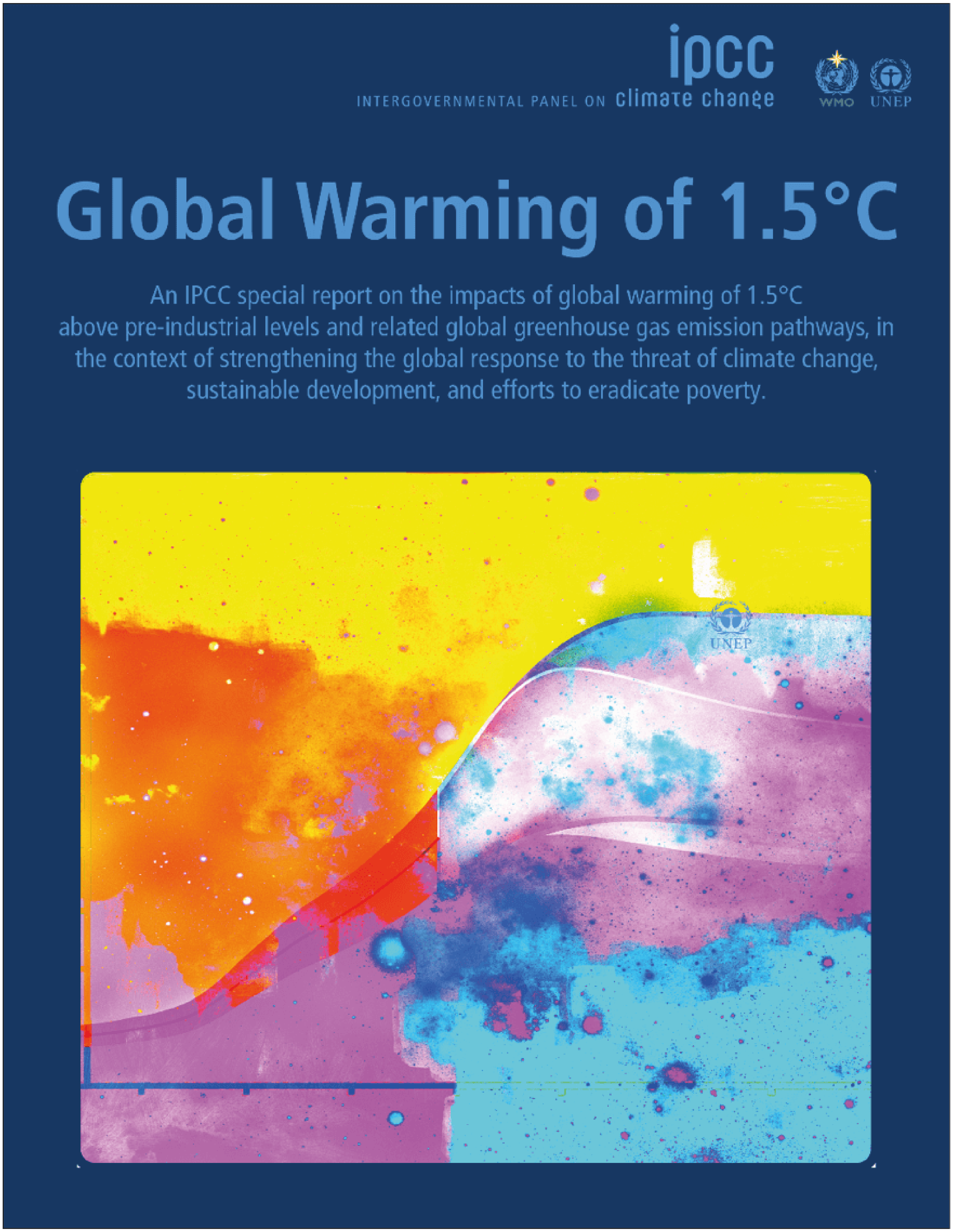


WMO | State of the Global Climate (2018)

The physical signs and socio-economic impacts of climate change are accelerating as record greenhouse gas concentrations drive global temperatures towards increasingly dangerous levels, according to a new report from the World Meteorological Organization.

The WMO Statement on the State of the Global Climate in 2018 , its 25th anniversary edition, highlights record sea level rise, as well as exceptionally high land and ocean temperatures over the past four years. This warming trend has lasted since the start of this century and is expected to continue.

WMO Report



IPCC | Climate Report (2018)

Limiting global warming to 1.5ºC would require rapid, far-reaching and unprecedented changes in all aspects of society, the Intergovernmental Panel on Climate Change (IPCC) said in a new assessment. With clear benefits to people and natural ecosystems, limiting global warming to 1.5ºC compared to 2ºC could go hand in hand with ensuring a more sustainable and equitable society.

IPCC Report

WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION | GLOBAL ATMOSPHERE WATCH

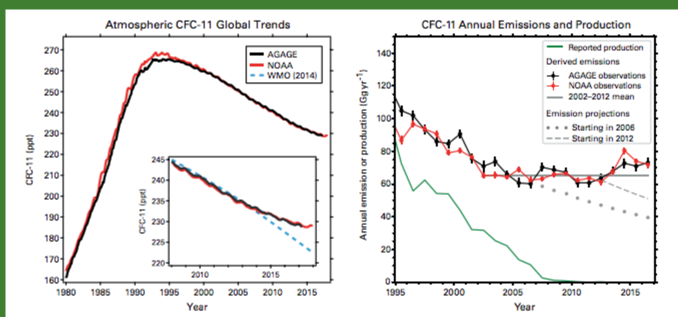
WMO GREENHOUSE GAS BULLETIN

The State of Greenhouse Gases in the Atmosphere Based on Global Observations through 2017

No. 14 | 22 November 2018

ISSN 2078-0796

Unexpected Increases in Global Emissions of CFC-11



Measurements of the atmospheric abundance of the chlorofluorocarbon CFC-11, a potent greenhouse gas (GHG) and a stratospheric ozone-depleting substance (ODS) regulated under the Montreal Protocol on Substances that Deplete the Ozone Layer, show that since 2012 its rate of decline has slowed to roughly two thirds of its rate of decline during the preceding decade [1, 2]. The most likely cause of this slowing is increased emissions associated with production of CFC-11 in eastern Asia. This discovery illustrates the importance of long-term measurements of atmospheric composition, such as are carried out under the auspices of the Global Atmosphere Watch (GAW) Programme of WMO, in providing effective support and additional constraints for emissions-control legislation.

The Montreal Protocol was designed to protect the stratospheric ozone layer by restricting the production of ODSs such as CFCs. As a consequence, CFC-11 (trichlorofluoromethane, or CCl_3F) production reported under the Montreal Protocol declined to zero by 2010. As CFC-11 was phased out, its atmospheric abundance peaked in the early 1990s and then declined in a manner largely consistent with declining production combined with residual emissions of CFC-11 gradually escaping from stored "banks" in existing products and equipment.

Atmospheric measurements of CFC-11 made by independent global networks show that since 2012 the rate of decrease in atmospheric CFC-11 has slowed to roughly two thirds of the rate that was observed between 2002 and 2012 [1, 2]. These global trends are shown in the left graph of the figure for the Advanced Global Atmospheric Gases Experiment (AGAGE; shown in black) and the National Oceanic and Atmospheric Administration (NOAA; shown in red) measurement networks. Also shown in the inset to this graph is the trend that was predicted in 2014 by WMO (blue dashed) assuming adherence to the Montreal Protocol [3].

Modelling results lead to the robust conclusion that these changes are predominately related to increased CFC-11 emissions rather than to other possible causes such as changing atmospheric transport. This conclusion is supported by recent increases in the northern to southern hemisphere difference in atmospheric concentration levels. Correlations between elevated abundances of CFC-11 and other measured gases further suggest that these increases originate from emissions in eastern Asia [1].

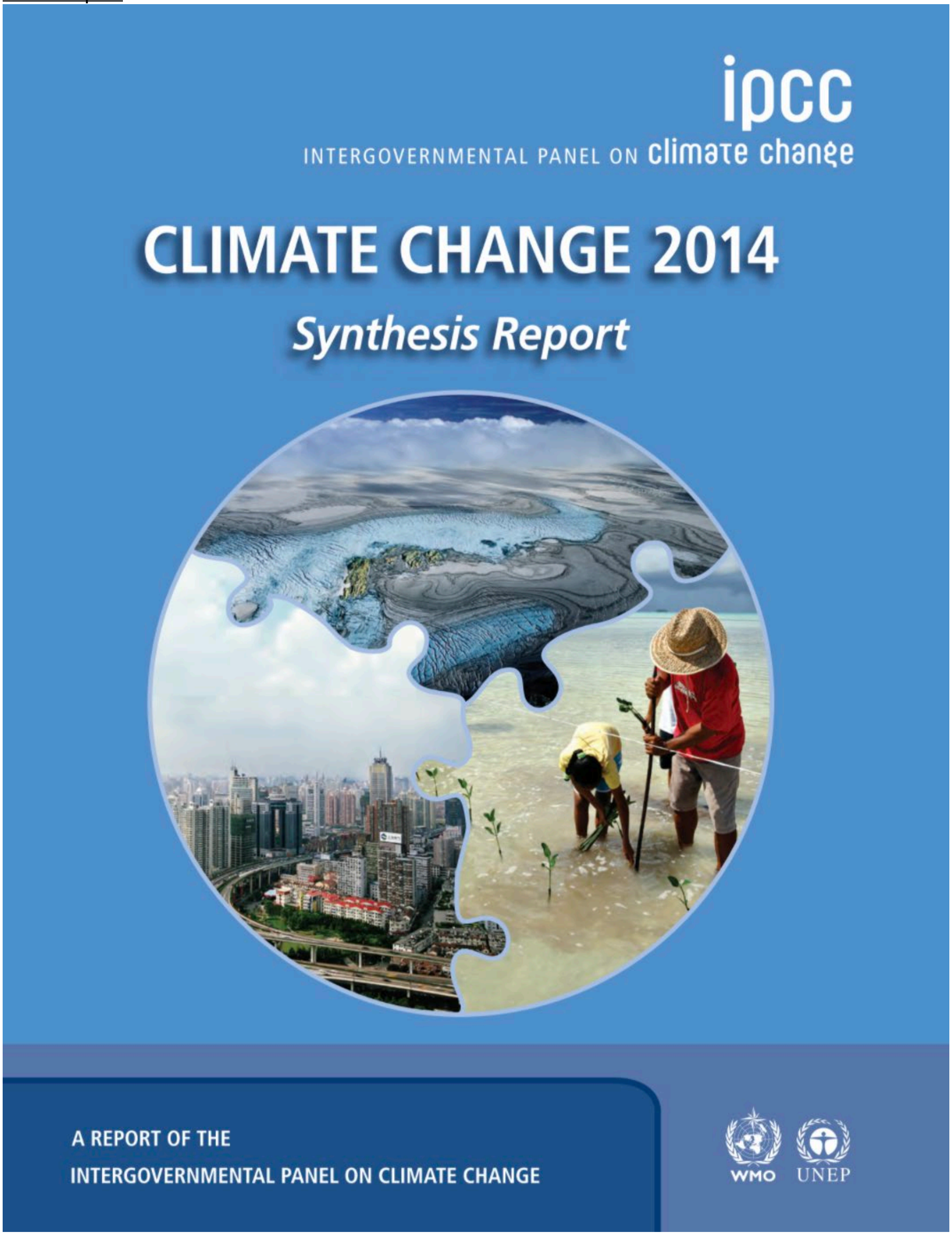
Separate CFC-11 emission trends resulting from model calculations taken from the 2018 WMO ozone assessment [2], based on data from each of the global measurement networks AGAGE (black) and NOAA (red), are shown in the graph on the right of the figure. They are contrasted to CFC-11 production as reported under the Montreal Protocol (green). These results show a levelling off of CFC-11 emissions around 2005, followed by an emission increase of about 15% after 2012. Emission scenario projections for the years 2006 and 2012 based on atmospheric data, reported production and releases from banks are shown as dots and dashes (grey), respectively.

This work demonstrates the importance of long-term measurements of atmospheric composition, such as are carried out under the auspices of the GAW Programme, in providing observation-based information to support national emission inventories, especially in the context of agreements to address anthropogenic climate change, as well as for the recovery of the stratospheric ozone layer.

WMO | Greenhouse Gas Bulletin (2018)

The WMO Greenhouse Gas Bulletin reports on atmospheric concentrations of greenhouse gases in the earth's atmosphere. The report found that levels of heat-trapping greenhouse gases in the atmosphere have reached another new record high, according to the World Meteorological Organization. There is no sign of a reversal in this trend, which is driving long-term climate change, sea level rise, ocean acidification and more extreme weather.

WMO Report



IPCC | AR5 Synthesis Report: Climate Change (2014)

The Synthesis Report (SYR) of the IPCC Fifth Assessment Report (AR5) provides an overview of the state of knowledge concerning the science of climate change. It shows that human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.

IPCC Report

EXHIBIT 11

California Air Pollution Control Officers Association

Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity

Designed for Local Governments, Communities, and Project Developers

California Air Pollution Control Officers Association

Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity

Designed for Local Governments, Communities, and Project Developers

Final Draft

December 2021

Measures to Reduce GHG Emissions

CHAPTER 3

The California Air Pollution Control Officers Association (CAPCOA) has included a wide range of measures that are frequently used to reduce greenhouse gas (GHG) emissions and provide other benefits, like improved air quality, energy and fuel savings, and water conservation. This chapter provides methods and data to quantitively evaluate many of the measures. While there is no one-size-fits-all approach to GHG planning, the guidance presented in this chapter has been developed to broadly apply across project types, land use types, and California regions.

Categorizing Measures

When thinking about minimizing GHG emissions in a community or for a project, it is useful to organize GHG reduction measures into categories. The standard method of categorizing emissions is to group them by economic sector, such as transportation or energy. Consistent with this practice, the emission reduction measures presented in this chapter are categorized into the following nine sectors. Measures in each sector apply to a similar emissions source or process, as described below.

- Transportation: Measures that promote transit and alternative transportation, support use of alternatively fueled vehicles, or encourage land use planning practices that reduce vehicle trips and vehicle miles traveled (VMT). Measures within the transportation sector are separated into six subsectors: Land Use, Neighborhood Design, Parking or Road Pricing/Management, Transit, Trip Reduction Programs, and Clean Vehicles and Fuels.
- Energy: Measures that target energy efficiency improvements/reduced natural gas consumption, renewable energy generation, building electrification, or methane (CH_4) recovery at landfills and wastewater treatment plants.
- Water: Measures that reduce water demand and/or use a less energy-intensive water source.
- Lawn and Landscaping: Measures that promote zero-emission landscaping equipment over conventional fossil fuel-powered counterparts.
- Solid Waste: Measures that require alternative waste management pathways, such as recycling and composting, to increase landfill waste diversion.
- Natural and Working Lands: Measures that enhance the sequestration capacity of natural lands or reduce the intensity of emissions from working lands.
- Construction: Measures that promote efficient construction management practices or alternatively fueled construction equipment.
- Refrigerants: Measures to reduce or replace high global warming potential (GWP) refrigerants with lower impact compounds.
- Miscellaneous: General measures that will reduce GHG emissions through the implementation of novel or off-site projects defined by the user.

EMISSIONS SECTORS

Categorizing emissions by sector is standard practice for GHG inventories and reduction plans, but users should note that there is often variation in the scope and nomenclature of sectors. For example, the sectors in this Handbook do not align exactly with the California Air Resources Board or U.S. Environmental Protection Agency inventories because of differences in scale and intended use. Users should take care when comparing sectors in this Handbook to other inventories or plans.

The nine emission sectors are illustrated in Figure 3-1. The figure shows all quantified GHG reduction measures included in this chapter. Users may click on an individual measure to navigate directly to the quantification method for that measure. Figure 3-1 does not include non-quantified measures. These measures are presented later in this chapter in *Supporting or Non-Quantified GHG Reduction Measures*.

Figure 3-1. Navigation Trees for Quantitative GHG Reduction Measures

Transportation

LAND USE

- T-1. Increase Residential Density
- T-2. Increase Job Density
- T-3. Provide Transit-Oriented Development
- T-4. Integrate Affordable and Below Market Rate Housing
- T-17. Improve Street Connectivity

TRIP REDUCTION PROGRAMS

- T-5. Implement Commute Trip Reduction Program (Voluntary)
- T-6. Implement Commute Trip Reduction Program (Mandatory Implementation and Monitoring)
- T-7. Implement Commute Trip Reduction Marketing
- T-8. Provide Ridesharing Program
- T-9. Implement Subsidized or Discounted Transit Program
- T-10. Provide End-of-Trip Bicycle Facilities
- T-11. Provide Employer-Sponsored Vanpool
- T-12. Price Workplace Parking
- T-13. Implement Employee Parking Cash-Out
- T-23. Provide Community-Based Travel Planning

PARKING OR ROAD PRICING/MANAGEMENT

- T-14. Provide Electric Vehicle Charging Infrastructure
- T-15. Limit Residential Parking Supply
- T-16. Unbundle Residential Parking Costs from Property Cost
- T-24. Implement Market Price Public Parking (On-Street)

NEIGHBORHOOD DESIGN

- T-18. Provide Pedestrian Network Improvement
- T-19-A. Construct or Improve Bike Facility
- T-19-B. Construct or Improve Bike Boulevard
- T-20. Expand Bikeway Network
- T-21-A. Implement Conventional Carshare Program
- T-21-B. Implement Electric Carshare Program
- T-22-A. Implement Pedal (Non-Electric) Bikeshare Program
- T-22-B. Implement Electric Bikeshare Program
- T-22-C. Implement Scootershare Program

TRANSIT

- T-25. Extend Transit Network Coverage or Hours
- T-26. Increase Transit Service Frequency
- T-27. Implement Transit-Supportive Roadway Treatments
- T-28. Provide Bus Rapid Transit
- T-29. Reduce Transit Fares

CLEAN VEHICLES AND FUELS

- T-30. Use Cleaner-Fuel Vehicles

Energy

ENERGY EFFICIENCY IMPROVEMENTS

- E-1. Buildings Exceed 2019 Title 24 Building Envelope Energy Efficiency Standards
- E-2. Require Energy Efficient Appliances
- E-3-A. Require Energy Efficient Residential Boilers
- E-3-B. Require Energy Efficient Commercial Packaged Boilers
- E-4. Install Cool Roofs and/or Cool Walls in Residential Development
- E-5. Install Green Roofs in Place of Dark Roofs
- E-6. Encourage Residential Participation in Existing Demand Response Program(s)
- E-7. Require Higher Efficacy Public Street and Area Lighting
- E-8. Replace Incandescent Traffic Lights with LED Traffic Lights
- E-9. Utilize a Combined Heat and Power System

RENEWABLE ENERGY GENERATION

- E-10-A. Establish Onsite Renewable Energy Systems—Generic
- E-10-B. Establish Onsite Renewable Energy Systems—Solar Power
- E-10-C. Establish Onsite Renewable Energy Systems—Wind Power
- E-11. Procure Electricity from Lower Carbon Intensity Power Supply

BUILDING DECARBONIZATION

- E-12. Install Alternative Type of Water Heater in Place of Gas Storage Tank Heater in Residences
- E-13. Install Electric Ranges in Place of Gas Ranges
- E-14. Limit Wood Burning Devices and Natural Gas/Propane Fireplaces in Residential Development
- E-15. Require All-Electric Development
- E-16. Require Zero Net Energy Buildings
- E-17. Require Renewable-Surplus Buildings

METHANE RECOVERY

- E-18. Establish Methane Recovery in Landfills
- E-19. Establish Methane Recovery in Wastewater Treatment Plants

Water

- W-1. Use Reclaimed Non-Potable Water
- W-2. Use Grey Water
- W-3. Use Locally Sourced Water Supply
- W-4. Require Low-Flow Water Fixtures
- W-5. Design Water-Efficient Landscapes
- W-6. Reduce Turf in Landscapes and Lawns
- W-7. Adopt a Water Conservation Strategy

Lawn and Landscaping

- LL-1. Replace Gas Powered Landscape Equipment with Zero-Emission Landscape Equipment

Solid Waste

- S-1. Institute or Extend Recycling Services
- S-2. Implement Organics Diversion Program

Natural and Working Lands

- N-1. Create New Vegetated Open Space
- N-2. Expand Urban Tree Planting
- N-3. Implement Management Practices to Improve the Health and Function of Natural and Working Lands
- N-4. Require Best Management Practices for Manure Management

Construction

- C-1-A. Use Electric or Hybrid Powered Equipment
- C-1-B. Use Cleaner-Fuel Equipment
- C-2. Limit Heavy-Duty Diesel Vehicle Idling
- C-3. Use Local Construction Contractors

Refrigerants

- R-1. Use Alternative Refrigerants Instead of High-GWP Refrigerants
- R-2. Install Secondary Loop and/or Cascade Supermarket Systems in Place of Direct Expansion Systems
- R-3. Install Transcritical CO_2 Supermarket Systems in Place of High-GWP Systems
- R-4. Install Microchannel Heat Exchangers in A/C Equipment in Place of Conventional Heat Exchanger
- R-5. Reduce Service Leak Emissions
- R-6. Reduce Operational Leak Emissions
- R-7. Reduce Disposal Emissions

Miscellaneous

- M-1. Establish a Carbon Sequestration Project
- M-2. Establish Offsite Mitigation
- M-3. Implement an Innovative Strategy for GHG Mitigation

Selecting Measures

The GHG reduction measures presented in this chapter are diverse. Users are encouraged to carefully review the measure factsheets to determine which measures are most applicable to their project and capable of achieving their GHG reduction goals. There are several reasons a user might implement measures to reduce GHG emissions. Some measures may be implemented voluntarily, simply because users are seeking to reduce their GHG footprint. Other users may be obligated under law or statute to mitigate current or future impacts of specific actions or activities. This can include project-level impacts, such as those evaluated under the California Environmental Quality Act (CEQA), or plan-level impacts, such those resulting from the implementation of a general plan or climate action plan.

When considering which measures are applicable from the Handbook, the underlying reasons and context for reducing GHG emissions should be incorporated into the decision-making process. For example, if a user is seeking to achieve substantial GHG reductions to comply with a CEQA requirement, measures that have the greatest potential to reduce emissions may be most applicable. Or, if a city is aiming to implement a climate action plan by engaging the community, measures that inspire community members and are easily accessible and affordable may be the most applicable.

Other factors for determining measure applicability include the project type, scale, and locational context. Some measures are broad and applicable to many types of projects (e.g., Measure E-2, *Require Energy Efficient Appliances*), while others have a narrower scope of application (e.g., Measure E-19, *Establish Methane Recovery in Wastewater Treatment Plants*). Additionally, certain measures are suitable for urban environments, while others are best implemented in rural contexts. The measure factsheets presented in *GHG Reduction Measure Factsheets and Quantification Methods* later in this chapter summarize these and other important considerations for measure selection to support informed decision making.

Consideration of Measure Co-Benefits

Co-benefits, or additional benefits that often are associated with emissions reduction measures, are valuable elements of climate action planning. Citing co-benefits has become increasingly prevalent in justifying funding, planning, and implementing of emission reduction measures. Like the quantification of GHG reductions, only those benefits with literature and methodologies to support their accurate and reliable quantification are presented in this chapter. Where quantification is not achievable, co-benefits are noted qualitatively for each measure.

The co-benefit categories considered in this Handbook include the following and are visually depicted in the measure factsheets by the corresponding icons.

Improved air quality. Criteria pollutant reductions.

Energy and fuel savings. Electricity, natural gas, refrigerant, propane, gasoline, or diesel reductions.

VMT reductions. Reductions in vehicle miles traveled.

Water conservation. Water use reductions.

Enhanced pedestrian or traffic safety. Reduced collisions; pedestrian/bicyclist safety.

Improved public health. Toxic air contaminant reductions (including exposure); increased physical activity; improved public safety.

Improved ecosystem health. Improved biological diversity and soil and water quality.

Enhanced energy security. Systemwide load reduction; local energy generation, levelling out peaks.

Enhanced food security. Stability of food systems; improved household access to food.

Social equity. Address existing social inequities (e.g., housing/anti-displacement, community engagement, availability of disposable income).

This Handbook assigns co-benefits to measures that are likely to result from measure implementation; however, it should be noted that the achievement of co-benefits is not guaranteed because many co-benefits are dependent on how the measure is implemented. Determining what co-benefits apply to an individual measure in a specific circumstance is not an exact science, and there is no single methodology that can be uniformly applied for this purpose. When considering co-benefits that may be achieved, it is best to comprehensively think through the implications of implementing that measure. For example, Measure E-12, *Install Alternative Type of Water Heater in Place of Gas Storage Tank Heater in Residences,* reduces GHG emissions because it eliminates the onsite combustion of natural gas. Because combusting natural gas also results in emissions of other air pollutants that can cause adverse health effects, this measure would also improve air quality and achieve public health benefits. These co-benefits would be achieved by the measure in all project applications. Depending on where and how the measure is implemented, it may also address disparities in social equity and protect a homeowner or renter from rapid changes in fossil fuel prices, especially if solar energy is produced locally or on site. Users are encouraged to use the co-benefit icons identified for each measure as a starting point for this type of thought exercise and expand or revise for their specific project or application.

Note that while all measures achieve at least one co-benefit, some measures may also yield a disbenefit. For example, measures that electrify a fossil-fuel source will lead to improved air quality and fuel savings but increased electricity consumption. Potential disbenefits are discussed, where appropriate, for individual measures.

Quantifying GHG Reductions

The emissions quantification methods in this chapter are designed to provide GHG estimates using readily available data and user-specified information. In general, emission reductions are quantified (1) as a percentage of emissions from a given source or activity, or (2) as absolute emissions reductions from a given source or activity implementation of the measure. Where appropriate, some measures refer readers to external tools to quantify GHG reductions.

Quantification methods that provide a percent reduction rely on the underlying assumption that GHG emissions are proportional to the emissions source. For example, emissions reductions achieved by transportation measures are estimated using the expected percent reduction in vehicle trips or VMT, with an associated adjustment to account for the relationship between VMT reduction and vehicle emissions, as described further in the *Transportation* section. For these measures, users will need to multiply the reduction percentage by the amount of emissions that would be generated by that source without implementation of the measure to calculate the absolute reductions.[2] This Handbook does not include methods for inventorying emissions from specific sources or under various scenarios, such as baseline or existing conditions. There are several tools and models available for inventorying project-level GHG emissions, including CAPCOA's California Emissions Estimator Model (CalEEMod).

Quantification methods that calculate absolute reductions estimate the amount of emissions that would be released as a result of the source or activity with implementation

[2] The reduction percentage is denoted as a positive value when specified in text or in tables as a "reduction," and is denoted as a negative value when calculated in equations.

of the measure (e.g., the reduction in water sector GHG emissions achieved from using reclaimed water). GHGs evaluated in this Handbook include carbon dioxide (CO_2), CH_4, nitrous oxide, and commonly used refrigerants. All GHG reductions are expressed in metric tons (MT) of carbon dioxide equivalents (CO_2e), where individual GHGs that would be reduced by a measure are converted to CO_2e by multiplying emissions by their GWP. GWP represent a ratio of the heat trapping characteristic of a gas compared to CO_2, which has a GWP of 1. This Handbook primarily uses GWPs from the Intergovernmental Panel on Climate Change's (IPCC) (2007) Fourth Assessment Report, consistent with statewide GHG emissions reporting protocol.[3] For commonly used refrigerants, GWPs were obtained from the IPCC's Fourth Assessment Report and databases from CARB and the World Meteorological Organization.

Measures presented in this chapter address those reductions over which a user can exercise direct control, as well as indirect emissions associated with electrical generation and the use of natural gas.

Quantification Accuracy and Reliability

IPCC (2006) defines *good practices* for GHG emissions quantification as those that "contain neither over- nor underestimates so far as can be judged, and in which uncertainties are reduced as far as practicable." Part of the challenge in developing methods that meet this standard of good practice is assuring the accuracy of the methods. This Handbook defines *accuracy* as the closeness of the agreement between the result of a measurement or calculation and the true value, or a generally accepted reference value. When a method is accurate, it will, for a particular case, produce a quantification of emissions that is as close to the actual emissions as can practicably be done with information that is reasonably available.

Quantification methods that meet the standard of good practice must also be *reliable*, which is different from being accurate. A reliable method will yield accurate results across a range of different cases, not only in one case. In some cases, the accuracy of quantification may be sacrificed to achieve reliability. This is because a method that can be applied across a range of scenarios must be generalized to some extent. For example, methods for transportation sector measures do not, for the most part, differentiate between peak and off-peak vehicle trips, even though off-peak trips will have a lower emission impact because of the effects of congestion on travel time and engine performance. To fully address all the factors that affect the emissions associated with vehicle trips for a specific project, a far more detailed analysis would be needed, and it would not be readily applied to other situations. The methods contained in this Handbook

[3] The Handbook uses the IPCC's (2007) Fourth Assessment Report because CARB currently (as of 2021) calculates CO_2e values for the statewide GHG inventory using GWPs from this report. GWPs are regularly reassessed by the IPCC, which published updated GWPs in their Fifth Assessment Report (IPCC 2014). Readers are encouraged to consult the latest IPCC assessment report and CARB statewide inventory guidance available at the time of their analysis to determine if alternative GWPs should be used.

have been developed to provide the best balance between accuracy and reliability, because accessibility and ease of use is an important consideration.

The quantification methods included in this Handbook will only be accurate to the degree that a project adheres to the assumptions, limitations, and other criteria specified for a given measure. Most of the quantification methods provide default assumptions for user consideration. The default values are based on the most up-to-date regional-, state-, or national-level data and may not be appropriate for all projects. Accordingly, it is recommended that defaults only be used if they adequately reflect analysis conditions, and no local or project-specific information is available. When a range of effectiveness may be quantified for a specific measure depending on defaults, this Handbook often presents those defaults that would yield the lower end of reductions to avoid overstating potential measure benefits. Where defaults are not available for a specific assumption, data must be provided by the user for the calculations to be valid. The quality of the data provided by the user will substantially affect the quality of the results achieved. Data supplied by the user could be a rough estimate, based on a small, onetime sample, or derived through a full project-specific study. Using a rough estimate for any of the data inputs will yield results that are less accurate than if higher quality data inputs are provided.

Users are encouraged to consider the intended use of the quantification, to make sure that the results achieved will be sufficiently rigorous to support the conclusions drawn from them. When quantification is performed for CEQA or other regulatory compliance, it is recommended that project-specific data be as robust as possible. Approximations and unsubstantiated numbers are discouraged. Moreover, it is strongly recommended that the source(s) and/or basis of all project-specific data supplied by the user be clearly identified in the analysis and the limitations of the data be discussed.

Measure Scales

GHG reduction measures can be applied at different scales or geographic levels. Some measures may only be applicable at the project-level, whereas others may be more appropriate within a broader planning context, such as for a general plan or climate action plan. Geographic levels considered in this Handbook include the Project/Site and Plan/Community. Project/Site refers to measures that reduce emissions at the scale of a parcel, employer, or development project. Plan/Community refers to measures that reduce emissions at the scale of a neighborhood (e.g., specific plan, general plan, climate action plan), corridor, or entire municipality (e.g., city- or county-level).

The transportation measures can be quantified at either the Project/Site scale or the Plan/Community scale, but never both. While some of the transportation measures could be implemented at both scales in practice, the quantification methods presented in this Handbook are limited to only the scale for which there is literature to defensibly support emissions quantification. For example, a bike-sharing program could be implemented at the Project/Site scale for employees to use at a business park, and it could be implemented at the Plan/Community scale by a municipality in their downtown district. However, there is limited defensible research on the GHG reductions associated with small scale, site-specific bike-share programs. Therefore, only the Plan/Community scale version of this measure is quantified in this Handbook. The *Transportation* section notes each instance in which a transportation measure could be implemented at a scale for which this document does not provide a quantification method.

Some non-transportation measures can be quantified at both the Project/Site scale and the Plan/Community scale. For example, a multi-family development at the Project/Site scale may construct homes without wood-burning devices, while a specific plan for new single-family housing at the Plan/Community scale could require that all future homes prohibit wood-burning devices. The quantification method for this measure would be the same, regardless of the scale of application.

Combining Measure Reductions

When quantifying measures, it is important to be mindful of potential interactions among different measures. Often, combining measures can lead to better emission reductions than implementing a single measure by itself. For example, for Measure LL-1, *Replace Gas Powered Landscape Equipment with Zero-Emission Landscape Equipment*, to succeed, electrical outlets on the exterior of buildings should be accessible so that the electric landscaping equipment can be charged. Measure LL-3, *Electric Yard Equipment Compatibility,* should, therefore, be considered as a supporting action to equipment electrification. Where appropriate, these synergistic relationships are noted within the individual measure quantification methods. However, the compounding effect of combining these select measures is not quantified in this Handbook.

Unfortunately, the effects of combining some measures are not always beneficial, linear, complementary, or accurate. There are two primary reasons for this. The first reason is that there may be diminishing returns when certain measures are implemented together to reduce a particular source of emissions. For example, there may be six measures to increase ridership on a public transit line, any one of which might increase transit ridership by 20 percent. But implementing all these measures will not necessarily increase ridership by 120 percent. In fact, for each successive measure applied, it is likely that a lesser effect will be observed. The second reason is that there may be competition between measures. For example, a campaign to increase ridership on a commuter rail line may be implemented while a new public transit bus line is established with overlapping service areas. Although the ridership campaign might be expected to cause 5 percent of drivers to switch to rail, some of those potential new riders might use the new bus service instead, making the ridership campaign less effective. At the same time, the new bus line might also be expected to reduce vehicle trips by 5 percent, but the actual reduction may be lower if some of the ridership comes from rail passengers. Together, the ridership campaign for the rail line and the new bus line may only reduce vehicle trips by 7 percent, and not the 10 percent predicted from summing the estimates of their independent effectiveness.

Where appropriate, guidance for combining measure reductions is provided within the introductions to each sector. Likewise, the quantification methods for each measure identify any applicable calculation maximums.

Combining Sector Reductions

The following procedures must be followed when combining measures among the nine sectors where the GHG reduction achieved by individual measures is calculated as a percentage of emissions from a given source or activity. Specifically, the relative magnitude of emissions between sectors must be considered. Users should first determine the percent contribution made by each individual sector to the overall project GHG emissions. This percent contribution by a sector should then be multiplied by the reduction percentages from measures in that sector to determine the scaled GHG emission reductions. This should be done for each sector to be combined. The scaled GHG emissions for each sector can then be added together to give a total GHG reduction for the combined measures in all sectors.

For example, consider a project with total GHG emissions that come from the following sectors: transportation (50 percent), building energy use (40 percent), water (6 percent), and solid waste (4 percent). This project implements transportation measures that result in a 10 percent reduction in VMT. The project also implements measures that result in a combined 30 percent reduction in water usage. The overall reduction in GHG emissions is calculated in the below example.

$$\% \text{ Reduction}_{Transport} = 50\% \text{ total emissions} \times 10\% \text{ sector reduction} = 5\% \text{ total reduction}$$

$$\% \text{ Reduction}_{Water} = 6\% \text{ total emissions} \times 30\% \text{ sector reduction} = 1.8\% \text{ total reduction}$$

$$\% \text{ Reduction}_{Total} = 5\% + 1.8\% = 6.8\% \text{ total reduction}$$

As discussed above, GHG reductions for some measures in this Handbook are expressed in terms of the absolute MT CO_2e that would be reduced. Reductions from these measures should be combined following the same approach as shown above. However, rather than multiplying percentages, users can simply subtract the expected reductions from the sector emissions.

Users may need to combine sector reductions that are a product of measures where reductions are given as both percentages and absolute values. This can be achieved by modifying the above equations to include actual project emissions. The following equations extend the above project example to include a 10 MT CO_2e reduction achieved by waste sector measures. Uncontrolled project emissions are assumed to be 2,000 MT CO_2e.

$$\begin{aligned} \text{Absolute Reduction}_{Transport} &= 2{,}000 \text{ MT } CO_2e \times 50\% \text{ total emissions} \times 10\% \text{ sector reduction} \\ &= 100 \text{ MT } CO_2e \text{ reduction} \end{aligned}$$

$$\begin{aligned} \text{Absolute Reduction}_{Water} &= 2{,}000 \text{ MT } CO_2e \times 6\% \text{ total emissions} \times 30\% \text{ sector reduction} \\ &= 36 \text{ MT } CO_2e \text{ reduction} \end{aligned}$$

$$\text{Absolute Reduction}_{Waste} = 10 \text{ MT } CO_2e$$

$$\text{Absolute Reduction}_{Total} = 100 \text{ MT } CO_2e + 36 \text{ MT } CO_2e + 10 \text{ MT } CO_2e = 146 \text{ MT } CO_2e$$

Limitations and Uncertainty

There are uncertainties associated with any type of estimation method. It is important to understand the limitations to properly apply the quantification methods presented in this Handbook. The following briefly discusses key limitations for user awareness and consideration.

Combination of Data Sources

Developing quantification methods for some of the measures required the use of multiple sources of data. Any time data are derived from different sources, there may be slight discrepancies in the underlying methodologies and data. When the information between two data sets is combined, the discrepancies may affect the ultimate quantification of emissions, either over- or underestimating them. It is not possible to determine the precise magnitude of error that combining data sets induces in the final quantification; however, every effort has been made to minimize potential errors through thorough review of available data and exclusion of incompatible data sets.

Level of Detail for Underlying Assumptions

Many of the calculations require users to input project-specific data or assumptions. Certain information about a project may not be known to the user and must be either estimated or assumed based on standard procedures. Likewise, users may rely on the available defaults provided in the Handbook to enable emissions quantification of applicable measures. While defaults provided in this Handbook are based on credible sources for use in emissions quantification, they are often based on historical regional, state, and national-level data and may produce an inaccurate representation of project-specific conditions or lead to an overestimate or underestimate of associated emissions. This limitation can be minimized to the extent the user can provide better quality data.

Use of Case Studies

Case studies generally have detailed information on reductions that may be achieved in practice by a measure. While these studies provide valuable insight that can support measure quantification, there may be features or characteristics in the case study that do not translate to a specific project and, therefore, may over- or underestimate the GHG emission reductions. Where case studies were used, they were carefully reviewed to ensure the study methods and data meet the quality requirements of this Handbook.

Prediction of Future Behavior

Some of these methods predict future behavior (e.g., water use and energy consumption) using historical data and trends. Although this is a commonly accepted practice, current behavior is not likely to remain constant over time due to technological improvements and increasing awareness of resource conservation. This limitation can be minimized to the extent the user can provide better quality data.

Combining Multiple Measures

Projects may involve the application of more than one measure. As discussed above, combining measures can have an additive effect on GHG reductions, or result in diminishing returns. This limitation is minimized through the establishment of sector and measure reduction caps, as described within the individual measure methods, as applicable. However, users should still exercise good judgement when selecting measures to ensure that the resulting quantification is appropriate and accurate.

Exclusion of Lifecycle and Biogenic CO_2 Emissions

Except for solid waste measures and certain measures in the refrigerants and transportation sectors, the quantification methods do not include analysis of full lifecycle emissions, which are those that are emitted from the energy and resources used throughout the lifecycle of a product or material. Lifecycle emissions include the extraction of raw resources, physical distribution, use of the product or material, and disposal at the end of a product's life. It is challenging to quantify these lifecycle emissions because identifying all the inputs that are necessary, especially for a generalized guidance document such as this Handbook, is infeasible. Because of these difficulties, lifecycle considerations are only included in the quantitative methods for those measures that cannot be quantified without a lifecycle analysis. The *Transportation*, *Solid Waste*, and *Refrigerants* sections discuss lifecycle considerations specific to those sectors. For all other measures, the quantification methods do not include analysis of full lifecycle emissions.

Except for Measure E-14, *Limit Wood Burning Devices and Natural Gas/Propane Fireplaces in Residential Development*, the methods do not address biogenic CO_2 emissions. Biogenic CO_2 emissions result from materials that are derived from living cells, as opposed to CO_2 emissions derived from fossil fuels, limestone, and other materials that have been transformed by geological processes. Biogenic CO_2 contains carbon that is present in organic materials, including wood, paper, vegetable oils, animal fat, and waste from food, animals, and vegetation (such as yard or forest waste). Biogenic CO_2 emissions are excluded from these GHG emissions quantification methods because they are the result of materials in the biological/physical carbon cycle, rather than the geological or anthropogenic carbon cycle.

Extent Reductions are Achieved in Practice

The reduction methods presented in this Handbook are based on specific underlying data and assumptions for how each measure should be implemented. The quantification methods will yield the most accurate and reliable results when the user adheres to all implementation requirements described in this Handbook. In practice, there is likely to be a wide range of how individual measures are implemented given project-specific considerations, such as cost to implement the measure, physical constraints, availability of technology, and regulatory restrictions.

GHG Reduction Measure Factsheets and Quantification Methods

Anatomy of the Factsheets

All quantified GHG reduction measures in this Handbook include a one-page measure factsheet. The factsheet highlights important considerations for each measure. They describe the measure, locational context, scale of application, implementation requirements, cost considerations, and options to expand measure effectiveness. The factsheets also show key measure indicators, such as the GHG reduction potential, co-benefits, and considerations for climate resilience and health and equity. Where available, the GHG reduction potential is provided as the estimated maximum percent reduction in emissions. For those measures where GHG reductions are calculated as absolute emissions, the GHG reduction potential is identified as small, moderate, large, or varies. This qualitative ranking characterizes the estimated quantity of reductions relative to the magnitude of emissions generated by the source. For example, Measure E-15, *Require All-Electric Development*, has the potential for a large reduction in GHG emissions from building energy use if all end uses are electrified and the local utility provides zero-carbon electricity. It's important to note that, while this measure could achieve a "large" reduction in building energy emissions, the overall reduction in project emissions could be small if building energy emissions are only a fraction of the project total.

Figure 3-2 illustrates the factsheet layout and annotates key content.

Figure 3-2. Annotated Outline of the Measure Factsheet

Each measure is numbered alphanumerically with the first letter of the emissions sector serving as the letter code (e.g., E = Energy).

Each measure includes a descriptive title

T-25. Extend Transit Network Coverage or Hours

Provides an overview of each measure's reduction potential.

GHG Mitigation Potential

4.6%

Up to 4.6% of GHG emissions from vehicle travel in the plan/community

Identifies benefits that may be achieved by the measure.

Co-Benefits (icon key on pg. 34)

Considerations relevant to climate risk reduction.

Climate Resilience

Increasing transit network coverage or hours improves the reliability of the transportation network and allows redundancy to exist even if an extreme event disrupts part of the system. They could also incentivize more people to use transit, resulting in less traffic and better allowing emergency responders to access a hazard site during an extreme weather event.

Considerations relevant to health and equity.

Health and Equity Considerations

This measure increases access to social, educational, and employment opportunities. Expansion of transit networks need to ensure equitable access by all communities to the transit system.

Measure Description

This measure will expand the local transit network by either adding or modifying existing transit service or extending the operation hours to enhance the service near the project site. Starting services earlier in the morning and/or extending services to late-night hours can accommodate the commuting times of alternative-shift workers. This will encourage the use of transit and therefore reduce VMT and associated GHG emissions.

Summarizes the measure at a high level and explains how the measure reduces GHG.

Subsector

Transit

Identifies the measure subsector (Transportation and Energy sector measures only).

Locational Context

Urban, suburban

Outlines considerations for measure implementation and application that are locationally relevant (Transportation sector measures only).

Scale of Application

Plan/Community

Identifies whether the measure is applicable at the Project/Site, Plan/Community, or both.

Implementation Requirements

There are two primary means of expanding the transit network: by increasing the frequency of service, thereby reducing average wait times and increasing convenience, or by extending service to cover new areas and times.

Provides key implementation requirements that must be met to achieve the cited GHG reductions.

Cost Considerations

Infrastructure costs for extending the physical network coverage of a transit system can be significant. Costs to expand of track-dependent transit, such as light rail and passenger rail, are high and can require resource- and time-intensive advanced planning. Costs to expand vehicle-dependent transit, such as busses, are likewise high but may be limited to procurement of additional vehicles. Any expansion of transit, including just service hours, would increase staffing and potentially maintenance costs. A portion of these costs may be offset by increased transit usage and associated income. Commuters who may more easily be able to travel without a car may also observe cost savings from reduce vehicle usage or ownership.

Considerations relevant to measure costs and savings.

Expanded Mitigation Options

This measure is focused on providing additional transit network coverage, with no changes to transit frequency. This measure can be paired with Measure T-26, *Increase Transit Service Frequency*, which is focused on increasing transit service frequency, for increased reductions.

Shows potential variations for how a measure could be implemented to achieve additional reductions or co-benefits.

TRANSPORTATION | 168

Following each measure's factsheet is the measure's quantification method. Accurate and reliable quantification of GHG reduction measures depends on properly identifying and understanding the important variables that affect the emissions from a source or activity. A consistent framework and presentation are used for all measure quantification methods to provide a clear summary of quantification variables and usable instructions on appropriate application of the method.

The quantification methodology for each measure is comprised of the mathematical formula(s), summary of all variables used in the formula, explanation of any calculation caps or maximums, an example calculation, and information on quantified co-benefits. The variables in the GHG reduction formula(s) are shown as letters (e.g., A, B) and are defined in the table that immediately follows the equation. The table categorizes variables as outputs, user inputs, or constants, assumptions, and defaults. Bolded variables are required user inputs (i.e., variables for which no defaults are available).

Only those measures with literature to defensibly support emissions quantification are discussed in this Handbook. Examples of credible sources consulted for this Handbook include government agency-sponsored studies, peer-reviewed scientific literature, case studies, government-approved modeling software, and widely adopted protocols. Additional measures for user consideration are presented in *Supporting or Non-Quantified GHG Reduction Measures.* Methods for quantifying these measures have not yet been developed, are not fully supported by available research, or require specific details that are difficult to address under a methodology with general applicability. Users are encouraged to consider including these non-quantified measures into their projects, as described further below.

The measure factsheets and quantification methods follow *Supporting or Non-Quantified GHG Reduction Measures*. As discussed above, measures are grouped into nine emission sectors. Information relevant to the general quantification of all measures within a sector is presented at the introduction of each sector. Users may manually scroll through the factsheets in this chapter or use Figure 3-1 (above) to automatically navigate to a specific measure's factsheet.

Supporting or Non-Quantified GHG Reduction Measures

As a supplement to the GHG reduction measures shown in the factsheets, there are supporting or non-quantified measures that may be of interest to users. Although not quantitatively evaluated in the Handbook, supporting or non-quantified measures may achieve emissions reductions and co-benefits on their own or may enhance the ability of quantified measures to attain expanded reductions and co-benefits. These measures may, therefore, strengthen implementation of a project mitigation strategy or community plan.

Beyond their potential to expand the efficacy of a reduction plan, supporting or non-quantified measures provide users with more options to develop a comprehensive set of mitigation strategies. For example, this section can be used as a resource for expanded CEQA mitigation to identify additional measures that may be feasible and applicable to a specific project. Local governments developing a climate action plan or update to their general plan may also find this section useful as inspiration for new or more comprehensive policies. Many of the measures will achieve co-benefits (e.g., water conservation), in addition to GHG reductions, and may therefore be impactful throughout several elements of a local general plan (e.g., air quality, conservation, environmental justice).

While benefits of supporting or non-quantified measures may not be quantitively captured (or fully captured), the measures can be implemented using many of the same mechanisms as for quantified measures. When identified in a CEQA document, measures can be incorporated into a project's mitigation monitoring and reporting program to ensure that they are implemented and enforced. Cities and counties can update their municipal codes to require measures or certain measure components, which would ensure that the measures are implemented through new development or renovations in existing development. Measures can also be included as a set of best management practices that a local government or project sponsor encourages or incentivizes.

Table 3-1 presents the list of supporting or non-quantified GHG reduction measures. Note that these measures are numbered sequentially to follow the quantified measures within each sector (refer to the measure factsheets at the conclusion of this section). The table defines the measure's sector, scale of application, locational context, and likely co-benefits. For simplicity, these measure "descriptors" have been abbreviated in Table 3-1 as follows.

- Shaded rows identify the sector and subsector (in parentheses, where applicable) for each group of measures. For example, "Transportation (Land Use)."
- The scale of application is abbreviated as one of the following:
  - P/S = Project/Site
  - P/C = Plan/Community
  - All = Project/Site and Plan/Community
- For transportation measures, abbreviations for locational context refer to the level of development at the census tract level. The three locational contexts identified in the Handbook are suburban (S), urban (U), and rural (R). Most transportation measures are applicable to development within at least one of these three locational context areas.

  The three locational contexts were developed from the eight neighborhood types described in *Quantifying the Effect of Local Government Actions on VMT* (Salon 2014), as summarized below.
  - S = suburb with multifamily housing; suburb with single-family homes

LOCATIONAL CONTEXT

The following neighborhoods are provided as representative examples for the three locational context areas.

Suburban — Malibu, Davis, Santee

Urban — Central Berkeley, Downtown Los Angeles, Downtown San Jose

Rural — Coronado, Mather, most of Alpine County

- U = urban low transit; central city urban; urban high transit
- R = rural; rural-in-urban

- Remaining columns identify co-benefits that may be achieved by the measure where:
  - ●= may be achieved by the measure
  - ⊙= may be achieved by the measure depending on local implementation specifics
  - ○= likely not achieved by the measure

Table 3-2 includes a more detailed description of each non-quantified measure, including equity considerations that lead agencies and project sponsors should review to ensure that measure implementation is as equitable as possible. Users should also refer to Chapter 4, *Assessing Climate Exposures and Measures to Reduce Vulnerabilities*, and Chapter 5, *Measures for Advancing Health and Equity*, for additional context on adaptation and equity that is also relevant to the supporting or non-quantified measures.

Finally, note that the inclusion of a measure in this section does not preclude it from quantification or indicate that it is impossible to quantify the benefits of the measure. If a user has access to specific data or methods, or if quantification guidance becomes available in the future, then users can quantitatively evaluate measures in those circumstances, if desired.

Table 3-1. Summary of Supporting or Non-Quantified GHG Reduction Measures and Descriptors

#	Measure Title	Scale of Application	Locational Context	Co-Benefits: Improved Air Quality	Energy and Fuel Savings	VMT Reductions	Water Conservation	Enhanced Pedestrian or Traffic Safety	Improved Public Health	Improved Ecosystem Health	Enhanced Energy Security	Enhanced Food Security	Social Equity
Transportation (Land Use)													
T-31-A	Locate Project in Area with High Destination Accessibility	P/S	U, S	●	●	●	○	●	●	○	○	○	⊙
T-31-B	Improve Destination Accessibility in Underserved Areas	P/C	U, S	●	●	●	○	●	●	○	○	○	●
T-32	Orient Project Toward Transit, Bicycle, or Pedestrian Facility	P/S	U, S, R [a], R [b], R [c]	●	●	●	○	●	●	○	○	○	⊙
T-33	Locate Project near Bike Path/Bike Lane	P/S	U, S	●	●	●	○	●	●	○	○	○	⊙
Transportation (Neighborhood Design)													
T-34	Provide Bike Parking	All	All	●	●	●	○	●	●	○	○	○	⊙
T-35	Provide Traffic Calming Measures	P/C	All	●	●	●	○	●	●	○	○	○	⊙
T-36	Create Urban Non-Motorized Zones	P/C	U	●	●	●	○	●	●	○	○	○	⊙
T-37	Dedicate Land for Bike Trails	P/C	All	●	●	●	○	●	●	○	○	○	⊙
Transportation (Trip Reduction Programs)													
T-38	Provide First and Last Mile TNC Incentives	P/C	U, S, R [b]	●	●	●	○	●	●	○	○	○	⊙
T-39	Implement Preferential Parking Permit Program	P/S	U, S	●	●	●	○	●	●	○	○	○	○

				Co-Benefits									
#	Measure Title	Scale of Application	Locational Context	Improved Air Quality	Energy and Fuel Savings	VMT Reductions	Water Conservation	Enhanced Pedestrian or Traffic Safety	Improved Public Health	Improved Ecosystem Health	Enhanced Energy Security	Enhanced Food Security	Social Equity
T-40	Implement School Bus Program	P/S	All	●	●	●	○	●	●	○	○	○	⊙
T-41	Implement a School Pool Program	P/S	All	●	●	●	○	●	●	○	○	○	⊙
T-42	Implement Telecommute and/or Alternative Work Schedule Program	P/S	All	⊙	⊙	⊙	○	⊙	⊙	○	○	○	⊙
Transportation (Transit)													
T-43	Provide Real-Time Transit Information	P/C	All	●	●	●	○	●	●	○	○	○	⊙
T-44	Provide Shuttles (Gas or Electric)	P/S	U, S	●	●	●	○	●	●	○	○	○	⊙
T-45	Provide On-Demand Microtransit	All	U, S	●	●	●	○	●	●	○	○	○	⊙
T-46	Improve Transit Access, Safety, and Comfort	P/C	U, S, R [b], R [c]	●	●	●	○	●	●	○	○	○	⊙
T-47	Provide Bike Parking Near Transit	P/C	U, S	●	●	●	○	●	●	○	○	○	⊙
Transportation (Parking or Road Pricing/Management)													
T-48	Implement Area or Cordon Pricing	P/C	U	●	●	●	○	●	●	○	○	○	○
T-49	Replace Traffic Controls with Roundabout	P/C	All	●	●	●	○	●	●	○	○	○	○
T-50	Required Project Contributions to Transportation Infrastructure Improvement	P/C	All	●	●	●	○	●	●	○	○	○	○

#	Measure Title	Scale of Application	Locational Context	Co-Benefits									
				Improved Air Quality	Energy and Fuel Savings	VMT Reductions	Water Conservation	Enhanced Pedestrian or Traffic Safety	Improved Public Health	Improved Ecosystem Health	Enhanced Energy Security	Enhanced Food Security	Social Equity
T-51	Install Park-and-Ride Lots	P/C	S, R	●	●	●	○	●	●	○	○	○	⊙
T-52	Designate Zero Emissions Delivery Zones	P/C	U	●	●	●	○	●	●	○	○	○	⊙
Transportation (Clean Vehicles and Fuels)													
T-53	Electrify Loading Docks	P/S	All	●	●	●	○	○	○	○	●	○	⊙
T-54	Install Hydrogen Fueling Infrastructure	All	—	●	●	○	○	○	●	○	●	○	○
Energy (Energy Efficiency Improvements)													
E-20	Install Whole-House Fans	P/S	—	○	●	○	○	○	○	○	●	○	⊙
E-21	Install Cool Pavements	All	—	●	●	○	○	●	●	●	●	○	⊙
E-22	Obtain Third-party HVAC Commissioning and Verification of Energy Savings	P/S	—	○	●	○	○	○	○	○	●	○	⊙
Energy (Renewable Energy Generation)													
E-23	Use Microgrids and Energy Storage	All	—	⊙	●	○	○	○	●	○	●	○	⊙
E-24	Provide Battery Storage	All	—	⊙	●	○	○	○	●	○	●	○	⊙
Energy (Building Decarbonization)													
E-25	Install Electric Heat Pumps	All	—	●	●	○	○	○	●	○	⊙	○	⊙

				Co-Benefits									
#	Measure Title	Scale of Application	Locational Context	Improved Air Quality	Energy and Fuel Savings	VMT Reductions	Water Conservation	Enhanced Pedestrian or Traffic Safety	Improved Public Health	Improved Ecosystem Health	Enhanced Energy Security	Enhanced Food Security	Social Equity
Lawn and Landscaping													
LL-2	Implement Yard Equipment Exchange Program	P/S	—	●	●	○	○	○	●	●	●	○	⊙
LL-3	Electric Yard Equipment Compatibility	P/S	—	○	○	○	○	○	●	○	○	○	○
Solid Waste													
S-3	Require Edible Food Recovery Program Partnerships with Food Generators	All	—	⊙	⊙	○	⊙	○	⊙	○	○	●	●
S-4	Recycle Demolished Construction Material	P/S	—	○	●	○	○	○	○	⊙	○	○	○
S-5	Source Wood Materials from Urban Wood Re-Use Program	All	—	○	●	●	●	○	○	●	○	○	○
Natural and Working Lands													
N-5	Establish a Local Farmer's Market	P/C	—	●	●	●	○	●	●	○	○	●	⊙
N-6	Establish Community Gardens	P/C	—	●	○	⊙	○	○	●	●	○	●	⊙
Construction													
C-4	Use Local and Sustainable Building Materials	All	—	○	●	●	○	○	○	⊙	○	○	○

#	Measure Title	Scale of Application	Locational Context	Co-Benefits: Improved Air Quality	Energy and Fuel Savings	VMT Reductions	Water Conservation	Enhanced Pedestrian or Traffic Safety	Improved Public Health	Improved Ecosystem Health	Enhanced Energy Security	Enhanced Food Security	Social Equity
Miscellaneous													
M-4	Require Environmentally Responsible Purchasing	P/S	—	⊙	⊙	○	⊙	○	○	⊙	○	○	○
M-5	Fund Incentives for Green Technologies	P/C	—	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙

Sector abbreviations: T = transportation; E = energy; W = water; LL = lawn and landscaping; S = solid waste; N = natural and working lands; C = construction; M = miscellaneous.

Scale of application column abbreviations: P/S = Project/Site; P/C = Plan/Community; All.

Locational context column abbreviations: — = non-applicable; R = rural; S = suburban; U = urban. Where applicable, the Handbook provides three land use distinctions within the R locational context category, where R [a] = rural only if the project is in master-planned community; R [b] = rural only if the project is adjacent to commuter a rail station with convenient rail service to a major employment center; R [c] = rural only if there is available transit and the project is close to jobs/services.

Co-benefits columns symbols: ● = may be achieved by the measure; ⊙ = may be achieved by the measure depending on local implementation specifics; ○ = likely not achieved by the measure.

Table 3-2. Description of Supporting or Non-Quantified GHG Reduction Measures

Transportation (Land Use)
T-31-A. Locate Project in Area with High Destination Accessibility The measure requires development in an area with high accessibility to destinations. Destination accessibility is measured in terms of the number of jobs or other attractions (e.g., schools, supermarkets, and health care services) that are reachable within a given travel time or travel distance, and tends to be highest at central locations and lowest at peripheral ones. When destinations are nearby, the travel time between them is less, thus increasing the potential for people to walk and bike to those destinations and, therefore, reducing the vehicle miles traveled (VMT) and associated greenhouse gas (GHG) emissions. As an implementation consideration, projects should consider accessibility by people of all functional abilities and incorporate design principles such as Universal Design.[4] See Measure T-31-B for a variation of this measure.
T-31-B. Improve Destination Accessibility in Underserved Areas This measure accounts for the VMT reduction that would be achieved by constructing job centers or other attractions (e.g., schools, supermarkets, and health care services) for residents in underserved areas (e.g., food deserts). When destinations are nearby, the travel time between them is less, thus increasing the potential for people to walk and bike to those destinations, reducing VMT and associated GHG emissions. As an implementation consideration, projects should consider accessibility by people of all functional abilities and incorporate design principles such as Universal Design. See Measure T-31-A for a variation of this measure.
T-32. Orient Project Toward Transit, Bicycle, or Pedestrian Facility This measure requires projects to minimize setback distance between the project and planned or existing transit, bicycle, or pedestrian corridors. A project that is designed around an existing or planned transit, bicycle, or pedestrian corridor encourages sustainable mode use. As an implementation consideration, projects should consider accessibility by people of all functional abilities and incorporate design principles such as Universal Design.
T-33. Locate Project near Bike Path/Bike Lane This measure requires projects to be located within 0.5-mile bicycling distance to an existing Class I or IV path or Class II bike lane. A project that is designed around an existing or planned bicycle facility encourages sustainable mode use. The project design should include a comparable network that connects the project uses to the existing off-site facilities that connect to work/retail destinations. As an implementation consideration, projects should provide sufficient and convenient bicycle parking and long-term storage, ideally near the bike lane itself, for residents, employees, and visitors, and a bicycle repair station with tools and equipment. This measure can be implemented with Measure T-9.
Transportation (Neighborhood Design)
T-34. Provide Bike Parking This measure requires projects provide short-term and long-term bicycle parking facilities to meet peak season maximum demand. Parking can be provided in designated areas or added within rights-of-way, including by replacing parking spaces with bike parking corrals. Ensure that bike parking can be accessed by all, not just project employees or residents.

[4] Universal Design is a concept that is comprised of seven principles that seek to make buildings and infrastructure accessible to all people. Accessibility is achieved by considering and implementing each principle during the design process. A project designed by Universal Design standards would ensure that adjacent transit facilities are accessible to people with diverse abilities, preferences, and language skills.

T-35. Provide Traffic Calming Measures

This measure requires projects to include pedestrian/bicycle safety and traffic calming measures above jurisdictional requirements. Roadways should also be designed to reduce motor vehicle speeds and encourage pedestrian and bicycle trips with traffic calming features. Traffic calming features may include marked crosswalks, count-down signal timers, curb extensions, speed tables, raised crosswalks, raised intersections, median islands, tight corner radii, roundabouts or mini-circles, on-street parking, planter strips with street trees, chicanes/chokers, and others. Providing traffic calming measures encourages people to walk or bike instead of using a vehicle. This mode shift will result in a decrease in vehicle miles traveled. In 2017, 3,904 people were killed and 277,160 injured by vehicle collisions in California; traffic calming can reduce injuries and death, which improves health (State of California et al., 2018). Traffic calming also promotes active transportation, which improves physical health.

T-36. Create Urban Non-Motorized Zones

The measure requires projects to convert a percentage of its roadway miles to transit malls, linear parks, or other non-motorized zones. These features encourage non-motorized travel and thus a reduction in vehicle miles traveled. This measure is only applicable to projects located in urban environments. Consider access issues for paratransit users and those with mobility impairments.

T-37. Dedicate Land for Bike Trails

This measure requires projects to provide for, contribute to, or dedicate land for the provision of off-site bicycle trails linking the project to designated bicycle commuting routes in accordance with an adopted citywide or countywide bikeway plan. Existing desire paths can make good locations, as it represents a community-identified transportation need.

Transportation (Trip Reduction Programs)

T-38. Provide First and Last Mile TNC Incentives

This measure requires a first-last mile partnership between a municipality/transit agency and a transportation network company (TNC) for subsidized, shared TNC rides to or from the local transit station within a specific geographic area. This measure encourages a shift to transit mode for longer trips. Consider providing inclusive mechanisms so people without bank accounts, credit cards, or smart phones can access the incentives.

T-39. Implement Preferential Parking Permit Program

This measure requires projects provide preferential parking in terms of free or reduced parking fees, priority parking, or reserved parking in convenient locations (such as near public transportation or building entrances) for commuters who carpool, vanpool, ride-share or use sustainably fueled vehicles. Projects should also provide wide parking spaces to accommodate vanpool vehicles. Commercial preferential parking can accommodate workers who work non-standard hours by providing opportunities to participate. Residential preferential parking can consider an equitable distribution of permits, giving priority to owners of sustainably fueled vehicles.

T-40. Implement School Bus Program

This measure will provide school bus service transporting students to a school project. A school bus service can reduce the number of private vehicle trips to drop-off or pick-up students, thereby reducing VMT and associated GHG emissions, as well as onsite air pollution emissions, especially if the bus is zero emissions. Best practices include concentrating service for students who live further away from schools, providing service both before and after school, and encouraging parents to utilize the service. This measure is more effective at schools that draw students from a larger enrollment area, such as high schools or private schools.

T-41. Implement a School Pool Program

This measure requires projects create a ridesharing program for school children. Most school districts provide bussing services to public schools only. School pool helps match parents to transport students to private schools, or to schools where students cannot walk or bike but do not meet the requirements for bussing. A school pool program can help reduce onsite air pollutant emissions at the school by reducing private vehicle trips, especially if the pool vehicle is zero emissions.

T-42. Implement Telecommute and/or Alternative Work Schedule Program

This measure requires projects to permit employee telecommuting and/or alternative work schedules and monitor employee involvement to ensure forecasted participation matches observed participation. While this measure certainly reduces commute-related VMT, recent research has shown that total VMT from telecommuters can exceed VMT from non-telecommuters (Goulias et al. 2020). In addition, telecommuting affects commercial and residential electricity use, complicating the calculation of the net effect and attribution of emissions. More specifically, an office with fewer employees could result in a decrease in the project's energy used to operate equipment and provide space heating and air conditioning. Conversely, an increase in telecommuters using their private homes as workspaces could result in a residential increase in energy for those same end uses and appliances. While this measure is currently not quantified and, according to some studies, could result in total VMT increases and other disbenefits, it is recommended that users review the most recent literature at the time of their project initiation to see if new findings more conclusively support a quantifiable emissions reduction.

Transportation (Transit)

T-43. Provide Real-Time Transit Information

This measure requires projects provide real-time bus/train/ferry arrival time, travel time, alternative routings, or other transit information via electronic message signs, dedicated monitor or interactive electronic displays, websites, or mobile apps. This makes transit service more convenient and may result in a mode shift from auto to transit, which reduces VMT.

T-44. Provide Shuttles (Gas or Electric)

This measure will provide local shuttle service through coordination with the local transit operator or private contractor. The shuttles will provide service to and from commercial centers to nearby transit centers to help with first and last mile connectivity, thereby incentivizing a shift from private vehicles to transit, reducing associated GHG emissions. Electric shuttle vehicles provide a marginally more effective reduction to GHG emissions compared to gas- or diesel-fueled shuttles due to their use of less emissions-intensive electric power. Shuttles that serve only the project residents and/or employees may be seen as increasing gentrification and exclusionary. Consider allowing all people to use the shuttle, regardless of status. Note that this measure can also be implemented at the Project/Site scale by a large employer as part of a Trip Reduction Program.

T-45. Provide On-Demand Microtransit

This measure will provide small-scale, on-demand public transit services that can offer fixed routes and schedules or flexible routes and on-demand scheduling (e.g., Metro Micro) through coordination with the local transit operator or private contractor. Microtransit aims to offer shorter wait times and improved reliability compared to the bus and rail system to further incentivize alternative transportation modes that are less emissions-intensive than private vehicle trips. On-demand rides can be booked using smartphone applications or call centers. Note that this measure may also be applicable at the Project/Site scale for a large employer (e.g., Google's Via2G pilot) as part of a Trip Reduction Program.

T-46. Improve Transit Access, Safety, and Comfort

This measure requires projects improve transit access and safety through sidewalk/crosswalk safety enhancements, bus shelter improvements, improved lighting, and other features. Work with the community to determine barriers to use, most desired improvements, and other access challenges.

T-47. Provide Bike Parking Near Transit

This measure requires the project to provide short-term and long-term bicycle parking near rail stations, transit stops, and freeway access points where there are commuter or rapid bus lines. Include locations for shared micromobility devices as well as higher-security parking for personal bicycles.

Transportation (Parking or Road Pricing/Management)

T-48. Implement Area or Cordon Pricing

This measure requires projects implement a cordon pricing scheme. The pricing scheme will set a cordon (boundary) around a specified area to charge a toll to enter the area by vehicle. The cordon location is usually the boundary of a central business district or urban center but could also apply to substantial development projects with limited points of access. The toll price can be based on a fixed schedule or be dynamic, responding to real-time congestion levels. It is critical to have an existing, high quality transit infrastructure for the implementation of this strategy to reach a significant level of effectiveness. The pricing signals will only cause mode shifts if alternative modes of travel are available and reliable. This measure should provide an exception for low-income residents or workers within the pricing zone.

T-49. Replace Traffic Controls with Roundabout

This measure requires projects install a roundabout as a traffic control device to smooth traffic flow, reduce idling, eliminate bottlenecks, and manage speed. In some cases, roundabouts can improve traffic flow and reduce emissions. The emission reduction depends heavily on what the roundabout is compared to (e.g., uncontrolled intersection, stop sign, traffic signal). Design roundabout so cyclists have the option to join traffic or bypass the roundabout with an adjacent path.

T-50. Required Project Contributions to Transportation Infrastructure Improvement

This measure requires projects contribute to traffic-flow improvements or other multi-modal infrastructure projects that reduce emissions and are not considered as substantially growth inducing. The local transportation agency should be consulted for specific needs. Larger projects may be required to contribute a proportionate share to the development and/or continuation of a regional transit system. Contributions may consist of dedicated right-of-way, capital improvements, or easements. Ensure the jurisdictional fee system does not disadvantage infill projects over greenfield projects.

T-51. Install Park-and-Ride Lots

This measure requires projects install park-and-ride lots near transit stops and high occupancy vehicle lanes. Park-and-ride lots also facilitate car- and vanpooling. Parking lots can also incorporate cool pavements, tree canopy, or solar photovoltaic shade canopies to reduce the urban heat island effect as well as evaporative emissions from parked vehicles and dedicated electric vehicle parking spots and/or charging infrastructure.

T-52. Designate Zero Emissions Delivery Zones

This measure requires the municipality to designate certain curbside locations as commercial loading zones exclusively available for zero-emission commercial delivery vehicles. Doing so replaces tailpipe diesel emissions from last-mile delivery vehicles as well as heavy duty drayage trucks moving goods with less emissions-intensive electric vehicles and potentially micromobility for food and parcel delivery. Locations should be prioritized based on land use density and existing exposure from air pollution.

Transportation (Clean Vehicles and Fuels)

T-53. Electrify Loading Docks

This measure will require that Transport Refrigeration Units and auxiliary power units (APUs) be plugged into the electric grid at the loading dock instead of running on diesel. The indirect GHG emission from electricity generation can partially offset the emissions reduction from fuel reductions. Electrifying loading docks can reduce exposure to air pollutants for workers and drivers.

T-54. Install Hydrogen Fueling Infrastructure

The measure requires projects to implement accessible hydrogen fuel cell fueling infrastructure. Drivers of fuel cell electric vehicles (FCEV), from individual passenger vehicles to haul truck fleets, will be able to refuel using this infrastructure. The expansion of hydrogen fueling locations indirectly supports the uptake of FCEV in place of the typical internal combustion engine vehicle fueled by carbon-emitting gasoline and diesel.

Energy (Energy Efficiency)

E-20. Install Whole-House Fans

This measure requires installation of whole-house fans. Whole-house fans draw cooler outdoor air through open windows, exhaust the warmer air into the attic, and then expel the air outside through attic vents. Whole-house cooling using a whole house fan can substitute for an air conditioner most of the year in most climates, resulting in a reduction in emissions associated with building energy use. Whole-house fans may be inappropriate in locations near sources that generate air pollutants during the evening hours, such as major roads and freeways.

E-21. Install Cool Pavements

This measure will install cool pavements in place of dark pavements. Cool pavements help to lower ambient outdoor air temperatures when compared to dark-colored, heat-absorbent pavements such as asphalt. This reduces the electricity needed to provide cooling, but in some climates, can also increase the energy emissions to provide heating, thereby reducing associated GHG emissions depending on the project parameters (e.g., climate, carbon intensity of local utility). Prioritize cool pavement installation in neighborhoods with high urban heat island effects, large amounts of paved areas, low tree canopy, or high vulnerability due to age, employment, income, linguistic isolation, and other indicators.

E-22. Obtain Third-party HVAC Commissioning and Verification of Energy Savings

This measure requires third-party review of heating ventilation and air conditioning (HVAC) systems to ensure proper installation and construction of energy reduction features. A user can obtain HVAC commissioning and third-party verification of energy savings in thermal efficiency components including HVAC systems, insulation, windows, and water heating. Note that the 2019 Title 24 Standards requires Home Energy Rating System (HERS) verification for all new low-rise residential building (3 stories or less). Taller residential buildings and non-residential buildings may or may or not require a HERS verification depending on other buildings elements.

Energy (Renewable Energy Generation)

E-23. Use Microgrids and Energy Storage

This measure requires management of a microgrid. Microgrids offer the opportunity to deploy more zero-emission electricity sources, thereby reducing GHG emissions. The microgrid manager (e.g., local energy management system) can balance generation from non-controllable renewable power sources, such as solar, with distributed, controllable generation, such as natural gas-fueled combustion turbines. They can also use energy storage and the batteries in electric vehicles to balance energy distribution and usage within the microgrid. Reliable electricity is vital for public health, especially vulnerable populations and people dependent on medical equipment.

E-24. Provide Battery Storage

This measure requires strategically deployed battery storage. Energy storage has no direct emissions effect. When deployed strategically, energy storage can make the grid more flexible, unlocking renewable energy and reducing GHG emissions. When deployed non-strategically, owners of energy storage assets are more likely to charge their facilities during off-peak periods when power prices are lower, in order to supply power during more expensive peak hours. Off-peak generation times such as nighttime hours are more likely to be dominated by conventional power sources, which, with the exception of nuclear and hydropower, are likely to be more emissions-intensive (Bistline and Young 2020). In California, the value of energy storage stems primarily from its ability to reduce renewable curtailment, thereby displacing fossil-fueled generation (Arbabzadeh et al. 2019). While this measure is currently not quantified and, according to some studies, could result in regional GHG and criteria pollutant emissions increases, it is recommended that users (1) review the most recent literature at the time of their project initiation and (2) evaluate any changes in policy or market for renewable energy to see if new findings more conclusively support a quantifiable emissions reduction.

Energy (Building Decarbonization)

E-25. Install Electric Heat Pumps

This measure requires installation of electric heat pumps as alternatives to conventional furnaces or air conditioners. Electric heat pumps use electricity to transfer heat between cool and warm spaces to either provide cooling or heating. When cooling is needed during the summer months, the pumps move warmer inside air to outside. The pumps operate in reverse during the winter, moving warmer outdoor air into the building to provide heat. Because heat pumps move warm air instead of generating heat, they are more efficient than conventional heating and cooling systems. When electric heat pumps replace fossil-fuel heating or cooling sources, they achieve a dual efficiency and decarbonization benefit. The most common types of heat pumps collect heat from the air (are air-to-air), water (water-to-air), or ground (geothermal-to-air). The performance and emissions reductions achieved by electric heat pumps depend heavily on the system type, cooling and heating loads, climate zone, season, and other project-specific variables.

Lawn and Landscaping

LL-2. Implement Yard Equipment Exchange Program

This measure requires the project to participate in an established yard equipment exchange program, supplement an established program, or implement a new program. When conventional gasoline-powered yard equipment (e.g., lawn mowers, leaf blowers and vacuums, shredders, trimmers, and chain saw) are exchanged for electric and rechargeable battery-powered yard equipment, direct GHG emissions from fossil-fuel combustion are displaced by indirect GHG emissions associated with the generation of electricity used to power the equipment. Commercial users of yard equipment should be targeted for this measure given their comparatively low adoption rate of electric yard equipment relative to residential users. If the specific equipment being replaced through the program is known, reductions may be quantified using the method described under Measure LL-1.

LL-3. Electric Yard Equipment Compatibility

This measure requires projects provide electrical outlets on the exterior of buildings as necessary for sufficient powering of electric lawnmowers and other landscaping equipment. For Measures LL-1 and LL-2 to be successfully implemented, electrical outlets on the exterior of buildings must be accessible so that the electric landscaping equipment can be charged.

Solid Waste

S-3. Require Edible Food Recovery Program Partnerships with Food Generators

This measure requires food service, wholesale, and retail sources of edible food partner with food recovery programs. Food recovery programs collect edible foods from commercial production and distribution channels that would otherwise be transported to a landfill and redistribute them for consumption. This measure would avoid emissions from the decomposition of non-diverted organic material in landfills.

S-4. Recycle Demolished Construction Material

This measure requires recycling of construction waste. Recycling demolished construction material reduces GHGs by displacing new construction materials, thereby reducing the need for new raw material acquisition and manufacturing. If the process of recycling construction materials is less carbon-intensive than the processes required to harvest and produce new construction materials, recycling results in a net reduction in GHG emissions. Using local recycled construction material would also reduce emissions associated with the transportation of new construction materials, which are typically manufactured farther away from a project site. Finally, recycling avoids sending materials to landfills. Wood-based materials decompose in landfills and contribute to methane (CH_4) emissions. Ensure onsite processing does not create nuisance issues for nearby residents.

S-5. Source Wood Materials from Urban Wood Re-Use Program

This measure requires projects to source wood materials from urban wood re-use programs. In areas where removed trees are sent to landfills, they decompose and contribute to CH_4 emissions. Wood re-use programs extend a tree's lifetime by converting it into a range of products and prolonging the sequestration benefit. Re-uses range from logs, lumber, woodchips, mulch, compost, biochar, animal fuel, paper products, engineered wood, furniture, and cellulosic ethanol.

Natural and Working Lands

N-5. Establish a Local Farmer's Market

This measure would establish a local farmer's market to provide project residents with a more local source of food, potentially reducing the number of trips and VMT by both consumers and food distribution to grocery stores and supermarkets. If the food sold at the local farmer's market is produced organically, it can also contribute to GHG reductions by displacing carbon-intensive food production practices. Work with local non-profits or foundations to provide Electronic Benefit Transfer (EBT) acceptance at the market, which facilitates access for lower-income populations. The USDA offers resource and guidance for farmer's markets accepting EBT, while some foundations offer multiplier programs, in which $1 of EBT funds becomes a greater value if spent at a farmer's market.

N-6. Establish Community Gardens

This measure would establish a community garden to provide project residents with locally sourced food, potentially reducing the number of trips and VMT by both consumers and food distribution to grocery stores and supermarkets. Community gardens can also contribute to GHG reductions by displacing carbon-intensive food production practices. Work with community residents and community-based organizations to make sure the gardens are designed inclusively and are open to all residents.

Construction

C-4. Use Local and Sustainable Building Materials

This measure requires using building materials that are locally sourced and processed (i.e., close to the project site, as opposed to in another state or country). This reduces VMT and therefore GHG emissions from fuel combustion. Using sustainable building materials, such as recycled concrete or sustainably harvested wood, also reduces GHG emissions due to the less carbon-intensive production process. Unlike measures that reduce GHG emissions during the operational lifetime of a project, using local and sustainable building materials mitigates emissions prior to the actual operational lifetime of a project.

Miscellaneous

M-4. Require Environmentally Responsible Purchasing

This measure requires projects to implement an environmentally responsible purchasing plan. Examples of environmentally responsible purchases include but are not limited to: purchasing products made from recycled materials or with sustainable packaging; purchasing post-consumer recycled paper, paper towels, and stationery; purchasing and stocking communal kitchens with reusable dishes and utensils; choosing sustainable cleaning supplies; purchasing products from restaurants, farms, or ranches that source materials or goods from locations that use soil conservation practices; and leasing equipment from manufacturers who will recycle the components at their end of life. Choosing locally made and distributed products reduces the distance required to transport the products from the distribution or manufacturing center to the project, thus reducing GHG emissions associated with transportation.

M-5. Fund Incentives for Green Technologies

This measure would fund incentives for green technologies. Examples of green technologies include energy-efficient and zero-emission vehicle fleets and off-road equipment, building electrification upgrades, low-flow fixtures in buildings, or energy-efficient stationary sources. The user may choose to contribute to an existing municipal energy fund or establish a new energy fund for the project. Recipients of energy fund grants could include neighborhood developers, home and commercial space builders, homeowners, and utilities. Energy funds allow recipients flexibility in choosing efficiency strategies while still achieving the desired effects of reduced energy use and associated GHG emissions. If coupled with local apprenticeship and job training, this measure can help provide workforce development in green jobs for the local community.

References

Arbabzadeh, M., R. Sioshansi, J. Johnson, and G. Keoleian. 2019. The role of energy storage in deep decarbonization of electricity production. *Nature Communications* 10(1):1–11. Available: https://www.nature.com/articles/s41467-019-11161-5.pdf. Accessed: October 2021.

Bistline, J., and D. Young. 2020. Emissions impacts of future battery storage deployment on regional power systems. *Applied Energy* 264:114678. Available: https://www.sciencedirect.com/science/article/abs/pii/S0306261920301902. Accessed: October 2021.

Goulias, K., R. Su, and E. McBride. 2020. *Revisiting the Impact of Teleworking on Activity-Travel Behavior Using Recent Data and Sequence-Based Analytical Techniques*. Pacific Southwest Region University Transportation Center. December. Available: https://metrans.org/assets/research/psr-19-15_goulias_final-report.pdf. Accessed: October 2021.

Intergovernmental Panel on Climate Change. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H. S., L. Buendia, K. Miwa, T. Ngara and K. Tanabe. (eds). Published: IGES, Japan.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp. Available: https://www.ipcc.ch/report/ar4/wg1/. Accessed: January 2021.

Intergovernmental Panel on Climate Change (IPCC). 2014. *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T. F., D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P. M. Midgley (eds.)]. Cambridge, United Kingdom, and New York, NY: Cambridge University Press. Available: https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf. Accessed: September 2021.

Salon, D. 2014. *Quantifying the Effect of Local Government Actions on VMT.* Institute of Transportation Studies, University of California, Davis. Prepared for the California Air Resources Board and the California Environmental Protection Agency. Available: https://ww2.arb.ca.gov/sites/default/files/classic/research/apr/past/09-343.pdf. Accessed: August 2021.

State of California, California State Transportation Agency, Department of California Highway Patrol. 2018. *2017 Annual Report of Fatal and Injury Motor Vehicle Traffic Crashes*. Available: https://www.chp.ca.gov/InformationManagementDivisionSite/Documents/2017%20ANNUAL%20REPORT%20CALIFORNIA.pdf. Accessed: November 2021.

EXHIBIT 12

Newhall Ranch Resource Management and Development Plan and Spineflower Conservation Plan

Final Additional Environmental Analysis

California Department of Fish and Wildlife
SCH No. 2000011025

June 12, 2017

Newhall Ranch
Resource Management and Development Plan
and Spineflower Conservation Plan

Final
Additional Environmental Analysis

PREPARED BY:

California Department of Fish and Wildlife
1416 Ninth Street
Sacramento, CA 95818

WITH ASSISTANCE FROM:

Ascent Environmental, Inc.
455 Capitol Mall, Suite 300
Sacramento, CA 95814

AND CONSULTATION WITH:

California Air Resources Board
1001 I Street
Sacramento, CA 95812

June 12, 2017

14010052.04

2 REVISED ADDITIONAL ENVIRONMENTAL ANALYSIS

Chapter 2 of the Final Environmental Analysis (Final AEA) presents updated versions of the environmental analysis and mitigation measure descriptions originally published in the Draft Additional Environmental Analysis (Draft AEA) for the greenhouse gas (GHG) analysis (Section 2.1 herein, formerly Chapter 2 of the Draft AEA) and unarmored threespine stickleback (Section 2.2 herein, formerly Chapter 3 of the Draft AEA). Specific revisions to these sections since the Draft AEA public circulation are shown with text deletions noted by ~~strikethrough~~ and text additions noted by underline. The revisions originate from either responses to public comments and/or clarifying information from the project applicant or California Department of Fish and Wildlife (CDFW). All information provided by the project applicant has been independently reviewed and analyzed prior to use in the Final AEA, consistent with CEQA Guidelines Section 15084(e).

The information contained within this chapter clarifies and expands on information in the Draft AEA and does not constitute "significant new information" requiring recirculation. Revisions do not involve identification of any new significant impacts, substantial increase in the severity of previously identified significant impacts, or feasible mitigation or alternative considerably different from those previously analyzed that the applicant declines to implement. (Public Resources Code Section 21092.1; CEQA Guidelines Section 15088.5.)

Sections 2.1, Global Climate Change/Greenhouse Gas Emissions, and Section 2.2, Unarmored Threespine Stickleback, are provided below.

2.1 GLOBAL CLIMATE CHANGE/GREENHOUSE GAS EMISSIONS

Section 2.1, Global Climate Change/Greenhouse Gas Emissions, was originally published as Chapter 2 of the Draft AEA. It is presented in its entirety in this section of the Final AEA with all updates and changes occurring since the publication of the Draft AEA. Section numbering and subheading levels have been adjusted herein to align with the organization of the Final AEA; however, table numbers, impact conclusion numbers, and mitigation measure numbers remain the same as published in the Draft AEA to keep them identical for ease of cross comparisons.

This section presents a summary of the current state of climate change science and greenhouse gas (GHG) emissions sources in California; a summary of applicable laws, regulations, and executive orders (EOs); quantification of project-generated GHG emissions; and discussion about their potential contribution to the cumulative impact of global climate change. The significance of the GHG emission impact of implementing the Newhall Ranch Resource Management and Development Plan (RMDP) and Spineflower Conservation Plan (SCP), collectively called the project herein, is assessed prior to the consideration of mitigation measures. Mitigation measures to reduce a potentially significant GHG impacts are described, based on independent review and analysis by CDFW, in consultation with ARB, of information and materials submitted by the project applicant.

Through the implementation of mitigation measures, including both emission reduction actions and offset projects/credits, the project applicant has committed to achieve zero net GHG emissions to eliminate the project's contribution of GHG emissions to the cumulative impact of climate change. The analysis in this section evaluates whether substantial evidence exists to demonstrate the feasibility and reliability of achieving the proposed zero net GHG emissions. Project emissions are analyzed at full buildout, which is planned to occur in 2030.

Table 2-1, shows project-generated GHG emissions, itemized by sector, including the unmitigated emissions, proposed reductions by mitigation measures, and post-mitigation emissions. Detailed analysis of project emissions and mitigation measures is provided in Section 2.1.3, Environmental Impacts and Mitigation Measures.

Table 2-1 Summary of Unmitigated and Post-Mitigation Annual Greenhouse Gas Emissions Associated with the Project at Full Buildout in the Planned Buildout Year (2030)

Emissions Activity/Mitigation Measure	Emissions (MT CO_2e/year)		
	Unmitigated	Reduction	Post Mitigation[1]
Mobile Sources	403,814		
		201,803	
			202,011
Electricity[2]	39,393		
		44,274	
			-4,880[3]
Natural Gas[2]	43,386		
		35,194	
			8,192
Area Sources	367		
		0	
			367
Water Consumption and Wastewater Treatment	8,190		
		0[4]	
			8,190
Solid Waste Generation	23,179		
		0[4]	
			23,179
Vegetation Removal	1,335		
		1,335	
			0
Construction	6,437		
		6,437	
			0
Sub-Total Annual Emissions (without MM 2-13)[5, 6]	**526,103**	**289,043**	**237,059**
MM 2-13 GHG Reductions		-237,059	
Total Annual Emissions	**526,103**		**0**

Notes: MT CO_2e/year = metric tons of carbon dioxide equivalent per year; TDV=Time Dependent Valuation; CEC=California Energy Commission; ZNE=Zero Net Energy

[1] Post mitigation emissions are calculated by subtracting estimated reductions from mitigation measures for each emission source from the unmitigated emission quantities, i.e., Post Mitigation Emissions = Unmitigated Emissions – Emissions Reductions.

[2] Reported unmitigated electricity and natural gas emissions are combined emissions from the CalEEMod output and the swimming pool calculations. To reflect compliance with the 2016 Title 24 Standards, CalEEMod default values were adjusted. The ZNE mitigation measures are split by assuming 78 percent of the mitigation will offset electricity and 22 percent will offset natural gas, consistent with actual emissions reductions from the 2016 Title 24 Standards. Emissions reductions from offsite building retrofits are split assuming 50 percent electricity reduction and 50 percent natural gas reduction. Refer to Technical Report Section 2.3.2 and Tables 2-13a through 2-14b of Draft AEA Appendix 1 for more detailed assumptions.

[3] Emissions reductions from direct and indirect energy consumption appear as a negative to represent TDV energy savings from use of photovoltaics combined with variations in natural gas pricing consistent with CEC's TDV model to achieve ZNE. Refer to Technical Report Tables 4-1a through 4-2d and Technical Report Appendix J of Draft AEA Appendix 1 for more detail.

[4] Emissions reductions from the area sources and water and wastewater treatment sectors were achieved through incorporation of emissions reducing project design features, and, therefore, are not quantified as mitigation reductions.

[5] Sub-Total Annual Emissions shown do not yet account for compensatory reductions proposed by the project applicant through use of direct measures and/or purchase of offset credits required by the GHG Reduction Plan in MM 2-13 except for MM 2-10. The project applicant has proposed commitment to achieve zero net GHG emissions, which would include direct measures and the use of offsets. Please refer to Section 2.3 for further explanation.

[6] Summarized emissions by mitigation measure are rounded to the nearest whole number; however, total emissions reflect the sum of exact emissions levels.

Source: Modeling conducted by Ramboll Environ in 2016. See Draft AEA Appendix 1 for detailed calculations.

2.1.1 Environmental Setting Relevant to GHG Emissions

GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE

Global climate change refers to changes in average climatic conditions (e.g., temperature, wind patterns, precipitation, and storms). Global warming, which is one aspect of climate change, is the observed increase in the average temperature of the Earth's surface and atmosphere. One identified cause of global warming is an increase of GHGs in the atmosphere; these gases allow the sun's rays to enter the Earth's atmosphere but trap the energy that is radiated back into space, resulting in a warming of the atmosphere called the "greenhouse effect."

The Physical Scientific Basis

Emissions of carbon dioxide (CO_2) are a leading cause of global climate change, with other pollutants such as methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons, and sulfur hexafluoride also contributing. (See Health & Saf. Code, Section 38505(g).) The magnitude of GHG impacts on global climate change differs because each GHG has a different global warming potential (GWP) (i.e., certain compounds have, on a pound-for-pound basis, greater contributions to global climate change than others). The impact of each GHG is measured as a combination of the volume of its emissions and its GWP using one pound of CO_2 as the common equivalent measure of GWP. (CO_2 has the greatest impact on global climate change because of the relatively large quantities of CO_2 emitted into the atmosphere.) Thus, GHG emissions are typically measured in terms of megagrams or metric tonnes (MT) of CO_2 equivalent (CO_2e). For the purposes of this analysis, a "tonne" refers to a metric ton (i.e., 1,000 kilograms or 2,204.6 pounds). GHG emissions are typically expressed as metric tons of carbon dioxide equivalent (MT CO_2e), where emissions of other GHGs are normalized with respect to the GWP of CO_2.

Greenhouse Gas Emission Sources

Emissions of GHGs contributing to global climate change are attributable in large part to human activities associated with the transportation, industrial/manufacturing, utility, residential, commercial, and agricultural emissions sectors (ARB 2014a). In California, the transportation sector is the largest emitter of GHGs, followed by electricity generation (ARB 2014a). Emissions of CO_2 are byproducts of fossil fuel combustion. CH_4, a highly potent GHG, primarily results from off-gassing (the release of chemicals from nonmetallic substances under ambient or greater pressure conditions) and is largely associated with agricultural practices and landfills. N_2O is also largely attributable to agricultural practices and soil management. CO_2 sinks, or reservoirs, include vegetation and the ocean, which absorb CO_2 through sequestration and dissolution (CO_2 dissolving into the water), respectively, two of the most common processes for removing CO_2 from the atmosphere.

The existing project site generally consists of vacant land, some agricultural uses, water wells, active oil and gas operations, abandoned oil wells, and associated access roads. As illustrated in Table 2.1-1, Summary of Existing On-Site GHG Emissions, the existing condition emissions inventory is estimated at approximately 11,021 MT CO_2e per year. Detailed calculations are shown in Technical Report Table ES-1 and Technical Report Appendix A, contained in Draft AEA Appendix 1.

Table 2.1-1 Summary of Existing On-Site GHG Emissions

Emissions-Generating Activity	Existing Emissions (MT CO_2e/year)
Methane emissions associated with oil wells	3,790
Energy use associated with oil wells	3,682
Energy use associated with water	2,987
N_2O emissions associated with fertilizer use	412
Emissions associated with diesel fuel usage	152
Total Existing On-Site GHG Emissions	**11,021**

Notes: MT CO_2e/year = metric tons of carbon dioxide equivalent per year; N_2O=nitrous oxide

Source: Modeling conducted by Ramboll Environ in 2016. See Technical Report Appendix A, contained in Draft AEA Appendix 1 for detailed calculations.

EFFECTS OF CLIMATE CHANGE ON THE ENVIRONMENT

Globally, climate change has the potential to impact numerous environmental resources through anticipated, though uncertain, impacts related to future air temperatures and precipitation patterns.

Scientific modeling predicts that the continued emissions of GHGs at or above current rates would induce more extreme climate changes during the 21st century than were observed during the 20th century. At the end of the 21st century, global surface temperature change is likely to exceed 1.5°C (relative to 1850-1900 levels) in all of the four assessed climate model projections but one (Intergovernmental Panel on Climate Change [IPCC] 2014).

The understanding of the role that GHG emissions plays on global climate trends is complex and involves varying uncertainties and a balance of different impacts. In addition to uncertainties about the extent to which human activity rather than solar or volcanic activity is principally responsible for increased warming, there also is evidence that some human activity has cooling, rather than warming, impacts, as discussed in publications by IPCC. IPCC is the leading international and intergovernmental body for the assessment of climate change and was established – in 1988 – by the United National Environment Programme and World Meteorological Organization to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts. Nonetheless, when all impacts and uncertainties are considered together, there is general scientific consensus that human activity contributes significantly to global climate change.

Acknowledging uncertainties regarding the rate at which anthropogenic (i.e., human-caused) GHG emission may continue to increase, and the impact of such emissions on climate change, IPCC devises emission scenarios that use various assumptions about the rates of economic development, population growth, and technological advancement over the course of the next century. These uncertainties are attributable to various factors under human control, such as future population growth and the locations of that growth; the amount, type, and locations of economic development; the amount, type, and locations of technological advancement; adoption of alternative energy sources; legislative and public initiatives to curb emissions; and public awareness and acceptance of methods for reducing emissions. For the IPCC Fifth Assessment Report, a set of four new scenarios, denoted Representative Concentration Pathways (RCP), were developed. RCPs are based on a combination of integrated assessment models, simple climate models, atmospheric chemistry and global carbon cycle models. The four RCPs include a mitigation scenario, two stabilizing scenarios, and one scenario with very high GHG emissions. "The RCPs can thus represent a range of 21st century climate policies, as compared with the no-climate policy of the Special Report on Emissions Scenarios (SRES) used in the AR3 and the AR4."

While the projected impacts of global climate change on weather and climate are uncertain and likely to vary regionally, the following impacts are expected by IPCC:

- it is very likely that the Arctic sea ice cover will continue to shrink and thin, with the Northern Hemisphere spring snow cover and global glacier volume also decreasing;
- it is virtually certain that there will be more frequent hot and fewer cold temperature extremes over most land areas on daily and seasonal timescales, with heat waves occurring at a higher frequency and duration;
- global surface temperature change for the end of the 21st century is likely to exceed 1.5°C relative to 1850 to 1900 for all RCP scenarios except the mitigation scenario. It is likely to exceed 2°C for the highest forcing scenario and one stabilizing scenario, and more likely than not to exceed 2°C for the remaining stabilizing scenario. Warming will continue beyond 2100 under all RCP scenarios except the mitigation scenario;
- the global ocean will continue to warm during the 21st century, with heat penetrating from the surface to the deep ocean and affecting ocean circulation;

- further uptake of carbon by the ocean will increase ocean acidification;
- changes in the global water cycle in response to the warming over the 21st century will not be uniform. The contrast in precipitation between wet and dry regions and between wet and dry seasons will increase, although there may be regional exceptions; and
- most aspects of climate change will persist for many centuries even if GHG emissions cease entirely.

Physical conditions beyond average temperatures could be indirectly affected by the accumulation of GHG emissions. For example, changes in weather patterns resulting from increases in global average temperature are expected to result in a decreased volume of precipitation falling as snow in California and an overall reduction in snowpack in the Sierra Nevada. Based upon historical data and modeling, the California Department of Water Resources (DWR) projects that the Sierra snowpack will experience a 25 to 40 percent reduction from its historic average by 2050 (DWR 2008:4). An increase in precipitation falling as rain rather than snow also could lead to increased potential for floods because water that would normally be held in the Sierra Nevada until spring could flow into the Central Valley concurrently with winter storm events (California Natural Resources Agency [CNRA] 2012:5). This scenario would place more pressure on California's levee/flood control system.

Another outcome of global climate change is sea level rise. Sea level rose approximately seven inches during the last century and, assuming that sea-level changes along the California coast continue to track global trends, sea level along the state's coastline in 2050 could be 10-18 inches higher than in 2000, and 31 to 55 inches higher by the end of this century (CNRA 2012: 9).

As the existing climate throughout California changes over time, the ranges of various plant and wildlife species could shift or be reduced, depending on the favored temperature and moisture regimes of each species. In the worst cases, some species would become extinct or be extirpated from the state if suitable conditions are no longer available (CNRA 2012: 11, 12).

Changes in precipitation patterns and increased temperatures are expected to alter the distribution and character of natural vegetation and associated moisture content of plants and soils. An increase in frequency of extreme heat events and drought are also expected. These changes are expected to lead to increased frequency and intensity of large wildfires (CNRA 2012: 11).

To protect the state's public health and safety, resources, and economy, CNRA — in coordination with other state agencies — has updated the *2009 California Climate Adaptation Strategy* with the 2014 *Safeguarding California: Reducing Climate Risk* plan (CNRA 2014). Additionally, in March 2016, CNRA released *Safeguarding California: Implementation Action Plans*, a document that shows how California is acting to convert the recommendations contained in the 2014 *Safeguarding California* plan into action. The 2016 *Action Plans* document is divided by ten sectors (i.e., agriculture, biodiversity and habitat, emergency management, energy, forestry, land use and community development, oceans and coastal resources and ecosystems, public health, transportation, and water), and shows the path forward by presenting the risks posed by climate change, the adaptation efforts underway, and the actions that will be taken to safeguard residents, property, communities, and natural systems.

Substantial work has been done at the international and national level to evaluate climatic impacts, and climate change and its potential impacts have been studied extensively in California. Cal-Adapt is a climate change scenario planning tool developed by the California Energy Commission (CEC) and the University of California Berkeley Geospatial Innovation Facility. Cal-Adapt currently downscales global climate model data to local and regional resolution under two emissions scenarios; the A-2 scenario represents a business-as-usual (BAU) future emissions scenario, and the B-1 scenario represents a lower GHG emissions future. According to Cal-Adapt, annual average temperatures in Los Angeles County are projected to rise by 3.8-6.4°F by 2100, with the range based on low- and high-emissions scenarios (Cal-Adapt 2016).

2.1.2 Regulatory Setting

FEDERAL

Clean Air Act

In *Massachusetts v. Environmental Protection Agency* (2007) 549 U.S. 497, the U.S. Supreme Court held that the U.S. Environmental Protection Agency (EPA) has authority under the Clean Air Act (CAA) to regulate CO_2 emissions if those emissions pose an endangerment to the public health or welfare.

In 2009, EPA issued an "endangerment finding" under the CAA, concluding that GHGs threaten the public health and welfare of current and future generations and that motor vehicles contribute to GHG emissions. These findings provide the basis for adopting national regulations to mandate GHG emission reductions under the CAA.

To date, EPA has exercised its authority to regulate mobile sources that reduce GHG emissions via the control of vehicle manufacturers, as discussed immediately below (see "Federal Vehicle Standards"). The EPA also has adopted standards that set a national limit on GHG emissions produced from new, modified, and reconstructed power plants, and has issued the Clean Power Plan, which is targeted toward the reduction of carbon emissions from existing power plants. Under the Clean Power Plan, EPA set state-specific interim and final performance rates for two subcategories of fossil fuel-fired electric generation units: fossil fuel-fired electric steam generating units and natural gas-fueled combined cycle generating units. The Clean Power Plan requires states to develop and implement plans that ensure that the power plants in their state – either individually, together or in combination with other measures – achieve the interim performance rates over the period of 2022 to 2029 and the final performance rates, rate-based goals or mass-based goals by 2030. In February 2016, the U.S. Supreme Court stayed implementation of the Clean Power Plan pending judicial review.

Federal Plan to Reduce GHG Emissions by 2025

In 2015, the U.S. State Department submitted the nation's GHG emissions reduction target to the United Nations Framework Convention on Climate Change. The submission, referred to as an Intended Nationally Determined Contribution, is a formal statement of the U.S. target to reduce the nation's emissions by 26 to 28 percent below 2005 levels by 2025.

The target is the culmination of a process that examined opportunities under existing regulatory authorities to reduce GHG emissions in 2025 from all sources in every economic sector. Several U.S. laws, as well as existing and proposed regulations thereunder, are relevant to the implementation of the U.S. target, including the CAA (42 U.S.C. Section 7401 et seq.), the Energy Policy Act (42 U.S.C. Section 13201 et seq.), and the Energy Independence and Security Act (42 U.S.C. Section 17001 et seq.) (The White House 2015).

Federal Vehicle Standards

In response to the *Massachusetts v. Environmental Protection Agency* decision, in 2007, the Bush Administration issued EO 13432 directing EPA, the Department of Transportation (DOT), and the Department of Energy (DOE) to establish regulations that reduce GHG emissions from motor vehicles, non-road vehicles, and non-road engines by 2008. In 2009, the National Highway Traffic Safety Administration (NHTSA) issued a final rule regulating fuel efficiency for and GHG emissions from cars and light-duty trucks for model year 2011; and, in 2010, EPA and NHTSA issued a final rule regulating cars and light-duty trucks for model years 2012–2016.

In 2010, President Obama issued a memorandum directing the same federal agencies to establish additional standards regarding fuel efficiency and GHG reduction, clean fuels, and advanced vehicle infrastructure. In response to this directive, EPA and NHTSA proposed stringent, coordinated federal GHG and fuel economy standards for model years 2017 to 2025 light-duty vehicles. The proposed standards are projected to achieve 163 grams/mile of CO_2 in model year 2025, on an average industry fleet-wide basis, which is equivalent to 54.5 miles per gallon (mpg) if this level were achieved solely through fuel efficiency. The final rule was adopted in 2012 for model years 2017–2021, and NHTSA intends to set standards for model years 2022–2025 in a future rulemaking.

In addition to the regulations applicable to cars and light-duty trucks described above, in 2011, EPA and NHTSA announced fuel economy and GHG standards for medium- and heavy-duty trucks for model years 2014 to 2018. The standards for CO_2 emissions and fuel consumption are tailored to three main vehicle categories: combination tractors, heavy-duty pickup trucks and vans, and vocational vehicles.

In August 2016, EPA and NHTSA adopted the next phase (Phase 2) of the fuel economy and GHG standards for medium- and heavy-duty trucks, which apply to vehicles with model year 2018 and later (EPA 2016). In response to EPA's adoption of the Phase 2 standards, ARB staff plan to propose a Phase 2 program for California, most likely in late 2016 or 2017 (ARB 2016a).

Energy Independence and Security Act

The Energy Independence and Security Act of 2007 (EISA) facilitates the reduction of national GHG emissions by requiring the following:

- increasing the supply of alternative fuel sources by setting a mandatory Renewable Fuel Standard (RFS) that requires fuel producers to use at least 36 billion gallons of biofuel in 2022;

- prescribing or revising standards affecting regional efficiency for heating and cooling products, procedures for new or amended standards, energy conservation, energy efficiency labeling for consumer electronic products, residential boiler efficiency, electric motor efficiency, and home appliances;

- requiring approximately 25 percent greater efficiency for light bulbs by phasing out incandescent light bulbs between 2012 and 2014; requiring approximately 200 percent greater efficiency for light bulbs, or similar energy savings, by 2020; and

- while superseded by EPA and NHTSA actions described above, (i) establishing mpg targets for cars and light trucks and (ii) directing NHTSA to establish a fuel economy program for medium- and heavy-duty trucks and create a separate fuel economy standard for trucks.

Additional provisions of the EISA address energy savings in government and public institutions, promote research for alternative energy, additional research in carbon capture, international energy programs, and the creation of "green jobs."

STATE

Numerous laws, plans, and regulations that require GHG emissions reductions have been implemented or are under development in California. This comprehensive statewide framework is summarized below.

Executive Order S-3-05

In 2005, former Governor Arnold Schwarzenegger signed EO S-3-05, which established the following GHG emission reduction goals for California:

- By 2010, reduce GHG emissions to 2000 levels;
- By 2020, reduce GHG emissions to 1990 levels; and
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

In adopting Assembly Bill (AB) 32, the Global Warming Solutions Act of 2006, and Senate Bill (32), the Global Warming Solutions Act of 2006: emissions limit, discussed below, the Legislature did not adopt the 2050 horizon-year goal from EO S-3-05.

Assembly Bill 32, the California Global Warming Solutions Act of 2006

AB 32 (Nunez, 2006), the California Global Warming Solutions Act of 2006, was enacted after considerable study and expert testimony before the Legislature. The heart of AB 32 is the requirement that statewide GHG emissions be reduced to 1990 levels by 2020 (Health & Saf. Code, Section 38550). To achieve this reduction mandate, AB 32 requires ARB to adopt rules and regulations in an open public process that achieve the maximum technologically feasible and cost-effective GHG reductions.

AB 32 charges ARB to monitor and regulate sources of GHG emissions to reduce the state's emissions level. In December 2007, ARB approved 427 million MT CO_2e as the total statewide GHG 1990 emissions level and 2020 emissions limit. This limit is an aggregate statewide limit, rather than sector- or facility-specific, and is in accordance with Health & Safety Code Section 38550.

Per Health & Safety Code Section 38561(b), ARB also is required to prepare, approve, and amend a scoping plan that identifies and makes recommendations on "direct emission reduction measures, alternative compliance mechanisms, market-based compliance mechanisms, and potential monetary and nonmonetary incentives for sources and categories of sources that [ARB] finds are necessary or desirable to facilitate the achievement of the maximum feasible and cost-effective reductions of greenhouse gas emissions by 2020."

ARB Climate Change Scoping Plan

In 2008, ARB approved the *Climate Change Scoping Plan: A Framework for Change* (2008 Scoping Plan) in accordance with Health & Safety Code Section 38561. During the development of the 2008 Scoping Plan, ARB created a planning framework that is comprised of eight emissions sectors: (1) transportation; (2) electricity; (3) commercial and residential; (4) industry; (5) recycling and waste; (6) high GWP gases; (7) agriculture; and, (8) forest net emissions. It establishes an overall framework for the measures that will be adopted to reduce California's GHG emissions from the eight emissions sectors to 1990 levels by 2020. In the Scoping Plan, ARB determined that achieving the 1990 emissions level in 2020 would require a reduction in GHG emissions of approximately 28.5 percent from the otherwise projected 2020 emissions level; i.e., those emissions that would occur in 2020, absent GHG-reducing laws and regulations (BAU).

To achieve the necessary GHG reductions to meet AB 32's 2020 target, ARB developed a series of reduction measures in the Scoping Plan covering a range of sectors and activities. Broadly, the reduction measures can be separated into capped sectors (i.e., covered by the Cap-and-Trade Program) and uncapped sectors. Emissions from capped sectors, which include the transportation, electricity, industrial, commercial, and residential sectors of the economy, were fixed under the rules of the Cap-and-Trade Program, and the majority of policy proposals developed by ARB and other state agencies pursuing GHG emissions-reducing strategies are designed to secure reductions from these sectors.

In 2011, ARB introduced the *Final Supplement to the AB 32 Scoping Plan Functional Equivalent Document (2011 Final Supplement)*, which contains the main strategies California will implement to achieve reduction from the state's projected 2020 emission level under a BAU scenario. ARB's revised 2020 projection takes into account the economic downturn that occurred in 2008, and includes reductions anticipated from the Renewable Portfolio Standard (RPS) and Advanced Clean Cars (ACC) (ARB 2015).

In May 2014, ARB released and has since adopted the *First Update to the Climate Change Scoping Plan* to identify the next steps in reaching AB 32 goals and evaluate the progress that has been made between 2000 and 2012 (ARB 2014a:4 and 5). According to the update, California is on track to meet the near-term 2020 GHG limit and is well positioned to maintain and continue reductions beyond 2020 (ARB 2014a:ES-2). The update also reports the trends in GHG emissions from various emission sectors.

Currently, ARB is preparing a 2030 Target Scoping Plan Update to address EO B-30-15 and SB 32, and specifically Governor Brown's statewide GHG emissions reduction target for 2030, as discussed below.

Senate Bill 375

SB 375 (Steinberg, 2008), the Sustainable Communities and Climate Protection Act, coordinates land use planning, regional transportation plans, and funding priorities to reduce GHG emissions from passenger vehicles through better-integrated regional transportation, land use, and housing planning that provides easier access to jobs, services, public transit, and active transportation options. SB 375 specifically requires the Metropolitan Planning Organization (MPO) relevant to the project area (here, the Southern California Association of Governments [SCAG]) to include a Sustainable Communities Strategy (SCS) in its Regional Transportation Plan (RTP) that will achieve GHG emission reduction targets set by ARB by reducing vehicle miles traveled (VMT) from light-duty vehicles through the development of more compact, complete, and efficient communities.

Executive Order B-30-15

In April 2015, Governor Brown signed EO B-30-15, which established the following GHG emission reduction goal for California: by 2030, reduce GHG emissions to 40 percent below 1990 levels. This EO also directed all state agencies with jurisdiction over GHG-emitting sources to implement measures designed to achieve the new interim 2030 goal, as well as the pre-existing, long-term 2050 goal identified in EO S-3-05 (see discussion above). Additionally, the EO directed ARB to update its Scoping Plan (see discussion above) to address the 2030 goal. Therefore, in the coming months, ARB is expected to develop statewide inventory projection data for 2030, and identify reduction strategies capable of securing emission reductions that allow for achievement of the EO's new interim goal.

Senate Bill 32 and Assembly Bill 197, Statutes of 2016

In August 2016, Governor Brown signed SB 32 and AB 197, which are aimed at California's GHG reduction programs beyond 2020. SB 32 amended the Health and Safety Code to include Section 38566, which contains language to requiring ARB to ensure that a statewide GHG emissions are reduced to at least 40 percent below the AB 32 goal of 1990 levels no later than December 31, 2030. SB 32 codified the targets established by EO B-30-15 for 2030, which set the next interim step in the state's continuing efforts to pursue the long-term target expressed in EOs S-3-05 and B-30-15 of 80 percent below 1990 emissions levels by 2050.

AB 197 amended the existing Health and Safety Code sections and established new statutory directions, including the following provisions. Section 9147.10 establishes a six-member Joint Legislative Committee on Climate Change Policies to ascertain facts and make recommendations to the Legislature. ARB is required to appear before this committee annually to present information on GHG emissions, criteria pollutants, and toxic air contaminants from sectors covered by the Scoping Plan. Section 38562.5 requires that ARB consider social cost when adopting rules and regulations to achieve emissions reductions, and prioritize reductions at large stationary sources and from mobile sources. Section 38562.7 requires that each Scoping Plan update identify the range of projected GHG and air pollution reductions and the cost-effectiveness of each emissions reduction measure.

Advanced Clean Cars Program

In 2012, ARB adopted the ACC program, an emissions-control program for passenger vehicles and light-duty truck for model years 2017–2025, thereby continuing the regulatory framework established under the Pavley standards beyond model year 2016. The program combines the control of smog, soot, and GHG emissions with requirements for greater numbers of zero emission vehicles. By 2025, when the rules will be fully implemented, new automobiles will emit 34 percent fewer GHGs and 75 percent fewer smog-forming emissions.

Low Carbon Fuel Standard

EO S-1-07, as issued by former Governor Arnold Schwarzenegger, called for a 10 percent or greater reduction in the average fuel carbon intensity for transportation fuels in California regulated by ARB by 2020. Carbon intensity is a measure of the GHG emissions associated with the various production, distribution and use steps in the "lifecycle" of a transportation fuel. In response, ARB adopted the Low Carbon Fuel Standard (LCFS) regulations in 2009, which became fully effective in April 2010. Thereafter, a lawsuit was filed challenging ARB's adoption of the regulations; and, in 2013, a court order was issued compelling ARB to remedy substantive and procedural defects of the LCFS adoption process under CEQA (*POET, LLC v. ARB* (2013) 217 Cal.App.4th 1214). However, the court allowed implementation of the LCFS to continue pending correction of the identified defects. In September 2015, ARB re-adopted the LCFS regulations.

Pavley Regulations

AB 1493 (Pavley, 2002) required ARB to adopt regulations to reduce GHG emissions from non-commercial passenger vehicles and light-duty trucks for model years 2009–2016. In September 2004, and pursuant to AB 1493, ARB approved regulations (which are often referred to as the "Pavley standards") to reduce GHG emissions from new motor vehicles beginning with the 2009 model year. In September 2009, ARB adopted amendments to the Pavley standards to reduce GHG emissions from new motor vehicles through the 2016 model year.

Zero Emissions Vehicles

Zero emission vehicles (ZEVs) include plug-in electric vehicles, such as battery electric vehicles and plug-in hybrid electric vehicles, and hydrogen fuel cell electric vehicles.

In 2012, Governor Brown issued EO B-16-2012, which calls for the increased penetration of ZEVs into California's vehicle fleet to help California achieve a reduction of GHG emissions from the transportation sector equaling 80 percent less than 1990 levels by 2050. In furtherance of that statewide target for the transportation sector, the EO also calls upon ARB, CEC, and the California Public Utilities Commission (CPUC) to establish benchmarks that will: (1) allow over 1.5 million ZEVs to be on California roadways by 2025, and (2) provide the state's residents with easy access to ZEV infrastructure.

In furtherance of those goals, in February 2013, the Governor's Interagency Working Group on ZEVs issued the *2013 ZEV Action Plan: A roadmap toward 1.5 million zero-emission vehicles on California roadways by 2025*. Additionally, in May 2014, the National Renewable Energy Laboratory issued the *California Statewide Plug-In Electric Vehicle Infrastructure Assessment* (Infrastructure Assessment report) prepared at the request of the CEC. In the Infrastructure Assessment report, CEC noted that "can't miss" ZEV charging locations are residential and workplace areas.

California is incentivizing the purchase of ZEVs through implementation of the Clean Vehicle Rebate Project, which is administered by a non-profit organization (The Center for Sustainable Energy) for ARB and currently subsidizes the purchase of passenger near-zero and ZEVs as follows:

- Hydrogen Fuel Cell Electric Vehicles: $5,000
- Battery Electric Vehicles: $2,500
- Plug-In Hybrid Electric Vehicles: $1,500
- Neighborhood Electric Vehicles and Zero Emission Motorcycles: $900

In its 2014 First Update to the Scoping Plan, ARB recognized that the light-duty vehicle fleet "will need to become largely electrified by 2050 to meet California's emission reduction goals" (ARB 2014a:48). Accordingly, ARB's ACC program – summarized above – requires about 15 percent of new cars sold in California in 2025 to be a plug-in hybrid, battery electric, or fuel cell vehicle (ARB 2014a:47).

Short-Lived Climate Pollutant Reduction Strategy

SB 605 (Lara, Chapter 523, Statutes of 2014) directed ARB to developed comprehensive short-lived climate pollutant (SLCP) strategy, in coordination with other state agencies and local air quality management and air pollution control districts. Governor Brown has identified reductions in SLCP emissions as one "pillar" to meet the goals of AB 32. ARB staff released a proposed SLCP Strategy in April 2016. Subsequently in September 2016, the Legislature passed and Governor Brown signed Senate Bill 1383 (Lara, Chapter 395, Statutes of 2016) mandating ARB to take certain specific actions with regard to the SLCP strategy. Specifically, it mandated that ARB, no later than January 1, 2018, approve and begin to implement the SLCP strategy developed under Health and Safety Code section 39730 to achieve specified targets identified for each of the pollutants and after carrying out certain procedures and analyses. In response to this new mandate, ARB is revising the SLCP Strategy to reflect the requirements of the bill. SB 1383 identifies specific reduction targets for three SLCPs (i.e., black carbon, fluorinated gases, and methane), which the SLCP Strategy will address.

Senate Bill X1-2 (2011) and Senate Bill 350 (2015)

SB X1-2 of 2011 requires all California utilities to generate 33 percent of their electricity from renewables by 2020. SB X1-2 sets a three-stage compliance period requiring all California utilities, including independently owned utilities, energy service providers, and community choice aggregators, to generate 20 percent of their electricity from renewables by December 31, 2013; 25 percent by December 31, 2016; and 33 percent by December 31, 2020. SB X1-2 also requires the renewable electricity standard to be met increasingly with renewable energy that is supplied to the California grid from sources within, or directly proximate to, California. SB X1-2 mandates that renewables from these sources make up at least 50 percent of the total renewable energy for the 2011-2013 compliance period, at least 65 percent for the 2014-2016 compliance period, and at least 75 percent for 2016 and beyond.

Most recently, Governor Edmund G. Brown signed into legislation SB 350 in October 2015, which requires retail seller and publicly owned utilities to procure 50 percent of their electricity from eligible renewable energy resources by 2030, with interim goals of 40 percent by 2024, and 45 percent by 2027.

California Building Efficiency Standards (Title 24, Part 6)

Title 24, Part 6 of the California Code of Regulations (CCR) regulates the design of building shells and building components. The standards are updated periodically to allow for consideration and possible incorporation of new energy efficiency technologies and methods. CEC's 2016 Building Energy Efficiency Standards (2016 Building Standards), which become effective on January 1, 2017, are the most current version of these standards.

CPUC, CEC, and ARB also have a shared, established goal of achieving Zero Net Energy (ZNE) for new construction in California. The key policy timelines include: (1) all new residential construction in California will be ZNE by 2020, and (2) all new commercial construction in California will be ZNE by 2030.

The ZNE goal generally means that new buildings must use a combination of improved efficiency and renewable energy generation to meet 100 percent of their annual energy need, as specifically defined by the CEC:

> "A ZNE Code Building is one where the value of the energy produced by on-site renewable energy resources is equal to the value of the energy consumed annually by the building, at the level of a single 'project' seeking development entitlements and building code permits, measured using the [CEC]'s Time Dependent Valuation (TDV) metric. A ZNE Code Building meets an Energy Use Intensity value designated in the Building Energy Efficiency Standards by building type and climate zone that reflect best practices for highly efficient buildings" (CEC 2015:41).

In addition to CEC's efforts, in 2008, the California Building Standards Commission adopted the nation's first green building standards. The California Green Building Standards Code (Part 11 of Title 24) are commonly referred to as CALGreen, and establish voluntary and mandatory standards pertaining to the planning and design of sustainable site development, energy efficiency, water conservation, material conservation, and interior air quality. CALGreen is periodically amended, and the 2016 CALGreen standards become effective on January 1, 2017.

The Building Energy Efficiency Standards are updated on approximately a three-year cycle. The 2019 standards will would achieve greater energy efficiency as compared to the 2016 standards. Residential and non-residential buildings built later than 2019 will be required to comply with the 2019 standards, as will other future residential and non-residential buildings constructed within the timeframe of future editions of the standards.

LOCAL

SCAG's Regional Transportation Plan/Sustainable Communities Strategy

As previously discussed, SB 375 requires SCAG to incorporate an SCS into its RTP that achieves the GHG emission reduction targets set by ARB. As required by SB 375, ARB adopted year 2020 and 2035 GHG reduction targets for each metropolitan region. The SB 375 targets for the Southern California region under SCAG's jurisdiction in 2020 and 2035 are reductions in per capita GHG emissions of 8 percent and 13 percent, respectively (ARB 2014b).

Pursuant to Government Code Section 65080(b)(2)(K), an SCS does not: (i) regulate the use of land; (ii) supersede the land use authority of cities and counties; or (iii) require that a city's or county's land use policies and regulations, including those in a general plan, be consistent with it.

2012 Sustainable Communities Strategy

In April 2012, SCAG adopted its first-ever SCS, which is included in the *2012–2035 Regional Transportation Plan/Sustainable Communities Strategy* (2012 RTP/SCS). The goals and policies of the SCS that reduce VMT (and result in corresponding GHG emission reductions) focus on transportation and land use planning that include building infill projects, locating residents closer to where they work and play, and designing communities so there is access to high quality transit service. SCAG's 2012 SCS is expected to reduce per capita transportation emissions by 9 percent in 2020 and by 16 percent in 2035. In 2012, ARB accepted SCAG's determination that the 2012 SCS would meet the region's GHG reduction targets (ARB 2012).

2016 Sustainable Communities Strategy

In April 2016, SCAG adopted the 2016-2040 RTP/SCS: A Plan for Mobility, Accessibility, Sustainability and a High Quality of Life (2016 RTP/SCS). SCAG's 2016 SCS is expected to reduce per capita transportation emissions by 8 percent in 2020, 18 percent in 2035, and 21 percent in 2040. In June 2016, ARB accepted SCAG's determination that the 2016 SCS would meet the region's GHG reduction targets for 2020 and 2035.

County of Los Angeles General Plan

The County Board of Supervisors adopted the Los Angeles County General Plan 2035 in October 2015. The General Plan directs future growth and development in the County's unincorporated areas and establishes goals, policies, and objectives that pertain to the entire County.

As part of the General Plan's Air Quality Element, the County adopted a Community Climate Action Plan (CCAP) to reduce GHG emissions associated with community (not municipal) activities in unincorporated Los Angeles County. The CCAP addresses emissions from building energy, land use and transportation, water consumption and waste generation, and sets forth the County's path to a sustainable future that achieves identified GHG reductions. More precisely, the CCAP includes 26 local actions that are grouped into five emissions reduction strategy areas: (1) green building and energy; (2) land use and transportation; (3) water conservation and wastewater; (4) waste reduction, reuse and recycling; and, (5) land conservation and tree planting.

County of Los Angeles Community Climate Action Plan

The County of Los Angeles CCAP provides that public agencies and private developers may use it to comply with project-level review requirements pursuant to CEQA, because it accords to the tiering requirements established by CEQA Guidelines Section 15183.5(b)(1). As such, the CCAP provides that project-specific environmental documents that incorporate applicable emissions reduction strategies can rely on the GHG analysis in the Environmental Impact Report (EIR) certified for the County's General Plan (including the CCAP) to meet project-level CEQA evaluation requirements for the time period covered by the CCAP. Projects that demonstrate consistency with applicable emissions reduction strategies can be determined to have a less-than-significant impact on GHG emissions and global climate change.

The CCAP focuses on compliance with AB 32 and includes GHG reduction strategies up to the year 2020 and provides a projected inventory for 2035. The actions included in the CCAP will help Los Angeles County achieve GHG reductions consistent with statewide goals by 2020. By 2021, the County will develop an update to the CCAP for the years following 2020. Because the current CCAP does not apply to the full project buildout year (2030), for the purposes of this project, the CCAP and its associated environmental documents cannot be relied on for GHG significance determinations. The updated CCAP containing projections and reduction strategies up through the year 2035 would be intended to serve as a qualified plan that may be applied to future project implementation actions occurring after the adoption of the updated CCAP.

South Coast Air Quality Management District

The South Coast Air Quality Management District (SCAQMD) is principally responsible for comprehensive air pollution control in the South Coast Air Basin, which includes Los Angeles, Orange, and the urbanized portions of Riverside and San Bernardino counties. SCAQMD works directly with SCAG, County transportation commissions, and local governments, and cooperates actively with all federal and state government agencies to regulate air quality.

Adopted Threshold for Stationary Source Projects

In 2008, SCAQMD's Governing Board adopted an interim CEQA GHG significance threshold of 10,000 MT CO_2e per year for industrial stationary source projects for which SCAQMD is the CEQA lead agency. When adopting its threshold, the Governing Board authorized the use of offsets as mitigation (SCAQMD 2008).

Draft Threshold for All Other Project Types

For all other projects (i.e., non-stationary source projects), SCAQMD staff developed a draft, multi-tier framework to assist with the CEQA significance evaluation process. The draft framework recognized the relevance of locally adopted GHG reduction plans, and allowed for the use of such plans in the significance evaluation process. Additionally, the draft framework included the development of the following efficiency targets:

> 2020: 4.8 MT CO_2e per year per service population (defined to include residents plus workers)
> 2035: 3.0 MT CO_2e per year per service population (same as above)

If none of the prescribed performance standards are met, the draft framework recognized the use of off-site mitigation.

As of October 2016, SCAQMD's Governing Board has not adopted the draft staff proposal. Therefore, no GHG significance thresholds are approved for use in the South Coast Air Basin by the applicable regional air district (i.e., SCAQMD).

Santa Clarita Valley Area Plan: One Valley One Vision 2012

The Santa Clarita Valley Area Plan: One Valley One Vision 2012 (Area Plan) serves as a long-term guide for development in the Santa Clarita Valley (Valley) Planning Area over the next 20 years. The Area Plan ensures consistency between the General Plans of the County and the City of Santa Clarita (City) to achieve common goals. The primary GHG-related policy of the Area Plan is the requirement that the County create and adopt a Climate Action Plan; that effort is complete, as discussed above.

2.1.3 Environmental Impacts and Mitigation Measures

GREENHOUSE GAS PROVISIONS IN CEQA GUIDELINES

In 2007, SB 97 was enacted calling for the preparation and adoption of CEQA Guidelines to address environmental impacts of GHG emissions. CEQA Section 21083.05 was added by the statute and directed that guidelines be developed "for the mitigation of greenhouse gas emissions or the impacts of greenhouse gas emissions as required by this division, including, but not limited to, impacts associated with transportation or energy consumption." A series of CEQA Guidelines amendments were added in 2010 to fulfill the requirements of SB 97. Key provisions relevant to determining the significance of GHG emissions are summarized as follows.

Section 15064.4 was added as one of a set of amendments addressing GHG. The Guidelines state:

(a) "The determination of the significance of greenhouse gas emissions calls for a careful judgment by the lead agency consistent with the provisions in Section 15064. A lead agency should make a good-faith effort, based to the extent possible on scientific and factual data, to describe, calculate or estimate the amount of greenhouse gas emissions resulting from a project…"

(b) A lead agency should consider the following factors, among others, when assessing the significance of impacts from greenhouse gas emissions on the environment:

(1) The extent to which the project may increase or reduce greenhouse gas emissions as compared to the existing environmental setting;

(2) Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project;

(3) The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of greenhouse gas emissions. Such requirements must be adopted by the relevant public agency through a public review process and must reduce or mitigate the project's incremental contribution of greenhouse gas emissions. If there is substantial evidence that the possible impacts of a particular project are still cumulatively considerable notwithstanding compliance with the adopted regulations or requirements, an EIR must be prepared for the project.

Additionally, under CEQA Guidelines Section 15126.4(c)(3)-(4), a project's GHG emissions can be reduced by "[o]ff-site measures, including offsets that are not otherwise required" and "[m]easures that sequester greenhouse gases." Therefore, the CEQA Guidelines allow projects to reduce GHG emissions by relying on voluntary market offsets that are not otherwise required as well as other offsite and sequestration measures that result in GHG reductions.

THRESHOLD OF SIGNIFICANCE FOR THE ADDITIONAL ENVIRONMENTAL ANALYSIS

Section 15064 of the CEQA Guidelines provides the foundational guidance for determinations of significant effect on the environment. As noted in subpart (b) of Section 15064, "(t)he determination of whether a project may have a significant effect on the environment calls for careful judgment on the part of the public agency involved, based to the extent possible on scientific and factual data. An ironclad definition of significant effect is not always possible because the significance of an activity may vary with the setting."

Recognizing that GHG emissions contribute to the cumulative impact condition of global climate change, Section 15064(h)(1) is also pertinent. When assessing if a significant environmental effect may occur, Section 15064(h)(1) states that "the lead agency shall consider whether the cumulative impact is significant and whether the effects of the project are cumulatively considerable." A cumulative impact may be significant when the project's incremental effect, though individually limited, is cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of other past, current, and reasonably foreseeable probable future projects. As discussed in Section 2.1, Environmental Setting, climate change is the product of incremental contributions of GHGs on a global scale; therefore, a project's cumulatively considerable GHG emissions, even if relatively small in magnitude compared to world-wide emissions, could ultimately contribute to the progression of climate change.

To define the appropriate approach to the judgment of significance in the case of this project and the Additional Environmental Analysis (AEA) prepared in response to a Supreme Court decision, CDFW has been guided and informed by principles detailed in CEQA Guidelines Sections 15064 and 15064.4 and relevant portions of Guidelines Appendix G. CDFW also recognizes the guidelines' recommendations for a lead agency to consider the project's consistency with relevant, adopted plans and the direction in CEQA Guidelines Section 15125(d) to discuss any inconsistencies with applicable regional plans, including plans for the reduction of GHG emissions. In Appendix G of the State CEQA Guidelines, two questions are provided to help assess if the project would result in a potentially significant impact on climate change. Would the project:

- generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment; or
- conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of GHGs?

In response to the Supreme Court's decision, the project applicant approached CDFW to propose extensive, tailored mitigation strategies to minimize GHG emissions from project land developments and then, for emissions that cannot be fully avoided, compensate through offsets, resulting in zero net GHG emissions compared to existing conditions (i.e., no net increase in GHG emissions). The project applicant has proposed the commitment to achieve zero net GHG emissions using feasible and reliable emission-reduction actions related to the land development project, the implementation of direct measures to reduce GHG emissions offsite, and the procurement of GHG offsets. The intended net outcome would be to eliminate any contribution of GHG emissions to the cumulative impact of global climate change.

In light of the project applicant's proposed commitment and modifications to the project, and in consideration of the direction from the CEQA Guidelines, the threshold of significance for the Newhall Ranch RMDP and SCP Project will be to feasibly and reliably attain the project applicant's commitment to achieve no net increase in GHG emissions. With such an outcome, the project would not increase GHG emissions, which is applicable to Section 15064.4(b)(1). Similarly for cumulative impacts, because of the commitment to achieve zero net GHG emissions, the project's incremental contribution to climate change would be eliminated, and therefore it would not be cumulatively considerable. With no increase in GHG emissions compared to existing conditions, any inconsistencies with relevant plans would be avoided. If, through the zero GHG emissions commitment, the project demonstrates that it may be implemented and operate without increasing emissions of GHGs beyond the existing conditions, the project-level and cumulative impact to global climate change would be less than significant.

In the evaluation of GHG-related impacts, CDFW has exercised its independent lead agency review and analysis, pursuant to Public Resources Code section 21082.1(c)(1). CDFW has applied its judgment and discretion, in consultation with ARB, in estimating the project's emissions, defining the zero net commitment detailed in the additional analysis, making the project-specific impact significance determination and cumulative considerable contribution determination, and including mitigation measures to achieve the project commitment.

The intent of this analysis is not to present the use of a zero GHG emissions commitment as a generally applied threshold of significance for GHG impacts. Its use herein is related directly to the facts surrounding the project and the project applicant's proposed commitment. Achieving zero net GHG emissions is the appropriate threshold for the proposed project in this case. CDFW recognizes there are multiple pathways available under CEQA for a lead agency to assess and analyze the significance of project-specific GHG emissions. Consistent with the CEQA Guidelines principles highlighted above, determining the significance of related effects is a matter of lead agency discretion, requiring careful judgment on a project-by-project basis. Achieving zero net emissions is just one way to reach a less-than-significant conclusion; it is not the only approach; and it may not be needed or appropriate for all projects.

ANALYSIS METHODS

Project-related operational emissions of GHGs were estimated for the following sources: area sources (e.g., landscaping-related fuel combustion sources), energy use associated with residential and non-residential buildings, water and wastewater treatment and distribution, solid waste, and mobile sources (e.g., passenger vehicles). In addition, the one-time increase in emissions associated with construction activities and vegetation changes was quantified. The typical types of GHG emissions resulting from mixed-use developments, such as the proposed project, are CO_2, CH_4, and N_2O. GHG emissions are measured in terms of MT CO_2e, which is calculated as the product of the mass emitted of a given GHG and its GWP.

The impact analysis in the AEA first estimates GHG emissions from the project construction and operation prior to consideration of mitigation measures. The project applicant has proposed mitigation measures to reduce and compensate for GHG emissions in response to the Supreme Court's decision on the previous 2010 Final EIR. The project applicant's proposal includes the commitment that the project would achieve zero net GHG emissions through the implementation of emission-reduction measures applied to project elements and activities, direct measures to reduce GHG emissions offsite, and the procurement of compensatory GHG offsets. CDFW has independently reviewed and analyzed, in consultation with ARB, the proposed mitigation measures. This section concludes by assessing the significance of the project's GHG emissions after consideration of the proposed mitigation measures.

Short-term construction-generated and long-term operational GHG emissions were calculated using the California Emissions Estimator Model (CalEEMod) Version 2013.2.2 computer program (SCAQMD 2013). CalEEMod uses widely accepted models for emission estimates combined with appropriate default data that can be used if site-specific information is not available. These models and default estimates use sources such as the EPA AP-42 emission factors, and ARB's on-road and off-road equipment emission models such as the EMission FACtor model (EMFAC) and the Emissions Inventory Program model (OFFROAD). EMFAC is an emission factor model used to calculate emissions rates from on-road vehicles (e.g., passenger vehicles). The emission factors used by CalEEMod are based on the ARB EMFAC2011 program. OFFROAD is an emission factor model used to calculate emission rates from off--road mobile sources (e.g., construction equipment, agricultural equipment). The off-road diesel emission factors used by CalEEMod are based on the ARB OFFROAD2011 program.

The 2013.2.2 version of CalEEMod does not incorporate the updated version of EMFAC (2014) which includes various updates, notably the incorporation of EPA and ARB regulations and standards. The updates were in response to regulations enacted through California's ACC Program and NHTSA Phase 1 standards. Therefore, EMFAC2014 information was incorporated into the analysis in lieu of CalEEMod's default use of EMFAC2011 information. Notably, EMFAC2014 (unlike EMFAC2011) excludes GHG emission reductions from LCFS.

In addition, CalEEMod contains default values and methodologies consistent with existing regulations for each region. Appropriate statewide default values can be used if regional default values are not defined. Default factors for Los Angeles County area (within the SCAQMD jurisdiction) were used for the GHG emission inventory, unless otherwise noted in the methodology descriptions below.

CalEEMod uses GWPs from the IPCC Second Assessment Report, which is 310 for N_2O and 21 for CH_4. Therefore, the GWPs in the IPCC Fourth Assessment Report of 298 for N_2O and 25 for CH_4 were manually incorporated to CalEEMod output as the Fourth Assessment Report to be consistent with current GWPs used by ARB in its current emission inventories.

Modeling assumptions are included in the Technical Report contained in Draft AEA Appendix 1. Where appropriate, directions to Technical Report sections, tables, and appendices within Draft AEA Appendix 1 that relate to specific modeling details are provided to support the GHG analysis.

Construction Emissions

Model assumptions for construction-related emissions were based on project-specific information (i.e., number and type of units, construction phasing based on site location, start date of construction, area to be graded, area to be paved, and year of operation); and default values in CalEEMod that are based on the project's location and land use types. The project's construction schedule consists of six stages, with construction-related activities commencing in March 2018 and concluding in December 2030. This schedule conservatively assumes that construction may continue to the end of 2030 when the project reaches full operation. While some construction phases are conservatively identified to conclude in the second half of the 2030 calendar year, the project's absorption schedule anticipates that the project would be fully constructed and occupied during the 2030 calendar year.

For each of the stages, the major construction phases included are grading, trenching or improvements, paving, building construction, and architectural coating. GHG emissions from these construction phases are largely attributable to fuel use from construction equipment and worker commuting vehicles. Construction-related emissions were estimated using CalEEMod Version 2013.2.2. The construction schedule, off-road equipment lists and equipment specifications used in CalEEMod are project specific estimates, and consistent with the total level of construction equipment activity analyzed in the *Final Joint Environmental Impact Statement/EIR (EIS/EIR) for the RMDP and SCP Project* GHG analysis.

Adjustments were made to CalEEMod's default parameters for the number of worker and vendor trips. CalEEMod default assumptions result in an over-estimation of the number of vendor and worker trips during the building construction and architectural coating phases due to the model's assumption that all buildings are constructed simultaneously during every year of construction activity. The project proposes to phase development such that construction-related activities would occur on various portions of the total development area from year-to-year. Therefore, an adjustment factor was applied to correct CalEEMod's number of vendor and worker trips based on the estimated number of residential dwelling units and non-residential square footage being built and painted in each calendar year. Additional details on construction-related inputs to CalEEMod are shown in Technical Report Tables 2.3-1 through 2.3-5 and Technical Report Appendix B, contained in <u>Draft</u> AEA Appendix 1.

Area Sources

Area sources in CalEEMod are direct sources of GHG emissions. The area source GHG emissions included in this analysis result from landscaping-related fuel combustion sources, such as lawn mowers. GHG emissions due to natural gas combustion in buildings, including fireplaces, are excluded from this section as they are included in the emissions associated with building energy use. Additional details on area source inputs to CalEEMod are shown in Technical Report Table 2-11 and Technical Report Appendix B, contained in <u>Draft</u> AEA Appendix 1.

Energy Use

Natural gas combustion used for space heating, water heating, and cooking is a direct source of GHG emissions from the project. GHGs are also emitted during the generation of electricity from fossil fuels; these emissions are considered to be indirect emissions.

Residential building energy use data for the project was generated by ConSol using the CEC-approved CBECC-Res 2016 software <u>(EnergyPro 6.8 and 7.1)</u>. The total residential energy use rates were input into CalEEMod. CalEEMod default values were used in combination with building energy use data prepared by ConSol using CEC-approved building energy modeling software (EnergyPro 6.8 and 7.1). The project<u>, for purposes of estimating unmitigated emissions,</u> was assumed to comply with the 2016 Title 24 efficiency standards; however, CalEEMod provides default values based on the 2008 Title 24 Standards. Therefore, the 2016 Title 24 energy efficiency improvement from 2008 Title 24 were applied to the relevant default energy intensity factors to estimate energy demand for the project. More detailed assumptions regarding residential building energy use is contained in Technical Report Tables 4-1a through 4-1d and Technical Report Appendix C, contained in <u>Draft</u> AEA Appendix 1.

The project's non-residential building energy use data was generated using default values in CalEEMod in combination with building energy use data prepared by ConSol using CEC-approved building energy modeling software (EnergyPro 6.8 and 7.1). Because CalEEMod is based on the 2008 Title 24 Standards, percentage reductions were applied to CalEEMod default energy intensity factors to estimate the energy savings resulting from implementation of the 2016 Title 24 Standards. Additional assumptions about non-residential building energy are shown in Technical Report Tables 4-2a through 4-2d and Technical Report Appendix C of <u>Draft</u> AEA Appendix 1.

The swimming pools at the project's private recreation centers were assumed to use electricity for filters and pumps, and natural gas for water heating. See Technical Report Table 2-14a of Draft AEA Appendix 1 for more detail.

Further, the CalEEMod default CO_2 intensity factor was modified to reflect compliance with 50 percent RPS for 2030 based on SCE Power/Utility Protocol (PUP) reports. CalEEMod intensity factors for CH_4 and N_2O were retained to provide a more conservative estimate for these emissions. Additional detail is contained in Technical Report Appendix B contained in Draft AEA Appendix 1.

Mobile Sources

Mobile Sources GHG emissions associated with on-road mobile sources are generated from residents, workers, customers, and delivery vehicles visiting the land uses developed as part of the project. Mobile-source emissions were estimated using CalEEMod, with adjustments based on EMFAC2014 emission factors, and estimates of project-generated vehicle trips from the traffic study conducted for the project by Stantec, which was derived using the Santa Clarita Valley Consolidated Traffic Model (SCVCTM).

SCVCTM takes into account five standardized trip types: home-based work trip, home-based shopping trips, home-based "other" (i.e., non-work, non-shopping) trips, other-based work trips, and other-based other trips. Trip generation numbers were adjusted to reflect the characteristics of a planned community (i.e., mixed-use development) which have higher internal trip capture rates than single-use developments. VMT data, which is generated by multiplying trip length with total number of daily trips, was adjusted by applying an internalization factor appropriate to each trip purpose to more appropriately reflect the anticipated vehicle travel patterns in the proposed project. Detailed assumptions regarding SCVCTM are located in Technical Report Section 2.3.5, Mobile Sources, and Technical Report Appendix D contained in Draft AEA Appendix 1.

CalEEMod, in combination with VMT estimates provided by SCVCTM, was used to calculate mobile source GHG emissions. CalEEMod provides the option to assign different trip lengths for different trip types; however, to calculate a more conservative estimate and ensure that the total annual VMT was consistent with estimates from SCVCTM, a consistent trip length was applied for all trip types. Further, CalEEMod's default approach is to specify a certain percentage of vehicle trips as pass-by or diverted trips, and assigns shorter trip length to these trips. To provide a more accurate and conservative VMT estimate, this default was overridden by designating all trips as primary trips rather than diverted or pass-by trips.

Additionally, to more accurately demonstrate the benefits from adopted regulatory programs such as Pavley and ACC, as discussed in Section 2.2, Regulatory Setting, EMFAC 2014, recently released by ARB, was incorporated into the analysis. Further, EMFAC 2014, unlike EMFAC 2011, excludes GHG emissions reductions from LCFS and results in more conservative estimates of mobile source GHG emissions. EPA/NHTSA's Phase 1 and Phase 2 advanced fuel economy and GHG standards for medium- and heavy-duty trucks were also incorporated. Additional details on the project's VMT calculations, internal trip capture adjustments, and mobile source emission factors are provided in Technical Report Tables 2-17a through 2-18b and Technical Report Appendix D, all contained in Draft AEA Appendix 1.

Water Consumption

Indirect GHG emissions also result from the production of electricity to convey, treat, and distribute the project's water and wastewater. GHG emissions from water consumption and wastewater treatment were estimated based on the volume of water that would be required by the project. The project's demand, recycled water usage, and wastewater generation values were based on Alternative D2 of the *Final Joint EIS/EIR for the RMDP and SCP Project*, and scaled by the change in land use square footage and number of dwelling units between the project and Alternative D2. The scaling factors and subsequent water use quantities are shown in Technical Report Tables 2-15a through 2-15e in Draft AEA Appendix 1.

The project's estimated water usage reflects a demand reduction for indoor potable water that is based on compliance with applicable regulatory water conservation and recycled water requirements. Specifically, the project would comply with the CALGreen Standards, which require a 20 percent reduction in indoor potable water use through the use of water saving fixtures and/or flow restrictors. Because the CALGreen Standards were adopted in 2010, after the development of the water usage estimates presented in the *Final Joint EIS/EIR for the RMDP and SCP Project*, the indoor water usage was reduced to reflect project compliance with the CALGreen Standards.

The project's estimated water usage also reflects that recycled water would be used to satisfy a portion of its demand for the outdoor, irrigation-related water demand, consistent with the mandate by the State Water Resources Control Board's (SWRCB's) recycled water policy (SWRCB 2013).

The CALGreen Standards, as well as the County of Los Angeles's Green Building Standards Code (Municipal Code Title 31) and previously adopted Newhall Ranch Specific Plan (NRSP) mitigation measures, and the local water purveyor (Valencia Water Company), would also require the incorporation of features to reduce the project's outdoor water demand. The analysis conservatively does not reduce the project's outdoor water usage to reflect these requirements.

For indirect emissions associated with the supply, treatment, and distribution of the project's water, CalEEMod default assumptions were used for the project's Valencia Commerce Center and Entrada planning areas, which would rely upon a blend of locally-sourced and State Water Project water. The default assumptions represent the average embodied energy for the supply, treatment, and distribution of water for Southern California, which are determined by a study commissioned by the CEC (CEC 2006). Because the NRSP area would exclusively use locally-sourced groundwater, different factors were used to account for the energy embodied in the NRSP's water use. Detailed water use estimates are provided in Technical Report Appendix B contained in Draft AEA Appendix 1.

The CalEEMod default assumptions conservatively estimate the GHG emissions associated with the distribution of the wastewater generated by the project's NRSP area. The Newhall Ranch Water Reclamation Plant (WRP) would be located within the NRSP area, and not outside the project as assumed by the default electricity intensity factor for wastewater treatment.

The direct and indirect emissions associated with the Newhall Ranch WRP's wastewater treatment processes are captured through the wastewater emissions estimates in CalEEMod for each of the project land uses in the NRSP that would send wastewater to the WRP; because the WRP is designed with the capacity to treat 6.8 million gallons per day (mgd) of wastewater, emissions were estimated based on the maximum capacity to provide a conservative estimate. See Technical Report Tables 2-15a through 2-15d in Draft AEA Appendix 1 for more detailed assumptions.

Solid Waste

Indirect GHG emissions associated with solid waste generated by the proposed land uses were estimated using the applicable module in CalEEMod and solid waste generation rate based on the City of Santa Clarita 2012 actual disposal rates. The analysis assumes that additional waste would be diverted from landfills by a variety of means, such as reducing the amount of waste generated, and increasing the amount of waste recycled, and/or composted to meet the statewide goal of 75 percent waste diversion (AB 341, Chapter 476, Statutes of 2011). Various plans and regulations applicable to the project support achieving the statewide diversion goal, including: (1) SW- 1: Waste Diversion Goal of the County's Community Climate Action Plan, which calls for compliance with all state mandates associated with diverting at least 75 percent of waste from landfill disposal by 2020; (2) the County's Green Building Standards Code (Municipal Code Title 31), which includes a number of sustainability requirements that apply to waste diversion; and, (3) AB 1826, which requires applicable commercial businesses to separate food scraps and yard trimmings, and arrange for recycling services for that organic waste. Various design elements of the project, such as the provision and location of recycling receptacles would also further the achievement of AB 341 goals. Additional detail regarding solid waste-related GHGs are shown in Technical Report Table 2-16 contained in Draft AEA Appendix 1.

Vegetation Change

The loss in sequestered carbon was also estimated in CalEEMod using the vegetation module. Permanent vegetation changes occur as a result of land use development constitute a one-time change in the carbon sequestration capacity of a project site. Thus, total one-time GHG emissions from the loss in carbon sequestration were estimated and then amortized over the operational life of the project (assumed to be 30 years for this analysis). This approach is consistent with SCAQMD's recommendations on the use of the vegetation module in CalEEMod (SCAQMD 2013). Land use change was based on CDFW's Draft Joint EIS/EIR for the RMDP and SCP Project (April 2009; SCH No. 2000011025), Volume XVI – Appendix 8.0 [ENVIRON International Corporation, Climate Change Technical Report (February 2009)]. Accounting for the loss in sequestered carbon in this way allows for the evaluation of whether ongoing operation of the proposed land uses would be efficient enough to "recoup" these one-time emissions. See Technical Report Section 2.2.2 and Technical Report Tables 2-10a and 2-10b in Draft AEA Appendix 1 for more detailed assumptions.

IMPACT ANALYSIS

While the section numbering has been revised to align with the organization of the Final AEA (i.e., Chapter 2 in the Draft AEA becomes Section 2.1 in the Final AEA), the impact conclusion and mitigation measure numbering remains identical to the Draft AEA to facilitate cross comparison.

Impact 2-1: Project-Generated GHG Emissions

The project is estimated to generate annualized construction emissions of 6,437 MT CO_2e amortized over 30 years (193,119 MT CO_2e total), net annualized vegetation change emissions of 1,335 MT CO_2e amortized over 30 years (40,059 MT CO_2e total based on net change in carbon sequestration/land use changes), and 518,330 MT CO_2e operations-related emissions at project buildout in 2030. Before consideration of mitigation measures proposed by the project applicant, total project emissions would be 526,103 MT CO_2e/year in 2030. This level of GHG emissions has the potential to result in a considerable contribution to cumulative emissions related to global climate change, and would be **potentially significant without the implementation of further mitigation.** The project applicant has proposed as mitigation the commitment for the project to achieve zero net GHG emissions (i.e., no net increase above existing conditions) through a combination of feasible and reliable emission-reduction actions, direct measures to reduce GHG emissions offsite, and the procurement of compensatory GHG offsets. With the implementation of the proposed mitigation measures and resulting achievement of zero net GHG emissions, the project would not make any contribution to cumulative GHG emissions, so the **GHG impact would be less than significant with mitigation.**

Construction-related activities that would generate GHGs include worker commute trips, haul trucks carrying supplies and materials to and from the project area, and off-road construction equipment (e.g., dozers, loaders, excavators) operating onsite. Construction of the land uses proposed under the project would occur over six stages with mass grading and utilities construction to begin in 2018. The construction emissions that would occur within each stage is summarized in Table 2.3-1.

Table 2.3-1 Summary of Greenhouse Gas Emissions by Construction Stage[1]

Stage	Year	Emissions (MT CO_2e/year)		
		Off-Road[2]	On-Road[3]	Total
1	2018	3,487	1,045	4,532
	2019	4,465	801	5,266
	2020	4,320	692	5,013
	2021	2,827	1,089	3,916
	2022	272	699	970
	2023	272	690	961
	2024	272	686	958

Table 2.3-1 Summary of Greenhouse Gas Emissions by Construction Stage[1]

Stage	Year	Emissions (MT CO_2e/year)		
		Off-Road[2]	On-Road[3]	Total
	2025	272	680	952
	2026	272	674	946
	2027	272	669	941
	2028	284	694	978
	Total	17,014	8,418	25,432
2	2018	2,909	311	3,220
	2019	4,564	670	5234
	2020	396	249	645
	2021	285	382	667
	2022	285	377	662
	2023	285	372	657
	2024	286	372	659
	Total	9,010	2,735	11,745
3	2020	10,233	796	11,029
	2021	8,812	949	9,761
	2022	2,751	1,593	4,345
	2023	3,290	1,600	4,890
	2024	5,268	1,924	7,192
	2025	7,722	2,116	9,837
	2026	737	1,455	2,192
	2027	737	1,444	2,181
	2028	734	1,429	2,163
	2029	737	1,426	2,163
	2030	816	1,419	2,235
	Total	41,835	16,152	57,987
4	2023	15,236	907	16,143
	2024	17,162	1,494	18,656
	2025	17,004	1,480	18,484
	2026	2,200	2,448	4,648
	2027	1,234	2,382	3,616
	2028	1,145	2,355	3,500
	2029	1,149	2,351	3,501
	2030	1,279	2,341	3,620
	Total	56,410	15,757	72,166
5	2018	3,587	676	4,263
	2019	2,101	276	2,378
	2020	656	266	922
	2021	473	422	894
	2022	384	411	795
	2023	384	406	789
	2024	387	407	793
	2025	385	401	786
	2026	385	398	783
	Total	8,741	3,662	12,403

Table 2.3-1 Summary of Greenhouse Gas Emissions by Construction Stage[1]

Stage	Year	Emissions (MT CO_2e/year)		
		Off-Road[2]	On-Road[3]	Total
6	2020	4,763	727	5,491
	2021	1,535	596	2,131
	2022	252	394	646
	2023	252	390	642
	2024	252	388	640
	2025	252	385	637
	2026	252	382	634
	2027	252	380	632
	2028	252	378	630
	2029	252	376	628
	2030	289	385	674
	Total	**8,604**	**4,782**	**13,386**
Grand Total				193,119[4]
30-Year Amortized				6,437

Notes: MT CO_2e/year=metric tons of carbon dioxide equivalent per year; EPA=Environmental Protection Agency~~0~~

[1] Sources of GHG emissions occur during construction activities such as grading, trenching, paving, building construction, and application of architectural coatings.

[2] This analysis assumes that the off-road, diesel-powered construction equipment greater than 50 horsepower used to grade the project site shall meet the EPA's Tier 3 standards at a minimum; construction equipment shall achieve the Tier 4 standards, where feasible.

[3] Emissions associated with worker and vendor trips for building construction and architectural coating were scaled by the adjustment factor to adjust for double-counting associated with analyzing phased construction in CalEEMod.

[4] Summarized emissions by year are rounded to the nearest whole number; however, total emissions reflect the sum of exact emissions levels.

Source: Modeling conducted by Ramboll Environ in 2016. See Technical Report Tables 2-3 through 2-9 and Technical Report Appendix B, contained in Draft AEA Appendix 1 for detailed calculations.

The project would generate a total of 193,119 MT CO_2e over the duration of construction activities (2018-2030). Total construction emissions were amortized over the project's 30-year life, consistent with guidance from SCAQMD. Amortized construction emissions are also shown in Table ~~2.3.3~~2.3-3.

The project would also include changes in vegetation types, which, as discussed under the heading, Analysis Methods, alters the carbon sequestration potential of a project site. Acres of vegetation change and type by area, as well as the corresponding emissions of CO_2 are provided in Table 2.3-2 below.

Table 2.3-2 Vegetation Change Evaluation

Area	Type of Vegetation Change	Land Use Change[1]		
		Existing (acres)	Final (acres)	Emissions[2] (MT CO_2e/year)
ES	Cropland	44.0	0	273
	Grassland	5.8	0	25
	Trees	1.7	0	189
	Scrub	149.3	0	2,135
	Total Vegetation Change	**200.8**	**0**	**2,621**

Table 2.3-2 Vegetation Change Evaluation

Area	Type of Vegetation Change	Land Use Change[1]		
		Existing (acres)	Final (acres)	Emissions[2] (MT CO_2e/year)
NRSP	Cropland	2,036.3	138	11,769
	Wetlands	8.8	0	0
	Trees[3]	107.0	0	11,877
	Grassland	950.5	0	4,097
	Trees	82.6	0	9,169
	Scrub	1,903.4	0	27,219
	Total Vegetation Change	5,088.6	138	64,130
VCC	Cropland	86.0	0	533
	Grassland	63.3	0	273
	Trees	18.5	0	2,054
	Scrub	37.6	0	538
	Wetland	0.6	0	0
	Total Vegetation Change	206.0	0	3,397
Total		5,495.4	138	70,149[5]
CO_2e Sequestered from Net New Trees[4]				-30,090
Total CO_2e Emissions Released				40,059
30-Year Amortized				1,335

Notes: MT CO_2e/year=metric tons of carbon dioxide equivalent per year; CDFW=California Department of Fish and Wildlife; EIS/EIR=Environmental Impact Statement/Environmental Impact Report; RMDP=Resource Management Development Plan; SCP=Spineflower Conservation Plan; ES=Entrada South; NRSP=Newhall Ranch Specific Plan; VCC=Valencia Commerce Center

[1] Land use change was based on the CDFW Draft Joint EIS/EIR for the RMDP and SCP Project, Table 4-2-B.

[2] Emissions were calculated using CalEEMod 2013.2.2 values.

[3] Two sets of tree land use changes were modeled based on the land designation of "Broad Leaf Upland" and "Riparian and Bottomland" in the table cited above (Table 4-2-B).

[4] Total CO_2e sequestered over 20-year active growth period of new trees is reported as recommended by the Intergovernmental Panel on Climate Change. The negative value indicates CO_2 emissions sequestered, as opposed to emissions released. Total number of new trees is 42,500.

[5] Summarized emissions by area are rounded to the nearest whole number; however, total emissions reflect the sum of exact emissions levels.

Source: Modeling conducted by Ramboll Environ in 2016. See Technical Report Tables 2-10a and 2-10b in Draft AEA Appendix 1 for detailed calculations.

The project would result in a total of 40,059 MT CO_2e from vegetation change associated with project implementation. These emissions reflect emissions of CO_2e from loss in vegetation type combined with sequestration of CO_2e from the planting of new trees. Total emissions are amortized over the project's 30-year life, consistent with guidance from SCAQMD. Amortized vegetation change emissions are also shown in Table 2.3-3.

Operation of the project would result in GHG emissions associated with motor vehicle trips to and from the project area; combustion of natural gas for space and water heating; consumption of electricity and water; conveyance, treatment, and discharge of wastewater; transport and disposal of solid waste; and use of equipment for landscaping. The removal of trees and vegetation would also result in the loss of sequestered carbon. Table 2.3-3 summarizes all the direct and indirect sources of GHG emissions associated with the project upon full buildout in 2030, along with existing emissions from the project site. The emissions estimates are based on the application of existing regulations pertaining to vehicle emissions, building standards, and electricity generation. See heading, Analysis Methods, above for further information.

As shown in Table 2.3-3, upon full buildout, GHG emissions associated with construction and operation of the proposed project would be 526,103 MT CO_2e/per year in 2030. This level of GHG emissions has the potential to result in a considerable contribution to cumulative emissions related to global climate change, and would be potentially significant without the implementation of further mitigation.

Table 2.3-3 Summary of Annual Greenhouse Gas Emissions Comparing Existing Emissions with Unmitigated Project Emissions at Full Buildout (2030)

Emissions Activity	Emissions (MT CO_2e/year)	
	Existing[1]	Unmitigated
Mobile Sources	152	403,814
Electricity	–	39,393
Natural Gas	–	43,386
Area Sources[1]	7,883	367
Water Consumption and Wastewater Treatment	2,987	8,190
Solid Waste Generation	–	23,179
Vegetation Removal	–	1,335
Construction	–	6,437
Total Annual Emissions	**11,021**	**526,103**[2]

Notes: MT CO_2e/year=metric tons of carbon dioxide equivalent per year; N_2O=nitrous oxide

[1] Existing emissions are categorized as follows:
Area Sources: methane emission associated with oil wells, energy use associated with oil wells, N_2O emissions associated with fertilizer use.
Water Consumption: energy use associated with water.
Mobile Sources: emissions associated with diesel fuel usage.

[2] Summarized emissions per sector are rounded to the nearest whole number; however, total emissions reflect the sum of exact emissions levels.

Source: Modeling conducted by Ramboll Environ in 2016. See Draft AEA Appendix 1 for detailed calculations.

The project applicant has proposed a commitment to CDFW to reach zero net emissions, in response to the California Supreme Court ruling in November 2015. Without incorporation of emission-reduction measures, the project would not be able to meet this commitment. Because the project's emissions would be a potentially considerable contribution to cumulative emissions influencing global climate change and in light of the project applicant's zero net GHG emissions commitment, the project applicant has proposed mitigation measures that would result in no net increase in GHG emissions above existing conditions. The mitigation measures presented below have been independently reviewed and analyzed by CDFW, in consultation with ARB, and modified, where needed, from the project applicant's original proposal. With the implementation of the following 13 mitigation measures, the project would feasibly and reliably achieve the zero net emissions commitment.

Consistent with SCAQMD recommendations, the mitigation considered the following geographic priorities: (1) project design feature/on-site reduction measures; (2) off-site within neighborhood; (3) off-site within district; (4) off-site within state; and (5) off-site out of state (SCAQMD 2008).

Mitigation Measure 2-1: Residential Zero Net Energy

Prior to the issuance of residential building permits for the project or a portion of the project, the project applicant or its designee shall submit one or more ~~a~~ Zero Net Energy Confirmation (ZNE) Reports (ZNE Report) prepared by a qualified building energy efficiency and design consultant to Los Angeles County for review and

~~approval~~ confirmation that the residential development covered by the ZNE Report achieves the ZNE standard specified in this mitigation measure. Specifically, a ~~The~~ ZNE Report shall demonstrate that the residential development within the RMDP/SCP project site subject to application of Title 24, Part 6, of the California Code of Regulations has been designed and shall be constructed to achieve ZNE, as defined by CEC in its 2015 Integrated Energy Policy Report, which requires the value of the net energy produced by project renewable energy resources to equal the value of the energy consumed annually by the project using the CEC's Time Dependent Valuation metric ~~or otherwise achieve an equivalent level of energy efficiency, renewable energy generation or greenhouse gas emissions savings~~.

A ZNE Report shall provide, at a minimum, the following information ~~may, but is not required to~~:

- Confirmation that the residential development shall comply with Title 24, Part 6 building standards that are operative at the time of building permit application.
- Identification of additional measures or building performance standards that shall be relied upon to achieve the ZNE standard (as defined above), assuming ZNE is not already achieved by meeting the operative Title 24, Part 6 building standards.

In demonstrating that the residential development achieves the ZNE standard, the ZNE Report may:

- Evaluate multiple buildings and/or land use types. For example, a ZNE Report may cover all of the residential and ~~commercial~~ non-residential buildings within a neighborhood/community, or a subset thereof, including an individual building.
- Rely upon aggregated or community-based strategies to support its determination that the subject buildings are designed to achieve ZNE. For example, shortfalls in renewable energy generation for one or more buildings may be offset with excess renewable generation from one or more other buildings~~, or off-site renewable energy generation~~. As such, a ZNE Report could determine a building is designed to achieve ZNE based on aggregated or community-based strategies even if the building on its own may not be designed to achieve ZNE.
- Make reasonable assumptions about the estimated electricity and natural gas loads and energy efficiencies of the subject buildings.
- If interconnection of the project's renewable generation is not sufficient to allow compliance with the ZNE standard for the project, or a portion of the project, then Los Angeles County shall allow the project applicant or its designee to achieve an equivalent level of GHG emissions reductions to mitigate such shortfall by providing 5.1 MT CO_2e of GHG reductions for every megawatt-hour of renewable energy generation that would have been needed to achieve the ZNE standard for the project, or a portion of the project, as demonstrated in the ZNE Report.

Discussion

Project-related emissions of GHGs from the residential energy sector (i.e., electricity and natural gas) would be substantially reduced through implementation of Mitigation Measure 2-1. Through the incorporation of zero-energy technology into new residential development, as prescribed by a qualified energy efficiency and design consultant, fossil fuel-related sources of GHGs associated with energy use would be reduced ~~not occur from project-related activities~~.

Mitigation Measure 2-1 is considered feasible and enforceable mitigation because the project applicant or its designee shall be required to comply with the standards and components of the measure before construction begins. Los Angeles County shall hold the project applicant or its designee accountable for meeting the criteria of Mitigation Measure 2-1 prior to approving or issuing residential building permits. Issuance of residential buildings permits shall be contingent upon the project applicant or its designee providing adequate evidence as to implementation of Mitigation Measure 2-1 as specified.

As shown below in Table 2.3-4, implementation of Mitigation Measure 2-1 would reduce operations-related GHG emissions by ~~30,659~~ 30,656 MT CO_2e/year from residential electricity and natural gas use. Details on this measure, including estimated reductions, supporting data and implementation mechanisms are provided in Technical Report Tables ES-3 and 4-1a through 4-1d and Technical Report Appendix C, all contained in Draft AEA Appendix 1.

Mitigation Measure 2-2: Non-Residential Zero Net Energy

Prior to the issuance of building permits for commercial development and private recreation centers, and prior to the commencement of construction for the public facilities, respectively, for the project or a portion of the project the project applicant or its designee shall submit one or more ~~a~~ Zero Net Energy Confirmation Reports (ZNE Report) prepared by a qualified building energy efficiency and design consultant to Los Angeles County for review and confirmation that the commercial development, private recreation centers, and/or public facilities covered by the ZNE Report achieve the ZNE standard specified in this mitigation measure ~~approval~~. Specifically, a ~~The~~ ZNE Report shall demonstrate that the commercial development, private recreation centers, and public facilities within the RMDP/SCP project site subject to application of Title 24, Part 6, of the California Code of Regulations have been designed and shall be constructed to achieve ZNE, as defined by CEC in its 2015 Integrated Energy Policy Report, which requires the value of the net energy produced by project renewable energy resources to equal the value of the energy consumed annually by the project using the CEC's Time Dependent Valuation metric ~~or otherwise achieve an equivalent level of energy efficiency, renewable energy generation or GHG gas emissions savings~~.

("Commercial development" includes retail, light industrial, office, hotel, and mixed-use buildings. "Public facilities" are fire stations, libraries, and elementary, middle/junior high and high schools.)

A ZNE Report shall provide, at a minimum, the following information ~~may, but is not required to~~:

- Confirmation that the commercial development, private recreation centers, and/or public facilities shall comply with Title 24, Part 6 building standards that are operative at the time of building permit application.

- Identification of additional measures or building performance standards that shall be relied upon to achieve the ZNE standard (as defined above), assuming ZNE is not already achieved by meeting the operative Title 24, Part 6 building standards.

In demonstrating that the commercial development, private recreation centers, and/or public facilities achieves the ZNE standard, the ZNE Report may:

- Evaluate multiple buildings and/or land use types. For example, a ZNE Report may cover all of the residential and non-residential buildings within a neighborhood/community, or a subset thereof, including an individual building.

- Rely upon aggregated or community-based strategies to support its determination that the subject buildings are designed to achieve ZNE. For example, short falls in renewable energy generation for one or more buildings may be offset with excess renewable generation from one or more other buildings~~, or off-site renewable energy generation~~. As such, a ZNE Report could determine a building is designed to achieve ZNE based on aggregated or community-based strategies even if the building on its own may not be designed to achieve ZNE.

- Make reasonable assumptions about the estimated electricity and natural gas loads and energy efficiencies of the subject buildings.

- If interconnection of the project's renewable generation is not sufficient to allow compliance with the ZNE standard for the project, or a portion of the project, then Los Angeles County shall allow the project applicant or its designee to achieve an equivalent level of GHG emissions reductions to mitigate such shortfall by providing 5.1 MT CO_2e of GHG reductions for every megawatt-hour of renewable energy generation that would have been needed to achieve the ZNE standard for the project, or a portion of the project, as demonstrated in the ZNE Report.

Discussion

Project-related emissions of GHGs from the non-residential energy sector (i.e., electricity and natural gas) would be substantially reduced through implementation of Mitigation Measure 2-2. Through incorporation of zero-energy technology into all non-residential development associated with the project, as prescribed by a qualified energy efficiency and design consultant, fossil fuel-related sources of GHGs associated with energy use would be reduced ~~not occur from project-related activities~~.

Mitigation Measure 2-2 is considered feasible and enforceable mitigation because the project applicant or its designee shall be required to comply with the standards and components of the measure before construction begins. Los Angeles County shall hold the project applicant or its designee accountable for meeting the criteria of Mitigation Measure 2-2 prior to approving or issuing non-residential building permits and prior to commencement of construction for public facilities. Issuance of non-residential building permits and/or commencement of construction shall be contingent upon the project applicant or its designee providing adequate evidence that Mitigation Measure 2-2 has been implemented as specified.

As shown below in Table 2.3-4, implementation of Mitigation Measure 2-2 would reduce operations-related GHG emissions by ~~24,512~~ 24,456 MT CO_2e/year from non-residential electricity and natural gas use. Details on this measure, including estimated reductions, supporting data and implementation mechanisms are provided in Technical Report Tables ES-3 and 4-2a through 4-2d and Technical Report Appendix C, all contained in Draft AEA Appendix 1.

Mitigation Measure 2-3: Swimming Pool Heating

Prior to the issuance of private recreation center building permits, the project applicant or its designee shall submit swimming pool heating design plans to Los Angeles County for review and approval. The design plans shall demonstrate that all swimming pools located at private recreation centers on the RMDP/SCP project site have been designed and shall be constructed to use solar water heating or other technology with an equivalent level of energy efficiency.

Discussion

Project-related emissions of GHGs from the energy sector (specifically natural gas) associated with heating swimming pools would be eliminated through incorporation of low-emission heating design for pools constructed as a result of project implementation. Swimming pools shall be designed and constructed to use solar water heating or other technology with an equivalent level of energy efficiency; therefore, no combustion of natural gas would occur during heating and operation of the swimming pools.

Mitigation Measure 2-3 is considered feasible and enforceable mitigation because the project applicant or its designee shall be required to comply with the standards and components of the measure before construction begins. Los Angeles County shall hold the project applicant or its designee accountable for meeting the criteria of Mitigation Measure 2-3 prior to approving or issuing private recreation center building permits. Issuance of private recreation center building permits will contingent upon the project applicant or its designee providing adequate evidence that Mitigation Measure 2-3 has been implemented as specified.

As shown below in Table 2.3-4, implementation of Mitigation Measure 2-3 would reduce operations-related GHG emissions by 22,356 MT CO_2e/year from natural gas use. Detailed calculations showing the estimated reduction are provided in Technical Report Tables ES-3 and 2-14a, contained in Draft AEA Appendix 1.

Mitigation Measure 2-4: Residential Electric Vehicle Chargers and Vehicle Subsidy

Prior to the issuance of residential building permits, the project applicant or its designee shall submit building design plans, to Los Angeles County for review and approval, which demonstrate that each residence within the

RMDP/SCP project site subject to application of Title 24, Part 6, of the California Code of Regulations shall be equipped with a minimum of one single-port electric vehicle (EV) charging station. Each charging station shall achieve a similar or better functionality as a Level 2 charging station.

Additionally, prior to the issuance of the first building permit for the RMDP/SCP project site, the project applicant or its designee shall establish and fund a dedicated account for the provision of subsidies for the purchase of ZEVs, as defined by ARB. The project applicant or its designee shall provide proof of the account's establishment and funding to Los Angeles County.

The dedicated account shall be incrementally funded, for each village-level project, in an amount that equals the provision of a $1,000 subsidy per residence – on a first-come, first-served basis – for 65 ~~50~~ percent of the village's total residences subject to application of Title 24, Part 6, of the California Code of Regulations.

Discussion

Project-related emissions of GHGs from the transportation sector would be substantially reduced through incorporation of EV charging stations. Use of ZEVs results in a reduction of GHG emissions from fossil fuel-combusting engines. Further, the electricity supplied to EV charging stations may originate from renewable resources provided by public utilities, as specified through RPS, or on-site sources of renewable energy. As discussed above in Section 2.2, Regulatory Setting, deployment of SB 350 would require public utilities to achieve a 50 percent renewable portfolio by 2030, the year of project buildout.

Mitigation Measure 2-4 is considered feasible and enforceable mitigation because the project applicant or its designee shall be required to comply with the standards and components of the measure before construction begins. Los Angeles County shall hold the project applicant or its designee accountable for meeting the criteria of Mitigation Measure 2-4 prior to approving or issuing residential building permits. Issuance of residential buildings permits shall be contingent upon the project applicant or its designee providing adequate evidence as to implementation of Mitigation Measure 2-4 as specified.

As shown ~~in~~ below in Table 2.3-4, implementation of Mitigation Measure 2-4 would reduce operations-related GHG emissions by ~~53,735~~ 53,724 MT CO_2e/year from the transportation sector. Detailed calculations showing the estimated reduction are provided in Technical Report Tables ES-3 and 4-3, contained in Draft AEA Appendix 1.

Mitigation Measure 2-5: Commercial Development Area Electric Vehicle Chargers

Prior to the issuance of commercial building permits, the project applicant or its designee shall submit building design plans, to Los Angeles County, which demonstrate that the parking areas for commercial buildings on the RMDP/SCP project site shall be equipped with EV charging stations that provide charging opportunities to 7.5 percent of the total number of required parking spaces. ("Commercial buildings" include retail, light industrial, office, hotel, and mixed-use buildings.)

The EV charging stations shall achieve a similar or better functionality as a Level 2 charging station. In the event that the installed charging stations use ~~more superior~~ functionality/technology other than Level 2 charging stations, the parameters of the mitigation obligation (i.e., number of parking spaces served by EV charging stations) shall reflect the comparative equivalency of Level 2 charging stations to the installed charging stations on the basis of average charge rate per hour. For purposes of this equivalency demonstration, Level 2 charging stations shall be assumed to provide charging capabilities of 25 range-miles per hour.

Discussion

Project-related emissions of GHGs from the transportation sector would be substantially reduced through incorporation of EV charging stations. Use of ZEVs results in a reduction of GHG emissions from fossil fuel-combusting engines. Further, the electricity supplied to EV charging stations may originate from renewable resources provided by public utilities, as specified through RPS, or on-site sources of renewable energy. As discussed ~~above~~ in Section 2.2, Regulatory Setting, deployment of SB 350 would require public utilities to achieve a 50 percent renewable portfolio by 2030, the year of project buildout.

Mitigation Measure 2-5 is considered feasible and enforceable mitigation because the project applicant or its designee shall be required to comply with the standards and components of the measure before construction begins. Los Angeles County shall hold the project applicant or its designee accountable for meeting the criteria of Mitigation Measure 2-5 prior to approving or issuing commercial building permits. Issuance of commercial buildings permits shall be contingent upon the project applicant or its designee providing adequate evidence as to implementation of Mitigation Measure 2-5 as specified.

As shown ~~in~~ below in Table 2.3-4, implementation of Mitigation Measure 2-5 would reduce operations-related GHG emissions by 39,109 MT CO_2e/year from the transportation sector. Detailed calculations showing the estimated reduction are provided in Technical Report Tables ES-3 and 4-4, contained in Draft AEA Appendix 1.

Mitigation Measure 2-6: Transportation Demand Management Plan

The project applicant-submitted Newhall Ranch Transportation Demand Management Plan (TDM Plan), located in ~~Technical Report~~ Final AEA Appendix 7~~contained in AEA Appendix 1~~, shall be implemented to reduce VMT resulting from project build out with oversight from Los Angeles County. The TDM Plan is designed to influence the transportation choices of residents, students, employees, and visitors, and serves to enhance the use of alternative transportation modes both on and off the project site through the provision of incentives and subsidies, expanded transit opportunities, bikeshare and carshare programs, technology-based programs, and other innovative means. Village-level implementation ~~Implementation~~ of relevant elements of the TDM Plan ~~will be included as a condition of approval~~ shall proceed in accordance with village-level applicability supplements prepared by a qualified transportation engineer that are reviewed and considered by Los Angeles County when approving tentative subdivision maps for land developments that are part of the project.

Accordingly, the TDM Plan identifies key implementation actions that are critical to the effectiveness of the VMT-reducing strategies, as well as timeline and phasing requirements, monitoring standards, and performance metrics and targets tailored to each of the strategies.

In accordance with the TDM Plan, a non-profit Transportation Management Organization (TMO) or equivalent management entity shall be established to provide the services required, as applicable.

Discussion

Implementation of the TDM plan would reduce project-related emissions of GHGs from the transportation sector through incorporation of measures and strategies designed to influence behavior and increase the efficiency of transportation modes. Implementation of the TDM strategy will result in increased rates of alternative modes of transportation, such as walking, bicycling, and public transit use, with a subsequent decrease in single-occupancy vehicle dependency through vanpooling, car-sharing, and ride-matching programs, which will reduce transportation-related GHG emissions on a community-wide scale. Incorporation of measures to improve the efficiency of transportation systems will lower rates of emissions associated with idling and braking. Pursuant to SB 375, TDM strategies have been developed by Metropolitan Planning Organizations (MPOs) and incorporated into RTP/SCSs. These plans are reviewed by ARB, which has concluded that TDM produces a notable reduction in GHG emissions from automobiles (ARB 2016b).

As shown ~~in~~ below in Table 2.3-4, implementation of Mitigation Measure 2-6 would reduce operations-related GHG emissions by ~~60,179~~ 60,168 MT CO_2e/year from the transportation sector. Details on this measure, including estimated reductions, supporting data and implementation mechanisms, along with components of the project applicant-submitted TDM plan are provided in Technical Report Tables ES-3 and 4-5 ~~and Technical Report Appendix E, all contained~~ in Draft AEA Appendix 1.

Mitigation Measure 2-7: Traffic Signal Synchronization

Prior to the issuance of traffic signal permits, the project applicant or its designee shall work with Los Angeles County and the California Department of Transportation (Caltrans), as applicable, to facilitate traffic signal coordination along:

- State Route 126 from the Los Angeles County line to the Interstate 5 north-bound ramps;
- Chiquito Canyon Road, Long Canyon Road, and Valencia Boulevard within the RMDP/SCP project site;
- Magic Mountain Parkway from Long Canyon Road to the Interstate 5 north-bound ramps; and
- Commerce Center Drive from Franklin Parkway to Magic Mountain Parkway.

To effectuate the signal synchronization and specifically the operational and timing adjustments needed at affected traffic signals, the project applicant or its designee shall submit traffic signal plans for review and approval, and/or pay needed fees as determined by Los Angeles County or Caltrans, as applicable.

A majority of the signals that will be synchronized will be new signals constructed/installed by the project. Thus, for these signals, the project will provide the necessary equipment at the signal controller cabinet, as well as within the new roadways themselves, to enable and facilitate synchronization. The project is responsible for paying 100 percent of the applicable fee amount for the signal synchronization work, with assurance that the necessary funding will be available to fully implement this measure.

Discussion

The improved synchronization of the aforementioned intersections will improve vehicle efficiency, thus decreasing transportation-related emissions of GHGs associated with project implementation. Emissions from inefficient travel (e.g., idling) shall be mitigated through signal synchronization and improved vehicle movement.

Mitigation Measure 2-7 is considered feasible and enforceable mitigation because the project applicant or its designee shall be required to comply with the standards and components of the measure prior to issuance of traffic signal permits. Los Angeles County and Caltrans shall hold the project applicant or its designee accountable for meeting the criteria of Mitigation Measure 2-7 prior to issuing traffic signal permits. Issuance of traffic signal permits shall be contingent upon the project applicant or its designee providing adequate evidence as to implementation of Mitigation Measure 2-7 as specified.

As shown ~~in~~ below in Table 2.3-4, implementation of Mitigation Measure 2-7 would reduce operations-related GHG emissions by ~~8,214~~ 8,212 MT CO_2e/year from the transportation sector. Detailed calculations showing the estimated reduction are provided in Technical Report Tables ES-3 and 4-6 and Technical Report Appendix I, all contained in Draft AEA Appendix 1.

Mitigation Measure 2-8: Zero-Emission ~~Electric~~ School Bus Program

Consistent with the parameters of the Newhall Ranch TDM Plan, the project applicant or its designee shall provide Los Angeles County with proof that funding has been provided for the purchase, operation and maintenance of ~~electric~~ zero-emission school buses in furtherance of the school bus program identified in the project's TDM Plan. The proof of funding shall be demonstrated incrementally as the school bus program is paced to village-level occupancy and student enrollment levels.

Discussion

Use of ~~electric~~ zero-emission school buses would mitigate transportation-related emissions of GHGs by reducing the use of GHG-emitting fossil fuels during operation of school buses. Proof of funding shall be demonstrated incrementally as the school bus program is paced to village-level occupancy and student enrollment levels.

As shown ~~in~~ below in Table 2.3-4, implementation of Mitigation Measure 2-8 would reduce operations-related GHG emissions by 157 MT CO_2e/year from the transportation sector. Detailed calculations showing the estimated reduction are provided in Technical Report Tables ES-3 and 4-7 in Draft AEA Appendix 1.

Mitigation Measure 2-9: Zero-Emission ~~Electric~~ Transit Bus Program

Prior to the issuance of the first 2,000th residential building permit within the RMDP/SCP project site and every 2,000th residential building permit thereafter, the project applicant or its designee shall provide Los Angeles County with proof that it has provided a subsidy of $100,000 per bus for the replacement of up to 10 diesel or compressed natural gas transit buses with ~~electric~~ zero-emission buses to the identified transit provider(s).

Discussion

Use of ~~electric~~ zero-emission transit buses would mitigate transportation-related emissions of GHGs by reducing the use of GHG-emitting fossil fuels (i.e., diesel fuel and natural gas) during operation of transit buses.

Mitigation Measure 2-9 is considered feasible and enforceable mitigation because the project applicant or its designee shall be required to comply with the standards and components of the measure before an incremental number of residential building permits are issued. Los Angeles County shall hold the project applicant or its designee accountable for meeting the criteria of Mitigation Measure 2-9 prior to issuing building permits. Issuance of buildings permits shall be contingent upon the project applicant or its designee providing adequate evidence as to implementation of Mitigation Measure 2-9 as specified.

As shown ~~in~~ below in Table 2.3-4, implementation of Mitigation Measure 2-9 would reduce operations-related GHG emissions by 619 MT CO_2e/year from the transportation sector. Detailed calculations showing the estimated reduction are provided in Technical Report Tables ES-3 and 4-8 in Draft AEA Appendix 1.

Mitigation Measure 2-10: Offsetting Construction and Vegetation Change Emissions

Prior to issuing grading permits for village-level development within the RMDP/SCP project site, Los Angeles County shall confirm that the project applicant or its designee shall fully mitigate the ~~related~~ construction and vegetation change GHG emissions associated with each such grading permit (the "Incremental Construction GHG Emissions") by relying upon one of the following compliance options, or a combination thereof, in accordance with the project applicant-submitted Newhall Ranch GHG Reduction Plan (GHG Reduction Plan; see ~~Technical Report~~ Final AEA Appendix 6 ~~F contained in AEA Appendix 1~~):

- Directly undertake or fund activities that reduce or sequester GHG emissions ("Direct Reduction Activities") and retire the associated "GHG Mitigation ~~reduction~~ Credits ~~credits~~ in a quantity equal to the Incremental Construction GHG Emissions~~;~~. A "GHG Mitigation Credit" shall mean an instrument issued by an Approved Registry that satisfies the performance standards set forth in the GHG Reduction Plan and shall represent the estimated reduction or sequestration of one metric tonne of carbon dioxide equivalent that will be achieved by a Direct Reduction Activity that is not otherwise required (CEQA Guidelines Section 15126.4(c)(3)). An "Approved Registry" is an accredited carbon registry as defined by the GHG Reduction Plan; or

- Obtain and retire "Carbon Offsets" ~~carbon credits that have been issued by a recognized and reputable carbon registry, as described in the GHG Reduction Plan,~~ in a quantity equal to the Incremental Construction GHG Emissions. "Carbon Offset" shall mean an instrument issued by an Approved Registry that satisfies the performance standards set forth in the GHG Reduction Plan and shall represent the past reduction or sequestration of one metric tonne of carbon dioxide equivalent achieved by a Direct Reduction Activity or any other GHG emission reduction project or activity that is not otherwise required (CEQA Guidelines Section 15126.4(c)(3)).

Discussion

Involvement in at least one of the actions listed above would be sufficient to offset the project's GHG emissions associated with construction- and vegetation change-related activities ~~to project implementation~~. The sum of ~~purchased~~ GHG Mitigation Credits ~~reduction credits~~ and/or Carbon Offsets ~~carbon credits~~ retired by the project applicant or its designee shall equal the total emissions generated during construction activities and vegetation removal associated with each such grading permit ~~as amortized over the life of the project (i.e., 30 years)~~. GHG Mitigation Credits and Carbon Offsets ~~credits~~ shall be of sufficient criteria to meet the standards of an Approved Registry ~~adequate carbon credit through a reputable carbon registry~~. Carbon Offsets ~~credits~~ purchased to offset construction and vegetation emissions shall be real, additional, quantifiable, enforceable, validated, and permanent. All GHG Mitigation Credits and Carbon Offsets must meet the performance standards identified in the GHG Reduction Plan. ~~The year of full buildout (2030), the project applicant shall engage in a one-time purchase of carbon offsets that can demonstrate GHG reductions shall continue over the life of the project on a yearly basis.~~

Mitigation Measure 2-10 is considered feasible and enforceable mitigation because the project applicant or its designee shall be required to comply with the standards and components of the measure prior to issuance of grading permits. Los Angeles County shall hold the project applicant or its designee accountable for meeting the criteria of Mitigation Measure 2-10 prior to issuing grading permits. Issuance of grading permits shall be contingent upon the project applicant or its designee providing adequate evidence as to implementation of Mitigation Measure 2-10 as specified.

As shown ~~in~~ below in Table 2.3-4, implementation of Mitigation Measure 2-10 would reduce construction- and vegetation change-related GHG emissions by ~~7,808~~ 7,773 MT CO_2e/year. Details on this measure, including estimated reductions, supporting data and implementation mechanisms are provided in Technical Report Tables ES-2 and ES-3 and Technical Report Appendices F and K, all contained in Draft AEA Appendix 1.

Mitigation Measure 2-11: Building Retrofit Program

Prior to the issuance of building permits for ~~every 100 residential units or 100,000 square feet of commercial development for each village-level project~~ development within the RMDP/SCP project site, the project applicant or its designee shall ~~provide proof of funding of~~ undertake or fund Direct Reduction Activities pursuant to the Building Retrofit Program ("Retrofit Program"), as included in Final AEA Appendix 13, to improve the energy efficiency of existing buildings located primarily in disadvantaged communities (as defined in the Retrofit Program). The project applicant or its designee shall retire GHG Mitigation Credits or Carbon Offsets issued by an Approved Registry based on such Direct Reduction Activities in a quantity equal to the ~~proportional percentage~~ sum of the ~~Building Retrofit Program (Retrofit Program),~~ following (together, the "Retrofit Reduction Requirement") as included in ~~Technical Report~~ Final AEA Appendix 13 ~~G contained in AEA Appendix 1, to Los Angeles County~~.

- For the residential portion of a building permit application, the product of the planned number of residential units for the village-level project multiplied by 0.0377 $MTCO_2e$;
- For the commercial portion of a building permit application, the product of the planned commercial development per thousand commercial square feet multiplied by 0.0215 MTCO2e. ~~(~~"Commercial development" includes retail, light industrial, office, hotel and mixed-use buildings.~~)~~

Building retrofits covered by the Retrofit Program can include, but are not limited to: cool roofs, solar panels, solar water heaters, smart meters, energy efficient lighting (including, but not limited to, light bulb replacement), energy efficient appliances, energy efficient windows, pool covers, insulation, and water conservation measures.

The Retrofit Program shall be implemented within the geographic area defined to include Los Angeles County and primarily within disadvantaged communities, as defined by the Retrofit Program, or in other areas accepted by the Los Angeles County Planning Director.

~~Funding shall be applied to implement retrofits strategies identified in the Retrofit Program or other comparable strategies accepted by the Los Angeles County Planning Director.~~

Discussion

The Retrofit Program would reduce emissions through the replacement of existing and less efficient technologies and addition of low-emission infrastructure. Cool roofs and improved insulation keep the internal temperatures of buildings low, thus reducing dependency on heating, ventilation and air conditioning systems and the indirect GHG emissions produced from their energy use. Solar panels and solar water heaters employ the sun's energy to heat and power buildings to meet energy demands while reducing GHG emissions from electricity and natural gas. Use of energy efficient lighting, meters, appliances, and windows lower the overall energy demand of a building or structure requiring less energy; therefore, lowering the rate of energy-related fossil fuel combustion. Implementation of water conservation strategies further reduce GHG emissions associated with water and wastewater treatment and conveyance.

Mitigation Measure 2-11 is considered feasible and enforceable mitigation because the project applicant or its designee shall be required to comply with the standards and components of the measure prior to issuance of building permits for a proportional number of residential units or square feet of commercial space. Los Angeles County shall hold the project applicant or its designee accountable for meeting the criteria of Mitigation Measure 2-11 prior to issuing building permits. Issuance of buildings permits shall be contingent upon the project applicant or its designee providing adequate evidence as to implementation of Mitigation Measure 2-11 as specified.

As shown ~~in~~ below in Table 2.3-4, implementation of Mitigation Measure 2-11 would reduce operations-related GHG emissions by 1,000 MT CO_2e/year from the energy sector. Detailed calculations showing the estimated reduction, along with supporting data, are shown in Technical Report Tables ES-3 and 4-9 and Technical Report Appendix G, all contained in Draft AEA Appendix 1.

Mitigation Measure 2-12: Off-Site Electric Vehicle Chargers

Prior to the issuance of the first building permit for the RMDP/SCP project site, the project applicant or its designee shall provide Los Angeles County with proof of installation of EV charging stations capable of serving 20 off-site parking spaces. Thereafter, the project applicant or its designee shall provide Los Angeles County proof of installation of EV charging stations prior to the issuance of residential and commercial building permits per the following ratios: one (1) off-site parking space shall be served by an electric vehicle charging station for every 30 dwelling units, and one (1) off-site parking space shall be served by an electric vehicle charging station for every 7,000 square feet of commercial development. ("Commercial development" includes retail, light industrial, office, hotel and mixed-use buildings.) Off-site EV charging stations capable of servicing 2,036 parking spaces would be required if the maximum allowable development facilitated by the RMDP/SCP project occurs; fewer EV charging stations would be required if maximum build-out under the RMDP/SCP project does not occur.

The EV charging stations shall achieve a similar or better functionality as a Level 2 charging station and may service one or more parking spaces. In the event that the installed charging stations use ~~more superior~~ functionality/technology other than Level 2 charging stations, the parameters of the mitigation obligation (i.e., number of parking spaces served by EV charging stations) shall reflect the comparative equivalency of Level 2 charging stations to the installed charging stations on the basis of average charge rate per hour. For purposes of this equivalency demonstration, Level 2 charging stations shall be assumed to provide charging capabilities of 25 range-miles per hour.

The EV charging stations shall be located within the geographic area defined to include Los Angeles County.~~,~~ ~~and~~ The EV charging stations shall be in areas that are generally accessible to the public, ~~For example, the charging stations may be located in~~ such as areas that include, but are not limited to, retail centers, employment centers and office complexes, recreational facilities, schools, and other categories of public facilities.

Discussion

The project would contribute to reductions from the transportation sector through incorporation of off-site EV charging stations. Use of ZEVs results in a reduction of GHG emissions from fossil fuel-combusting engines. Further, the electricity supplied to EV charging stations may originate from renewable resources provided by public utilities, as specified through RPS, or on-site sources of renewable energy. As discussed above in Section 2.2, Regulatory Setting, deployment of SB 350 would require public utilities to achieve a 50 percent renewable portfolio by 2030, the year of project buildout.

Mitigation Measure 2-12 is considered feasible and enforceable mitigation because the project applicant or its designee shall be required to comply with the standards and components of the measure prior to issuance of an incremental number of building permits for residential and commercial uses. Los Angeles County shall hold the project applicant or its designee accountable for meeting the criteria of Mitigation Measure 2-12 prior to issuing building permits. Issuance of buildings permits shall be contingent upon the project applicant or its designee providing adequate evidence as to implementation of Mitigation Measure 2-11 as specified.

As shown ~~in~~ below in Table 2.3-4, implementation of Mitigation Measure 2-12 would reduce operations-related GHG emissions by 39,813 MT CO_2e/year from the transportation sector. Detailed calculations showing the estimated reduction are provided in Technical Report Tables ES-3 and 4-4 in Draft AEA Appendix 1.

Mitigation Measure 2-13: Implement a GHG Reduction Plan

In addition to Mitigation Measures 2-1 through 2-12, the project applicant or its designee shall offset GHG emissions to zero by funding or undertaking Direct Reduction Activities ~~activities that directly reduce or sequester GHG emissions~~ or, if necessary, obtaining Carbon Offsets ~~carbon credits~~ through the Newhall Ranch GHG Reduction Plan. The project applicant-submitted Newhall Ranch GHG Reduction Plan focuses on achieving GHG reductions or sequestration through the Direct Reduction Activities ~~direct investment in specific programs or projects~~ in coordination with an Approved Registry ~~accredited carbon registry~~, such as the Climate Action Reserve. If these Direct Reduction Activities ~~direct investment efforts~~ do not achieve the necessary ~~an adequate~~ amount of GHG reductions, the project applicant or its designee can obtain Carbon Offsets issued by an Approved Registry ~~carbon credits from accredited carbon registries~~.

~~SCAQMD recommends that mitigation be considered in the following prioritized manner: (1) project design feature/on site reduction measures; (2) off site within neighborhood; (3) off site within district; (4) off site within state; and (5) off-site out of state (SCAQMD 2008).~~ Prior to issuing building permits for development within the RMDP/SCP project site, Los Angeles County shall confirm that the project applicant or its designee shall fully offset the project's remaining (i.e., post implementation of Mitigation Measures 2-1 through 2-12) operational GHG emissions over the 30-year project life associated with each such building permit ~~permits~~ (the "Incremental Operational GHG Emissions) by relying upon one of the following compliance options, or a combination thereof, in accordance with the Newhall Ranch GHG Reduction Plan:

- Undertake or fund Direct Reduction Activities ~~Demonstrate that the project applicant has directly undertaken or funded activities that reduce or sequester GHG emissions ("Direct Reduction Activities")~~ that are estimated to result in GHG Mitigation Credits ~~reduction credits~~, as described in the GHG Reduction Plan, and retire such GHG Mitigation Credits ~~reduction credits~~ in a quantity equal to the Incremental Operational GHG Emissions ~~emissions~~;

- ~~Provide a guarantee that it shall retire carbon credits issued in connection with Direct Reduction Activities in a quantity equal to the Incremental Operational GHG emissions;~~

- Undertake or fund Direct Reduction Activities and retire the associated Carbon Offsets ~~carbon credits~~ in a quantity equal to the Incremental Operational GHG Emissions; or

- If necessary, as determined by the Los Angeles County Planning Director in accordance with the GHG Reduction Plan, ~~it is impracticable~~ to fully offset Incremental Operational GHG Emissions ~~through the Direct~~

~~Reduction Activities~~, the project applicant or its designee may purchase and retire Carbon Offsets ~~carbon credits~~ that have been issued by an Approved Registry ~~a recognized and reputable, accredited carbon registry~~ in a quantity equal to the Incremental Operational GHG Emissions.

Compliance with MM 2-13 shall be demonstrated incrementally prior to obtaining building permits~~, and shall in the context of the project overall follow the preferred geographic hierarchy recommended by SCAQMD, discussed above~~.

The Incremental Operational GHG Emissions ~~emissions~~ shall be equal to the sum of (1) the number of proposed residential units covered by the applicable building permit multiplied by a “GHG Residential Ratio” ~~108.89 MT CO_2e~~ and (2) every thousand square feet of proposed commercial development covered by the applicable building permit multiplied by “a “GHG Commercial Ratio.” (“Commercial development” includes retail, light industrial, office, hotel, and mixed-use buildings.) GHG Residential Ratio and GHG Commercial Ratio shall mean the emissions ratios in $MTCO_2e$ set forth in the applicable CEQA analysis completed by the County of Los Angeles for a specific village-level project to ensure that the related GHG emissions are reduced to zero ~~506.86 MT CO_2e~~.

Discussion

See Technical Report Appendix K, contained in Draft AEA Appendix 1 for detailed information regarding the derivation of the GHG Residential Ratio and GHG Commercial Ratio for the project. For example, the GHG Residential Ratio would be 108.89 $MTCO_2e$ per residential unit and the GHG Commercial Ratio would be 506.86 $MTCO_2e$ per thousand square feet of commercial development if the maximum allowable development facilitated by the RMDP/SCP project occurs. However, as noted above, the applicable GHG Residential Ratio and GHG Commercial Ratio for each village-specific project will be set forth in the applicable CEQA documentation for such village-level project ~~these estimates for the project~~.

Implementation of Mitigation Measure 2-13 shall be adequate to fully mitigate the Incremental Operational GHG Emissions through Direct Reduction Activities that result in GHG Mitigation Credits ~~direct investment in GHG reduction activities~~ and/or the efficacy of Carbon Offsets ~~carbon credits~~ and the reductions they produce. The parameters of the compliance options provided above ensure that the GHG Mitigation Credits and/or Carbon Offsets ~~carbon offsets~~ purchased by the project applicant or its designee meet the criteria of a successful and effective GHG reduction offset. To be accredited by an Approved Registry ~~a recognized carbon registry~~, Carbon Offsets ~~carbon offsets~~ must be ~~demonstrate that they are~~ real, additional, quantifiable, enforceable, validated, and permanent. Carbon Offsets ~~offsets~~ purchased to implement Mitigation Measure 2-13 ~~following project implementation~~ shall meet these standards, and the GHG Mitigation Credits and/or Carbon Offsets obtained by the project applicant or its designee shall produce levels of GHG reductions ~~carbon offsetting on a yearly basis~~ to mitigate the Incremental Operational ~~Operation~~ GHG Emissions during project implementation. All GHG Mitigation Credits and Carbon Offsets must meet the performance standards identified in the GHG Reduction Plan.

The Carbon Offsets ~~carbon offsets~~ associated with the aforementioned compliance options ~~responses~~ are considered appropriate and applicable mitigation for the Incremental Operational GHG Emissions produced by the project following deployment of Mitigation Measures 2-1 through 2-12. Accredited projects and programs participating in local, regional, and global carbon markets shall be subject to the standards enforced by Approved Registries ~~carbon registries~~. If it is found that a Carbon Offset project or program loses its ability to meet the criteria of being real, additional, quantifiable, enforceable, validated, and permanent, the Carbon Offset ~~it~~ loses its accreditation as an active carbon reducing or sequestrating action. The Carbon Offsets ~~carbon credits~~ purchased as a result of Mitigation Measure 2-13 shall be subject to the same standards. Therefore, in ~~In~~ the event that a Carbon Offset project or program providing Carbon Offsets ~~offsets~~ to the project applicant or its designee loses its accreditation, the project applicant or its designee shall comply with the rules and procedures of retiring Carbon Offsets ~~offsets~~ specific to the registry involved and will undertake additional direct investments or purchase an equivalent number of credits to recoup the loss.

Project Emissions with Implementation of Mitigation Measures 2-1 through 2-13

GHG reductions associated with each mitigation measure were quantified and are reported in Draft AEA Appendix 1, along with underlying assumptions and supporting data. Mitigation Measures 2-1 through 2-12 reduce the project's GHG emissions by 289,043 MT CO_2e/year. The project would need additional reductions pursuant to Mitigation Measure 2-13 to meet its zero net emissions commitment. Implementation of Mitigation Measure 2-13 further reduces project-related GHG emissions to zero net emissions. Table 2.3-4 shows estimated reductions associated with each mitigation measure and how the project will meet its commitment to achieve zero net emissions of GHGs. References to corresponding tables in Draft AEA Appendix 1 are included to provide additional details on reduction quantification.

Table 2.3-4 Summary of Greenhouse Gas Emissions Reductions Associated with Mitigation Measures at Full Buildout (2030)

Mitigation Measure	Emissions Reduction (MT CO_2e/year)	Source (Draft AEA Appendix 1)
Mobile Sources		
MM 2-4: Residential EV Chargers and Vehicle Subsidy	53,724	Tables ES-3 and 4-3 Appendix H
MM 2-5: Commercial Development Area EV Chargers	39,109	Tables ES-3 and 4-4
MM 2-6: Transportation Demand Management Plan	60,168	Tables ES-3 and 4-5 Appendix E
MM 2-7: Traffic Signal Synchronization	8,212	Tables ES-3 and 4-6 Appendix I
MM 2-8: Zero-Emission ~~Electric~~ School Bus Program	157	Tables ES-3 and 4-7
MM 2-9: Zero-Emission ~~Electric~~ Transit Bus Subsidy	619	Tables ES-3 and 4-8
MM 2-12: Off-Site EV Chargers	39,813	Tables ES-3 and 4-4
Electricity[1]		
MM 2-1: Residential Zero Net Energy	18,930	Tables ES-3, 4-1a, 4-1b, 4-1c, and 4-1d Appendix C
MM 2-2: Commercial Zero Net Energy	24,843	Tables ES-3, 4-2a, 4-2b, 4-2c, and 4-2d Appendix C
MM 2-11: Building Retrofit Program	500	Tables ES-3 and 4-9 Appendices G and J
Natural Gas[1]		
MM 2-1: Residential Zero Net Energy	11,726	Tables ES-3, 4-1a, 4-1b, 4-1c, and 4-1d Appendix C
MM 2-2: Commercial Zero Net Energy	612	Tables ES-3, 4-2a, 4-2b, 4-2c, and 4-2d Appendix C
MM 2-3: Swimming Pool Heating	22,356	Tables ES-3 and 2-14a
MM 2-11: Building Retrofit Program	500	Tables ES-3 and 4-9 Appendices G and J
Vegetation Removal		
MM 2-10: Offsetting Construction and Vegetation Change Emissions	1,335	Tables ES-2 and ES-3 Appendices F and K

Table 2.3-4 Summary of Greenhouse Gas Emissions Reductions Associated with Mitigation Measures at Full Buildout (2030)

Mitigation Measure	Emissions Reduction (MT CO_2e/year)	Source (Draft AEA Appendix 1)
Construction		
MM 2-10: Offsetting Construction and Vegetation Change Emissions	6,437	Tables ES-2 and ES-3 Appendices F and K
Subtotal GHG Reductions by Measures 1 – 12 (Mitigation)	289,043	Table ES-3
Offset of Remaining Emissions (GHG Reduction Plan)		
MM 2-13: Zero GHG Plan (Mobile)	202,011	Table ES-2
MM 2-13: Zero GHG Plan (electricity) [1]	-4,880[2]	Table ES-2
MM 2-13: Zero GHG Plan (Natural Gas) [1]	8,192	Table ES-2
MM 2-13: Zero GHG Plan (Area Sources)	367	Table ES-2
MM 2-13: Zero GHG Plan (Water Consumption and Wastewater Treatment)	8,190	Table ES-2
MM 2-13: Zero GHG Plan (Solid Waste Generation)	23,179	Table ES-2
Subtotal GHG Reductions by Measure 13 (GHG Reduction Plan)	237,059	Table ES-2
Total Reductions	526,103[3]	

Notes: MT CO_2e/year=metric tons of carbon dioxide equivalent per year; MM=mitigation measure; EV=electric vehicle; TDV=Time Dependent Valuation; CEC=California Energy Commission; ZNE=Zero Net Energy

[1] The zero net energy mitigation measures (MM 2-1 and MM 2-2) are applied by assuming 80% of the mitigation applies to electricity and 20% of the mitigation applies to natural gas consumption associated with the respective land use type (residential and non-residential)

[2] Emissions reductions from direct and indirect energy consumption appear as a negative to represent TDV energy savings from use of photovoltaics combined with variations in natural gas pricing consistent with CEC's TDV model to achieve ZNE.

[3] Summarized emissions by mitigation measure are rounded to the nearest whole number; however, total emissions reflect the sum of exact emissions levels.

Source: Modeling conducted by Ramboll Environ in 2016. See Draft AEA Appendix 1 for detailed calculations.

GHG emissions are anticipated to decrease into the future based on ongoing improvements in technology and implementation of regulations to reduce GHGs (i.e., the reductions of energy-related emissions due to 50 percent RPS based on SB 350 and the reductions in mobile source-related emissions due to fleet turnover and fuel efficiency improvements due to Pavley and ACC). Based on modeling performed for the project and incorporation of the above-mentioned mitigation measures, carbon offsets totaling 237,059 MT CO_2e/year would be required over the 30-year project life to meet the zero net commitment. This translates to ~~7,026,846~~ 7,026,845 MT CO_2e in total carbon offsets required. Technical Report Appendix K contained in Draft AEA Appendix 1 includes detailed calculations of the remaining net operational emissions over the project's operational life of 30 years, and the relationship to the proposed residential and commercial land uses and the offset ratios identified in MM 2-13. This estimate of offsets is conservative in that it likely overstates the amount of GHG emissions that would need to be offset because additional regulatory programs and technology will likely be developed in the future under new state mandates, which will reduce the actual GHG emissions associated with the project at buildout.

Table 2.3-5 shows project emissions for each source after implementation of Mitigation Measures. The Sub-Total emissions value remaining after implementation of Mitigation Measures 2-1 through 2-12 represents the amount that would need to be offset through implementation of Mitigation Measure 2-13 to meet the zero net emissions commitment for the project.

Table 2.3-5 Summary of Annual Greenhouse Gas Emissions at Full Buildout

Emissions Activity	Emissions (MT CO_2e/year)		
	Existing	Unmitigated	Post Mitigation
Mobile Sources	152	403,814	202,011
Electricity[1]	–	39,393	-4,880[2]
Natural Gas[1]	–	43,386	8,192
Area Sources	7,883	367	367
Water Consumption and Wastewater Treatment	2,987	8,190	8,190
Solid Waste Generation	–	23,179	23,179
Vegetation Removal	–	1,335	0
Construction	–	6,437	0
Sub-Total Annual Emissions	11,021	526,103	237,059
MM 2-13 GHG Reductions			-237,059
Total Annual Emissions[2]			0[3]

Notes: MT CO_2e/year=metric tons of carbon dioxide equivalent per year; MM=mitigation measure; TDV = Time Dependent Valuation; CEC=California Energy Commission; ZNE = zero net energy

[1] Unmitigated electricity and natural gas emissions are split based on the CalEEMod output and the swimming pool calculation. The ZNE mitigation measures are split by assuming 78% of the mitigation offsets electricity and 22% offsets natural gas, consistent with actual emissions reductions. The off-site building retrofits are split assuming 50% electricity and 50 % natural gas. Refer to Technical Report Section 2.3.2 and Tables 2-13a through 2-14b of Draft AEA Appendix 1 for more detailed assumptions.

[2] Emissions reductions from direct and indirect energy consumption appear as a negative to represent TDV energy savings from use of photovoltaics combined with variations in natural gas pricing consistent with CEC's TDV model to achieve ZNE. Refer to Technical Report Tables 4-1a through 4-2d and Appendix J of Draft AEA Appendix 1 for more detail.

[3] Summarized emissions by sector are rounded to the nearest whole number; however, total emissions reflect the sum of exact emissions levels.

Source: Modeling conducted by Ramboll Environ in 2016. See Draft AEA Appendix 1 for detailed calculations.

Significance after Mitigation

Adoption and implementation of Mitigation Measure 2-1 through 2-13 would reduce mobile source-, electricity-, natural gas-, vegetation removal-, and construction-related emissions by 526,103 MT CO_2e/year (see Tables 2.3-2, 2.3-3, and 2.3-4). These measures reduce the projected unmitigated GHG emissions levels of the project (unmitigated emissions of 526,103 MT CO_2e/year above existing conditions) that would otherwise occur on the project site, leading to no net contributions of GHG emissions from the project, or zero net emissions. Because the project would result in no net increase of GHG emissions after implementation of mitigation measures, there would be no contribution of GHG emissions to cumulative GHG emissions influencing global climate change.

In addition, because the project would result in no net increase of GHG emissions, it would not conflict with any plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs. The state, and by extension regional and local climate policy is rooted in achieving emissions level below the reference year of 1990 and is based on levels established by scientific evidence to avoid the most adverse impacts of climate change. Therefore, relevant plans, such as ARB's Scoping Plan, SCAG's RTP/SCS, and Los Angeles County's CCAP, all establish non-zero targets (i.e., some level of positive net emissions above existing conditions for land developments to accommodate planned growth) to achieve future GHG emissions targets. By achieving the project applicant's commitment to reach zero net emissions, the feasibility and reliability of which has been demonstrated in the analysis above, the project would lead to no net increase in GHG emissions and would not, therefore, result in any adverse change that could conflict with any relevant plan, policy, or regulation adopted for the purpose of reducing GHG emissions.

In response to public comments, the following supplemental commitment is proposed by the project applicant:

Project Applicant-Proposed Supplemental Commitment

In addition to the installation of EV charging stations required by Mitigation Measures 2-5 and 2-12, and although not required for the project to achieve net zero GHG emissions, the project applicant or its designee shall provide Los Angeles County with proof of installation of EV charging stations prior to the issuance of residential and commercial building permits per the following ratios: one (1) parking space shall be served by an electric vehicle charging station for every 50 dwelling units, and one (1) parking space shall be served by an electric vehicle charging station for every 15,900 square feet of commercial development. ("Commercial development" includes retail, light industrial, office, hotel and mixed-use buildings.) EV charging stations capable of servicing 1,010 parking spaces would be required if the maximum allowable development facilitated by the RMDP/SCP project occurs; fewer EV charging stations would be required if maximum build-out under the RMDP/SCP project does not occur.

The EV charging stations shall achieve a similar or better functionality as a Level 2 charging station and may service one or more parking spaces. In the event that the installed charging stations use functionality/technology other than Level 2 charging stations, the parameters of the mitigation obligation (i.e., number of parking spaces served by EV charging stations) shall reflect the comparative equivalency of Level 2 charging stations to the installed charging stations on the basis of average charge rate per hour. For purposes of this equivalency demonstration, Level 2 charging stations shall be assumed to provide charging capabilities of 25 range-miles per hour.

The EV charging stations shall be located either on the project site or within the jurisdictional area of the Southern California Association of Governments. The EV charging stations shall be in areas that are generally accessible to the public, such as areas that include, but are not limited to, retail centers, employment centers and office complexes, recreational facilities, schools, and other categories of public facilities.

2.1.4 References – ~~GHG~~ Greenhouse Gas

ARB. *See California Air Resources Board.*

Cal-Adapt. 2016. *Local Climate Snapshot: Los Angeles County.* Available: http://cal-adapt.com/tools/factsheet/. Accessed: August 22, 2016.

California Air Pollution Control Officers Association. 2008 (January). *CEQA and Climate Change.* Available: http://www.energy.ca.gov/2008publications/CAPCOA-1000-2008-010/CAPCOA-1000-2008-010.PDF. Accessed: August 22, 2016.

California Air Resources Board. 2012 (May). *Technical Evaluation of the Greenhouse Gas Emission Reduction Quantification for the Southern California Association of Governments' SB 375 Sustainable Communities Strategy.* Available: https://www.arb.ca.gov/cc/sb375/scag_scs_tech_eval0512.pdf. Accessed: October 12, 2016.

______. 2014a. (May). *First Update to the Climate Change Scoping Plan*. Available: http://www.arb.ca.gov/cc/scopingplan/document/updatedscopingplan2013.htm. Accessed: August 22, 2015.

______. 2014b. *Air Resources Board Preliminary Draft Staff Report SB 375 Greenhouse Gas Emissions Reduction Target Update Process.* Available: https://www.arb.ca.gov/cc/sb375/pre_draft_target_update_sr.pdf. Accessed: October 12, 2016.

______.2015. *2020 Business-as-Usual Emissions Projection 2014 Edition.* Available: http://www.arb.ca.gov/cc/inventory/data/bau.htm. Accessed: April 18, 2016.

______. 2016a. *CA Phase 2 GHG webpage*. Available: http://www.arb.ca.gov/msprog/onroad/caphase2ghg/caphase2ghg.htm. Accessed: August 22, 2016.

______. 2016b (September). *Technical Evaluation of the Greenhouse Gas Emissions Reduction Quantification for the Sacramento Area Council of Governments' SB 375 Sustainable Communities Strategy.* Available: https://www.arb.ca.gov/cc/sb375/sacog_2016_scs_evaluation.pdf. Accessed: October 26, 2016.

California Department of Water Resources. 2008. 2008 (October). *Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water*. Available at http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf. Accessed August 22, 2016.

California Energy Commission. 2006. (December). Refining Estimates of Water-Related Energy Use in California. Sacramento. CA. CEC-500-2006-118. Available: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF. Accessed October 7, 2016.

______. 2015. *Integrated Energy Policy Report.* Available: http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-01/TN212017_20160629T154354_2015_Integrated_Energy_Policy_Report_Small_File_Size.pdf. Accessed: August 22, 2016.

California Natural Resources Agency. 2012. *Our Changing Climate: Vulnerability & Adaptation to the Increasing Risks of Climate Change in California*. Available: http://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf. Accessed: August 22, 2016.

______. 2014 (July). *Safeguarding California: Reducing Climate Risk, an Update to the 2009 California Climate Adaptation Strategy.* Available: http://resources.ca.gov/docs/climate/Final_Safeguarding_CA_Plan_July_31_2014.pdf. Accessed: August 22, 2016.

CAPCOA. *See California Air Pollution Control Officers Association.*

CEC. *See California Energy Commission.*

CNRA. *See California Natural Resources Agency.*

DWR. *See California Department of Water Resources.*

EPA. See *U.S. Environmental Protection Agency*

Intergovernmental Panel on Climate Change. 2014. *Fifth Assessment Report. Climate Change 2014: Synthesis Report*. SPM.2.2. Available at: https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf. Accessed: October 26, 2016.

SCAQMD. *See South Coast Air Quality Management District.*

South Coast Air Quality Management District. 2008. Governing Board Agenda Item 31, Interim CEQA GHG Significance Threshold for Stationary Sources, Rules and Plans. December 5, 2008. http://www.aqmd.gov/docs/default-source/ceqa/handbook/greenhouse-gases-(ghg)-ceqa-significance-thresholds/ghgboardsynopsis.pdf?sfvrsn=2

EXHIBIT 13

Major construction firms team up to get the carbon out of concrete

The Climate Group's ConcreteZero initiative will set standards and create markets for low-carbon concrete. Experts say its early goals are well within reach.

6 July 2022

(Ben Hasty/MediaNews Group/Reading Eagle via Getty Images)

Jeff St. John

A consortium of construction firms, property developers and building engineers plans to use their collective heft to drive down the carbon emissions of one of the world's most ubiquitous building materials. As part of the new ConcreteZero initiative, 17 companies have pledged to bring the proportion of "low-emissions" concrete they use to 30 percent by 2025 and 50 percent by 2030. The companies — which include major European construction firms such as Laing O'Rourke, Mace, Skanska UK and Willmott Dixon; property owners and developers such as Canary Wharf Group and Grosvenor; and engineering firms such as Buro Happold and Thornton Tomasetti — say they'll use only zero-carbon concrete by 2050.

That 2050 goal is a bold one that will be hard to achieve. Production of cement, the raw material in concrete, accounts for between 7 and 8 percent of global carbon emissions today, due both to the fossil fuels used in its high-heat production and the chemical composition of the raw materials and processes that make it. These emissions have been rising, not only because of the ever-increasing demand for concrete for buildings, roads and bridges but also because the carbon-intensity of global cement production is increasing, according to recent research.

The International Energy Agency has tracked a 1.8 percent annual increase in the carbon-intensity of global cement production from 2015 to 2020, a trend line that is moving in the opposite direction of the 3 percent annual declines IEA says the industry must achieve to be on track with its net-zero by 2050 goal.

But the options to reduce the carbon-intensity of concrete — the combination of cement and gravel, sand and other aggregate materials that is mixed with water and poured into forms that harden into rocklike rigidity — are broadly available, practical and cost-effective today, building decarbonization experts say.

That's why Climate Group, the U.K.-based nonprofit leading the ConcreteZero initiative, is enlisting concrete-using companies in demanding lower-carbon methods and materials and setting the definitions and standards for what counts as "low" and "zero"-emissions concrete.

"It's time for concrete targets to reduce carbon emissions in years, not decades," Jen Carson, Climate Group's head of industry, said in a statement on Monday. "ConcreteZero is signaling to the industry that the biggest buyers want the industry to innovate and act now."

ConcreteZero is modeled on similar Climate Group initiatives that have enlisted corporations to pledge to boost their use of renewable energy and, more recently, to commit to sourcing a rising quantity of low-carbon steel, another major source of global carbon emissions that will be hard to decarbonize.

Boosting demand for concrete that carries a lower "embodied carbon" footprint will be a vital step in driving the concrete industry to invest in the alternatives available today that could allow ConcreteZero members to hit their goals through 2030, said Victor Olgyay, a principal in the carbon-free buildings practice of nonprofit think tank RMI. (Canary Media is an independent affiliate of RMI.)

"Today, there are ways to cost-effectively reduce the climate impact of cement and, by extension, concrete, by 50 percent with essentially no cost," Olgyay said in a Monday interview. The trick is not to try to reduce the energy- and chemistry-derived carbon emissions of making cement, which are still in the early stages of technological development, but to concentrate on reducing how much cement is used in the concrete going into construction.

The low-hanging fruit for reducing concrete's embodied carbon impact

Engineers and architects can reduce the proportion of cement in a number of ways, Olgyay said. One is to use higher-quality aggregate that imparts more structural integrity to the concrete that's made with it, he said.

Another is by using what's called "supplementary cementitious materials" to replace a portion of the cement used in different mixes of concrete. Fly ash from coal plants and slag from steel mills are the most common alternatives and are being put to use by some major cement and concrete companies such as Cemex. But rice husks, ground glass and several other alternatives can "replace anywhere from 10 to 40 percent of the cement," Olgyay said.

However, there are barriers to making these shifts, Olgyay went on to explain. The first is that "concrete is a structural material that holds up buildings, and engineers are very cautious about messing around with the mix."

Convincing concrete specialists such as ConcreteZero members Byrne Bros. and Morrisroe to designate standards for concrete mixes that use varying proportions of these alternative aggregates and cementitious materials for different purposes could help eliminate this barrier. The U.S.-based Structural Engineering Institute has published guidelines on how to avoid the overuse of concrete to reduce carbon impact. Similarly, the mixes employed for high-strength concrete used in bridges or skyscrapers are very different than that used to pave sidewalks, Olgyay said.

The second barrier to more widespread adoption "is that there's currently not a lot of demand" for lower-carbon concrete, he said. That puts relatively little pressure on the "ready-mix" companies, which combine cement with the various sources of aggregate materials available locally to serve regional construction needs, to seek out or invest in alternative materials.

Efforts like ConcreteZero's could play a valuable role in boosting this demand, Olgyay said. So too will regulatory pushes like the U.S. federal government's call to the concrete and asphalt industries to provide lower-emissions materials for federal construction projects, or the state-by-state policies mandating lower-carbon concrete standards for government contracts.

Setting the standards for measuring the carbon footprint of different concrete materials and mixes is also needed to provide transparency between concrete makers and buyers, Olgyay added. Luckily, environmental product declarations that assess the embodied carbon footprint of different mixes of cement and concrete are generally available, with those provided by the Embodied Carbon in Construction Calculator (EC3) tool serving as today's gold standard.

"Three or four years ago, virtually nobody was talking about this in the construction industry," said Andrew Himes, director of collective impact at the Carbon Leadership Forum, the nonprofit group that developed the methodology behind the EC3 tool. But the understanding that up to half of a building's lifetime carbon impact is tied up in the materials used to build it, not just the energy used to heat, cool, light and otherwise operate it, has changed that situation dramatically, he said.

Cement production: The tougher part of decarbonizing concrete

Reducing the carbon emissions associated with making Portland cement, the type of cement used in most of the world's concrete, will be more challenging, Olgyay said. Making Portland cement involves heating kilns to temperatures of greater than 1,400 degrees Celsius, a level of heat that's hard to achieve without burning fossil fuels. And the raw material of cement, limestone or calcium carbonate releases carbon as part of the process that transforms it into "clinker," a precursor material to cement, accounting for between 50 to 65 percent of cement production's total emissions.

Various methods are being explored to reduce emissions without altering the fundamental formula for making Portland cement, Olgyay said. Canadian startup CarbonCure has developed a technique of injecting carbon dioxide captured from emitting sources into concrete as a means of storing the carbon and strengthening the concrete, for example.

Still others are looking at ways to reduce the amount of energy needed for the heating portion of this carbon emissions profile or to switch to carbon-neutral sources of energy. Others are exploring alternative materials to calcium carbonate that won't emit carbon dioxide when heated to form cement. More esoteric concepts include using living organisms to "grow" cement.

These new chemistries for cement are "very interesting, but they're emerging technologies," Olgyay said. In the meantime, he said, existing methods to reduce the carbon intensity of concrete should be the industry's focus, rather than waiting for cost-effective means to capture and store the carbon emissions from their facilities to achieve the final reductions necessary to achieve zero-carbon goals.

That makes for some uncertainty on how to reach this end goal, he said. But in the meantime, the group's 2025 and 2030 goals are "both easily achievable and broadly in line with" targets set by the United Nations' Intergovernmental Panel on Climate Change for reducing greenhouse gas emissions at a pace and scale needed to limit the most catastrophic harms of climate change.

EXHIBIT 14

Exhibit A to Planning Commission Resolution No. 10187

CITY OF PITTSBURG

GENERAL PLAN
ANNUAL PROGRESS REPORT
(Calendar Year 2021)

Prepared pursuant to Government Code Section 65400(b)
Accepted by the Planning Commission on March 22, 2022
Submitted to the City Council on April 4, 2022

GENERAL PLAN ACTION POLICIES

Legend: **BLUE BOLD TEXT** – Policies with completed implementation
GREEN BOLD TEXT – Policies with ongoing implementation

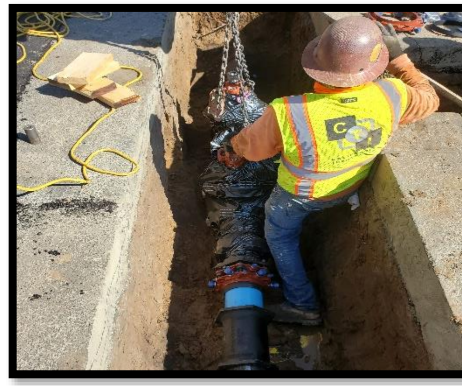
LAND USE ELEMENT		
ACTION POLICIES		**STATUS (AS OF 12/31/21)**
2-P-1	**Review the City's Sphere of Influence every 5 years. Ensure necessary annexation and SOI changes through coordination with the county and LAFCo, in accordance with Figure 2-3.**	Implementation Ongoing. Sky Ranch, Ambrose Park and Mirant annexations were completed in 2008. Annexation of Northeast Industrial properties to DDSD boundary completed in 2010. Voter Measure I amending the ULL to include the property commonly known as Chevron East approved in November 2011. Environmental Impact Report for the proposed James Donlon Boulevard Extension corridor annexation project was certified in September 2014; however, initiation of annexation is still pending. Property owner-initiated annexations of Montreux and Tuscany Meadows properties completed in 2016 and 2017. Property owner-initiated annexation of the SW Hills/Faria property still underway.
2-P-2	**Update the City's Zoning Ordinance and Subdivision Regulations for consistency with the General Plan, including the General Plan Diagram.**	Phase 1 & 2 Zoning Code Updates are completed. First phase of Title 17 (Subdivision Ordinance) update completed in April 2009 and incorporated various updates in accordance with the state Subdivision Map Act. Title 17 further updated to streamline review of tentative maps in 2015. A tree preservation ordinance and wireless telecommunications ordinance, along with a variety of other miscellaneous amendments, adopted in 2015. Ordinances to define and regulate placement of smoke shops and smoking lounges, further update the wireless telecommunications regulations, as well as the retail sale and distribution of marijuana, adopted in 2016. Adopted ordinances in 2017, streamlining the permitting process for accessory dwelling units and expanding the types of businesses allowed in Old Town. In 2018, adopted an ordinance modifying the land use definitions, application process, permit requirements, and enforcement provisions for massage establishments. Adopted ordinances incorporating water-efficient landscaping provisions in 2020.

LAND USE ELEMENT		
ACTION POLICIES		**STATUS (AS OF 12/31/21)**
2-P-66	**Work with Los Medanos College and the City of Antioch to undertake a study exploring the viability of a street connection between Leland and Buchanan Roads, along the eastern edge of the College at the border of the two cities.**	Proposed “Standard Oil Avenue” is identified as a planned future route of regional significance in the East County Action Plan adopted by TRANSPLAN in August 2009 and the Countywide Transportation Plan adopted by the Contra Costa Transportation Authority in June 2009.
Buchanan		
2-P-71	**New residential development south of Buchanan Road should:** ○ **Ensure that adequate acreage is dedicated for an elementary school and community park directly adjacent to Buchanan Rd.;** ○ **Not result in any net increase of peak-hour stormwater flow;** ○ **Preserve and enhance existing north-south creeks; and** ○ **Respect natural topography in the design and construction of new units.**	Ongoing as part of development review. Highlands Ranch Park (10.42 acres) was constructed sometime between 1999 and 2002 as part of the Highlands Ranch Subdivision. The Tuscany Meadows Subdivision approved in 2016 will dedicate approximately 12 acres of parkland, some of which will also function as stormwater detention facilities.
2-P-72	**Pursue construction of the Buchanan bypass, as designated in the General Plan Diagram, providing an alternative route for commuters traveling from Kirker Pass Rd. to destinations east of Pittsburg.**	Ongoing. Final environmental impact report certified in 2014. Identified as CIP Project ST-36 (James Donlon Extension Project). The project is still in the design stage with 65% construction drawings complete.

TRANSPORTATION ELEMENT		
ACTION POLICIES		**STATUS (AS OF 12/31/21)**
7-P-5	**Apply for Federal Congestion Mitigation Air Quality (CMAQ) grant funding, designed to improve air quality through roadway improvement projects.**	Implementation ongoing. In 2018, the City received $203,000 in CMAQ funding for school area safety improvements and $1.3 M for the multimodal transfer facility.
7-P-6	**Design roadway improvements and evaluate development proposals based on Level of Service standards set forth in Goal 7-G-1.**	Implemented as part of development review.
7-P-10	**Require mitigation for development proposals which result in projected parking demand that would exceed the proposed parking supply on a regular and frequent basis.**	Implemented as part of development review.
7-P-12	**Continue to collect fees, plan and design for the future construction of Buchanan Bypass. Ensure preparation of a feasibility and environmental impact study to determine the precise alignment, costs, mitigation measures, and impacts on adjacent uses.**	Final environmental impact report certified in 2014. Identified as CIP Project ST-36 (James Donlon Extension Design and Construction).
7-P-16	**Continue to collect fees for the extension of West Leland Road to Willow Pass Road, subject to the Traffic Mitigation Fee program. As established by nexus, require new development adjacent to the extension to dedicate right-of-way and construct or fund new intersections and frontage improvements.**	Implementation ongoing. CIP Project ST-54 (Avila Road Widening) and ST-55 (W. Leland Road Extension Phase 2) would: 1) widen Avila Road to four lanes; and 2) extend W. Leland Road from San Marco Boulevard to Avila Road. The new extension would be four lanes with a raised median and sidewalks. The project would accommodate bicycle facilities where appropriate.
7-P-17	**Pursue the design and construction of an interchange/overpass at State Route 4 and Range Road. Work with Caltrans to design an interchange facility that will accommodate future traffic demands.**	Implementation ongoing. CIP Project ST-1 (Range Road Overcrossing) would include planning, design, and construction of an overcrossing on SR 4 at Range Road. This project would significantly improve the level of service of the overcrossings at Railroad Avenue and Bailey Road. It will accommodate bicycle facilities where appropriate.

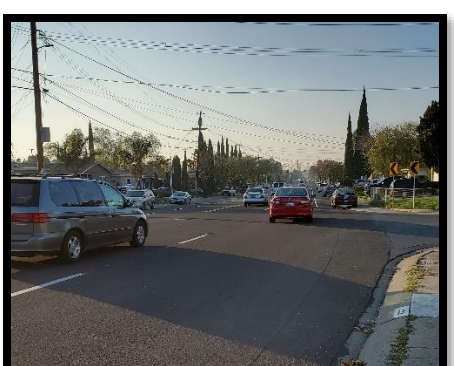
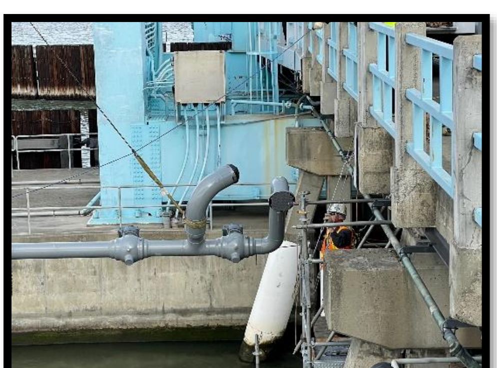
EXHIBIT 15





CAPITAL IMPROVEMENT PROGRAM

SCHEDULE PROJECTS


STREET PROJECTS
Project Summary

Item No.	Finance No.	Project Name	Estimated Project Cost ($)	Funding/Source ($)	CIP Funding Schedule						Total Funding
				Identified Funding Available (N) = New allocation (F) = Future allocation (E) = Existing	Current Project Funding ($)	FY 2022-23 ($)	FY 2023-24 ($)	FY 2024-25 ($)	FY 2025-26 ($)	FY 2026-27 ($)	
ST-1		Range Road Overcrossing	$25,000,000								$0
ST-2	2019	BART Pedestrian/Bicycle Connectivity	$5,520,000	3,870,000 OBAG-2 600,000 PBTF, 50,000 Measure J 300,000 LTMF 700,000 SR2BART	$5,520,000						$5,520,000
ST-4		Delta DeAnza Trail Roadway Crossing Improvement	$150,000	120,000 TDA (E)	$120,000						$120,000
ST-5		Street Median/Landscape Improvements	$520,000								$0
ST-6		Bailey Road Pavement Rehabilitation	$615,000								$0
ST-7	2038	HSIP 10- Signing and Striping Improvement Project (Rename)	$2,965,700	$2,965,700 HSIP	$2,965,700						$2,965,700
ST-8	2026	Bridge Maintenance & Repairs	$100,000	5,000 HUTA $40,000 HUTA (F)	$5,000		$20,000		$20,000		$45,000
ST-9		Intersection Geometric Improvements (San Marco Boulevard/ W. Leland Road) Geometric Improvements	$125,000								$0
ST-10		El Pueblo Area Reconstruction/ADA Improvements	$300,000								$0
ST-11	2028	HSIP 10-Crestview Drive Pavement and Pedestrian Improvement Project	$650,000	$378,220 HSIP $41,180 RMRA $100,000 RMRA (N) 100,000 HUTA (N)	$419,400	$200,000					$619,400
ST-12		San Marco Blvd Widening	$125,000								$0
ST-15		East Third Street Streetscape Improvements	$1,500,000								$0
ST-16	4065	FY 2021/22 CDBG ADA Curb Ramp Project	$250,000	$250,000 CDBG							$0
ST-19		Marina Blvd Buffered Bicycle Lanes	$140,000	56,100 TDA (E)	$56,100						$56,100
ST-20		SB1-FY 2025/26 Pavement Improvement Project	$1,100,000	$1,100,000 RMRA (F)					$1,100,000		$1,100,000
ST-21		Railroad Ave./Leland Rd. Geometric Improvements	$525,000								$0
ST-23		Left Turn Lane Bailey Rd/Willow Ave	$200,000								$0
ST-25		Rebuild Range Road/Willow Pass Road Interchange	$4,200,000								$0
ST-27		Bailey Road Operational Safety Improvements	$300,000								$0
ST-28	2205	West Leland Street Lighting Project (Railroad Avenue to Crestview Drive & Crestview @ Trail)	$760,000	458,000 HUTA (E) 277,000 CCIF (E) 25,000 PDF (E)	$760,000						$760,000
ST-29		Westbound Hwy 4 Offramp at Railroad Avenue	$12,100,000								$0
ST-30		E. Leland Rd./Los Medanos College (eastern entrance)	$420,000								$0
ST-31		Century Boulevard Class III Bicycle Facility	$60,000								$0

STREET PROJECTS
Project Summary

Item No.	Finance No.	Project Name	Estimated Project Cost ($)	Funding/Source ($) Identified Funding Available (N) = New allocation (F) = Future allocation (E) = Existing	CIP Funding Schedule: Current Project Funding ($)	FY 2022-23 ($)	FY 2023-24 ($)	FY 2024-25 ($)	FY 2025-26 ($)	FY 2026-27 ($)	Total Funding
ST-32		Century Boulevard Class II Bicycle Lanes	$75,000								$0
ST-33	2029	SB1 FY 2021/22 Pavement Management	$1,100,000	1,100,000 RMRA	$1,100,000						$1,100,000
ST-34		West Leland Road Safety Improvements	$150,000								$0
ST-36	3015	James Donlon Boulevard Extension (Design/Construction)	$95,610,000	1,880,000 LTMF 14,220,000 Developer Obligated LTMF 63,404,800 RTMF 14,495,200 TBD	$6,200,000						$6,200,000
ST-37		Railroad Avenue Complete Streets	$1,000,000								$0
ST-38	3113	West Leland Road Pavement Markers/Markings and Speed Signage Improvements	$376,800	376,800 HSIP	$376,800						$376,800
ST-40		FY 2025/26 Street Maintenance Project	$400,000	$200,000 HUTA (F) $200,000 RMRA (F)					$400,000		$400,000
ST-41	2017/3332	Annual Citywide Fence/ Soundwall/ Streetlight Replacement/Sidewalk Installation & Repair	$580,000	280,000 MJ (E) 75,000 MJ (N) 225,000 MJ (F)	$280,000	$75,000	$75,000	$75,000	$75,000	$75,000	$655,000
ST-42	2207	West Leland High Friction Surface Treatment	$718,000	60,000 RMRA 548,000 HSIP 110,000 MJ	$718,000						$718,000
ST-43	3114	West Leland Road Pavement Delineation, Warning Signage, High Visibility Crosswalk Improvements and Traffic Signal Modification at Range Road	$265,900	265,900 HSIP	$265,900						$265,900
ST-44		Annual Citywide Sidewalk Replacement	$100,000								$0
ST-47	2232	FY 2020/21 Street Maintenance Project (PW)	$850,000	850,000 HUTA & RMRA (E)	$850,000						$850,000
ST-48	2024	FY 2021/22 Street Maintenance Project (move to 2232)	$400,000	36,000 HUTA (E) 36,000 RMRA (E)	$72,000						$72,000
ST-49		Marina Blvd. Improvements (Marina Master Plan Phase III)	$1,550,000								$0
ST-50		Railroad Avenue Northbound Right-Turn Lane at Highway 4	$300,000								$0
ST-51	3115	Stoneman Avenue Pedestrian Safety Improvements	$1,230,000	880,000 HSIP8 300,000 RMRA	$1,180,000						$1,180,000
ST-52	2219/2229/ 2239	Annual Citywide Striping & Signage	$267,000	200,000 HUTA (E) 50,000 HUTA (N) 200,000 HUTA (F)	$200,000	$50,000	$50,000	$50,000	$50,000	$50,000	$450,000
ST-54		Avila Road Widening Phase II (City Limits to Santa Teresa)	$11,520,000								$0
ST-55	3011	W. Leland Road Extension Phase II (San Marco to Avila)	$10,000,000	50,000 LTMF	$50,000						$50,000

ST-36: JAMES DONLON BOULEVARD EXTENSION DESIGN AND CONSTRUCTION

Project No.
3015

Estimated Project Cost:
$95,610,000

Status:
Design in Progress

Project Limits:
Eastern city limits to Kirker Pass Road

Funding Sources:

Eligible Funding Source: TMF, Regional TMF/ PRTDIM/Developer/Measure J
Identified Funding: $1,880,000 LTMF,
$14,220,000 Developer/Local Match,
$63,404,800 RTMF,
$14,495,200 TBD ($6,200,000 has been allocated to this project)

Project Description:
The project will design and construct an additional east-west connection between East and Central County by adding a new link between James Donlon Boulevard in Antioch and Kirker Pass Road. The new roadway, formerly known as the Buchanan Road Bypass, will relieve congestion and other future travel demand on Buchanan Road. This project will be funded with 68% RTMF, 22% LTMF, 7% other funds.

ST-36: JAMES DONLON BOULEVARD EXTENSION DESIGN AND CONSTRUCTION

S-3: TRAFFIC SIGNAL INTERCONNECT EXPANSION PROJECT

Project No.
TBD

Status:
Awaiting funding

Estimated Project Cost:
$275,000

Project Limits:
Citywide

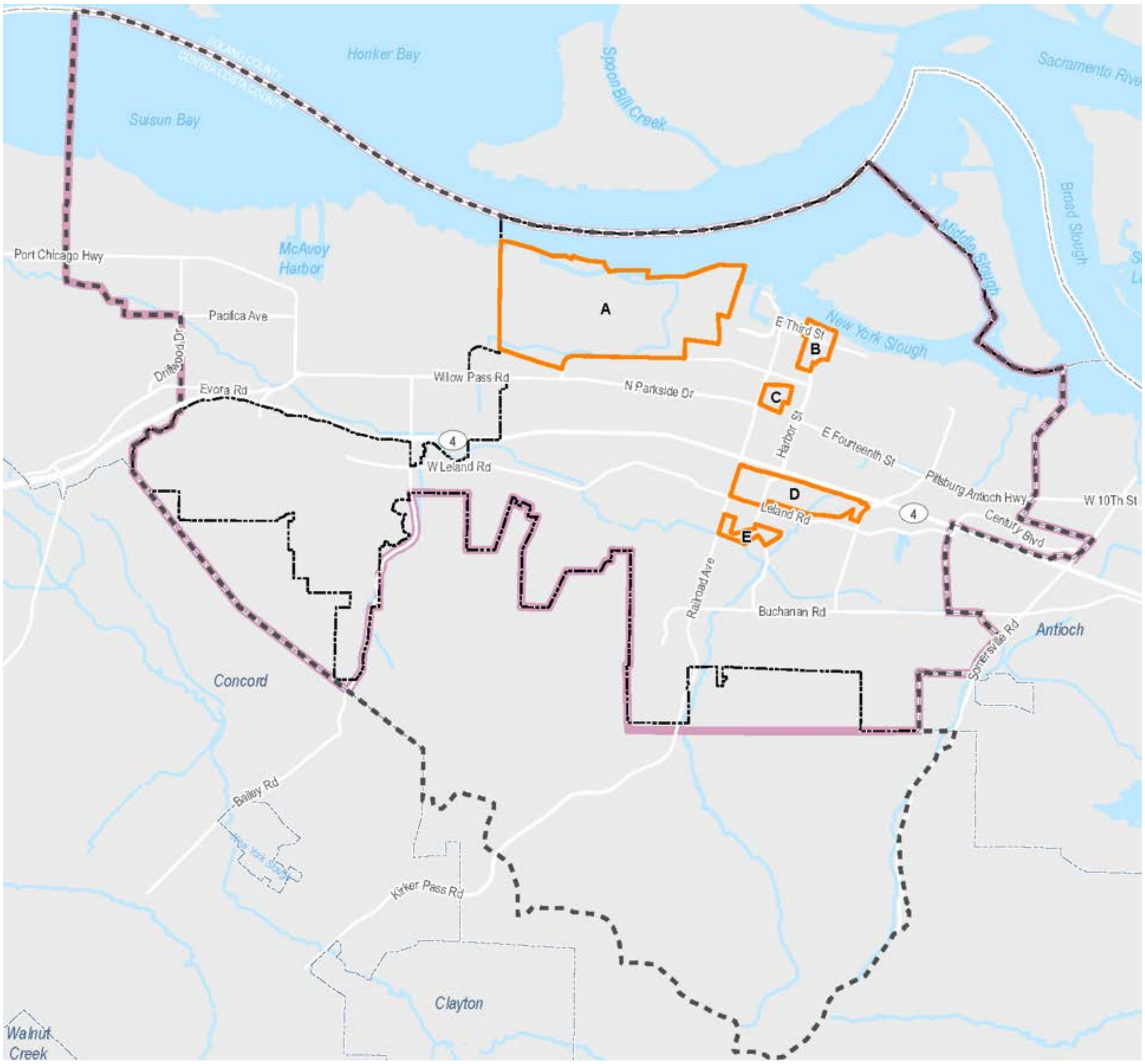
Funding Sources
Eligible Funding Source: Measure J

Identified Funding: None

Project Description:
This project will consist of interconnecting a total of 42 traffic signals to our traffic network. Signal interconnect cables, ethernet switches and wireless antennas for cellular service will be installed at each traffic signal intersection. This will allow communication and transfer of operational data between traffic signal cabinets with City traffic network. From an operational perspective, this allows City and transportation staff the ability to monitor and maintain the traffic network and to allow full integration of new Intelligent Transportation Systems (ITS) technologies. Since monitoring and changes can be performed from a remote traffic management location, this will ultimately reduce staff costs by not having to deploy signal technician staff to the site to perform operational changes.

EXHIBIT 16

ENVISION
Pittsburg



March 2021

LAND USE ALTERNATIVES AND CAPACITY REPORT

City of Pittsburg General Plan Update and Brownfields Revitalization Planning

Figure 4:

ALTERNATIVE B

Legend

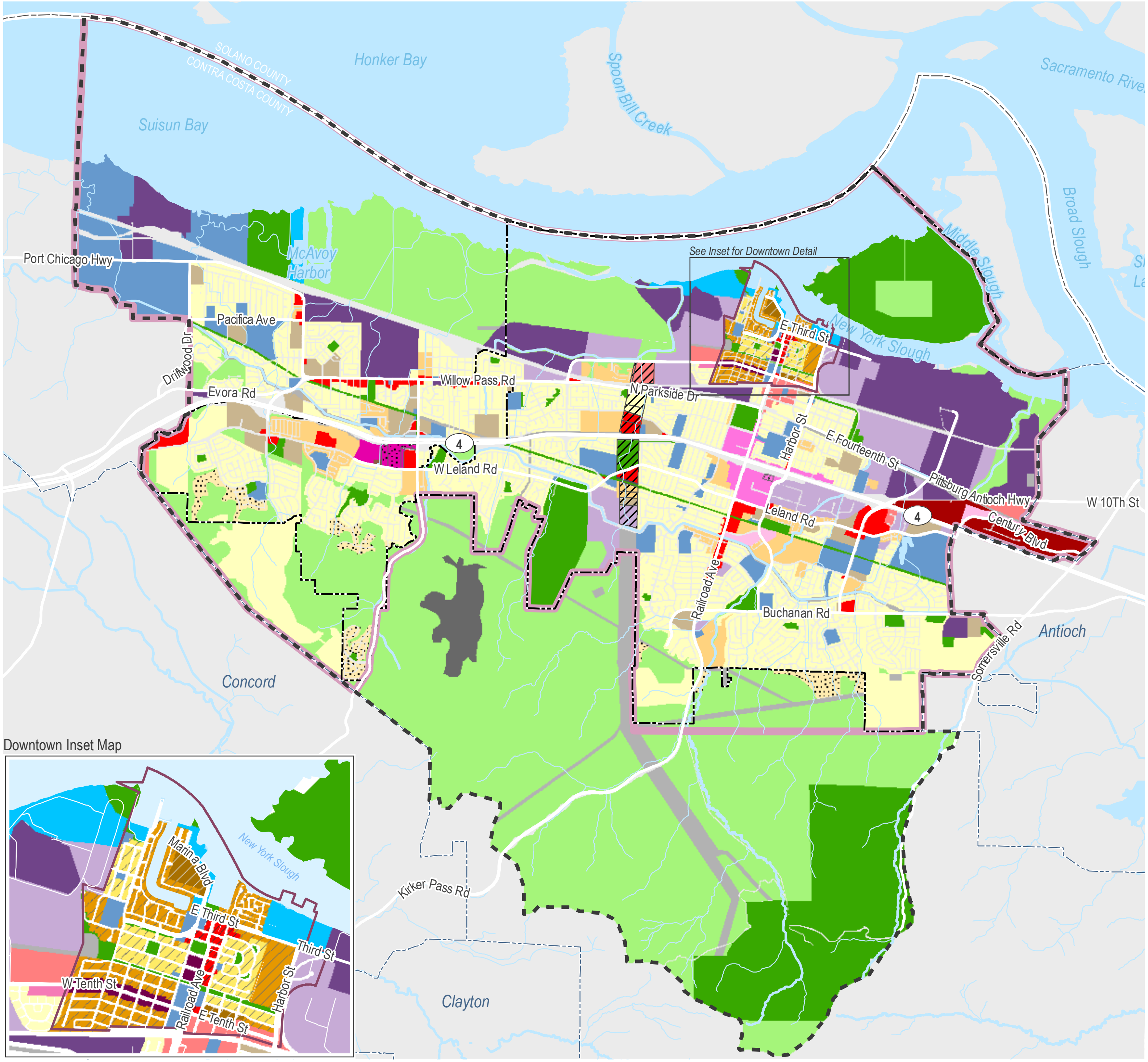
- Pittsburg City Limits
- Pittsburg Sphere of Influence
- Downtown Sub-Area
- Planning Area
- Neighboring City

General Plan Land Use Designation

- Hillside Low Density Residential
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Very High Density Residential
- Regional Commercial
- Service Commercial
- Community Commercial
- Mixed Use (General)
- Mixed Use (Community Commercial)
- Mixed Use (Downtown)
- Mixed Use (P/BP BART)
- Mixed Use (Railroad Ave SPA)
- Marina Commercial
- Employment Center Industrial
- Industrial
- Landfill
- Open Space
- Park
- Public/Institutional
- Utility/ROW
- Downtown Low Density Residential
- Downtown Med Density Residential
- Downtown High Density Residential
- Downtown Commercial
- Water
- PG&E Corridor Conversion Overlay
- BART TOD Overlay

0 ½ 1
Miles
NORTH

De Novo Planning Group
A Land Use Planning, Design, and Environmental Firm



Sources: City of Pittsburg, Contra Costa County. Map date: February 15, 2021.

Figure 5:

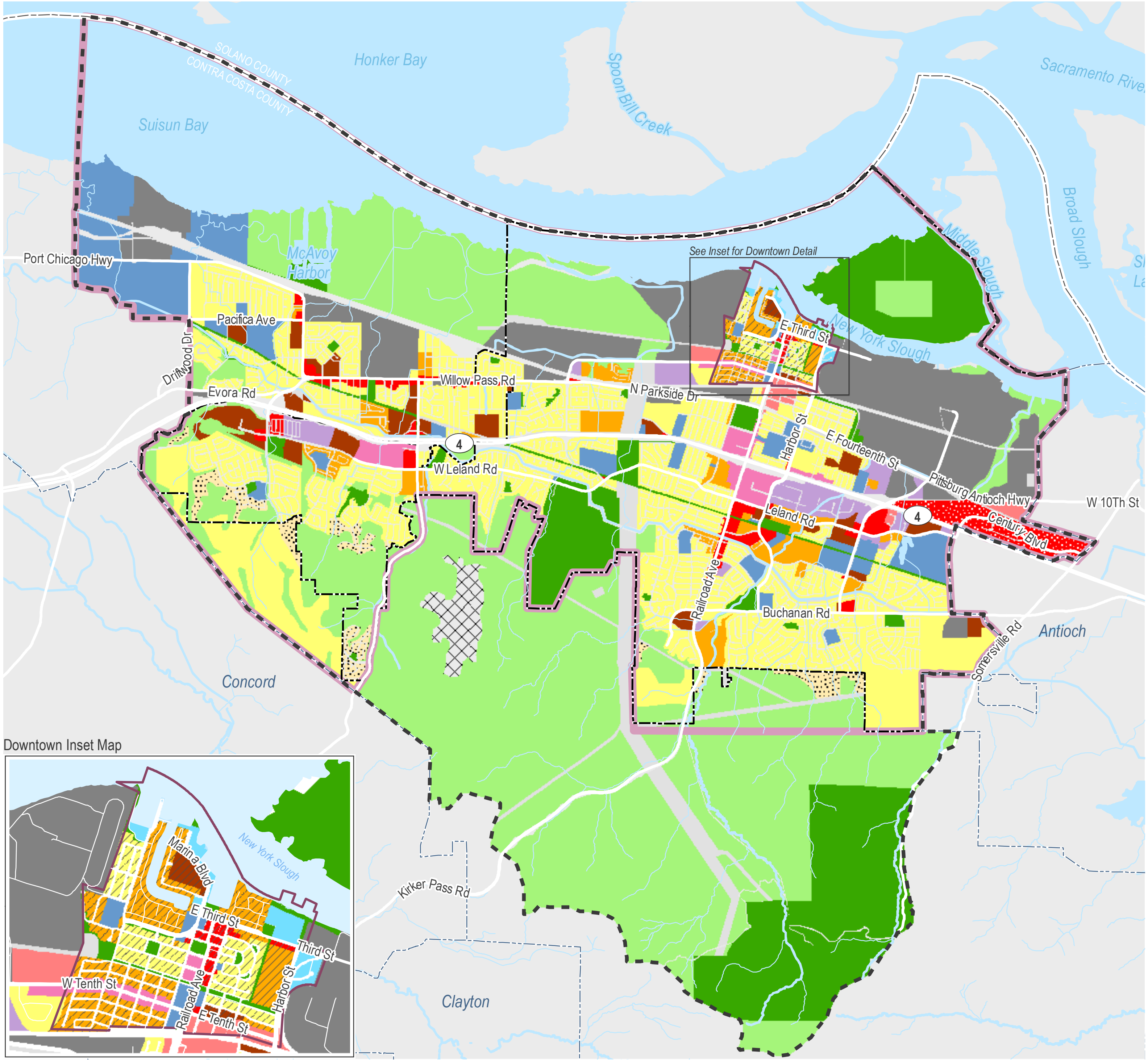
ALTERNATIVE C

Legend

- Pittsburg City Limits
- Pittsburg Sphere of Influence
- Downtown Sub-Area
- Planning Area
- Neighboring City

General Plan Land Use Designation

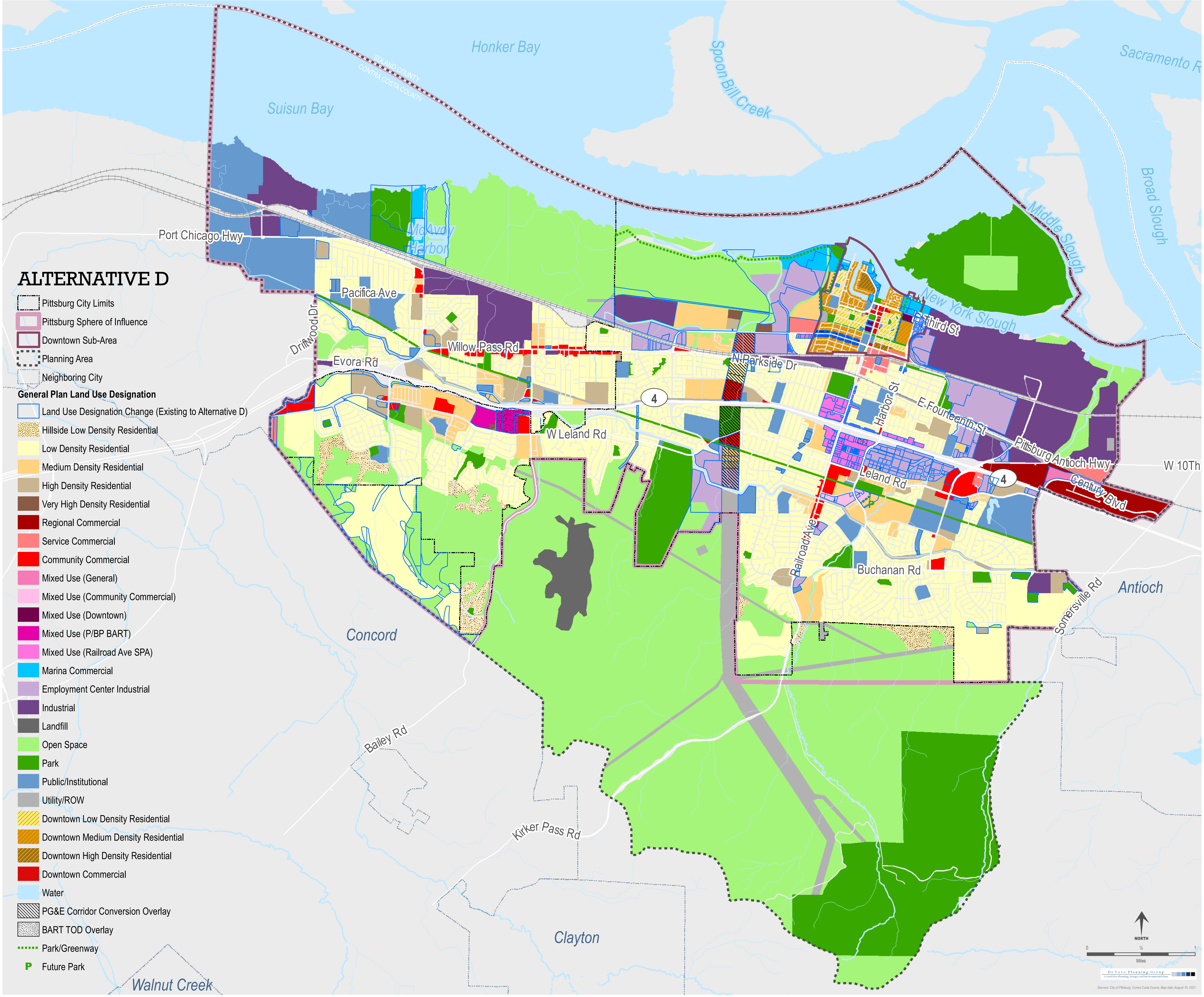
- Hillside Low Density Residential
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Business Commercial
- Community Commercial
- Service Commercial
- Regional Commercial
- Marine Commercial
- Industrial
- Landfill
- Mixed Use
- Open Space
- Park
- Public/Institutional
- Utility/ROW
- Downtown Low Density Residential
- Downtown Med Density Residential
- Downtown High Density Residential
- Downtown Commercial
- Water



0 ½ 1
Miles
NORTH

Sources: City of Pittsburg, Contra Costa County. Map date: February 15, 2021.

EXHIBIT 17



ALTERNATIVE D
Pittsburg City Limits
Pittsburg Sphere of Influence
Downtown Sub-Area
Planning Area
Neighboring City
General Plan Land Use Designation
Land Use Designation Change (Existing to Alternative D)
Hillside Low Density Residential
Low Density Residential
Medium Density Residential
High Density Residential
Very High Density Residential
Regional Commercial
Service Commercial
Community Commercial
Mixed Use (General)
Mixed Use (Community Commercial)
Mixed Use (Downtown)
Mixed Use (P/BP BART)
Mixed Use (Railroad Ave SPA)
Marina Commercial
Employment Center Industrial
Industrial
Landfill
Open Space
Park
Public/Institutional
Utility/ROW
Downtown Low Density Residential
Downtown Medium Density Residential
Downtown High Density Residential
Downtown Commercial
Water
PG&E Corridor Conversion Overlay
BART TOD Overlay
Park/Greenway
P
Future Park
Honker Bay
Suisun Bay
Spoon Bill Creek
Sacramento R
Broad Slough
Middle Slough
New York Slough
SOLANO COUNTY
CONTRA COSTA COUNTY
McAvoy Harbor
Port Chicago Hwy
Pacifica Ave
Driftwood Dr
Willow Pass Rd
Evora Rd
N Parkside Dr
Third St
Harbor St
E Fourteenth St
Pittsburg Antioch Hwy
W 10Th
4
W Leland Rd
Leland Rd
Century Blvd
Railroad Ave
Buchanan Rd
Somersville Rd
Antioch
Concord
Bailey Rd
Kirker Pass Rd
Clayton
Walnut Creek
NORTH
0
½
1
Miles

From: Louis Parsons <lparsons@discoverybuilders.com>
To: Kristin Pollot <KPollot@ci.pittsburg.ca.us>
Subject: Faria - Master Plan Exhibits
Date: 2020-07-10 17:12:39 -0700
Importance: Normal
Attachments: 201001_Faria_SW_Hills_Master_Plan_Exhibits_Contour_Highlight_06-23-2020.pdf; 201001_Faria_SW_Hills_Master_Plan_Exhibits_Contours_&_Grading_06-23-2020.pdf; 201001_Faria_SW_Hills_Master_Plan_Exhibits_No_Lots_06-23-2020.pdf

---

Kristi

Please see attached.

We have more open space than previously shown on these exhibits as a result of our discussions with USFWS and HCP

I don’t think this will cause an issue with the EIR, but the updated exhibits should be referenced in the FEIR and in the staff report so that there is consistency with the HCP agreement

Call me to discuss at your convenience

Louis Parsons

FARIA SW HILLS MASTER PLAN

JUNE 23, 2020

GENERAL NOTES:

1. OWNERS: FARIA LAND INVESTORS INC.
4061 PORT CHICAGO HIGHWAY, SUITE H
CONCORD, CA. 94524-4113
(925) 682-6419

2. CIVIL ENGINEER: ISAKSON & ASSOCIATES
2255 YGNACIO VALLEY ROAD SUITE C
WALNUT CREEK, CA 94598
(925) 937-9333

3. TOTAL AREA: 606.3 AC

4. ASSESSORS PARCELS: 097-180-002 & -006
097-190-002
097-200-002 & -003
097-230-004
097-240-002
097-230-008

1" = 400'

(IN FEET)
1 INCH = 400 FT.

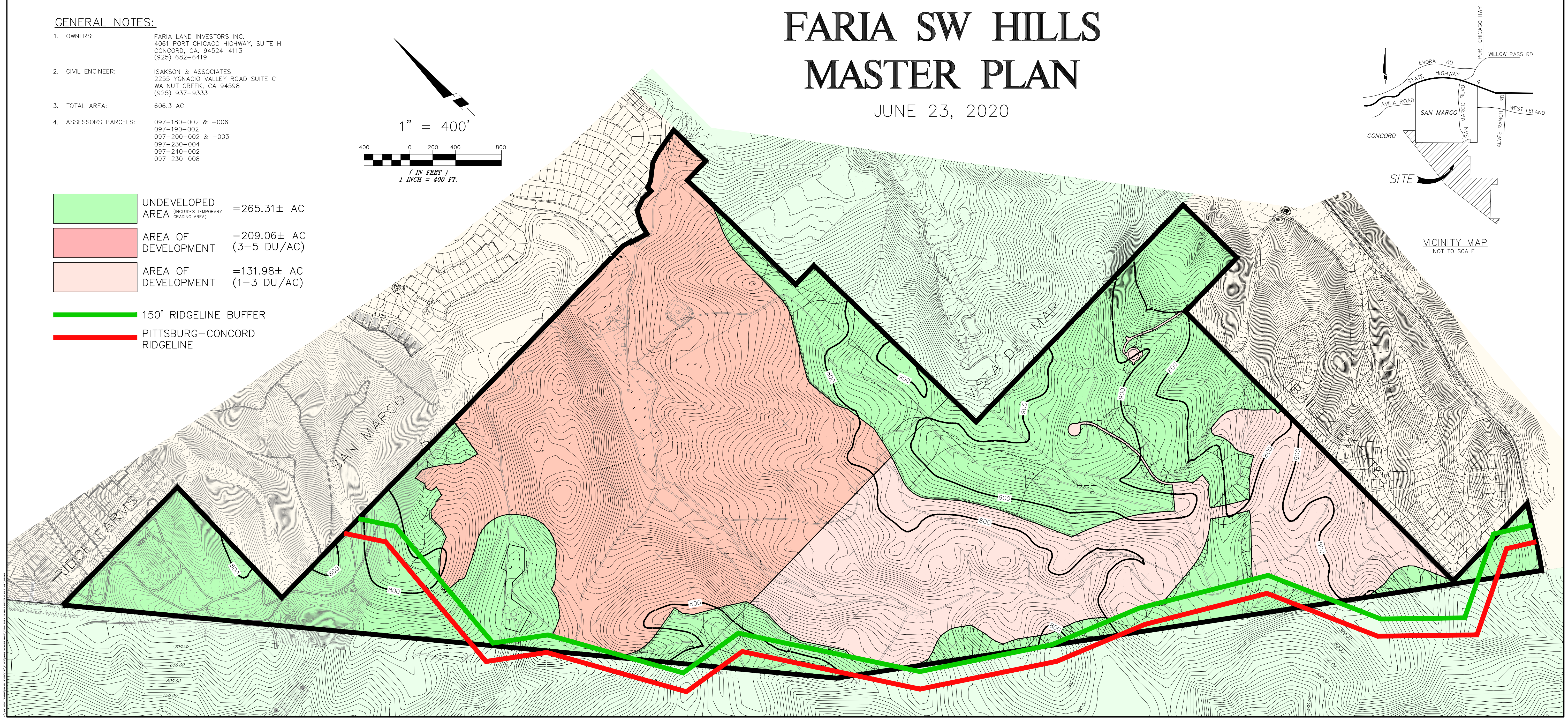
UNDEVELOPED AREA (INCLUDES TEMPORARY GRADING AREA) =265.31± AC

AREA OF DEVELOPMENT =209.06± AC (3-5 DU/AC)

AREA OF DEVELOPMENT =131.98± AC (1-3 DU/AC)

150' RIDGELINE BUFFER

PITTSBURG-CONCORD RIDGELINE



VICINITY MAP
NOT TO SCALE

FARIA SW HILLS MASTER PLAN

JUNE 23, 2020

GENERAL NOTES:

1. OWNERS: FARIA LAND INVESTORS INC.
4061 PORT CHICAGO HIGHWAY, SUITE H
CONCORD, CA. 94524-4113
(925) 682-6419

2. CIVIL ENGINEER: ISAKSON & ASSOCIATES
2255 YGNACIO VALLEY ROAD SUITE C
WALNUT CREEK, CA 94598
(925) 937-9333

3. TOTAL AREA: 606.3 AC

4. ASSESSORS PARCELS: 097-180-002 & -006
097-190-002
097-200-002 & -003
097-230-004
097-240-002
097-230-008

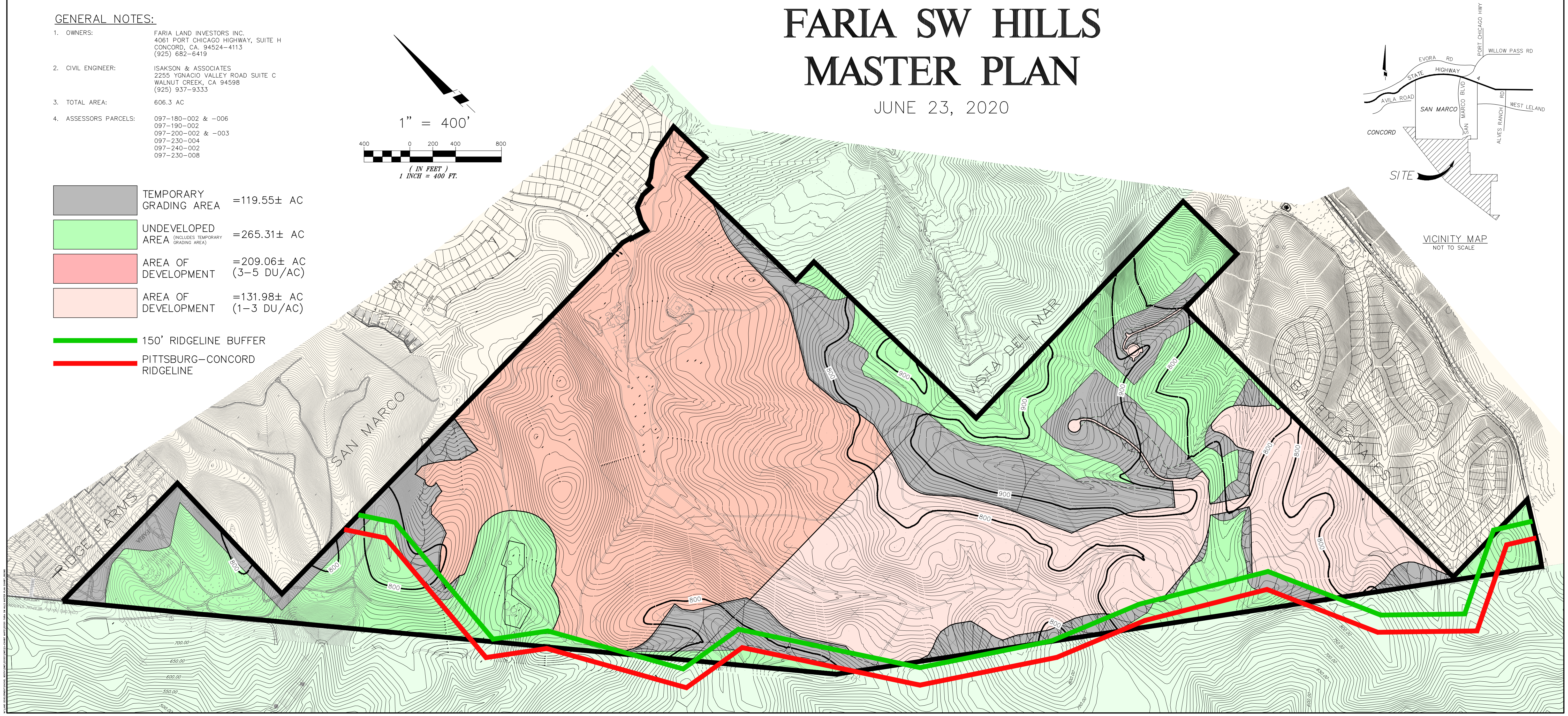
TEMPORARY GRADING AREA	=119.55± AC	
UNDEVELOPED AREA (INCLUDES TEMPORARY GRADING AREA)	=265.31± AC	
AREA OF DEVELOPMENT	=209.06± AC	(3-5 DU/AC)
AREA OF DEVELOPMENT	=131.98± AC	(1-3 DU/AC)

150' RIDGELINE BUFFER

PITTSBURG-CONCORD RIDGELINE

1" = 400'

(IN FEET)
1 INCH = 400 FT.



VICINITY MAP
NOT TO SCALE

FARIA SW HILLS MASTER PLAN

JUNE 23, 2020

GENERAL NOTES:

1. OWNERS: FARIA LAND INVESTORS INC.
   4061 PORT CHICAGO HIGHWAY, SUITE H
   CONCORD, CA. 94524-4113
   (925) 682-6419
2. CIVIL ENGINEER: ISAKSON & ASSOCIATES
   2255 YGNACIO VALLEY ROAD SUITE C
   WALNUT CREEK, CA 94598
   (925) 937-9333
3. TOTAL AREA: 606.3 AC
4. ASSESSORS PARCELS: 097-180-002 & -006
   097-190-002
   097-200-002 & -003
   097-230-004
   097-240-002
   097-230-008

TEMPORARY GRADING AREA	=119.55± AC	
UNDEVELOPED AREA (INCLUDES TEMPORARY GRADING AREA)	=265.31± AC	
AREA OF DEVELOPMENT	=209.06± AC	(3–5 DU/AC)
AREA OF DEVELOPMENT	=131.98± AC	(1–3 DU/AC)

150' RIDGELINE BUFFER

PITTSBURG–CONCORD RIDGELINE

1" = 400'

(IN FEET)
1 INCH = 400 FT.