April 4, 2022

Liane Randolph, Chair
Deputy Executive Officer
California Air Resources Board
1001 "I" Street
Sacramento, CA 95814

Re: Earthjustice and Leadership Counsel for Justice & Accountability Comments on the Draft Scoping Plan – March 15, 2022 Workshop

Dear Chair Randolph and Members of the Board:

Earthjustice and Leadership Counsel for Justice and Accountability respectfully submit these comments in response to the initial modeling results for the 2022 Scoping Plan released by CARB on March 15, 2022. The modeling just conducted for the Scoping Plan is significant in that it must communicate all possible emissions reductions from all feasible or soon-to-be-feasible reduction strategies known to date, and must accurately calculate the emissions reductions resulting from these strategies. Inaccurate and skewed modeling can significantly misguide California's climate policy and lead to continued, disproportionate harm to communities who have historically not been visible in CARB's research, modeling, or policy development. Our comments and requests for additional clarity on the modeling results flow from our shared concern that the Scoping Plan must provide an honest assessment of the unprecedented transformation necessary to both avert greater climate catastrophe and to repair the deep injustice of our fossil-fueled energy and agricultural systems. **We believe the modeling presented in the workshop fails to meet these needs and that major revisions are therefore necessary.**

The most prudent and just path to carbon neutrality will maximize immediate emission reductions through an accelerated shift from polluting to zero-emission solutions in a manner that prioritizes benefits in disadvantaged communities, while avoiding reliance on yet-to-be commercialized technologies that allow extraction and combustion to persist. There is significant uncertainty about the optimal solution set for decarbonizing the final, most challenging portions of our economy, but they do not alter the fundamental need to accelerate our transition from fossil fuels in the vast majority of sectors where scalable solutions already exist. In the Scoping Plan, CARB must chart a path towards this rapid decarbonization, but its current modeling falls far short of this task and puts California at risk of failing to fulfill its climate and environmental justice mandates. We therefore urge CARB to take the following actions, which we explain in more detail below:

- ➔ Amend Alternative 4 to, at a minimum, meet the targets set forth in existing State goals and directives.
- ➔ Provide a breakdown of emissions for the energy sector (and ideally, sub-sector) to better understand how final energy demand in each category equates with remaining emissions.

- ➔ Confirm that the carbon intensity of dairy biogas excludes avoided methane emissions and is not treated as carbon negative.
- ➔ Update the modeling across all scenarios, accounting for the reassessed environmental harms and benefits caused by dairy digesters to rural, disadvantaged communities.
- ➔ Clarify that, in Alternatives 1 and 2, the rates of herd size reduction are *in addition* to CARB's 5% annual herd size reduction figure.
- ➔ Ensure scenarios which increase digesters account for persistent methane leakage, and do not assume continued, historic rates of herd size reductions and their associated enteric emission reductions.
- ➔ Include a discussion of how livestock transition strategies can accelerate emission reductions, improve carbon sequestration from natural and working lands, and enhance environmental justice benefits.
- ➔ Model outstanding agroecological emissions reduction strategies.
- ➔ Correct Alternatives 2-4 to align with CARB's input assumption that CCS is added to refineries in 2030, and not in 2022 as currently shown.
- ➔ Assume refining emissions prior to 2030 are without CCS in all scenarios.
- ➔ Explore more realistic assumptions of capture rates (60-70%) in at least some of the scenarios and factor in emissions from process energy to power CCS.
- ➔ A broader suite of mitigation options with a stronger record of efficacy should be incorporated into the scenarios for Industrial emissions.
- ➔ Include discussion of a gas transition strategy across all scenarios that includes orderly decommissioning of most or all of the gas network.
- ➔ Not consider hydrogen blending in the residential and commercial gas distribution system.
- ➔ Ensure "Smart Growth/VMT" strategies lead to reductions in the overall vehicle population, which may impact assumptions about renewable energy and vehicle deployment.
- ➔ Increase the scale and pace of electric sector emissions reductions for Alternatives 2, 3, and 4: Alternative 2 and either alternative 3 or 4 Should reach 10 MMT by 2035 with the remaining Alternative achieving 10 MMT by 2045 and all alternatives eventually achieving 0 MMT.
- ➔ Include in Alternative 1 full retirement of the gas fleet and include gas plant retirements in all Alternatives**.**
- ➔ Exclude new gas capacity from all Alternatives.

Scenarios and Key Metrics

We appreciate the challenge of distilling several possible paths to carbon neutrality into four scenarios. These four scenarios should, in theory, provide a view into possible trade-offs between ambition, feasibility, cost, and climate and public health benefits, among other factors. However, existing State policies, goals, and commitments should serve as a basic feature of all the scenarios. Existing policies and goals—while unquestionably inadequate to achieve carbon neutrality by 2045—provide at least a first order screen of the minimum targets necessary for a viable path for California's energy transition.

➔ CARB should amend Alternative 4 to, at a minimum, meet the targets set forth in existing State goals and directives.

Unfortunately, CARB has used one of its four scenarios on an Alternative which demonstrably fails to meet this minimum threshold. The assumptions used to construct Alternative 4 fail to meet multiple State goals and commitments outlined in Legislation, CARB resolutions, and Executive Orders spanning 3 Governors across both major political parties. Specifically, Alternative 4:

- Fails to meet Executive Orders B-30-15[1] and S-3-05,[2] and the Legislature's findings in SB 350, to reduce emissions of greenhouse gases 80% below 1990 levels by 2050.[3]
- Fails to meet Governor Newsom's directive to analyze pathways that phase out oil extraction across the state "by no later than 2045"[4]
- Fails to align with Governor Newsom's Executive Order that requires all new car and passenger truck sales in California be zero-emission vehicles (ZEVs) by 2035[5]
- Fails (along with Alternatives 2 and 3) to meet the requirements of SB100 to ensure a "transition to a zero-carbon electric system for the State of California."[6]
- Fails to fulfill the requirements of AB 197 to prioritize policies that "result in direct emission reductions at large stationary sources of greenhouse gas emissions sources and direct emission reductions from mobile sources."[7] Instead, the pathway relies on 120 million metric tons (MMT) of carbon removal in 2045 (a more than 10,000 fold increase from the current global annual capacity of direct air capture).

We therefore urge CARB to amend Alternative 4 to, at a minimum, meet these basic targets already enshrined in California's State policies and commitments.

➔ A more useful Alternative 4 would match the more aggressive energy efficiency and clean energy, vehicle, and appliance deployment schedules of Alternative 1, while allowing a longer "tail" for carbon neutrality.

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[1] Governor Edmund Brown, Executive Order B-30-15 (Apr. 29, 2015) https://www.library.ca.gov/wp-content/uploads/GovernmentPublications/executive-order-proclamation/39-B-30-15.pdf

[2] Governor Arnold Schwarzenegger, Executive Order S-3-05 (June 1, 2005) http://static1.squarespace.com/static/549885d4e4b0ba0bff5dc695/t/54d7f1e0e4b0f0798cee3010/1423438304744/California+Executive+Order+S-3-05+(June+2005).pdf.

[3] Senate Bill No. 350, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350.

[4] Office of Governor Gavin Newsom, "Governor Newsom Takes Action to Phase Out Oil Extraction in California" (Apr. 23, 2021) https://www.gov.ca.gov/2021/04/23/governor-newsom-takes-action-to-phase-out-oil-extraction-in-california/

[5] Governor Gavin Newsom, Executive Order N-79-20 (Sept. 23, 2020) https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf.

[6] Senate Bill No. 100, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100.

[7] Assembly Bill No. 197, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB197.

As we have argued in previous comments, to meet the spirit of Governor Newsom's request to analyze pathways for more ambitious reductions of greenhouse gases, CARB should include a scenario which examines the potential to maximize near-term progress toward decarbonization, even if full carbon neutrality is not achieved in 2035. A more useful Alternative 4 would fully leverage proven, scalable, and existing solutions, while acknowledging the uncertainty and additional time needed for optimally decarbonizing the final, hardest to abate emissions in certain sectors. This would provide a useful foil to Alternative 1 by incorporating the greatest ambition feasible for relatively low-regret mitigation options (e.g. efficiency and accelerated clean energy deployment) while allowing for an evaluation in the trade offs of avoiding early retirements and leveraging "reach" solutions like hydrogen for aviation later in the transition, when they are more likely to reach maturity.

- ➔ CARB should provide a breakdown of emissions for the energy sector (and ideally, sub-sector) to better understand how final energy demand in each category equates with remaining emissions.

Finally, it would be helpful to have further disaggregation of energy emissions by sub-sector, similar to the breakdown of non-energy emissions shown in Slide 11. While there is some indication of this information by total emissions in Slide 9, these do not provide a full story of how varying ambition of mitigation in each sector yields different levels of reduction. For example, it is not clear how many emissions remain from road transportation, off-road transportation, buildings, industry, etc. The sector specific slides show how the scenarios compare in terms of final energy demand, but it is not clear how this corresponds with emissions.

Agriculture & Dairies

- ➔ CARB should confirm that the carbon intensity of dairy biogas excludes avoided methane emissions and is not treated as carbon negative.

CARB has been made aware of the deep concerns by rural, environmental justice communities regarding the inaccurate calculation of carbon intensity (CI) and inflating LCFS crediting of dairy biogas. It is not clear what CI value the Scoping Plan modeling assigns to biomethane from dairies, but it is vital for the Plan's integrity that any biomethane generated from dairy manure not be misleadingly quantified as having a negative CI, as is current practice within the low carbon fuel standard (LCFS). The negative CI for dairy biomethane is based on the flawed assumption that, but for the LCFS, waste methane would be dumped directly into the atmosphere. As researchers have stressed, "[t]his assumption is flawed if one also assumes that GHG emissions reductions are a policy priority, as existing practice is not the appropriate baseline for determining counterfactual management practice…"[8] As the study points out, "if the methane can be captured for RNG production, it can be captured for diversion to a flare, and it is unrealistic to assume that capturable methane would be vented under a ghg conscious policy regime."[9]

[8] Emily Grubert, At Scale, Renewable Natural Gas systems Could be Climate Intensive: The Influence of Methane Feedstock and Leakage Rates (Aug. 11, 2020) https://iopscience.iop.org/article/10.1088/1748-9326/ab9335.
[9] *Id*.

Indeed, because the exercise at hand in the scoping plan is to determine the various paths to carbon neutrality, there is no scenario where the counterfactual management practice is the current practice: allowing methane pollution from factory farms to continue unmitigated. SB 1383 requires CARB to consider regulating methane emissions from dairies by January 1, 2024, and at that point, the baseline counterfactual must be that all methane from manure is either captured and diverted to flare, or mitigated through alternative manure management. Treating the capture of unregulated yet anthropogenic sources of methane emissions as negative emissions completely undermines the concept of genuine carbon removal, which every scoping plan scenario appears to rely on in some form—either natural or engineered.

- ➔ In addition, CARB should update the modeling across all scenarios, accounting for the reassessed environmental harms and benefits caused by dairy digesters to rural, disadvantaged communities.

Apart from failing to exclude methane capture, the current carbon intensity calculation for dairy biomethane is inaccurate due to the "system boundary" for factory farm gas being considered only narrowly as methane from manure in storage. Upstream methane from enteric sources and feed production are excluded from CARB's "well to wheel" system boundary approach to calculating carbon intensity of manure methane. Additionally, downstream nitrous oxide emissions from digestate composting and land application are excluded from the "well to wheel" system boundary approach; including such emissions would largely cancel out methane reductions from factory farm gas. While CARB has communicated the intention of investigating dairy biogas' carbon intensity after the Scoping Plan, the fact remains that a multidecadal Scoping Plan is in development now and must not use inaccurate assumptions.

- ➔ CARB should clarify that, in Alternative 1 and 2, the rates of herd size reduction are *in addition* to CARB's 5% annual herd size reduction figure.

CARB staff shared verbally at the modeling workshop on March 15, 2022 that the current rate of herd size decline in California is around 5%, and that model Alternative 1 assumes a 2% herd size reduction while Alternative 2 assumes a 1% herd size reduction.

- ➔ CARB should ensure scenarios which increase digesters account for persistent methane leakage, and do not assume continued, historic rates of herd size reductions and their associated enteric emission reductions.

As an initial matter, dairy methane mitigation strategies that rely on digesters must account for the methane leakage from the digester equipment, which would be additional relative to strategies that eliminate the generation of methane in the first instance. It is unreasonable for CARB to assume that strategies relying on digesters, which actually increase the amount of methane produced in manure lagoons - will capture 100% of their methane. Leakage rates observed in the biogas industry range from 3 to 5.5% (not including gas transportation).

Additionally, the economic logic of digesters, given their high upfront costs, means they will require continual (and preferably, growing) levels of gas production and sale.[10] As a result, we would expect this to reverse, or at a minimum halt, any current trends in dairy herd size reductions associated with confined animal feeding operations (CAFOs) that install digesters. Therefore, a conservative approach to modeling the effect of high digester adoption for a scenario should be that herd size reductions – and accordingly, enteric emission reductions – cease. This would have the effect of accurately reflecting the relative weakness in mitigation strategies that rely on existing animal livestock practices persisting.

- ➔ The Scoping Plan should include a discussion of how livestock transition strategies can accelerate emission reductions, improve carbon sequestration from natural and working lands, and enhance environmental justice benefits.

Mitigation strategies that do not rely on digesters should not merely assume a linear reduction in herd sizes. Many scientists, researchers, and agro-ecological practitioners recognize that one of the best strategies for reducing emissions from factory farms is transitioning them to either integrated crop-livestock systems or to plant and vegetable agriculture. Transitioning to mixed or integrated crop-livestock systems can improve the economic viability of farms while eliminating the need for manure lagoons while creating efficient nutrient cycles between plants and animals, thereby both reducing methane emissions and potentially increasing carbon sequestration through improved soil health.[11] Transitioning factory farms entirely away from livestock production, as many farmers and animal welfare advocates have already piloted, can eliminate both manure and enteric emissions entirely.[12] A bill introduced in the United States Senate, with support from farmers, labor organizations, and health and environmental advocates, would create a fund to assist farmers that want to voluntarily transition from CAFO ownership to organic vegetable production.[13] A recent study in Nature Food found that shifting from animal to plant-based agriculture in wealthy nations could deliver a significant "double climate dividend" as the land spared from shifting away from livestock could be restored to natural vegetation and increase carbon sequestration.[14]

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[10] See, e.g., Aaron Smith, "What's Worth More: A Cow's Milk or its Poop?" (Feb. 3, 2021) https://asmith.ucdavis.edu/news/cow-power-rising.

[11] See, e.g. Michael Russelle et al., Reconsidering Integrated Crop-Livestock Systems in North America (2007) 10.2134/agronj2006.0139; Patrick Veysett et al., Mixed Crop-Livestock Farming Systems: A Sustainable Way to Produce Beef? Commercial Farms Results, Questions, and Perspectives (2014) https://doi.org/10.1017/S1751731114000378.

[12] See, e.g. Nadra Nittle, The Plant-Based Movement to Transition Farmers Away from Meat and Dairy Production (Jan. 13, 2020) https://civileats.com/2020/01/13/the-plant-based-movement-to-transition-farmers-away-from-meat-and-dairy-production/

[13] Office of Senator Cory Booker, "Booker Reintroduces Bill to Reform Farm System With Expanded Support From Farm, Labor, Environment, Public Health, Faith Based and Animal Welfare Groups" (Jul. 15, 2021) https://www.booker.senate.gov/news/press/booker-reintroduces-bill-to-reform-farm-system-with-expanded-support-from-farm-labor-environment-public-health-faith-based-and-animal-welfare-groups

[14] Zhongxiao Sun et al., Dietary Change in High-Income Nations Alone Can Lead to Substantial Double Climate Benefit (Jan 2022)

Given the growing stockpile of cheese in U.S. cold storage to deal with oversupply, and the significant growth in demand for healthy, plant-based foods, the Scoping Plan must include a discussion of the role livestock-transition strategies could play in helping California shift to a lower-emitting, more just food system. Such a discussion must center the opportunity to improve air, water, and soil quality while delivering high-quality land-based jobs in rural communities. CARB should initiate a community-informed process for determining the specific transition options that are best suited for each geography, ecosystem, and community's needs.

- ➔ To more accurately model the emissions reductions possible from the agricultural sector, CARB must model outstanding agroecological emissions reduction strategies.

The modeling results report that "agriculture and other methane and fugitive emissions are a large source of remaining emissions in all alternatives explored." CARB staff have also described in more detail that much of these remaining agricultural emissions come from polluting practices of large-scale agriculture such as application of nitrogen fertilizer, use of combustion-fueled agricultural equipment, and enteric and manure-caused dairy emissions. These persistent agricultural emissions reported in the modeling can indeed be further reduced through a transition to agroecological practices like utilizing organic fertilizers and natural pesticides, and transitioning to smaller-scale dairy farms. These models have been tested and are known to be effective solutions for minimizing environmental harm from agriculture.[15] Emissions from combustion-fueled equipment can also be mitigated - a slew of new electric tractor and equipment startups are targeting electrification of agriculture,[16] and hydraulic efficiency improvements alone can slash emissions, even where equipment remains reliant on diesel.[17]

Oil and Gas Extraction and Petroleum Refining

- ➔ Even if the precise date by which this full phase out is achieved varies, it should be the State's goal to pursue decarbonization in a manner that ultimately eliminates reliance on the extraction and refining of fossil fuels.

We appreciate that CARB has included an Alternative which examines the full phase-out of fossil fuel extraction and refining. The fossil fuel supply chain not only emits large amounts of greenhouse gas, it poisons the air, water, and soil of communities and ecosystems that are forced to live adjacent to them. These communities, predominantly low-income communities of color, have become sacrifice zones for the oil and gas supply chain. Even if decarbonization through other means could prove viable - which we seriously doubt - it would not alter the fundamental obligation we have to fully transition away from fossil fuel extraction and combustion for the health and safety of all California's communities.

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[15] https://civileats.com/2022/03/04/op-ed-evidence-agroecology-transform-food-system-justice-sovereignty/

[16] Kyle Stock, "Tractors are Finally Getting the Tesla Treatment" (Aug. 18, 2021) https://www.bloomberg.com/features/2021-monarch-electric-tractors-self-driving/.

[17] Brianna Jackson, "Can't Easily Electrify Tractors, But You Can Slash Emissions with Hydraulics" (Feb. 2022) https://www.interactanalysis.com/you-cant-easily-electrify-tractors-but-you-can-slash-emissions-with-hydraulics/.

➔ Keeping warming to 1.5 degrees Celsius while accounting for equity in carbon budgets requires wealthy, high-emitting nations to phase out all oil and gas production by 2034.

While it may be useful to examine the tradeoffs of various timelines, climate scientists have made clear that retaining a realistic chance of limiting global warming to 1.5 degrees means wealthy, oil-producing nations will have to phase out fossil fuels much faster to allow the poorest, fossil fuel dependent countries until mid-century. According to a recent study, the United States and other rich oil-producing nations must phase out oil production by 2034 to stay within the Paris Agreement's carbon budget. Given California is the wealthiest State in the nation, with one of the most well-diversified economies of any oil-producing jurisdictions, it has an obligation to at a minimum meet this phase-out goal.[18]

➔ Alternatives 2-4 should be corrected to align with CARB's input assumption that CCS is added to refineries in 2030, and not in 2022 as currently shown. The Scoping Plan should assume refining emissions prior to 2030 are without CCS in all scenarios.

Another confusing aspect of fossil fuel supply chain emissions is that in the most aggressive scenario—Alternative 1—emissions from petroleum refining are higher than all other scenarios with less aggressive reductions in oil demand until about 2032. In fact, Slide 10 shows that Alternatives 2-4 (the less ambitious scenarios) achieve far lower emissions of petroleum refining than Alternative 1 starting as early as 2022.

We believe this must be an error. To the extent that these alternatives have lower emissions because they rely on carbon capture and sequestration (CCS), it cannot be assumed that CCS will be constructed and operating on most refineries starting this year. CARB's scenario assumption inputs from December note that Alternatives 2-4 will use CCS on the "majority of operations by 2030."[19] Even the assumption that CCS can be constructed and operating at refining facilities in California within the next eight years is an incredibly ambitious assumption—beyond upgrades to the refinery itself, CCS depends on a vast network of pipeline infrastructure and dedicated compressing and storage facilities that would require several years to build even in the most optimistic case. It is incorrect to assume that CCS will be operating at all refineries starting immediately.

➔ The Alternatives should explore more realistic assumptions of capture rates (60-70%) in at least some of the scenarios and factor in emissions from process energy to power CCS.

Another unreasonable assumption for the fossil fuel supply chain sector is that CCS is assumed to have a 90% capture rate in each alternative. This is an unrealistic assumption. To date, more than 80% of all

[18] Dan Calverly et al., Phaseout Pathways for Fossil Fuel Production Within Paris-Compliant Carbon Budgets, (Mar. 2022) https://www.research.manchester.ac.uk/portal/en/publications/phaseout-pathways-for-fossil-fuel-production-within-pariscompliant-carbon-budgets(c7235a8e-e3b1-4f44-99de-c27958c03758).html

[19] CARB, Pathways Scenario Modeling - 2022 Scoping Plan Update (Dec. 15, 2021) at 8 https://ww2.arb.ca.gov/sites/default/files/2021-12/Revised_2022SP_ScenarioAssumptions_15Dec.pdf.

carbon capture projects proposed have ended in failure.[20] At least some of the alternatives should model more realistic assumptions about capture rates, in line with the chronic failure of CCS projects to capture anywhere near their promised rates.[21] In the same way that each alternative models varying rates of clean technology adoption, it is reasonable and practical for CARB to model varying rates of feasible carbon capture that more closely align with the current reality of poor capture rates.

Moreover, powering CCS is extremely energy intensive - in the context of a gas power plant, it can cannibalize 30-50% of a plant's energy output.[22] Because the alternatives that rely on CCS (Alternatives 2-4) never fully decarbonize the grid, powering CCS will require dedicated, off-grid renewable energy to avoid increasing process emissions. It is important to capture the impacts to cost and renewable energy demand that these Alternatives entail by requiring CCS for persistent petroleum refining.

Industrial Emissions

- ➔ Rather than over-rely on CCS, a broader suite of mitigation options with a stronger record of efficacy should be incorporated into the scenarios for Industrial emissions.

We are concerned that the role of CCS is overstated as a simple fix for industrial emissions when a much broader range of mitigation options is likely superior. The IPCC estimates that CCS will play the smallest role of any mitigation option evaluated in 2030.[23] CCS even appears to be called on to mitigate less than half of the emissions achieved by cementitious material substitution (a proposal the EJAC requested CARB evaluate in the scenarios in workshops last summer, but which does not appear in the modeling results).[24] Enhanced recycling and material efficiency are both expected to play a far larger roles in mitigating industrial emissions than CCS, and at substantially lower cost, but it does not appear that CARB will consider these in its model, either. This is a significant error. While CARB's analysis appears to capture the primary role of fuel switching in some of scenarios, it assumes virtually all the rest of the sector will rely on CCS. Over-relying on what the IPCC classifies as the highest cost, lowest impact mitigation option will unnecessarily skew the Scoping Plan away from solutions that are vastly more cost-effective and better suited to reducing – rather than extending – reliance on fossil fuels.

[20] Ahmed Abdullah et al., Explaining successful and failed investments in U.S. carbon capture and storage using empirical and expert assessments (Sept. 9, 2020) https://doi.org/10.1088/1748-9326/abd19e.
[21] See, e.g. Bruce Robertson et al., "Carbon Capture to Serve Enhanced Oil Recovery: Overpromise and Underperformance" (Mar. 2022) https://ieefa.org/wp-content/uploads/2022/02/Carbon-Capture-to-Serve-Enhanced-Oil-Recovery-Overpromise-and-Underperformance_March-2022.pdf; and David Schlissel et al., "Blue Hydrogen" (Feb. 2022) at slides 18-20 http://ieefa.org/wp-content/uploads/2022/02/Blue-Hydrogen-Presentation_February-2022.pdf.
[22] Craig Bettenhaus, "The Life or Death Race to Improve Carbon Capture" (July 18, 2021) https://cen.acs.org/environment/greenhouse-gases/capture-flue-gas-co2-emissions/99/i26.
[23] IPCC, Climate Change 2022 - Mitigation of Climate Change (April 4, 2022) at SPM-50 https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_FullReport.pdf.
[24] Id,

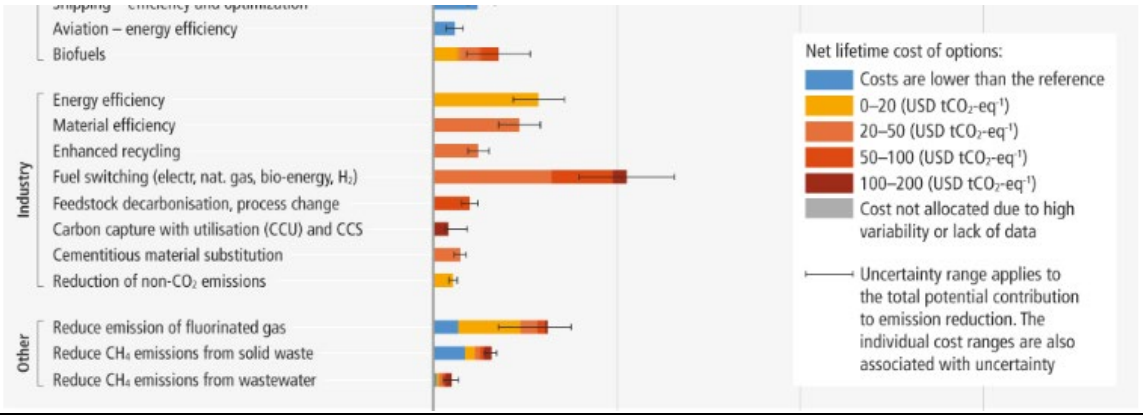

Figure 1: Overview of Mitigation Options and their Estimated Ranges of Costs and Potentials in 2030

Building Energy Demand

➔ <u>The Scoping Plan should include discussion of a gas transition strategy across all scenarios that includes orderly decommissioning of most or all of the gas network.</u>

We are pleased to see that Alternative 1 achieves full retirement of the gas distribution system by 2035, through a swift end to new sales of polluting appliances and an ambitious rate of existing building retrofits. A building transition strategy that seeks to prune, and ultimately completely decommission, the low-pressure gas distribution system would eliminate emissions while maximizing reductions in methane leakage pervasive throughout the gas delivery system and avoiding potentially surging costs for remaining gas ratepayers that would need to maintain the system.

While the date by which 100% of new appliance sales are electric varies, such a phaseout is common across all scenarios. This implies that eventually, the gas distribution system will need to be retired (or at least substantially trimmed) in all scenarios, given that remaining gas appliances will need to be replaced by electric ones upon burnout, and the gas delivery system will eventually become a stranded asset.

➔ <u>Scenarios that delay or fail to decommission sections of the gas system should reflect higher levels of leakage methane leakage (at least 3.6%) from the gas distribution system and remaining appliances.</u>

Furthermore, recent research underscores the severity and pervasiveness of methane leakage in the gas distribution system - upstream emissions from the production stage alone are estimated to average a 2.8% leakage rate for California.[25] A new study by researchers at Stanford just this year found that unburnt methane leaked from gas stoves, even when they were not on, equaled roughly 0.8-1.3% of the gas they used.[26]

[25] Diana Burns et al., Attribution of production-stage methane emissions to assess spatial variability in the climate intensity of US natural gas consumption (Jan. 2021) https://doi.org/10.1088/1748-9326/abef33.
[26] Eric Lebel et al., Methane and NOx Emissions from Natural Gas Stoves, Cooktops, and Ovens in Residential Homes (Jan. 2022) https://doi.org/10.1021/acs.est.1c04707.

➔ CARB should not consider hydrogen blending in the gas residential and commercial distribution system.

Given the imperative of a near-total transition off the gas system in order to slash emissions from buildings, improve public health by reducing exposure to indoor combustion, lower costs for ratepayers and businesses, we strongly urge CARB to exclude proposals that blend small amounts of hydrogen into the gas distribution grid. As an initial matter, such a strategy hits a dead-end well short of full or even meaningful decarbonization – the existing gas distribution grid and gas appliances do not have any viable path to operate on substantial volumes of pure hydrogen without unacceptable risk of explosion.

Countless independent analyses conclude that blending green hydrogen into the gas distribution grid for low-grade heat is among the worst possible applications for its use. The National Renewable Energy Laboratory concluded that gas pipeline injection is the least compelling of four potential applications of hydrogen in California.[27] Bloomberg New Energy Finance founder Michael Liebreich rated using hydrogen for domestic heating an "F", calling the idea of blending clean hydrogen into the natural gas grid to reduce carbon emissions "stupidly inefficient."[28] And a recent study by the Fraunhofer Institute ranked heat for buildings last in the "merit order" of potential applications.[29]

No credible climate decarbonization scenario should squander extremely expensive and supply-constrained hydrogen to achieve miniscule emission reductions. It would not alter the imperative to reduce gas throughput quickly and dramatically and would require substantial investment into upgrading a system originally intended to handle pure methane. Doing so would undoubtedly result in unacceptable levels of asset stranding, given the scenarios all include 100% sales of electric appliances, implying an eventual end for gas consumption in residential and commercial buildings. The Alternatives should ensure green hydrogen supply is reserved for more socially optimal applications.

Transportation

➔ CARB should ensure "Smart Growth/VMT" strategies lead to reductions in the overall vehicle population, which may impact assumptions about renewable energy and vehicle deployment.

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[27] John Eichman & Francisco-Flores Espino, California Powerto-Gas and Power-to-Hydrogen Near-Term Business Case Evaluation, NREL (Dec. 2016)

[28] Leigh Collins, Liebreich: 'Oil sector is lobbying for inefficient hydrogen cars because it wants to delay electrification', Recharge (June 30, 2011), https://www. rechargenews.com/energy-transition/liebreich-oil-sectoris-lobbying-for-inefficient-hydrogen-cars-because-it-wantsto-delay-electrification-/2-1-1033226.

[29] Norman Gerhardt et al., Fraunhofer Institute for Energy Economics, Hydrogen in the Energy System of the Future: Focus on Heat in Buildings, at 5 (May 2020) https://www.iee.fraunhofer.de/content/dam/iee/energiesystemtechnik/en/documents/StudiesReports/FraunhoferIEE_Study_H2_Heat_in_Buildings_final_ EN_20200619.pdf.

CARB's scenario inputs for the Alternatives include varying degrees of ambition in smart growth and other strategies for reducing vehicle-miles-traveled ("VMT"). From Slide 20, it does not appear that varying VMT reduction scenarios across the Alternatives results in differences in the statewide vehicle fleet. We think this is a flawed assumption. In practice, these strategies will most likely reduce not just the number of miles traveled by each vehicle, but dependence on vehicles and accordingly, the overall vehicle population. If VMT can be reduced to the degrees assumed in the scenarios, it will largely be because greater mass transit and active transportation adoption, as well as improved land-use, will make the need for vehicles obsolete (not just make the same number of vehicles have fewer or shorter journeys). This is important to capture in the scenarios because shrinking the overall vehicle population will accurately convey the co-benefits in terms of easing the number of vehicles that need to be turned over and the amount of potentially the amount of renewable energy expected to be necessary to fully electrify the fleet.

Electricity Sector

- ➔ CARB should increase the scale and pace of emissions reductions for Alternatives 2, 3, and 4: Alternative 2 and either alternative 3 or 4 Should reach 10 MMT by 2035 with the remaining Alternative achieving 10 MMT by 2045 and all alternatives eventually achieving 0 MMT.

Without explanation, CARB uses only one scenario, Alternative 1, to model a 0 MMT CO2e target, while Alternatives 2, 3, and 4 remain at or near 30 MMT through 2050. [30] For several reasons, CARB should revise Alternatives 2, 3, and 4 to include lower GHG levels.

First, CARB's use of three scenarios that achieve no incremental reductions past 2030 or 2045 flies in the face of climate reality.[31] The United Nation's Intergovernmental Panel on Climate Change has called a "code red" for humanity due to the irrefutable evidence of climate change's devastating impacts.[32] To address this crisis, California must take bold and ambitious action within the next decade, and CARB must accordingly design the alternatives for the electric sector to achieve rapid decarbonization. Specifically, Alternative 2 and either Alternative 3 or 4 should reach 10 MMT by 2035 with the remaining alternative achieving 10MMT by 2045. All alternatives should eventually achieve 0 MMT, even if they demonstrate different technology mixes and timescales.

Second, as noted above, the purpose of this exercise is to understand alternatives and trade-offs across different emissions reductions scenarios. CARB's decision to set an outlier of ambition (Alternative 1) in combination with three additional, minimally varying alternatives (Alternatives 2, 3, and 4) does not fulfill this purpose. More variation among Alternatives 2, 3, and 4 is needed to enable a full and productive discussion of possible future energy mixes.

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[30]Scoping Plan Modeling Results, slide 23 (showing electric sector summary and electric sector GHG emissions by Scenario).
[31] Scoping Plan Modeling Results, slide 23 (showing Alternative 2 remains at 30 MMT after 2030 and Alternatives 3 and 4 remain at 30 MMT after 2045).
[32] United Nations, IPCC report: 'Code red' for human driven global heating, warns UN chief, https://news.un.org/en/story/2021/08/1097362.

Third, in response to requests from the Environmental Justice Advisory Committee ("EJAC"), CARB committed to a 10MMT-by-2035 scenario. In the January 25, 2022 workshop, CARB representatives explained that they had incorporated multiple changes to the planned modeling in response to EJAC recommendations. The slides listed one EJAC recommendation to "Achieve a zero-carbon electricity grid by 2035," and CARB noted that it had responded to this recommendation by making the following modification "2035 sector GHG target reduced to 0 MMTCO2e (Alt 1) and 10 MMTCO2e (Alt 2) in 2035."[33] CARB must therefore make this change. Throughout the Scoping Plan process, CARB has requested EJAC recommendations to receive input from frontline communities in hopes of achieving a more equitable Scoping Plan. We urge CARB to fulfill its commitment to EJAC here.

Fourth, reducing the GHG emissions limit for Alternatives 2, 3, and 4 would foreclose the need to explore costly and unproven CCS technologies. As discussed above and in our September 2, 2021 comments, CCS should not be relied upon because its efficacy is unproven, it is extremely expensive to build and operate when compared to renewables, and, when paired with fossil-fueled generation, it could extend the life of polluting, uneconomic gas plants that disproportionately harm California's disadvantaged communities.[34] Given these risks, CARB should modify Alternatives to avoid reliance on CCS.

➔ CARB should overhaul its treatment of gas plant retirements and new gas capacity.

CARB improperly considers only partial gas fleet retirement for the "no combustion" Alternative 1 (retiring only ~7GW of gas retirements in 2035, which is a mere fraction of the 27GW of gas resources currently available)[35] and requires no retirements in the three other alternatives. Further, all Alternatives, even the "no combustion" Alternative 1, erroneously include new gas build.[36]This treatment of harmful gas generation as a perpetual component of California's energy future is unsupported and unjust.

A. Alternative 1 should include full retirement of the gas fleet, and gas plant retirements should be modeled in all alternatives**.**

Rapid retirement of California's gas fleet is a public health and environmental justice necessity. Gas plants harm the climate and California's disadvantaged communities, which bear the brunt of the

[33] Update on PATHWAYS Scenario Modeling Assumptions (Jan. 25, 2022), slide 3, available at https://ww2.arb.ca.gov/sites/default/files/2022-01/Scenario%20Slides%20for%20Jan25%20EJAC%20Mtg_01242022.pdf.
[34] Earthjustice and Sierra Club California, Scoping Plan Response to Staff Questions (Sept. 3, 2021), pp. 4-6 https://www.arb.ca.gov/lists/com-attach/68-sp22-concepts-ws-UTQHYFwvVnEHaQZs.pdf.
[35] See CEJA and Sierra Club Comments on CPUC Staff Paper on Additional Gas Capacity (Oct. 21, 2021), p. 7 https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M415/K874/415874485.PDF (citing Staff Paper at p. 5).
[36] Scoping Plan Modeling Results, slide 25 (showing cumulative new resource capacity build in 2035, including Alternative 1 retiring ~7GW of gas capacity and ~6GW of new gas build for capacity (CF: 0%)); slide 26 (showing new gas for all alternatives by 2045).

pollution burden from these facilities.[37] These facilities, many of which are located in the state's most polluted air basins, emit a wide range of pollutants harmful to human health, including sulfur dioxide, nitrogen oxides, and particulate matter, each of which can irritate and damage the lungs, with particular risks to children, the elderly, and people with asthma.[38] The U.S. Environmental Protection Agency suspects that long exposures to elevated nitrogen oxide concentrations may cause asthma and increased susceptibility to respiratory infections.[39] In addition to harmful emissions from gas combustion, continued reliance on gas also increases the risks of methane leakage, as occurred in Aliso Canyon where residents suffered severe health impacts from the release of released at least 109,000 tons of methane from the gas storage facility. [40]

Critically, as long as gas resources remain online, they can be called upon by other markets as exports and cause significant harm from the associated cycling emissions. Data show that the pollution from one start from cycling can exceed the emissions from an entire day of operation.[41] Thus, maintenance of the gas fleet, even for intermittent uses, will cause significant pollution harms.

Moreover, it is unclear whether gas plants are needed for reliability. The California Energy Commission's 2021 Mid-Term Reliability (MTR) Analysis found: "[a] portfolio of preferred resources can provide equivalent system reliability to gas resources."[42] In addition, recent data shows that gas plants are not reliable during extreme heat. For example, during the June 2021 heat wave, almost 11,000 MW were offline due to outages, and many of those outages impacted gas plants.[43] CAISO reported that during the June 17 and 18, 2021 heat events, the grid lost about 2,200 MW of gas capacity.[44] The Preliminary Root Cause Analysis of the Mid-August 2020 Heat Storm found that the gas fleet experienced 1,400 to 2,000

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[37] Brightline Defense, California Offshore Wind (Dec. 2020), p. 2 https://www.offshorewindnow.com/brightline-defense-report ("78% of gas-powered plants [in California] are located in frontline environmental justice communities.").
[38] American Lung Association, Sulfur Dioxide, https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/sulfur-dioxide; American Lung Association, Nitrogen Dioxide, https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/nitrogen-dioxide.
[39] U.S. EPA, Basic Information about NO2, https://www.epa.gov/no2-pollution/basic-information-about-no2#Effects.
[40] 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, (Nov. 2019), https://www.sciencedirect.com/science/article/pii/S0160412018327314?via%3Dihub.
[41] Aspen Environmental Group, Cal. Independent System Operator SB 350 Studies, Volume 9, Table 4.4-3, p. 100 (2016), *available at* https://www.caiso.com/Documents/SB350Study-Volume9EnvironmentalStudy.pdf.
[42] CEC MTR Analysis, Slide 41.
[43] Coby Bermel, *'Old clunkers': California power plants break down during heat wave* (Jun 30, 2021) https://www.politico.com/states/california/story/2021/06/30/old-clunkers-california-power-plants-break-down-during-heat-wave-1387507.
[44] CAISO, 2021 Summer Readiness – July Update, EPR Joint Agency Workshop on Summer 2021 Electric and Natural Gas Reliability (July 8, 2021), https://efiling.energy.ca.gov/getdocument.aspx?tn=238737, Slide 3; see also https://www.politico.com/states/california/story/2021/06/30/old-clunkers-california-power-plants-break-down-during-heat-wave-1387507.

MW of forced outages during peak demand.[45] The Final Root Cause Analysis confirms this finding and also appears to suggest over 2,000MW of forced outages occurred during certain hours.[46] Overall, the forced outage rate of gas plants has been increasing in recent years, with some types of gas facilities experiencing an average rate of 14%,[47] which is higher in extreme heat.[48] Thus, CARB should not assume that gas capacity is required for reliability.

CARB must accordingly revise its assumptions to include full retirement of the existing gas fleet for Alternative 1, and it should include different levels of gas plant retirements for the remaining alternatives. Finally, CARB should disclose the assumptions associated with its gas plant retirement results so that stakeholder can understand the basis for its findings.

B. CARB should exclude new gas capacity from all Alternatives.

In addition to revising its assumptions related to retirement, CARB should revise all Alternatives to exclude new gas build. New gas generation is inconsistent with numerous state mandates and policies requiring an equitable transition away from reliance on fossil-fueled generation.[49] The International Energy Agency has stated in no uncertain terms that we must stop investing in fossil fuels to meet climate targets.[50] As detailed above, new gas capacity will harm public health and the climate and exacerbate the injustices imposed on California's vulnerable communities by the existing gas fleet. Further, there is no evidence that new gas capacity is needed for reliability. Indeed, even new gas plants can pose public safety risks that also make them unreliable, as demonstrated by the May 27, 2021 explosion at the Russell City Energy City in Hayward, CA. The explosion hurled large pieces of metal into the air, two of which landed on city buildings, penetrating the roof of one.[51] The gas plant was taken offline for weeks after the

[45] CAISO, CPUC, and CEC, Preliminary Root Cause Analysis of the Mid-August 2020 Heat Storm (Oct. 6, 2020), p. 8 http://www.caiso.com/Documents/Preliminary-Root-Cause-Analysis-Rotating-Outages-August-2020.pdf (the gas fleet experienced 1,400 to 2,000 MW of forced outages during the outages).
[46] See CAISO, CPUC, and CEC, Final Root Cause Analysis, Figure 4.4, Figures B.8-B.19 (Jan. 13, 2021) http://www.caiso.com/Documents/Final-Root-Cause-Analysis-Mid-August-2020-Extreme-Heat-Wave.pdf (showing almost 3,000MW of forced outages at natural gas plants at various hours of the day during August 14 and 15).
[47] See, e.g., CEC MTR Analysis, Slide 22.
[48] Another study showed the connection between increased forced outage rates and extreme heat. See, e.g., Sinott Murphy et al., Resource adequacy implications of temperature-dependent electric generator availability (Mar. 15, 2020), https://www.sciencedirect.com/science/article/pii/S0306261919321117.
[49] SB 350, Clean Energy and Pollution Reduction Act of 2015 (De León, 2015-2016); SB 32, California Global Warming Solutions Act of 2006: emissions limit (Pavley, 2015-2016); SB 100, California Renewables Portfolio Standard Program: emissions of greenhouse gases (De León, 2017-2018); Governor Gavin Newsom, Electricity System of the Future (July 30, 2021), https://www.gov.ca.gov/wp-content/uploads/2021/07/Electricity-System-of-the-Future-7.30.21.pdf.
[50] International Energy Agency, Pathway to critical and formidable goal of net-zero emissions by 2050 is narrow but brings huge benefits (May 18, 2021), https://www.iea.org/news/pathway-to-critical-and-formidable-goal-of-net-zero-emissions-by-2050-is-narrow-but-brings-huge-benefits.
[51] City of Hayward, Russell City Energy Center, https://www.hayward-ca.gov/your-government/departments/city-managers-office/russell-city-energy-center; Specht, M. I Toured "the Best Damn Plant in the Fleet." Two Years Later It Exploded. (Aug. 12, 2021), https://blog.ucsusa.org/mark-specht/i-toured-the-best-damn-plant-in-the-fleet-two-years-later-it-exploded/.

explosion providing no power for the grid. This evidence shows that California should not be relying on gas plants and CARB should accordingly eliminate new gas from all of the alternatives. In addition, CARB should disclose the assumptions underlying is gas capacity findings to enable a robust discussion of the evidentiary basis for its analysis.

Energy Demand by Fuel

- ➔ We request that CARB provide a detailed breakdown of the proportion of hydrogen from electrolysis and from biomass gasification, and a breakdown of what biomass feedstocks are assumed to be used for hydrogen production.

CARB should provide a clear breakdown of what sources of hydrogen are produced from renewable electrolysis and what sources are from biomass gasification. Biomass gasification for the production of hydrogen is an extremely nascent technology – we are not aware of any commercialized projects. Even if this technology ever achieves maturity, the environmental benefit of it is entirely dependent on the provenance of the feedstock. The supply of genuinely sustainable biomass available is extremely limited, and most of it will only be available at significant cost. The economic reality is that most cost-effective and logistically manageable sources of biomass are not dispersed waste streams, but energy crops, which have a poor record of actually increasing greenhouse gas emissions through impacts on land use. Similarly, timber biomass feedstocks should not be treated as carbon neutral, given there is no assurance that thinned forests will regrow, and it could take more than a century to recapture the carbon that enters the atmosphere. We request that CARB clarify the sources of biomass contemplated for hydrogen production, and avoid making harmful, simplifying assumptions that most biomass feedstocks are carbon-neutral.

Conclusion

We urge CARB to incorporate these urgent corrections into the modeling. A thorough, well-considered model is essential to provide accurate insights into the serious trade-offs we face in deciding our course for an unprecedented energy transition. We appreciate the opportunity to share our input.

Sincerely,

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