June 24, 2022

California Air Resources Board ("CARB")
California Air Resources Board Staff
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SUBMITTED VIA EMAIL

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RE: Comments on Specific Sectors and Greenhouse Gas Emission Reduction Measures in the 2022 Draft Scoping Plan

Dear Board Members of the California Air Resources Board:

As members of the California Environmental Justice Alliance ("CEJA"), we thank you for this opportunity to comment on the 2022 Draft Scoping Plan ("Draft Scoping Plan"), the Draft Environmental Analysis ("Draft EA"), and other accompanying documents to the Draft Scoping Plan.

CEJA's comments are based on our fundamental commitment to ensure well-being and equity for all Californians, including low-income communities and communities of color who experience the worst climate and pollution impacts. AB 32, SB 32, AB 197, and other key climate laws also embody the values of well-being and equity. Under AB 32, CARB must design GHG emission reduction measures "in a manner that is equitable, [] seeks to minimize costs and maximize the total benefits to California,"[1] and ensure that these measures "do not disproportionately impact low-income communities."[2] Similarly, AB 197 requires CARB to "protect the state's most impacted and disadvantaged communities" and prioritize direct emissions reductions when adopting rules and regulations to reduce GHG emissions.[3]

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[1] Cal. Health & Safety Code § 38562(b)(1).
[2] Health & Safety Code Section § 38562(b)(2); *see also* Draft Scoping Plan, Appendix B at 13 (Project Objective 13).
[3] Cal. Health & Safety Code § 38562.5.

Unfortunately, CARB's Proposed Scenario ("Alternative 3") and the Draft Scoping Plan fail to meet these clear mandates. As detailed in the proceeding sections, CARB has failed to meet these statutory directives for the following reasons:

- Alternative 3, if adopted, will not ensure that California's GHG emission reduction measures are direct, equitable, and maximize the total benefits to California, in violation of both AB 32 and AB 197.
- Alternative 3 will not allow the State to meet its 2030 emission reduction target and 2045 carbon neutrality goal.
- If adopted, Alternative 3 will create an overreliance on costly and high-risk mechanical carbon capture and sequestration ("CCS") and carbon dioxide removal ("CDR") actions.
- Alternative 3 will perpetuate unacceptable climate, air quality, and health impacts resulting from the extraction and refining of oil and gas, transportation, electricity generation, building emissions, industrial agriculture, and livestock methane sectors.
- CARB fails to analyze a range of viable and cost-effective alternatives that would allow CARB to meet all of the Scoping Plan's objectives while maximizing short and long-term health, environmental, and economic benefits. S*ee* Attachment A: Real Zero Alternative.
- Despite relying on Cap-and-Trade as a vehicle for emissions reductions, CARB improperly defers its analysis of California's Cap-and-Trade until after its adoption of the Final Scoping Plan.
- Additionally, the environmental impacts, alternatives, public health, and social costs analyses in the Draft Scoping Plan and Draft EA are inadequate.

As a result of these profound inadequacies, the Draft Scoping Plan and Draft EA fail to provide crucial information that the CARB Board needs in order to meaningfully evaluate the costs and benefits of each proposed alternative, and ensure that the alternative that is ultimately adopted will not disproportionately harm low-income and disadvantaged communities. As such, we request that the Board direct CARB staff to substantially revise the Draft Scoping Plan and accompanying Draft EA to achieve compliance with the State's climate laws and the California Environmental Quality Act ("CEQA"). We specifically request that CARB analyze and adopt the Real Zero Alternative, attached below as Attachment A.

Below, we provide detailed comments focusing on CARB's proposed alternatives and measures associated with specific AB 32 GHG Inventory sectors. We submit additional, cross-sector comments on the Draft Scoping Plan in a separate letter.

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I. CARB Must Phase Out Oil and Gas Extraction By 2035.

The Draft Scoping Plan provides sparse analysis of oil and gas extraction under the Proposed Scenario. In doing so, it fails to explore the potential benefits of measures designed to reduce supply-side fossil fuel exploration and extraction, in violation of AB 32, AB 197, and Governor Newsom's recent directive to CARB to phase out oil and gas extraction no later than 2045.[4] Rather than comply with these directives, the Draft Scoping Plan takes the defeatist and unsupported stance that supply-side reductions will only serve to facilitate leakage.

While CARB acknowledges these directives and includes a phaseout of oil and gas extraction by 2045 in its table of actions for the proposed scenario,[5] as well as its scenario modeling assumptions,[6] it confoundingly contradicts itself in its analysis of its oil and gas extraction measures. Indeed, CARB's sector-specific analysis of oil and gas extraction is clearly irreconcilable with its purported commitment to phasing out oil and gas extraction by 2045. CARB goes so far as to state that "while significant GHG reductions from oil and gas extraction will be achieved as demand for fossil fuels is reduced due to strategies in this Draft 2022 Scoping Plan, it is not feasible to phase out oil and gas production fully by 2045 given this remaining demand."[7] Despite CARB's inclusion of a 2045 phaseout of oil and gas extraction in its phaseout modeling assumptions, the sector-specific analysis anticipates an 85 percent reduction in emissions from oil and gas extraction, an estimation that, as detailed below, likely overstates the efficacy of the demand-side reduction measures on which it relies.

We urge CARB to update the Draft Scoping Plan to resolve these inconsistencies and clarify that it proposes to phase out oil and extraction under Alternative 3. We discuss in detail CARB's legal responsibility to proactively phase out oil and gas extraction, and how it would be improper for CARB to simply rely on demand-side measures. Moreover, we urge CARB to adopt a 2035 target for the phaseout of oil and gas operations so that California can avoid further climate and health impacts.

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[4] Cal. Health & Safety Code § 38562(b) (CARB must "[e]nsure that activities undertaken to comply with the regulations do not disproportionately impact low-income communities" and "[c]onsider overall societal benefits, including reductions in other air pollutants, diversification of energy sources, and other benefits to the economy, environment, and public health"); Cal. Health & Safety Code § 38562.5)(a) (CARB must prioritize direct emissions reductions from stationary sources); Office of Governor Gavin Newsom, *California Moves to Prevent New Oil Drilling Near Communities, Expand Health Protections* (2021), available at: https://www.gov.ca.gov/2021/10/21/california-moves-to-prevent-new-oil-drilling-near-communities-expand-health-protections-2/.

[5] Draft Scoping Plan at 85.

[6] Draft Scoping Plan, Appendix C at 4.

[7] Draft Scoping Plan at 79.

a. CARB cannot absolve itself of its legal and moral responsibility to drastically reduce oil and gas exploration and production under the guise of reducing leakage.

In an apparent attempt to avoid adopting stronger regulatory measures and strategies that would accelerate the complete phaseout of oil and gas exploration in California, CARB errantly relies on AB 32's mandate to reduce leakage.[8] AB 32 provides that, "[t]o the extent feasible and in furtherance of achieving the statewide greenhouse gas emissions limit, [CARB] shall . . . [m]inimize leakage."[9] However, this language does not signal a legislative intent to prioritize illusory reductions in leakage over actual, realized benefits to California's climate and environmental justice communities. In its attempt to reduce oil and gas leakage, CARB ignores numerous other statutory mandates and goals requiring the Draft Scoping Plan to include plans to completely phase out oil and gas extraction near vulnerable frontline communities,[10] prioritize direct emissions reductions,[11] promote equity,[12] consider overall societal benefits,[13] and maintain ambient air quality standards.[14] CARB cannot simply ignore these clear mandates under the pretense of reducing leakage.

California prides itself on its leadership in global climate change policy. But by clinging to its policy of "minimizing leakage," the Proposed Scenario contributes to a global collective-action problem, allowing fossil fuel extraction and exploration to continue unabated. Jurisdictions across the globe must take action to stop fossil fuel extraction at its source, and California cannot simply disregard this moral and legal imperative while simultaneously claiming to be a leader on climate action.

By failing to supplement demand-side measures with decisive supply-side action, the Draft Scoping Plan actively accelerates the climate crisis. A recent study by the Institute of Physics calls for aggressive action to halt the development of oil and gas operations in order to meet global climate goals.[15] This study found that "the world is very close to a 'point of no return' past which no new fields and mines can be developed without jeopardizing the well below 2 °C limit, unless an equivalent or greater amount of carbon already under production is stranded or sequestered."[16] To prevent this scenario and to protect disproportionately impacted frontline communities from bearing the brunt of negative climate impacts, California must do its part to immediately phase out oil and gas exploration and extraction.

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[8] *Id.* at 78.
[9] Cal. Health & Safety Code § 38562(b)(8).
[10] Office of Governor Gavin Newsom, *California Moves to Prevent New Oil Drilling Near Communities, Expand Health Protections* (2021), available at: https://www.gov.ca.gov/2021/10/21/california-moves-to-prevent-new-oil-drilling-near-communities-expand-health-protections-2/.
[11] Cal Health & Safety Code § 38562.5.
[12] *See, e.g.*, Draft Scoping Plan at 12.
[13] Cal. Health & Safety Code § 38562(b)(6).
[14] *Id.* at (b)(4).
[15] Kelly Trout et al., *Existing Fossil Fuel Extraction Would Warm The World Beyond 1.5 °C*, 17 ENV'T RES. LETTERS 1, 9 (June 2022), available at: https://iopscience.iop.org/article/10.1088/1748-9326/ac6228/pdf.
[16] *Id.*

Despite the urgency of this scenario, the Draft Scoping Plan shows a deeply misplaced reliance on industry-endorsed arguments related to reducing leakage. As explained below, these arguments fail for three key reasons: (1) evidence supporting the feasibility and impact of leakage reductions is tenuous; (2) crude oil extracted in California has a greater carbon intensity than crude oil extracted in other jurisdictions, thereby making it more environmentally harmful than other sources; and (3) CARB can further reduce reliance on imports of crude oil through more effective demand-reduction measures.

i. CARB's assumption that phasing out oil and gas extraction will result in significant leakage is unsupported and incorrect.

The Draft Scoping Plan relies on the unsupported and incorrect claim that increased production of imported crude oil would offset supply-side reductions in domestic crude oil production. While the Draft Scoping Plan speculates that a full phaseout of oil and gas "could result in GHG emissions leakage and in-state impacts to crude oil imported into the state," a range of studies indicate that this assumption is false or, at a minimum, grossly overstated.[17]

Following international adoption of the Kyoto Protocol,[18] recent analyses have found that phaseout commitments did not lead to increases in carbon imports. Countries that stayed committed to emissions targets either did not increase imports, or did so only minimally, while carbon outsourcing during this period was dominated by countries that did not implement the Kyoto Protocol.[19] In fact, the findings indicate that foreign oil producers, including OPEC member states, will not counteract supply-side policies by increasing exports.[20]

Further, the Draft Scoping Plan completely abstracts its analysis from the reality that elasticity of demand and changing price signals will minimize the effects of leakage. First, price changes following emission targets modify the incentives to innovate and adopt new technology or behavioral changes, including adoption of ZEVs or other VMT reduction measures, to ameliorate some of the impacts of leakage.[21] Indeed, contrary to the arguments advanced in the Draft Scoping Plan, exports from refineries in California are currently increasing (as we discuss below in Section III and Attachment D (Karras Report)), which indicates that supply has outpaced demand. Previous studies have found that, in jurisdictions where supply outpaces demand, a full phaseout of oil and gas exploration is in fact more efficient and cost-effective than the costs associated with undertaking less aggressive regulatory measures, as CARB seeks to do here.[22]

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[17] Draft Scoping Plan at 81.
[18] The United States signed, but did not ratify, this agreement. *Kyoto Protocol Fast Facts*, CNN (Apr. 7, 2022), available at: https://www.cnn.com/2013/07/26/world/kyoto-protocol-fast-facts/index.html.
[19] Tobias Nielsen et al., *The Risk of Carbon Leakage in Global Climate Agreements*, 21 Int'l Env't Agreements: Pol., L. & Econ., 147, 156-57 (Sept. 2020), available at https://doi.org/10.1007/s10784-020-09507-2; Rahel Aichele et al., *Kyoto and Carbon Leakage: An Empirical Analysis of the Carbon Content of Bilateral Trade*,. 97 Rev. Econ. & Stat. 104 (Mar. 2015), available at https://doi.org/10.1162/REST_a_00438.
[20] Katinka Holtsmark, *Supply-Side Climate Policy in Norway*, NORDIC ECON. POL'Y REV. 2019: CLIMATE POLICIES IN THE NORDICS 198, 203–05 (Lars Calmfors et al. eds., 2019).
[21] Corrado Di Maria, & Edwin van der Werf, *Carbon Leakage Revisited: Unilateral Climate Policy with Directed Technical Change.* 39 Env't & Res. Econ. 55, 57 (2008), available at: https://doi.org/10.1007/s10640-007-9091-x.
[22] Holtsmark, *supra* note 20 at 203-05.

As these studies note, "it is increasingly clear that supply-side policies can bring important benefits."[23] These policies have the potential to reduce emissions at the same or even lower costs than demand-side measures. Furthermore, these measures would ease social, political, and economic reliance on fossil fuels, making it easier for low- or no-carbon alternatives to compete with fossil fuels, in addition to widening the mitigation cost curve by broadening the range of measures available to cut emissions.[24] Supply-side policies also have strong distributive benefits in low-income communities where adaptation may be challenging and costly.[25] Combined with policies to reduce demand, policies that reduce or eliminate fossil fuel extraction are essential to enhancing the speed, effectiveness, and efficiency of an equitable energy transition.

ii. California's oil has a higher carbon intensity than fuels from other jurisdictions and therefore carries greater environmental impacts, which CARB fails to consider.

The Draft Scoping Plan ultimately couches its analysis of oil and gas extraction on the false assumption that market demand for oil and gas is inelastic, to such an extent that supply-side reductions would not result in a consequent reduction in demand, resulting in leakage. As noted above, the Draft Scoping Plan fails to support this conclusion and ignores clear evidence to the contrary.[26]

As the Draft Scoping Plan concedes, California crude oil is heavier, on average, than most other sources of crude oil.[27] According to the U.S. Energy Information Administration, California's average American Petroleum Institute gravity (API)[28] of 26.18 places it among the heaviest in the United States.[29] Heavier oil requires more energy intensive techniques to extract, including steam generation and hydraulic fracturing.[30] These techniques consume significantly

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[23] Michael Lazerus & Harro van Asselt, *Fossil Fuel Supply and Climate Policy: Exploring the Road Less Taken*, 150 CLIMATIC CHANGE 1, 10 (2018), available at: https://link.springer.com/content/pdf/10.1007/s10584-018-2266-3.pdf; Fergus Green & Richard Denniss, *Cutting with Both Arms of the Scissors: The Economic and Political Case for Restrictive Supply-Side Climate Policies*, 150 CLIMATIC CHANGE 73, 78 (2018), available at: https://link.springer.com/content/pdf/10.1007/s10584-018-2162-x.pdf; Eric Biber & Jordan Diamond, *Keeping it all in the Ground?*, 66 Ariz. L. Rev. 279, 268 (2021).

[24] Lazarus & van Asselt, *supra* note 23; Peter Erickson & Michael Lazarus, *Would constraining US fossil fuel production affect global CO2 emissions? A case study of US leasing policy*, 150 Climatic Change 29, 42, available at: https://doi.org/10.1007/s10584-018-2152-z.

[25] Holtsmark, *supra* note 20 at 203-05.

[26] Judith Lewis Mernit, *Why Does California Pump the Dirtiest Oil in the U.S.*, Yale School of the Environment, (Oct. 19, 2017), https://e360.yale.edu/features/why-does-green-california-pump-the-dirtiest-oil-in-the-u-s (describing how extracting and refining heavier California crude oil is less efficient than from comparable sources).

[27] Draft Scoping Plan at 82.

[28] API is a "commonly used index of the density of a crude oil or refined products." A higher API indicates that a product has a lower density and is therefore less energy intensive to extract. Tim Fitzgibbon, *API Gravity*, McKinsey Energy Insights (last visited June 23, 2022), available at: https://www.mckinseyenergyinsights.com/resources/refinery-reference-desk/api-gravity/.

[29] U.S. Energy Info. Admin., *The API gravity of crude oil produced in the U.S. varies widely across states*, (Apr. 19, 2017) https://www.eia.gov/todayinenergy/detail.php?id=30852 ("California's oil is mostly heavy (more dense), and more than 90% has an API gravity of less than 30 degrees").

[30] *Supra* Mernit, note [26].

more energy than alternative extraction methods that are viable on deposits of lighter crude outside of California. Moreover, "at the refining stage, producers use more natural gas to transform heavy crude into gasoline."[31] Due to these compounding factors, the life cycle carbon emissions associated with California's crude oil stock can be greater than 150% that of typical West Texas light crude.[32] Compared to a barrel of light crude (measured at 50 API), California crude may result in as much as 37 percent higher GHG emissions per barrel. The Draft Scoping Plan's failure to consider these significantly increased emissions is a substantial oversight and calls both its analysis and conclusions into question.

California's stock of heavy crude oil does not just produce greater GHG emissions than other sources; it also emits more toxic contaminants, including heavy metals and sulfur.[33] As a result, oil and gas extraction activities in California pose especially severe health and safety risks and impacts to residents who live near oil drilling facilities. We discuss these risks and impacts in Section I.F. below.

iii. CARB's assumption that a reduction in crude production in California would result in increased imports is unsupported and incorrect.

The Draft Scoping Plan dismisses the increased air pollution and GHG emissions associated with the continued in-state production of heavy crude oil. Namely, the plan illogically asserts that, "[i]f 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."[34] The report continues: "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."[35]

This argument ignores the reality that California currently imports most of the crude oil that it processes. In reality, domestic crude oil supply accounts for only about 30 percent of inputs to the state's refineries.[36] It is thus unfounded to assert that reducing in-state oil production would require the development of additional infrastructure "to store and deliver crude to in-state refineries."[37] In an attempt to justify this baseless assertion, CARB states, without evidence, that demand for heavy crude oil will continue at current levels "due to [the use of] legacy fleets that will not be replaced until end of life."

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[31] *Id.*
[32] E. Allison & B. Mandler, HEAVY OIL: ABUNDANT BUT HARD TO WORK WITH, HEAVY OIL HAS SOME SPECIFIC ENVIRONMENTAL IMPACTS, AMERICAN GEOSCIENCES INST. 11-2 (2018), available at: https://www.americangeosciences.org/sites/default/files/AGI_PE_HeavyOil_web_final.pdf (heavy oil produced by steam injection in California's Midway Sunset field emits 725 kg CO_2 lifecycle emissions, as compared to 729-736 kg CO_2 emissions for Canadian oil sands and 480 kg CO_2 emissions of typical light West Texas oil).
[33] *Id.* at 11-1.
[34] Draft Scoping Plan at 82.
[35] *Id.*
[36] *Id.* at 81-82, figure 2-7, 2-8.
[37] *Id.*

This analysis is deeply flawed for several reasons. First, demand will only prevail at current levels in the absence of appropriate demand-side reductions by CARB. While California's refining of domestic crude oil supply represents a substantial contribution to the state's GHG and toxic air emissions—and thus a significant burden on public health—it is unrealistic to claim that eliminating it would require the development of additional import infrastructure. Even if CARB's demand projections were accurate, the state's ports and refineries have more than sufficient existing capacity to handle such an increase. The persistent use of such circular reasoning throughout the Draft Scoping Plan directly undermines any confidence in the agency's ability to independently evaluate effective strategies for achieving carbon neutrality.

iv. An ambitious VMT reduction measure would reduce fossil fuel demand.

VMT reduction remains a powerful policy tool that—if properly implemented—in addition to significant health benefits, would allow California to significantly reduce instate demand for oil and gas. See detailed recommendations on VMT reduction in Section V.A.1.

b. CARB's failure to take meaningful steps to reduce oil and gas extraction jeopardizes the health and well-being of disadvantaged communities and violates AB 32 and AB 197.

If CARB fails to propose and adopt a measure to phase out oil and gas extraction in the Scoping Plan by 2035, it will exacerbate the disproportionate existing environmental justice in frontline communities throughout California that have suffered from living near oil wells. CARB will also violate AB 32's mandate that CARB's actions must not disproportionately impact low-income communities and AB 197's mandate that CARB protect low-income and disadvantaged communities and prioritize direct emission reduction measures.[38]

Community-based research and countless studies have shown that frontline communities suffer from an array of severe negative health impacts resulting from dangerous neighborhood drilling activities. These include, but are not limited to: poor birth outcomes (preterm births, low birth weight, and small-for-gestational age births), respiratory ailments including childhood asthma, frequent nosebleeds, skin rashes, cardiovascular disease, various cancers, and even reduced life expectancy.[39]

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[38] Cal. Health & Safety Code § 38562(b)(2); *see also* Appendix B at 13 (Project Objective 13)Cal. Health & Safety Code § 38562.5.

[39] *See*, *e.g.*, Aneesh Patnaik et al., *Racial Disparities and Climate Change*, Princeton Student Climate Initiative (2020), available at: https://psci.princeton.edu/tips/2020/8/15/racial-disparities-and-climate-change; Laier-Rayshon Smith Urban Heat Management and the Legacy of Redlining, *American Planning Association* (Feb. 2021), available at: https://planning.org/blog/9212209/urban-heat-management-and-the-legacy-of-redlining/; *See also*, Kathy V. Tran et al., Residential Proximity to Oil and Gas Development and Birth Outcomes in California: A Retrospective Cohort Study of 2006-2015 Births, 128 *Env't Health Persps.* 1, 6-8 (2020), available at: https://ehp.niehs.nih.gov/doi/full/10.1289/EHP5842; University of California, Berkeley and PSE Healthy Energy Letter to California Department of Conservation, Re: Response to CalGEM Questions for the California Oil and Gas Public Health Rulemaking Scientific Advisory Panel (Oct. 2021), at 10-11, available at:

A recent Stanford study details numerous negative health impacts associated with oil drilling operations, noting that these dangers reach as far as 2.5 miles.[40] Numerous other scientific studies have identified carcinogens and highly toxic explosive materials used regularly during oil drilling operations.[41] While there is no proven safe distance from oil drilling, it is well documented that oil and gas extraction activities are even more dangerous when placed near residential neighborhoods and other sensitive uses.

Yet, an overwhelming majority of oil drilling facilities operate adjacent to low-income communities and communities of color, areas where residents are already disproportionately saddled with polluted air, water, and soil from other industrial operations. Not only are these operations concentrated in environmental justice communities, including Wilmington, Richmond, Rodeo, and Kern County, these operations are systematically sited in dangerous proximity to sensitive receptors such as schools, playgrounds, and parks, where young children are especially susceptible to enduring the most dangerous health impacts.[42] For instance, while 72 percent of Los Angeles County residents who live near oil drilling operations are people of color, these same individuals are much more likely than wealthier, white residents to live near the most dangerous and least regulated oil drilling operations in the state.[43]

Members of this coalition have championed important local actions to combat fossil fuel exploration and expansion.[44] However, local action alone is not sufficient to address this statewide public health crisis. Rather, state regulatory bodies like CARB must take bold action to improve the health and well-being of frontline communities while rapidly accelerating a rapid statewide phaseout of drilling operations. This is not simply a moral imperative; statutory, regulatory, and executive mandates require CARB to incorporate these pressing public health and racial equity concerns into the Draft Scoping Plan.

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https://www.conservation.ca.gov/calgem/Documents/public-health/Public%20Health%20Panel%20Responses_FINAL%20ADA.pdf.

[40] *See* David J.X. Gonzalez et al., *Upstream oil and gas production and ambient air pollution in California*, 806 Sci. of the Total Env't 1, 2 (2022) ("Adjusting for geographic, meteorological, seasonal, and time-trending factors, we observed higher concentrations of ambient air pollutants at air quality monitors in proximity to preproduction wells within 4 km and producing wells within 2 km"), available https://www.sciencedirect.com/science/article/pii/S0048969721053754.

[41] *See* Seth D.C. Shonkoff and Donald Gautier, *A Case Study of the Petroleum Geological Potential and Potential Public Health Risks Associated with Hydraulic Fracturing and Oil and Gas Development in The Los Angeles Basin*, in CAL. COUNCIL ON SCIENCE AND TECHNOLOGY, AN INDEPENDENT SCIENTIFIC ASSESSMENT OF WELL STIMULATION IN CALIFORNIA VOL. III, CH. 4 (July 2016), available at: https://ccst.us/wpcontent/uploads/160708-sb4-vol-III-4.pdf; *See also* CENTER FOR BIOLOGICAL DIVERSITY, *Dirty Dozen: The 12 Most Commonly Used Air Toxics in Unconventional Oil Development in the Los Angeles Basin*, available at https://www.biologicaldiversity.org/campaigns/california_fracking/pdfs/LA_Air_Toxics_Report.pdf.

[42] Kathy V. Tran, et al., *supra* note 39.

[43] See LIBERTY HILL FOUND., DRILLING DOWN: THE COMMUNITY CONSEQUENCES OF EXPANDED OIL DEVELOPMENT IN LOS ANGELES 5 (2015), available at: https://psr-la.org/wp-content/uploads/2015/11/Drilling-Down-Report-Final.pdf.

[44] *See, e.g.*, Alison Hahm & Gissela Chavez, *No Drilling Where We're Living: the Los Angeles City Council Voted to Phase Out Oil Drilling,* CMTYS. FOR A BETTER ENV'T (Jan. 27, 2022) (detailing decades of grassroots organizing by community-based organizations leading to a measure to phase out oil and gas drilling in the City of Los Angeles), available at: https://www.cbecal.org/media/blog/no-drilling-where-were-living-the-los-angeles-city-council-voted-to-phase-out-oil-drilling/.

Finally, through its misplaced reliance on current trends signaling a decline in statewide oil and gas production, CARB fails to consider the myriad health, societal, and technological *benefits* that would result from expediting a comprehensive oil and gas phaseout. The benefits of strong supply-side policies that supplement consistent demand-side measures include that they are less costly to monitor and enforce,[45] can reduce costs by expanding the range of policy tools available to governing bodies,[46] and address acute community-level environmental and health impacts.[47]

II. CARB Must Commit to a Phase Down of Refinery Operations by 2045.

CARB fails to propose phasing down refinery operations in the Draft Scoping Plan. CARB relies on "CCS on majority of operations by 2030" and the assumption that "[p]roduction reduced in line with petroleum demand," i.e. refining will automatically phase itself out due to changes to the transportation sector.[48]

However, this assumption is unsubstantiated, has *not* panned out so far, and will not in the future. For example, CARB fails to account for the increasing refinery *export* of fossil fuels as fossil transportation fuels become outmoded in California, as demonstrated in detail in Section III of this letter and the attached Karras Report (Attachment D). Furthermore, CARB cannot rely on infeasible and dangerous refinery CCS (Section IV), nor a failed Cap-and-Trade (Section VIII) or Low-carbon Fuel Standard program (Section V.C).

Instead, CARB must commit to a plan to phase down oil refining by 2045 in order for CARB to be able to meet its climate targets while reducing environmental and health impacts. CARB should complete this plan by 2024. The following language should be inserted to modify Table 2.2 for oil refinery actions. Changes are shown in blue crossed-off or underlined text as follows:

Modified Table 2-2: Actions for the Proposed Scenario: AB 32 GHG Inventory sectors

[45] Green & Denniss, *supra* note 23 at 78.
[46] *Id.* at 74; Cathrine Hagem & Halvor Briseid Storrøsten, Supply-Versus Demand-Side Policies in the Presence of Carbon Leakage and the Green Paradox, 121 SCANDINAVIAN J. ECON. 379, 389-90 (2019).
[47] Green & Denniss, *supra* note 23 at 78.
[48] Draft Scoping Plan at 58-59.

Sector	Action	Statutes, Executive Orders, Outcome
Petroleum Refining	~~CCS on majority of operations by 2030~~ ~~Production reduced in line with petroleum demand~~ Begin a plan to coordinate and manage the phase down of oil refining by 2045. By 2024, in collaboration with impacted workers and communities, adopt an interagency plan with regular milestones to manage the decline of California oil refinery production of gasoline, diesel, and other fossil fuels, reflecting California's plans to decarbonize transportation. Create a robust, multi-year safety net for fossil fuel workers and impacted communities.	Reduce GHGs and improve air Quality AB197: direct emissions reductions AB32, SB32: Ensure that activities complement efforts to achieve and maintain federal and state ambient air quality standards and that regulations do not disproportionately impact low-income communities.

Since CARB already assumes that fossil transportation will gradually phase down through its ZEV and other transportation regulations and plans, this phasedown of oil refineries is also in line with CARB's existing transportation goals. Failure to harmonize these two sectors means that California could become the gas station of the Pacific Rim: continuing harmful refining for products it does not even need.

III. CARB Must Phase Down Refinery Operations to Minimize Leakage.

a. CARB Will Make California the "Gas Station" of the Pacific Rim if It Continues Increasing Oil Refining for Export While Reducing In-State Petroleum Demand.

Increasing refining for export is strongly linked to decreasing in-state demand for refined fuels by the State's own data, documented in detail in the attached report (Attachment D: Karras Report).[49] For example, from 2010–2019, in-state demand for *gasoline and diesel fuel* together fell by approximately 320 million barrels ("Mb") or seven percent compared to 2000-2009, while

[49] Greg Karras, TECHNICAL REPORT REGARDING THE DRAFT 2022 SCOPING PLAN UPDATE AND ENVIRONMENTAL ASSESSMENT. Prepared for the California Environmental Justice Alliance. (hereinafter "Karras Report") (see Attachment D) (CEJA requests CARB to respond separately and in detail to this technical report).

California refinery exports of these fuels rose by approximately 423 Mb, or 71%. CARB's Draft Scoping Plan relies upon the disproven assertion that reduced demand for in-state fuels alone will proportionately reduce in-state refining rates. CARB models petroleum demand reduction measures of approximately 90% (e.g., through transportation electrification) while rejecting calls for direct curbs on in-state refining.[50] That is likely to cause exports of far more petroleum GHG than in 2000–2019.

This failure undermines the effectiveness of the plan in cutting GHGs toward the state's 2030, 2035, 2045, and 2050 GHG emission reduction goals, and causes new environmental impacts. Under CEQA, CARB must analyze the "reasonably foreseeable responses" to its proposed measures under the Draft Scoping Plan. However, CARB fails entirely in its Draft EA to analyze and mitigate potentially significant air quality and environmental health impacts that would result from the likely increase of refinery exports. These exports cause significant increased global climate impacts downstream due to use of these exported fuels. CARB is required to minimize such emission shifting under AB32. Furthermore, this increase in petroleum refining for export can result in significant continued local air quality impacts through local refining, transport, and shipping, particularly in refining communities which are already known to be disproportionately impacted by pollution.[51] The Draft EA does not analyze or propose mitigation measures for these reasonably foreseeable impacts.

b. The Draft Scoping Plan is likely to result in significant impacts and emission shifting due to incentivizing growth of diesel biofuel production without phasing down crude refining.

Heavily subsidized biofuels in California have further pushed petroleum diesel refined in California to export, increasing GHG emissions. At the same time, GHG emissions from increased biofuel production in California also increased GHG emissions. In other words, new biofuels did not replace petroleum diesel as part of overall refining volume as envisioned by the State. This is shown by the State's own data. Refiners profited from otherwise unprofitable assets by further shifting to refining diesel for export. Statewide refining actually increased. Failure to use direct refinery phase down measures enables refining for export. The Draft Scoping Plan would further double down on subsidized food system-based "renewable diesel" growth while rejecting phase down measures. That can increase total biofuel plus petroleum diesel-related GHG emissions by some 65 to 75 MMT during 2023–2045, compared with 2015–2019 rates. It could increase cross-

[50] Draft Scoping Plan at 84, Footnote 150 ("This reduction in demand does not assume any need for ongoing operations to support exports to neighboring states.")

[51] For example, the Office of Environmental Health Hazard Assessment recently found that of facilities categorized in high CalEnviroScreen quartiles [highest disproportionate impacts], 71% were Refineries, This report also found that "Black Californians experience three times greater exposure from refinery emissions than all other stationary source sectors covered by the Cap-and-Trade Program combined," and that "four of the top five entities that use the most offsets own petroleum refineries, and refineries contribute more to PM disparity by CES score and race/ethnicity than any other sector." Moreover, "[r]efineries and other combustion sources are even more likely to be near communities with high CES scores and high percentage people of color." CAL. OFFICE OF ENV'T HEALTH HAZARD ENF'T, IMPACT OF GREENHOUSE GAS EMISSIONS LIMITS WITHIN DISADVANTAGED COMMUNITIES: PROGRESS TOWARD REDUCING INEQUITIES (Feb. 2022), available at: https://oehha.ca.gov/media/downloads/environmental-justice/impactsofghgpoliciesreport020322.pdf.

border emission shifting contrary to State law. At the same time, it could prolong and worsen toxic health impacts from excess refining for export in California. The EA does not identify or mitigate these significant potential impacts. These issues are detailed in the Karras Report (Attachment D).

c. The Draft Scoping Plan Would Foreclose Currently Feasible Climate Stabilization Measures Through Delayed Implementation of Refinery Phase Downs.

Climate impacts and goals are not only the result of emissions in a single year (such as 2030 or 2045), they are the result of cumulative emissions over time. Delaying fossil fuel transition results in higher cumulative emissions over time. Cuts which start sooner allow for gradual reduction while meeting cumulative climate goals. But if the Scoping Plan delays fossil fuel transition, larger, faster, and more disruptive cuts are needed, as the time left to meet targets shorten. Otherwise, climate goals will not be met.

The attached Karras Report finds that even if all other emissions are cut to their share of the State's GHG goal, the goal cannot be achieved without cutting refining rates (which CARB rejects in Alternative 3). Without crude rate cuts, emissions from the petroleum fuel chain linked to refining in California would drive total statewide carbon emissions to exceed the State's 2050 direct emissions goal. In-state fuels demand reduction measures alone cannot ensure the needed refining rate phase down. Acting now to start five to seven percent per year gradual refinery phase downs would provide petroleum fuel chain cuts that enable cumulative emissions to meet the 2050 direct emission goal. Delay until after 2029 could force the need for rapid phase down of refinery capacity —if the 2050 direct emission goal is to be met at all. The Draft Scoping Plan would fail to achieve "maximum feasible" direct emission reductions required by AB 32. The Draft EA does not identify or mitigate the severe impacts which could result from this failure.

IV. CARB Should Not Rely on Costly and High Risk Mechanical Carbon Capture and Sequestration and Carbon Dioxide Removal Actions.

a. Alternative 3 is based on deeply flawed and inaccurate assumptions about carbon sequestration and storage in the refinery sector, resulting in incorrect conclusions.

The Proposed Scenario, as well as all of CARB's offered alternatives, rely on the use of carbon capture and sequestration (CCS) at oil refineries, are based on deeply flawed and demonstrably incorrect modeling assumptions regarding the feasible timeline for implementing refinery CCS. These flawed assumptions fatally undermine the ability for Alternative 3 to meet the state's 2030 GHG emission reduction target and 2045 neutrality goal, and Scoping Plan's corresponding project objectives, as we discuss in our Cross-Sector Comments.

CARB's Initial Modeling Results incorrectly relied on the assumption that CCS could be implemented beginning in 2021 and immediately produce substantial emissions reductions in oil refineries.[52] In response to public comments submitted by Communities for a Better Environment in April 2022, CARB conceded that these assumptions were incorrect.[53] CARB also admits, in the Draft Scoping Plan, that "[w]hile the modeling included CCS as being available in the first half of this decade, implementation barriers now indicate that is unlikely, and those emissions will be emitted into the atmosphere."[54] Moreover, during the May 23, 2022 meeting of the Environmental Justice Advisory Committee (EJAC), CARB staff acknowledged that they now assume refinery CCS will be unavailable until "later this decade." Despite CARB's initial recognition that its CCS assumptions are flawed, CARB has yet to correct this error in all of the proposed alternatives, including Alternative 3, the Proposed Scenario.

As Figure 1 and Table 1 show below, CARB's modeling for Alternative 3 erroneously projects that refinery CCS would have been implemented starting 2021 and result in immediate, substantial emission reductions through 2045. CARB assumes that 2 MMT GHGs will be reduced through refinery CCS in 2021 alone, ramping up to a peak of 13 MMT GHG emission reduction in 2030, and continued capture through 2045.[55]

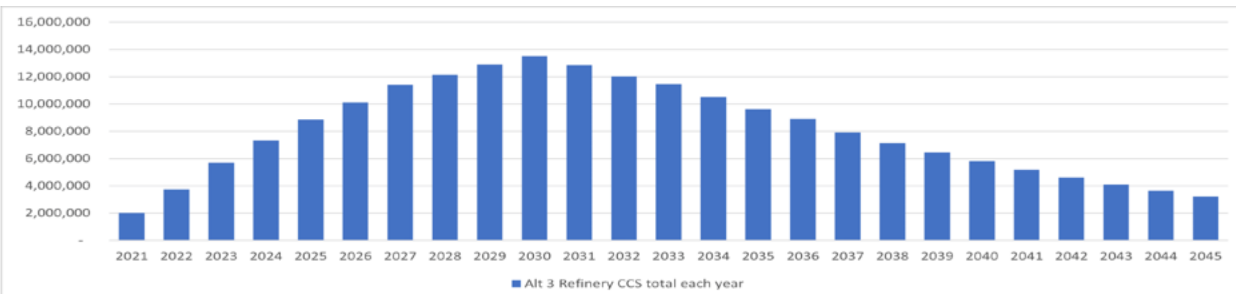

Figure 1. Anticipated Refinery Carbon Capture and Sequestration 2021-2045 Under the Proposed Scenario.[56]

[52] See *infra*, Figure 1.
[53] CARB Comment Log Display (Comment 51 for Public Workshop on the 2022 Scoping Plan Update), Public comment submitted by Communities for A Better Environment (Apr. 4, 2022), available at: https://www.arb.ca.gov/lispub/comm2/bccomdisp.php?listname=sp22-modelresults-ws&comment_num=56&virt_num=51.
[54] Draft Scoping Plan at 68.
[55] Commun. for a Better Env't , Technical Fact Sheet 1-2 (Attachment E).
[56] CARB's modeler (E3) provided year-by-year GHGs captured by carbon capture and sequestration (CCS) at oil refineries in the 2022 Draft Scoping Plan, Modeling Information, AB 32 GHG Inventory Sectors Modeling Data Spreadsheet, last Sheet in Excel spreadsheet (CCS by fuel). We totaled the Refinery CCS emissions captured associated with use of the four categories identified by year (petroleum coke, pipeline gas, petroleum and process gas, and waste heat) for Alternative 3, and graphed CARB's CCS data. *Id.* at 1.

Table 1. Anticipated Refinery Carbon Capture and Sequestration Under the Proposed Scenario in 5-Year Increments.

Year	*Projected GHG Emission Reduction (MMTCO2e)*
2021-2025	27.6
2026-2030	60
2031-2035	56.4
2036-2040	36.2
2041-2045	20.7
Total	**201**

CARB's current modeling regarding the implementation of CCS on California refineries is based on arbitrary, unsupported, and simply incorrect assumptions.

First, refinery CCS does not exist in California, and CARB erred in assuming that GHG emissions reductions from refinery CCS would have already begun last year. Indeed, we could not find a single existing major refinery comprehensively retrofitted with CCS worldwide. Much smaller demonstration projects exist in sections of related operations outside California (such as hydrogen plants) and at one small, newly built, Canadian refinery that includes CCS in a remote rural area.[57]

Second, even if CARB staff now assume that refinery CCS will not be deployed until later in the decade, this assumption is overly optimistic. As CBE discussed in their April 4 letter (Attachment B), CCS projects take many years to design, permit, and construct. Additionally, we discuss in Section IV.C below that it would take at least a decade to implement any new system in existing refineries, which does not include other activities such as design, funding, and rulemaking/permitting.

If CARB updates modeling to assume that refinery CCS begins in 2031, it would need to propose much more ambitious or additional emission reduction measures under Alternative 3 in order to reduce the almost 88 MMT of GHG emissions that would not be captured through CCS.

[57] Commun. for a Better Env't , Technical Fact Sheet 2-4 (Attachment E).

CARB would also need to substantially update its health, direct economic costs and GDP analyses, which are also based on the false and unsupported assumptions above.

Third, CARB must revise its capture rate assumptions. CARB staff cited the Petra Nova project as a source for the 90% CCS capture rate assumption,[58] but the operational data on the Petra Nova project indicates that it failed to deliver not only in terms of its capture rate, but also its reliability and cost effectiveness. Based on a review of emissions data from the U.S. EPA and the U.S. DOE, this $1 billion project captured only 33% of emissions from a coal unit and, after considering the emissions generated to power the carbon capture infrastructure, only 7% of the entire coal plant emissions.[59] News reports document "suffered chronic mechanical problems and routinely missed its targets before it was shut down [in 2020], according to a report submitted by the project's owners to the U.S. Department of Energy.[60] The technical report reveals a significant number of operational reliability problems because of the carbon capture infrastructure, averaging at an outage one every three days.[61] The project was mothballed with significant financial losses.[62] The high financial risk and enormous cost is not unique to Petra Nova.

The Draft Scoping Plan never once mentions the critical lessons of the December 2021 federal oversight report from the Government Accountability Office (GAO), "Carbon Capture and Storage: Actions Needed to Improve DOE Management." The GAO criticized the DOE for engaging in high-risk selection and negotiation processes for projects that either never came to fruition or failed, like the Petra Nova project. Lured by industry promises, the DOE fully committed to projects at their initial selection in order to spend down federal funds instead of allowing time for further review of technical and financial risks. Additionally, according to DOE documentation and officials, senior leadership directed actions to support projects even though they were not meeting required key milestones. The GAO report concluded that the "DOE may risk expending significant taxpayer funds on CCS demonstrations that have little likelihood of success."[63] CARB must ensure that it does not fall into a similar trap.

Finally, even if CARB updated its modeling to reflect its new assumption that CCS could be deployed and replicated across refineries in California in a few years, its fundamental assumption that refinery CCS in California is feasible is unsupported. CARB has not demonstrated feasibility or safety of implementing refinery CCS in California refineries in the Draft Scoping

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[58] See *supra* note 53 and accompanying text.
[59] Joe Smyth, *Petra Nova Carbon Capture Project Stalls With Cheap Oil*, THE ENERGY AND POLICY INSTITUTE (Aug. 6, 2020), available at: https://www.energyandpolicy.org/petra-nova/#:~:text=NRG%20Energy's%20Petra%20Nova%20project,its%20%241%20billion%20price%20tag.
[60] *See e.g.*, Nichola Groom, *Problems Plagued U.S. Co2 Capture Project Before Shutdown*, REUTERS (Aug. 6, 2020), available at: https://www.reuters.com/article/us-usa-energy-carbon-capture/problems-plagued-u-s-co2-capture-project-before-shutdown-document-idUSKCN2523K8.
[61] PETRA NOVA DOE NETL REPORT, FINAL SCIENTIFIC/TECHNICAL REPORT 41 (Mar. 31, 2020), available at: https://www.documentcloud.org/documents/7010068-Petra-Nova-DOE-NETL-Report#document/p42/a574092.
[62] NRG ENERGY, 2019 10-K 127, available at: https://www.documentcloud.org/documents/7011788-NRG-2019-10-K#document/p127/a574550 (filings with the Securities and the Exchange Commission showed a decline in value of Petra Nova that was 'other-than-temporary' and recorded an impairment loss).
[63] GOV'T ACCOUNTABILITY OFFICE, CARBON CAPTURE AND STORAGE: ACTIONS NEEDED TO IMPROVE DOE MANAGEMENT, GAO-22-105111 23 (Dec. 21), available at: https://www.gao.gov/assets/gao-22-105111.pdf.

Plan. As CBE discussed in their April 4 letter and we discuss further in the sections below, CARB fails to consider the extreme economic costs, difficulty, and danger of deploying new CCS technology inside highly complex oil refineries in California. We also discuss the extreme health and safety risks of transporting and storing greenhouse gases, in Sections IV.F and G below.

CARB should only use modeling assumptions that are based on commercially reasonable, realistic deployment rates that account for operational space limitations, and timelines adequate to pay off capital investments. Based on these criteria, there should be no CCS assumed in the refinery sector at all. Instead of continuing to promote Alternative 3 that relies on erroneous and fictitious assumptions on the timing and technological feasibility of refinery CCS, CARB should correct its errors by analyzing and adopting feasible, direct emission reduction measures under the Real Zero Alternative.

b. Other data and modeling discrepancies in CARB's analysis of the refinery sector.

It is important to note that in addition to the 88 MMT of unsupported refinery emissions reductions due to incorrect CCS implementation assumptions, Alternative 3 (and the Business As Usual or Reference Scenario) contains far larger, entirely unexplained cuts in refinery emissions.

For example, Alternative 3 shows refinery GHG emissions going all the way down from 31 MMT in 2021 to only 2 MMT CO2e in 2045, though CARB does not propose any measure requiring them to do so, and does not otherwise substantiate these projected reductions.[64] Thus there are very large, unsupported oil refinery emissions reductions in Alternative 3 that need to be replaced through direct emission reduction measures under the Real Zero Alternative.

c. California's oil refineries are aging and highly complex; prior rulemakings demonstrate the long timelines required to build new systems, and known space-constraints increase safety hazards if new controls are forced.

CARB's fundamental assumption that refinery CCS in California is technologically and logistically feasible is unsupported. CARB has not demonstrated feasibility of implementing refinery CCS in California refineries in the Draft Scoping Plan. Additionally, CARB has failed to analyze in the Draft Scoping Plan and EA the space constraints, lengthy timelines, or environmental as well as health and safety hazards associated with deploying CCS technology at California refineries. Many of the comments below were originally submitted to CARB on April

[64] *See* CARB spreadsheet in the 2022 Draft Scoping Plan, Modeling Information, AB 32 GHG Inventory Sectors Modeling Data Spreadsheet, fifth Sheet in Excel spreadsheet (Energy GHGs Detailed). For example, total Refinery 2021 emissions for BAU add up to 33.3 MMTCO2e (from Coke, Electricity, Pipeline Gas, Refinery and Process Gas, and Waste Heat), but in 2045 add up to 22.8 MMTCO2e, with no explanation of how refinery emissions would go down under BAU. Furthermore, an even larger reduction is present for refineries in Alternative 3, beyond what is shown for CCS reductions. For example in Alternative 3, refinery emissions in 2021 are given as 31.3 MMT, but 2045 Refinery emissions are down to 2 MMT, without any explanation.

4, 2022, following CARB's release of its Initial Modeling Results.[65] We include them here again since these concerns have not been adequately addressed in the Draft Scoping Plan and Draft EA.

California refineries are massive complexes with hundreds of boilers, heaters, and combustion stacks, interspersed with miles of complex piping and storage tanks, and often surrounded by densely populated neighborhoods and businesses; they frequently take up thousands of acres. These factors make them drastically different from much smaller industrial facilities typically envisioned by CARB for CCS applications, and they must be separately analyzed. That is not to say that smaller CCS operations do not present dangers – those can also require CO2 pipeline transport and sequestration, which have the same dangers no matter what industry they come from. But oil refineries require specific engineering design, discussed below, which CARB entirely failed to consider.

Because of the well documented reality that most California refineries are highly space-constrained and host numerous combustion sources, regulatory bodies have faced significant challenges in implementing new emissions controls at in-state refineries.

Numerous case studies regarding other types of pollution illuminate the reality that implementation of refinery CCS would not be an effective source of GHG emissions reductions especially before 2030, and even if delayed, would introduce new dangers. For instance, the South Coast Air Quality Management District ("SCAQMD") adopted Rule 1109.1 in November 2021 after conducting many years of rulemaking proceedings. The rule, which was designed to address high emissions of nitrogen oxides ("NOx") at oil refineries, required significant time and resource investment from SCAQMD due to substantial logistical hurdles and organized industry opposition. As a result, even following formal adoption, the rule will not be fully implemented for more than a decade.

During rulemaking proceedings, SCAQMD performed an updated assessment of the number and type of individual combustion units currently in use at South Coast refineries which as the largest oil refining region in California, serves as a ready example of statewide issues and source of critical insights. The next largest region is the Bay Area, with additional substantial refining activities operating in Bakersfield and Santa Maria.

The SCAQMD staff report on Rule 1109.1 ("staff report") included the following graphics, charts, and tables, identifying the hundreds of major refinery and refinery hydrogen plant sources that exist in the South Coast Air Basin alone.[66] For instance, Figure 5, below, identifies nine petroleum refineries, three small refineries, and four related hydrogen plants and sulfuric acid

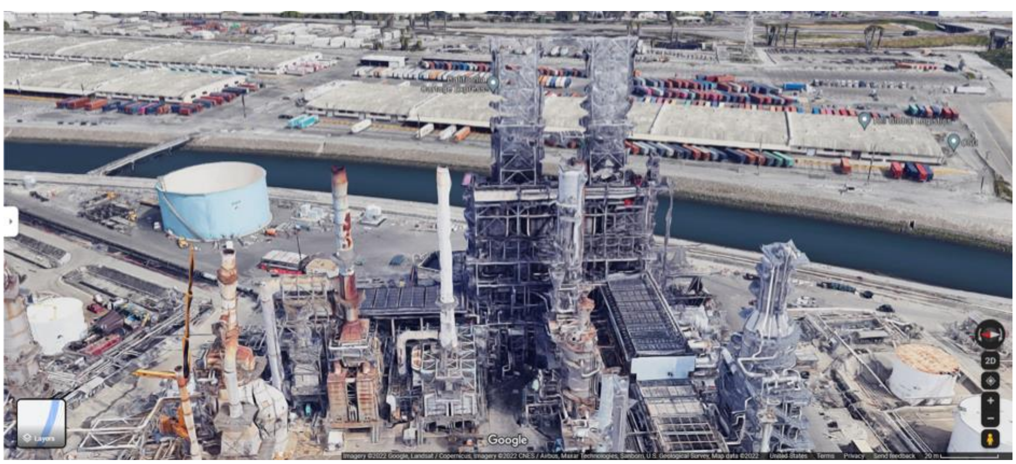
[65] CARB Comment Log Display (Comment 51 for Public Workshop on the 2022 Scoping Plan Update), Public comment submitted by Communities for A Better Environment (Apr. 4, 2022), available at: https://www.arb.ca.gov/lispub/comm2/bccomdisp.php?listname=sp22-modelresults-ws&comment_num=56&virt_num=51.

[66] S. COAST AIR QUALITY MGMT. DIST., FINAL STAFF REPORT PROPOSED RULE 1109.1: EMISSIONS OF OXIDES OF NITROGEN FROM PETROLEUM REFINERIES AND RELATED OPERATIONS 2-1 (Nov. 5, 2021), available at http://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2021/2021-Nov5-034.pdf?sfvrsn=6.

plants, which constitute significant sources of emissions. Just one refinery heater can combust as much fuel in one hour as four homes using natural gas combust over the course of an entire year.[67]

Figure 5. PR 1109.1 Affected Facilities

As a point of reference illustrating the massive size of refinery equipment, the satellite imagery below shows two massive coker heaters at the Marathon (Tesoro) Wilmington refinery, one of the hundreds of combustion units operating throughout the South Coast Air Basin. These sprawling complexes dwarf the warehouses and container units seen directly across the channel and hide multiple burners inside. While NOx, CO_2, and various other pollutants emitted through the tall stacks are not visible to the naked eye, they have profound impacts on the health of nearby residents and contribute significantly to California's refinery GHG emissions.



Google Maps satellite image of Marathon Los Angeles Refinery (Wilmington).[68]

[67] One million British Thermal Units (BTUs) of heat content is present in approximately 1,000 cubic feet of natural gas (which varies slightly in energy content). AMERICAN GAS ASS'N, AMERICA'S ENERGY: NATURAL GAS UTILITIES DELIVER (2015 PLAYBOOK) (2015) 78, available at: https://www.aga.org/sites/default/files/aga_2961_2015_aga_playbook_final_0.pdf. ("In 2012, the average U.S. home consumed 61,200 cubic feet of natural gas (or 62.7 million Btu)." Therefore, a refinery heater rated at 250 million BTUs per hour can burn the same amount of fuel in one hour as about four American households burn in an entire year (250/62.7 = ~4)).

[68] Google Maps, Los Angeles Marathon Refinery (last visited June 23, 2022), available at: https://www.google.com/maps/place/Marathon+Los+Angeles+Refinery+-+Wilmington/@33.7936939,-

As demonstrated below, sprawling refinery complexes exist throughout the Greater Los Angeles region, particularly in the communities of Wilmington, Carson, and West Long Beach. Several satellite images of these complexes are presented below.

Panning further out shows the extreme density of the area, with five oil refineries (two Marathon, two Phillips 66, and one Valero), numerous warehouses and other industrial facilities, thousands of homes, and numerous schools and sensitive receptor sites.

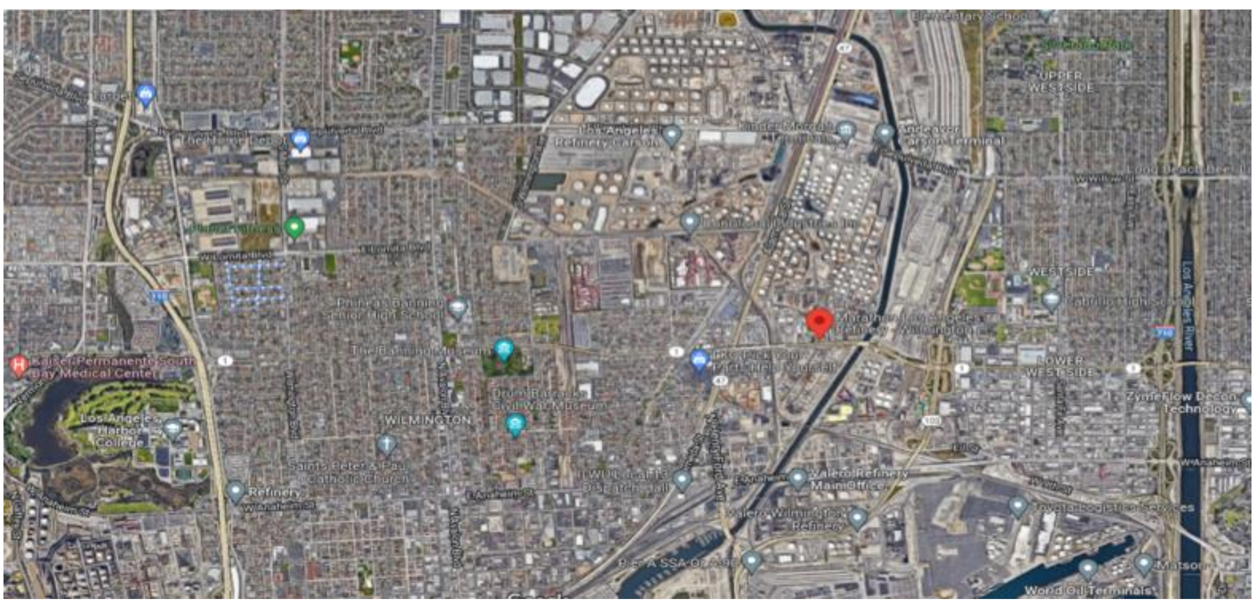


Table 2.1 from the staff report below identifies 228 process and steam methane reforming (SMR) heaters and boilers in the South Coast region, plus 56 other combustion units.[69]

118.2326505,101a,35y,90h,67.92t/data=!3m1!1e3!4m5!3m4!1s0x0:0xd7b4f3577c33236!8m2!3d33.7920787!4d-118.2341308.

[69] S. Coast Air Quality Mgmt. Dist., *supra* note 66 at 2-3.

Table 2-1. PR 1109.1 Affected Equipment by Facility

	Process Heater/ SMR Heater/ Boiler	SRU/TG Incinerator	Vapor Incinerator	Gas Turbine	Start-Up Heater/ Boiler	FCCU	Coke Calciner	Flare
Tesoro-Carson	30	2	0	4	1	1	0	0
Tesoro-Wilmington	33	0	0	2	0	0	0	0
Tesoro-Sulfur Recovery Plant	0	2	0	0	0	0	0	0
Tesoro-Coke Calciner	0	0	0	0	0	0	1	0
Torrance	28	2	2	0	1	1	0	0
Chevron	37	4	5	4	1	1	0	0
P66-Carson	10	2	0	0	0	0	0	0
P66-Wilmington	34	2	0	1	2	1	0	0
Ultramar	19	1	0	1	1	1	0	0
AltAir	25	1	4	0	0	0	0	0
Lunday Thagard	5	0	2	0	0	0	0	0
Air Products-Carson	1	0	0	0	0	0	0	0
Air Products-Wilmington	1	0	0	0	0	0	0	0
Air Liquide	1	0	0	0	0	0	0	0
Eco-Services	0	0	0	0	2	0	0	1
Valero Asphalt Plant	4	0	0	0	0	0	0	0
Total	228	16	13	12	8	5	1	1

When faced with the prospect of controlling these numerous combustion sources, refinery operators argued that implementation of new control technologies would take many years. SCAQMD's final NOx rule includes an implementation plan that will stretch more than ten years after adoption, following a three-year rulemaking process. The difficulty of implementing these technologies, even on a regional scale, makes clear the absurdity of the Draft Scoping Plan's unfounded reliance on immediately deploying untested CCS technology at refineries across the state. Even in the highly unlikely event that CARB can significantly expedite design, permitting, and construction processes across broad parts of California oil refineries, the physical space to accommodate widespread application of CCS technology at refineries is very unlikely to be found and safely implemented. Moreover, the exceptionally high costs associated with implementation of CCS would require significant public investment. These same funds would be far better spent on implementing comprehensive fossil fuel phaseouts—a tradeoff that CARB fails to even consider here.

Over the course of other regulatory proceedings, oil refiners successfully argued against stringent pollution controls, based on severe physical space limitations at existing facilities. Refinery operators argued that it would require additional stages of selective catalytic reduction ("SCR") equipment to meet CARB's original 2 ppm NOx standard, without sufficient physical space available. The same combustion sources at refineries that emit NOx are also major emitters of GHGs—including the hundreds of boilers and heaters identified during the SCAQMD rulemaking process. Successful deployment of CCS, in addition to new SCR equipment, would require the installation of additional, pollution control equipment than was proposed under the original SCAQMD rule. Therefore, it is highly unlikely that the CCS proposal which CARB advances here could be implemented without significant industry opposition and logistical difficulty for refineries.

The scarcity of space was not a small or rare complaint. The SCAQMD staff report identified widespread industry and Air District expert concerns about space constraints, particularly in extremely old facilities.[70] As detailed in the staff report, the Fossil Energy Research Corporation Assessment (FERCo) conducted site visits to five major South Coast Air Basin refineries—Chevron, Marathon (Tesoro Refinery), Phillips 66, Torrance, and Valero—to evaluate and discuss facility constraints and challenges of implementing SCR on specific refinery systems.

During these site visits, refinery stakeholders frequently raised the issue of space limitations and the limited ability to install post-combustion controls.[71] Based on the site visits, FERCo concluded that every facility exhibited space limitations to varying degrees. Further, not all open space that surrounds a unit is available for an SCR system, as open space may be necessary for maintenance work, and therefore, facility safety.[72] As a result, advanced technology, engineering, and design for additional pollution controls will be required specifically to address space constraints, at significant expense.[73] The cost for two refining facilities operating at around 8 parts per million by volume ("ppmv") to replace their existing SCR equipment, or to add new technology to meet 2 ppmv while addressing space constraints, ranged from $75 million to $220 million.

Another important rulemaking where space constraints were highlighted was SCAQMD Rule 1410, which would have banned the use of hydrogen fluoride or modified hydrofluoric acid (MHF) at two South Coast area refineries. This regulation was defeated by industry complaints, despite public comments by the Los Angeles County Department of Public Health which urged the phaseout of MHF due to the risk that a large-scale release of MHF would "incur severe health damage and casualties" and put "potentially millions of people at risk."[74]

Despite the dire need for regulation to replace MHF with another chemical, a major reason for opposition was space constraints at the Valero refinery in Wilmington: "Of particular note, available plot space adjacent to the existing HF alkylation unit was identified as a key criteria for

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[70] "The affected refineries were built 50 to over 100 years ago and while equipment has changed over the years, most of the equipment affected by the rule is old and the spacing configuration of the sites are dense. Thus, to install pollution control requires creative engineering and design to accommodate the space necessary and perform properly. Some projects currently taking place involve building vertically requiring deep earth pylons to support the structure housing the control technology or constructing complex ducting to house the SCR catalyst beds that stretch long distances horizontally away from the basic equipment." *Id.* at 2-19; "Replacing conventional burners with LNB or ULNB often requires special attention because of the flame dimensions and limited space within a refinery process heater," *Id.* at A-6; Refinery stakeholders immediately raised the concern that staff did not consider space availability and constraints for this type of design. Refineries cannot accommodate a second SCR reactor which makes the alternative pathway not technically feasible. *Id.* at B-20.

[71] *Id.* at 2-47.

[72] *Id*. at 2-47.

[73] *Id*. at 2-36.

[74] LOS ANGELES COUNTY DEPARTMENT OF PUBLIC HEALTH, LETTER TO WAYNE NASTRI, EXECUTIVE OFFICER, S. COAST AIR QUALITY MGMT. DIST., RE: PROPOSED RULE 1410, HYDROGEN FLUORIDE STORAGE AND USE AT PETROLEUM REFINERIES IN LA COUNTY (Apr. 2, 2019), available at: https://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/1410/1410-comment-letters/county-of-los-angeles-public-health-04282019.pdf?sfvrsn=9.

success; as the [Air] District is well aware, such plot space does not exist at the Wilmington Refinery."[75]

The planned installation of SCR controls for NOx emissions at Southern California refineries will further constrain available plot space at the region's oil refineries. The record in the SCAQMD proceedings illustrates the shortsightedness of CARB's assumption that additional end-of-pipe emissions controls would provide a feasible choice for limiting refinery emissions, particularly when the implementation of long-proven technologies such as SCR has been reduced in scope in the face of organized industry opposition and complex logistical challenges. These problems will only be further exacerbated if CARB attempts to implement unproven technology like CCS, which does not currently exist at any California refineries.

Oil and chemical industry risk management literature also identifies the need to maintain adequate space for safety at oil refineries (where major explosions and fires already frequently occur). For example, an industry analysis found that:

> Loss experience clearly shows that fires or explosions in congested areas of oil and chemical plants can result in extensive losses. Wherever explosion or fire hazards exist, proper plant layout and adequate spacing between hazards are essential to loss prevention and control. Layout relates to the relative position of equipment or units within a given site. Spacing pertains to minimum distances between units or equipment.[76]

While this analysis identified many specific hazards, it recommended performing detailed site by site risk analysis and identified general comments about access between process units. We have excerpted some key recommendations to illustrate the complexity of the safety issues, but request that CARB consider the entire document and its implications to conduct a realistic assessment regarding the feasibility of implementing CCS at oil refineries. The authors' final recommendations included each of the following:

- "**Do not consider the clear area between units as a future area for process expansion."**
- Provide access roadways between blocks to allow each section of the plant to be accessible from at least two directions.
- Avoid dead end roads.
- Size road widths and clearances to handle large moving equipment and emergency vehicles or to a minimum of 28 ft (8.5 m), whichever is greater.
- Maintain sufficient overhead and lateral clearances for trucks and cranes to avoid hitting piping racks, pipe ways, tanks or hydrants.
- Do not expose roads to fire from drainage ditches and pipeways.

[75] VALERO, LETTER TO SUSAN NAKAMURA, CHIEF OPERATING OFFICER, SOUTH COAST AIR QUALITY MGMT. DIST., (Sept. 18, 2017), available at: https://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/1410/1410-comment-letters/valero-2017-09-18-working-group-meeting-5.pdf?sfvrsn=6.
[76] AXA XL RISK CONSULTING, OIL AND CHEMICAL PLANT LAYOUT AND SPACING, PROPERTY RISK CONSULTING GUIDELINES, 1 (2020), available at: https://axaxl.com/prc-guidelines/-/media/axaxl/files/pdfs/prc-guidelines/prc-2/prc252oilandchemicalplantlayoutandspacingv1.pdf?sc_lang=en&hash=996EA28071174510C4DA5D35102A9222.

- Slightly elevate roads in areas subject to local flooding.
- Locate hydrants and monitors along roads to allow easy hook-up of firefighting trucks.
- Provide at least two entrances to the plant for emergency vehicles to prevent the possibility of vehicles being blocked during an incident, e.g., open bridge, railway.
- Plan and implement a "Roadway Closure" permit system authorized and controlled by site Emergency Response personnel as part of the site impairment handling system.
- Provide spacing between units based upon the greater of either Table 1 or a hazard assessment. The space between battery limits of adjoining units should be kept clear and open.

As these recommendations make clear, broad application of CCS at the hundreds of combustion units operating at oil refineries across the state without any assessment of space constraints would create new safety hazards and substantially increase the risk of serious health impacts for workers and nearby residents

d. The Draft Scoping Plan inadequately responds to the dangers presented above, depends on theoretical and non-operational technologies, and fails to evaluate alternatives that would avoid these hazards.

In response to our comments on the environmental, health and safety impacts of deploying CCS in refineries, CARB states only that "[t]here are newer technologies with smaller footprints that can be deployed in modular configurations to capture CO2 in space constrained and multiple point source facilities such as refineries."[77]

CARB's statement is unsupported. The agency identifies only a single company, Carbon Clean, that hopes to develop this unproven technology. Contrary to CARB's claims, no California refinery employs any new CCS technology in "modular configurations to capture CO2 in space constrained" facilities. Even more tellingly, Carbon Clean's website makes clear that it has never employed any such technology at any refinery. The Carbon Clean web page shows that the company's goals of employing this technology are aspirational, not operational.

Carbon Clean's publicly available literature reaffirms our concerns that oil refineries present unique barriers to implementing CCS. It notes: "[t]raditional carbon capture is difficult in refineries due to multiple CO_2 point sources, limited space, and remote locations."[78] But the company website only identified "success stories" at non-refinery sites, none which involved existing oil refinery operations. These examples included:

- A collaboration with Tuticorin Alkali Chemical and Fertilizers Ltd. system in India.
- A biogas solvent system developed in collaboration with Arcanum Energy to upgrade facilities in Germany.

[77] Draft Scoping Plan at 68, fn. 120.
[78] Carbon Capture for Refineries, *Carbon Clean Solutions Limited* (2022), available at: https://www.carbonclean.com/industries/refineries.

● Completed testing on steel corrosion to reduce costs of carbon capture building materials.[79]

The Carbon Clean website hosts an interactive map showing 44 locations where its technology is currently in use worldwide. Only two of these sites are identified as being in the oil and gas extraction sector and none refer to oil refinery operations.[80] Many of the company's publicly identified project sites are affiliated with academic institutions or U.S. Department of Energy projects. A majority of these operations were described as being in various phases of testing, research, and development—and even these non-refinery projects are mostly not completed or operational. For instance, the listing for a Chevron-owned site in California's Central Valley describes the project as a "[g]as turbine carbon capture plant with Cyclone CC" and states that it is currently in the "engineering phase." Carbon Clean does not identify a single oil refinery site where its technology is currently in use.

The Carbon Clean website also indicates that "[i]f you want to capture more than 100 tonnes of CO_2 per day from your site, a custom open-plant design using our technology license is necessary."[81] In other words, for large operations such as oil refineries, you cannot plug in a small, ready-to-play system. CARB, in the Draft EA, has inappropriately relied on bold industry marketing claims without analyzing real-world conditions . Even under a conservative estimate relying on CARB's unsupported claim that CCS would cut up to 2 million tonnes annually from California's total refinery CO2 emissions, the state would still exceed Carbon Clean's maximum threshold of 100 tonnes per installation, and would therefore require a custom open-plant design for each facility.[82]

Carbon Clean's website mentions long-term goals for the mid-2030s or 2050, not short-term, ready systems. Because CCS at oil refineries is being used to justify short-term fossil hydrogen plants at oil refineries, these dates matter—this fossil hydrogen will not be greenwashed by these systems for many years. The company also lists major investors for the purpose of further developing this program, including a statement by Chevron: "We invest in breakthrough technologies that both lower emissions in oil and gas and are integral to low carbon value chains. Our investment in Carbon Clean aims to help commercialize and scale carbon capture utilization and storage technologies, a key part of delivering on our commitment."[83] These statements make clear that this technology is still undergoing development and is not ready to be deployed at the scale contemplated by CARB.

The hazard created by adding CCS to space-constrained refineries is entirely avoidable through the Real Zero Alternative, which does not rely on CCS and instead calls for

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[79] Carbon Clean Solutions Limited, *Custom CO2 Capture Technology Solutions* (last visited June 23, 2022), available at: https://www.carbonclean.com/technology-licence?hsLang=en.
[80] Carbon Clean Solutions Limited, *About Us (Interactive Map)* (last visited June 23 2022), available at: https://www.carbonclean.com/about-us.
[81] Carbon Clean Solutions Limited, *Custom CO2 Capture Technology Solutions* (last visited June 23, 2022), available at: https://www.carbonclean.com/technology-licence.
[82] At 2 million tonnes/year, across 18 active refineries operating in California, each refinery would on average need to capture an average of 304 tonnes of CO_2 per day to meet this estimate.
[83] Carbon Clean Solutions Limited, *Carbon Capture for Refineries – Chevron Client Testimonial by Barbara Burger, President of Chevron Technology Ventures*, (last visited June 23, 2022), available at: https://www.carbonclean.com/industries/refineries.

implementation of a complete refinery phaseout by 2045. See Attachment A. As CARB has already acknowledged that refinery CCS emission cuts will not happen until late this decade—a still highly-ambitious assumption—there is no short-term avenue to achieve emission reductions through refinery CCS. As such, CARB must analyze and adopt the Real Zero Alternative to reduce California's reliance on fossil fuel production through a managed refinery phaseout plan.

e. CARB must update its cost analyses to include realistic, evidence-based deployment and capitalized cost timelines.

CARB estimates direct costs for the AB 32 GHG Inventory Sector alternatives only for two "snapshot" years: 2035 and 2045.[84] Because CARB Staff erroneously assumed that most CCS would already be implemented at refineries by 2035 (as we discuss in Section IV.A above), the bulk of CCS costs are not captured by solely evaluating direct costs in 2035 and 2045. Even if CARB updates its modeling to begin implementing CCS around 2029, the cumulative costs of refinery CCS from 2029 to 2034 would not be included in the 2035 and 2045 snapshots of direct costs. In other words, CARB's approach to evaluating direct costs in only 2035 and 2045 makes it appear, incorrectly, that Alternatives 2-4, which rely heavily on CCS, would have lower direct costs than Alternative 1. We urge CARB to instead evaluate the cumulative direct costs from 2021-2045, for the AB 32 GHG Inventory Sector alternatives. Only then will the Board and the public be able to meaningfully evaluate and compare the direct costs of these alternatives.

Furthermore, it is unlikely that CARB is utilizing cost projections based on real projects and their capitalized cost timelines. CARB should disclose the capitalized cost assumptions, and apply them to the modeling so that deployment timelines are adequate to pay off the capital investment.

f. CARB failed to analyze and mitigate the environmental and health impacts of transporting captured CO2 in pipelines associated with Refinery CCS or any CCS strategy. CO2 pipelines are highly specialized, dangerously under-regulated, and vulnerable to seismic, subsidence, and other rupture hazards.

In the Draft EA, CARB provides that reasonably foreseeable compliance responses to its proposed actions on mechanical CDR and CCS include the "modification of existing or construction of new industrial facilities to capture CO2 emissions (CCS), and construction of new infrastructure, such as pipelines, wells, and other surface facilities to enable the transport and injection of CO2 into a geologic formation for sequestration."[85] However, CARB fails to analyze environmental and health impacts of transporting captured CO2.

In particular, CARB fails to analyze potential long-term air quality and health impacts and other environmental impacts from possible CO2 pipeline explosions in the Draft EA. See the

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[84] Draft Scoping Plan at 94-96.
[85] Draft EA at 21.

comments of Dr. Phyllis Fox in Attachment C, detailing many severe and special hazards of CO2 transportation pipelines, including the following:

> ● CO2 pipelines are the dominant form of transport (above trucks and rail) for CCS activities because of economic factors, and would have to be used to transport CO2 from coastal refineries to Central Valley reservoirs in the Scoping Plan's proposed scenario.
> ● CO2 pipelines are unlike natural gas and other conventional pipelines – they transport CO2 in a supercritical state under high pressure, and are vulnerable to zipper-like ruptures.
> ● When CO2 is released, because it is heavier than air, it does not necessarily disperse rapidly, can travel in dense clouds for miles, and can cause asphyxiation through displacement of oxygen.
> ● CO2 pipelines can also be contaminated with Hydrogen Sulfide gas (another hazardous gas – see more below).
> ● Existing pipeline regulations are missing a critical safety factor – they do not limit water contamination in CO2 pipelines, which with CO2 forms extremely corrosive carbonic acid (increasing the risk of accident.)
> ● The Draft EA must include a risk analysis and health risk assessment regarding these severe impacts closely associated with the CCS strategy.

One issue described in Dr. Fox's report was the major CO2 leak and poisoning which *already* occurred in 2020 at Satartia Mississippi (*Gassing Satartia: Carbon Dioxide Pipeline Linked To Mass Poisoning*).[86] In this case, the pipeline included both CO2 and H2S. The article outlines a frightening set of near-death experiences including people passing out, shaking on the ground, dazed from extreme CO2 exposure during this blow-out. Terry Gann, Chief Investigator of the County Sheriff's Department (who had to drive in and out to evacuate people) said: *"It was almost like something you'd see in a zombie movie. They were just walking in circles," he said. "I kept telling 'em, 'Y'all get in the truck.' And they would just look at me with this blank look on their face. And the girl was holding a phone up to her head but she wasn't saying nothing. ... Finally I just yelled at 'em, I said, 'Get in the truck or you're gonna die!'"* After carrying out such rescues and being exposed himself through repeated trips, he became disoriented and confused, got lost, and required two hours of oxygen treatment.

The article provided many reports of severe impacts and continued impacts in the aftermath: "*"It was bad enough that I thought my mama wouldn't make it, and she still has trouble breathing," said Army veteran Hugh Martin, who fled Satartia in a pickup truck with his 78-year-old mother as he struggled to remain conscious. "She never had asthma or COPD, now she's on inhalers full time." Even months later, the town's residents reported mental fogginess, lung dysfunction, chronic fatigue and stomach disorders."*

The article outlined many important factors , including the lack of widespread experience in the U.S. with large networks of CO2 pipelines: *"Some experts estimate this network will need to be as large as or even larger than the 2.6 million miles of existing petroleum pipelines.*

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[86] Dan Zegart, *Gassing Satartia: Carbon Dioxide Pipeline Linked to Mass Poisoning*, THE HUFFINGTON POST (Aug. 26, 2021), available at: https://www.huffpost.com/entry/gassing-satartia-mississippi-co2-pipeline_n_60ddea9fe4b0ddef8b0ddc8f.

Meanwhile, there are only 5,000 miles of existing CO2 lines, meaning there is a wide range of operational — and safety — issues likely to arise from such a massive new system." This point again emphasizes the importance of CARB *carefully* considering these issues in the Scoping Plan EIR, rather than assuming that refinery CCS with CO2 piped to the Central Valley can be easily and safely made into an extensive state strategy.

CARB's website elsewhere states: *"Hydrogen sulfide (H_2S) is a colorless gas with the odor of rotten eggs. The most common sources of H_2S emissions are oil and natural gas extraction and processing, and natural emissions from geothermal fields."*[87]

H2S gas is acutely toxic, highly irritating to humans at low levels, and deadly at high levels. (See below.) A Technical Support Document for acute chemical health impacts prepared by California's Office of Environmental Health Hazard Assessment (OEHHA)[88] found that hydrogen sulfide is an extremely hazardous gas, it is the most common cause of sudden death in the workplace, that accidental releases to the outside air can cause serious health impacts, and at lower levels it can cause not only strongly offensive odors but nausea and headaches. The report found that people can still experience nausea and headache at California's ambient air quality standard for H2S (0.03ppm), and that the World Health Organization recommends a much lower limit (0.005ppm).[89] OEHHA's website also identifies harms to the nervous system from acute exposure and respiratory harms from chronic exposure.[90]

Another OEHHA report found H2S *chronic* exposure effects include nasal inflammation; low blood pressure, headache, nausea, loss of appetite, weight loss, ataxia,[91] eye membrane inflammation, and chronic cough.[92] Widespread perforation of Central Valley reservoirs may result in widespread new leaks of H2S. **Though CO2 is benign at low levels, at high levels it can cause asphyxiation hazards by displacing oxygen.** Such high levels could occur for example, during a pipeline blow-out or major reservoir leak, because CO2 is heavier than air and can pool in lower-lying areas and replace oxygen.[93] CO_2 poisoning can include physiological

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[87] California Air Resources Board, *Hydrogen Sulfide and Health* (last visited June 23, 2022), available at https://ww2.arb.ca.gov/resources/hydrogen-sulfide-and-health.
[88] CAL. OFFICE OF ENV'T HEALTH HAZARD ASSESSMENT, ACUTE RELS AND TOXICITY SUMMARIES USING THE PREVIOUS VERSION OF THE HOT SPOTS RISK ASSESSMENT GUIDELINES 145 (June 2008) ("At the current California Ambient Air Quality Standard (CAAQS) of 0.03 ppm, the level would be detectable by 83% of the population and would be discomforting to 40% of the population. These estimates have been substantiated by odor complaints and reports of nausea and headache"), available at: https://oehha.ca.gov/media/downloads/crnr/appendixd2final.pdf; *see also* Cal. Office of Env't Health Hazard Assessment, *Acute, 8-hour and Chronic Reference Exposure Level (REL) Summary* (last visited June 23, 2022), available at: https://oehha.ca.gov/air/general-info/oehha-acute-8-hour-and-chronic-reference-exposure-level-rel-summary.
[89] *Id.* at 145.
[90] *See supra* note 81 and accompanying text.
[91] Cal. Office of Env't Health Hazard Assessment, *Analysis of Refinery Chemical Emissions and Health Effects*, OEHHA (Mar. 2019), at 24, available at https://oehha.ca.gov/media/downloads/faqs/refinerychemicalsreport032019.pdf.
[92] CAL. OFFICE OF ENV'T HEALTH HAZARD ASSESSMENT, ANALYSIS OF REFINERY CHEMICAL EMISSIONS AND HEALTH EFFECTS 24 (Mar. 2019), available at: https://oehha.ca.gov/media/downloads/faqs/refinerychemicalsreport032019.pdf.
[93] Public Awareness Newsletter (Issue 2), Denbury Aware (Dec. 2014), available at: https://s1.q4cdn.com/594864049/files/doc_responsibility/Aware/AWARE-Issue-2-122014.pdf.

changes in circulatory, cardiovascular, and autonomic (nervous) systems.[94] Leaks of either or both could be very hazardous or deadly. See more in Dr. Fox Report.

The Pipeline and Hazardous Materials Safety Administration (PHMSA), a regulatory agency under the U.S. Department of Transportation (DOT), recently issued a bulletin detailing the risk of subsidence or seismic activity ("changing subsurface geological conditions") which threaten pipeline safety.[95] Importantly, the agency guidance notes that:

> PHMSA is issuing this updated advisory bulletin to remind owners and operators of gas and hazardous liquid pipelines, including supercritical carbon dioxide pipelines, of the potential for damage to those pipeline facilities caused by earth movement in variable, steep, and rugged terrain and terrain with varied or changing subsurface geological conditions. Additionally, changing weather patterns due to climate change, including increased rainfall and higher temperatures, may impact soil stability in areas that have historically been stable. These phenomena can pose a threat to the integrity of pipeline facilities if those threats are not identified and mitigated. Owners and operators should consider monitoring geological and environmental conditions, including changing weather patterns, in proximity to their facilities.

CARB fails to evaluate the risk of seismic hazards with regard to significant challenges this presents to safely operating the extensive network of CO2 pipelines that would be required to support operation of CCS at refineries in California. In accordance with the above-referenced PHMSA bulletin, these significant environmental and safety risks must be carefully addressed and evaluated.

g. Refinery CCS also increases risk of hazardous gas leaks to the surface at storage sites in the Central Valley that were not evaluated.

CARB anticipates that the use of CCS at oil refineries would be accompanied by storing CO2 in underground reservoirs in the Central Valley.[96]

Yet the Draft EA failed to analyze potentially significant environmental and health impacts in the Central Valley that could result from this anticipated storage. CCS storage could result in the emission of harmful gases (such as CO2 gas and Hydrogen Sulfide, or H2S) due to wellbore leaks, seismic events and other causes. Such leaks specific to carbon capture activities have already

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[94] *See* Fox Report (Attachment C).

[95] Pipeline and Hazardous Materials Safety Administration (PHMSA), Pipeline Safety: Potential for Damage to Pipeline Facilities Caused by Earth Movement and Other Geological Hazards, Federal Register 87 F.R. 33576 (June 2, 2022), available at: https://www.federalregister.gov/documents/2022/06/02/2022-11791/pipeline-safety-potential-for-damage-to-pipeline-facilities-caused-by-earth-movement-and-other.

[96] *See* Draft Scoping Plan at 67. ("California's deep sedimentary rock formations in the Central Valley represent world-class CO2 storage sites that would meet the highest standards, with storage capacities of at least 17 billion tons of CO2"); *see also* Draft EA at 190 (describing reasonably foreseeable compliance responses associated with CCS actions, including modification of existing or new industrial facilities to capture CO2 emissions and construction of pipelines, wells, and other surface facilities near the emitting facility).

occurred, for example in Canada. These new potential hazards add to already substantial pollution hazards facing communities of color and low income communities in the Central Valley.

Many years ago, industry literature had already identified the potential for leaks of CO2 and H2S gas from geological storage sites due to CCS operations. For example, Watson and Bachu (2009) concludes that wellbores themselves down to underground storage can introduce new leakage pathways for CO2 and other gases to the surface.[97]

In particular, the Watson and Bachu article concluded that: *"**This information is useful not only for future operations of CO2 storage in geological media**, but also for current operations relating to the exploration and production of hydrocarbons."*[98] It states:

> **Implementation of carbon dioxide (CO2) storage in geological media requires a proper assessment of the risk of CO2 leakage from storage sites. Leakage pathways may exist through and along wellbores, which may penetrate or be near to the storage site.** One method of assessing the potential for CO2 leakage through wells is by mining databases that usually reside with regulatory agencies. These agencies collect data concerning wellbore construction, oil and gas production, and other regulated issues for existing wells. The Alberta Energy Resources Conservation Board (ERCB), the regulatory agency in Alberta, Canada, collects and stores information about more than 315,000 oil, gas, and injection wells in the province of Alberta. The ERCB also records well leakage at the surface as surface-casing-vent flow (SCVF) through wellbore annuli and gas migration (GM) outside casing, as reported by the industry.
>
> **The evaluation of a leakage pathway through wellbore casing or annuli and what causes these wellbore leaks are the first step in determining what factors may contribute to wellbore leakage from CO2-storage sites.** (emphasis added)[99]

The article highlighted new gas leak risks caused by wellbores. **This factor is *separate from* and *in addition to* the evaluation of the quality of underground geologic formations as reservoirs.** The Draft Scoping Plan EIR apparently assumes that the natural presence of "world class" underground geologic formations in California will by itself provide safe storage , but the study shows this is not the case – *new perforations introduced to inject CO2 below ground become their own leak hazard*. The article identified different risk factors contributing to leaks, including poor cement bonds and internal or external corrosion of casings and others. It found that: *"Cased wells account for 98% of the SCVF/GM incidence in the ERCB data."*[100]

The study also identified the presence of H2S, a hazardous gas in deep formations. For example, it stated: *"Usually in Alberta, H2S is found in deep carbonate formations."* But the Draft Scoping Plan EIR did not provide such an evaluation of H2S gas presence in California in

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[97] Theresa Watson & Stefan Bachu, *Evaluation of the Potential for Gas and CO2 Leakage Along Wellbores*, 24 SPE DRILLING & COMPLETION 115 (2009), available at: https://www.researchgate.net/publication/254526287_Evaluation_of_the_Potential_for_Gas_and_CO2_Leakage_Along_Wellbores [hereinafter "Watson and Bachu Article"].
[98] Watson and Bachu Article at 115.
[99] Watson and Bachu Article at 115.
[100] Watson and Bachu article at 121.

deep reservoirs, nor its potential leakage to the surface. Further it did not evaluate H2S as a corrosive agent that could in itself cause additional leaks in well casings.[101] These evaluations are crucial, to identify both the potential to free pathways for more H2S and for harmful levels of CO2 up to the surface. (See earlier discussion on H2S and CO2 health harm.)

Though any of the above risks should give pause before lightly adopting CCS strategies, there is another unique risk in California – seismic hazards. While seismic hazards were briefly mentioned here and there in the EA, it did not evaluate how the potential that toxic leaks due CCS could be made much more likely due to seismic hazards (either from existing faultline risks, or because sequestration itself can increase risk of earthquakes). This risk, particularly regarding CO2 pipeline transport and storage underground, must be evaluated.

h. CARB fails to adequately analyze the environmental impact, safety, and mitigation strategies necessary for mechanical carbon dioxide removal (CDR) technology.

California must not rely heavily on nascent, uncertain technologies mechanical CDR technologies. CARB must fully evaluate the ramifications of adopting emerging technologies that would directly capture carbon from the atmosphere. While some Direct Air Capture (DAC), a subset of CDR, is being proposed to remove excess CO2 from the air, it is also eligible for subsidies in California as a means to *offset continued fossil fuel operations.*[102] Such an application would further delay a necessary fossil fuel phaseout, undermine projected emission cuts, and would instead increase cumulative GHG emissions over time (see Karras Report, Attachment D), and allow continued harmful smog-forming and toxic pollutants from fossil fuel industries.

New infrastructure required for mechanical CDR is also likely to disproportionately impact low-income communities of color whose health already suffers from over-pollution and undue safety risks of volatile fossil fuel infrastructure. As we discussed above, California's Central Valley, where much of the CO2 sequestration would be located,[103] is heavily disproportionately impacted by air pollution and health vulnerabilities.[104] New impacts of CO2, Hydrogen Sulfide (H2S), as well as construction impacts of the new infrastructure is likely to heavily impact any

[101] *Id.*
[102] Cal. Air Res. Bd., Carbon Capture and Sequestration Project Eligibility FAQ (Dec. 2021) . https://ww2.arb.ca.gov/resources/fact-sheets/carbon-capture-and-sequestration-project-eligibility-faq.
[103] Scoping Plan at 67 (citing Lawrence Livermore National Laboratory. 2020. Getting to Neutral: Options for Negative Carbon Emissions in California. Revision 1.); *see also* Sammy Roth, Is a Michigan energy firm using dark money to influence California's climate plans?, LOS ANGELES TIMES (June 23, 2022) available at : https://www.latimes.com/environment/newsletter/2022-06-23/michigan-energy-firm-dark-money-california-climate-plans-boiling-point.
[104] Cresencio Rodriguez-Delgado, *California has Some of the Worst Air Quality in the Country. The Problem is Rooted in the San Joaquin Valley*, PBS NEWS HOUR (June 16, 2022) (The San Joaquin Valley "has been out of compliance with Environmental Protection Agency standards for 25 years, earning the region the unwanted distinction of being among the most polluted regions in the country . . . [a]s California heads into another wildfire season, environmentalists and lawmakers are trying to revive a decades-long push to strengthen air quality regulation to curb pollution and reduce the many consequences of daily life with dirty air, including rising health care costs"), available at: https://www.pbs.org/newshour/nation/california-has-some-of-the-worst-air-quality-in-the-country-the-problem-is-rooted-in-the-san-joaquin-valley.

regions across which CO2 pipeline corridors may need to be sited in order to reach sequestration sites as proposed in the Central Valley. However, CARB has failed to adequately analyze the environmental and health impacts of mechanical CDR, especially on low-income and disadvantaged communities.

In addition, CARB failed to evaluate the following: (1) the amount of electricity sector generation and other energy use required for all steps to operate DAC, transport, and store carbon; (2) the feasibility and impact of siting, construction, and sequestration, as well as regional operational feasibility considerations in the regions identified as reasonably foreseeable candidates for storage; (3) the total amount of CO2 storage available without triggering seismic events, an issue that has yet to be fully considered by the the EPA Title VI permitting process.[105]

DAC may actually undermine California's climate goals if it is used to offset new fossil fuel emissions instead of removing legacy excess carbon in the atmosphere because (1) CARB does not include all reasonably available options for fossil fuel phaseout such as oil refining phasedown in Alternative 3; (2) many DAC developers are funded through oil industry investment;[106] and (3) DAC is currently eligible for LCFS credits that can be used by polluting industries.[107]

CARB attributes large cumulative quantities of emission reductions (542 MMTCO2e) to DAC technology from 2033 to 2045.[108] CARB estimates that direct air capture (DAC) technology will remove either 79 MMT or 100 MMT CO_2e in residual emissions under Alternative 3.[109] However, this amount could be much smaller if CARB adopted direct emission reduction measures, including a phase out of oil and gas and phase down of refinery operations as well as accelerated targets in other sectors such as in the transportation or electricity sectors.

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[105] Video, Mark Zoback, Geomechanical Issues Affecting Long-Term Storage, Stanford Center for Capture Storage, Jan. 25, 2022, https://www.youtube.com/watch?v=IDwOQhhQ9Uk.

[106] Exxon Mobile, *ExxonMobil expands agreement with Global Thermostat, sees promise in direct air capture technology* (last visited June 23, 2022), available at: https://corporate.exxonmobil.com/News/Newsroom/News-releases/2020/0921_ExxonMobil-expands-agreement-with-Global-Thermostat-re-direct-air-capture-technology; *Chevron, Occidental invest in CO2 removal technology*, REUTERS (Jan. 9, 2019), available at: https://www.reuters.com/article/us-carbonengineering-investment/chevron-occidental-invest-in-co2-removal-technology-idUSKCN1P312R.

[107] Cal. Air Res. Bd., *Carbon Capture and Sequestration Project Eligibility FAQ* (Dec. 2021) ("DAC projects that store the captured carbon dioxide (CO_2) underground may apply for CCS Permanence Certification regardless of location"), available at: https://ww2.arb.ca.gov/resources/fact-sheets/carbon-capture-and-sequestration-project-eligibility-faq#:~:text=Do%20CCS%20projects%20have%20to,capture%20(DAC)%20projects.

[108] 2022 Scoping Plan, Modeling Information: AB 32 GHG Inventory Sectors Modeling Data Spreadsheet, Sum of CDR in Alternative 3 through 2045 (May 10, 2022), available at: https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents#:~:text=The%202022%20Scoping%20Plan%20Update%20focuses%20on%20outcomes%20needed%20to,economic%2C%20environmental%2C%20energy%20security%2C.

[109] There is a confusing discrepancy between the initial modeling results presentation in which the Key Metrics chart and graph show 95 MMT of residual emissions to be removed by DAC in 2045, and the data spreadsheet of emissions provided for the modeling (Alternative 3, CDR) at 79 MMT, which necessitates explanation by CARB.

i. CARB must not incentivize carbon capture for enhanced oil recovery.

Burying a critical fossil fuel extraction measure in the Draft EA, CARB opens the door to the utilization of carbon capture for "enhanced oil recovery" (EOR). The Draft Plan contemplates the potentially significant impact of EOR, outlining how EOR from carbon capture, utilization and storage (CCUS) projects could result in "emissions…released into the air, soil, aquifers, or surface waterways because of unidentified and/or poorly abandoned wells or other pathways (e.g., natural fractures)."[110] CARB then fails to adequately describe and analyze such a significant potential action under the Draft Scoping Plan.[111]

Instead, California should explicitly prohibit the use of carbon capture for Enhanced Oil Recovery (EOR). The notion of allowing building subsidized systems to capture carbon, in order to extract more climate-harming crude oil is so inherently counter to climate goals that it should be considered nonsensical.

V. CARB Must Adopt More Ambitious Transportation Measures.

CARB states that the transportation sector accounted for more than 50 percent of California's GHG emissions in 2019.[112] At the same time, per capita VMT increased by more than 1 percent annually from 2000 to 2019, peaking at 24.6 miles.[113] CARB recognizes that increased adoption of zero-emission vehicles ("ZEVs") is not sufficient to achieve carbon neutrality by 2045, and that California must also reduce overall driving demand in order to meet this and other climate, air quality and equity goals.[114] Although we appreciate CARB's proposal to reduce per capita vehicle miles traveled (VMT) to 22 percent below 2019 levels by 2045,[115] California must achieve a 30 percent VMT reduction below 2019 levels by 2035 to ensure that CARB meets its target of reducing GHG emissions by at least 40 percent below 1990 levels by 2030.[116] We are also concerned that CARB has not adequately considered or implemented VMT reduction and other transportation measures, including expanding transit and active transportation. For instance, CARB has failed to conduct a cost savings analysis on VMT reductions in the draft Scoping Plan. Moreover, CARB must analyze the economic, environmental, and health benefits and impacts of transit and active transportation expansion measures.

While we support CARB's goal of achieving 100% light-duty electric vehicle ("LDV") sales by 2035, in line with Governor Newsom's 2020 executive order,[117] We recommend that

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[110] Draft Scoping Plan at 132.
[111] Draft Scoping Plan at 141.
[112] Draft Scoping Plan at 147.
[113] Draft Scoping Plan, Appendix E at 5.
[114] Draft Scoping Plan at 155, Appendix E at 5-6.
[115] Draft Scoping Plan at 58, 140, 156; Draft EA at 15.
[116] CAL. STATE TRANSP. AGENCY, CALIFORNIA TRANSPORTATION PLAN 2050 91 (Feb. 3, 2021), available at: https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/ctp-2050-v3-a11y.pdf.
[117] GOVERNOR NEWSOM ANNOUNCES CALIFORNIA WILL PHASE OUT GASOLINE-POWERED CARS & DRASTICALLY REDUCE DEMAND FOR FOSSIL FUEL IN CALIFORNIA'S FIGHT AGAINST CLIMATE CHANGE, Office of the Cal. Governor (Sep. 23, 2020), available at: https://www.gov.ca.gov/2020/09/23/governor-

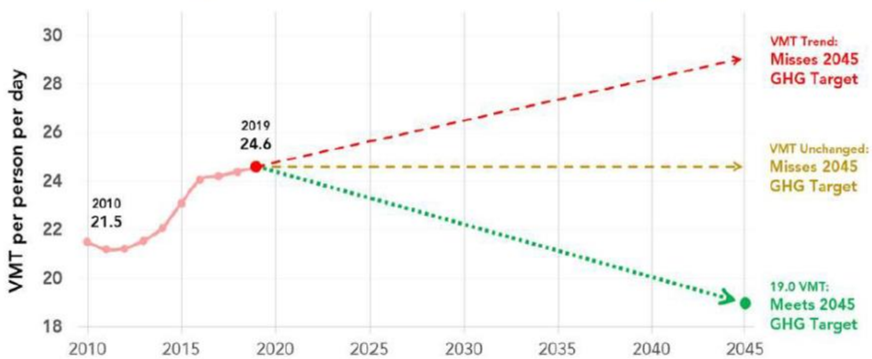
CARB include the interim goal of achieving 75% LDV sales by 2030. Moreover, as detailed below, CARB must remove the early retirement program from Alternative 1.

a. Vehicle Miles Traveled and Transit

i. CARB must increase its VMT reduction target to 30 percent of 2019 levels by 2045.

In the draft Scoping Plan, CARB emphasizes that California "must [] pursue policies that result in less driving[,] in order to meet [the State's] GHG and air quality targets."[118] Specifically, CARB states that "VMT reductions will play an indispensable role in reducing overall transportation energy demand and achieving our climate, air quality, and equity goals even as vehicles transition to ZEV technology."[119] CARB further acknowledges that California is not on track to achieve the State's VMT reduction target, and concludes that "**the latest Scoping Plan scenario modeling shows California will not meet its climate goals without reducing the amount people drive on a daily basis.**"[120] CARB presents Figure W in Appendix E to illustrate that per capita VMT is steadily increasing.

Figure W. VMT and California GHG reduction goals



CARB recognizes that it is difficult to reduce VMT because "transportation planning has been developed in service of private cars," and single-use and low-density housing and land use practices also encourage single-occupancy vehicle travel.[121] CARB also acknowledges that California's current driving-centric planning places a disproportionate burden on low-income families, who must expend significant time and money commuting long distances in cars.[122]

To reduce driving demand in California and build more sustainable equitable communities, CARB proposes to reduce VMT by 12 percent below 2019 levels by 2030, and at least 22 percent below 2019 levels by 2045.[123] However, CARB fails to demonstrate the extent to which these proposals would reduce climate impacts or resolve the inequity inherent to California's driving-

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newsom-announces-california-will-phase-out-gasoline-powered-cars-drastically-reduce-demand-for-fossil-fuel-in-californias-fight-against-climate-change/.

[118] Draft Scoping Plan at 147 (emphasis added).

[119] Draft Scoping Plan at 154-55.

[120] Draft Scoping Plan at 89, Appendix E at 4-5 (emphasis added).

[121] Draft Scoping Plan at 154-55.

[122] Draft Scoping Plan at 155.

[123] Draft Scoping Plan at 58, 140, 156; Draft EA at 15.

centric planning. Appendix E simply states that "future per capita daily driving [] must decline from 24.6 miles in 2019 to no more than 19.0 miles by no later than 2045 to support California's climate goals".[124]

Rather, CARB must adhere to the goals articulated in the California Transportation Plan 2050.[125] This plan calls for a 25 percent reduction in VMT of percent below 2019 levels by 2030, and 30 percent below 2019 levels by 2045 to meaningfully reduce vehicle emissions.[126]

ii. CARB must conduct a cost savings and environmental impacts analysis for its VMT reduction measure.

Under AB 197, CARB must identify (a) the range of projected GHG emissions reductions; (b) the range of projected air pollution reductions; and (c) the cost-effectiveness, including avoided social costs, for each proposed measure.[127] While CARB includes VMT targets as an emissions reduction measure under all of the AB 32 GHG Inventory Alternatives, it has failed to analyze potential cost savings that the Draft Scoping Plan could achieve through VMT reductions. In their April 20, 2022 presentation, E3 noted that its modeling does not evaluate cost savings related to VMT reduction measures.[128] CARB has not explained why it excluded, in violation of AB 197, any estimation of potential cost savings from the proposed VMT reduction measures, in violation of AB 197.

The draft EA also fails to analyze the potential environmental impacts of the reasonably foreseeable responses to this measure, including expanding transit, active transportation, and "new mobility" options as specified in Appendix E.

iii. CARB fails to model or otherwise analyze feasibility, cost savings, and environmental impacts of potential active transportation expansion measures in the proposed AB 32 GHG Sector alternatives.

In the Draft Scoping Plan, CARB staff also propose to "[i]nvest in making public transit a viable alternative to driving by increasing affordability, reliability, coverage, service frequency, and consumer experience"; and "reallocate[e] revenues to improve transit, bicycling, and other sustainable transportation choices".[129] Appendix E provides additional strategies, including (1)

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[124] Draft Scoping Plan, Appendix E at 5.
[125] Cal. State Transp. Agency, *supra* note 116.
[126] *Id.* at 91.
[127] Cal. Health & Safety Code § 38562.7.
[128] Cal. Air Res. Bd. & Energy, Economy, and Environment Modeling, *2022 Scoping Plan Update - Initial Air Quality & Health Impacts and Economic Analyses* Slide 3 (Apr. 20, 2022), available at: https://ww2.arb.ca.gov/sites/default/files/2022-04/SP22-Initial-AQ-Health-Econ-Results-ws-E3_0.pdf ("Costs for Vehicle Miles Traveled (VMT) Reduction Measures [are] not included"); *See also* Video, *2022 Scoping Plan Update - Initial Air Quality & Health Impacts and Economic Analyses Workshop*, at 15:04-16:30, available at: https://www.youtube.com/watch?v=PtsFweUncT4.
[129] Draft Scoping Plan at 156.

rescoping Caltrans' project pipelines; (2) implementing recommendations in the Climate Action Plan for Transportation Infrastructure (CAPTI); (3) doubling transit coverage and service frequencies by 2030; and (4) increasing transit affordability through easing local and state-level funding restrictions.[130]

Although CARB proposes various measures under the category of "Deploy ZEVs and reduce driving demand" in the Draft Scoping Plan, most of these measures focus on improving vehicle fuel economy and transitioning to electric or hydrogen powered vehicles, with the exception of the VMT reduction measure discussed above.[131]

CARB must analyze the measures to reduce driving demand, as outlined in Appendix E. These measures, including doubling transit coverage and service frequency by 2030, may facilitate greater emissions reductions at potentially lower cost than the one-to-one zero-emission passenger vehicle adoption that CARB proposes. However, because transit expansion measures were not modeled in the draft alternatives, CARB did not compare the cost-effectiveness of these additional transportation measures against its proposals to increase deployment of zero-emission passenger vehicles and associated charging infrastructure.

In light of CARB's proposed strategy to expand transit and active transportation in the Draft Scoping Plan, CARB's failure to conduct any modeling or analysis on cost savings or cost-effectiveness of this measure, contrary to AB 197.[132]

b. Zero-emission vehicles ("ZEVs")

We appreciate that Alternative 3 for the AB 32 GHG Inventory Sector alternatives includes the target of 100% light-duty vehicle ("LDV") ZEV car sales by 2035, in accordance with Executive Order N-79-20.[133] However, we recommend that CARB revise the Scoping Plan to establish an interim target of 75% ZEVs for new car sales by 2030 to reduce direct emissions from LDVs as soon as possible and ensure that the State meets its 2035 GHG emissions reductions target.[134] This interim 2030 target is also consistent with CARB's 2020 Mobile Source Strategy.[135]

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130 Appendix E at 13-16 (emphasis added).

131 Draft Scoping Plan at 58-63, Table 2-2 (listing GHG reduction measures under Alternative 3); Draft Scoping Plan, Appendix C at 2-10, Table C-1 (comparing measures for all AB 32 GHG Inventory alternatives).

132 Cal. Health & Safety Code § 38562.7.

133 Cal. Exec. Order No. N-79-20 § 2(a) ("[t]he State Air resources Board, to the extent consistent with State and federal law shall develop and propose . . . [p]assenger vehicle and truck regulations requiring increasing volumes of new zero-emission vehicles sold in the State towards the target of 100 percent of in-state sales by 2035").

134 John Fleming, ALL-ELECTRIC DRIVE: HOW CALIFORNIA'S CLIMATE SUCCESS DEPENDS ON ZERO-EMISSION VEHICLES, CTR. FOR BIOLOGICAL DIVERSITY 1 (Dec. 2020), available at: https://www.biologicaldiversity.org/programs/climate_law_institute/pdfs/All-Electric-Drive-California-zero-emissions-vehicles-report.pdf ("All cars and light-duty trucks sold in the state in 2030 and beyond must run on electricity alone, and nearly all internal combustion engine vehicles must be off California roads by 2045").

135 Cal. Air Res. Bd., 2020 Mobile Source Strategy (Oct. 28, 2021), available at: https://ww2.arb.ca.gov/sites/default/files/2021-12/2020_Mobile_Source_Strategy.pdf.

CARB should also include in the Final Scoping Plan a target to require 100 percent of medium and heavy-duty truck sales to be ZEV by 2035, in line with the Mobile Source Strategy.[136] By proposing to delay compliance until 2040,[137] CARB would allow new, polluting internal combustion trucks to stay on the roads well beyond 2050, undermining Governor Newsom's Executive Order, which aims to expand the use of ZEVs in all sectors to the extent feasible. As CARB implements measures to reduce statewide demand for oil and gas, the phaseout of new combustion sales represents a low-cost, high impact mitigation strategy. This is especially true in light of CARB's own analyses, which indicate that all categories of zero-emission trucks will be cheaper to own as early as 2030.[138]

To improve equity and public health outcomes, CARB must implement measures to achieve a rapid transition to zero-emission heavy-duty vehicles. These measures are critical for low-income communities of color, who face the highest concentrations of diesel particulate matter and other air pollution in California. In particular, port-adjacent communities are disproportionately impacted by the continued use of diesel drayage equipment, including drayage trucks.[139] To ameliorate these impacts, CARB should set a target of 100 percent adoption of on-road ZEV drayage trucks by the year 2030. Doing so would align with and further codify complementary measures that are adopted or proposed at California ports; for example, the Port of San Diego recently adopted a goal of 100% zero-emission vehicle target for all trucks at the port by 2030.[140]

Alternative 3 proposes a 100 percent sales target for heavy and medium-duty vehicles by 2040. CARB should adopt a more ambitious timeline in the Final Scoping Plan. Multiple reports make clear that a 2035 timeline for 100% heavy-duty vehicle sales is feasible. With a lifespan of up to 20 years, it is critical that the timeline for zero-emission heavy-duty and medium-duty vehicles is accelerated. Specifically, CARB did not include the analysis of a small scale early vehicle retirement program for heavy-duty vehicles. We propose the inclusion of analysis of a program that looks at retirement of approximately 130,000 13 -18 year old trucks as proposed by the Coalition for Clean Air in July 2021.

The Scoping Plan should also ensure that 100 percent of transit buses on the road are zero-emission by 2030. Finally, the Final Scoping Plan must reflect that the January Draft of the State Implementation Plan Strategy calls for the retirement of at the end of their useful life. Incorporating

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[136] CAL. AIR RES. BD., MOBILE SOURCE STRATEGY 68, Table 11 (Oct. 28, 2021), available at: https://ww2.arb.ca.gov/sites/default/files/2021-12/2020_Mobile_Source_Strategy.pdf.

[137] Draft Scoping Plan at 150; Draft Scoping Plan, Appendix C at 2, Table C-1.

[138] CAL AIR RES. BD, DRAFT ADVANCED CLEAN FLEETS TOTAL COST OF OWNERSHIP DISCUSSION DOCUMENT 8 (Sept. 2021), available at: https://ww2.arb.ca.gov/sites/default/files/2021-08/210909costdoc_ADA.pdf (detailing how total cost of ownership of ZEV trucks will be lower than their diesel counterparts by 22-33 percent, leading to cost annual cost savings of $47,000-251,000 per vehicle).

[139] *See,* e.g., S. Coast Air Quality Mgmt. Dist., *Multiple Air Toxics Exposure Study in the South Coast Air Basin V (MATES-V)*, at ES-12, ES-17, 1-4, 2-32, 4-6, 4-13, 4-28 (2021) (describing various pollutants and disease risks associated with proximity to the Los Angeles/Long Beach Port Complex, including diesel particulate matter and formaldehyde, and noting that the area near the Port Complex has the highest cancer risk in the region), available at: http://www.aqmd.gov/docs/default-source/planning/mates-v/mates-v-final-report-9-24-21.pdf?sfvrsn=6.

[140] PORT OF SAN DIEGO, PORT OF SAN DIEGO ADOPTS MOST AMBITIOUS MARITIME CLEAN AIR STRATEGY OF ITS KIND IN CALIFORNIA (Oct. 14, 2021), available at: https://www.portofsandiego.org/press-releases/general-press-releases/port-san-diego-adopts-most-ambitious-maritime-clean-air.

this policy into the Draft Scoping Plan would ensure greater consistency between CARB's air and climate policies and reaffirm its commitment to crucial policies to replace fossil fuels with their ZEV equivalents.[141]

i. CARB should remove the early vehicle retirement measure from Alternative 1.

In Alternative 1 for AB 32 GHG Inventory Sectors, CARB incorporates an early retirement and buy-back program that aims to replace all internal combustion vehicles with ZEVs by.[142] This measure contributes significantly to the projected costs of Alternative 1, artificially inflates the overall cost analysis for this alternative, and drags down other viable measures that are unfairly wrapped under the umbrella of "stock costs" alongside the buy-back program. The decision to incorporate the buy-back program into Alternative 1 rests solely on CARB; neither EJAC nor CEJA advocated for any such measure, precisely because its prohibitive costs threaten to undermine any alternative to which this program is attached.

Further, CARB fails to demonstrate that this early vehicle retirement program is feasible or equitable. Although CARB staff does not actually show how much the program would cost since it is bundled with other stock costs for Alternative 1 in Figure H-11, CARB assumes that manufacturers would pass this cost to the end-consumer through "an increase in prices."[143] CARB provides no further detail explaining which goods or services would see an increase in prices, or how significant this price increase would be. By failing to consider how this program would cause price variation would impact low-income Californians. And since this program assumes a one to one vehicle replacement ratio, it will perpetuate California's driving demand—directly countering the State's need to reduce overall driving demand regardless of vehicle type. The early vehicle retirement program is also unnecessary as the Real Zero Alternative demonstrates (Attachment A).

CARB recognizes that the early retirement program is responsible for the high economic costs modeled for Alternative 1.[144] Indeed, CARB's inclusion of this program has skewed the stock costs, and therefore overall costs, of Alternative 1 so that it is significantly higher than the overall costs of Alternatives 2-4. CARB staff use this skewed number to conclude that the economic costs of Alternative 1 are much higher than the other alternatives, especially in 2035. More importantly, by bundling stock costs in a consolidated chart instead of disclosing the costs of each type of stock separately, CARB has failed to provide information that the Board needs to make an independent, informed decision on the costs of each measure and alternative.

We recommend that CARB staff revise Alternative 1 to remove the early vehicle retirement program altogether, or at the very least allow CARB Board to evaluate the costs of a vehicle early

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[141] CAL. AIR RES. BD., DRAFT 2022 STATE STRATEGY FOR THE STATE IMPLEMENTATION PLAN 42 (Jan. 31, 2022), available at: https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf.
[142] Draft Scoping Plan at 44; Appendix C at 2, Table C-1.
[143] Draft Scoping Plan at 96, Figure 3-2; Draft Scoping Plan, Appendix H at 89-90.
[144] Draft Scoping Plan, Appendix H at 89 ("As modeled in PATHWAYS, Alternative 1 has high stock costs due to the accelerated retirement of vehicles and equipment. The stock cost in Alternative 1 includes the residual value in equipment that is retired before the end of life.").

retirement program and other "stock costs" separately. We also propose a new alternative (See Attachment A: Real Zero Alternative) that would allow California to feasibly meet its climate goals without an early vehicle retirement program.

c. Low-carbon fuel standard

The Proposed Scenario indicates that CARB should consider increasing the stringency of Carbon Intensity (CI) targets through a public decision-making process.[145] Although increasing the stringency of CI targets appears to further the goal of reducing GHG emissions from transportation fuels, in practice, it is likely to perversely *increase* real GHG emissions from transportation fuels. CARB's reliance on more stringent CI targets incorrectly presumes that the methodology used to calculate CI of alternative fuels reflects reductions in GHG emissions in the real world. In actuality, the calculation of CI for livestock biomethane excludes both upstream and downstream emissions, including feed and land application of digestate, leading to inaccurate calculations of dairy biomethane's CI targets.[146]

The obvious result of increased CI stringency paired with artificially carbon negative factory farm gas (dairy biomethane) credits is that deficit holders are incentivized to purchase even more credits from factory farm gas, raising their value even further. This, in fact, is ostensibly CARB staff's intent, given the recommendation to develop 380 additional dairy digesters in the Proposed Scenario.[147]

CARB must revise the Draft Scoping Plan to expand the scope of rulemaking proceedings on the LCFS to include a public process assessing whether factory farm gas is properly receiving its significantly negative CI scores and whether factory farm gas should be an eligible source of credits under the LCFS at all. CARB must also revise the Draft Scoping Plan to clarify whether GHG emissions reductions under the LCFS are additional, and that the LCFS is not double counting emissions reductions from manure-to-energy pathways that would have occurred even in the absence of the LCFS. This rulemaking is essential to ensure the integrity of the LCFS program and that it results in real world GHG emissions reductions.

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[145] *See* Draft Scoping Plan at 145, 154.

[146] *See* Ruthie Lazenby, et al., BEFORE THE CAL. AIR RES. BD., PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD, PUBLIC JUSTICE (Oct. 2021), available at: https://food.publicjustice.net/wp-content/uploads/sites/3/2021/10/Factory-Farm-Gas-Petition-FINAL.pdf (describing how CARB's tier 2 pathways exclude upstream and downstream emissions, including "the inputs and infrastructure necessary to sustain a dairy cow or a pig: its food and water, the methane animals produce through enteric fermentation, the construction and maintenance of the lagoons required to hold manure, trucking livestock and other inputs, combustion of fuels at the dairy facility for electricity," as well as "negative downstream emissions from the use of distillers grains as dairy feed").

[147] *See* Draft Scoping Plan at 187; Draft Scoping Plan, Appendix H at 21-28.

VI. California Must Decarbonize the Electric Sector As Soon As Possible.

CARB Staff's Proposed Scenario leaves more than 20 GW of gas plants online and sets a 30 $MMTCO_{2}e$ target for the electricity sector by 2045.[148] These goals and targets constitute legal and factual error, which must be remedied in the final Scoping Plan by adopting the Real Zero Alternative (Attachment A)(which includes no CCS, CDR or additional gas capacity or combustion, and 0 $MMTCO_{2e}$ for the electric sector by 2035), or by setting targets for the electricity sector that align with those articulated in Alternative 1 (23 MMT by 2030 and a 0 MMT_{2e} by 2035 with no combustion on the system at all).

Contrary to CARB staff's assertion, Alternative 3 does not meet, let alone "exceed" statutory emission reduction targets.[149] To support this conclusion, CARB Staff assert that Alternative 3 deploys a "broad portfolio of existing and emerging fossil fuel alternatives and clean technologies, and align[s] with statutes and executive orders."[150] They further claim that the Plan is "equity-focused," achieves carbon neutrality, "displace[s] fossil-fuel fired electrical generation,"[151] and that it "most closely aligns with existing statute and Executive Orders."[152] Staff's assertions could not be further from the truth. A closer look reveals that the Proposed Scenario, and the underlying assumptions on which it rests, does not align with the relevant statutes and executive orders, and fails to consider all relevant technologies and information. This results in a portfolio that fails to meet air quality, climate, and equity requirements.

Of the four scenarios advanced in the Draft Scoping Plan, CARB staff only attempt to argue that the first three could meet California's GHG reduction mandates.[153] Among Alternatives 1, 2 and 3, there is no question that the Proposed Scenario, as recommended in the Draft Scoping Plan, would lead to the largest increases in air pollution and GHGs. Consequently, the Proposed Scenario would put the health of every community, but especially environmental justice communities, in California at greater risk.[154] CARB bases this willingness to jeopardize the health of our communities and the climate on purported cost savings. However, the underlying assumptions and cost data reveal a deeply flawed cost-benefit analysis. In addition to underestimating the Alternative 3 costs, CARB's analysis omits significant monetary benefits to the economy that arise from protection of air quality and the climate.

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[148] Draft Scoping Plan at 60.
[149] Draft Scoping plan at i ("[t]his is the first Scoping Plan that adds carbon neutrality as a science-based guide and touchstone beyond statutorily established emission reduction targets").
[150] Draft Scoping Plan at 41.
[151] Draft Scoping Plan at i.
[152] Draft Scoping Plan at iv.
[153] The Staff Proposal describes how Scenario 4 does not meet California's requirement to achieve an 80 percent GHG reduction by 2050. *See Id.* at 46 ("this scenario does not achieve the 2050 80 percent reduction in GHGs below 1990 levels as called for in Executive Order S-3-05").
[154] *Id.* at 54.

As we discuss in detail below, CARB's treatment of the electric sector errs in five primary ways:

- First, CARB fails to consider all air emissions and proposes Alternative 3, a scenario that will likely increase air pollution. Consequently, it is in contravention of State GHG and air pollution policies and requirements.
- Second, CARB legally errs by failing to include line losses when examining compliance with SB 100, which is inconsistent with statutory language and regulatory precedent.
- Third, CARB overstates the costs of Alternative 1 by failing to consider additional available resources that would lower emissions and costs, while omitting costs needed to keep fossil fueled generation online. These failures show the Staff's selection of the Proposed Scenario is not based in fact.
- Fourth, CARB errs by setting a GHG electric sector target that is inconsistent with carbon neutrality requirements, state policy, IEA recommendations, United Nations' warnings, and President Biden's calls to decarbonize the electric sector as soon as possible.
- Fifth, CARB errs by choosing a scenario that wrongly relies on costly and polluting resources that will likely disproportionately harm disadvantaged communities.

CARB's failure to effectuate its statutory and regulatory requirements necessitates significant revisions to its treatment of the electric sector. Moreover, its omission of critical information and failure to consider available resources evinces a basic lack of CEQA compliance, particularly in its project description and alternatives analysis. To remedy these shortcomings, the Board must adopt a scenario requiring the electric sector to achieve 0 MMT by 2035, and incorporate the above suggestions into the Draft Scoping Plan. Further, it must revise its Draft EA to incorporate a full analysis of the environmental impacts resulting from any scenario that CARB ultimately adopts. Moreover, the Draft EA must comply with CEQA's mandate to avoid, where feasible, significant adverse effects to the environment. *City of Arcadia v. State Water Res. Control Bd.*, 135 Cal. App. 4th 1392, 1422. This is the best way to ensure that California meets its air quality, climate, and equity goals and requirements.

a. The Proposed Scenario fails to consider all emissions from the electric sector, is the worst scenario for air pollution, and will likely increase air pollution in contravention of state policies and requirements.

The Proposed Scenario is flawed, and CARB Staff should reject it because it would increase air pollution, fails to consider all air emissions, and carries significant negative implications for environmental justice communities living by polluting electrical generating facilities. The Proposed Scenario would leave the entire gas fleet online, while also leading to significant increases in biomass pollution and pollution due to exported power and cycling.[155] As

[155] *Id.* at 162, Figure 4-5 (projecting continued expansion of gas-fired electrical generation and growth of biomass).

explored below, when the likely emissions are reasonably projected, it appears more likely than not that the Proposed Scenario would *increase* air pollution from the electric sector in contravention of State policies and requirements.

i. CARB errs by choosing the scenario with the largest biomass emissions and failing to analyze and mitigate those emissions.

CARB staff concedes that, of Alternatives 1 through 3, its proposed scenario produces the most biomass emissions.[156] This high level of biomass emissions is a significant concern, especially for communities living near biomass facilities. Biomass facilities burn organic materials, including plants and wood, and emit enormous amounts of pollutants per megawatt-hour of generation. In fact, biomass facilities can emit over 150 percent the N_2O, 600 percent the VOCs, 190 percent the particulate matter, and over 125 percent the CO per MWh, as a coal-fired plant.[157] Emissions from a biomass plant can also exceed those from a natural gas fired power plant for every major pollutant.[158] This is in part because biomass plants tend to be much less efficient than gas and coal-fired plants, and in part because biomass fuels tend to have far more water content to burn off to produce usable energy.[159] In addition to criteria pollutants, biomass facilities emit hazardous pollutants, including dioxins, lead, arsenic, mercury, and even emerging contaminants like phthalates.[160] All of these are dangerous to human health. In fact, biomass facilities cause more negative health impacts nationwide than coal.[161] In addition, although wood-burning power plants are often promoted as being carbon neutral, the low efficiency of plants means that they emit almost 50 percent more CO_2 than coal per unit of energy produced.[162]

CARB staff admits that its estimates do not capture local variation,[163] which is likely to be significant with increased biomass emissions. Although CARB indicates in its EA that it analyzes community-level issues to the degree feasible and appropriate, it makes no attempt to discuss the

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[156] Draft Scoping Plan at 55 ("[t]he Proposed Scenario and NWL Alternative 4 produce higher levels of biomass relative to NWL Alternatives 1 and 2. The Proposed Scenario is likely to generate the second highest technically recoverable biomass residue for use in product markets or for use with CDR technologies to sequester an estimated 5–10 million metric tonnes of carbon dioxide equivalent ($MMTCO_2e$) annually").

[157] Mary S. Booth, TREES, TRASH, AND TOXICS: HOW BIOMASS ENERGY HAS BECOME THE NEW COAL, P'SHIP FOR POL'Y INTEGRITY (Apr. 2, 2014), available at: https://www.pfpi.net/trees-trash-and-toxics-how-biomass-energy-has-become-the-new-coal.

[158] *Id.*

[159] *Id.*

[160] *Id.* (describing how biomass plants emit these pollutants sometimes at higher rates than incinerators due to lax regulatory requirements).

[161] Jonathan J. Buoncore, et al., *A Decade Of The U.S. Energy Mix Transitioning Away from Coal: Historical Reconstruction of the Reductions in the Public Health Burden*, 16 ENV'T RES. LETT. (2021), available at: https://iopscience.iop.org/article/10.1088/1748-9326/abe74c ("nationwide, in 2017, health impacts of biomass and wood combustion are higher than combustion of coal and gas individually").

[162] Booth, *supra* note 157 at ("[t]he analysis also found that although wood-burning power plants are often promoted as being good for the climate and carbon neutral, the low efficiency of plants means that they emit almost 50% more CO_2 than coal per unit of energy produced").

[163] Draft Scoping Plan at 117 ("[i]n 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 Draft 2022 Scoping Plan").

reasonably foreseeable local impacts of its predicted expansion of biomass facilities.[164] Neither the Draft Scoping plan nor the Draft EA take community-level impacts arising from new biomass into account, and they both also fail to consider the increased GHGs that result from burning biomass by wrongfully assuming it is carbon neutral. Given that the locations of existing biomass plants is known, increased emissions are reasonably foreseeable, and failing to analyze them is a basic derogation of CEQA's fundamental requirements to accurately describe, analyze and mitigate project impacts, and adopt less harmful alternatives.

ii. CARB errs by bailing to analyze and mitigate the impacts of GHG and co-pollutant emissions from exports.

CARB staff states that "[e]ach of the scenarios is designed to achieve reductions in emissions from sources within the state."[165] The Draft Scoping Plan fails, however, to consider in-state emissions from exported energy or from facilities that achieve statutory compliance through renewable energy credits ("RECs").[166] In fact, the Draft Scoping Plan fails to make *any* explicit reference to energy exports or RECs. The Draft EA includes cursory recognition of the potential for increasing exports of energy from dairy digesters and biomass generation facilities.[167] However, it incorrectly fails to adopt, or even consider, any mitigation measures, such as prioritizing retirement of gas-fired generation in disadvantaged communities, that could address the impacts from generating energy for export or based on RECs. This failure contravenes CEQA's clear mandate that CARB consider and mitigate significant environmental impacts to the extent feasible.

The Draft Scoping Plan and the Draft EA must include an estimate of *all* electrical sector emissions in the state, regardless of whether the energy is exported or if a REC is later purchased. Section 38505 of the Health and Safety Code confirms this interpretation, defining "Statewide greenhouse gas emissions" as:

> The *total* annual emissions of greenhouse gases in the state, including all emissions of greenhouse gases from the generation of electricity delivered to and consumed in California, accounting for transmission and distribution line losses, whether the electricity is generated in state or imported. Statewide emissions shall be expressed in tons of carbon dioxide equivalents.[168]

In other words, total annual emissions to be tallied must not exclude categories such as line losses. It in no way limits the emissions to be analyzed. The statute further defines "direct environmental benefits in the state" as "the reduction or avoidance of emissions of *any* air pollutant

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[164] Draft EA at 7.
[165] Draft Scoping Plan at 39.
[166] The Draft Scoping contains a similar treatment relating to exports of refined fuels. It notes, without further explanation, that its estimated demand reductions "do[] not assume any need for ongoing operations to support exports to neighboring states." Nonetheless, it asserts that "[i]f demand assumes an ongoing need to support exports to neighboring states, the residual demand would require a five-fold increase in finished fuel imports." Draft Scoping Plan at 84, fn. 150-51.
[167] Draft EA at 220, 226-27.
[168] Cal. Health & Safety Code § 38505(m).

in the state."[169] Section 38530(b)(1) of the Health and Safety Code also requires "the monitoring and annual reporting of greenhouse gas emissions from greenhouse gas emission sources beginning with the sources or categories of sources that contribute the most to statewide emissions."[170] As this plain language demonstrates, CARB must consider *all* emissions in the state, especially from sources such as power plants that contribute the most to statewide emissions. Therefore, this language mandates the inclusion of emissions from exports and RECs, and potential future increases of emissions from exports, in its Draft Scoping Plan and Draft EA.

The requirement to consider both GHGs from imports and line losses does not in any way change the first, more general requirement to monitor and require reporting of *all* GHG emissions emitted in the state. This necessarily includes GHGs from electricity that suppliers export to other states. Exported power produces GHGs and harmful criteria and toxic co-pollutants in communities, no matter where that energy is ultimately exported.

CARB Staff's failure in the Draft EA to analyze GHG and air pollution emissions related to exports, despite the projected increase in gas-fired generation,[171] is in violation of its mandate to analyze the environmental impacts of this reasonably foreseeable compliance response under Alternative 3.[172] CARB shirks its duty to explore the possibility that its proposed target will lead to increased exports and associated emissions.

Furthermore, neither the Draft Scoping Plan nor the Draft EA consider the likelihood that some utilities will satisfy their Renewable Portfolio Standard ("RPS") requirements by purchasing RECs. While the RPS requirements limit purchases of unbundled RECs, there still is a possibility that utilities will rely on RECs while still combusting fuel at facilities in the State. Therefore, CARB cannot rely on chimeric distinctions between actual in-state emissions and illusory emissions reductions secured through RECs. The failure to examine this potential is in error and must be included for consideration of any possible electric sector target.

iii. CARB errs by failing to consider significant cycling and partial load emissions.

CARB staff admits that in its modeling, "[o]nly existing sources/facilities are included, and no major functional changes to existing sources are assumed."[173] CARB Staff's estimate of air emissions from the electric sector fails to include increased emissions from fossil facilities that are cycling and operating at partial load. CARB must employ a specific production cost model analysis to better evaluate the increased emissions from fossil fuel cycling and operation at partial load.

As California continues its transition to solar and wind resources, the fossil-fuel fired power plants are running as back-up resources. Although CARB may serve resilience needs through alternative resources like increased storage, demand response, or hydroelectric power, the

[169] Cal. Health & Safety Code § 38562(c)(2)E(iii) (emphasis added).
[170] Cal. Health & Safety Code § 38530(b)(1).
[171] Draft Scoping Plan at 162.
[172] 17 C.C.R. § 60004.2(a)(3).
[173] Draft Scoping Plan, Appendix H at 65.

Proposed Scenario instead relies on the continued operation of fossil fuel generation. This necessarily means that remaining fossil-fuel power plants will have more acute impacts on air quality, as fossil fuel units that start, stop, and operate at partial load more frequently will emit more pollutants per MWh than units operating at full capacity.

In addition to increased emissions from cycling, fossil fuel facilities also emit more per unit of energy when operating at partial load.[174] It is likely that remaining natural gas facilities will be more frequently cycled and operated at partial load to back up renewables. As a joint report by the North American Electric Reliability Corporation and the California Independent System Operator ("CAISO") summarized: "the existing and planned generation fleet will likely need to operate for more hours at lower minimum operating levels and provide more frequent starts, stops, and cycling over the operating day."[175] The Draft Scoping Plan must account for these additional emissions per unit of energy.

A California study found that natural gas facilities emit significantly more air pollution while starting than they do during full-load steady state operation.[176] In fact, the pollution from one start at a natural gas power plant can be greater than a full day of steady-state operations.[177] The amount of pollution emitted in a start may vary significantly, emitting NO_x anywhere from the equivalent of 5 to 38 hours of steady-state operations .[178] Although these estimates are based on permitted values, data shows that actual emissions can be even higher. For example, during a start in May of 2020, the Colusa facility emitted more than 900 pounds of NO_x, more than 90 times its regular hourly rate of NOx emissions, during one start.[179] These values demonstrate how significant startup emissions can be and why the Draft Scoping Plan and Draft EA must account for increased cycling of fossil fuel power plants to protect air quality.

As California increasingly relies on wind and solar energy, distributors will likely call upon any remaining natural gas facilities to start and stop much more frequently, and this change in operation could result in significant increases in emissions for each unit of energy produced. However, CARB does not appear to have fully taken these increased emissions into account in its modeling, which creates significant gaps in its analysis and ignores potentially significant impacts such as ?.

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[174] ASPEN ENVT'L GROUP, SENATE BILL 350 STUDY, VOL. IX: ENVIRONMENTAL STUDY 99 (Nov. 2013) (citing National Renewable Energy Laboratory, finding that natural gas plants may emit around 30% more NOx pollution at partial load), available at: https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC-CAISO_VG_Assessment_Final.pdf.

[175] NORTH AMERICAN ELECTRIC RELIABILITY CORP. & CAL. INDEPENDENT SYSTEM OPERATOR, 2013 SPECIAL RELIABILITY ASSESSMENT: MAINTAINING BULK POWER SYSTEM RELIABILITY WHILE INTEGRATING VARIABLE RESOURCES – CAISO APPROACH (Nov. 2013), available at: https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC-CAISO_VG_Assessment_Final.pdf.

[176] ASPEN ENVIRONMENTAL GROUP, *supra* note 174 at 100, Table 4.4-3.

[177] *Id.* This information is based on permitted values. The U.S. EPA tracks actual hourly rates of emissions, but it does not track startup emissions. Nevertheless, review of that data demonstrates that the hourly rate of emissions during startup is higher than steady-state emissions. *See*, *e.g.*, U.S. EPA, *Clean Air Markets Database, Panoche Energy Center Emissions* (last visited June 23, 2022), available at https://ampd.epa.gov//ampd/.

[178] ASPEN ENVIRONMENTAL GROUP, *supra* note 174 at 99.

[179] *See* U.S. EPA, *Clean Air Markets Database, Colusa Power Plant* (May 28, 2020) (according to the continuous emissions monitor data, the plant emitted 145, 393, and 404 pounds of NOx during its first three hours of operation. After those first three hours, the next 11 hours were between 8 and 10.5 pounds of NOx per hour), available at: https://ampd.epa.gov//ampd/.

In the Draft EA, CARB staff does not analyze the potential for increased air pollution from electrical generation facilities that are projected to utilize CCS, even though Staff admits that the Council of Environmental Quality has highlighted the need to "further assess and quantify potential impacts [of CCS deployment] on local criteria air pollutants and other emissions."[180]

iv. Increases in air pollution directly contravene state requirements.

Although the Scoping Plan is the preeminent blueprint to achieve GHG reduction, CARB has a legal mandate to choose the scenario that best minimizes air pollution, pursuant to language in AB 32, SB 398, SB 350, and AB 197. Importantly, AB 32 repeatedly requires CARB to consider air quality when drafting the Scoping Plan. For instance, it directs CARB to "prevent any increase in the emissions of toxic air contaminants or criteria air pollutants" when designing a compliance mechanism.[181] AB 32 further mandates that CARB ensure the Scoping Plan does not interfere with efforts to "achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions."[182] AB 32 also requires that CARB consider "reductions in other air pollutants" when adopting a plan.[183] AB 398 also emphasizes the importance of reducing emissions, declaring its intent that CARB adopt emissions requirements that "complement[] the state's efforts to improve air quality."[184] Regarding the electric sector, SB 350 contains numerous directives to consider and minimize air pollution, including that utilities prioritize disadvantaged communities when minimizing air emissions with a priority for disadvantaged communities.[185] CARB must consider all electric sector emissions under AB 197, which requires the Scoping Plan to evaluate the range of GHG and air emissions.[186]

The Proposed Scenario, which represents the worst scenario for air quality, is in direct contravention of these mandates. As most gas plants are located in disadvantaged communities, any proposal to keep gas plants online will result in direct harm to these communities. Furthermore, it is unclear how a proposal that increases air emissions from the electric sector, as discussed above, could be consistent with the statewide strategy and state efforts to move toward attaining ambient air quality standards.[187] To remedy this, the Board should adopt the proposed Real Zero Alternative, which provides the highest level of emissions reductions, consistent with California mandates.

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[180] Draft Scoping Plan at 70.
[181] Cal. Health & Safety Code § 38570(b)(2).
[182] *Id.* § 38562(b)(4).
[183] *Id.* § 38562(b)(6).
[184] *Id.* § 38501(h); Cal. Health & Safety Code § 38501(h).
[185] Cal. Pub. Util. Code § 454.52(a)(1)(H).
[186] Cal. Health & Safety Code § 38562.7.
[187] CAL. AIR. RES. BD., DRAFT 2022 STATE STRATEGY IMPLEMENTATION PLAN (Jan. 31, 2022), available at: https://ww2.arb.ca.gov/sites/default/files/2022-01/Draft_2022_State_SIP_Strategy.pdf.

b. CARB Staff legally errs by interpreting retail sales as excluding all line losses, which is inconsistent with the plain language of the statute, regulatory precedent, and state utility billing practices.

SB 100 was a transformative piece of legislation that codified the requirement for California's electricity system to reach 100% clean and renewable energy by 2045. SB 100 was lauded as being no less than monumental in its reach of "100 percent of the state's retail electricity *supply*."[188] While signing the legislation, then-Governor Jerry Brown signaled that getting to 100% clean and renewable energy would not be easy, and that the path must focus on increased energy storage, increased efficiency, and demand response.[189] Governor Brown and the legislative history did not mention the possibility of keeping the entire gas fleet online—because that was not the intent. Rather, SB 100's clear intent was to provide a path for California to lead the world and decarbonize the electric sector.

SB 100 sets the stage to put California on a path to a zero-carbon grid, in which gas-fired power plants no longer jeopardize the climate. The plain text of the statute requires that California plan for "a transition to a zero-carbon electric system."[190] Its legislative history further confirms that SB 100 "establishes a new policy which plans for *all* electricity by December 31, 2045 to be from a mix of both RPS-eligible and zero-carbon resources."[191] The legislative history goes on to confirm that its zero-emissions requirement covers all "remaining electricity procurement,"[192] and warns that "new assets could be stranded assets in the future if they are powered by fossil fuels."[193] In other words, SB 100 requires that all electricity in California be either renewable or zero-carbon, not from fossil fuels. A zero MMT target for the electricity sector is the only path towards compliance with this mandate.

While the statutory language on its face applies to "retail sales," that language is not intended to artificially separate transmission and distribution losses. Such an interpretation would allow SB 100 to achieve an absurd result—under CARB's interpretation, the electric sector would not decrease emissions at all beyond the target that most utilities are projecting to meet in 2030. This interpretation would artificially limit SB 100's coverage to roughly 80% of all electricity generation. Not only is this absurd, but it is also inconsistent with how "retail sales" is interpreted both in practice and by the plain language of SB 100.

Specifically, CARB justifies its failure to achieve emissions reductions from the electric sector, as required under SB 100, by separating all line losses from retail sales.[194] This interpretation assumes that line losses are somehow separate from the retail sales and that the power generated and lost are not to be included within the category of retail sales. This assumption is factually incorrect and is therefore unreasonable, arbitrary, and capricious. Retail sales in

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[188] OFFICE OF CAL. GOVERNOR EDMUND G. BROWN, JR., LETTER TO THE MEMBERS OF THE CALIFORNIA STATE SENATE (Sept. 10, 2018) (emphasis added), available at: https://www.ca.gov/archive/gov39/wp-content/uploads/2018/09/SB-100-Signing-Message.pdf.
[189] *Id*.
[190] Cal. Pub. Util. Code § 454.53(a), (d)(2).
[191] SB 100 Senate Floor Analysis, at 4 (Aug. 28, 2018) (emphasis added).
[192] *Id*.
[193] *Id*.
[194] Draft Scoping Plan at 60, fn. 110.

California, like those throughout the country, include the losses incurred to meet the relevant energy demand. In other words, retail customers pay for transmission and distribution losses in their bills, and are included in the energy requirement to fulfill a particular retail sale. As ISO New England describes, line losses are one of the critical components that determine the actual price of a sale.[195] Including line losses in retail sales is also consistent with a long line of regulatory decisions. The California Public Utilities Commission ("CPUC") scales up marginal energy costs by estimated line losses in general rate cases.[196] For example, in a ratemaking case, the CPUC provided this table:

	PG&E (capped)	TURN (capped)	WMA (capped)	WMA (uncapped)
Base Discount	6.53	6.53	21.43	26.43
Line Loss Adjustment (Add)	1.02	1.02	1.02	1.02
DBA (Subtract)	(5.15)	(5.15)	(5.15)	(5.15)
Net Discount	2.40	2.40	17.30	22.30

As this table shows, line losses are not separate from the retail sales—they are integral to the sale and the procurement decisions necessary to provide the energy to meet that sale. California ratepayers have been paying for these line losses in their bills, demonstrating that line losses are in no way separate from retail sales.

The statutory language supports this interpretation. Indeed, SB 100 was called the "100 Percent Clean Energy Act," not the 85% or 80% Clean Energy Act, despite the Draft Scoping Plan's attempts to interpret it as such. This is also confirmed by the plain language of the statute, which ties the 100% requirement specifically to procurement, not to the smaller amount of electricity that will enter a customer's building after a loss. This language requires sellers to "*procure a minimum quantity* of eligible renewable energy sources for each…compliance period."[197] When determining how much energy to procure to meet a certain requirement, utility procurement decisions assume that some energy will be lost. That is why retail sales include losses within the sale—it is considered part of the same transaction. In other words, to procure renewable energy that is "equal to an average of 60 percent of the sales," a retail seller must procure more than the end user needs to account for losses. Inclusion of statutory language related to "retail sales" therefore does not signal a legislative intent to exclude line losses, as these losses are packaged within the meaning of retail sales.

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[195] ISO NEW ENGLAND, INC., WHOLESALE VS. ELECTRICITY RETAIL COSTS (2022), available at: https://www.iso-ne.com/about/what-we-do/in-depth/wholesale-vs-retail-electricity-costs.
[196] Lana Wong, A REVIEW OF TRANSMISSION LOSSES IN PLANNING STUDIES, CAL. ENERGY COMM'N 24 (SEPT. 2011), available at: https://www.wecc.org/Administrative/TN%2062058%2009-1-11%20CEC%20Staff%20Report%20a%20Review%20of%20Transmission%20Losses%20in%20Planning%20Studies.pdf.
[197] Cal. Pub. Util. Code § 399.15 (emphasis added).

The only direct mention of line losses within the Health and Safety Code requires CARB to explicitly consider line losses as part of its greenhouse gas emission accounting:

> "Statewide greenhouse gas emissions" means the total annual emissions of greenhouse gases in the state, including all emissions of greenhouse gases from the generation of electricity delivered to and consumed in California, *accounting for transmission and distribution line losses*, whether the electricity is generated in state or imported. Statewide emissions shall be expressed in tons of carbon dioxide equivalents.[198]

This definition suggests that losses are tied to and included in any calculation of greenhouse gas emissions, just as imports are. CARB errantly includes only half of this equation by considering imports in its SB 100 calculation excluding losses. That interpretation is not supported by the plain language. This language and the plain language of SB 100 support including both losses and imports when determining GHGs from the electric sector.

Federal law also confirms that line losses are included within sales, requiring payments under the Public Utility Regulatory Policies Act of 1978 to include line losses, as this reflects a more accurate accounting of costs that a utility would have had to pay had they not contracted for the energy from a qualifying facility.[199]

CARB itself seemingly acknowledges this reality, recognizing that SB 100 covers "[r]etail sales load," not the amount of retail sales.[200] The "retail sales load" is the total load necessary to fulfill those retail sales, not just the portion actually delivered to consumers. This interpretation is supported by the language of SB 100, established billing practices, and how procurement needs are satisfied. CARB cannot and should not interpret it any differently here. CARB must correct this legal error and comply with SB 100 as written by including line losses in calculating and reducing GHG emissions from the electric sector under the Scoping Plan.

c. CARB staff errs by failing to consider additional resources such as vehicle-to-grid integration and behind-the-meter batteries, which lower emissions and costs.

CARB staff wrongly reject Alternatives 1 and 2 due to purported costs and build rates based on insufficient, erroneous, and incomplete information. Specifically, the Staff state that:

> Alternative 1 delivers the most health savings in 2045, but it comes with the highest cost and impacts to the economy and jobs, and least feasibility due to the pace of growth needed for clean energy.

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[198] Cal. Health & Safety Code § 38505 (emphasis added).
[199] Cal. Pub. Utils. Comm'n, Decision 09-05-030, at 2 (May 21, 2009) (download available at: https://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/101544.doc).
[200] Draft Scoping Plan at 60.

This conclusion, however, is not supported by facts in the record, as the Draft Scoping Plan fails to consider: (1) the increasingly significant costs of keeping fossil gas online;[201] (2) the monumental costs of CCS;[202] (3) the availability of many other clean energy resources; and (4) the availability of numerous demand-side programs.[203] Staff's limited look at potential available clean resources fails to take into account significant increases in availability of behind-the-meter storage, vehicle-to-grid technologies, and the numerous demand-side programs recently approved by the CPUC. Inclusion of these resources alone can provide many GW of energy at lower prices than those assumed in the Proposed Scenario, and the failure to include consideration of these resources constitutes error.

Vehicle-to-grid technology has enormous potential to provide back-up power and to reduce the need for gas plant back-ups. The legislature, recognizing this potential, passed SB 676 in 2019, which requires the CPUC to maximize the use of "feasible and cost-effective" vehicle-to-grid integration by 2030. This important work has already begun. Indeed, pursuant to that mandate, the CPUC recently approved projects that are projected to do exactly that—provide resilience, back-up power, and exports to the grid.[204] Deploying vehicle-to-grid technologies not only has enormous technical potential—it will likely also lead to significant cost savings. Researchers from Lawrence Berkeley National Laboratory found that deploying the equivalent of 5 GW of vehicle-to-grid capability could save California between $12.8 and $15.4 billion in stationary source investments.[205] Inclusion of this source would allow California to implement the Proposed EJ Scenario at a much lower cost than projected, and the failure to include real consideration of this significant resource was in error.

Further, CARB's projections fail to consider the likely magnitude of behind-the-meter ("BTM") storage that will be utilized by 2045. Nonetheless, the Draft Scoping Plan acknowledges that more BTM resources are coming online.[206] California's current information on the rate at which BTM systems are paired with storage demonstrates that around 13% of photovoltaic systems are accompanied by storage.[207] This percentage is only increasing as the costs of storage decrease and the installation costs improve. Yet the CEC's 2021 IEPR forecast assumes that only around 4% of PV systems will include storage in 2035. Confoundingly, this is only a third of the rate of storage systems in place *today*. The Draft Scoping Plan must correct the significant differential between actual installations and projected installations, and the faulty assumptions on which they rest, because the growth of BTM storage will make a significant contribution to California's supply to meet peak demand. If the forecast is revised to include accurate projections of BTM storage, it should include several more GW of capacity.

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[201] *See infra* Section VI.D.
[202] *See infra* Section IV.
[203] *See generally*, Draft Scoping Plan, Appendix H, at 11-12 (describing the resource assumptions in the RESOLVE model).
[204] Cal. Pub. Utils. Comm'n, Draft Resolution E-5192 (Apr. 7, 2022), available at: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M456/K322/456322989.PDF.
[205] Jonathan Coingard, et al., *Clean Vehicles as a Enabler for a Clean Electricity Grid*, 13 ENVIRON. RES. LETT. (2018), available at: https://iopscience.iop.org/article/10.1088/1748-9326/aabe97/pdf.
[206] Draft Scoping Plan at 159.
[207] *See* California Distributed Generation Statistics (data current through May 31, 2022), available at: http://www.californiadgstats.ca.gov/.

CARB further errs by not considering as inputs the many demand-side programs that the CPUC has recently approved to develop an Emergency Load Reduction Program ("ELRP"). This program approved demand reductions from numerous customers, including residential customers, and is anticipated to provide hundreds, if not thousands, of MW reduction at times when the grid is stressed.[208] Inclusion of these programs will reduce the need for any back-up resources by hundreds, if not thousands, of MW. Moreover, it will reduce the environmental impacts of cycling, as energy providers will no longer have to rely as heavily on fossil fuel powered generation. Thus, failure to include consideration of these already-authorized programs constitutes a significant oversight and calls CARB staff's conclusions into question.

Finally, CARB errs by failing to include the additional load to implement CCS in its Proposed Scenario.[209] CARB staff admits that the modeling fails to include the specific technology and the "corresponding energy source" to power CCS.[210] CARB must look at all emissions and load when making its determination. A closer look at the load, costs, environmental impacts, and infeasibility of CCS will likely help close the cost gap between the Proposed Scenario and our Proposed EJ Scenario.

CARB's Staff Proposal states that "Annual build rates for the Proposed Scenario will need to increase over 150 percent and over 500 percent for solar and battery storage, respectively, compared to historic maximum rates."[211] CARB also estimates that GHG reductions beyond 30 MMT will cost $450/ton by 2045.[212] None of these estimates are based upon substantiated evidence, as CARB failed to include all relevant facts in its analysis. As described above, CARB did not consider several different types of available resources that could significantly reduce the needed build rates as well as the costs associated with Alternative 1. Without consideration of these available resources, and the costs of CCS/CDR and will demonstrate that moving to 0 MMT is feasible and cost-effective.

d. The GHG electric sector target is inconsistent with carbon neutrality requirements, state policy, IEA recommendations, United Nations' warnings, and President Biden's calls to decarbonize the electric sector as soon as possible.

i. CARB staff's proposed electric sector target is inconsistent with international and domestic calls to decarbonize the electric sector as soon as possible.

CARB Staff's proposal for a 30 MMT electric sector target by 2045 that keeps fossil gas plants online and builds new ones is inconsistent with numerous calls to decarbonize the electric sector as soon as possible. The only way to meet these calls to action is to set a 0 MMT sector

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[208] *See* Cal. Pub. Utils. Comm'n, Docket R.20-11-003.
[209] Draft Scoping Plan at 161.
[210] Draft Scoping Plan, Appendix H, at 9.
[211] Draft Scoping Plan at 161.
[212] *Id.* at 125.

target by 2035, as proposed in Alternative 1 and the Real Zero Alternative (*see* Attachment A). Indeed, President Biden has set a goal to create a carbon pollution-free power sector by 2035,[213] and the IEA has called for all advanced nations' electricity sectors to be carbon free by 2035.[214] The IEA followed its economy-wide report with a detailed roadmap calling for Group of Seven ("G7") countries to decarbonize their electricity sectors in this timeframe, explaining that "G7 action must accelerate to reach key milestones on the path to net zero electricity by 2035."[215] As IEA Executive Director Fatih Birol put it, "G7 members have the financial and technological means to bring their electricity sector emissions to net zero in the 2030s, and doing so will create numerous spill-over benefits for other countries."[216] California, as the wealthiest state in the wealthiest country of any G7 nation, cannot justify falling short of this milestone.

California also cannot credibly claim it is a global climate leader while declining to achieve in 2045 what several G7 nations have now committed to doing 10 years sooner. Prime Minister Boris Johnson's plan commits the United Kingdom to a fully decarbonized electricity system by 2035—15 years before the previous target.[217] Germany, the coal-heavy industrial powerhouse of the European Union, adopted plans to transform its power sector to nearly-100% renewable energy by 2035, including specific plans to double onshore wind, and to quadruple both offshore wind and solar PV by 2030, relative to current capacity.[218]

To remain a global leader, California must match these levels of ambition. CARB should at least require that the electric sector meets 0 MMT by 2035.

ii. CARB errs by recommending a GHG target inconsistent with its carbon neutrality study.

A 30 MMT goal is also inconsistent with California's requirements to achieve carbon neutrality as soon as possible. In 2018, then Governor Brown signed an executive order establishing a statewide goal to achieve carbon neutrality as soon as possible, and no later than

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213 THE WHITE HOUSE, PRESIDENT BIDEN SETS 2030 GREENHOUSE GAS POLLUTION REDUCTION TARGET (Apr. 21, 2021), available at: https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/.

214 INT'L ENERGY AGENCY, NET ZERO BY 2050: A ROADMAP FOR THE GLOBAL ENERGY SECTOR (May 2021), available at: https://iea.blob.core.windows.net/assets/7ebafc81-74ed-412b-9c60-5cc32c8396e4/NetZeroby2050-ARoadmapfortheGlobalEnergySector-SummaryforPolicyMakers_CORR.pdf.

215 INT'L ENERGY AGENCY, ACHIEVING NET ZERO ELECTRICITY SECTORS IN G7 MEMBERS (Oct. 2021), available at: https://iea.blob.core.windows.net/assets/9a1c057a-385a-4659-80c5-3ff40f217370/AchievingNetZeroElectricitySectorsinG7Members.pdf.

216 Press Release, INT'L ENERGY AGENCY, G7 MEMBERS HAVE A UNIQUE OPPORTUNITY TO LEAD THE WORLD TOWARDS ELECTRICITY SECTORS WITH NET ZERO EMISSIONS (Oct. 20, 2021), available at: https://www.iea.org/news/g7-members-have-a-unique-opportunity-to-lead-the-world-towards-electricity-sectors-with-net-zero-emissions.

217 Press Release, UK DEP'T FOR BUS., ENERGY & INDUS. STRATEGY, PLANS UNVEILED TO DECARBONISE UK POWER SYSTEM BY 2035 (Oct. 7, 2021), available at: https://www.gov.uk/government/news/plans-unveiled-to-decarbonise-uk-power-system-by-2035.

218 Pieter de Pous, *Germany's Bold and Ambitious 100% Renewable Energy Plan*, *Third Generation Environmentalism Ltd. (E3g)* (Apr. 8, 2022), available at: https://www.e3g.org/news/germany-s-bold-and-ambitious-100-renewable-power-plan/.

2045.[219] CARB's analysis of how best to achieve carbon neutrality across the economy is reflected in an E3 report, "Achieving Carbon Neutrality in California" ("Carbon Neutrality Report").[220] This report sets forth the parameters for putting the state on a trajectory for meeting and achieving its neutrality goals. CARB Staff acknowledges the need to consider and build off this report in the Draft Scoping Plan,[221] and yet set a 30 MMT electric sector target that is wholly inconsistent with the conclusions reached in the report.

The highest MMT scenario from the Carbon Neutrality Report includes a 15 MMT target for 2045 under the "High Carbon Dioxide Removal" scenario. Furthermore, the CARB Carbon Neutrality Report acknowledges that the 15 MMT-in-2045 scenario is riskier than the more ambitious scenarios and is unlikely to realize climate and air quality goals and requirements, explaining that:

> This scenario represents the highest risk scenario, from a climate mitigation perspective, because it has the highest remaining direct GHG emissions, and relies on relatively untested [carbon dioxide removal] strategies which are not widely commercialized. The scenario also has the highest remaining quantity of fuel combustion, which means the air quality impacts, though far improved relative to today, will likely be highest among the three carbon neutral scenarios evaluated. Both the climate risks and the technology adoption and implementation risks of relying so significantly on [carbon dioxide removal] are high. Continuing to emit such a large share of gross emissions into the atmosphere through 2045 could result in an overshoot of emissions, with a risk of missing the state's climate goals.[222]

By establishing an emissions target for the electric sector that is double the 15 MMT target under the "highest risk scenario" in the Carbon Neutrality Report, CARB will be unlikely to meet its climate, air quality, and health mandates. Rather, CARB should set its target in line with the Zero Emissions Scenario described in the CARB Carbon Neutrality Report, which assumes that all gas retires.[223] Notably, even E3's Balanced Scenario assumes a 0 MMT 2045 target for the electricity sector,[224] and the 2040 Starting Point Scenario for SB 100 analysis assumes 15,000 MW of gas retirements.[225]

CARB Staff acknowledges that Executive Order B-55-18 requires that future "Scoping Plans identify and recommend measures to achieve the carbon neutrality goal."[226] The 30 MMT

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[219] Cal. Exec. Order B-55-18 § 1 (Sept. 10, 2018), available at: https://www.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf.
[220] *See* ENERGY & ENVT'L ECON. INC. (E3), ACHIEVING CARBON NEUTRALITY IN CALIFORNIA: PATHWAYS SCENARIOS DEVELOPED FOR THE CALIFORNIA AIR RESOURCES BOARD (Oct. 2020) (hereinafter "CARB Carbon Neutrality Report"), at 4, available at: https://ww2.arb.ca.gov/sites/default/files/2020-10/e3_cn_final_report_oct2020_0.pdf.
[221] Draft Scoping Plan at v.
[222] *See* CARB Carbon Neutrality Report, *supra*, at 4.
[223] *See Id.* at 4-6.
[224] *Id.*
[225] CAL. ENERGY COMM'N, CAL. PUB. UTILS. COMM'N, CAL. AIR RES. BD., 2021 SB 100 JOINT AGENCY REPORT (Mar. 15, 2021), at 14, available at: https://www.energy.ca.gov/publications/2021/2021-sb-100-joint-agency-report-achieving-100-percent-clean-electricity.
[226] Draft Scoping Plan at 29.

alternative, by relying on the emissions even higher than the "highest risk scenario," fails to accomplish that.

e. CARB staff's proposed electric sector target is inconsistent with state goals.

Continued investment in gas is also inconsistent with Governor Newsom's recent statement, which emphasized that: "[w]e must remove carbon emissions from our energy sources to support a sustainable future" and that "[a]lthough California has made great strides in eliminating coal power plants and increasing renewable energy resources, our current electricity system is still producing greenhouse gas emissions and contributing to unhealthy air quality in communities."[227] The direction from the Governor is clear: CARB must act rapidly now to reduce reliance on fossil fuels. CARB staff's proposal also does not meet Governor Newsom's call to explore meeting carbon neutrality for the electric sector ten years earlier, by 2035.[228] Given this, CARB should require 0 MMT to be achieved as soon as possible, or else the State has no chance of meeting its goals and requirements.

A 0 MMT target is also necessary to continue on the trajectory projected in CARB's 2017 Scoping Plan. The 2017 Scoping Plan calls for California to follow a trajectory to limit GHG emissions "in-line with California's role in stabilizing global warming below dangerous levels."[229] President Biden, IEA, and the United Nations have all clearly articulated California's role in reducing harmful effects of climate change—California must move to decarbonize the entire electric sector as soon as possible.

f. CARB's proposed scenario wrongly relies on costly and polluting gas resources that will likely disproportionately harm disadvantaged communities.

CARB has failed to meet its AB 32 mandate by failing to consider and analyze adverse impacts to disadvantaged communities that would result from maintaining and increasing power plant emissions. CARB staff acknowledges that: "[a]n important part of our equity consideration is ensuring the transition to a zero-emission economy is an affordable one and does not further disadvantage low-income communities and communities of color."[230] And yet, the staff's proposal does exactly that—it requires paying for costly, polluting gas resources that will further

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[227] Press Release, OFFICE OF CAL. GOV. GAVIN NEWSOM, CALIFORNIA'S ELECTRICITY SYSTEM OF THE FUTURE (July 30, 2021), available at: https://www.gov.ca.gov/wp-content/uploads/2021/07/Electricity-System-of-the-Future-7.30.21.pdf.
[228] Press Release, OFFICE OF CAL. GOV. GAVIN NEWSOM, GOVERNOR NEWSOM HOLDS VIRTUAL DISCUSSION WITH LEADING CLIMATE SCIENTISTS ON STATE'S PROGRESS TOWARD CARBON NEUTRALITY (July 9, 2021), available at: https://www.gov.ca.gov/2021/07/09/governor-newsom-holds-virtual-discussion-with-leading-climate-scientists-on-states-progress-toward-carbon-neutrality/.
[229] CAL. AIR. RES. BD., CALIFORNIA'S 2017 CLIMATE CHANGE SCOPING PLAN 18 (Nov. 2017), available at: https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf, (describing the state's trajectory to 2050).
[230] Draft Scoping Plan at vi.

disadvantage low-income communities and communities of color. Specifically, a 30 MMT scenario assumes that many gas plants remain online and new ones need to be built, which would emit more GHGs while polluting some of the State's most disadvantaged communities. In addition to the negative impacts of continuing to emit GHGs, leaving old gas plants online or building new ones must be avoided because gas plants will overburden DACs with air pollution, health problems, and stranded assets; are costly; are unreliable during the hottest days; and emit toxic air pollution, release GHGs, and leak methane. These negative impacts will be compounded because gas plants are likely to be called on with increasing frequency for exports.[231]

i. Continued reliance on gas resources will harm disadvantaged communities.

Gas-fired power plants produce harmful pollution and can release toxic methane emissions. Fine particulate matter, for example, is closely connected to decreased lung function, more frequent emergency department visits, additional hospitalizations, and increased morbidity.[232] Any additional pollution is a serious issue in California where many of the state's air basins are in serious, extreme, and/or severe nonattainment for one or more criteria pollutants.[233] Gas generation exacerbates environmental and health harms in California's most polluted air basins. There are "unique risks that increased gas plant emissions pose to disadvantaged communities, particularly during the COVID-19 pandemic."[234] Notably, the majority of California's gas plants are located in the most disadvantaged communities.[235]

In addition, as described above,[236] the cycling of gas plants to back up renewables produces significant amounts of pollution, as emissions control systems are not as effective at capturing pollutants when plants are starting and stopping. Additionally, as long as gas resources remain on-line, they can be called upon by other markets as exports, which leads to increased pollution in many parts of the state already breathing some of the worst air in the country. This potential is not currently accounted for in CARB's modeling, even though the potential adverse impacts to DACs are significant. A lower GHG target is crucial, along with enforcement of that target, to help prevent this harmful pollution increase, especially in our most vulnerable communities.

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[231] As described above, CARB failed to consider this in its modeling for the Draft Scoping Plan.

[232] AMERICAN LUNG ASS'N., PARTICLE POLLUTION (last updated Apr. 20, 2020), available at: https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/particle-pollution.

[233] U.S. EPA, GREEN BOOK: CURRENT NONATTAINMENT COUNTIES FOR ALL CRITERIA POLLUTANTS (data current as of June 24, 2022), available at https://www3.epa.gov/airquality/greenbook/ancl.html.

[234] X. Wu et al., *Air Pollution and Covid-19 Mortality in the United States: Strengths and Limitations of an Ecological Regression Analysis*, 6 SCI. ADVANCES 45 (2020), available at: https://doi.org/10.1126/sciadv.abd4049; Yaron Ogen, *Assessing Nitrogen Dioxide (No2) Levels as a Contributing Factor to Coronavirus (Covid-19) Fatality*, 726 SCI. DIRECT (2020), available at: https://doi.org/10.1016/j.scitotenv.2020.138605.

[235] Eddie Ahn et al., BRIGHTLINE DEFENSE, CALIFORNIA OFFSHORE WIND: WINDING UP FOR ECONOMIC GROWTH & ENVIRONMENTAL EQUITY 2 (Dec. 2020), available at: https://www.offshorewindnow.com/brightline-defense-report (noting that "78% of gas-powered plants [in California] are located in frontline environmental justice communities").

[236] *See, supra*, Section VI.A.3.

ii. Continued reliance on gas resources will cost more than a transition to renewables.

The cost of keeping polluting gas plants online is only going up, with the CPUC's recent Resource Adequacy ("RA") report noting "significant increases in prices reported in prior years."[237] Indeed, recent data show that contracts can cost over $15 per kW-month.[238] In addition to high RA costs, there are many costs of retaining gas that make them economically risky, including high ongoing maintenance costs (especially for cycling units), the costs to maintain aging fossil fuel pipelines and infrastructure, the costs of additional air pollution including potential methane leaks, the social cost of carbon, and the high market costs due to market power. The Joint Agency SB 100 Report acknowledged that a comparison to the California Energy Commission's average resource adequacy prices show that they are likely underestimating gas retention costs, and "[h]igher than modeled gas fleet maintenance costs may decrease economic gas retention or increase total scenario cost or both."[239] These additional cost considerations likely significantly underestimate the real cost of keeping gas online. As CARB described:

> There are additional costs to society outside of the [social cost of carbon], including costs associated with changes in co-pollutants, the social cost of other GHGs including methane and nitrous oxide, and costs that cannot be included due to modeling and data limitations. The IPCC has stated that the [Interagency Working Group] [social cost of carbon] estimates are likely *underestimated* due to the omission of significant impacts that cannot be accurately monetized, including important physical, ecological, and economic impacts.[240]

Given the high costs of gas, assuming a high GHG scenario with gas retained is neither just nor reasonable. A lower GHG target of 0 MMT in 2035 will enable the State to plan to replace these old, costly resources.

Most egregiously, CARB staff assumes that new gas resources will be built despite their acknowledgment that CARB "must avoid making choices that will lead to stranded assets and incorporate new technologies that emerge over time."[241] Building new gas resources at a time when State law, the country, and the world is calling for a transition to a carbon-free grid will dig us into an unaffordable hole so deep that we may not be able to get out of it. Even worse, as Gridworks noted in its report on California's gas system, "the combination of reduced gas usage, increased costs, and a declining customer base will result in exponentially higher gas rates, along with a disproportionate burden on customers unable to afford to implement electrified technologies."[242] This "reactive path" is most likely to hurt low-income and disadvantaged communities.[243]

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[237] *See* CAL. PUB. UTILS. COMM'N, 2020 RESOURCE ADEQUACY REPORT 27 (Apr. 2022), available at: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/resource-adequacy-homepage/2020_ra_report-revised.pdf (showing annual average price increases from 2020 to 2022).
[238] *Id*. at 27 (showing that, in September 2020, some contracts exceeded $15/kW-month).
[239] *Id.*; *see also* 2021 SB 100 JOINT AGENCY REPORT, *supra* note 175, at 79.
[240] *Id.*; CALIFORNIA'S 2017 CLIMATE CHANGE SCOPING PLAN, *supra* note 229, at 41.
[241] Draft Scoping Plan at vii.
[242] GRIDWORKS, CALIFORNIA'S GAS SYSTEM IN TRANSITION: EQUITABLE, AFFORDABLE, DECARBONIZED AND SMALLER 2 (Sept. 2019), available at: https://gridworks.org/wp-content/uploads/2019/09/GW_Calif-Gas-System-report-1.pdf.
[243] *Id.*

A better and more affordable way to plan the electric grid is to transition to carbon-free resources. This has been shown time and time again to be cheaper than the polluting alternatives. As CARB staff acknowledges:

> Renewable energy and energy storage are cheaper than polluting alternatives. . . . For example, modeling related to the most recent integrated resource planning process at the CPUC showed 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.[244]

The reality that clean investment is cheaper is becoming more stark due to the volatility of fossil gas rates. The time to start planning for the transition beyond gas is now. It is more affordable in the long run, and it is the only way to meet climate, equity, and air quality goals.

iii. Continued reliance on gas resources is not likely to help reliability on the hottest days.

The forced outage rate of gas plants has been increasing in recent years, with some types of gas facilities experiencing an average forced outage rate of 14%,[245] with higher rates in extreme heat.[246] As one article describes, these "old clunkers" are "breaking left and right."[247] Heat waves are also a significant concern for natural gas power plant efficiency because these plants need ambient air to produce electricity, and the higher the ambient temperature, the lower the efficiency.[248] These findings suggest that California should not be relying on gas plants for reliability because they simply cannot deliver. Rather than relying on "old clunkers," the State should be moving as aggressively as possible to renewable energy, demand response and energy storage - resources that have been found time and time again to provide system reliability.[249]

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[244] Draft Scoping Plan at vii.

[245] *See*, *e.g.*, CAL. ENERGY COMM'N & CAL. PUB. UTILS. COMM'N, MIDTERM RELIABILITY ANALYSIS A-10 (Sept. 2021), available at: https://www.energy.ca.gov/sites/default/files/2021-09/CEC-200-2021-009.pdf.

[246] *See*, *e.g.*, Sinott Murphy et al., *Resource Adequacy Implications of Temperature-Dependent Electric Generator Availability*, 262 APPLIED ENERGY (2020) 2-3, available at: https://doi.org/10.1016/j.apenergy.2019.114424 (showing the connection between increased forced outage rates and extreme heat).

[247] Colby Bermel, *Old Clunkers: California Power Plants Break Down During Heat Wave*, POLITICO (July 6, 2021), available at: https://www.politico.com/states/california/story/2021/06/30/old-clunkers-california-power-plants-break-down-during-heat-wave-1387507.

[248] Kamia Handayani, HOW CLIMATE-RELATED WEATHER CONDITIONS DISRUPT POWER PLANTS AND AFFECT PEOPLE, PHYS.ORG (Jan. 22, 2020), available at: https://phys.org/news/2020-01-climate-related-weather-conditions-disrupt-power.html.

[249] *See*, *e.g.*, RELIABLY REACHING CALIFORNIA'S CLEAN ELECTRICITY TARGETS, ENERGY INNOVATION POL'Y & TECH. LLC, et al. (May 2022), available at: https://energyinnovation.org/wp-content/uploads/2022/05/GridLab_California-2030-Study-Technical-Report-1.pdf (modeling demonstrated reliability of systems with 85 percent or more clean and renewable energy).

iv. Continued reliance on gas resources risks methane leakage.

Continued reliance on gas capacity also risks additional methane leakage. Keeping "old clunkers" around, with all their pipelines and old equipment, will lead to methane leaks. These leaks can arise from storage facilities, like the Aliso Canyon gas storage facility, from natural gas plants themselves, like the Valley Generating Station,[250] or from the many pipelines interconnecting the natural gas generators to the natural gas system. Satellite data have found massive methane leaks from gas infrastructure, suggesting that gas leaks may be a more significant problem than currently estimated,[251] especially considering methane's high global warming potential.

In addition to its potent global warming potential, methane leakage can cause severe health impacts, as witnessed by the community living near the Aliso Canyon gas storage facility. Between October 2015 and February 2016, the Aliso Canyon natural gas storage facility released at least 109,000 tons of methane, forcing the relocation of thousands of residents for several months.[252] A UCLA study found that many community members living around Aliso Canyon experienced elevated indoor levels of air toxins and persistent health impacts following the leaks.[253] After finding many patients with symptoms including headaches, nausea, stomach aches, dizziness, and trouble breathing following the leak, a local physician analyzed blood samples and found signs of bone marrow suppression, which can lead to anemia and leukemia.[254]

The best way to prevent these methane leaks from occurring is to retire the infrastructure used for keeping the gas plants online. A 0 MMT by no later than 2035 GHG target would facilitate the planning necessary to make this transition.

In conclusion, the Board must not rely on CARB staff's erroneous proposal. Rather, the Board must require that the electric sector move toward 0 $MMTCO_{2e}$ by 2035. Numerous studies have demonstrated that this is feasible and cost-effective,[255] and this is the best way to ensure that California meets air quality, climate, and equity goals and requirements.

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[250] Nichola Groom, *Los Angeles Natural Gas Plant has Been Leaking Methane for Years*, *REUTERS* (Aug. 26, 2020), available at: https://www.reuters.com/article/usa-methane-california/los-angeles-natural-gas-plant-has-been-leaking-methane-for-years-idUKL1N2FS29W.

[251] Dan Charles, *A Satellite Finds Massive Methane Leaks from Gas Pipelines*, NPR (Feb. 3, 2022), available at: https://www.npr.org/2022/02/03/1077392791/a-satellite-finds-massive-methane-leaks-from-gas-pipelines.

[252] Press Release, CAL. AIR RES. BD., ALISO CANYON LEAK EMITTED 109,000 METRIC TONS OF METHANE (Oct. 21, 2016), available at: https://ww2.arb.ca.gov/news/aliso-canyon-leak-emitted-109000-metric-tons-methane.

[253] Diane A. Garcia-Gonzales, et al., *Associations Among Particulate Matter, Hazardous Air Pollutants and Methane Emissions from the Aliso Canyon Natural Gas Storage Facility During the 2015 Blowout*, 132 ENV'T INT'L (2019), available at: https://doi.org/10.1016/j.envint.2019.05.049.

[254] Sharon McNary, *What Did Porter Ranch Residents Breathe During the Massive Gas Leak? Here's What One Doctor's Quest Revealed*, LAIST (Nov. 5, 2019), available at: https://laist.com/2019/11/05/aliso-canyon-porter-ranch-gas-leak-blowout-health-benzene-nordella.php.

[255] *See*, e.g., Daniel Kammen, et al., *California Must And Can Accelerate Climate Action,* THE CLIMATE CENTER (Oct. 2021), available at: https://theclimatecenter.org/california-must-and-can-accelerate-commitments-to-global-climate-leadership/.

VII. California Must Decarbonize Buildings As Soon As Possible.

a. CARB must adopt bold regulatory measures to rapidly phase out the use of in-home gas appliances to avoid dangerous health and climate impacts.

CARB notes that fossil gas currently supplies about half of all end-use energy supply to California's residential and commercial buildings.[256] Residential use alone accounts for more than 20 percent of the state's total natural gas ("gas") consumption.[257] CARB recognizes that in-home gas appliances release dangerous air pollutants, including CO_2, NOx, $PM_{2.5}$, and formaldehyde, and create serious health hazards for those who rely upon them.[258]

The continued use of in-home gas appliances disproportionately burdens BIPOC communities—especially low-income BIPOC communities—who are more likely to be renters and, therefore, more likely to live in older or poorly maintained buildings.[259] As a result, low-income renters must often rely on older, less efficient gas appliances, and frequently live in spaces lacking adequate indoor air ventilation.[260] Any delay in the adoption of appropriate regulatory measures to fully phase out the use of in-home gas appliances will perpetuate dangerous health and climate impacts and must be avoided at all costs.

Despite knowing the climate and inequitable health impacts of in-home gas appliances, CARB currently proposes to retire gas appliances "at the end of their useful life with electric alternatives" under the Proposed Scenario.[261] Additionally, CARB does not propose to decommission the entire gas system by 2045.[262]

CARB's proposals under Alternative 3 are not nearly ambitious enough to adequately address the climate impacts and health hazards created by the continued use of in-home gas appliances. Instead, we urge CARB to analyze and adopt the following measures: (1) retire gas appliances before they reach their end-of-life stage; (2) require 100% new gas appliance sales by 2030; and (3) plan for full decommissioning of the gas system by 2045. These measures are included in our Real Zero Alternative (Attachment A).

The technology and resources necessary to adopt fully electric alternatives are available now and must be implemented without delay. As CARB notes in Appendix D, local governments

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[256] Draft Scoping Plan at 169.
[257] U.S. Energy Information Administration, *Natural Gas Consumption by End Use* (May 2022), available at: https://www.eia.gov/dnav/ng/ng_cons_sum_dcu_SCA_a.htm.
[258] Draft Scoping Plan at 169.
[259] Marisol Cuellar Mejia et al., *California's Housing Divide*, PUB. POL'Y INST. OF CAL. (May 13, 2022), available at: https://www.ppic.org/blog/californias-housing-divide/; David Wagner, *To Fight Slum Landlords, LA County Launches Plan to Strengthen Housing Inspections*, LAIST (Apr. 5, 2022), https://laist.com/news/housing-homelessness/to-fight-slumlords-la-county-launches-plan-to-strengthen-housing-inspections.
[260] Dr. Yifang Zhu et al., *Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California*, UCLA FIELDING SCHOOL OF PUB. HEALTH DEPT. OF ENVT HEALTH SCI. 17 (Apr. 2020), available at: https://coeh.ph.ucla.edu/effects-of-residential-gas-appliances-on-indoor-and-outdoor-air-quality-and-public-health-in-california/.
[261] Draft Scoping Plan at 171; see also Draft Scoping Plan, Appendix C at 6.
[262] Draft Scoping Plan, Appendix C at 6.

have existing authority to adopt building ordinances that exceed statewide standards, including by requiring all new construction to be fully electric.[263] The 2022 California Building Code has been updated to promote the use of all-electric appliances in new residential construction. These include requirements to install electric heat pump space or water heaters in standard building design, further electrification-readiness through appropriate electric, space, and plumbing designs to accommodate a heat pump water heater where not initially installed, and increasing ventilation requirements in buildings that include gas stoves.[264] CARB should support these important efforts to accelerate rapid building decarbonization and encourage other agencies and local entities to adopt similar policies minimizing the harmful effects that will result from their continued use.

Retiring residential and commercial gas appliances by 2035 will allow CARB to stop the methane leakage and gas combustion pollution that would otherwise occur if it allows gas appliances to continue operating for decades. This approach risks leaving the last customers on the gas system—likely tenants and low-income BIPOC communities—without heat as skyrocketing gas rates and infrastructure costs to retain the system are spread across fewer customers.[265]

We therefore recommend that CARB revise the Draft Scoping Plan to include strategic retrofits before end-of-life to protect customers from loss of service, to maximize climate and health benefits. All gas end-uses must be completely retired by 2045. Given that all of CARB's scenarios eventually achieve 100% sales of electric appliances, the eventual retirement of the gas distribution system is implied in all scenarios by varying dates. The costs of early retirements for the progressive, strategic decommissioning of the gas system are likely substantially lower than the costs of safely maintaining an aging system that is fated to be shut down.

To reduce the scale of early retirements, CARB should require that all sales of new appliances are electric by 2030, as opposed to 2035 as currently proposed by CARB staff in Alternative 3. The Netherlands, a notably gas-dependent country, recently announced that by 2026, all new heating systems (both in new constructions and replacements in existing buildings) will need to be, at minimum, hybrid heat pumps.[266] Germany is planning to accelerate its prohibition on the sale of new gas heating systems from 2025 to 2024. California should aim to hit this milestone by no later than 2030.[267] California should follow Europe's lead and commit to swiftly making the necessary public investments to minimize the burden and expense upon low-income homeowners and renters while effectuating a rapid and just transition to building decarbonization.

Finally, we recommend that the Scoping Plan require that all gas end-uses must be completely retired by 2045. Given that all of CARB's scenarios eventually achieve 100% sales of

[263] Draft Scoping Plan, Appendix D, at 2.
[264] CAL. ENERGY COMM'N, 2022 BUILDING ENERGY EFFICIENCY STANDARDS SUMMARY 8 (2022), available at: https://www.energy.ca.gov/sites/default/files/2021-08/CEC_2022_EnergyCodeUpdateSummary_ADA.pdf.
[265] Appendix F acknowledges that as more households move away from using natural gas, those remaining on the natural gas system are likely to pay an increasingly large share of systemwide costs. *See* Draft Scoping Plan, Appendix F at 19.
[266] Jack Woodfield, *Netherlands to Ban Gas Boiler Installations From 2026*, HOMEBUILDING & RENOVATING (May 19, 2022), available at: https://www.homebuilding.co.uk/news/netherlands-to-ban-gas-boiler-installations-from-2026.
[267] Isaac Bah, *Germany to Start Gas Phase-Out from 2024*, MONTEL (Mar. 24, 2022), available at: https://www.montelnews.com/news/1308596/germany-to-start-gas-phase-out-from-2024.

electric appliances, the eventual retirement of the gas distribution system is implied in all scenarios by varying dates. The costs of early retirements for the progressive, strategic decommissioning of the gas system are likely substantially lower than the costs of safely maintaining an aging system that is fated to be shut down.

b. CARB must revise the Draft Scoping Plan to eliminate, or substantially reduce, continued reliance on liquid fuels, including hydrogen and biomethane.

CARB proposes that "gaseous fossil fuel use [in industrial facilities as well as residential and commercial buildings] can be displaced by four primary alternatives: zero-carbon electricity, solar thermal heat, hydrogen, and biogas/biomethane."[268] It is important to note, however, that hydrogen and biofuels are associated with negative effects on air quality. For instance, direct emissions from gas appliances contribute to indoor and outdoor air pollution, worsening health outcomes in California communities, and particularly in low-income communities.[269] Studies have also found that gas appliances deteriorate indoor air quality, at times producing levels of NO2 that exceed EPA outdoor air quality standards.[270] Concentrations of CO and NO2 are generally highest for apartments, due to the smaller average square footage than detached houses, and thus disproportionately impact low-income families that are more likely to live in multifamily housing.[271] This indoor air pollution can negatively impact residents' health by increasing the risk of asthma in children and other acute and chronic health effects.[272]

c. CARB must narrowly restrict the use of "alternative fuels" in the Proposed Scenario; in particular, hydrogen and biomethane should not be used for residential and commercial buildings to avoid negative public health outcomes in low-income BIPOC communities.

CARB inappropriately suggests that biomethane and hydrogen may be blended to replace natural gas in residential and commercial buildings.[273] As we discussed in Section V.C above, CARB should not consider biomethane as a low-carbon fuel, and therefore should not promote its development or application. We also urge CARB to revise the Scoping Plan to: (1) only consider the use of green hydrogen in implementing the Scoping Plan; (2) narrowly defines the meaning of "green hydrogen," and (3) restrict its use to hard-to-electrify sectors such as ocean-going vessels and airplanes.

CARB should further define green hydrogen as hydrogen that is produced from the electrolysis of excess renewable energy. This definition excludes hydrogen produced from any methods which involve reforming or refining fossil fuels, biogas, biomass, biomethane, purposely grown feedstocks, or blending these sources green hydrogen. Therefore, CARB must delete its

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268 Draft Scoping Plan at 164.
269 Zhu et al., *supra* note 260 at 13.
270 Brady Seals Andee Krasner, *Health Effects from Gas Stove Pollution*, ROCKY MOUNTAIN INST., MOTHERS OUT FRONT, PHYSICIANS FOR SOCIAL RESPONSIBILITY, AND SIERRA CLUB 7 (May 2020), available at https://rmi.org/insight/gas-stoves-pollution-health?utm_campaign=C%26S%20Gas&utm_source=twitter&utm_medium=social&utm_content=Gas%20Stoves%20Twitter%20.
271 Zhu, et al., *supra* note 260 at 6.
272 *Id.* at 13.
273 Draft Scoping Plan at 170.

erroneous and misleading definition of green hydrogen as "not limited to only electrolytic hydrogen produced from renewables" in the Draft Scoping Plan.[274]

CARB should not use any of these "green" hydrogen "alternatives" in residential and commercial buildings, as doing so will increase GHG emissions and perpetuate environmental injustice in California.[275]

Existing research shows that blending hydrogen with natural gas for power generation or use in buildings may increase GHG emissions "while thwart[ing] more viable decarbonization pathways[,] increasing consumer costs, exacerbating air pollution, and imposing safety risks."[276] Thus, CARB must exercise strict regulatory oversight over any proposed use of green hydrogen to ensure it does not increase local GHG emissions or negatively impact public health.

For instance, a recent study found that, without adequate safeguards in place, even small leaks of hydrogen could produce more harmful GHG emissions, in CO_2e, than its currently-employed fossil fuels counterparts.[277] A greenhouse gas itself, the planet-warming effects of hydrogen are severely under-studied, and may be up to 20 times more potent than CO2. "Green" hydrogen, produced via electrolysis, risks worsening short-term atmospheric warming because even moderate leaks have significant climate impacts.

Additionally, the state's existing network of gas pipelines—including those which run directly through low-income communities of color in Southern California, the San Joaquin Valley, and the Bay Area—are not properly suited to support hydrogen transport. Namely, hydrogen risks causing "embrittlement" of pipes in fossil gas pipelines, and existing gas lines do not have adequate systems in place to detect dangerous hydrogen leaks.[278] This necessarily means that, to be carried out safely and effectively, hydrogen production would require staggering investments to build an entirely new network of dedicated hydrogen transport pipelines. Even if hydrogen producers build this infrastructure with strict pollution control measures to protect public health, doing so would demand further industrial development in frontline environmental justice communities, which would only deepen existing disparities.

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[274] Draft Scoping Plan at i, fn. 2.

[275] For example, the California Public Utilities Commission has found that biogas facilities emit higher levels of air pollutants than other electricity-generating resources, and certain sources of biomethane disproportionately burden disadvantaged communities by contaminating air and water resources. CAL. PUB. UTIL. COMM'N, ENERGY DIVISION, UPDATED IRP CRITERIA POLLUTANT ANALYSIS, at slides 6-7 (Feb. 20, 2020), available at: ftp.cpuc.ca.gov/energy/modeling/CriteriaPollutantAnalysisUpdate_20200221.pdf; *see* California Public Utilities Commission Decision 20-12-022, at 37 (Cal. P.U.C. Dec. 22, 2020).

[276] Sara Baldwin et al., *Assessing the Viability of Hydrogen Proposals: Considerations for State Utility Regulators and Policymakers*, ENERGY INNOVATION 2, 7-11 (March 2022), available at: https://energyinnovation.org/wp-content/uploads/2022/04/Assessing-the-Viability-of-Hydrogen-Proposals.pdf.

[277] Steven Hamburg and Ilissa Ocko, *For Hydrogen To Be a Climate Solution, Leaks Must Be Tackled*, ENVIRONMENTAL DEFENSE FUND (March 7, 2022), available at: https://www.edf.org/blog/2022/03/07/hydrogen-climate-solution-leaks-must-be-tackled.

[278] Sasan Saadat and Sara Gersen, *Reclaiming Hydrogen for a Renewable Future: Distinguishing Fossil Fuel Industry Spin from Zero-Emission Solutions*, EARTHJUSTICE 19 (Aug. 2021), available at: https://earthjustice.org/sites/default/files/files/hydrogen_earthjustice_2021.pdf.

Lastly, we support CARB's recommendation to "[p]rioritize alternative fuel transitions in vulnerable communities first."[279] This recommendation is important because, as detailed above, low-income BIPOC communities have historically borne, and continue to bear, a disproportionate negative health impact resulting from the use of gas-fueled appliances in homes, business, and industrial facilities. However, this transition must not include the use of liquid fuels such as hydrogen and biomethane, due to the serious public health burdens with which these fuels are associated. These recommendations are consistent with those of the EJAC. That is, to transition away from fossil fuels in disadvantaged communities first, not to replace them with dangerous, polluting fuels like biomethane and hydrogen, which will further entrench racially disparate health burdens and curtail California's ability to achieve its climate goals.[280]

d. The proposed use of "alternative" liquid fuels in industrial buildings is unnecessary and raises similar health and safety concerns as in residential settings.

The Draft Scoping Plan incorrectly assumes that decarbonizing certain industrial processes will require alternative liquid fuels such as biomethane, hydrogen, "and other low-carbon fuels," and wrongly relies on the promotion of biomethane in hard-to-electrify industrial applications that would negatively impact the health of low-income BIPOC communities.[281] For example, the California Public Utilities Commission has found that biogas facilities emit higher levels of air pollutants than other electricity-generating resources, and certain sources of biomethane disproportionately burden disadvantaged communities by contaminating air and water resources.[282]

CARB's Scoping Plan should encourage full electrification in industrial facilities where possible, and even where certain industrial processes may require higher-temperature heat. CARB should not rely on liquid fuels like biomethane that will result in negative health impacts in low-income BIPOC communities. Where industrial facilities are unable to fully electrify, alternatives such as hydrogen should be used for limited applications such as fuel cell batteries to maintain electric reliability. Energy efficiency is also a key component of reducing GHG emissions from industrial facilities, and CARB should further explore how "implementing advanced energy efficiency projects and tools" can eliminate the need for alternative liquid fuels across industrial subsectors.[283] Given these alternatives of fuel cell batteries and advanced energy efficiency and demand response, combustion of liquid fuels must be phased out from all industrial facilities, as combustion of biomethane or hydrogen will further entrench the negative public health impacts associated with these fuels.

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[279] Draft Scoping Plan at 169.
[280] CEJA et al., Opening Comments, Cal. Pub. Util. Comm'n Rulemaking 19-01-011 (Jan. 31, 2019), available at: https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M432/K773/432773561.PDF.
[281] Draft Scoping Plan at 165, 166-67, 169.
[282] CPUC Energy Division, Updated IRP Criteria Pollutant Analysis, at slides 6-7 (Feb. 20, 2020), available at ftp.cpuc.ca.gov/energy/modeling/CriteriaPollutantAnalysisUpdate_20200221.pdf. See California Public Utilities Commission Decision 20-12-022, at 37 (Cal. P.U.C. Dec. 22, 2020).
[283] Draft Scoping Plan at 168.

e. The Draft Scoping Plan's assumption that high building electrification will require construction of new electric infrastructure is overstated.

The Draft Scoping Plan assumes that increased electricity demand from the electrification of buildings "could result in construction of new infrastructure" such as electric transmission infrastructure.[284] This assumption is likely overstated, as increased electricity demand over the long-term can be addressed by demand-side management and distributed energy strategies, as well as planned for through existing electric grid planning processes such as the Integrated Resource Planning and Electric Grid Planning efforts at the CPUC. These processes should be utilized to maximize the use of existing grid infrastructure and therefore minimize the need for building new infrastructure. CARB should use its authority to convene a cross-agency working group with CPUC, CAISO, CEC, and other California agencies to properly prepare California's electric grid to keep pace with projected electrification scenarios, and ensure that investments into new electric infrastructure are necessary and first address needs within low-income BIPOC communities.

f. CARB must ensure an equitable decarbonization of residential buildings that benefits low-income families.

CARB correctly focuses on building decarbonization as a strategy to reduce GHG emissions, improve indoor air quality, and advance equity. Moreover, we appreciate that CARB appropriately considers the potential negative consequences on low-income communities and renters. Nonetheless, CARB has failed to incorporate adequate protections into the Draft Scoping Plan to ensure that decarbonization benefits and does not disproportionately impact low-income communities. We recommend that CARB include in the Scoping Plan a commitment to proactively ensure that California's residential building electrification efforts will benefit and not negatively impact low-income communities. We provide specific recommendations below.

i. CARB must minimize building retrofit costs on low-income communities.

We support CARB's recommendations to strengthen building standards by mandating that new construction be all-electric. Such a mandate would serve to minimize investment in stranded assets of gas pipelines,[285] expand and fund incentive programs and financial assistance for frontline communities,[286] design utility rates to support building decarbonization,[287] and expand consumer education efforts around the benefits and efficacy of building decarbonization.[288] While these suggestions are a good starting point, CARB must ensure its building electrification measures for both new construction and retrofit projects do not bring unintended negative consequences on low-income communities.

First, CARB must use its authority to increase building retrofit funding for low-income communities and buildings occupied by low-income families. As noted in Appendix F of the Draft

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[284] Draft Scoping Plan at 20.
[285] *Id.* at 24.
[286] *Id.* at 25, 34-26.
[287] *Id.* at 32.
[288] *Id.*

Scoping Plan, CARB must implement broad, statewide actions to reduce retrofit costs.[289] For example, investments in and subsidies for low-amperage water heating technologies would allow low-income communities and buildings to afford expensive electrical panel upgrades. Because low-amperage heating upgrades are currently possible only where occupants have limited heating needs, CARB should advocate for developing and increasing production of zero-emission appliances that are ready to fit within existing homes and match the current electrical capacity of existing buildings. We support CARB's recommendation to adopt a "whole building approach" that pairs investments in building decarbonization investments with improvements to health and habitability improvements.[290] Together, these strategies will achieve the most cost-effective range of benefits for renters and ensure that low-income communities throughout the state are supported in the transition.

Further, CARB should collaborate with authorities like the CPUC, California Independent System Operator, the California Legislature, and the Governor's Office to establish funding streams for infrastructure expansion and modernization in low-income and disadvantaged communities. In particular, we recommend CARB work with these authorities to advance funding streams prioritizing grid modernization through both the General Fund and ratepayer dollars, and ensure that costs included in the rate base are recovered equitably. The success of building decarbonization initiatives hinges on CARB taking an active role in developing a concrete and equity-focused approach to large-scale electric infrastructure upgrades in low-income and disadvantaged communities. These communities disproportionately rely on propane and suffer from poor quality of service. As such, CARB must prioritize infrastructure improvements that can support reliable and widespread building electrification.

Similarly, CARB must use its authority to coordinate with agencies like the California Department of Housing and Community Development to develop performance standards for existing buildings, protect tenants from absorbing costs of decarbonization, and prioritize implementing these standards in large, corporate-owned buildings.[291] As CARB acknowledged in the Draft Scoping Plan, performance standards for existing buildings can impact low-income communities and renters significantly.[292]

Finally, the Draft Scoping Plan identifies research documenting instances of landlords using repair and maintenance requirements as a pretext for displacing tenants or increasing rent.[293] We share concerns that property owners could misuse decarbonization and retrofit policies to harm renters. We recommend that CARB revise Appendix D to encourage local jurisdictions to adopt and enforce anti-displacement policies, such as just-cause eviction, tenant right to counsel, tenant opportunity purchase acts, and tenant anti-harassment statutes, and ban the pass-through of decarbonization upgrade costs from building owners.[294] The San Joaquin Valley Affordable

[289] *Id.* at 15.
[290] *Id.* at 16.
[291] *Id.*
[292] Draft Scoping Plan, Appendix F, at 28.
[293] *Id.* at 18.
[294] Chelsea Kirk, *Los Angeles Building Decarbonization Tenant Impact and Recommendations*, STRATEGIC ACTIONS FOR A JUST ECONOMY 4 (December 2021), https://www.saje.net/wp-content/uploads/2021/12/LA-Building-Decarb_Tenant-Impact-and-Recommendations_SAJE_December-2021-1.pdf.

Energy Pilots, the SOMAH program, and the phased approach for New York's Local Law 97 provide examples of how local entities can implement tenant protections in future programs.[295]

As CARB moves to implementing the Scoping Plan in 2023, we recommend CARB employ inclusive and accessible engagement processes and convene cross-sector working groups to hear from impacted stakeholders, including environmental justice communities, workers, and tenants, so that the most marginalized and impacted communities are prioritized in the transition.34 Such actions are necessary complements to direct emissions reductions policies to ensure that tenants can remain in their homes with affordable rents.

i. CARB must minimize rate change impacts on low-income communities.

Although CARB is not responsible for electric rate oversight, the Scoping Plan's decarbonization measures will likely alter electricity rates for all Californians, especially low-income families. CARB should engage with the cross-sector working group to ensure that rate reform is implemented in an equitable manner that minimizes additional cost burdens on low-income families. The CPUC is already considering income-based rates and utilities are in the process of designing all-electric rates. As a critical piece of CARB's vision for California's climate future, CARB must utilize the Draft Scoping Plan process to assess potential pathways for rate reform.

Finally, the Draft Scoping Plan identifies research documenting instances of landlords using repair and maintenance requirements as a pretext for displacing tenants or increasing rent.[296] We share concerns that property owners could misuse decarbonization and retrofit policies to harm renters. Local jurisdictions should adopt and enforce anti-displacement policies, such as just-cause eviction, tenant right to counsel, tenant opportunity purchase acts, and tenant anti-harassment statutes, and ban the pass-through of decarbonization upgrade costs from building owners.[297] The San Joaquin Valley Affordable Energy Pilots, the SOMAH program, and the phased approach for New York's Local Law 97 provide examples of how local entities can implement tenant protections in future programs.[298]

This presents an opportunity to work directly with community-based organizations and provide them with much-needed incremental funding to support tenants in understanding their rights and aiding enforcement of existing and future tenant protections. We recommend CARB employ inclusive and accessible engagement processes and convene cross-sector working groups to hear from impacted stakeholders, including environmental justice communities, workers, and tenants, so that the most marginalized and impacted communities are prioritized in the transition.[34]

[295] D. Shields, *Lessons Learned (So Far) In Targeted Building Electrification*, GRIDWORKS (2021), available at: https://gridworks.org/2021/09/lessons-learned-so-far-in-targeted-building-electrification/?author=3 ; Elise Hunter, *San Joaquin Valley Pilots: Tenant Protection Principles & SOMAH Case Study*, GRID ALT. (Jan. 30, 2019), available at: https://www.cpuc.ca.gov/-/media/cpuc-website/files/uploadedfiles/cpucwebsite/content/utilitiesindustries/energy/energyprograms/infrastructure/dc/grid-alternatives-sjv-tenant-protection-jan30-19-v2.pdf.

[296] Draft Scoping Plan, Appendix F, at 18

[297] Kirk, *supra* note 294, at 12.

[298] *See supra* note 295 and accompanying text.

Such actions are necessary complements to direct emissions reductions policies to ensure that tenants can remain in their homes with affordable rents.

b. We support CARB's proposal to scale back natural gas infrastructure.

We appreciate CARB's statement that the transition to building decarbonization "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."[299] We fully support CARB's effort to decommission existing gas infrastructure, and recommend that CARB prioritize doing so in low-income and environmental justice communities while supporting the transition to renewable energy in these communities.

A recent report demonstrates that scaling back gas infrastructure is essential to achieving emissions reductions and avoiding stranded costs on low-income customers unable to electrify.[300] As Appendix F notes, the CPUC Staff Proposal recommends eliminating natural gas-related incentives for developers to defray costs of extending gas mains and service lines to all new buildings.[301] Importantly, eliminating incentives and subsidies will also benefit low-income customers by eliminating the cost of LEAs from gas rates and residents of affordable housing to the extent removing incentives motivates all-electric rather than dual-fuel construction.[302]

VIII. CARB Must Include an Analysis on the Effectiveness and Environmental Impacts of the Cap-and-Trade Program, and Consider Reforming Cap-and-Trade In This Scoping Plan.

As noted in the Draft Scoping Plan, CARB states that the Cap-and-Trade program is a critical "part of the portfolio to achieve the state's GHG reduction targets.[303] However, CARB improperly defers analysis or evaluation of California's Cap-and-Trade program until 2023, after the adoption of the Final Scoping Plan.[304] CARB must take this opportunity to analyze the effectiveness, as well as the environmental impacts, of the Cap-and-Trade program.

These analyses may give rise to new or modified regulatory measures and inform current and future decision-making related to the role of Cap-and-Trade in California. To facilitate informed policy solutions, further involve the public, and facilitate transparency, the Draft Scoping Plan must include robust analysis and modeling. The Draft Scoping Plan can also leverage existing analysis that has already identified major flaws in California's Cap-and-Trade design and implementation.

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[299] Draft Scoping Plan at 170.
[300] *Gas Resource and Infrastructure Planning for California: A Proposed Approach to Long-Term Gas Planning*, GRIDWORKS 7-8 (Jan. 2021), available at: https://gridworks.org/wp-content/uploads/2021/01/CA_Gas_Resource_Infrastructure_Plan_Report_FINAL.pdf.
[301] Draft Scoping Plan, Appendix F at 23-24.
[302] CEJA et al., Opening Comments, Rulemaking 19-01-011, *supra* note 280 at 8.
[303] Draft Scoping Plan at 86.
[304] *Id.* at 87.

By failing to provide these analyses, CARB paints an incomplete picture of the efficacy and environmental and health impacts of the Scoping Plan. Further, it ignores substantial evidence of significant environmental impacts resulting from its implementation of Cap-and-Trade. Cap-and-Trade leads to emissions of harmful co-pollutants from covered facilities, the majority of which are within half a mile of a disadvantaged community.[305] Another report issued in fall 2016 showed that the number of GHG-emitting facilities in an area is correlated with the percentage of people of color in that area.[306] Further, as described in detail below, the continued issuance of offsets runs the risk of further jeopardizing these same communities.

Consequently, CARB must also analyze and adopt reforms to Cap-and-Trade to reduce the program's disproportionate air quality and other environmental impacts on low-income and disadvantaged communities. Although it is welcome information that Cap-and-Trade is likely to play a reduced role in California's future climate policy,[307] CARB fails to provide a compelling explanation for why the Draft Scoping Plan does not analyze or consider potential changes to the Cap-and-Trade program, particularly post-2030. Nor does it provide any firm guarantee that CARB will reduce the role of Cap-and-Trade through future regulatory processes.

CARB has the necessary data to consider reforms to its Cap-and-Trade program during the Scoping Plan process. CARB's failure to provide this data for public review and comment undermines the Board and public's ability to comment on Cap-and-Trade in the context of other measures proposed in the Scoping Plans. Accordingly, we call for CARB Staff to adopt a revised Draft Scoping Plan that includes: (1) modeling and analysis of Cap-and-Trade's efficacy and environmental impacts, and (2) consideration of potential reforms to its Cap-and-Trade program.

a. CARB must analyze the extensive evidence demonstrating that Cap and Trade has not been effective in cutting GHG emissions.

In 2017, California acknowledged that its implementation of Cap-and-Trade had not achieved any reduction in GHG emissions. In a programmatic analysis of Cap-and-Trade, the Legislative Analyst's Office (LAO) found that Cap-and-Trade has likely not contributed to recent emissions reductions: "the cap is likely not having much, if any, effect on overall emissions in the first several years of the program."[308] In the years following LAO's findings, CARB's 2018 and 2019 data showed the same lack of progress in cutting GHG emissions. Through 2019—the most

[305] CAL. OFFICE OF ENV'T HEALTH HAZARD ASSESSMENT. TRACKING AND EVALUATION OF BENEFITS AND IMPACTS OF GREENHOUSE GAS LIMITS IN DISADVANTAGED COMMUNITIES 22-23 (Jan. 2017), available at: https://oehha.ca.gov/media/downloads/environmental-justice//impactsofghgpoliciesreport020322.pdf.

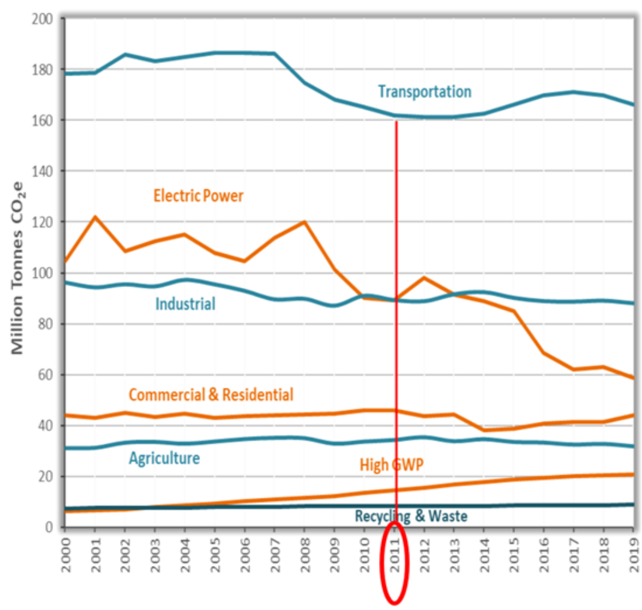
[306] Manuel Pastor et al., A PRELIMINARY ENVIRONMENTAL EQUITY ASSESSMENT OF CALIFORNIA'S CAP-AND-TRADE PROGRAM, UC BERKELEY 2, Table 1 (Sept. 2016) ("neighborhoods with a facility that emitted localized GHGs within 2.5 miles have a 22 percent higher proportion of residents of color and 21 percent higher proportion of residents living in poverty than neighborhoods that are not within 2.5 miles of such a facility. Neighborhoods within 2.5 miles of a facility are also more than twice as likely to be among the worst statewide in terms of their CalEnviroScreen score, a relative ranking of cumulative impact based on indicators of social and environmental stressors to health"), available at: https://dornsife.usc.edu/assets/sites/242/docs/Climate_Equity_Brief_CA_Cap_and_Trade_Sept2016_FINAL2.pdf.

[307] Draft Scoping Plan at 89.

[308] Mac Taylor, THE 2017-18 BUDGET: CAP-AND-TRADE, LEGIS. ANALYST'S OFF. 14 (Feb. 2017), available at: https://lao.ca.gov/reports/2017/3553/cap-and-trade-021317.pdf.

recent sector-by-sector emissions data available through CARB—most of California's reductions in GHG emissions came from direct regulatory measures, as demonstrated by the graph below. However, CARB fails to acknowledge its documented failure to reduce GHG emissions through the Cap-and-Trade program.

Indeed, as acknowledged by LAO, California's emissions reductions are attributable to direct emissions reductions measures, including California's Renewable Portfolio Standard. Outside of the electric sector, emissions at the end of 2019 were close to the same as—or higher than—they were in 2011 when CARB adopted Cap-and-Trade. LAO further found that emissions reductions prior to 2011 were largely attributable to reduced economic activity related to the 2008 recession.[309]



Cap-and-Trade's failure to reduce emissions has garnered widespread attention. Bloomberg News recently published an article noting that Cap-and-Trade has failed to achieve significant reductions in GHG emissions:

> [N]early 10 years after "cap and trade" began, there's little proof the system has had much direct impact on curbing planet-warming pollutants. California has seen big cuts in greenhouse gas emissions — but such gains have little to do with the much-vaunted carbon market. As officials debate how to reach the state's goal of zeroing out emissions by 2045, critics on both sides of the political spectrum say the market isn't working.[310]

Numerous scientific articles further highlight reasons why carbon trading systems could and did fail, including the extensive banking and overallocation of cheap emissions credits. As noted in these academic articles:

> The California climate regulator has called for cap-and-trade to deliver nearly half of the emission reductions needed to achieve the state's legally binding limit on greenhouse gas emissions in 2030, making the program the single biggest driver of the state's post-2020 policy portfolio. However, the program's supply of compliance instruments has persistently exceeded emissions subject to the program—a condition known as overallocation, which independent studies have projected may continue into the mid-2020s. *If market participants purchase and bank excess compliance instruments for future*

[309] *Id.*
[310] David R. Baker, *California Carbon Market Falls Short in Fight to Curb Emissions*, BLOOMBERG (May 11, 2022), available at: https://news.bloomberglaw.com/esg/california-carbon-market-falls-short-in-fight-to-curb-emissions?utm_source=rss&utm_medium=CTNW&utm_campaign=00000180-b449-d526-abdd-b7ff17b00003.

use, they may be able to comply with the program's regulations while nevertheless emitting significantly in excess of the state's legally binding 2030 limit (emphasis added).[311]

At the time of its adoption, many parties accurately predicted Cap-and-Trade's failure for several reasons. Chief among these were: (1) overallocation of emissions credits and distribution of free credits; (2) an insufficient price floor, resulting in cheap credits; (3) permitting polluters and speculators to bank credits; (4) circulation of credits that did not achieve actual emissions reductions, including credits that are not additional (i.e., credits distributed for activities would have happened without Cap-and-Trade); and (5) fraudulent credits. Each of these design failures had repeatedly happened in European carbon trading markets.

Despite CARB's assurances to the contrary, California's Cap-and-Trade replicated similar overallocation problems, allowing polluters to acquire and bank very cheap or free credits, absolving them of any obligation to take more effective actions to achieve emissions reductions.

Indeed, CARB has designed these cheap credits into its design of Cap-and-Trade. Costs have frequently been as low as $10/ton, although speculative investment has also given rise to volatile price fluctuations.[312] Nonetheless, even at its highest price, credit prices have not reached high enough levels to push serious energy change at covered facilities. The cost of emission would have to be far higher—between $100 and $250 per ton of CO_2e—to have an effect. For example, analyses on the European Union carbon market have found that, to reach net zero by 2050, carbon costs must reach at least $100/ton. Another study by the International Energy Agency estimated that carbon prices must reach between $200 to $250 per ton of CO_2e to achieve this same goal of net zero by 2050.

By failing to set an appropriate emissions cap and pushing a glut of cheap emissions credits into circulation, California has sanctioned an ineffective Cap-and-Trade program that functions more as a pay-to-pollute system than as a functional regulatory program. Many studies and reports have evaluated these same issues over the years.[313]

CARB has not and must review key studies and reports, including those described in this section, to analyze whether Cap-and-Trade has been effective in reducing emissions. Moreover, California jurisdictions have overseen failed experiments in emissions trading in other contexts. For example, in 1994, the South Coast Air Quality Management District (SCAQMD) implemented the Regional Clean Air Incentives Market (RECLAIM), an emissions trading market designed to

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[311] Cullenward et al, *Tracking banking in the Western Climate Initiative Program*, 14 ENV'T RES. LETTERS 1 (Nov. 14, 2019), available at: https://iopscience.iop.org/article/10.1088/1748-9326/ab50df/pdf.

[312] Jack Farchy et al., *Hedge Funds Seek Riches in California's Carbon Market*, BLOOMBERG (Nov. 17, 2021), available at: https://www.bloomberg.com/news/articles/2021-11-17/hedge-funds-seek-riches-in-california-s-carbon-market#xj4y7vzkg.

[313] *See, e.g.*, Cullenward, *supra* note 312; McAllister, Lesley K., *The Overallocation Problem in Cap-and-Trade: Moving Toward Stringency* (2009). 34 Colum. J. Env't L., 395, 397 (2009), available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1276405 (finding that all carbon trading programs evaluated in the U.S. and Europe suffered from overallocation either during earlier years, or in *every* year of the program); Christina Hood, *Reviewing Existing and Proposed Emissions Trading Systems*, Int'l Energy Agency (2017) (finding that unambitious goals, free allocations, overallocation, banking and other flaws caused trading programs to fail to achieve emissions reduction goals), available at: https://www.oecd-ilibrary.org/docserver/5km4hv3mlg5c-en.pdf?expires=1654206452&id=id&accname=guest&checksum=952816EA646CA7B269126557F2F11685.

help the region achieve its goals of reducing NOx emissions. After a long legacy of failure to effectively reduce emissions, SCAQMD ultimately made the decision to sunset RECLAIM and replace it with prescriptive regulations. Rule 1109.1—which replaced RECLAIM—has achieve major reductions in NOx emissions, and will total approximately 8 tons per day, the largest industrial emissions reduction of NOx in the South Coast for decades.[314]

Learning from SCAQMD, CARB must recognize in the Scoping Plan the abundant evidence that Cap-and-Trade is not working as intended. CARB cannot defer analysis of its Cap-and-Trade program until 2023; rather, it must address these problems as part of the Scoping Plan process to ensure that California can achieve its climate targets and provide an accurate and reality-based roadmap for California's climate future.

b. CARB fails to include adequate analysis on how Cap-and-Trade has contributed to statewide GHG emissions reductions.

CARB fails to provide programmatic analysis, modeling inputs, or any other assessments that would demonstrate whether California's Cap-and-Trade program is effective in reducing emissions. In February 2022, the Independent Emissions Market Advisory Committee (IEMAC) called for the Draft Scoping Plan to further assess inputs to the modeling related to Cap-and-Trade, including:

> [T]he approximate abatement potential of the [C]ap-and-[T]rade program, including offsets, and specifically evaluate the required level of the emissions cap to act as a backstop for meeting climate goals . . . an appropriate cap level (i.e., an appropriate allowance budget) is essential to achieving these goals and providing regulatory certainty—and thus a key input for modeling the abatement needed from other policies. IEMAC is concerned that none of the proposed Scoping Plan scenarios consider the level of the emissions cap or the rate at which it could decline.[315]

CARB has not evaluated the abatement potential of Cap-and-Trade in the Draft Scoping Plan. Nor has it determined appropriate cap levels to verify additional reductions needed from other policies, as called for in the IEMAC report. As the IEMAC report notes, most of the emissions reductions thus far achieved are attributable to direct regulatory measures.[316]

This information is critical, considering the well-above-expected banking of emissions credits through 2030. This raises questions about Cap-and-Trade's ability to realize actual emissions reductions from sources covered by the emissions cap. Currently, there are over 310 million allowances currently in circulation,[317] an amount greater than the emissions reductions expected from the program over the coming decade.[318] Further, "[a]n additional reserve supply of allowances totaling 274 million tons resides in public accounts and could also enter the market,

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[314] S. Coast Air Quality Mgmt. Dist. Staff Report, *supra* note 66 at 6.
[315] Dallas Burtraw et al., 2021 ANNUAL REPORT OF THE INDEPENDENT EMISSIONS MARKET ADVISORY COMMITTEE 4 (Feb. 2022) (hereinafter "IEMAC Report"), available at: https://calepa.ca.gov/wp-content/uploads/sites/6/2022/02/2021-IEMAC-Annual-Report.pdf.
[316] *Id.*
[317] *Id.* at 87.
[318] *Id.*

depending on future prices."[319] It is unclear whether this glut of credits is a product of direct regulatory measures reducing emissions at covered sources, savings or investments in anticipation of a steadily decreasing emissions cap, or declines in operations of covered facilities related to the COVID-19 pandemic.[320]

The abundant supply of emissions credits speaks to a fundamental failure in CARB's market design, and undermines California's Cap-and-Trade program. A robust abatement analysis, included in the Draft Scoping Plan, would shed light on future policy decisions related to the need for Cap-and-Trade through 2030. This coalition has advocated in past iterations of the Scoping Plan against implementation of Cap-and-Trade due to extensive evidence of its failures and harms. Now that we are further along the timeline of Cap-and-Trade failures and increasing climate catastrophe, there is a greater need than ever for CARB to provide clarity on the limitations of this program in meeting California's 2030 goal and beyond. Otherwise, the Board will not have the requisite information to adopt effective and informed emission reduction measures in the Scoping Plan.

c. CARB must reduce the use of carbon offsets to reduce community-level exposure to air contaminants.

The Draft Scoping Plan notes that the 2021 updates to the Cap-and-Trade program have reduced the role of offsets from 8 to 4 percent, with half of these offsets required to 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."[321] Although CARB presents the reduced offset allowance as its response to environmental justice concerns, the 4 percent offset allowance is, in fact, the maximum number of offsets that may be issued under AB 398.[322]

CARB's continued reliance on offsets neglects to respond to harmful co-pollutants and further jeopardizes members of environmental justice communities. Despite finding "that companies that use the most offsets often own the facilities that contribute to local $PM_{2.5}$ exposure," the Draft Scoping Plan ostensibly takes the position that it has not verified a causal relationship between the use of offsets and concentration of harmful co-pollutants in fence line communities.[323] Although the Draft Scoping Plan reduces this discussion to a two-sentence footnote, it tellingly downplays the serious concerns related to offsets and local pollution sources raised by environmental justice advocates. Indeed, the OEHHA report cited in the Draft Scoping Plan is unequivocal: "four of the top five entities that use the most offsets own petroleum refineries, and refineries contribute more to PM[2.5] disparity by CES score and race/ethnicity than any other

[319] *Ibid.*
[320] *Id.*
[321] *Id.* at 86.
[322] Cal. Health & Safety Code § 38562(c)(2)(E)(i)(I).
[323] Draft Scoping Plan at 86, fn. 156.

sector."[324] This same report notes that emissions of $PM_{2.5}$ from facilities that use offsets are more than two and a half times greater than from facilities that do not use offsets.[325]

AB 398 requires CARB to prioritize disadvantaged communities when approving new offset protocols.[326] This directive necessarily means that CARB must perform its duty to explore the link between use of offsets and community-level pollution impacts. While the Draft Scoping Plan acknowledges the disproportionate use of offsets in environmental justice communities, it embeds this fact in a brief two-sentence footnote and does not attempt to provide any further insight. CARB must reduce its use of offsets to ensure that Cap-and-Trade does not continue to harm disadvantaged communities, in compliance with its mandate under AB 398 and AB 32 to protect and not harm disadvantaged communities.

IX. CARB Should Not Rely on Dairy Digesters and BioMethane, and Should Directly Cap Livestock Methane Emissions to Ensure Effective Reductions.

CARB's proposed strategies to reduce livestock methane will not put California on course to effectively methane derived from livestock operations and will undermine California's efforts to achieve the 40 percent methane emission reduction from 2013 levels by 2030 target set forth in SB 1383.[327] However, CARB proposes to significantly expand dairy digesters, which commodify and perversely incentivize the production of manure and, consequently, associated climate and environmental impacts. CARB also proposes to address enteric emissions through unproven and speculative technologies. Further, CARB evinces a misplaced reliance on a continued reduction in California's population of cattle, despite the potential for this trend to be counteracted through CARB's incentive programs encouraging increased production of manure by awarding low carbon credits and other subsidies. In effect, CARB's proposed measures on livestock methane will perpetuate pollution and health impacts in already overburdened communities, in violation of both AB 32 and SB 1383.

a. CARB's assumption that building 380 additional dairy digesters will reduce methane emissions is unsupported. CARB also fails to adequately analyze the environmental and health impacts that will result from the proposed massive expansion.

Under Alternative 3, CARB proposes to build 380 new dairy digesters on operations that have not implemented a manure management project by 2030.[328] CARB assumes that dairy digesters capture and prevent the release of methane, but this assumption is unsubstantiated.[329] Rather than reducing methane emissions *at the source*, dairy digesters function only to capture and

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[324] OEHHA, *supra* note 305 at 8.
[325] *Id.*
[326] Cal. Health & Safety Code § 38591.1(a).
[327] Cal. Health and Safety Code § 39730.5
[328] Draft Scoping Plan, Appendix H at 24
[329] *Id.* at 25.

commodify livestock methane from manure and, perversely, incentivize the *creation of methane*.[330] Additionally, dairy digesters do not at all address methane from enteric emissions.

Operating as a complement to subsidies for the development of dairy digesters, CARB's Low Carbon Fuel Standard (LCFS) allows owners of dairy digesters and dairies to sell dairy-derived biomethane (also referred to as factory farm gas) and low carbon credits for an inflated price, therefore incentivizing herd expansions, herd consolidations, and enteric methane emissions.[331] Research shows that dairy revenue from LCFS biomethane sales rivals revenues from milk, ranging from one-third to half of total dairy revenues.[332] Trade representatives have confirmed that California's subsidies and policies have created a lucrative market for manure.[333] Dairy digesters capitalize on, and thus encourage, the creation and accumulation of massive amounts of manure, which, in turn, produces significant methane emissions.

The San Joaquin Valley, in particular, has seen increases in dairy herd sizes by as much as two-fold and at least one into the *tens of thousands* of dairy cows.[334] Although these documented expansions of dairy herd operations give rise to significant concerns on CARB's treatment of livestock methane emissions, opaque data reporting requirements and oversight on dairy herd sizes make it likely that several significant expansions are not or have not been documented; CARB's Low Carbon Fuel Standard Program redacts information on dairy herd sizes in data available on dairies participating in the program. These massive herds cause myriad harms to local communities and the environment. For example, all 42 dairies in the industry's own dairy groundwater monitoring program experience some degree of nitrate contamination.[335] The majority of nitrogen loading comes from land application of manure, which digestion of manure does not address. The San Joaquin Valley, where most of these dairies are located, is famously known as one of the most $PM_{2.5}$ and ozone-polluted air basins in the country,[336] with air pollution from feed, fresh manure, and cow burps as leading sources of much of the volatile organic compounds and ammonia that

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330 *See* Public Justice et al., CAL. AIR RES. BD. PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD 24-26 (Oct. 27, 2021), available at: https://food.publicjustice.net/wp-content/uploads/sites/3/2021/10/Factory-Farm-Gas-Petition-FINAL.pdf.
331 *Id*. at 13-14.
332 Aaron Smith, *What's Worth More: A Cow's Milk or its Poop?* UC DAVIS (Feb. 3, 2021), available at: https://asmith.ucdavis.edu/news/cow-power-rising; UNION OF CONCERNED SCIENTISTS, QUANTIFICATION OF DAIRY FARM SUBSIDIES UNDER CALIFORNIA'S LOW CARBON FUEL STANDARD (Sep. 2021).
333 McCully, Michael, *Energy Revenue Could Be a Game Changer for Dairy Farms*, HOARD'S DAIRYMAN, (Sept. 23, 2021), available at: https://hoards.com/article-30925-energy-revenue-could-be-a-game-changer-for-dairy-farms.html.
334 Given how opaque data on dairy herd sizes is, we assume there are several expansions that have not been documented.
335 Central Valley Reg. Water Cont. Dist., Summary Representative Monitoring Report (Revised), Central Valley Dairy Representative Monitoring Program 6-10 (April 1, 2019), available at: https://www.waterboards.ca.gov/centralvalley/water_issues/confined_animal_facilities/groundwater_monitoring/srmr_20190419.pdf.
336 Rory Carroll, *Life in San Joaquin valley, the place with the worst air pollution in America*, THE GUARDIAN (May 13, 2016), available at: https://www.theguardian.com/us-news/2016/may/13/california-san-joaquin-valley-porterville-pollution-poverty.

form the Valley's air pollution.[337] On top of this, factory farm gas actually increases ammonia emissions.[338]

Moreover, the inadequacies identified herein render the Scoping Plan's Draft Environmental Analysis ("Draft EA") deficient under CEQA. While CARB's proposal to massively increase dairy digesters will directly and indirectly result in environmental and health impacts, CARB fails to adequately analyze these impacts in the Draft EA. The Draft EA fails to adequately disclose, analyze, and mitigate impacts to, among other resource areas, air quality, greenhouse gas emissions, water quality, biological resources, and agriculture and forest resources, from the Scoping Plan's *incentivization of dairy biogas*. Promoting factory farm gas with windfall financial rewards has the perverse effect of actually *increasing* methane generation and entrenching the myriad co-pollutants and nuisances associated with ever larger dairies that would be producing this alternative fuel. CARB cannot ignore these serious environmental impacts.

b. CARB must set regulatory caps on livestock methane emissions.

Under AB 197, CARB is legally mandated to prioritize direct emissions reductions.[339] CARB also has the authority to directly regulate livestock methane starting in 2024 under SB 1383.[340] Unfortunately, CARB has failed to use this opportunity to fully explore and consider the direct regulation of the livestock methane sector. CARB must act on its authority to directly cap and regulate livestock methane emissions starting in 2024, in order to achieve California's 40% methane emission reduction goal. Planning for such a regulatory program must begin now, through the Scoping Plan process, to ensure that the Draft Scoping Plan paints an accurate portrait of California's GHG emissions reductions efforts, and to leverage public engagement around the Scoping Plan. We provide additional details in our proposed Real Zero Alternative (Attachment A).

X. CARB Must Adopt Ambitious Sustainable Agriculture and Pesticide Use Reduction Targets and Measures.

We appreciate that CARB includes, for the first time, some measures and discussion relating to sustainable pest management and organic agriculture. These approaches are crucial to building a safer, more sustainable, and 'climate-smart' agricultural system. CARB also recognizes the importance of sustainably managed natural and working lands, including croplands, in fostering climate, air, water, soil, public health, and other co-benefits. We also appreciate some of the strategies that are incorporated into the Scoping Plan from the Climate Smart Strategy, including whole orchard recycling.

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[337] *Id.*

[338] *See* Michael A. Holly et al., *Greenhouse gas and ammonia emissions from digested and separated dairy manure during storage and after land application Agriculture*, 239 AGRIC., ECOSYSTEMS & ENV'T 410, 418 (Feb. 15, 2017), https://doi.org/10.1016/j.agee.2017.02.007.

[339] Cal. Health & Safety Code § 38562.5.

[340] CARB has the ability to directly regulate livestock methane starting in 2024, per SB 1383. Cal. Health & Safety Code § 39730.7(b)(4).

Nonetheless, we recommend that CARB recommend stronger policies to achieve CARB's and partner state agencies' goals of reducing pesticide use and impacts, particularly in disadvantaged communities. We join our colleagues at Californians for Pesticide Reform and Pesticide Action Network in calling for:

1. An accelerated and more ambitious organic agriculture target of 30% agricultural acreage being organically farmed by 2030;
2. A measurable target of reducing synthetic pesticide use by 50% by 2030;
3. A commitment by CARB to research, model and quantify health, climate and environmental benefits of pesticide use reduction; and
4. The establishment and expansion of financial mechanisms that support pesticide reduction and ecological pest management that does not use synthetic pesticides

While Alternative 3 includes a goal of increasing organic agriculture to 20% of all cultivated acres by 2045, this goal does not represent any additional increases in organic agriculture over a business-as-usual scenario. Based on the current rate of organic production in California, organic production would grow to more than 30% of total agriculture by 2045 even in the absence of any government incentives.[341] Consequently, CARB should incorporate into the Draft Scoping Plan a more ambitious goal of 30% organic farming by 2030. To realize the full potential of the greenhouse gas savings and reduce synthetic inputs resulting from organic agriculture, CARB must incorporate this stronger target into the Draft Scoping Plan.

We also continue to urge CARB to include a goal of 50 percent reduction in synthetic pesticide use by 2030. Pesticide reduction is listed in the Draft as an intended outcome of climate-smart agriculture and organic agriculture adoption. However, for CARB to achieve this outcome, CARB must ensure actual, measurable reductions in pesticide use. Residents across the state, including in ag-dominated regions like the San Joaquin Valley, have long been calling for direct reductions in synthetic pesticide use *and* "reducing harmful pesticide exposure."[342] Unless synthetic pesticide use reduction is incorporated into the 2022 Scoping Plan, the health impacts of synthetic pesticide exposure will continue to fall primarily on residents of color in California.

Additionally, at a minimum, CARB should commit to researching, modeling and quantifying health, climate, and environmental benefits of pesticide use reduction. While CARB proposes to "conduct research on the intersection of pesticides, soil health, GHGs, and pest resiliency via a multiagency effort with [the California Department of Pesticide Regulations], [the California Department of Food and Agriculture], and CARB," CARB does not model or analyze measures to reduce pesticide use or engage in this multiagency effort. Although we are interested in learning more about what type of research CARB currently plans to conduct on pesticides and GHGs, CARB currently has access to a wide body of existing research verifying the link between pesticides and GHG emissions.[343] We also continue to advocate for a Community Support Fund

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[341] CAL. DEP'T OF FOOD AND AGRIC., CALIFORNIA AGRICULTURAL STATISTICS REVIEW, 2019–2020 (last visited June 24, 2022), available at: https://www.cdfa.ca.gov/is/organicprogram/pdfs/2019_2020_California_Agricultural_Organic_Report.pdf.

[342] Draft Scoping Plan at 202.

[343] Jones, C. D. et al., *Quantification of Greenhouse Gas Emissions from Open Field-Grown Florida Tomato Production*. 113 AGRIC. SYSTEMS 64-72 (Nov. 2012); Spokas K. & Wang D., *Stimulation of nitrous oxide*

overseen by the Department of Pesticide Regulation that provides direct prevention and protections from synthetic pesticide use by deploying strategies and technologies such as buffer zones, indoor home air purifiers/filters, tarping, personal protective equipment, and other actions that minimize synthetic pesticide exposure for residents of California.

Lastly, we urge CARB to commit, in the Final Scoping Plan, to establishing and expanding financial mechanisms to support pesticide reduction and ecological pest management that does not rely on synthetic pesticides. The Proposed Scenario currently includes a goal to increase healthy soils practices, currently funded under the Healthy Soils Program at the California Department and Food and Agriculture. However, this program does not include any specific pesticide reduction goals or organic agriculture programs. As such, it falls on CARB to ensure the provision of additional funding to support these goals.

Thank you for considering our comments above and our separately-submitted Cross-cutting Sector Comments on the Draft Scoping Plan. We hope to continue working with CARB staff and the Board to adopt a Scoping Plan that meets California's climate and equity mandates to promote well-being for all Californians and our planet.

Sincerely,

Julia May, *Senior Scientist*
Connie Cho, *Attorney*
Gabriel Greif, *Legal Fellow*
Communities for a Better Environment

Shayda Azamian, *Climate Policy Coordinator*
Leadership Counsel for Justice and Accountability

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Lucia Marquez, *Associate Policy Director*
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Central Coast Alliance United for a Sustainable Economy

Amee Raval, *Policy and Research Director*
Asian Pacific Environmental Network

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production resulted from soil fumigation with chloropicrin, 37 ATMOSPHERIC ENV'T, 3501, 3507 (Aug. 2003) https://doi.org/10.1016/S1352-2310(03)00412-6.

Eric Romann, *Director of Strategy and Campaigns*
Physicians for Social Responsibility-Los Angeles

Agustin Cabrera, *Policy Director*
Strategic Concepts in Organizing and Policy Education

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California Environmental Justice Alliance

Attachment A: Real Zero Alternative - June 2022

Sector		Alternative 1	Alternative 3	Real Zero Alternative
		Carbon Neutral by 2035	**Carbon Neutral by 2045**	**Carbon Neutral by 2045** **80% - 92% GHG reductions by 2045*** **The majority of our recommendations are based on most ambitious scenario in E3's 2020 Achieving Carbon Neutrality Report, which if implemented would result in 80-92% statewide GHG emissions reduction from 1990 levels by 2045. We note below policy measures that were recommended in that report.*
Transportation	VMT	VMT per capita reduced 25% below 2019 levels by 2030, and 30% below 2019 levels by 2035	VMT per capita reduced 12% below 2019 levels by 2030 and 22% below 2019 levels by 2045	VMT per capita reduced 25% below 2019 levels by 2030, and 30% below 2019 levels by 2035[1]
Transportation	LDV ZEVs	100% LDV sales are ZEV by 2030	100% LDV sales are ZEV by 2035	100% LDV sales are ZEV by 2035, and at least 75% LDV sales are ZEV by 2030[2]
Transportation	Truck Heavy-Duty ZEVs	100% of MD/HDV sales are ZEV by 2030	100% of MD/HDV sales are ZEV by 2040	100% of MD/HDV sales are ZEV by 2035[3]; 100% of all transit buses ZEV by 2030
Transportation	Port Operations	100% of cargo handling equipment is zero-emission by 2030; 100% of drayage trucks are zero-emission by 2030	100% of drayage trucks are zero emission by 2035	100% of drayage trucks are zero emission by 2030[3]; 100% of cargo handling equipment is zero-emission by 2030[4]
Transportation	Vehicle Early Retirements	LDV: 16M 5 - 16 yr. old MD/HDV: 1.4M 5 - 16 yr. old	N/A	HDV: ~131,000 13 - 18 yr. old trucks[5]
Fossil Fuels	Oil & Gas Extraction	Phase out operations by 2035	Phase out operations by 2045**	Phase out operations by 2035
Fossil Fuels	Petroleum Refining	Phase out production by 2035 in line with petroleum demand	CCS on majority of operations by 2030 Production reduced in line with petroleum demand	Phase out production by 2045[3]
Fossil Fuels	Petroleum Refining Remaining	2035: 0% 2045: 0%	The Draft Scoping Plan contains inconsistent data regarding refinery emissions.	2035: Proportional based on planning[3] 2045: 0%[3]
Fossil Fuels	Total CCS Needs (Industrial & Refining)	2035: <1MMT 2045: <1MMT	2035: 10MMT 2045: 4MMT	2035: <1 MMT 2045: <1 MMT
Electricity	Electricity Generation	GHG target of 23 MMTCO2e in 2030, and 0 MMTCO2e in 2035	GHG target of 38 MMTCO2e in 2030, and 24 MMTCO2e in 2045	GHG target of 0 MMTCO2e in 2035; Total load coverage; Renewable Portfolio Standard (RFS)-eligible and zero carbon resource generation, and no new gas build or expansion. Instead, scale up peak shaving measures; No CDR/CCS in electric sector
Electricity	Annual Build Rates	Solar: 10GW Battery: 5GW	Solar: 7GW Battery: 2GW	Solar: 6 GW Wind: 1.5 GW Battery: 4 GW
Building Decarb	Existing Residential Buildings	80% of appliance sales are electric by 2025; 100% of appliance sales are electric by 2030; All buildings retrofitted to electric appliances by 2035	80% of appliance sales are electric by 2030; 100% of appliance sales are electric by 2035; Appliances are replaced at end of life	100% of appliance sales are electric by 2030[3]; Establish and fully fund programs for no/little up front cost retrofits (weatherization, efficiency, conservation, demand management / load shifting, efficient electric appliances) for low-income communities by 2025; Retrofit 50% of all existing residential buildings (replace gas-fired space heating, A/C and water heaters with efficient electric heat pump appliances) by 2035; 100% of existing residential buildings retrofitted by 2045; All gas end uses retired by 2045[3]
Building Decarb	Residential Early Retirements	7M electric homes. Appliances 5-16 yr old	N/A	No recommendation
Industry and Agriculture	Agriculture Energy Use	50% energy demand electrified by 2030, and 100% by 2035	25% energy demand electrified by 2030, and 75% electrified by 2045	No recommendation
Industry and Agriculture	Low Carbon Fuels for Buildings & Industry	RNG directed to Cement facilities by 2035	In 2030s RNG blended in pipeline Renewable hydrogen blended in natural gas pipeline at 7% energy (~30% by volume), ramping up between 2030 and 2040	No RNG use and no hydrogen blending for use in buildings
Industry and Agriculture	Non-Combustion Methane Emissions	No additional landfill or dairy digester methane capture; Rate of dairy herd size reduction increases compared to historic levels	Increase landfill and dairy digester methane capture; Moderate adoption of enteric strategies by 2030	Directly regulate and enforce necessary decreases in livestock methane emissions to achieve 40% reduction target set forth in SB 1383; Accelerate alternative, sustainable farming models that will also help sustain farm production, starting 2024; Remove incentives for dairy biogas[6]; Disontinue dairy digester program and retire dairy digesters at latest by 2030; Redirect millions in funding to further develop regenerative, agroecological programs; Significantly reduce density of the California's dairy herd, which is necessary to support manure management techniques that do not incentivize methane production; Limit alternative manure management projects to only those that reduce methane production at the source
	Residual Carbon Emissions *Current global DAC 0.01MT/year*	2035: 48MMT 2045: 37MMT	2035: 0MMT 2045: 100MMT	2035: 0 MMT 2045: X for residual MMT[3] *The most ambitious pathway in the Carbon Neutrality Report estimated a remainder of 33 MMT CO2e by 2045, representing a 92% reduction in gross emissions relative to 1990 levels.*

1. CAL. STATE TRANSP. AGENCY, CALIFORNIA TRANSPORTATION PLAN 2050 91 (Feb. 3, 2021), available at: https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/ctp-2050-v3-a11y.pdf.
2. This recommendation is consistent with our advocacy in CARB's Advanced Clean Cars II rulemaking process.
3. ENERGY & ENVT'L ECON. INC. (E3), ACHIEVING CARBON NEUTRALITY IN CALIFORNIA: PATHWAYS SCENARIOS DEVELOPED FOR THE CALIFORNIA AIR RESOURCES BOARD (Oct. 2020), available at: https://ww2.arb.ca.gov/sites/default/files/2020-10/e3_cn_final_report_oct2020_0.pdf.
4. PORT OF SAN DIEGO, MARITIME CLEAN AIR STRATEGY (Oct. 2021), available at: https://pantheonstorage.blob.core.windows.net/environment/20211214-Final-MCAS.pdf.
5. This recommendation is based on the Coalition for Clean Air's Truck Retirement Proposal to CARB in July 2021.
6. Michael Sainato, "California subsidies for dairy cows' biogas are a lose-lose, campaigners say," The Guardian (Feb 4, 2022), available at: https://www.theguardian.com/environment/2022/feb/04/california-subsidies-biogas-dairy-cows-emissions-climate; *Petition for Rulemaking to Exclude All Fuels Derived From Biomethane From Dairy and Swine Manure From The Low Carbon Fuel Standard,* available at: https://food.publicjustice.net/wp-content/uploads/sites/3/2021/10/Factory-Farm-Gas-Petition-FINAL.pdf.

** It is unclear whether CARB affirmatively proposes this measure, due to other contradictory statements in the Draft Scoping Plan.

Last Updated: 6/24/22

Attachment B

April 4, 2022

COMMUNITIES FOR A BETTER ENVIRONMENT
established 1978

California Air Resources Board
1001 "I" Street
Sacramento, CA 95814

Energy + Environmental Economics (E3)
44 Montgomery Street, Suite 1500
San Francisco, California 94104

Submitted through CARB Portal

Re: CARB Draft Scoping Plan: AB32 Source Emissions Initial Modeling Results

To CARB and E3 Representatives:

Communities for a Better Environment ("CBE") submits the following comments on the CARB Draft Scoping Plan: AB32 Source Emissions Initial Modeling Results ("Initial Modeling Results") presented by E3 at the California Air Resources Board ("CARB") Public Workshop on the 2022 Scoping Plan Update – Initial Modeling Results Workshop on March 15, 2022. The comments focus on the Petroleum Refining and associated Hydrogen Production sector.[1] (Note that we are separately commenting about the electricity sector.) We request the publication of the detailed input assumptions used in the modeling soon as possible, even if only available in draft form.

CBE is a statewide environmental justice ("EJ") organization with a strong focus on addressing the fossil fuel energy sources that heavily pollute the California communities of Wilmington, Southeast Los Angeles, East Oakland, Richmond, and surrounding areas where we organize, live, and work. Climate change, smog, and toxic emissions severely and disproportionately impact our communities, including oil refineries, oil wells and drilling, power plants, transportation and other sources.

Despite our appreciation for the modeling work and presentation from E3, we are disturbed by the glaring omission of detailed written information explaining critical underlying input assumptions of the PATHWAYS modeling results. During the Q&A portion of the March 15 workshop, CARB indicated it does not intend to correct this serious flaw in the public process and plans to release that information alongside the draft Scoping Plan. At best, failing to disclose such critical assumptions creates fertile ground for extremely unrealistic concepts that skews public discourse and creates a bias for poor decision-making. Without this information, the public is left to speculate. Furthermore, it is essential that CARB disclose and ultimately revise its assumptions for the refinery sector. A recent OEHHA analysis indicated that communities living around refineries and hydrogen plants have seen an increase in GHG and PM2.5 toxic emissions during the period of the Cap and Trade program.[2] Four of the top five entities

[1] SP22-MODEL-RESULTS-E3-PPT.PDF, available at: https://ww2.arb.ca.gov/resources/documents/2022-scoping-plan-update-initial-modeling-results-workshop.

[2] Office of Environmental Health Hazard Assessment (OEHHA), Impacts of Greenhouse Gas Limits Within Disadvantaged Communities: Progress Toward Reducing Inequities, Feb. 2022, Table 2. Direction of Emission Changes at Facilities Near High-Scoring CES Communities Varies by Pollutant and Sector (2018 Compared to 2012 Emissions), p. 38

that use the most offsets own petroleum refineries.[3] The 2022 Scoping Plan must use the best available evidence to provide a clear path forward for the refining sector and refinery communities.

In the case of the Petroleum Refinery sector, the lack of real-world technical evidence to support the assumptions risks premature, or worse, predetermined policy decision-making. The comments below ask questions regarding the reasoning and inputs behind several key results and figures. **These include:**

- the assumed carbon capture rates on individual pieces of equipment and across a whole refinery,
- the lack of evidence of operational and comparable carbon capture and sequestration ("CCS") systems at existing refineries,
- hypothetical CCS-driven emission reduction timelines which inexplicably start immediately,
- non-CCS versus CCS starting points,
- assessment of major physical constraints for siting CCS equipment at California refineries,
- and accompanying safety implications, for starters.

I. Present capture rate assumptions and emissions reductions results for petroleum refining GHGs indicate alarming need for disclosure of additional assumptions and rigorous review of corresponding evidence base.

A. REQUEST FOR RESPONSE: Please clarify the "90% CCS capture" percentage assumption in the context of a whole refinery's emissions.

1. Please detail the total percentage of the overall refinery that is assumed to be covered by CCS,

2. Please detail which parts of the refinery are assumed covered by CCS, including oil refinery hydrogen plants.

3. Please also refer to Table 2-1 of the South Coast 1109.1 report, later excerpted, which lists hundreds of different major refinery combustion equipment (heaters, boilers, incinerators, turbines, FCCUs, calciners, flares, etc.). Did the modeling consider the feasibility of applying CCS to such a complex set of equipment at California refineries, when determining the percentage of emissions covered by CCS? Please detail which specific types of the listed equipment are assumed covered.

4. Please explain whether or how much capture may occur over combustion sources, and whether the percentage is only for carbon dioxide or additionally methane fugitive emissions and other pollutants. Please provide the detailed accompanying spreadsheets used for the relevant portions of the GHG inventory.

[3] Id. at 8

5. Please provide citations on the basis of the assumption that 90% of emissions are captured, where CCS is applied within a refinery, and also identify all existing and operational refinery CCS systems in place in the U.S. and in California that can help assess the validity of the modeling assumptions.

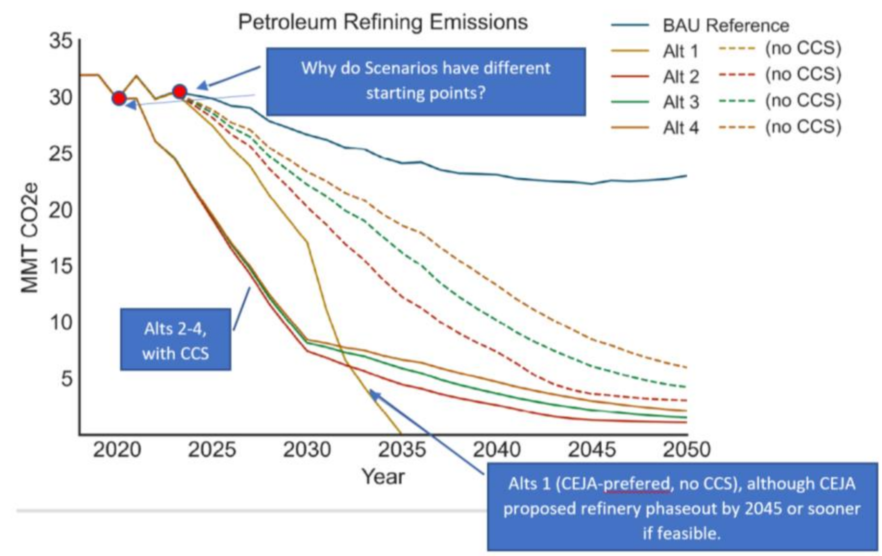
During an Environmental Justice Advisory Committee (EJAC) Fossil Fuel Transportation Working Group, CARB staff indicated the Quest carbon capture and storage project in Alberta provided CARB with a basis for understanding CCS on refineries. We highly discourage CARB from relying on the existence of this project to validate the idea of investing in CCS on refineries generally. The project cost $1.35B (of which $865 Million came from the Canadian government[4]) and only captured a third of the upgrader's emissions. And despite initially claiming that its project Polaris would capture more than 90% of emissions,[5] Shell now states that it is only expected to capture up to 40% from the refinery as a whole and up to 30% from the chemicals plant.[6] We request an explanation for the capture assumption that addresses which part of the Quest project data CARB has considered, if at all.

B. REQUEST FOR RESPONSE: Please explain the reasoning behind the starting time and levels of emission reductions results in scenarios with CCS.

To assist comments on the oil refining sector, below is an annotated version of the graph on refining emissions as presented on Slide 10 at the workshop on March 15, 2022. This graph includes projected emissions in the four Alternatives ("Alt") scenarios 1-4, plus BAU ("Business As Usual").

We interpret this graph to mean, as recommended by the Environmental Justice Advisory Committee ("EJAC"), Alt 1 for refineries does not include CCS. As a result, there is only one Alt 1 line shown, whereas Alts 2-4 are shown both with and without CCS. The three closely grouped solid lines which fall quickly prior to 2030 are Alts 2-4 *with* CCS. The dotted lines are Alts 2-4 *without* CCS.

[4] https://sequestration.mit.edu/tools/projects/quest.html
[5] See: https://www.cnbc.com/2022/01/24/shell-ccs-facility-in-canada-emits-more-than-it-captures-study-says.html "The hydrogen projects we're planning – like Polaris – will use a new technology that captures more than 90% of emissions."
[6] See: https://www.shell.ca/en_ca/media/news-and-media-releases/news-releases-2021/shell-proposes-large-scale-ccs-facility-in-alberta.html



Given that **no CCS units currently exist at California oil refineries**, and for reasons further detailed below, this sharp decline indicates magical thinking around the current state of California refineries and refinery carbon capture technology.

6. Please provide any underlying evidence base for the assumption that results in all three scenarios with CCS (Alternatives 2-4, shown as three tightly-grouped solid lines above) rapidly declining through 2030, *starting immediately.*

7. Please explain why non-CCS scenarios and CCS scenarios use different starting points of emissions. Why do CCS scenarios begin earlier at a lower level of refinery emissions (which might reflect low refinery production and emissions during the pandemic), yet all the non-CCS scenarios start at the higher level, apparently after refinery production and emissions increased again. Or is there another reason for the spike in emissions after 2021?

II. Carbon capture of high percentages of refinery carbon emissions is unlikely at refineries due to their complexity, and the infeasibility of adding controls to hundreds of massive combustion units and thousands of fugitive sources.

Setting any assumptions for a new technology for refineries must be, at least in part, informed by the immensely complex and large physical scale of oil refinery emissions sources and controls. Just last fall 2021, the South Coast Air Quality Management District (SCAQMD) adopted Regulation 1109.1 to address high emissions of Nitrogen Oxides (NOx) at oil refineries after years of rule development, and also after decades of failure of the NOx pollution trading program in the South Coast called RECLAIM.

This is relevant to the Scoping Plan analysis and modeling, because NOx is another combustion pollutant emitted with CO2 when hydrocarbon fuels are burned or otherwise used at oil refineries.[7] As a result, the data collected on these combustion sources, and the engineering difficulties in siting emissions controls, is also at issue in the Scoping Plan process related to evaluations of Carbon Capture equipment.

The South Coast District performed an updated assessment of the numbers and types of individual combustion units at South Coast refineries. As the largest oil refining region in California, it serves as a ready example of statewide issues and source of critical insights. The next largest region is the Bay Area, with additional substantial refining activities in Bakersfield and Santa Maria.

The South Coast 1109.1 regulation staff report included the following graphics, charts, and tables identifying the large number of major refinery and refinery hydrogen plant sources at play in the South Coast alone. Figure 5 for instance identifies 9 petroleum refineries, 3 small refineries, and 4 related Hydrogen Plants and Sulfuric Acid Plants that are substantial emissions sources (p. 2-1):

Figure 5. PR 1109.1 Affected Facilities

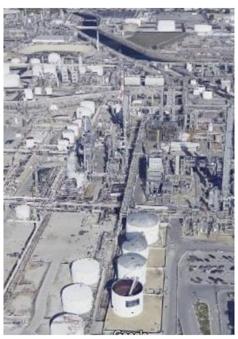
The SCAQMD report identified hundreds of major combustion sources within these facilities. Each one is massive - one refinery heater can combust as much fuel in an hour as four homes using natural gas burn in a year.[8] For a visual, the google map below shows two massive coker heaters at the Marathon (Tesoro) Wilmington refinery, out of the hundreds of combustion units at South Coast refineries and related operations. They dwarf the warehouses and container units seen across the channel and hide multiple burners inside. The NOx, CO2, and other pollutants emitted through the tall stacks are invisible.

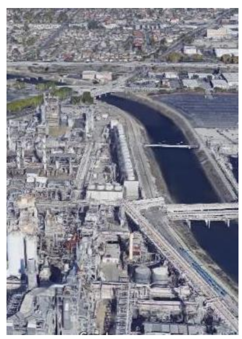
[7] For example, SCAQMD Rule 1109.1 staff report, p. A-1 describes combustion reactions resulting on both NOx and CO2 emissions, such as Fuel NOx Formation (R-N + O2 → NO, NO2, **CO2,** H2O, trace species), or Prompt NOx Formation (R + O2 + N2 → NO, NO2, **CO2**, H2O, trace species).

[8] A million BTUs (British Thermal Units) of heat content is present in approximately 1000 cubic feet of natural gas (which varies a little in energy content). *"**In 2012, the average U.S. home consumed** 61,200 cubic feet of natural gas (or **62.7 million Btu**)."* (American Gas Association Playbook, 2015, p. 78) So a refinery heater rated at 250 million BTUs per hour can burn the same amount of fuel hourly as about 4 homes burn in an entire year. (250/62.7 =~4)

[Google map of Marathon LA Refinery]

For an idea of the complexity of refineries in the Wilmington / Carson / W. Long Beach area, here are a few refinery views from google maps:





Panning further out shows the extreme density of the area, with 5 oil refineries (two Marathon, two Phillips 66, and one Valero), numerous warehouses and other industrial facilities, thousands of homes, and numerous schools and sensitive receptors:

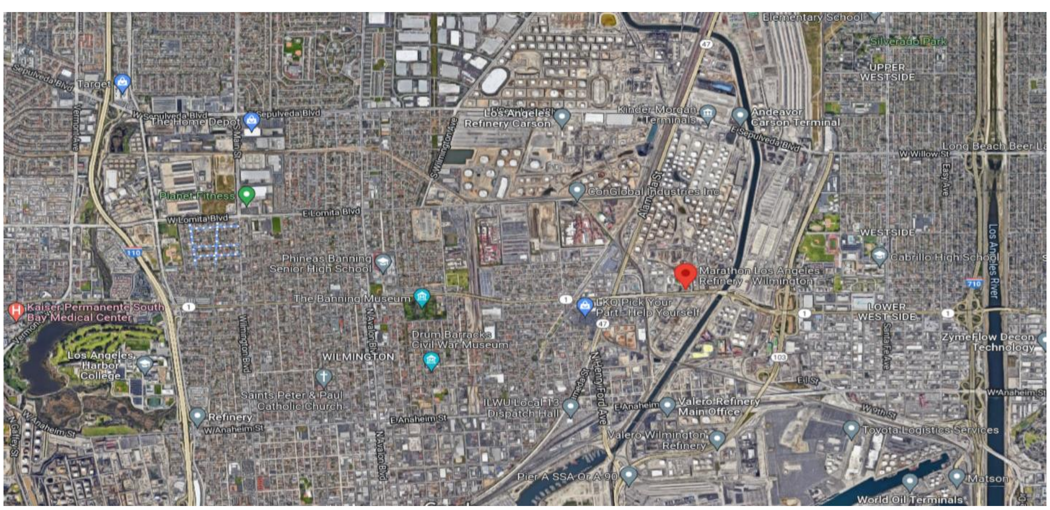


Table 2.1 from the South Coast staff report below identifies 228 Process and SMR[9] heaters and boilers in the South Coast, plus 56 other combustion units. (p. 2-3)

Table 2-1. PR 1109.1 Affected Equipment by Facility

	Process Heater/ SMR Heater/ Boiler	SRU/TG Incinerator	Vapor Incinerator	Gas Turbine	Start-Up Heater/ Boiler	FCCU	Coke Calciner	Flare
Tesoro-Carson	30	2	0	4	1	1	0	0
Tesoro-Wilmington	33	0	0	2	0	0	0	0
Tesoro-Sulfur Recovery Plant	0	2	0	0	0	0	0	0
Tesoro-Coke Calciner	0	0	0	0	0	0	1	0
Torrance	28	2	2	0	1	1	0	0
Chevron	37	4	5	4	1	1	0	0
P66-Carson	10	2	0	0	0	0	0	0
P66-Wilmington	34	2	0	1	2	1	0	0
Ultramar	19	1	0	1	1	1	0	0
AltAir	25	1	4	0	0	0	0	0
Lunday Thagard	5	0	2	0	0	0	0	0
Air Products-Carson	1	0	0	0	0	0	0	0
Air Products-Wilmington	1	0	0	0	0	0	0	0
Air Liquide	1	0	0	0	0	0	0	0
Eco-Services	0	0	0	0	2	0	0	1
Valero Asphalt Plant	4	0	0	0	0	0	0	0
Total	**228**	**16**	**13**	**12**	**8**	**5**	**1**	**1**

When faced with regulating the many combustion sources, oil refiners complained of the need for long timelines. The final rule includes implementation through 2035, fourteen years after adoption, in addition to a 3-year rulemaking process.

These issues illustrate the complexity of the detailed rulemaking process, engineering and design, and construction of complex oil refinery emissions controls. **These realities underline the absurdity of setting modeling assumptions (even if space could be found), that assume non-existent CCS technologies can be quickly constructed and implemented across broad parts of California oil refineries.** This is to say nothing of the high costs.

III. Carbon capture at scale is unrealistic at California refineries due to major limitations in physical space at oil refineries.

During many regulatory proceedings, oil refineries have successfully argued against adding pollution controls, based on physical space limitations. For example, SCAQMD relaxed the originally

[9] Steam Methane Reforming

proposed NOx standard under Regulation 1109.1 from the demonstrated achievable level of 2 ppm, up to 5ppm and higher. Refiners claimed it would require additional stages of Selective Catalytic Reduction (SCR) equipment to meet the 2ppm standard, without sufficient physical space available. The same combustion sources at refineries which emit NOx are also major emitters of GHGs – including hundreds of Boilers & Heaters identified in South Coast rulemaking.

The space issue was not a small or rare complaint. The Staff Report for SCAQMD Rule 1109.1 (Heaters and Boilers and Other Refinery Combustion Sources) identified widespread industry and Air District concerns about space constraints in extremely old facilities.[10] As reported in the Staff Report, the Fossil Energy Research Corporation Assessment (FERCo) conducted site visits to the five major refineries, Chevron, Marathon (Tesoro Refinery), Phillips 66, Torrance, and Valero, to evaluate and discuss facility constraints and challenges of implementing SCR on specific refinery systems. The main concern refinery stakeholders frequently raised to staff was the issue of space and the ability to install post-combustion control.[11] Based on the site visits, FERCo concluded that ***all the facilities exhibited space limitations to varying degrees.*** Not all open space that surrounds a unit is available for an SCR system, as ***open space may be necessary for maintenance work and thus, safety***.[12] As a result, advanced technology, engineering, and design for additional pollution controls are required specifically to address space constraints.[13] The cost for two facilities operating around 8 ppmv NOx to upgrade and meet 8 ppmv NOx was approximately $1 million to $3 million, but to completely replace the SCR or add new technology to meet 2 ppmv ***while addressing space constraints*** ranged from $75 million to $220 million.[14]

Another important example includes the South Coast Rule 1410 rulemaking process, which would have banned the use of deadly Hydrogen Fluoride or Modified Hydrogen Fluoride at two South Coast refineries. This regulation was killed by industry complaints, despite the County of LA's Health Dept. stating that the use of this chemical caused the risk of severe injury or death to a million people in the region. Despite the dire need for regulation, one reason given by the industry opposing the regulation was space constraints at the Valero Wilmington refinery: "Of particular note, available plot space adjacent to the existing HF alkylation unit was identified as a key criteria for success; ***as the District is well aware, such plot space does not exist at the Wilmington Refinery***."[15]

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[10] "The affected refineries were built 50 to over 100 years ago and while equipment has changed over the years, most of the equipment affected by the rule is old and **the spacing configuration of the sites are dense**. Thus, to install pollution control requires creative engineering and design to accommodate the space necessary and perform properly. Some projects currently taking place involve building vertically requiring deep earth pylons to support the structure housing the control technology or constructing complex ducting to house the SCR catalyst beds that stretch long distances horizontally away from the basic equipment", p. 2-19; "Replacing conventional burners with LNB or ULNB often requires special attention because of the flame dimensions and limited space within a refinery process heater," p. A-6; Refinery stakeholders immediately raised the concern that staff did not consider space availability and constraints for this type of design. Refineries cannot accommodate a second SCR reactor which makes the alternative pathway not technically feasible, p. B-20.

[11] p. 2-47.

[12] "Despite the space limitations, some facilities have devised several workarounds such as vertical SCR orientation, running ductwork over existing roadways, and replacement of air heaters with SCR reactors. In addition, FERCo also identified that the locations or sites for SCR installations may hold many unknowns such as electrical capacity for the SCR and uncertainties that can complicate foundation work such as underground pipes," p. 2-47.

[13] p. 2-36.

[14] p. 2-36.

[15] Valero letter to AQMD, Sept. 18, 2017 to Susan Nakamura, South Coast Air Quality Management District, In response to August 23 PR1410 Working Group Meeting, p. 2, available at: https://www.aqmd.gov/docs/default-

Especially after the adoption and planning of broad application of SCR (Selective Catalytic Reduction) controls for NOx, oil refinery real estate will be even more constrained. The record in these proceedings illustrates the foolishness of assuming that additional end of pipe emissions controls are a feasible choice even with regard to a well-established technology, unlike CCS, which does not exist at California refineries.

IV. Oil and chemical plant risk assessment literature states that increasing oil refinery density also increases dangers during fires and explosions.

Oil and chemical industry risk management literature also identifies the need to maintain adequate space for safety at oil refineries (which already regularly have major explosions and fires). For example, an analysis called *Oil and Chemical Plant Layout and Spacing* found:

> **Loss experience clearly shows that fires or explosions in congested areas of oil and chemical plants can result in extensive losses.** Wherever explosion or fire hazards exist, proper plant layout and adequate spacing between hazards are essential to loss prevention and control. Layout relates to the relative position of equipment or units within a given site. Spacing pertains to minimum distances between units or equipment. [16]

While this analysis identified many specific hazards, it recommended performing detailed site by site risk analysis, and identified general comments about access between process units. We have excerpted some recommendations to illustrate the complexity of the safety issues, but also request that CARB and modelers consider the entire document and its implications for realistic assessment of added CCS at oil refineries. Importantly, the final recommendation on this list, which was highlighted in bold by the authors, stated: "**Do not consider the clear area between units as a future area for process expansion.**"

> Provide access roadways between blocks to allow each section of the plant to be accessible from at least two directions.
>
> > • Avoid dead end roads. • Size road widths and clearances to handle large moving equipment and emergency vehicles or to a minimum of 28 ft (8.5 m), whichever is greater.
> >
> > • Maintain sufficient overhead and lateral clearances for trucks and cranes to avoid hitting piping racks, pipe ways, tanks or hydrants.
> >
> > • Do not expose roads to fire from drainage ditches and pipeways.

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source/rule-book/Proposed-Rules/1410/1410-comment-letters/valero-2017-09-18-working-group-meeting-5.pdf?sfvrsn=6

[16] Property Risk Consulting Guidelines, A Publication of AXA XL Risk Consulting, PRC.2.5.2, Copyright 2020, AXA XL Risk Consulting, available at: https://axaxl.com/prc-guidelines/-/media/axaxl/files/pdfs/prc-guidelines/prc-2/prc252oilandchemicalplantlayoutandspacingv1.pdf?sc_lang=en&hash=996EA28071174510C4DA5D35102A9222

• Slightly elevate roads in areas subject to local flooding. • Locate hydrants and monitors along roads to allow easy hook-up of firefighting trucks.

• Provide at least two entrances to the plant for emergency vehicles to prevent the possibility of vehicles being blocked during an incident, e.g., open bridge, railway.

• Plan and implement a "Roadway Closure" permit system authorized and controlled by site Emergency Response personnel as part of the site impairment handling system.

Provide spacing between units based upon the greater of either Table 1 or a hazard assessment. The space between battery limits of adjoining units should be kept clear and open.

Do not consider the clear area between units as a future area for process expansion.

Thus, increases in hazards at oil refineries through broad application of CCS at the hundreds of combustion units at oil refineries represents a *new* safety hazard, increasing the risk for workers and neighbors.

V. CARB Should Request New Modeling to Reflect a 2045 Phasedown Target Without CCS to Support a Commitment to a Statewide Plan to Manage Refinery Phasedown.

Ultimately, we urge CARB to begin crafting new modeling assumptions for the refining sector. We support the EJAC recommendation to model a 2045 phaseout date *without* the use of CCS. Currently, the initial modeling results are rife with cognitive dissonance between phasing out fossil fuel transportation while allowing oil refineries to continue operating in disproportionately pollution burdened communities of color.

California must lead by choosing modeling inputs that reflect the values of environmental justice *and* which will succeed in truly addressing impending climate disaster. Fossil fuel corporations repeatedly and regularly state to investors their intentions to *expand export*s of transportation fuels produced at California oil refineries (including gasoline, diesel, etc.), to add emissions during a climate crisis. Exporting outside of California over the Pacific Rim, prolonging the life of otherwise stranded assets which carry multi-billion dollar clean up liabilities, leaves California environmental justice communities holding the bag of continued harmful toxic emissions and eventual remediation liabilities or workers' pension losses at the point of bankruptcy. For a just and equitable transition, CARB must sound the alarm on the need for a fossil fuel worker and community safety net and commit to develop a plan by 2024 to manage the decline and coordinate the phasedown of California oil refineries by 2045. As the EJAC recommendations discussed and the comments above reflect, the oil refineries are enormously complex and require thoughtful and rigorous planning now.

We appreciate the hard work involved in this modeling, including the many valid assumptions and results that do appear. However, the public, both community-based organizations and corporations alike, need transparent access to the assumptions used and to understand which parts are unchangeable technical matters and which are a matter of policy choice.

We look forward to the background documentation so we can more fully comment in the future.

Sincerely;

Julia May, Senior Scientist, CBE Connie Cho, Associate Attorney, CBE

Kiran Chawla, JD/PhD Candidate, '24,
Stanford Environmental Law Pro Bono Project

Attachment C

Phyllis Fox, Ph.D., PE
Environmental Management
745 White Pine Ave.
Rockledge, FL 32955

Julia May
Senior Scientist
Communities for a Better Environment
6325 Pacific Blvd.
Huntington Park, CA 90255

Dear Ms. May:

As you requested, I have reviewed the Draft Environmental Analysis (DEA) for the California Air Resources Board's (CARB's) Scoping Plan[1] to evaluate the disposal of the large quantities of CO2 that would be captured from stationary industrial sources under the staff-proposed scenario.[2] Industries are the major source of CO2 in California, contributing 21.1% of the total statewide CO2. The major industrial sources of CO2 are refineries (6.9%) and cement plants (1.9%).[3] These percentages are only for CO2 and omit other greenhouse gases, including methane, nitrous oxide, and fluorinated gases.

CO2 captured from these facilities must either be used at or near the capture site or transported to another location for use or underground storage. The DEA does not identify local uses for the large quantities of CO2 that would be captured from refineries and cement plants. The largest contributor to the CO2 from these industrial sources is refineries located along the coast of California while the currently known suitable storage sites for captured CO2 are saline or depleted oil and gas reservoirs or oil fields recoverable by enhance oil recovery that are mostly located in the Central Valley of California.[4] Figure 1.[5]

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[1] CARB, Draft 2022 Scoping Plan, Appendix B, Draft Environmental Analysis; https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents.

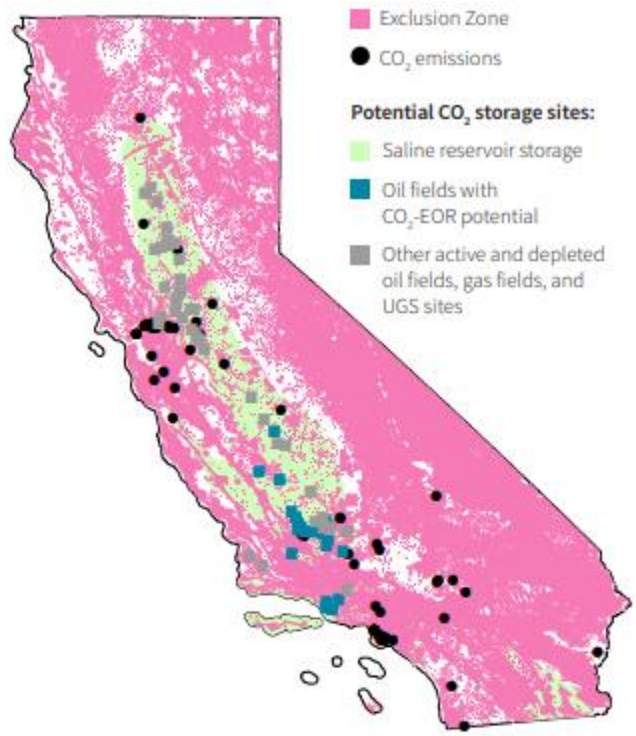
[2] CARB, Draft 2022 Scoping Plan Update, Table 2-2: Actions for the Proposed Scenario: AB 32 GHG Inventory sectors, pdf 86, *["Petroleum Refining", "CCS on majority of operations by 2030"]; https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents.*

[3] CARB, 2019 GHG Emission by Scoping Plan Sub-Category; https://ww2.arb.ca.gov/ghg-inventory-graphs.

[4] CARB, Carbon Capture and Sequestration Protocol under the Low Carbon Fuel Standard, August 13, 2018; https://ww2.arb.ca.gov/sites/default/files/2020-03/CCS_Protocol_Under_LCFS_8-13-18_ada.pdf. See also: http://gif.berkeley.edu/westcarb/images/maps/saline_formations.pdf; Larry Myer, An Overview of Geologic Carbon Sequestration Potential in California, CGS Special Report 183, September 30, 2005; https://www.osti.gov/servlets/purl/903323.

[5] Stanford, An Action Plan for Carbon Capture and Storage in California: Opportunities, Challenges, and Solutions, October 2020, pdf 87, Figure 3-11; https://sccs.stanford.edu/sites/g/files/sbiybj17761/files/media/file/EFI-Stanford-CA-CCS-FULL-rev2-12.11.20_0.pdf.

Figure 1. Potential CO2 Storage Sites



The captured CO2 can be transported by truck, rail, ship, or pipeline to storage and use sites. Transport by truck, rail, and ship are viable for small quantities, from 4 tonnes to a few hundred tonnes. Trucks can complement ship transport, moving small quantities of CO2 from port CO2 terminals to industrial sites for subsequent use. Trucks can also be used to move CO2 from the capture site to a nearby storage location. The cost of CO2 transport by truck and rail ranges from three to ten times more per tonne than by pipeline due to economies of scale. Given the large volumes of CO2 that would be captured from industrial sources in coastal areas, transport by truck and rail into the Central Valley and other distant locations for storage is not economical. Thus, most of the industrial CO2 is likely to be transported by pipeline to underground storage sites in the Central Valley. Figure 1.

The DEA generally acknowledges that "pipelines" will be used to transport CO2 to storage sites, mentioning pipelines 174 times. All of these citations appear to assume either existing pipelines or new pipelines can be used.[6] The DEA is silent on the form of the CO2 (gas, liquid) and the type of pipelines that would be used to transport CO2, apparently assuming

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[6] See DEA, pdf 35, 55, 101, 122, 146-147, 166-167, 204, 215, 217, 221, 226, 229, 231, etc.

conventional pipelines.[7] However, "…new and specialized pipelines are needed as existing pipelines that transport other fluids are not designed to accommodate the high pressures required for CO2 transport."[8] Existing oil and gas pipelines cannot be used as impurities in the CO2 stream, including water, can cause damage to pipelines and lead to dangerous leaks and explosions as the compressed fluid rapidly expands to a gas. The exceedingly cold temperatures can also cause pipelines and supporting equipment to become brittle.[9] (Even with temperatures within the pipeline above ambient temperature, during a release, the temperature of high-pressure CO2 drops drastically, potentially to very low temperatures, overcoming the fracture toughness of the pipeline.[10]) The DEA is silent on the type of pipelines that will be required and the risks that they pose.

Pipeline transport of CO2 is currently usually in a supercritical state[11] at a pressure greater than 74 bars and a temperature higher than 31° C. In this phase, the CO2 is a highly compressed fluid that has properties of both a liquid and a gas. This phase is called a dense fluid or supercritical fluid to distinguish it from normal vapor and liquid.[12] This type of transportation requires energy to maintain adequate pressures and may require midway recompressions, depending on distance.[13]

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[7] See, for example, the discussion at pdf 122, p. 108, Impact 6.b, Section (e) Mechanical Carbon Dioxide Removal and Carbon Capture and Sequestration Actions; the discussion at pdf 166-167, pp. 152-153, Impact 10.b, Section (d) Mechanical Carbon Dioxide Removal and Carbon Capture and Sequestration Actions., which refers to "…construction of new infrastructure, such as pipelines, wells, etc…" and Impact 113.b: Section (e) Mechanical Carbon Dioxide Removal and Carbon Capture and Sequestration Actions, which refers to "…existing or new industrial facilities to capture CO2 emissions and construction of new infrastructure, such as pipelines, wells…"

[8] Stanford, October 2020, pdf 59.

[9] Resources for the Future, Carbon Capture and Storage 101, Transportation Challenges, May 2020, updated February 3, 2022; https://www.rff.org/publications/explainers/carbon-capture-and-storage-101/?gclid=Cj0KCQjw4uaUBhC8ARIsANUuDjWtOIEgdpaBXahlwXhDwCQvDixiPm-lahCf7wcfslZsPs4gVZ2T6soaAp9MEALw_wcB.

[10] Pressure responses and phase transitions during the release of high pressure CO2 from a large-scale pipeline, Guo et al, School of Chemical Machinery and Safety, Dalian University of Technology, Dalian, China, pp. 3-4, *["The rupture of a CO2 pipeline will result in a series of expansion waves that propagate into the undisturbed fluid in the pipe*. ***Significant Joule-Thomson cooling associated with the rapid expansion of the inventory can result in very low and potentially harmful temperatures in the fluid and pipe wall*** *[14]. The precise tracking of these expansion waves and temperature variations, and their propagation as a function of time and distance along the pipeline, is necessary to predict a pipeline's propensity to fracture [15]*. ***A pipeline failure (most commonly a puncture) may escalate to a fracture if the force acting on the defect overcomes the fracture toughness of the wall material. The fracture may be either in the ductile or brittle regime depending on the nature of the rupture*** *[16]."];* https://core.ac.uk/download/pdf/81676078.pdf.

[11] Stanford, October 2020, pdf 59.

[12] Club CO2, CO2 Transport; https://www.club-co2.fr/en/content/co2-transport#:~:text=When%20transported%20via%20pipeline%2C%20the,recompressions%2C%20depending%20on%20the%20distance.

[13] Stanford, October 2020, pdf 59.

The word fluid refers to anything that will flow and applies to gas and liquid. Pure compounds in the dense phase normally have a better dissolving ability than they do in their liquid state. Compounds in the dense phase have a viscosity like that of a gas, but a density closer to that of a liquid. The dense phase is the best condition for transporting CO2 and injecting it into saline formations for geologic storage and into oil and natural gas reservoirs for enhanced oil recovery (EOR).[14]

The pipeline transportation of CO2 should have been addressed in the DEA as the Pipeline and Hazardous Materials Safety Administration (PHMSA) currently has no regulations applicable to pipelines transporting CO2 as a gas, liquid, or in a supercritical state at concentrations of CO2 less than 90%.[15] Many other regulatory gaps have been identified in this cited analysis and others below, including for supercritical CO2 fluid at concentrations above 90%.[16] These regulatory gaps mean that current federal pipeline safety regulations are inadequate because CO2 pipeline companies could develop CO2 gas and liquid pipelines that fall outside of this narrow federal rule. CO2 pipelines could be designed, constructed, operated, and maintained with no federal or state oversight.[17] The DEA has failed to bridge this gap.

In order to safely carry the condensed, highly pressurized fluid CO2, pipelines must be designed for CO2 as existing oil and gas pipelines cannot be used. Pipeline transport of CO2 poses potentially significant environmental issues that are not addressed in the DEA. Accidents resulting in releases from CO2 pipelines are distinct from releases from hydrocarbon liquid or natural gas transmission pipelines for many reasons as follows:

First, CO2 is transported as a fluid that is pumped through pipelines at high pressure. Significant energy is required to compress CO2 and maintain high pressure throughout the pipeline. The generation of this energy is a source CO2 and other pollutants.

Second, impurities in the captured CO2, including water and hydrogen sulfide (H_2S), can cause damage to pipelines, leading to dangerous leaks and explosions as the compressed fluid rapidly expands to a gas.[18] A recent report, for example, concludes:[19]

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[14] National Petroleum Council, Meeting the Dual Challenge, A Roadmap to At-Scale Deployment of Carbon Capture, Use, and Storage, Chapter Six – Co2 Transport, p. 6-3, December 2019, updated March 12, 2021; p. 6-3, https://dualchallenge.npc.org/files/CCUS-Chap_6-030521.pdf.

[15] Richard Kuprewicz , Accufacts' Perspectives on the State of Federal Carbon Dioxide Transmission Pipeline Safety Regulations as it Relates to Carbon Capture, Utilization, and Sequestration within the U.S., pp. 1, 4, March 23, 2022; https://pstrust.org/wp-content/uploads/2022/03/3-23-22-Final-Accufacts-CO2-Pipeline-Report2.pdf.

[16] Ibid.. For example, pp.1-2 *['Moreover, even the regulations for supercritical CO2 pipelines are incomplete or inadequate and place the public at great risk, especially from the tens of thousands of miles of CO2 pipelines that may be driven by CCS efforts."]*

[17] Ibid.. pp. 5-6

[18] Resources for the Future, Carbon Capture and Storage 101, May 2020, updated February 3, 2022, Transportation Challenges.

> Hydrogen sulfide, or H_2S, is mentioned here because of a supercritical state CO_2 pipeline rupture failure in Satartia, Mississippi in early 2020. First responders reported seeing a "green cloud" from the pipeline release, which is a possible indication of high levels of H_2S. The Center for Disease Control has stated that H_2S levels of 300 ppm or higher are "immediately dangerous to life or health."

Further, water in the CO2 stream can form carbonic acid in the pipeline, which is incredibly corrosive to carbon steel.[20] The U.S. DOT's PHMSA regulations do not limit water in CO2 pipelines, an omission that could lead to accidents.[21]

Third, CO2 is currently usually shipped in pipelines in a supercritical state, which makes pipelines more susceptible to ductile fractures that "unzip" the steel and open great lengths of the pipeline.[22] A rupture in a high pressure CO2 pipeline will eject CO2 "…in a dense, powdery white cloud that sinks to the ground and is cold enough to make steel so brittle it can be smashed with a sledgehammer."[23] These extreme rupture forces throw tons of pipe, pipe shrapnel, and ground coverings, generating large craters along the failed pipeline. It is well known that CO2 pipelines operating in dense phase, either supercritical or as a liquid, are particularly susceptible to such running ductile fractures.[24]

Fourth, because CO2 is a dense gas that is heavier than air, it will form clouds of cold dense gas fog, which, upon warming, flow considerable distances from the pipeline unobserved, displacing oxygen while settling or filling in low areas as it is colorless, odorless and non-flammable and thus difficult to locate. These plumes may persist at the ground surface rather than rise upwards and quickly dissipate.[25] Thus, CO2 releases from pipelines can adversely affect exposed parties. Because CO2 is heavier than air, a small amount can travel for miles and fall into low-lying areas where it could adversely affect nearby people and first responders.[26] Because CO2 gas is odorless, colorless, and doesn't burn, CO2 pipeline releases are harder to

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[19] Pipeline Safety Trust, CO2 Pipelines – Dangerous and Under-Regulated, March 30, 2022, p. 4; https://pstrust.org/wp-content/uploads/2022/03/CO2-Pipeline-Backgrounder-Final.pdf.

[20] Ibid., pdf 4.

[21] Ibid., pdf 4.

[22] Ibid., pdf 3.

[23] Dan Zegart, The Gassing of Satartia, Huff Post, August 26, 2021; https://www.huffpost.com/entry/gassing-satartia-mississippi-co2-pipeline_n_60ddea9fe4b0ddef8b0ddc8f.

[24] Kuprewicz 2022, p. 6.

[25] Pipeline Safety Trust, 2022, p. 2.

[26] CO2 Pipelines Are Coming. A Pipeline Safety Expert Says We're Not Ready; https://bestwriteit.com/co2-pipelines-are-coming-a-pipeline-safety-expert-says-were-not-ready/. See also Pipeline Safety Trust, 2022 ("Upon warming, CO2 plumes flow considerable distances from the Pipeline unobserved, traveling over terrain, displacing oxygen while settling or filling in low areas.")

observe and avoid, especially as a released plume can spread and migrate well off the pipeline right-of-way.[27]

Fifth, liquid CO2 is a powerful cerebral dilator. At concentrations between 2% and 10%, it can cause nausea, dizziness, headache, mental confusion, and increased blood pressure and respiratory rate. Above 8%, nausea and vomiting appear. Above 10%, suffocation and death can occur within minutes.[28] Thus, the principal health risk of a high-pressure CO2 leak is asphyxiation of bystanders (>10% by volume as CO2 s at high concentrations in air) and rapidly fatal at very high concentrations (>25%). CO2 accidents kill 100 workers a year.[29]

Sixth, in contrast to pipeline leaks of hydrocarbons, the lack of odor and invisibility of CO2 means that it may not be possible for exposed parties to determine if they are in a hazard area before they are harmed, unless they have access to a CO2 detection meter. A pipeline expert explained that "[o]nce a CO2 pipeline release has been warmed by the surrounding environment, it travels unseen influenced by gravity, terrain, and the wind, preferentially settling in low spots, displacing air and providing no warning to persons and animals caught in the invisible release plume."[30] Conventional hydrocarbon releases can usually be detected by smell or sight.

In sum, existing pipeline safety regulations do not address the risks of leaks from CO2 pipelines, which are reported to have "terrifyingly large gaps on carbon dioxide pipelines."[31] A recent review concluded:[32]

> The Pipeline and Hazardous Materials Safety Administration (PHMSA) currently exercises no jurisdiction over pipelines transporting CO_2 as a gas or liquid, and only regulates CO_2 pipelines with a concentration of more than 90% carbon dioxide compressed to a supercritical state, rendering any pipeline moving CO_2 in any other state or with less than 90% purity entirely unregulated by the federal pipeline safety agency. There are other large regulatory gaps around siting, fracture mitigation, determining potential impact areas, use of odorant, emergency response, and contaminants.

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[27] Kuprewicz 2022, p. 8.

[28] Universal Industrial Gases, Inc., Material Safety Data Sheet: Liquid CO2; https://looksolutionsusa.com/wp-content/uploads/2015/08/co2_msds.pdf.

[29] Justine Calma, Watch Out for a New Generation of Pipelines, August 26, 2021; https://www.theverge.com/2021/8/26/22642806/co2-pipeline-explosion-satartia-mississippi-carbon-capture.

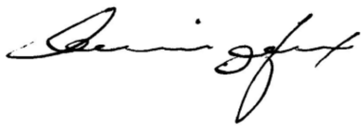
[30] Kuprewicz 2022, p. 8.

[31] Kuprewicz 2022; See also: Richard Kuprewicz, Pipeline Lessons #1; https://www.youtube.com/watch?v=L5ikPFK0vvo.

[32] Pipeline Safety Trust, CO2 Pipelines – Dangerous and Under-Regulated, March 30, 2022, pdf 2; https://pstrust.org/wp-content/uploads/2022/03/CO2-Pipeline-Backgrounder-Final.pdf.

The DEA is silent on these risks, which should have been evaluated in a risk of upset analysis and a health risk assessment.[33]

Sincerely,



Phyllis Fox, Ph.D., PE

[33] See, for example, Alberto Mazzoldi and Curtis M. Oldenburg, Leakage Risk Assessment of CO2 Transportation by Pipeline at the Illinois Basin Decatur Project, Decatur, Illinois, October 19, 2011, Revised February 26, 013; https://www.osti.gov/servlets/purl/1164323.

Attachment D

COMMUNITY ENERGY reSOURCE

Comment before the

California Air Resources Board (CARB)

regarding the

Draft 2022 Scoping Plan Update

and its

Draft Environmental Assessment

Technical Report

Greg Karras, Community Energy reSource
Prepared for the California Environmental Justice Alliance (CEJA)

22 June 2022 – Revised 24 June 2022

CONTENTS

On 10 May 2022 the California Air Resources Board ("CARB") released the Draft 2022 Scoping Plan Update ("Draft Scoping Plan") and Draft Environmental Analysis for the proposed Draft 2022 Scoping Plan for Achieving Carbon Neutrality ("Environmental Analysis" or "EA") for public review and comment.

This technical report focuses on the adequacy of the Draft Scoping Plan and EA in addressing potential climate, air quality, and environmental health impacts associated with (1) petroleum refining for export, (2) diesel biofuel addition to combustion fuel chains, and (3) the timing of proven measures that can be used to reduce petroleum fuel chain emissions by phasing down California refining rates.

1 Potential emission impacts from unlimited petroleum refining for export.

California hosts the predominant petroleum refining center in Western North America, which has been built and expanded over decades to fuel in-state and cross-border markets.[1] Refining for export is baked into the fuel chain linked to the refineries, reinforced by business imperatives to produce from otherwise idled refining assets and seek returns to scale. Increasing refining for export is strongly linked to decreasing in-state demand for refined fuels by the State's own data.[2] In its Draft Scoping Plan however, CARB relies upon the disproven assertion that reduced in-state fuels demand alone will proportionately reduce in-state refining rates to propose needed petroleum demand reduction measures while rejecting calls for direct curbs on in-state refining. The Draft Scoping Plan could thereby further increase petroleum refining for export, resulting in significant local air quality and global climate impacts.

1.1 State policy has increased California petroleum refining for export.

1.1.1 California climate policies have set no direct refinery emission control standard

California climate policies have set no curbs on in-state refining rates. Standards limiting production rates or "throughput" limit increased refining rates to produce excess fuel for export. This is because oil flow through the petroleum fuel chain—the series of interdependent steps that extract crude, refine it into useable fuels, and burn those fuels for energy in transportation and industry—would be limited by the throughput of the refining link in the fuel chain. Absent such standards, the cap-and-trade program, which does not apply to emissions from burning exported fuels, and Low-Carbon Fuel Standard ("LCFS"), which does not apply to fuel chain emissions associated with exported fuels, cannot curb and have not curbed increasing refining for export.[3]

1.1.2 State policy has at the same time helped to reduce in-state demand for petroleum fuels

The Draft Scoping Plan and EA identify existing measures to reduce emissions by reducing in-state demand for petroleum fuels, including motor vehicle fuel efficiency and zero emission vehicle standards, measures to curb vehicle miles traveled, fuel substitution incentive measures, and others.[4] The Draft Scoping Plan asserts that existing measures contributed to reduced in-state petroleum fuels demand, and projects that they will continue to do so, in its quantitative Reference Scenario modeling.[5] In-state petroleum fuels demand has begun to decline (§§ 1.1.3). Stronger in-state petroleum demand reduction measures are a clearly necessary component of achieving a just transition from oil for climate stabilization. But effective measures upstream and mid-stream in the petroleum fuel chain are needed as well. Indeed, presuming that in-state

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[1] See CEJA, *Climate Pathways in an Oil State* Prepared by Greg Karras. Feb 2022; and CBE, *Decommissioning California Refineries* Prepared by Greg Karras. Jul 2020.

[2] See CEJA, *supra*; CBE, *supra*; CARB, *Fuel Activity for California's Greenhouse Gas Inventory by Sector & Activity (Fourteenth Ed.: 2000 to 2019)* Jul 2021; and California Energy Commission (CEC), *Refinery Inputs and Production* Jun 2022 (Fuel Watch data). See also Exhibit 1, appended hereto, for the CARB and CEC data.

[3] CBE, *supra*

[4] See Draft Scoping Plan, pages 8, 18, 26–30, 56, 148, 153. 167; and EA Appendix A, pages 13, 33–39, and 56–62.

[5] See Draft Scoping Plan Modeling Information, AB 32 GHG Inventory Sectors Modeling Data Spreadsheet, May 2022. Energy Demand tab.

demand reduction alone will reduce in-state refining rates, and failing on that presumed basis to apply direct control measures to refineries, has backfired.

1.1.3 State data document the resultant dramatic rise of in-state refining for export

California collects, verifies and reports high quality data for refinery production[6] and fuels use[7] in the state, from which net fuels exports can be derived (the State is a net petroleum fuels exporter;[8] its excess refinery production is sold to other states and nations[9]). Decadal volumes for gasoline and petroleum distillate ("PD")[10] from these data are compared in Table 1. These multi-year volumes provide more accurate and reliable information about real structural trends, which can be masked by short-term variability due to factors unrelated to the structural trend, such as economic cycles.[11]

Review of Table 1 reveals first that a long-term structural decline in statewide demand for the major petroleum ground transportation fuels has begun, and second, the resultant increase in the export of those fuels. Consistent with their business imperatives to produce from otherwise idled assets and seek returns to scale, California refiners shifted more of their production to exports as in-state demand for those fuels declined.

As compared with the decade from 2000–2009, during 2010–2019 in-state demand for total gasoline and petroleum distillate (PD) combined fell by approximately 320 million barrels (Mb) or seven percent, while California refinery exports of these fuels rose by ≈423 Mb, or 71 percent. See Table 1. Instead of phasing down their production of petroleum ground transportation fuels when in-state demand for these fuels declined, statewide refiners more than compensated for the in-state decline by refining for export.

California refinery production increased over these decades, and although it shifted among the fuels, this is why refinery exports exceeded the demand decline shown in Table 1. PD production rose by ≈135 Mb during 2010–2019 compared with 2000–2009 (Exhibit 1) as PD demand fell by ≈16 Mb (Table 1), accounting for the ≈151 Mb rise in PD exports shown (135 + 16 = 151).

Expanding State climate efforts did not stop further export growth during 2010–2019. California refiners remained major net exporters of gasoline and PD to other states and nations.[12] Refining for export served the transportation fuels link of their fuel chain in other US states, primarily Arizona, Nevada and Oregon, and other nations, primarily on the Pacific Rim.[13] Refining for export accounted for ≈350 Mb, or 21 percent of total California refined fuels production during 2013–2015, rising to ≈412 Mb, or 24 percent during 2017–2019.[14] Those figures exclude jet fuel and are larger still when jet fuel burned in cross-border flights is included.[15]

[6] CEC, *supra;* Exhibit 1 appended hereto.
[7] CARB, *supra;* Exhibit 1 appended hereto.
[8] Energy Information Administration (EIA) *West Coast Transportation Fuels Markets* Sep 2015.
[9] *Id*.
[10] This acronym for petroleum distillate ("PD") is used for brevity as the term is repeated for precision in the text.
[11] Similarly, this analysis generally excludes data that reflect the anomalous transportation energy conditions observed during the COVID-19 pandemic and thus can mask long term structural trends.
[12] EIA, *supra*
[13] *Id*.
[14] CEJA, *supra*
[15] *Id.*

Table 1. California-refined Gasoline and Distillate-diesel: Decadal Changes in California Demand and Exports to Other States and Nations, 2000–2019.

Total volumes reported for ten-year periods

	Volume (millions of barrels)		Decadal Change (%)	
	Demand	Exports	Demand	Exports
Gasoline				
1 Jan 2000 to 31 Dec 2009	3590	358	—	—
1 Jan 2010 to 31 Dec 2019	3270	630	–9 %	+76 %
Distillate-diesel				
1 Jan 2000 to 31 Dec 2009	940	235	—	—
1 Jan 2010 to 31 Dec 2019	924	386	–2 %	+64 %
Gasoline and diesel				
1 Jan 2000 to 31 Dec 2009	4530	593	—	—
1 Jan 2010 to 31 Dec 2019	4190	1020	–7 %	+71 %

Data from CARB, *Fuel Activity Inventory* and CEC *Fuel Watch*. Figures may not add due to rounding.

Compared with 2010 rates, during 2011–2019 statewide PD exports rose by ≈69 Mb on PD production and demand increments of ≈84 Mb and ≈15 Mb, respectively. See Exhibit 1 for data. Volumetric equivalence of these distillate fuel shifts—refiners exported 69 Mb more on a refining increment of 84 Mb after serving 15 Mb more demand—is further confirmed by partial least squares regression analysis on annual data for total distillate use and export from 2010 through 2019.[16]

In an extraordinary omission, however, this crucial information for climate stabilization measures planning is not disclosed or addressed in the Draft Scoping Plan.

1.2 The Draft Scoping Plan could further increase refining for export.

Assuming that refineries here will automatically shrink themselves "in line with demand" for their fuel sales here alone, the Draft Scoping Plan ignores the supply-demand imbalance by which State policy has contributed to increased refining for export. It would establish no direct refinery emission control standard while at the same time worsening that very supply-demand imbalance which increased refining for export.

Though wrong about the resultant impact, CARB itself projects this supply-demand imbalance. Its modeling for its proposed alternative projects that combined in-state demand for gasoline, PD and petroleum jet fuel during 2023–2030 and 2023–2045 would fall by cumulative totals of 14.32 and 24.24 exajoules, respectively, from 2015–2019 levels.[17] Based on CARB fuel energy density data[18] and the analysis of State data described in §§ 1.1.3, this equates to potential export increments of ≈214 Mb by 2030 and ≈953 Mb by 2045.

[16] Partial least squares regression results for analyses of data in Exhibit 1 are appended hereto as Exhibit 2.
[17] CARB *AB32 GHG Inventory Sectors Modeling Data Spreadsheet* May 2022. Energy Demand, *in* California PATHWAYS Model Outputs.
[18] LCFS Regulation Order, Title 17, CCR, §§ 95480–95503.

1.3 The Draft Scoping Plan is likely to result in major greenhouse gas and co-pollutant increases associated with refining for export in communities near California refineries.

This potential for 214 Mb of additional refining for export by 2030 and 953 Mb by 2045 would emit criteria and other toxic air pollutants into communities near California refineries, pollution that would be directly linked to the greenhouse gas ("GHG")[19] combustion emissions exported with the refined fuels. Refinery criteria pollutant emission rates are directly related to refining rates at any given pollutant emission intensity. Some 50 years of State and federal emissions control effort demonstrate this direct relationship, which supports emission standards that are expressed as process rate "throughput" in refinery air permits and CARB's acknowledgment of ongoing elevated health risk in Black and Brown communities near industries like refineries.[20]

Supply-demand imbalances that drive these increased community health risks from refining for export would increase to a greater extent under the Draft Scoping Plan than its no project alternative.[21] Moreover, toxic effects of air pollutants are a function of the duration or repetition of exposure along with the inherent toxicity of the chemicals and their concentration in the air we breathe. Thus, by resulting in new and prolonged exposures to harmful air pollutant emissions associated with prolonged or increased refining for export, the Draft Scoping Plan could result in significant air quality and environmental health risk impacts.

1.4 The Draft Scoping Plan could result in major climate impacts from emission-shifting associated with refining for export in conflict with state climate law.

1.4.1 State law requires minimizing GHG emission-shifting to the extent feasible

CARB argues that despite rejecting direct refinery control measures the Draft Scoping Plan demand reduction measures would reduce GHG emissions from petroleum fuels in California. Though correct as to that limited point, CARB's analysis is incomplete; it ignores the resultant emission shifting. GHG emissions impact climate globally wherever GHG emits. Recognizing this, the California Health and Safety Code requires CARB to minimize emission shifting, which the Code defines as "a reduction in emissions of greenhouse gases within the state that is offset by an increase in emissions of greenhouse gases outside the state." Cal. Health & Safety Code §§ 38505 (j), 38562 (b) (8). But by rejecting feasible direct refinery control, the Draft Scoping Plan would expand an incomplete set of measures which already results in the GHG emission shift defined. This would appear to conflict with State climate law.

1.4.2 The Draft Scoping Plan could increase petroleum emissions outside the state as much or more than its demand-side measures cut petroleum emissions in state

CARB could have used the evidence described in § 1.1 and other available data to estimate the GHG emission shift that could result from its in-state fuels demand cuts without direct curbs on refining under the Draft Scoping Plan. Table 2 provides an example.

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[19] Herein, "GHG" means carbon dioxide equivalents (CO_2e) at the 100-year climate forcing horizon.

[20] Draft Scoping Plan at page 15. Numeric emission limits expressed as throughput have long been applied to California refineries in Clean Air Act Title V air permits. This comment incorporates additional information regarding health risks of refining for export in part 3 herein.

[21] Compare Alternative 3, Reference Scenario in CARB *AB32 GHG Inventory Sectors Modeling Data Spreadsheet* (*supra*) for potential to induce refining for export.

Table 2. Potential cross-border GHG emission shift due to increased refining for export that could result from Draft Scoping Plan implementation, example estimate [a]

GHG: CO_2e, 100-year GWP **Mb:** million barrels **b:** barrel; 42 U.S. gallons
CI: carbon intensity in kg/b **MMT:** million metric tons

Petroleum shift increments		Baseline [b]	Potential Emission Shift Increments [c]	
		2013–2019	2023–2030	2023–2045
Cross-border fuels exports				
volume	(Mb)	—	214	953
combustion CI	(kg/b)	395.5	395.5	395.5
combustion GHG	(MMT)	—	84.6	377
Crude imports refined for export				
volume	(Mb)	—	190	844
extraction CI	(kg/b)	79.14	79.14	79.14
extraction GHG	(MMT)	—	15.0	66.8
Net GHG increments	(MMT)	—	100	444

a. Estimated shift for gasoline, petroleum distillate and jet fuel only; estimates for all refined fuels may exceed values shown. **b.** Baseline carbon intensity (CI) values estimated from State data for 2013–2019 in CEJA (2022) Table S1. Post-2019 data are excluded from this baseline due to anomalous conditions during COVID. Baseline volumes, from Draft Scoping Plan fuel energy modeling, which was not reported before 2015, are from 2015–2019. **c.** Cumulative volume and mass emission increments from baseline: Fuel volumes are from Draft Scoping Plan fuels energy modeling and fuel energy densities in the CARB LCFS Regulation Order. Crude volumes from fuel volumes and processing volume expansion based on data in CEJA (2022) Table S1. Shift increments estimated at the 1:1 ratio shown from data discussed in §§ 1.1.3 herein, conservatively assuming no increase in the CI or in-state refinery production of crude or fuels. Figures may not add due to rounding.

As shown in § 1.2 CARB projects cumulative in-state petroleum fuels demand cuts that could result from the Draft Scoping Plan, –214 Mb by 2030 and –953 Mb by 2045, on an energy-equivalent volume basis. CARB could have applied the volumetric equivalence of petroleum fuel shifts described by State data (§§ 1.1.3) to estimate the cross-border fuels export shifts shown in Table 2. Similarly, it could have used State refinery crude input and fuels production data[22] to quantify the effect of volume expansion during processing and estimate the slightly lower crude volume increments that would be imported for this refining for export, also shown in Table 2. This is relevant because in-state crude supply has dwindled below that needed to meet in-state fuels demand alone,[23] so that cross-border extraction emissions would occur from crude import increments linked to the refining-for-export increments.

Baseline fuel combustion and imported crude extraction carbon intensity ("CI") values shown in Table 2 are from State data for statewide refining from 2013–2019.[24] Conservatively assuming no further increase in CI or refinery production, CARB could have applied these CI values to the emission shift volumes in Table 2. As shown in the table, these data support potential GHG emission shift increments of ≈100 million metric tons (MMT) by 2030 and ≈444 MMT by 2045.

These 100 MMT and 444 MMT GHG increments outside the state, however, do not include emissions associated with Draft Scoping Plan measures that reduce in-state petroleum fuels demand. In one important example, CARB has estimated GHG emissions associated with

[22] CEJA, *Climate Pathways in an Oil State* Prepared by Greg Karras. Feb 2022. See data in Table S1.
[23] *Id.*
[24] *Id.*

renewable diesel elsewhere,[25] and the Draft Scoping Plan relies upon renewable diesel for in-state petroleum fuels demand reduction to a considerable extent.[26] Had CARB considered all available data and information, it could have found that the Draft Scoping Plan petroleum demand reduction measures—alone, absent direct refinery control measures—have a reasonable potential to increase cross-border GHG emissions by substantially more than these measures would decrease in-state GHG emissions.

1.4.3 A feasible measure the Draft Scoping Plan excludes could minimize emission shifting

CARB can establish standards limiting refinery throughput rates. As explained above, this could limit in-state refining for export because oil flow through the petroleum fuel chain would be limited by the throughput of its in-state refining link. Moreover, this measure may be required to minimize GHG emission shifting and, at a minimum, that requirement further supports its feasibility.

1.5 The Environmental Assessment (EA) is factually incomplete.

Presuming that in-state petroleum refining will phase down in line with demand without any direct refinery emission control measure is an error. The EA does not identify, describe, assess, or analyze mitigation for the air quality, environmental health, or climate impacts associated with refining for export and emission-shifting that could result from the Draft Scoping Plan. A feasible measure could lessen or avoid these impacts.

2 Potential emission impacts from enhanced growth of diesel biofuel that fails to replace petroleum distillate fuel

Outcomes recorded by the State's own data disprove the hypothesis that diesel biofuel use reduces GHG emissions by replacing petroleum distillate-diesel in the combustion fuel chain. Without disclosing or addressing this evidence, the Draft Scoping Plan would expand financial and policy support to further increase diesel biofuel production and combustion in California. This action could result in significant climate, air quality, and health impacts by further shifting petroleum distillate refining to export, increasing emissions from refining for export locally and distillate fuels globally. The EA does not identify or mitigate these potential impacts.

2.1 State policy has increased GHG emissions associated with distillate fuels production and combustion.

2.1.1 State biofuel policy supports diesel biofuel growth financially based on a hypothesis that adding diesel biofuel to the combustion fuel chain reduces GHG emissions by replacing higher-emitting petroleum distillate (PD) fuel globally

As the Draft Scoping Plan states: "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

[25] LCFS Regulation Order, Title 17, CCR, §§ 95480–95503.
[26] Draft Scoping Plan at pages 18, 153; Draft Scoping Plan, Appendix H, at page 61.

development, and interviews with industry representatives and independent experts, point to [the] LCFS as a more important factor in market development, at least in recent years."[27]

The LCFS seeks to reduce the carbon intensity ("CI"), not the amount or mass emissions, of transportation fuels through a system of financial credits and debits in which credits are tradeable among companies that supply fuels used in California.[28] It assigns these credits and debits based on the energy equivalent "gallons" supplied, and the calculated CI of each fuel relative to a declining statewide CI standard.[29] Suppliers of California fuels deemed lower-CI than petroleum fuels can thus receive credits based on this energy equivalent gallon-for-gallon comparison. An LCFS credit was worth an average of $17 in 2012, rising to $192 in 2019.[30] Diesel biofuel ("DB")[31] suppliers received ≈25.4 million LCFS credits during 2011–2019.[32]

Apart from its success in reducing the carbon intensity of statewide fuels, however, the LCFS has not confirmed that DB reduced climate impacts of GHG emissions associated with PD by actually *replacing* PD. CARB suggests that DB "displaced" PD.[33] To where, it does not say. Refinery PD production increased.[34] In effect, State policy gave distillate fuel refiners LCFS credits based on the hypothesis that DB replaces PD.

2.1.2 In fact, diesel biofuel additions in California are not replacing, but adding to, petroleum distillate globally

Observed outcomes provide evidence to disprove the hypothesis that DB reduces GHG emissions by replacing PD. Adding DB to the PD refined in California added volume to the total distillate combustion fuel chain.[35] Instead of curtailing otherwise productive assets, California refiners further shifted to refining for export.[36] California PD production increased, and PD combustion increased globally.[37]

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27 Draft Scoping Plan at page 18.
28 LCFS Regulation Order, Title 17, CCR, §§ 95480–95503.
29 *Id.*
30 CARB *Monthly LCFS Credit Transfer Activity Reports* Accessed Jun 2022.
31 This acronym for diesel biofuel ("DB") is used for brevity as the term is repeated for precision in the text. DB includes biodiesel and renewable diesel.
32 CARB *LCFS Quarterly Summary Report* Accessed Jun 2022.
33 *Id*.
34 CEC *supra*. The CEC defines petroleum distillate as the mix of No. 1, No.2 and No. 4 diesel and fuel oils. When diesel biofuel substitutes for petroleum distillate in one location, refiners adjust processing to seek the highest-value mix of petroleum distillate component sales across their global fuel chain.
35 Based on CARB, *Fuel Activity for California's Greenhouse Gas Inventory by Sector & Activity (Fourteenth Ed.: 2000 to 2019)* Jul 2021; and California Energy Commission (CEC), *Refinery Inputs and Production* Jun 2022 (Fuel Watch data); and Exhibit 1, appended hereto, reporting CARB and CEC data.
36 CARB, *supra;* CEC, *supra;* Exhibit 1.
37 CEC, *supra;* Exhibit 1 (reporting in-state production and world consumption data).

Moreover, causal mechanisms for these outcomes reflect the resistance to change of established fossil fuel systems and development paths.[38] [39] [40] [41] [42] [43] [44] [45]

2.1.3 State data document the further shift to petroleum distillate refining for export induced by diesel biofuel addition in California

California collects, verifies and reports high quality data for in-state DB use, as well as in-state PD production and use,[46] from which statewide PD export rates are known. See §§ 1.1.3 herein. Analysis of these data demonstrates that the balance between refinery production and demand drives PD exports. *Id*. Direct effects of DB addition to total distillate demand in California are illustrated in Chart 1 based on these State data.

DB use (orange in Chart 1) induced a further shift from PD use here (brown) to PD export (black) from California to other states and nations. DB served increasing shares of total California distillate demand, which reached its previous three-year high during 2016–2018 compared to 2005–2007, increasing the shares of PD refined in the State that shifted to export.

Importantly, statewide refinery production of PD increased from 2010–2019 alongside DB use.[47] Partial least squares regression modeling of the State data from 2010–2019 found that DB use was a stronger factor in PD export than PD production, and both factors together explain 87 to 96 percent of the interannual change in PD export, with the 87 percent estimate due to including a potentially anomalous outlier year in that analysis.[48] PD use was the weaker factor, with effects on PD export that spanned zero (standardized coefficients, 95% confidence) when compared alongside DB use.[49] Modeling results for the 2010–2019 data are illustrated in Chart 2.

DB can account for essentially all of the PD export increment. During 2011 through 2019 as compared with 2010 rates, DB use rose by approximately 70 million barrels (Mb), PD demand rose by ≈15 Mb, in-state refinery production of PD rose by ≈84 Mb, and refinery exports of PD rose by ≈69 Mb.[50]

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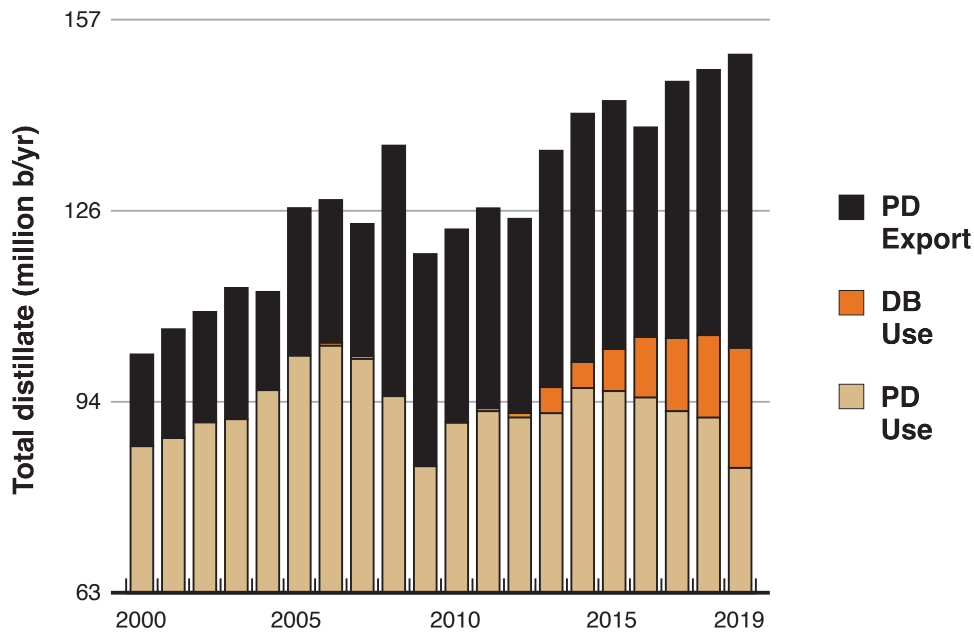
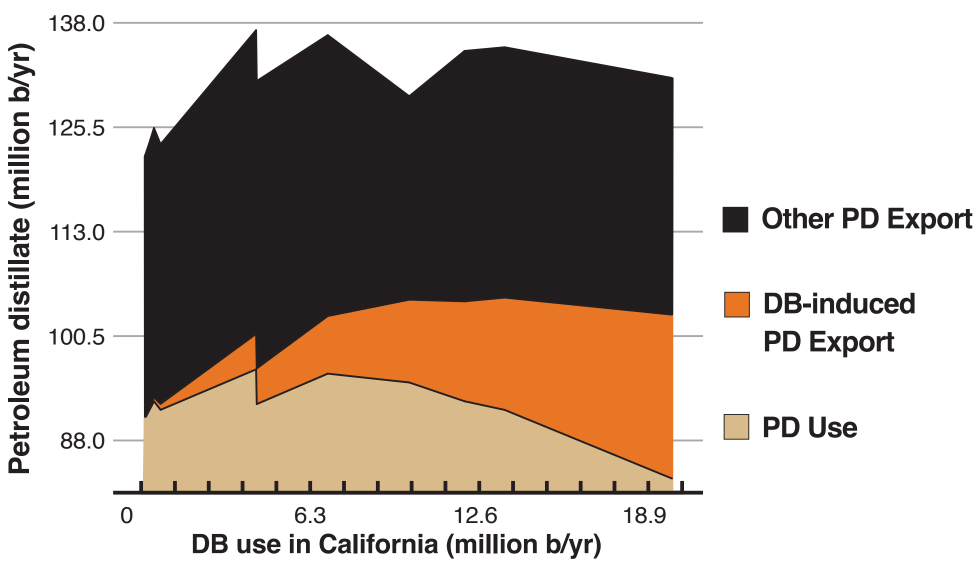
[38] Ha-Duong et al. Influence of socioeconomic inertia and uncertainty on optimal CO_2-emission abatement *Nature* 390:270. Nov 1997.
[39] Unruh. Understanding carbon lock-in *Energy Policy* 28: 817 Mar 2000.
[40] Davis et al. Future CO_2 Emissions and Climate Change from Existing Energy Infrastructure *Science* 329: 1330 Sep 2010.
[41] Davis and Socolow. Commitment accounting of CO_2 emissions *Env. Res. Letters* 9. Aug 2014.
[42] Rozenberg et al. Climate constraints on the carbon intensity of economic growth *Env. Res. Letters* 10. Sep 2015.
[43] Seto et al. Carbon Lock-in: Types, Causes, and Policy Implications *Annu. Rev. Environ. Resour*. 41:425. Sep 2016.
[44] Smith et al. Current fossil fuel infrastructure does not yet commit us to 1.5 ºC warming *Nature comm.*10:101. Jan 2019.
[45] Tong et al. Committed emissions from existing energy infrastructure jeopardize 1.5 ºC climate target *Nature* 572: 373. Jul 2019.
[46] CEC, *supra;* CARB, *supra;* Exhibit 1 appended hereto.
[47] CEC, *supra;* CARB, *supra;* Exhibit 1 appended hereto.
[48] Exhibit 2; Partial least squares regression results for data from CEC, *supra* and CARB, *supra;* appended hereto.
[49] Exhibit 2; Partial least squares regression results for data from CEC, *supra* and CARB, *supra;* appended hereto.
[50] CEC, *supra;* CARB, *supra;* Exhibit 1 appended hereto.



1. Diesel biofuel (DB) added to petroleum distillate (PD) in California
From CARB Fuel Activity Inventory and CEC Fuel Watch. See Exhibit 1 for data.

This PD export increment was caused by DB use that served some of the in-state demand for total distillate, so that the PD demand increment rose less than the PD production increment (84 – 15 = 69). Thus, adding the 70 Mb DB increment shifted an additional 69 Mb of PD refining to export, and each barrel of DB use increased PD export by ≈0.99 barrel, on a volume basis.



2. Diesel biofuel (DB) shifts petroleum distillate (PD) refining to export
Modeling results on California data from 2010–2019 plotted against DB use. See Exhibit 2.

On an energy basis, this 70 Mb DB increment had the energy content of ≈67 Mb of PD,[51] and each DB barrel increased PD export by ≈1.03 barrel. Further accounting for interannual changes via partial least squares regression analysis of all the State distillate use and export data from 2010 through 2019 indicates that each barrel of DB addition increases PD export by 1.00 barrel.[52] Finally, the US Environmental Protection Agency estimates that each energy-weighted barrel of US biofuels changes US petroleum imports by 0.99 barrel.[53] Taken together, available evidence supports DB-induced PD exports of equivalent volume (range, 1:0.99 to 1:1.03).

Downstream impacts of this DB-induced refining for export contributed to increased PD combustion across the global fuel chain linked to California refineries. During 2011–2019 world PD consumption rose from 2010 rates by ≈5,870 Mb for all uses of PD and ≈7,860 Mb for PD use in transportation.[54] These increments exceed the 84 Mb California PD refining and 69 Mb PD export increments, indicating that DB addition here contributed to increased PD combustion globally. Moreover, it may have increased world PD use by more than the 69 Mb export increment observed. A substantial body of peer reviewed work suggests that biofuel-induced petroleum fuel exports to global markets can reduce fuel prices enough to induce further petroleum fuels refining and growth.[55] [56] [57] [58] [59] [60] [61]

Emissions from DB that failed to replace PD added to those from PD that was not replaced, increasing GHG emissions from the total distillate combustion fuel chain.

2.2 <u>The Draft Scoping Plan could further increase GHG emissions associated with subsidized diesel biofuel addition to the petroleum fuel chain</u>.

2.2.1 The Draft Scoping Plan would increase subsidized diesel biofuel addition in California

CARB asserts that its LCFS is "key driver" of renewable diesel growth.[62] The LCFS provides financial support to DB, including biodiesel and renewable diesel, via a mechanism that rewards

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[51] Based on energy densities of 126.13 MJ/gal. biodiesel, 129.65 MJ/gal. renewable diesel, and 134.47 MJ/gal. ULSD from the LCFS Regulation Order, Title 17, CCR, §§ 95480–95503; a 34%/66% biodiesel/renewable diesel mix of in-state DB use from 2011–2019 from CARB *LCFS Dashboard* Figure 10 data table; and the calculations 0.34 • 126.13 MJ/gal. + 0.66 • 129.65 MJ/gal. ≈ 128.45 MJ/gal. (DB mix) and,
128.45 MJ/gal. (DB mix) ÷ 134.47 MJ/gal. (ULSD) • 70 Mb ≈ 67 Mb (PD energy-equivalent BD added, in Mb).

[52] Exhibit 2; Partial least squares regression results for data from CEC, *supra* and CARB, *supra;* appended hereto.

[53] USEPA *Draft Regulatory Impact Analysis: RFS Annual Rules* EPA-420-D-21-002. Dec 2021.

[54] Energy Information Administration (EIA) *Transportation sector energy consumption by region and fuel* Data table accessed Mar 2022; International Energy Agency *World Production and Final Consumption of Gas/Diesel* IEA Data and Statistics; Data Tables; Oil; accessed Mar 2022; and Exhibit 1, appended hereto, reporting these data.

[55] Drabik and de Gorter. Biofuel Policies and Carbon Leakage *AgBioForum* 14: 3. 2011.

[56] Chen and Khanna. The Market-Mediated Effects of Low Carbon Fuel Policies *AgBioForum* 15:1. 2012.

[57] Grafton et al. US biofuels subsidies and CO_2 emissions: An empirical test for a weak and a strong green paradox *Energy Policy* 68: 550. Dec 2013.

[58] Bento and Klotz. Climate Policy Decisions Require Policy-Based Lifecycle Analysis *Environ. Sci. Technol.* 48: 5379. Apr 2014.

[59] Rajagopal et al. Multi-objective regulations on transportation fuels: Comparing renewable fuel mandates and emission standards *Energy Economics* 49: 359. Mar 2015.

[60] Hill et al. Climate consequences of low-carbon fuels: The United States Renewable Fuel Standard *Energy Policy* 97: 351. Aug 2016.

[61] Abdul-Manan. Lifecycle GHG emissions of palm biodiesel: Unintended market effects negate direct benefits of the Malaysian Economic Transformation Plan *Energy Policy* 104: 56. Jan 2017.

[62] Draft Scoping Plan at page 18.

increasing DB volume (§§ 2.1.1), and gave DB ≈25.4 million credits from 2011–2019[63] as per-credit values rose steeply to $192 by 2019.[64] The Draft Scoping Plan would further expand this financial support by relying on renewable diesel to a considerable extent in its selected suite of petroleum fuels demand reduction measures.[65] In its modeling for the Draft Scoping Plan, CARB projects renewable diesel use would rise from its 2015–2019 mean by a cumulative total of ≈5.394 exajoules,[66] or an energy-equivalent volume of ≈80.4 Mb,[67] during 2023–2045.[68]

2.2.2 Potential diesel biofuel use and petroleum distillate export volume increments

The DB-induced PD export effect of this 80.4 MB DB increment is readily foreseeable, as documented in §§ 2.1.3. Further, CARB could have estimated its extent. For example, CARB could use publicly reported State and federal data to estimate that each barrel of DB shifts 0.99 to 1.03 barrel of PD to export, as described in §§ 2.1.3. CARB could apply this 0.99 to 1.03 range to its modeled DB increment (80.4 Mb) to estimate a potential DB-induced PD export increment of 79.6 Mb to 82.8 Mb through 2045, as shown in Table 3.

2.2.3 Potential diesel biofuel use and petroleum distillate export emission increments

CARB estimates the full fuel chain "life cycle" carbon intensity ("CI") of both fuels in its LCFS and could have done so for its projected Scoping Plan fuel volume increments. Fuel-specific energy density and default CI values[69] indicate a CI factor of 567.3 kg CO_2e/barrel PD, and CI factors of 245.0 to 353.9 kg CO_2e/barrel renewable diesel, depending on whether it is derived from "residue" or "crop" oil feedstock. CARB could have used these data with the volume increments in Table 3 to estimate potential impacts that could result from the Draft Scoping Plan renewable diesel expansion. These results are shown in Table 3.

Thus, CARB could have estimated cumulative GHG emission increments, during 2023–2045 over 2015–2019 mean rates, that range from 19.7 to 26.4 MMT associated with DB addition in California, and 45.2 to 47.0 MMT associated with DB-induced PD exports from California.

Importantly, since DB fails to replace PD and DB-induced PD exports contribute to increased PD emissions globally (§§ 2.1.3), emission increments from both fuels (64.9 to 75.4 MMT) describe the potential direct contribution of DB-related effects to climate impacts.

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[63] CARB *LCFS Quarterly Summary Report* Accessed Jun 2022.
[64] CARB *Monthly LCFS Credit Transfer Activity Reports* Accessed Jun 2022.
[65] Draft Scoping Plan at pages 18, 153; Draft Scoping Plan, Appendix H, at page 61.
[66] CARB *AB32 GHG Inventory Sectors Modeling Data Spreadsheet* May 2022. Energy Demand, *in* California PATHWAYS Model Outputs.
[67] Based on CARB fuel energy data from the LCFS Regulation Order, Title 17, CCR, §§ 95480–95503.
[68] The CARB projection may understate potential DB growth in California substantially. Planned renewable diesel feedstock refining capacity expansions by Phillips 66 at Rodeo (29.2 Mb/year), Marathon at Martinez (17.5 Mb/y) and AltAir at Paramount (7.8 Mb/y new capacity) suggest more rapid DB growth than CARB projects. If build as scheduled and run targeting a feasible 68.1% distillate yield on feed, these three California lipids refining projects could add some 37.2 Mb/y of renewable diesel capacity. If all three projects are built, commissioned on schedule and can overcome lipids feedstock supply limitations to operate at capacity, the growth of DB use in California by 2030 could be more than double that which CARB projects. But targets announced by refiners for projects not yet built are uncertain forecasts, and there are good reasons to limit reliance on hydrotreated lipids-based diesel biofuels.
[69] See LCFS Regulation Order, Title 17, CCR, §§ 95480–95503.

Table 3. Potential total distillate fuel shift and GHG emission increments from diesel biofuel expansion in the Draft Scoping Plan, total increments during 2023–2045

GHG: CO_2e, 100-year GWP **Mb:** million barrels **MMT:** million metric tons

		Diesel biofuel addition in CA		Petroleum distillate export induced by biofuel	
		lower bound	upper bound	lower bound	upper bound
Volume [a]	(Mb)	80.4	80.4	79.6	82.8
CI [b]	(kg/b)	245.0	353.9	567.3	567.3
Emissions [c]	(MMT)	19.7	28.4	45.2	47.0

a. Estimated cumulative diesel biofuel increments during 2023–2045 *versus* the time-weighted mean fuel volumes from 2015–2019. DB increment based on renewable diesel increment point estimate from Draft Scoping Plan fuels energy modeling and fuel energy density from CARB LCFS regulation order; PD increment range based on DB use to PD export range of 1:0.99 to 1:1.03 from analysis of State data in this report §§ 2.1.3. **b.** Carbon intensity (CI, in kg/b) values based on fuel energy densities and default fuel chain "life cycle" emission factors in CARB LCFS regulation order; the CI range for DB is based on renewable diesel CI factors for "residue" (lower bound) and "crop" (upper bound) lipids biomass feeds. **c.** CO_2e mass emission increments are calculated from the fuel volumes and CI factors shown for each fuel. Since DB use in California shifts PD to export and the estimated CI of PD is greater than that of DB, most of the resultant total distillate emission increment estimated (64.9 to 75.4 MMT) would shift outside the state. Figures may not add due to rounding.

2.3 <u>The Draft Scoping Plan could result in major air quality and environmental health impacts associated with renewable diesel refining and diesel biofuel-induced petroleum distillate refining for export in communities near California refineries</u>.

This potential for 79.6 to 82.8 Mb of additional PD refining for export through 2045 would emit criteria and other toxic air pollutants in communities near California refineries, pollution that would be directly linked to the GHG emissions exported with the refined fuels. Supply-demand imbalances that drive these increased community health risks from PD refining for export would increase to a greater extent under the Draft Scoping Plan than its no project alternative.[70] [71] BD refining impacts, and in particular the potential for extremely hydrogen-intensive renewable diesel processing to result in acute air pollutant exposures from more frequent flaring,[72] would add new risks in nearby communities. Thus, by resulting in new and prolonged exposures to harmful air pollutant emissions associated with prolonged or increased refining for export and increased biorefining, the Draft Scoping Plan could result in significant air quality and environmental health risk impacts.

2.4 <u>The Draft Scoping Plan could result in major climate impacts from emission shifting caused by biofuel-induced refining for export in apparent conflict with state climate law</u>.

2.4.1 State law requires minimizing GHG emission-shifting to the extent feasible

CARB asserts that the Draft Scoping Plan DB expansion measures would reduce GHG emissions from petroleum fuels in California. Though correct as to that limited point, CARB's analysis is incomplete; it ignores the resultant emission shifting. GHG emissions impact climate globally wherever GHG emits. Recognizing this, the California Health and Safety Code requires CARB

[70] Compare Alternative 3, Reference Scenario in CARB *AB32 GHG Inventory Sectors Modeling Data Spreadsheet* (*supra*) for potential to induce refining for export.
[71] Additional support for this comment specific to refinery emission impact is provided in § 1.3 and part 3 herein.
[72] Karras. *Changing Hydrocarbons Midstream* Aug 2021. Prepared for the NRDC.

to minimize emission shifting, which the Code defines as "a reduction in emissions of greenhouse gases within the state that is offset by an increase in emissions of greenhouse gases outside the state." Cal. Health & Safety Code §§ 38505 (j), 38562 (b) (8). But by financing increased DB use which shifts PD to export while rejecting feasible direct control measures, the Draft Scoping Plan would result in the GHG emission shift defined. This would appear to conflict with State climate law.

2.4.2 Cross-border GHG emissions associated with petroleum distillate refining for export could exceed in-state GHG emission reduction from diesel biofuel substitution

GHG emissions from DB that fails to replace PD and from that PD would contribute to global climate impacts. However, the Draft Scoping Plan limits its focus to emissions in California alone. It subtracts emissions associated with PD (which would in fact be exported) from emissions associated with DB used in-state to find emission reductions within the State. Results in Table 3 indicate a potential incremental GHG emission reduction *within the state* ranging from ≈16.8 (45.2 – 28.4 = 16.8) to 27.3 (47.0 – 19.7 = 27.3) MMT. PD emissions from the DB-induced PD export increments, however, would exceed this in-state reduction at 45.2 to 47.0 MMT (Table 3). Thus, the smaller GHG emission reduction within the state would be offset by the larger GHG emission increase outside the state.

2.4.3 Feasible measures the Draft Scoping Plan excludes could minimize emission shifting

CARB can establish direct emission control standards expressed as throughput limits to each refinery in California. This measure has proven feasible when implemented on an air quality and environmental health basis and can effectively limit refining for export. See §§ 1.1.1 and § 1.3. Moreover, this measure may be required to minimize GHG emission shifting and, at a minimum, that requirement further supports its feasibility. This measure is further discussed in §§ 1.4.3.

CARB also can establish a numeric cap on statewide DB usage. A lipids-derived DB cap has been suggested by the State's expert advisors on transportation measures to achieve its climate goals,[73] and could lessen or avoid new air quality and climate impacts associated with DB fuel chain emissions and those from DB-induced refining for export. This measure also could support lower-emitting and more scalable non-combustion freight and shipping alternatives.

2.5 <u>The Environmental Assessment (EA) is factually incomplete</u>.

Presuming that diesel biofuel replaces petroleum distillate fuel, when it does not, represents a fatal error in the Draft Scoping Plan *and* the EA. The EA does not identify, describe, assess, or analyze feasible mitigation for air quality, environmental health, or climate impacts associated with refining and burning more total distillate that could result from the Draft Scoping Plan.

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[73] Brown et al. *Driving California's Transportation Emissions to Zero* Apr 2021. UC Office of the President, ITS reports. See pages 392–396.

3 Potential impacts from delayed refining phase down on the feasibility of climate stabilization pathways

Putting off transition impacts by delaying direct refining phase down measures CARB can take now to transition from oil, the Draft Scoping Plan would lead to a vicious cycle: Cumulative emissions increase faster while time left for cutting them shortens. This forces deeper cuts faster to our climate goal. That increases the severity of transition impacts, reinforcing the vicious cycle. Delay, then, can be a dead-end path to climate disaster. Analysis of high-quality data demonstrates that the Draft Scoping Plan phase down delay could breach clearly foreseeable feasibility tipping points. Major impacts that could result from its rejection of "maximum feasible" measures include conflict with State climate law, prolonged toxic health impacts near refineries, and total cumulative emissions that far exceed the State GHG emissions goal. The Draft Scoping Plan and EA obscure these impacts through a series of errors and omissions.

3.1 <u>The Draft Scoping Plan obscures potential impacts of delayed refinery phase down</u>.

3.1.1 Delayed refining cuts make emissions targets less feasible to achieve

This point is simple and crucial. Suppose one sector in the statewide economy emits 50 percent of total statewide emissions and all other sectors emit the other 50 percent. When we need total emissions to be cut 25 percent, if the super-emitter delays its cuts, all the other sectors must cut their emissions by 50 percent to make the cut. That makes the total cut less feasible than it would be if all sectors did their share. When we need total emissions cut 50 percent, if the super-emitter still delays its cuts, all other sectors must cut their emissions by 100 percent (go to zero) to make the cut. That makes the needed cut much less feasible.

In fact, the petroleum fuel chain linked to California refineries emits up to 65 percent of total GHG linked to all activities in California.[74] Moreover, accounting for the emission shifting enabled by an absence of direct refinery GHG emission standards, which allowed export refining as in-state petroleum demand began to decline, sustained cuts in those refining-linked petroleum fuel chain emissions were, in fact, delayed.[75] The Draft Scoping Plan omits these facts.

3.1.2 The Draft Scoping Plan does not quantify and report any path to the State's direct emissions targets that is known to be feasible based on measures proven in practice

State climate emission reduction targets, expressed in shorthand as –40% by 2030 and –80% by 2050, are direct emission reduction goals, which "carbon neutrality" measures such as industrial or biological carbon sequestration are explicitly meant to supplement but not to replace.[76] The State's "carbon neutrality goal is layered on top of the state's existing commitments to reduce greenhouse gas emissions 40% below 1990 levels by 2030 ... and 80% below 1990 levels by

[74] CEJA, *Climate Pathways in an Oil State* Prepared by Greg Karras. Feb 2022.
[75] *Id*.
[76] *Executive Order B-55-18 to Achieve Carbon Neutrality* Edmund G. Brown Sep 2018.

2050."[77] This distinction is important because CARB climate plans and measures are required to achieve the "maximum feasible" GHG emission reductions,[78] and carbon-capture-sequestration has not been proven feasible at the necessary scale.[79]

In essence, State policy calls on CARB to refrain from delaying feasible measures to meet State GHG emission targets in favor of unproven carbon neutrality measures that may not prove feasible and in any case are to be "layered on top" after the State emission targets are met. But that is not what the Draft Scoping Plan does. None of its scenarios include direct refinery phase-down standards. All of them lump proven direct measures and unproven carbon capture measures together, conflate the emission reduction target and carbon neutrality goal analyses, or both. It does not quantify and report any path to the direct emission reduction targets that is known to be feasible based on measures that are proven in practice.

3.1.3 The Draft Scoping Plan obscures climate impacts of delay through failure to disclose and compare cumulative emissions from its scenarios over time

Emitted CO_2 accumulates in the upper atmosphere, where it contributes to climate-forcing "greenhouse" impacts on the climate system for hundreds of years. *Cumulative* emission over time is a direct metric for climate effects of the Draft Scoping Plan. Annual emission snapshots are not. However, the Draft Scoping Plan presents analysis focused on snapshots of annual emission rates. This obscures climate impacts that could result from the Draft Scoping Plan.

First it obscures impacts of delayed emission cuts on climate. For example, the Draft Scoping Plan (Alternative 3) delays GHG emission cuts from replacing fossil fuels in vehicles, power plants and industry compared with Alternative 1. It presents Alternative 3 as resulting in equivalent GHG emission cuts to Alternative 1 between 2020 and 2045 (–355 MMT), based on its comparison of *annual* emissions between those two years.[80] Adding up the data for all years from 2020 through 2045, however, *cumulative* GHG emissions from the Draft Scoping Plan exceed those from Alternative 1 by ≈1,520 MMT, or ≈26 percent.[81] Sole focus on the annual emissions obscures a 1,520 MMT climate impact of delay that cumulative analysis reveals.

Second, focusing solely on annual emissions obscures impacts of delayed emission cuts on the *feasibility* of climate stabilization. In the example above it missed 1,520 MMT of cumulative emissions that are more feasible to prevent than to suck out of the air after the GHG emits. Both limiting the accumulation of GHG emissions to a climate-forcing impact of 1.5 to 2 ºC global heating, and the feasibility of measures which could do that, have a timing component. Their timing and feasibility are interdependent. Quantifying this interdependence has been a central problem in CARB climate planning. Pairing technology pathways analysis with cumulative emission trajectories analysis can solve this problem.[82] Indeed, this inclusive data analysis method appears necessary to estimate the feasibility of climate pathways accurately.

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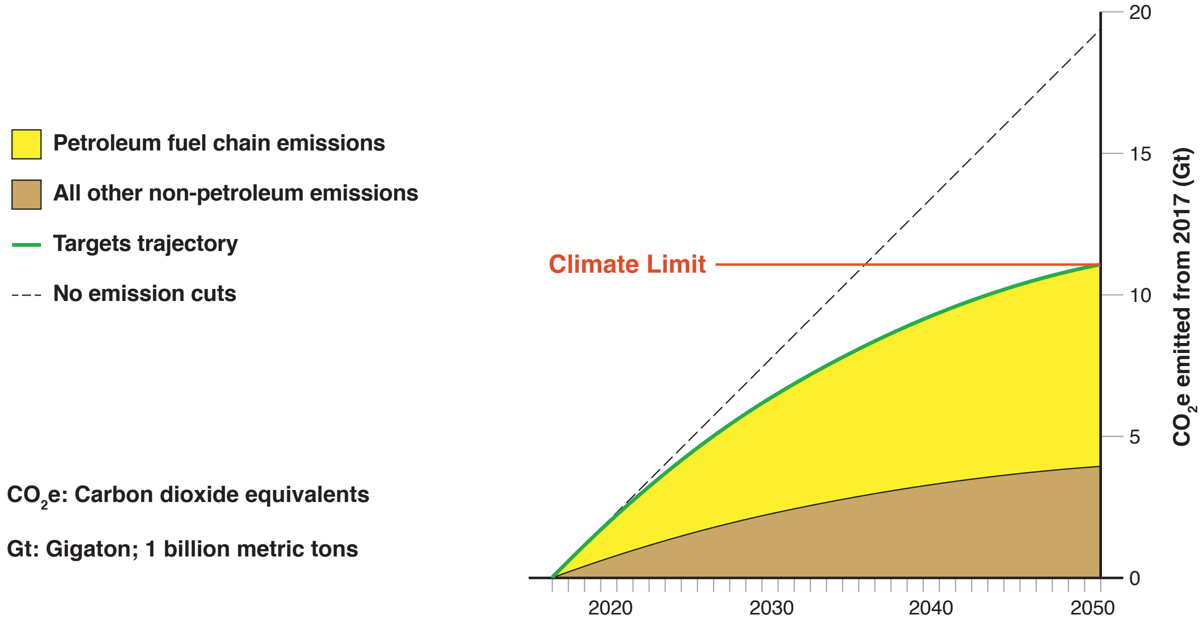
[77] Mahone et al. *Achieving Carbon Neutrality in California: PATHWAYS Scenarios Developed for the California Air Resources Board* Energy and Environmental Economics. Oct 2020. See page 14.
[78] See Cal. Health & Safety Code §§ 38560.5 (c), 38561 (a), (c), 38562 (a).
[79] See Draft Scoping Plan comments of Julia May on behalf of the California Environmental Justice Alliance.
[80] CARB *AB32 GHG Inventory Sectors Modeling Data Spreadsheet* (*supra*)
[81] *Id*.
[82] CBE (2020) *supra;* CEJA (2022) *supra*.

Moreover, the Draft Scoping Plan does not disclose that the State's direct emission targets were developed and timed to limit *cumulative* emission at the State's share of global emission that is consistent with holding climate heating below 2 ºC. Its direct emission targets define this climate limit. The targets seek continuous, proportionate annual cuts in direct emissions during three periods.[83] First, back to the emission rate in 1990 by 2020, then 40 percent below the 1990 rate by 2030, then 80 percent below the 1990 rate by 2050. Now we are past 2020, statewide emissions were close to that first target, and we have reliable and accurate emissions data representative of current pre-COVID conditions from 2013–2019[84] to assess the proportionate annual cuts to the 2030 and 2050 targets. With these cuts, a certain amount of CO_2e will be emitted each year through 2050. The climate limit is simply the sum total of these proportionately declining annual emissions. See Chart 3.



3. State Climate Target: Cumulative emission limit through 2050 defined by state climate targets
For data and details of methods see CEJA (2022) Supporting Material, esp. Table S9.

Chart 3 illustrates cumulative emission trajectories defined by State climate targets. The trajectories start with actual emissions as of 2017 based on high quality State and federal data.[85] Reduced emissions defined by the targets add to cumulative emissions in each subsequent year. The non-petroleum (brown shading), petroleum fuel chain (yellow shading), and total (green curve) trajectories bend downward because of these sustained emission cuts. The climate limit (red line) is the total emissions through 2050, approximately 11.1 gigatons (Gt) or 11,100 MMT. This cumulative emission limit is consistent with State's share of global emission reductions for a 67 percent chance of holding global heating to between 1.5 and 2.0 ºC.[86]

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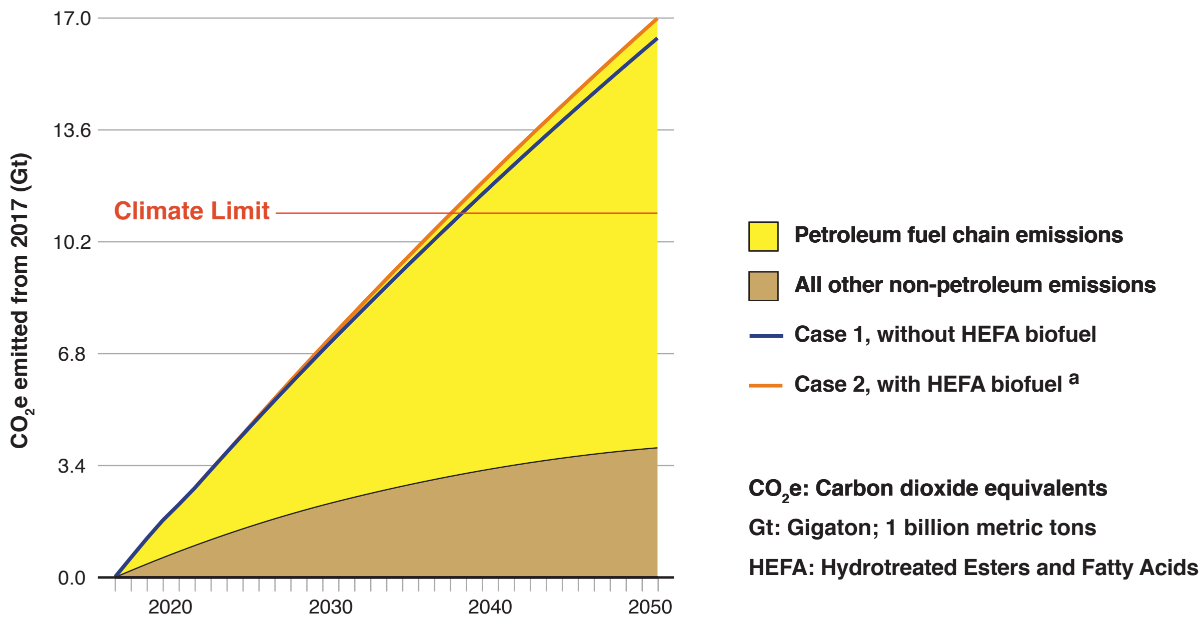
[83] See CBE (2020) *supra*
[84] CEJA (2022) *supra*, see Table S1.
[85] *Id.*
[86] CEJA (2022) *supra*, see tables S9, S10.

3.2 Even if all other, non-petroleum emissions are cut to their share of the State direct emissions reduction goal, this goal cannot be achieved without petroleum refining rate cuts.

To assess potential climate impacts, CEJA compared cumulative emissions from the petroleum fuel chain linked to California refineries with the climate limit, along pathways without crude rate reductions. Uncut petroleum emissions would build up more than in the climate limit trajectory illustrated in Chart 3. But how much more? CARB did not say.

Chart 4 illustrates the potential for climate impacts from the petroleum fuel chain alone, by showing emissions associated with all other, non-petroleum activities statewide as they would appear if cuts to their share of the climate limit will be sustained along the entire path from 2017 through 2050. The "all other, non-petroleum" trajectory in Chart 4 is the same as its climate limit trajectory as illustrated in Chart 3 above (brown shading in both charts).



4. Cumulative emission along petroleum fuel chain pathways without refinery crude rate cuts.
Assumes all other non-petroleum emissions are cut to their share of the climate limit. (a) Without refinery crude rate cuts, Case 2 includes only crude-to-biofuel refinery conversions which would not reduce capacity to maintain current refining rates on all climate pathways. For data and details of methods see CEJA (2022) Supporting Material, tables S11, S12.[1]

Uncut petroleum fuel chain emissions without crude rate cuts (yellow shading) drive a dramatic buildup of total cumulative emissions (rising blue and orange curves) to exceed the climate limit (red horizontal line) by a wide margin before 2050. Pathways without crude rate cuts exceed the climate limit trajectory by 13 to 16 percent in 2030, irreversibly exceed the 2050 climate limit by 2038, and exceed the limit by 5,300 to 5,900 MMT, or 48 to 53 percent, by 2050.[87] That vast accumulation of climate forcing GHG would contribute to global climate heating significantly.

This climate protection failure would occur despite cutting all other non-petroleum emissions to their share of the climate limit. See Chart 4. It would occur despite falling in-state demand for petroleum fuels. See §§ 1 and 2 herein. Ongoing refiner efforts to protect their otherwise

[87] CEJA (2022) *supra*, see table S11 and S12.

stranded assets and seek returns to scale by increasing refining for export across the global fuel chain in response to decreasing in-state demand would be among its proximate causes. *Id.* A root cause would be State failure, despite clearly foreseeable and significant local and global impacts of this emission shifting, to directly control and phase down petroleum refining in-state. By rejecting this measure the Draft Scoping Plan could result in this climate protection failure.

THE EFFECT OF DELAY ON ANNUAL REFINERY CUTS IS SIMPLE MATH.

Suppose a polluter emits ten tons per year, and its climate limit for the next three years is a cumulative total of 24 tons.

What happens if it starts the cuts now? It could cut emissions by 1 ton per year for three years to meet the 24 ton limit. That would emit 9 tons this year, 8 tons next year, and 7 tons the third year. Here's the math: 9 tons + 8 tons + 7 tons = 24 tons.

What if it waits a year? After emitting 10 tons this year it could cut emissions by 2 tons per year in each of the next two years to meet the limit: 10 tons + 8 tons + 6 tons = 24 tons. But that 2 tons per year is twice the pace of the 1 ton per year cut if it starts now.

What if it waits two years? It would emit 20 tons during those two years. Only 4 tons would be left out of its total limit of 24 tons. To meet the limit it must cut 6 tons in the third year: 10 tons + 10 tons + 4 tons = 24 tons. But cutting 6 tons in a year after waiting two years is **six times** the one-ton-per-year pace if it starts now.

Box: CBE (2020)

3.3 <u>By rejecting gradual implementation of direct refinery phase down measures that can be in effect before 2031, the Draft Scoping Plan could result in a significant climate impact through failure to include the "maximum feasible" measures, contrary to state climate law</u>.

Cuts to zero emissions "will not happen overnight."[88] Even with deep non-zero cuts, cumulative emission keeps rising, as shown for the "all other, non-petroleum" emissions in Chart 4. This shows waiting for emissions to approach the climate limit can delay action until it is too late.

Tipping points in the feasibility of meeting our climate limit, as measured by refining capacity lost annually along climate pathways, are different from tipping points in the climate system. Compared with the complexity and uncertainty of climate system tipping points, these feasibility tipping points are certain to occur with delay, and predictable based on simple math. See Box.

Tipping points can be quantified based on available data[89] that CARB could have analyzed in its Draft Scoping Plan feasibility analysis. However, the Draft Scoping Plan fails to disclose clearly foreseeable tipping points in the feasibility of achieving State emission targets that are directly linked to the timing of refinery phase downs. Chart 5 illustrates the deeply diving downward curves of annual refining capacity losses that would be caused by delays in starting crude rate cuts along 91 pathways to the climate limit.

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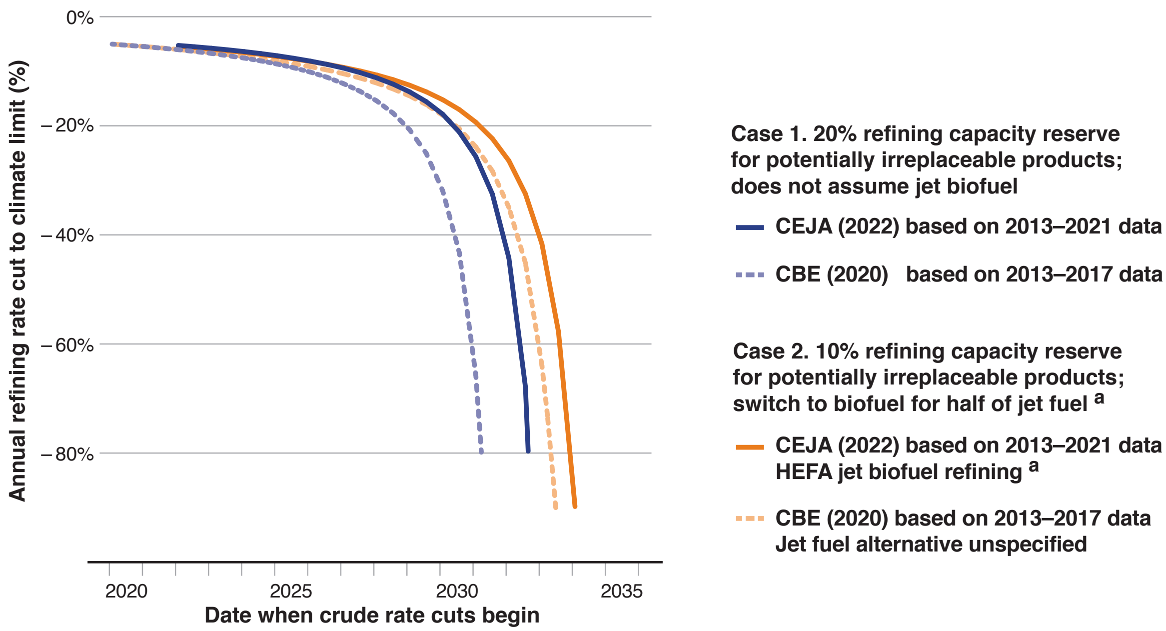
[88] CARB itself makes this point. See Draft Scoping Plan at pages vii, 78, 152.

[89] See CEJA (2022) *supra.* Charts 3, 4 and 5 and discussions of them herein draw on exhaustive analysis of high-quality primary data from CARB and other State and federal agencies in CBE (2020) *supra* and CEJA (2022) *supra*, which updates the CBE (2020) analysis to include more recent new and revised data. The Box above is from CBE.



5. Effect of delay on annual refinery crude rate cuts to the State climate limit.
Assumes non-petroleum emission cuts to their share of the climate limit. (a) Case 2, in this report, assumes repurposing refining capacity lost along climate pathways with HEFA refining up to the 50/50 biofuel/petroleum jet fuel blending limit. HEFA: Hydrotreated esters and fatty acids; type of biofuel. For data and details of methods see CEJA (2022) Tables 11, 12.

Pathways to the climate limit that decommission refinery capacity gradually at five to seven percent per year (Chart 5, left) would be foreclosed by delaying the start date for sustained crude rate cuts in the petroleum fuel chain from left to right in the chart. Delay until 2032 (Case 1) or 2034 (Case 2) would force refining capacity losses of 80 to 90 percent in a single year to meet the climate limit (chart, right). That enormous increase in sudden statewide refinery closures, hence worsening of transition impacts, would substantially and irreversibly impair the social feasibility of meeting the State climate limit. But the tipping point would come sooner.

Tipping points for the feasibility of meeting the climate limit, after which delay drives these transition impacts over a cliff, from around 20 percent to 80 or 90 percent refinery capacity losses per year to meet the limit, would arrive by 2031 at the latest (orange curve) and could trigger irreversible impairment of state climate limit feasibility by 2030 (blue curve).

Worse, it can take years from official proposal to actual enforcement of refinery emission cuts.[90] Refinery rulemaking to avoid the feasibility "cliff" illustrated in Chart 5 must start right away. The Draft Scoping Plan would delay direct refinery phase down measure rulemaking.

California climate law requires CARB climate measures and plans to achieve the "maximum feasible" GHG emission reductions.[91] Instead, the Draft Scoping Plan would reject planning for, and thereby foreclose via delay, a feasible measure that is needed to meet State GHG emission reduction targets and depends upon starting sooner for its feasibility. That would appear contrary to State climate law and could result in a significant climate impact.

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[90] CEJA (2022) *supra*, page 15.
[91] Cal. Health & Safety Code §§ 38560.5 (c), 38561 (a), (c), 38562 (a).

3.4 <u>Significant air quality, health, and environmental justice impacts could result from the failure of the Draft Scoping Plan to include a direct refining phase down measure</u>.

As shown throughout this report, climate, air quality and health impacts that could result from the Draft Scoping Plan are linked to increased refining for export and could be lessened or avoided by a feasible measure to phase down oil refining. This measure, facility-level direct standards expressed as refinery throughput that decline over time, was further shown to be justified on an air quality and environmental health basis, which further supports its feasibility. This subsection (3.4) incorporates §§ 1.3, 1.5, 2.3, 2.5 herein by reference and further supports that measure.

Low income Black and Brown populations in California communities that host refineries have long been shown[92] to face disparately worsened exposures to harmful refinery emissions of CO_2e co-pollutants, such as particulate matter, nitrogen oxides, sulfur oxides, and other criteria and toxic air pollutants. Doubling down on this toxic racism, a substantial and potentially growing portion of that disparately severe exposure is being caused by refining for export of fuels that Californians do not need or use.[93]

The same refinery-specific direct control measures needed to reduce crude rates before our most feasible pathways to the State climate limit are foreclosed would reduce these emissions from refineries as well. These direct control measures would benefit environmental justice communities, further enhancing the feasibility of least-impact pathways to the climate limit. Conversely, further delaying them would prolong and worsen an acute social injustice in California communities that host refineries, further impairing the feasibility of delayed action pathways to the climate limit. For example, consider Table 4.

Table 4. Refining for export community emission impacts avoidable by the least-impact climate pathway starting crude rate reductions in January 2023

t (ton): metric ton **Mt** (Megaton): 1 million tons **No CCR:** no crude rate reduction

	CO_2e emitted by refining for export (Mt/y) [a]			Co-pollutant emissions from refining for export (t/y) [b]			
Year	No CRR	Climate path	Export refining	PM	NOx	SOx	Subtotal
2022	35.64	35.64	0.00	0	0	0	0
2023	35.64	33.58	2.06	129	457	263	848
2025	35.64	29.81	5.83	364	1,290	744	2,400
2030	35.64	22.13	13.51	843	3,000	1,720	5,560
2035	35.64	16.43	19.21	1,200	4,260	2,450	7,910
2040	35.64	12.20	23.44	1,460	5,200	2,990	9,650
2045	35.64	9.06	26.58	1,660	5,900	3,390	10,900
2050	35.64	7.14	28.50	1,780	6,330	3,630	11,700

PM: particulate matter; PM_{10} including $PM_{2.5}$ **NOx:** oxides of nitrogen **SOx:** oxides of sulfur
a. CO_2e emissions from refining for export without crude rate cuts are the difference of No CRR and climate path emissions from the least-impact pathway starting CRR in Jan 2023. **b.** CO_2e co-pollutant emissions from refining for export were based on co-emission factors (e.g., t PM/Mt CO_2e) derived from state refinery emissions data. For data and details of methods see CEJA (2022) tables S11, S13. The table shows only new, post-2022, refining for export impacts. Table adapted from CEJA (2022). Figures may not add due to rounding.

[92] Pastor et al. *Minding the Climate Gap: What's at stake if California's climate law isn't done right and right away* U. Cal. Berkeley and U. Southern California. Apr 2010.
[93] See §§ 1.1, 1.2, 1.3 and 3.2 herein.

Compared with the least-impact climate pathway, in which direct measures launch a gradual phase down of refining in 2023, delaying the phase-down start date could foreclose annual criteria air pollution cuts from statewide refineries of approximately 5,560 metric tons by 2030, 9,650 tons by 2040, and 11,700 tons by 2050 from refining for export alone. Table 4.[94] Applying enhanced direct throughput reduction standards to California refineries is therefore strongly supported on the basis of need, authority and obligation to cure air quality, health, and equity impacts in communities in the shadows of refinery emission stacks.

But despite the consequent climate impacts and emission shifting contrary to State climate law,[95] the Draft Scoping Plan proposes to reject this feasible, needed climate and health measure. This proposed action would arbitrarily expose disparately pollutant-burdened communities to more harmful air pollution, to which people in communities near refineries would be exposed routinely and episodically for an unnecessarily prolonged period. The Draft Scoping Plan could thus result in significant air quality and environmental health impacts.

This evidence further supports refinery-specific phase down standards for climate justice.

3.5 The Environmental Assessment (EA) is factually incomplete.

California's Final Scoping Plan can apply throughput standards to phase down refineries before the rising carbon flow through their combustion fuel chain overwhelms its all-source emission reduction targets, further poisons nearby Black and Brown communities, and blows through our share of cumulative global GHG emission to hold climate heating below 2 ºC. This measure is feasible given the gradual refining phase down schedule that is still available now, and appears essential to ensure statewide all-source emission targets can be met. Instead, the Draft Scoping Plan would exempt refineries from this measure now, while there is still time for gradual refinery phase downs, and could thereby foreclose this now-feasible measure through delay.[96]

The EA does not identify, describe, assess, or analyze feasible mitigation for air quality, health, or climate impacts associated with foreclosing feasible refining rate reductions through delay. which could result from the Draft Scoping Plan.

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[94] Table 4 was adapted from CEJA (2022), *supra*

[95] See §§ 1.4, 2.1, 2.2, 2.4, 3.2 and 3.3 herein.

[96] As stated, CARB's rationale for this oil industry exemption fails on the facts. Refiners have not phased down in line with in-state petroleum demand; they increased production on increased exports across the Pacific Rim. Diesel biofuel did not replace or reduce petroleum distillate refining or combustion; refiners exported petroleum distillate and boosted its production. Refining is not a separate, small, or fungible part of the statewide GHG equation; it enables fuel chain carbon flow that emits more than half of total statewide GHG. There is no evidence for rejecting a proven measure like refining rate control based on the presumed cost-effectiveness of an unproven measure like carbon capture and storage; cost "effectiveness" of unproven measures cannot be known until they prove effective. It is not valid to compare climate effects of deploying different arrays of measures over time ("scenarios," "trajectories" or "pathways") based on annual emissions in their final year alone; the pathway that delays measures may cut to the same emission rate in that final year but emit much more along the way—and cumulative emissions over time, not 'blips' in any one year, drive climate heating. This list of relevant errors and omissions in the Draft Scoping Plan and EA is not necessarily exhaustive.

4 List of Exhibits and Attachments Provided with this Report

Exhibits

Exhibit 1. Distillate Fuels Data, California and World, page 27.

Exhibit 2. Partial Least Squares Regression Results, page 28.

Attachments

Abdul-Manan, A. F.N. Lifecycle GHG emissions of palm biodiesel: Unintended market effects negate direct benefits of the Malaysian Economic Transformation Plan (ETP). *Energy Policy* **2017.** 104: 56–65. http://dx.doi.org/10.1016/j.enpol.2017.01.041. Attachment file label: Abdul-Manan_*Lifecycle GHG emissions of palm biodiesel*_Jan_2017

Bento, A. M.; Klotz, R. Climate Policy Decisions Require Policy-Based Lifecycle Analysis. *Environ. Sci. Technol.* **2014.** 48: 5379-5387. dx.doi.org/10.1021/es405164g Attachment file label: Bento and Klotz_*Climate Policy Decisions Require Policy-Based Lifecycle Analysis*_Apr 2014

Brown, A. L.; Sperling, D; Austin, B et al. *Driving California's Transportation Emissions to Zero;* University of California Office of the President, ITS reports. **2021.** DOI: 10.7922/G2MC8X9X. https://escholarship.org/uc/item/3np3p2t0. Attachment file label: Brown et al_*Driving California's Transportation Emissions to Zero*_Apr_2021

CARB *AB32 GHG Inventory Sectors Modeling Data Spreadsheet;* E3, California PATHWAYS Model Outputs. 2 May 2022. Excerpt includes Emissions and Energy Demand sheets. California Air Resources Board: Sacramento, CA. Attachment file label: CARB_AB32 Modeling Excerpts_May_2022.

CARB *Fuel Activity for California's Greenhouse Gas Inventory by Sector & Activity (Fourteenth Edition: 2000 to 2019);* California Air Resources Board: Sacramento, CA. Fuel Combustion and Heat Content; https://ww2.arb.ca.gov/ghg-inventory-data. Attachment file label: CARB_*Fuel Activity 2000–2019*_Jul_2021

CARB *LCFS Data Dashboard Figure 10, Data Table "DMAggregatedFuelVolumes";* Accessed Jun 2022. California Air Resources Board: Sacramento, CA. https://www.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm. Attachment file label: CARB_*LCFS Dashboard*_Jun_2022 CARB_

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EXHIBIT 1. Distillate Fuels Data, California and World

All data in millions of barrels (Mb)

PD: petroleum distillate **DB:** diesel biofuel; biodiesel and renewable diesel **b:** (barrel); 42 U.S. gallons

California	DB use [a]	PD use (demand) [a]	PD production [b]	PD net export [c]
2000	0.0476	87.0246	102.0795	15.0549
2001	0.0595	88.4041	106.2020	17.7979
2002	0.0952	90.9339	109.0410	18.1071
2003	0.0214	91.4559	113.0250	21.5691
2004	0.0333	96.2476	112.3970	16.1494
2005	0.0612	101.9456	126.1429	24.1972
2006	0.4669	103.5919	127.0643	23.4723
2007	0.4157	101.4276	123.1786	21.7509
2008	0.2786	95.2376	136.2452	41.0076
2009	0.1648	83.7293	118.4643	34.7349
2010	0.1754	90.9053	122.5405	31.6351
2011	0.4765	92.7767	125.7095	32.9328
2012	0.7219	91.7536	123.7548	32.0011
2013	4.3051	92.4435	131.3690	38.9256
2014	4.2772	96.6300	137.4976	40.8676
2015	6.9430	96.1149	136.9000	40.7851
2016	9.9767	95.0480	129.5357	34.4878
2017	12.0350	92.7873	134.9905	42.2032
2018	13.5250	91.7491	135.4357	43.6866
2019	19.7508	83.4752	131.7381	48.2629

World	World consumption of PD for all uses [d]	World use of PD in transportation [e]
2010	8,497.76	6,706.22
2011	8,659.04	6,935.68
2012	8,815.78	7,105.51
2013	8,943.98	7,236.73
2014	9,114.00	7,425.49
2015	9,273.51	7,612.81
2016	9,227.47	7,736.16
2017	9,414.91	7,903.35
2018	9,475.86	8,096.96
2019	9,420.83	8,161.30

a. Data from *Fuel Activity for California's Greenhouse Gas Inventory by Sector & Activity (Fourteenth Edition: 2000 to 2019);* California Air Resources Board: Sacramento, CA. Fuel Combustion and Heat Content; https://ww2.arb.ca.gov/ghg-inventory-data

b. Data from *Refinery Inputs and Production;* California Energy Commission: Sacramento, CA. Fuel Watch. https://www.energy.ca.gov/data-reports/reports/weekly-fuels-watch/refinery-inputs-and-production

c. PD net export is PD production minus PD use. California refiners export PD to other states and nations.

d. Data converted to volume at an assumed energy density of 134.47 MJ/gal. from energy data in *Transportation sector energy consumption by region and fuel;* US Energy Information Administration: Washington, D.C. Report downloaded 29 March 2022 from: https://www.eia.gov/outlooks/aeo/data/browser/#/?id=49-IEO2021&region=0-0&cases=Reference&start=2010&end=2050&f=A&linechart=Reference-d210719.3-49-IEO2021&ctype=linechart&sourcekey=0

e. Data converted to volume at an assumed energy density of 134.47 MJ/gal. from energy data in *World Production and Final Consumption of Gas/Diesel;* International Energy Agency: Paris, FR. Downloaded 29 March 2022 from IEA Data and Statistics, Data Tables, Oil; https://www.iea.org/data-and-statistics/data-tables/?country=WORLD&energy=Oil

EXHIBIT 2. Partial Least Squares Regression Results

DB: diesel biofuel **PD:** petroleum distillate **LB (UB):** lower bound (upper bound) of 95% confidence interval

A. PD Export v. DB use and PD production

California (N, 10)

Model: PD Export ≈ 0.478 • DB use + 0.521 • PD production – 5.268

R-squared	0.869		
Standardized coefficients (y variable PD export)			
x variable	Coefficient	95% Confidence LB	95% Confidence UB
DB use	0.555	0.301	0.809
PD production	0.507	0.368	0.645
Residuals tests	**p-value (two-tailed)**	**alpha**	
Shapiro-Wilk	0.147	0.05	
Anderson-Darling	0.084	0.05	
Lilliefors	0.079	0.05	
Jarque-Bera	0.351	0.05	

California (N, 9)

Model: PD Export ≈ 0.505 • DB use + 0.505 • PD production – 4.869

R-squared	0.957		
Standardized coefficients (y variable PD export)			
x variable	Coefficient	95% Confidence LB	95% Confidence UB
DB use	0.601	0.363	0.838
PD production	0.505	0.400	0.610
Residuals tests	**p-value (two-tailed)**	**alpha**	
Shapiro-Wilk	0.411	0.05	
Anderson-Darling	0.431	0.05	
Lilliefors	0.484	0.05	
Jarque-Bera	0.597	0.05	

B. PD Export v. DB use and PD use

California (N, 10)

Model: PD Export ≈ 0.769 • DB use + 0.119 • PD use + 3.509

R-squared	0.734		
Standardized coefficients (y variable PD export)			
x variable	Coefficient	95% Confidence LB	95% Confidence UB
DB use	0.893	0.254	1.532
PD use	0.078	–0.589	0.745
Residuals tests	**p-value (two-tailed)**	**alpha**	
Shapiro-Wilk	0.396	0.05	
Anderson-Darling	0.401	0.05	
Lilliefors	0.301	0.05	
Jarque-Bera	0.424	0.05	

California (N, 9)

Model: PD Export ≈ 0.926 • DB use + 0.450 • PD use – 1.399

R-squared	0.931		
Standardized coefficients (y variable PD export)			
x variable	Coefficient	95% Confidence LB	95% Confidence UB
DB use	1.100	0.516	1.684
PD use	0.295	–0.041	0.631
Residuals tests	**p-value (two-tailed)**	**alpha**	
Shapiro-Wilk	0.281	0.05	
Anderson-Darling	0.301	0.05	
Lilliefors	0.440	0.05	
Jarque-Bera	0.649	0.05	

continued next page

EXHIBIT 2. Partial Least Squares Regression Results *continued*

DB: diesel biofuel **PD:** petroleum distillate **LB (UB):** lower bound (upper bound) of 95% confidence interval

C. Total Distillate v. PD use, DB use and PD export

California (N, 10)

Model: Total Distillate ≈ 1.000 • PD use + 1.000 • DB use + 1.000 • PD export + 0.000
R-squared ≈ 1.000
Standardized coefficients (y variable Total Distillate)

x variable	Coefficient	95% Confidence LB	95% Confidence UB
PD use	0.350	–0.012	0.712
DB use	0.620	0.349	0.891
PD export	0.534	0.380	0.687

CA input data tests	**p-value (two-tailed)**	**alpha**
PD use data		
Shapiro-Wilk	0.043	0.05
Anderson-Darling	0.055	0.05
Lilliefors	0.089	0.05
Jarque-Bera	0.138	0.05
DB use data		
Shapiro-Wilk	0.360	0.05
Anderson-Darling	0.462	0.05
Lilliefors	0.543	0.05
Jarque-Bera	0.678	0.05
PD export		
Shapiro-Wilk	0.444	0.05
Anderson-Darling	0.443	0.05
Lilliefors	0.596	0.05
Jarque-Bera	0.758	0.05

Notes: California data from Exhibit 1 for 2010 through 2019. PLS regressions and normality tests by XLSTAT (2022). Input data and residuals test p-values that exceed the alpha value of 0.05 suggest normal distributions of PLS residuals and, separately, PLS input data sets.

A. Results for the main drivers of PD export, DB use and PD production. Standardized coefficients and R-squared values indicate the strength of BD use influence, PD production influence, and the combined influence of these two factors on PD export.

B. The 95% confidence intervals of the standardized coefficients for PD use span zero, indicating the weak influence of PD use, relative to DB use and PD production, on PD export.

C. Modeled values approach unity (and PLS residuals could not be distinguished from zero), due to the inclusion of observations for all distillate fuels in the model. Given this very tight fit to the data, the standardized coefficient confidence interval for PD use that spans zero in this analysis reflects the rise and fall of California PD use as its DB use and PD exports continued to rise (Exhibit 1). Results thus describe the expected conservation of fuel volume in shifts among distillate components.

"N, 9" results for models in **A** and **B** help to inform possible effects of a potential input data anomaly. "N,10" results reflect the inclusion of a potentially anomalous outlier year (2016), when hydrocracking capacity may have shifted from distillate to gasoline production after an explosion idled substantial in-state gasoline production for 17 months.* This may have affected results from analyses A and/or B, which did not intrinsically balance all distillate data. Results of those analyses including *and* excluding the suspect data are shown for comparison.

* See *West Coast Transportation Fuels Markets;* U.S. Energy Information Administration: Washington, D.C. PADD 5 Transportation Fuels Markets. September 2015. www.eia.gov/analysis/transportationfuels/padd5; and Schremp, G. *Transportation Fuels Trends, Jet Fuel Overview, Fuel Market Changes & Potential Refinery Closure Impacts;* BAAQMD Board of Directors Special Meeting. 5 May 2021. Gordon Schremp, Energy Assessments Division, California Energy Commission: Sacramento, CA. Virtual meeting report presentation.

Attachment E

FACT CHECK: California's 2022 Draft Scoping Plan for Oil Refineries

Released Data Show CARB Relies on Unfounded Assumptions for Carbon Capture in the Refinery Sector, Making Results Invalid

COMMUNITIES FOR A BETTER ENVIRONMENT established 1978

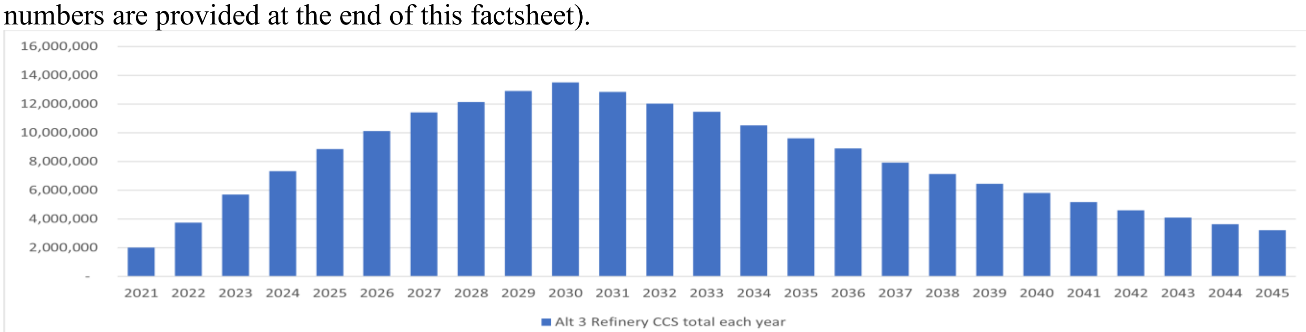
On Tuesday, May 10, 2022, CARB finally published the 2022 Scoping Plan modeling assumption spreadsheets. These key datasets underlying the foundational climate modeling for the Scoping Plan were surprisingly unavailable to support charted results in previous modeling results workshops. Now that detailed numbers are public, the nature of CARB's faulty input assumptions are clearer. These reflect forced policy decisions, not faults in the modeling program. The E3 modeling spreadsheets[1] provide year-by-year greenhouse gases assumed captured by carbon capture and sequestration (CCS) at oil refineries. These faulty assumptions invalidate the results of the refinery sector in the staff-preferred Alternative 3, the Proposed Scenario.

- As presented in the graph and citations below, **CARB modeling assumed CCS technology in refineries would need to start capturing over 2 million metric tonnes (MMT CO2e) at refineries, in 2021.** Capture would ramp up to a **peak of 13 million in 2030** and continue capture through 2045.

But these carbon capture systems do not currently exist at any refinery in California. Worldwide, we could not find a single existing major refinery comprehensively retrofitted with CCS. Much smaller demonstration projects exist in sections of refineries, such as refinery hydrogen plants (steam methane reformers) and one small, newly built Canadian refinery which includes CCS in a spacious rural area.[2]

By contrast, California refineries are massive complexes, with hundreds of refinery boilers, heaters, and other combustion stacks, interspersed with miles of complex piping and storage tanks, and most surrounded by neighbors and businesses.[3] That most California refineries are highly space-constrained is well-documented, for instance, in South Coast Air Quality Management District (SCAQMD) Rulemaking 1109.1. Adding widespread CCS to hundreds of boilers and heaters presents a major safety hazard according to expert studies, making the assumption of widespread refinery CCS use not only improbable but dangerous, if forced.

To make assumed CCS numbers visible, we used the newly released assumptions data to total Refinery CCS amounts each year for four refinery fuels evaluated in E3 modeling (petroleum coke, pipeline gas, petroleum and process gas, and waste heat) for Alternative 3, from the "CCS by fuel" sheet. We graphed it as follows (specific numbers are provided at the end of this factsheet).



[1] 2022 Draft Scoping Plan, Modeling Information, AB 32 GHG Inventory Sectors Modeling Data Spreadsheet, last Sheet in Excel spreadsheet is CCS by fuel.

[2] For more on the low capture rates and high cost of three operational steam methane reformer demonstration projects, none of which comport with CARB's "at the stack" 90% capture rate assumption, please see Stanford academic comment letters. Wara, Michael et al, May 3, 2022, www.arb.ca.gov/lists/com-attach/62-sp22-econ-health-ws-VDVSJgNgVloBdAVm.pdf and Wara, Michael et al, https://www.arb.ca.gov/lists/com-attach/65-sp22-modelresults-ws-BWQFcVMwUFxWI1Az.pdf.

[3] For more detail on the physical limitations and hazards at California's refineries, see May, Julia, CBE, April 4, 2022, CBE Comments on Scoping Modeling – Refineries, Re: CARB Draft Scoping Plan: AB32 Source Emissions Initial Modeling Results, pp. 4-10, available at CARB comment portal.

The projected cumulative totals of carbon dioxide removed by CCS at refineries reach:

► 2021-2025: 27.6 million (metric tonnes) ►2026-2030: another 60 million

► 2031-2035: another 56.4 million ►2036-2045: another 57 million

Carbon capture at California refinery hydrogen plants must be considered *within the entire refinery system*. At the Initial Modeling Workshop, CARB indicated it was using a 90%[4] capture rate "at the stack."[5] Yet no such rate has been demonstrated at a refinery hydrogen plant.[6] As entirely new technology to California oil refineries, CCS in refineries face several years, if not at least a decade to be a serious consideration for operation, after site-specific engineering design, development of refinery-specific regulatory frameworks, site-specific environmental review, construction, and de-bugging.

CARB's imaginary CCS, even if implemented, would allow continued emissions throughout most of the refinery, be publicly subsidized, very costly, delay and undermine the real goal – phasing out fossil fuel infrastructure. The absence of a formal plan to manage the decline of oil refining in California by 2045 is shockingly missing from the Draft Scoping Plan. This transition planning is needed so that communities and workers have certainty in their transition to accompany the transition to zero emission cars and trucks, and in order to survive the climate disaster, as well as the public health crisis from smog.

Alternative 3 Refinery CCS Totals Each Year *(Tonnes CO2)* are as follows:

2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
2,003,225	3,740,895	5,691,755	7,334,956	8,860,179	10,116,780	11,402,646	12,129,938	12,903,767	13,504,086

2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
12,840,721	12,037,585	11,451,916	10,502,560	9,613,486	8,910,653	7,929,212	7,134,874	6,455,638	5,817,768

2041	2042	2043	2044	2045
5,164,447	4,606,671	4,097,655	3,644,028	3,213,948

See Attachments A & B for detailed Refinery Data from E3 modeling.

For more information, contact: Julia May, Senior Scientist, or Connie Cho, Attorney, CBE

Last updated: May 13, 2022

[4] Mahone et al., CARB Draft Scoping Plan: AB 32 Source Emissions Initial Modeling Results, Slide 10 - Oil & Gas Extraction and Petroleum Refining Emissions, Mar. 15, 2022, https://ww2.arb.ca.gov/sites/default/files/2022-03/SP22-Model-Results-E3-ppt.pdf.

[5] CARB Deputy Executive Rajinder Sahota clarified in verbal comments at the Workshop and the following EJAC meeting.

[6] See Footnote 2 and Footnote 3.

Attachment A Refinery CCS: Excerpt from Scoping Plan E3 Spreadsheets: *CCS Captured Emissions By Fuel, Post-combustion* – Refineries, Alt 3 (tCO2) (CBE added totals)

Fuel	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Coke	431,902	810,353	1,241,882	1,613,147	1,958,683	2,250,237	2,550,208	2,731,180	2,925,039	3,083,143
Pipeline Gas	679,251	1,261,687	1,938,415	2,518,790	3,032,947	3,445,594	3,868,705	4,089,664	4,322,966	4,491,074
Refinery & Process Gas	830,344	1,553,467	2,373,925	3,074,842	3,722,879	4,264,933	4,819,836	5,147,344	5,497,234	5,778,156
Waste Heat	61,729	115,388	137,533	128,178	145,669	156,016	163,897	161,750	158,528	151,713
Total	2,003,225	3,740,895	5,691,755	7,334,956	8,860,179	10,116,780	11,402,646	12,129,938	12,903,767	13,504,086

Fuel	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Coke	2,947,821	2,779,721	2,659,595	2,457,293	2,266,784	2,117,399	1,903,309	1,730,080	1,582,601	1,442,878
Pipeline Gas	4,253,353	3,968,189	3,758,179	3,418,846	3,101,734	2,849,233	2,499,625	2,216,619	1,972,258	1,744,383
Refinery & Process Gas	5,509,131	5,180,516	4,942,886	4,554,268	4,189,592	3,902,720	3,498,487	3,171,371	2,893,112	2,630,508
Waste Heat	130,417	109,159	91,256	72,153	55,376	41,301	27,791	16,804	7,667	-
Total	12,840,721	12,037,585	11,451,916	10,502,560	9,613,486	8,910,653	7,929,212	7,134,874	6,455,638	5,817,768

Fuel	2041	2042	2043	2044	2045
Coke	1,298,900	1,176,350	1,066,569	967,491	872,809
Pipeline Gas	1,503,952	1,297,331	1,102,375	931,705	771,288
Refinery & Process Gas	2,361,595	2,132,990	1,928,711	1,744,833	1,569,851
Waste Heat	-	-	-	-	-
Total	5,164,447	4,606,671	4,097,655	3,644,028	3,213,948

Attachment B: REFINERY EMISSIONS: Excerpts, totaled from E3 Spreadsheets: Refinery BAU, Alt 3 & CCS we totaled from two sheets: Energy GHG Details, and CCS by Fuel.

Below these, we showed BAU minus refinery CCS, to show that there is another unidentified Refinery emission reduction assumed (from Cap & Trade? or lower demand? – this is not identified). **Since there are no proposed *requirements* for refineries to reduce production, this appears to be another unrealistic assumption, especially since Refinery GHGs have not gone down under Cap & Trade.** (This sheet in is in million tonnes, previous page in tonnes.)

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
BAU	33.31	31.09	31.57	31.28	30.94	30.22	29.98	28.75	28.06	27.38
Alt 3 Total emissions	31.27	27.24	25.62	22.92	20.38	17.64	15.34	12.71	10.54	8.53
Alt 3 CCS	2.00	3.74	5.69	7.33	8.86	10.12	11.40	12.13	12.90	13.50
BAU minus CCS*	31.31	27.35	25.88	23.94	22.08	20.10	18.58	16.62	15.15	13.88

	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
BAU	26.93	26.22	26.06	25.23	24.74	24.82	24.15	23.83	23.77	23.69
Alt 3 Total emissions	8.10	7.59	7.21	6.60	6.03	5.57	4.95	4.44	4.01	3.61
Alt 3 CCS	12.84	12.04	11.45	10.50	9.61	8.91	7.93	7.13	6.46	5.82
BAU minus CCS*	14.09	14.18	14.61	14.73	15.12	15.91	16.22	16.70	17.32	17.88

	2041	2042	2043	2044	2045
BAU	23.36	23.20	23.10	23.02	22.85
Alt 3 Total emissions	3.20	2.85	2.53	2.25	1.98
Alt 3 CCS	5.16	4.61	4.10	3.64	3.21
BAU minus CCS*	18.19	18.60	19.00	19.37	19.63