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Liane Randolph
Chair, California Air Resources Board
1001 I St
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CA 95814

RE: Draft 2022 Scoping Plan Update

Dear Chair Randolph,

We thank you for the opportunity to comment on the draft 2022 Scoping Plan Update by the California Air Resources Board (CARB). Clean Air Task Force is an environmental non-profit dedicated to catalyzing the development and global deployment of low-carbon energy technologies, and other climate protective technologies, through research, public advocacy leadership, and partnerships with the private sector.

Transportation Sustainability

California has designed and deployed some of the world's most innovative and aggressive strategies for reducing greenhouse gas emissions from its transportation sector. The state has sensibly built its approach to transportation decarbonization around core policies that:

- Reduce the carbon intensity of energy carriers used by vehicles (in particular, the Low Carbon Fuel Standard (LCFS)); and
- Mandate a transition to zero-emissions vehicles (ZEV), through measures like the Advanced Clean Cars II regulation and the Advanced Clean Truck regulation.

A key attribute of both approaches is that rather than require the use of specific systems or technologies, they require outcomes. For example, producers can generate credits under the LCFS from the sale of various types of energy carriers—e.g., electricity, hydrogen, and some biofuels—as long as the energy carriers' carbon intensities, measured on a lifecycle basis, fall below the declining threshold established by the policy. Similarly, different types of vehicle technologies can be deployed to comply with the state's ZEV mandates—e.g., battery electric vehicles and hydrogen-powered fuel cell electric vehicles—provided those vehicles emit zero greenhouse gases.

California's LCFS and its ZEV mandates also complement each other in various ways. First, each policy reinforces the other. For example, customers of hydrogen fuel cell electric vehicles or battery electric vehicles benefit directly from the automakers' obligation to sell a certain number of ZEVs, but those purchases are also indirectly supported by an LCFS that lowers the price and increases the availability of the hydrogen and electricity those customers will purchase. Second, the policies create a policy framework for transportation decarbonization that effectively distributes the regulatory obligation between vehicle manufacturers and fuel suppliers, rather than putting it entirely on one industry or the other. Vehicle manufacturers organize their businesses to comply with the ZEV mandates and energy producers organize their

businesses to comply with the fuel standard; consequently, the industries' respective investments do not hinge on the efficacy of a single policy.

Although CATF supports California's pursuit of these policies (and others detailed in the draft 2022 Scoping Plan Update) to transition the state's transportation sector "…*away from fossil fuels to zero-emission technologies with all possible speed*…" [p147], California will have to evolve its core policies, especially the LCFS, to fully eliminate emissions from the sector. A clean fuel standard will be most effective if it aims to fully eliminate greenhouse gas emissions from the transportation sector by midcentury—i.e., if it is a zero-carbon fuel standard (ZCFS). Shifting from an LCFS to a ZCFS approach sends an explicit signal to the producers of energy carriers (i.e., fuels or electricity) that their products need to achieve a carbon intensity (CI) of zero by a date certain. The zero CI target will clarify that fuels that cannot achieve a carbon intensity of zero by mid-century might be short- and medium-term strategies at best, while also focusing attention on and directing investment toward fuels and technologies that are compatible with a zero-carbon transportation sector.

Clean Electricity Grid

Text

Page 158-160: *"…fossil gas generation will continue to play a critical role in grid reliability until other clean, dispatchable alternatives are available and can be deployed. […] to help address this challenge, resource installations that pair solar with batteries, as well as a greater amounts of battery build-out, are coming online currently and over the next five years."*

Comment

This section comments on the criticality of clean, affordable, reliable, and dispatchable power. However, the primary strategy to maintain this goal appears to be the use of battery storage. In implementing a carbon-neutral target, most recent studies demonstrate that employing an "all-of-the-above" suite of clean energy technologies will likely be necessary to achieve deep decarbonization at least cost.[1]

The continued use of fossil gas generation to maintain grid reliability until other clean, dispatchable alternatives are available may require the use of natural gas with carbon capture and sequestration to reduce greenhouse gas emissions more rapidly to meet California's interim greenhouse gas reduction goals while maintaining a reliable electricity grid. Taking action that accelerates the development of clean firm power within California is the only way to decrease its reliance on fossil fuels and maintain a path towards carbon neutrality in 2045.[2]

As long as the wind and solar proportion of the system is small, the variability can be readily managed, and system costs could even decline. However, as penetration of variable resources increases within the proportion of electric system supply, strategies such as building substantially more capacity than is required to meet peek demand and

[1] https://www.vibrantcleanenergy.com/wp-content/uploads/2021/10/US-Econ-Decarb_CCSA.pdf See also: Net Zero America Project Report (https://netzeroamerica.princeton.edu/img/Princeton_NZA_Interim_Report_15_Dec_2020_FINAL.pdf) and Decarb America "Pathways to Net-Zero Emissions (https://decarbamerica.org/report/pathways-to-net-zero-emissions/)

[2] Long, Jane C.S., Ejeong Baik, Jesse D. Jenkins, Clea Kolster, Kiran Chawla, Arne Olson, Armond Cohen, Michael Colvin, Sally M. Benson, Robert B. Jackson, David G. Victor, and Steven P. Hamburg. "Clean Firm Power is the Key to California's Carbon-Free Energy Future." *Issues in Science and Technology* (March 24, 2021).

having a robust demand flexibility need to be deployed, causing costs to rise substantially and the value of the variable renewable resources (i.e., wind and solar) to plummet.[3]

Superhot rock energy is not included as a potential source of clean firm power. If developed, superhot rock energy could play a lead role in providing a significant source of affordable, resilient, always-available energy that is able to significantly displace fossil fuels. Accelerating the development of superhot rock energy could bring California significantly closer to its electricity production goals. It could also enable the cogeneration of green hydrogen due to its high availability and 24x7 production profile. Superhot rock energy is in the demonstration phase, and therefore requires funding and permit acceleration to prove the technology innovation and achieve commercial adoption. Once developed, it may be able to significantly offset fossil fuels as a major source of energy and provide power density and scalability potential that could rapidly electrify the grid. The development of superhot rock energy in California would be transformative for enabling a resilient clean energy grid that is not reliant on fossil fuels.

Text

Page 162-163: *"This transformation will drive investments in a large fleet of generation and storage resources but will also require significant transmission to accommodate these new capacity additions. Transmission needs include high-voltage lines to access out-of-state resources and major in-state generation pockets…The outlook calls for significant transmission development to access offshore wind and out-of-state wind and reinforce the existing CAISO footprint at an estimated cost of $30.5 billion."*

Comment

As is detailed above, reaching the goals of SB 100 will require a tremendous amount of new clean energy infrastructure. Specifically, the transmission system will likely need to double in size to accommodate new uses of clean electricity and to connect dispersed renewable energy resources. However, it is becoming more difficult and expensive to build major new transmission facilities, especially in states like California that are already facing an energy affordability crisis. Transmission costs alone have increased 150% over the past decade and, as is stated in the draft 2022 Scoping Plan Update, it can take 8-10 years to develop a major transmission line. Even today, insufficient transmission capacity is delaying the climate, affordability, and clean air benefits of dozens of large solar projects in California. Furthermore, even though it is a specific goal of California to transfer away from the use of fossil fuels, the insufficient transmission capacity is contributing to continued use of polluting fossil fuel facilities.

Recognizing these challenges, the Joint Agencies' *Report to the Governor on Priority SB 100 Actions to Accelerate the Transition to Carbon-Free Energy*[4] recommends creating "*a California transmission authority…that can either on its own, or through public private partnerships, fund and build new transmission projects needed to meet clean energy goals*." CATF strongly believes in the value of this type of policy reform for reducing the cost, time, and complexity of transmission development, while integrating with, rather than duplicating, California's existing transmission planning process.

CATF envisions the Transmission Authority supporting the most critical, yet challenging, transmission needs of California (e.g., integrating offshore wind turbines or strengthening ties between the north and south regions of California). Given the decade-long development timeline and growing costs for major transmission projects,

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[3] From: Millstein, Dev, Ryan Wiser, Andrew D. Mills, Mark Bolinger, Joachim Seel, and Seongeun Jeong. "Solar and wind grid system value in the United States: The effect of transmission congestion, generation profiles, and curtailment." *Joule* (2021).

[4] https://www.energy.ca.gov/sites/default/files/2021-09/CEC-200-2021-008.pdf

California must urgently identify solutions to support the low-cost and efficient development of critical transmission in California.

Several capabilities will be necessary to allow the Transmission Authority to help California reach the electricity sector decarbonization goals of the draft 2022 Scoping Plan Update:

- Providing low-cost financing via revenue bonds or other mechanisms,
- Avoiding redundant permitting requirements,
- Allowing the Transmission Authority to act as a lead agency for the California Environmental Quality Act (CEQA),
- Ensuring the needs of the state can override local zoning requirements, and
- Supporting local economic developments in host communities.

CARB should consider evaluating how much transmission will be needed to achieve full electricity sector decarbonization, the challenges to reaching the pace and scale of deployment this will require, and the value of policy reforms to accelerate transmission development across California.

Carbon Dioxide Removal

CATF recognizes that, to date, California has made significant progress in decarbonizing its economy and meeting its climate goals. However, despite the state's long history of climate action, it still expects to fall about 125 million metric tons of CO_2 emissions short of its 2045 targets.[5] In order to reach carbon neutrality by 2045, with negative emissions thereafter, CO_2 emissions must be reduced or eliminated from large point sources and CO_2 must be removed directly from the atmosphere. Carbon capture, removal, and storage technologies provide permanent carbon mitigation solutions to address California's emissions gap and can be used in tandem with traditional mitigation efforts.

CATF supports CARB's inclusion of carbon capture, removal, and storage technologies in the draft 2022 Scoping Plan Update. CARB's latest modeling efforts show that all 4 proposed scenarios for achieving carbon neutrality rely on carbon capture, removal, and storage deployment at varying levels. CARB's proposed scenario (Alternative 3) requires significant, large-scale deployment of carbon capture on a range of industrial sectors and significant deployment of carbon dioxide removal technologies.

CARB's projected timeframe for large-scale deployment of carbon capture and storage is extremely ambitious given current constraints that these technologies face in the State, calling for over 87 million metric tons of CO_2 captured and stored by 2030.[6] Achieving this level of deployment by 2030 will be challenging without appropriate support, and CATF recommends that CARB re-evaluate the modeled rate of adoption of carbon capture and storage technologies by 2030 and amend the proposed deployment timeline to a more realistic rate of deployment, considering the permitting and logistical barriers that these technologies currently face in the State.

CATF supports CARB's proposed strategy for achieving success in the carbon dioxide removal sector, noting that appropriate support is critical to successful deployment of

[5] https://gs.llnl.gov/sites/gs/files/2021-08/getting_to_neutral.pdf
[6] AB32 GHG Inventory Sectors Modeling Data Spreadsheet

carbon capture, removal, and storage technologies. CATF emphasizes the following strategies outlined in the draft 2022 Scoping Plan Update, which are critical to success for this sector:

- Incorporation of CARB's Carbon Capture and Sequestration (CCS) Protocol into the Cap-and-Trade program
- Inclusion of electricity generation with zero carbon emissions through the use of carbon capture and storage as an eligible zero-carbon resource under SB100
- Improved financing mechanisms and incentives to address market barriers in this sector
- Streamlining permitting processes for carbon capture and storage projects
- Supporting carbon management infrastructure projects through research, development, and demonstration (RD&D) programs
- Convening a multi-agency Carbon Capture and Sequestration group to evaluate the current status and barriers of carbon capture and storage and develop a community engagement process

CATF supports CARB's proposed strategy to "*explore options for how local air quality benefits can be achieved when CCS is deployed*." Carbon capture can significantly reduce non-CO_2 air pollutants, as described below.

The flue gas of many industrial plants includes sulfur dioxide (SO_2), oxides of nitrogen (including NO and NO_2; collectively termed NOx), and particulate matter. These constituents contribute to unhealthy air pollution, such as ozone smog and fine particulates linked to asthma attacks, chronic bronchitis, hospital admissions, and premature mortality.

Carbon capture can dramatically reduce these pollutants as co-benefits of removing CO_2. Air pollutants such as SO_2, NO_2, and particulate matter are not only harmful to human health, but they also adversely impact the amine used to capture CO_2. For example, SO_2 and NO_2 form heat stable salts after reacting with the amine solution, while condensable particulate (particularly sulfuric acid and organic compounds) causes loss of solvent and increased solvent emissions. The capture system must be designed to remove these pollutants to protect the amine solvent and ensure its reliable and economical operation. Depending upon the application, removal steps might include the installation of wet electrostatic precipitators (ESPs) to remove particulates, upgrading NOx controls, and direct contact cooling systems that remove acid gasses such as SO_2.

The International CCS Knowledge Centre prepared an engineering study of the Lehigh cement plant in Edmonton, Alberta. They found that adding carbon capture to the cement plant resulted in significant reductions in air pollutants, as shown in Table 1 below:

Table 1. Reduction in air pollutants associated with the installation of carbon capture at the Lehigh cement plant in Edmonton, Alberta.[7]

Emission	Before Carbon Capture	After Carbon Capture	Percent Reduction
CO_2	3,604 tonnes/day	354 tonnes/day	90%
SO_2	7 tonnes/day	0 tonnes/day	100%
NOx	2.4 tonnes/day	1.05 tonnes/day	56%
PM_{10}	190 kg/day	15 kg/day	92%
$PM_{2.5}$	65 kg/day	7 Kg/day	70%

Operating a carbon capture system consumes extra energy due to the need for steam within the amine system and electricity for CO_2 compression. The design of the capture system can address the CO_2 and other air emissions associated with this energy increase by routing the CO_2 and other air emissions through the pretreatment and CO_2 capture equipment. CATF recommends that CARB establish a carbon capture goal that ensures that the installation of carbon capture systems results in significant health benefits from non-CO_2 air pollutant reduction.

CATF notes that, in addition to improving local air quality by reducing non-CO_2 air pollutants, carbon capture, removal, and storage technologies can provide significant economic and workforce benefits for California communities,[8] but further research dedicated to exploring local impacts of carbon management projects is still needed. CATF notes that carbon capture, removal, and storage projects can benefit local communities and workforce, provided that appropriate safeguards are in place and community engagement around project siting and implementation is undertaken to ensure that projects are designed to maximize community benefits and minimize negative local impacts. CATF recommends that CARB requires project developers to

[7] Summary for Decision Makers on Large-Scale CCS on Cement - Based on Lehigh Edmonton CCS Feasibility Study. International CCS Knowledge Centre. [November 2021]

[8] John Larsen, Whitney Herndon, Galen Hiltbrand, Ben King, *The Economic Benefits of Industrial Carbon Capture: Investment and Employment opportunities for Eastern and Western States*, (Rhodium Group, 2021) https://rhg.com/wp-content/uploads/2021/01/The-Economic-Benefits-of-Carbon-Capture-State-Investment-and-Employment-Estimates_Phase-II.pdf

demonstrate local community benefits and develop community benefit agreements when applying for permits.

Short-Live Climate Pollutants (SLCP)

Text

Page 195: "*In addition to SLCP emissions, there are remaining non-combustion emissions that are anticipated to persist in the coming decades, as shown in Figure 4-19. These include CO_2 from industrial processes such as cement manufacturing, oil and gas extraction, and geothermal electric power."*

Comment

It is untrue to imply that all geothermal electric power has carbon emissions—only conventional hydrothermal systems produce a small amount of carbon emissions. Advanced geothermal plants using superhot rock energy systems, closed-loop systems, and hydrothermal systems with carbon mineralization promise to be carbon-neutral.

Therefore, this text should be changed to say "hydrothermal electric power" rather than "geothermal electric power" to distinguish the exact type of geothermal power that may produce carbon emissions.

Biomethane

The draft 2022 Scoping Plan Update appropriately recognizes that methane is a very harmful climate pollutant and that more must be done to reduce California's methane emissions, including biomethane from waste and agricultural sources. However, CARB must avoid policy structures that rely on subsidies for the use of biomethane as a fuel to incentivize the capture of biomethane. While utilizing biomethane as a fuel for hard-to-decarbonize sectors is, on paper, an attractive "win-win" approach, such approaches should not be relied on as a strategy to mitigate methane emissions. These approaches are infrastructure-intensive, and therefore time consuming and expensive to implement. That infrastructure is subject to methane leaks. Subsidies large enough to economically justify the installation of this expensive infrastructure then incentivize operators of digesters, etc., to generate and capture more methane, rather than minimize emissions. One danger is that large subsidies (such as those available for biomethane used as a transport fuel under the Renewable Fuel Standard) encourage operators of digesters to obtain more material for the digester - including material that isn't really waste - rather than using the digester to minimize methane emissions.

It is important to note that biomethane cannot be the answer to decarbonize hard-to-decarbonize sources, because there simply isn't and won't be nearly enough biomethane to achieve this goal. This is not to say that use of biomethane as a fuel for sources like heavy-duty transport is not appropriate when it can be done efficiently and without any significant methane leaks or slippage. However, it simply cannot be viewed as a strategy for decarbonization of heavy transport because there is such an insufficient supply of biomethane. This is doubly true in the case of sectors like power generation and building heating, where energy demand far outstrips the supply of biomethane.

Therefore, it is very important that CARB develop policy approaches that directly require and incentivize elimination of methane emissions, rather than only incentivizing methane capture and sale.

Dairy and Livestock Methane

CATF recognizes that California has been a leader on addressing methane from manure management and enteric fermentation. It is particularly helpful that California has been proactive in researching effective approaches to mitigate methane from enteric fermentation.

However, the draft 2022 Scoping Plan Update should be clear that there are many substantial hurdles to be overcome before California can implement enteric fermentation strategies on a meaningful scale - including barriers that are beyond California's control. While there are many indications that strategies such as feed additives have potential to significantly reduce emissions, large-scale and long-term studies that consider life-cycle emissions of greenhouse gases and fully assess the implications of the intervention on animal and human health will be needed before these strategies can move forward. Feed additives, in particular, may need approval by the U.S. Food and Drug Administration (FDA) before they can be used in the US.; it is not clear how the FDA will approach this work and how long it may take to do so.

Finally, California must work to design efficient and effective incentives to promote widespread adoption of methane mitigation measures. These must be carefully designed, since imperfectly designed incentives can lead to many types of poor outcomes, ranging from low uptake to inefficient (costly) implementation to counterproductive outcomes, such as profitable subsidies that lead to larger herd sizes. California must not wait until interventions are appearing on the market to address the issue of effective incentive design.

It is important that CARB continue investing in this field and working toward the goal of implementing measures to reduce California's enteric methane emissions. However, given these substantial hurdles, including those beyond the control of California legislators and agencies, CARB must account for the likelihood of not achieving substantial reductions in methane emissions from enteric fermentation through 2030, and therefore exploring additional contingent measures to reduce methane emissions from other sectors over that time.

Landfill Methane

CATF commends CARB's actions to reduce methane emissions in the waste sector. CARB is right to prioritize the prevention and diversion of food and green waste from landfills, expand infrastructure, and improve technical capacities to treat this waste.

CATF also recognizes that controls on emissions from landfills must also remain a priority to reduce emissions from organics already in place and residual organics not captured through diversion programs. CARB should work towards near elimination of methane from landfills by 2030. CATF believes the best way to do this is through progressively tighter emissions performance standards for landfills, rather than extension and tightening of work practice standards. CATF applauds CARB's plans to regularly use remote sensing and other advanced methane emissions quantification technologies to verify that emissions are below the level allowed by the standard, identify leaks, and improve the state's understanding of these emissions sources.

CATF encourages CARB to be more transparent about the steps California will take to scale up the diversion of organic waste to the 75% target by 2025, as required by SB 1383. As noted in the draft 2022 Scoping Plan Update, California did not achieve an interim goal set for 2020, so the program will need to be implemented rapidly to ensure success. An upfront and transparent plan will give stakeholders the opportunity to provide feedback and note difficulties, allowing CARB to finetune actions and ensure success of the program.

Upstream Oil and Gas Methane Reduction

California put in place regulations on upstream oil and gas infrastructure in 2017. Since then, work practice and equipment standards for the oil and gas industry in leading states have moved forward, and California's standards now trail behind those from leading states, including Colorado and New Mexico. Most importantly, California's standards for leak detection, tanks, and pneumatic controllers are materially weaker than the standards in these two leading states.

Beyond the near-term opportunity to catch up to the standards of the leading states, given the challenges in reducing emissions from other sectors (e.g., agriculture, especially enteric methane), CARB should set its sights on near elimination of methane from the oil and gas sector by 2030. We believe that the best way to do this is to set progressively tighter emissions performance standards for oil and gas operations, including the regular use of remote sensing or other advanced methane emissions quantification technologies to verify that emissions are below the level allowed by the standard.

Finally, California imports large quantities of both oil and natural gas from other parts of the U.S. and, in the case of oil, from other nations. CARB should not ignore the "embedded emissions" in these imports, just as it does not ignore embedded emissions associated with electricity imports. Instead, CARB should evaluate approaches to incentivize importers of hydrocarbons to purchase oil and gas from producers who can document observational evidence of lower methane emissions, in line with current initiatives for differentiated gas.

Communities and Environmental Justice

CATF applauds CARB's efforts to chart an equity-focused pathway to carbon neutrality and to incorporate environmental justice principles across all aspects of the draft 2022 Scoping Plan Update. We urge California to continue to prioritize climate and clean energy investments in disadvantaged and underserved communities, and to prioritize climate solutions that maximize co-benefits to these communities, including local air pollution reduction and the creation of high quality, family-sustaining clean energy jobs. We also emphasize the importance of developing robust financing and incentive structures that support clean energy access and increased housing and energy affordability for low-income Californians.

Contact

If you would like to connect with CATF directly, please reach out to CATF's U.S. State Policy and Advocacy Manager, Angela Seligman (email: aseligman@catf.us, cell: 314.022.5293).

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