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Earthjustice Comments on Workshop on Hydrogen Program Implementation

Additional submitted attachment is included below.

December 16, 2022

Jonah Steinbuck, Deputy Director
Energy Research and Development Division
D. 22-ERDD-03
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

Re: Earthjustice Comments on the CEC's Clean Hydrogen Program Workshop

Dear Jonah Steinbuck:

Assembly Bill ("AB") 209 appropriated $100 million to the California Energy Commission ("CEC") for a Hydrogen Program, providing a unique opportunity to deploy hydrogen technologies that can help achieve California's 2045 climate goals and alleviate the air quality crises in the state's most polluted air basins. The $8 billion in funding for hydrogen hubs under the Federal Infrastructure Investment and Jobs Act, as well as the significant, uncapped production tax credit for hydrogen under the Inflation Reduction Act create broad and unprecedented support for the hydrogen industry. California's additional investments, which can be stacked on these federal subsidies, have the opportunity to steer this hydrogen industry towards outcomes that are genuinely compatible with our State's carbon neutrality goals while also tackling the State's air pollution crisis. California must structure its investments in ways that support redressing long-standing environmental injustices.

However, if the CEC is not careful in its program implementation, it could support polluting production processes or end-uses that are unlikely to play a significant role in a decarbonized economy and that are incompatible with achieving health-based air quality standards. Earthjustice appreciates the thoughtful recommendations in the Staff presentation, which generally positions the CEC to implement a successful Hydrogen Program. We urge the CEC to incorporate the following improvements into the program:

- To prioritize projects that maximize air quality, equity, and health benefits, limit funding for hydrogen production to electrolytic technologies or other zero-emission production pathways in all sub-programs;
- Adopt clear and robust criteria to ensure the program only funds renewable hydrogen production;
- Prioritize projects that supply zero-emission end-uses, consistent with AB 209's requirement to prioritize projects that maximize air quality and public health benefits;
- Require end-uses to align with state carbon neutrality goals for all sub-programs;
- Omit the blanket exclusion on funding projects that supply oil refineries;
- Prioritize projects that demonstrate improvements in hydrogen storage, delivery and handling technologies, such as technologies that enhance safety, avoid emissions or minimize leakage.

I. Feedback on Cross-Cutting Issues

A. Funding Appropriate Hydrogen Production Pathways

1. Maximize air quality, equity, and public health benefits by solely funding zero-emission hydrogen production technologies in all sub-programs.

AB 209 requires the Commission to prioritize projects that maximize air quality, equity, and health benefits.[1] In funding hydrogen production projects, the straightforward strategy for maximizing air quality and health benefits is to restrict funding to technologies that have demonstrated the ability to produce hydrogen without emitting air pollution. Zero-emission electrolytic technologies are available and ready to scale, obviating any need for investment in polluting equipment. Moreover, California's most polluted air basins will not be able to achieve federal health-based air quality standards without a wholesale transition of their stationary sources to zero-emission technologies.[2] It would be irrational for California to invest in hydrogen production technologies that it cannot deploy in its most populous regions without impeding attainment of these air quality standards.

An exclusive focus on zero-emissions hydrogen production will also advance the Legislature's equity goal because catalyzing the market for zero-emissions hydrogen production is necessary to address the disparate impacts that hydrogen production has on disadvantaged communities ("DACs"). Currently, industry relies on steam reformation of methane to produce hydrogen, which emits nitrogen oxides ("NOx"), particulate matter, carbon monoxide, and other pollution.[3] These emissions burden the low-income communities of color near California's oil refiners because the state's hydrogen production facilities are located near petroleum refineries.[4] Under no circumstances should the CEC exacerbate this environmental injustice by funding criteria pollution-emitting hydrogen production facilities in DACs or non-attainment areas.

2. Focus on electrolytic technologies is essential to speed market transformation.

Targeting investments to zero-emission, electrolytic hydrogen sends a clear market message that more effectively directs the outcomes needed for the energy transition: a relatively-affordable source of zero-carbon fuel, and high-performing fuel cell and electrolyzer equipment that can produce or operate on that fuel with zero emissions. Hydrogen produced from

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[1] AB 209 (2022) § 25664.1(g).

[2] *See, e.g.*, South Coast Air Quality Management District, Revised Draft 2022 Air Quality Management Plan, at ES-6 (2022) (finding that "there is no viable pathway to achieve the needed reductions [in NOx emissions to achieve federal health-based air quality standards] without widespread adoption of zero emissions (ZE) technologies across all mobile sectors and stationary sources, large and small"), http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-qualitymanagement-plan/draft-final-2022-aqmp/dfaqmp.pdf?sfvrsn=13.

[3] Pingping Sun et al, Criteria Air Pollutants and Greenhouse Gas Emissions from Hydrogen Production in U.S. Steam Methane Reforming Facilities, Env't Sci. & Tech., Vol. 53 (Apr. 2019), www.osti.gov/pages/servlets/purl/1546962.

[4] Haris R. Gilani and Daniel L. Sanchez, Introduction to the Hydrogen Market in California (Draft 2020), at Table 2, https://bof.fire.ca.gov/media/10190/introduction-to-the-hydrogen-market-in-california-draft-for-comment_ada.pdf.

electrolysis powered by 100% renewable energy (the most common meaning of "green hydrogen") also has the greatest potential for reaching tipping points and cost declines that are essential if it is to support decarbonization at scale this decade.[5] Because fuel cells are essentially the same technology as electrolyzers operating in reverse, they share similar components and supply chains.[6] Electrolyzer investments therefore have the added benefit of contributing to economies of scale for higher-performing fuel cells, which are needed to create a hydrogen ecosystem that is zero-emission from end to end. Green hydrogen has other unique benefits as a decarbonization tool—its deployment scales renewable electricity generation that will be needed under any decarbonization scenario, and it alone has the potential to harness surplus variable solar and wind energy. Given that it can be produced wherever there is water and electricity, green hydrogen can be produced close to where it is needed, and avoid costly transportation infrastructure.[7] This is not a quality of technologies like biomass gasification or biomethane reformation, which requires the transportation of small, scattered supplies of bioenergy to large, centralized production facilities.[8] An "all of the above" hydrogen production strategy would come with a steep opportunity cost: slowing progress on scalable, zero-emission solutions by wasting public resources on technologies that unnecessarily lock in pollution.

3. The CEC should limit funding to hydrogen production projects that rely solely on renewable energy to avoid increasing emissions and straining the grid.

The CEC should ensure that the hydrogen production projects it funds *only* use new or excess Renewable Portfolio Standard ("RPS")-eligible energy sources. Projects that use co-located variable renewable resources in combination with unspecified grid energy would exacerbate the climate crisis. In contrast, requiring funded projects to rely entirely on additional renewable resources would encourage industry to invest in energy storage and force them to produce hydrogen in a manner that aligns with California's carbon neutrality goals.

While Earthjustice is not able to calculate the emissions impact of increasing load on the electric grid to produce hydrogen, the available data indicates that this hydrogen production strategy could be detrimental to the climate. Electrolytic hydrogen that relies on what CARB terms "grid average" electricity is even more carbon-intensive than the diesel and fossil gas that they hydrogen is most likely to displace.[9] However, the climate impact of relying on the grid to

[5] *See, e.g.*, Yuki Numata et al, Green Hydrogen on an S-Curve: Fast, Beneficial, and Inevitable (Oct. 12, 2022) https://rmi.org/green-hydrogen-fast-beneficial-and-inevitable/.
[6] *See, e.g.*, U.S. Department of Energy, Water Electrolyzers and Fuel Cells Supply Chain – Supply Chain Deep Dive Assessment (Feb. 24, 2022) https://www.energy.gov/sites/default/files/2022-02/Fuel%20Cells%20%26%20Electrolyzers%20Supply%20Chain%20Report%20-%20Final.pdf.
[7] Renee Cho, "Why We Need Green Hydrogen", Columbia University - State of the Planet (Jan. 7, 2021), https://blogs.ei.columbia.edu/2021/01/07/need-green-hydrogen/#:~:text=So%2C%20what%20is%20green%20hydrogen,its%20only%20byproduct%20is%20water.
[8] Iain Staffel et al, The Role of Hydrogen and Fuel Cells in the Global Energy System, (Jan. 2019) at 477 https://pubs.rsc.org/en/content/articlepdf/2019/ee/c8ee01157eat.
[9] California Air Resources Board, Table 7-1: Lookup Table for Gasoline and Diesel and Fuels that Substitute for Gasoline and Diesel (listing 164.46 gCO_2e/MJ as the carbon intensity of compressed

power electrolysis is even greater than what one might infer from CARB's analysis of electrolysis with "grid average" electricity, which includes data for the zero-emissions resources on the California grid. The emissions impact of adding load to the grid is a function of the marginal unit that is dispatching energy to serve additional load in that time and place. In California, it is foreseeable that industry will seek to maximize profits by co-locating electrolyzers with solar generation resources and using grid energy when solar production ebbs. **This business model would cause significant increases in climate and criteria pollution at gas-fired power plants because gas-fired generation facilities are usually the marginal generation units that are dispatched to serve additional load in California outside of the mid-day period.**[10] Increasing load on these marginal gas-fired units would not only jeopardize the climate benefits of electrolytic hydrogen production, but also increase criteria pollution in the communities near the fossil-fueled generators.

Allowing funded hydrogen production facilities to use grid energy during evening ramps would also undermine the Legislature's intent to use AB 209's clean energy programs to reduce net peak grid loads. AB 209 requires the CEC to publicly report to the Legislature on the electrical generation or storage capacity that is deployed during net peak periods or critical grid conditions as a result of the Hydrogen Program.[11] If the program funds projects that exacerbate grid demand during net peak hours, the CEC should both quantify those impacts and explain its decision.

If the CEC is not convinced it would be feasible for funded projects to rely solely on renewable energy, it could allow hydrogen producers to take energy from the grid to meet operational needs, provided that the carbon-intensity of the hydrogen they produce does not exceed .45 $kgCO_2e/kgH_2$. That carbon-intensity is the threshold for claiming the highest tier of tax subsidies under the Inflation Reduction Act.[12] The federal government is providing a lavish and uncapped tax credit of $3/kg to hydrogen producers that meet this standard, buoying the economics of projects that reflect the urgency of the energy transition. Even so, industry may ask the CEC to set weak carbon-intensity standards that are untethered from the steep emissions reductions necessary to meet California's climate goals. For instance, some hydrogen producers may seek to maximize profits by stacking funding from the CEC with a lower tax credit for producing hydrogen with a carbon intensity of 4 $kgCO_2e/kgH_2$—a tax credit that politicians

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hydrogen produced through electrolysis with California average grid electricity, 100.45 gCO_2e/MJ as the carbon intensity of diesel fuel in California, and 79.21 gCO_2e/MJ as the carbon intensity of compressed gas from average North American fossil gas) https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/ca-greet/lut.pdf.

[10] The California ISO provides data on the emission and energy-supply trends over the course of each day, which show that emissions tend to spike in the late afternoons as production declines from solar resources and gas-fired generators and imports ramp up. California ISO, Today's Outlook, Emissions https://www.caiso.com/TodaysOutlook/Pages/emissions.html; California ISO, Today's Outlook, Supply, https://www.caiso.com/TodaysOutlook/Pages/supply.html.

[11] AB 209, § 25660.2(d).

[12] 26 U.S.C. § 45V(b)(2)(D).

outside California enacted to subsidize the production of hydrogen from fossil fuels.[13] The CEC should not use taxpayer dollars to support such highly polluting hydrogen projects.

4. Prevent double-counting of renewable attributes.

AB 209 also requires the CEC to take steps so that the Hydrogen Program does not "result in duplicative offset credits, renewable energy credits, or other forms of compliance credits."[14] At a minimum, the CEC should clarify that renewable energy credits associated with the energy used to power hydrogen production at funded facilities must be retired and not used for RPS compliance.

B. Supplying Appropriate End-Uses

1. Consideration of criteria pollution emissions from end-use is mandatory in all sub-programs.

AB 209 prohibits CEC from funding projects unless they "help reduce sector-wide emissions."[15] Accordingly, the CEC should include demonstration of reductions of sector-wide climate and criteria emissions as an eligibility criterion for funding and prioritize applications that maximize reductions. At a minimum, the CEC must not violate this provision by funding hydrogen production projects that increase NOx emissions from the building sector by supplying hydrogen for injection into the gas distribution system.[16] Similarly, the Hydrogen Program must not increase NOx emissions from the electricity generation sector by supplying hydrogen for burning at gas-fired power plants.[17] The CEC should not attempt to evade the requirement to reduce sector-wide emissions by ignoring the end-use emissions that will result from any of its sub-programs.

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[13] Joe Manchin, Press Release: Manchin's Inflation Reduction Act Will Lower Energy and Healthcare Costs, Increase Domestic Energy Production and Pay Down National Debt (Aug. 7, 2022) (explaining that the act's hydrogen tax credits "Explicitly include credits for 'blue' hydrogen production from fossil fuels with carbon capture"), https://www.manchin.senate.gov/newsroom/press-releases/manchins-inflation-reduction-act-willlower-energy-and-healthcare-costs-increase-domestic-energy-production-and-pay-down-national-debt.

[14] *Id.* § 25664.1(d).

[15] *Id.* § 25664.1(e).

[16] A recent review of literature on the NOx impacts of operating residential gas equipment on hydrogen blends found that the cost of health damage from increased NOx emissions in a mean scenario would exceed the avoided damage costs of reducing greenhouse gas emissions. Madeleine L. Wright and Alastair C. Lewis, "Emissions of NOx from blending of hydrogen and natural gas in space heating boilers", Elementa: Science of the Anthropocene (2022) 10(1) at 9, available at https://online.ucpress.edu/elementa/article/10/1/00114/183173/Emissions-of-NOx-from-blending-ofhydrogen-and.

[17] Leticia Gonzales, Natural Gas Intelligence, New York Hydrogen-Natural Gas Blending Study Offers Mixed Results to Cut Emissions (Oct. 4, 2022) ("gas turbine outlet NOx levels increased by up to 24% as the hydrogen fuel fraction increased"), https://www.naturalgasintel.com/new-york-hydrogen-natural-gas-blending-study-offers-mixed-results-to-cut-emissions/.

Indeed, in each of the sub-programs, the CEC should follow AB 209's requirement to prioritize projects that maximize air quality and public health benefits[18] by prioritizing projects that supply zero-emission end-uses. It would also be inconsistent with the Legislative command to prioritize projects maximize equity to fund projects that exacerbate the disproportionate health burdens in DACs by supplying hydrogen for NOx-emitting end-uses in DACs. Air quality impacts should be among the highest priority criteria for scoring applications.

2. Aligning end-uses with California climate goals.

Earthjustice appreciates Staff's proposal to require alignment between state carbon neutrality goals and end-uses in the distributed hydrogen production sub-program.[19] However, there is no reason to limit this requirement to a single program, as it would be wasteful to promote hydrogen production in any context to support end-uses that are inconsistent with state policy. Wherever CEC applies this criterion, it will need to clearly explain what it means.

A reasonable demonstration of alignment with California's carbon neutrality goals would exclude end-uses that have electric decarbonization options that are available today. California policy demands achieving carbon neutrality as quickly as possible, but no later than 2045.[20] To meet this goal, California will need to quickly achieve widespread deployment of commercially available decarbonization technologies in multiple sectors, including the light-duty vehicle sector and the building sector.[21] Waiting for hydrogen technologies to catch up would unreasonably inflate the cost of decarbonization.[22] Consequently, funding hydrogen decarbonization strategies in sectors with commercially available electric options would not align with state goals. **We therefore urge the CEC to include in its cost and technology readiness evaluations a comparison to available emissions mitigation alternatives.** A comparative evaluation, especially against established decarbonization solutions such as energy efficiency and electrification of end-uses, will be essential for the CEC to ensure it is targeting hydrogen to socially and environmentally optimal end-uses.

Aligning hydrogen end-uses with California's climate neutrality goals also requires excluding end-uses that burn a blend of hydrogen and fossil fuels. For instance, blending hydrogen into California's gas distribution system is a dead-end decarbonization scheme because it can only reduce climate pollution from gas-burning equipment by about 7% in the most

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[18] AB 209, § 25664.1(g).
[19] CEC, Staff Workshop on the Implementation of the Clean Hydrogen Program (Dec. 1, 2022) ("CEC Workshop Presentation") at 20.
[20] Cal. Health & Safety Code 38562.2(c) (added by AB 1279 (2022)).
[21] *E.g.*, Dan Aas et al, The Challenge of Retail Gas in California's Low-Carbon Future, CEC Final Project Report, at 2 (Apr. 2020) ("If building electrification is delayed, missing the lower-cost opportunities for all-electric new construction and replacement of equipment upon failure, there is a greater risk that expensive early retirement of equipment may be needed, or that the climate goals could be missed."), https://www.energy.ca.gov/sites/default/files/2021-06/CEC-500-2019-055-F.pdf.
[22] *Id.* at 70 ("should building electrification be delayed in the hope that RNG technology will progress more rapidly than considered in the optimistic P2G cost scenario here, and these RNG cost reductions do not materialize, then it will be difficult to recover from delays in building electrification and it may prove difficult to reduce emissions at reasonable cost.").

optimistic scenarios.[23] There is no feasible strategy for eliminating the remaining ~93% of climate pollution from this equipment.[24] As the National Academies of Sciences has warned, strategies that achieve only incremental reductions without facilitating transformation toward a zero-emissions economy "can lead to technology lock-in and emissions cul-de-sacs that make deep decarbonization by mid-century unattainable."[25] **We therefore request the CEC include as a funding eligibility criteria an evaluation of whether the proposed project contributes to the market transformation necessary for California's long-term goal of carbon neutrality, and not merely incremental carbon reductions.**

3. Reconsider the proposal to exclude refinery end-users.

One of the least regrets strategies for deploying hydrogen as a decarbonization strategy is transitioning to renewable hydrogen in the industrial sectors that use hydrogen as a chemical feedstock, including oil refining.[26] Earthjustice recommends making hydrogen production projects that supply petroleum refineries eligible for funding from the CEC's Hydrogen Program. Such projects could help deliver carbon and criteria pollution reductions in a sector that already consumes nearly 1 million metric tons of fossil-derived hydrogen. While the State has committed to phase out oil refineries by no later than 2045, they are still certain to be the largest off-taker of hydrogen in California for the next decade or more. **Displacing fossil-derived hydrogen in California should be a higher priority than creating new pots of demand, especially while green hydrogen supply remains exceptionally scarce.** As CEC panelist Matthew Bravante explained, green hydrogen for decarbonizing oil refining is "unavoidable" whereas it has either "low potential" or is "uncompetitive" for the new demand categories being considered in road-transport and buildings.[27] Transitioning to zero-emission hydrogen at the petroleum refineries would indirectly benefit hydrogen users in other sectors by scaling up zero-emission hydrogen production. And refineries already have bespoke infrastructure necessary for handling hydrogen that will reduce the need for additional, dedicated infrastructure construction, allowing any green

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[23] Sara Baldwin et al, Energy Innovation, Assessing the Viability of Hydrogen Proposals: Considerations for State Utility Regulators and Policymakers (March 2022) at 7, https://energyinnovation.org/wp-content/uploads/2022/03/Assessing-the-Viability-of-Hydrogen-Proposals.pdf.

[24] Even under the gas industry's "high resource potential" scenario, methane from landfills, animal manure, food waste, and water treatment facilities could displace less than 9% of the fossil gas this country currently uses each year. American Gas Foundation, *Renewable Sources of Natural Gas: Supply and Emissions Reduction Assistant*, at 11, 14 (Dec. 2019) (showing a potential of 1,425.3 tBtu/year for landfill gas, animal manure, food waste, and water resource recovery facilities and noting an average U.S. annual consumption of fossil gas of 15,850 tBtu), https://gasfoundation.org/wp-content/uploads/2019/12/AGF-2019-RNG-Study-Full-Report-FINAL-12-18-19.pdf.

[25] National Academies of Sciences, Engineering, and Medicine, Accelerating Decarbonization of the U.S. Energy System, at 65 (2021), https://doi.org/10.17226/25932 (citing Dr. James Williams et al, Pathways to Deep Decarbonization in the United States, E3, LBNL, & PNNL (Nov. 2014)).

[26] *E.g.*, Agora Energiewende, No-regret hydrogen: Charting early steps for H2 infrastructure in Europe (2021) at 3, https://static.agora-energiewende.de/fileadmin/Projekte/2021/2021_02_EU_H2Grid/A-EW_203_No-regret-hydrogen_WEB.pdf.

[27] Matthew Bravante, BloombergNEF Remarks - CEC 2022 Hydrogen Consultation (June 21, 2022), available at https://efiling.energy.ca.gov/GetDocument.aspx?tn=243616.

hydrogen produced to be shifted to other end-uses without significant stranded assets as refinery demand is phased out.

C. Considerations for Hydrogen Storage, Delivery and Handling

The Staff presentation did not include proposed selection criteria involving a project's hydrogen storage, delivery, and handling technologies. Failing to include selection criteria related to these issues would be a missed opportunity to promote important technology advancements. The CEC should prioritize projects that demonstrate technologies that improve safety and minimize leakage.

II. Feedback on Specific Program Components

A. Large-scale Centralized Clean Hydrogen Production

By proposing to limit funding to electrolytic technologies, CEC Staff proposal for funding large-scale hydrogen production would properly focus limited public resources on hydrogen technologies that are compatible with California's decarbonization trajectory and air quality imperatives. As discussed above, the CEC will need to adopt robust eligibility requirements to ensure that the electrolytic hydrogen from funded facilities is produced solely from additional RPS-eligible resources to avoid increasing pollution burdens in the communities neighboring gas-fired power plants.

The CEC should modify Staff's proposed approach to funding hydrogen storage and delivery infrastructure. The workshop presentation notes that one of the goals of the program is to demonstrate cost-effectiveness for the delivery and storage of centralized clean hydrogen production. However, cost-effectiveness should not be the only priority for this equipment. The CEC should prioritize projects that demonstrate advanced storage, delivery and handling technologies that improve safety and minimize leakage. As a general principle, it is reasonable to assume that the longer or more expansive the hydrogen handling infrastructure, the greater the likelihood for leakage. Avoiding oversized hydrogen storage and distribution infrastructure investments will reduce costs and the risks of leakage that can undermine climate benefits. The CEC should also require that any funded projects that deliver hydrogen by truck use zero-emission delivery trucks.[28, 29]

The CEC must also require applicants to specify the end-uses they will supply so that it has the information it needs to follow AB 209's mandates to reduce sector-wide emissions and prioritize funding for projects that maximize air quality, public health, and equity. Specifying

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[28] There are currently 213 models of zero-emission trucks and buses commercially available in North America, including 28 different ZE heavy-duty trucks. CALSTART, Zero Emission Technology Inventory – Data Explorer (Accessed Nov. 30, 2022), https://globaldrivetozero.org/tools/zeti-data-explorer/.

[29] Hydrogen projects receiving CEC investments should not be permitted to add diesel or methane-burning truck trips that run counter to the State's well-established goals of achieving zero-emissions trucks everywhere feasible. *See, e.g.*, CARB, Governor Newsom's Zero-Emission by 2035 Executive Order (N-79-20), https://ww2.arb.ca.gov/resources/fact-sheets/governor-newsoms-zero-emission-2035-executive-order-n-79-20.

end-uses is also necessary to ensure the CEC is supporting the use of hydrogen in end-uses that are aligned with California's carbon neutrality goals. The CEC should take reasonable steps to avoid wasting public funds on hydrogen production for sectors where least-cost deep decarbonization strategies do not require hydrogen. Finally, the program should not place a blanket prohibition on funding projects that supply petroleum refineries, as projects may provide local benefits if they displace hydrogen production from steam methane reformation.

B. Onsite/Distributed Clean Hydrogen Production and Use

The proposed "neutral" approach to hydrogen production technology threatens to syphon scarce public resources toward polluting technologies.[30] Industry proponents have repeatedly pushed the CEC to value technology neutrality as a good in-and-of-itself, and to myopically focus on carbon-intensity while remaining agnostic on any non-carbon factors in production.[31] **At their core, these requests ask the CEC to ignore factors related to environmental justice and public health, which would be contrary to the CEC's mandate to prioritize projects that maximize air quality and health benefits in this context.**[32] The CEC should revise the proposed requirements for the Onsite/Distributed Clean Hydrogen funding category by limiting funds to hydrogen production technologies that emit zero climate or health-harming pollution. It would be particularly inappropriate to fund hydrogen production projects that emit criteria pollution in DACs and non-attainment areas, given the Legislative direction to maximize equity benefits.

Earthjustice believes the already-lengthy list of applications where distributed electrolyzer deployment requires support likely exceeds what the CEC can fund using a $30 million budget. For instance, for scaling electrolyzer innovation and deployment alone, this sub-program could fund:

- Highly efficient and more durable electrolyzers, which will be vital for scaling up use of hydrogen as an energy carrier;[33]
- Demonstration of electrolyzers that are compatible with saline water feedstocks;[34]
- Demonstration of electrolyzers that function in reverse as fuel cells in microgrid applications; and[35]

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[30] CEC Workshop Presentation at 19.
[31] *See, e.g.*, Humberto Orantes, Shell Comments to Clean Hydrogen Program (Dec. 6, 2022), available at https://efiling.energy.ca.gov/GetDocument.aspx?tn=247960&DocumentContentId=82244.
[32] AB 209 § 25664.1(g).
[33] The U.S. Department of Energy has identified several research needs for improving the durability and efficiency of electrolyzers. U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, https://h2new.energy.gov/research.html.
[34] *See, e.g.*, Jamesh Mohammed-Ibrahim and Harb Moussab, Recent advances on hydrogen production through seawater electrolysis, 3 Materials Science for Energy Technologies 780-807 (2020), https://www.sciencedirect.com/science/article/pii/S2589299120300537
[35] *See, e.g.*, Timothy N. Hutty et al, Long Term energy storage with reversible solid oxide cells for microgrid applications, 7 Energy Reports 24-33 (May 2021), https://www.sciencedirect.com/science/article/pii/S2352484721001578.

- Demonstration of offshore electrolyzers to harness marine energy that is otherwise difficult to capture and transport it to load centers.

Similarly, there is a significant need for distributed, renewable, electrolytic hydrogen production paired with zero-emission, stationary fuel cells across the State. For example, end-to-end zero emission hydrogen projects include:

- Displacing the growing fleet of diesel back-up generators, especially those in disadvantaged communities;[36]
- Enabling accelerated roll-out of fast-charging stations for electric cars and trucks in rural areas that avoid the need for lengthy grid upgrades; and[37]
- Demonstrating decentralized, on-farm fertilizer production that eliminates the need for importing fossil-derived nitrogen into the San Joaquin Valley.[38]

Air pollution-burdened geographies that would depend on these solutions cannot afford onsite hydrogen production methods that cause health-harming emissions. If the CEC has any doubt about its ability to identify zero-emission hydrogen production projects that merit a total of $30 million in funding to promote the goals of this sub-program,[39] it should reallocate funding to other sub-programs.

The proposal to require alignment of end-uses with California's carbon neutrality goals is laudable. However, as discussed above, we are concerned that this requirement may not have the desired effect unless the CEC develops specific criteria that give it teeth.

The CEC should also prioritize end-uses that maximize air quality and public health benefits and impose reporting requirements that will enable the CEC to fulfill its duties to report to the Legislature. As in all sub-programs, consideration of the end-use's criteria pollution emissions is necessary to ensure CEC is following the Legislative mandate to maximize air quality, public health, and equity benefits. Further, AB 209 requires CEC to report to the Legislature on the onsite criteria pollutant impacts that occur as a direct result of the Hydrogen Program.[40] For funded projects that co-locate hydrogen production and use, the CEC will need to report on all onsite emissions impacts.

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[36] *See, e.g.*, John Roach, "Hydrogen Fuel Cells Could Provide Emission Free Backup Power at Datacenters, Microsoft Says" (July 28, 2022), https://news.microsoft.com/innovation-stories/hydrogen-fuel-cells-could-provide-emission-free-backup-power-at-datacenters-microsoft-says/.

[37] *See, e.g.*, Plug Power, "Hydrogen for EV Charging Stations Will Get More EVs on the Road" (July 18, 2022), https://www.plugpower.com/hydrogen-for-ev-charging-stations-will-get-more-evs-on-the-road/.

[38] *See, e.g.*, Tina Casey, "Green Ammonia to Rescue US Farmers from Fertilizer Supply Woes" (July 25, 2022), https://cleantechnica.com/2022/07/25/green-ammonia-to-rescue-us-farmers-from-fertilizer-supply-woes/.

[39] The identified goals for this sub-program are to "Advance earlier stage technologies to support longer term, sustainable, cost-effective deployments" and to "Demonstrate technological and market advancement of onsite clean hydrogen production and use." CEC Workshop Presentation at 19.

[40] AB 209 § 25660.2(e).

While the CEC Staff recognize that storage is within the sub-program scope, their statement of the sub-program's goals does not mention the advancement of storage technologies. The CEC should prioritize projects that use storage technologies, such as low-pressure metal hydride storage, that minimize explosion risk.[41] These benefits are particularly compelling in the distributed hydrogen production sub-program because it is more likely to fund projects sited near population centers.

C. Federal Cost Share

The CEC should adopt clear project selection criteria for this sub-program to ensure funding flows to applications that best advance State policies and to increase transparency over CEC decision making. The sub-program's goals are stated in very general terms,[42] which invites some uncertainty regarding how the CEC will select grantees. As with all other sub-programs, the CEC should place a high priority on funding projects that maximize air quality and public health benefits.

Earthjustice supports Hydrogen Program funding for the illustrative list of project types in the Staff presentation.[43] One strategy for protecting public confidence in this sub-program would be to limit grants to projects in these categories.

III. Conclusion

Earthjustice appreciates this opportunity to provide feedback on Staff's proposals for the CEC's Hydrogen Program. After incorporating stakeholder feedback, the program can provide important decarbonization investments. Careful program design will also help the CEC avoid squandering scarce taxpayer resources on polluting and dead-end technologies.

Sara Gersen, Senior Attorney
Sasan Saadat, Senior Research and Policy Analyst
Earthjustice

[41] *See* Jose Bellosta von Colbe et al, Application of hydrides in hydrogen storage and compression: Achievements, outlook and perspectives, 44 International Journal of Hydrogen Energy 7780 (March 2019), https://www.sciencedirect.com/science/article/pii/S0360319919302368.
[42] CEC Workshop Presentation at 20.
[43] CEC Staff provided three examples of project types that would be eligible for funding from the Federal Cost Share sub-program: "Improving efficiency, durability, and costs of producing electrolytic hydrogen", "Advancing new clean hydrogen equipment manufacturing technologies" and "Innovative and practical approaches to increase the reuse and recycling of clean hydrogen technologies". *Id.*