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CSG et al - Comments on EPIC 4 Investment Plan Proposed Draft Initiatives

Additional submitted attachment is included below.

August 18, 2021

California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

Re: Docket # 20-EPIC-01, Comments on EPIC 4 Investment Plan

The undersigned thank you for the opportunity to comment on the California Energy Commission's (CEC) Electric Program Investment Charge 2021-2025 Investment Plan (EPIC 4 Investment Plan) Proposed Draft Initiatives. We commend the CEC's continued efforts to support the development and commercialization of technologies that address climate change-induced grid reliability threats and inform California's transition to an equitable, clean energy system.

While we are encouraged by the number of forward-thinking proposals in the Draft Initiatives, we see a critical gap in relation to support for engineered carbon dioxide removal (CDR) technologies, including bioenergy with carbon capture and storage (BECCS) and direct air capture (DAC). Multiple analyses have found that engineered CDR is necessary for California to achieve its climate goals.[1,2] **We recommend that the CEC develop a new investment initiative as part of the final EPIC 4 Investment Plan that supports the research, development, and demonstration of engineered CDR technologies in California.**

Recent research has shown that for California to achieve net-zero emissions by 2045, both aggressive emission reductions as well as some engineered CDR will be required. Reports by Energy and Environmental Economics[1] and Lawrence Livermore National Laboratory (LLNL)[2] estimate a need for engineered CDR ranging from about 30 $MtCO_2$ per year to almost 100 $MtCO_2$ per year by midcentury. As engineered CDR options are relatively newer, public investment is essential to push these technologies down the cost curve; so that they might be a real option for deployment to support California's climate goals.[3] Engineered CDR is also necessary to achieve meaningful and reliable net-negative emissions. There is a compelling ethical argument that developed economies like California should take responsibility for removing such legacy or historic CO_2 emissions from the atmosphere.[4]

At the federal level, both the White House[5] and Department of Energy[6] (DOE) have demonstrated a clear commitment to support the research, development and demonstration of engineered CDR

[1] Energy and Environmental Economics (2020). "Achieving Carbon Neutrality in California – PATHWAYS Scenarios Developed for the California Air Resources Board". https://ww2.arb.ca.gov/sites/default/files/2020-10/e3_cn_final_report_oct2020_0.pdf
[2] Baker, S., Stolaroff, J.K, Peridas, G. et al. (2020). "Getting to Neutral: Options for Negative Carbon Emissions in California". Lawrence Livermore National Laboratory. https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf
[3] van Vuuren, D.P., Hof, A.F., van Sluisveld, M.A.E. et al. (2017). Open discussion of negative emissions is urgently needed. *Nature Energy* 2, 902–904. https://doi.org/10.1038/s41560-017-0055-2
[4] Batres, M., Wang, F.M., Buck, H. et al. (2020). Environmental and climate justice and technological carbon removal. *The Electricity Journal*. https://www.sciencedirect.com/science/article/pii/S1040619021000932
[5] White House Council on Environmental Quality (2021). Report to Congress on Carbon Capture, Utilization, and Sequestration. https://www.whitehouse.gov/wp-content/uploads/2021/06/CEQ-CCUS-Permitting-Report.pdf
[6] Department of Energy, Office of Fossil Energy and Carbon Management. (2021). Combatting the Climate Crisis with Carbon Capture and Storage Technology https://www.energy.gov/fe/articles/combatting-climate-crisis-carbon-capture-and-storage-technology

technologies. The $1 trillion bipartisan infrastructure bill includes earmarks of more than $8 billion for carbon capture and storage (CCS) technology, which includes engineered CDR options.[7]

California is well-positioned to partner with the federal government on CCS and CDR. Specifically, in their recent groundbreaking *Net-Zero America* study Princeton University highlighted the importance of deploying large-scale CO_2 storage in the Central Valley for the purpose of achieving a national net-zero emissions by 2050 goal.[8] This is because there are no other locations west of the Rocky Mountains that are suitable to perform geologic CO_2 storage (Fig. 1). California has an opportunity to position itself as a regional CO_2 storage hub to support deep decarbonization of the American West. Initial state investments via the EPIC program, such as to support site appraisals, feasibility studies, and first-mover projects could feasibly be paired with substantial federal monies. A number of recent analyses have highlighted the importance of large-scale CCS deployment to support California's mitigation goals.[9,10]

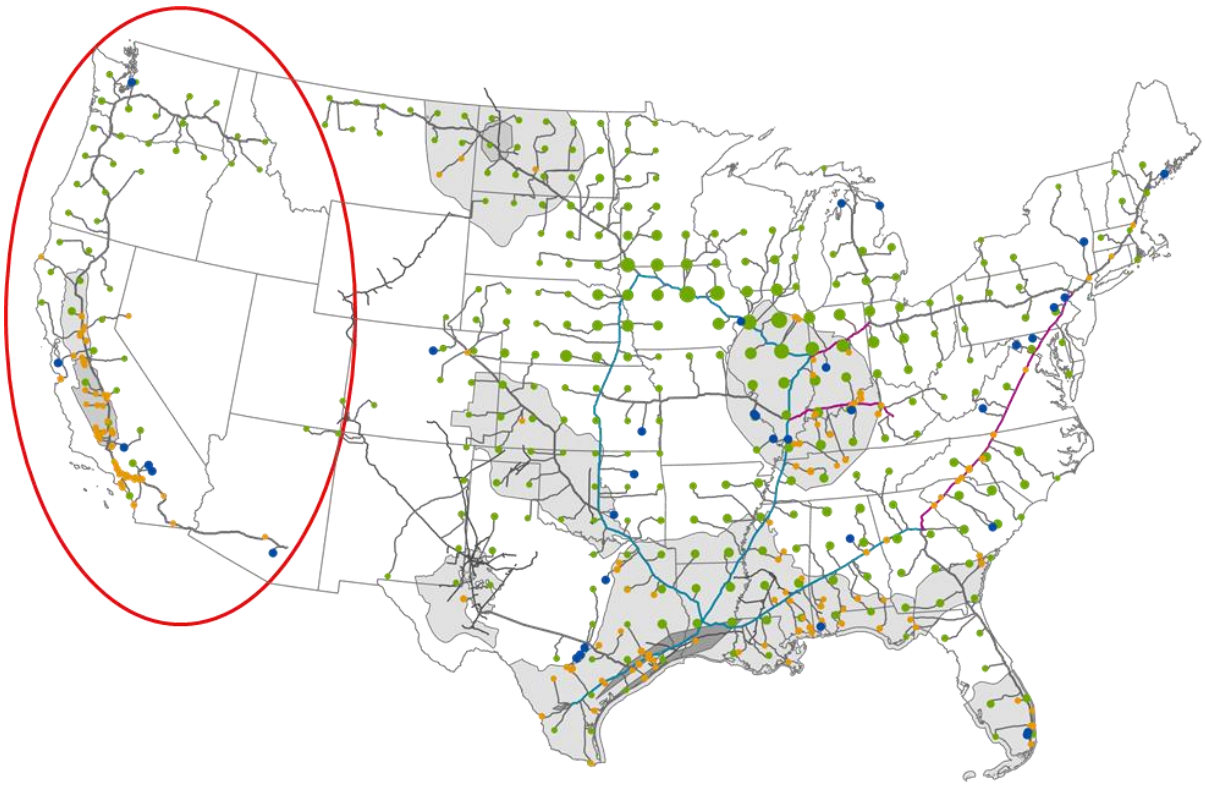

Fig. 1*: This diagram illustrates the extensive CO_2 transport and storage networks necessary to achieve net-zero emissions in the U.S. by 2050. The red circle highlights how the only reliable CO_2 storage sites in the American West are in California (shaded in grey). Due to the Rocky Mountain range, a separate Western States CO_2 transport and storage network is required. Therefore, CA's ability to deploy CCS is not only important for state goals, but also national goals.* ***Source****: Princeton University (2020)*

[7] Congressional Infrastructure Bill. H.R. 3684, Pages 1491 – 1543. (2021). https://drive.google.com/file/d/1XmTwQj4sk3IU5W5_QqOQBXcGJ_P8790H/view

[8] Larson, E.D., Greig, C., Jenkins, J.D. et al. (2020). "Net-Zero America: Potential Pathways, Infrastructure, and Impacts." Princeton University. https://netzeroamerica.princeton.edu/the-report.

[9] Energy Futures Initiative and Stanford University. (2020). "An Action Plan for Carbon Capture and Storage in California: Opportunities, Challenges, and Solutions." https://sccs.stanford.edu/sites/g/files/sbiybj7741/f/efi-stanford-ca-ccs-full-rev1.vf-10.25.20.pdf

[10] Long, J.C.S., Baik, E., Jenkins, J.D. et al. (2021). "California needs clean firm power, and so does the rest of the world." Issues in Science and Technology. https://issues.org/california-decarbonizing-power-wind-solar-nuclear-gas/.

California has favorable attributes for deploying engineered CDR, with the possibility of creating a host of important environmental and social co-benefits.[11] In the case of BECCS, diverting California's abundance of biomass *waste* streams that are otherwise mostly openly burned, landfilled, or left to decompose in fields could avoid severe air quality and greenhouse gas (GHG) emissions, including of short-lived climate "super pollutants" in the forms of methane and black carbon.[12,13,14] This volume of waste is anticipated to increase substantially, owing to the state's goal to increase its level of wildfire fuels reduction treatments to one million acres per year by 2025.[13] In the case of DAC, it is possible that California could pioneer 'renewable DAC' by coupling the technology with geothermal heat and power at the Salton Sea.[15] This not only presents a major climate leadership opportunity for California, but could also create jobs and enhance local tax revenues in the Imperial Valley to support air quality, public health, and other local priorities in disadvantaged communities. Finally, deployment of CO_2 transport and storage networks could allow at-risk oil and gas workers to repurpose their skills in CO_2 geologic assessment, project siting, drill rig and CO_2 pipeline construction and operation, and synthetic or biofuels refining, distribution and storage.

Overall, LLNL estimated that a full-scale build-out of carbon-negative biofuels supply chains plus some renewable DAC at the Salton Sea in California could provide a significant **150 million tons of GHG mitigation per year** to support the state's ambition to achieve net-zero emissions by 2045. This underscores the importance of allocating some portion of EPIC funds to support engineered CDR. As it is unclear what combination of options will prove to be viable for California to achieve its climate goals, it is important that as many options as possible, particularly those with substantial potential, are kept on the table.[11]

Summary of Recommendations

We provide a summary of key recommendations in response to the Draft Initiatives of the EPIC 4 Investment Plan below. While this comment letter has focused on the role of engineered CDR, there are additional and related recommendations we make in relation to the Draft Initiatives:

- **Develop new investment initiative to support research, development and demonstration of engineered CDR technologies in California.** While engineered CDR technologies offer significant climate mitigation potential, the technologies are not yet widely deployed, and further investment is needed to demonstrate and develop their capacity for large-scale deployment. Biomass gasification, pyrolysis, and Fischer-Tropsch processes could produce a variety of very low carbon and carbon-negative liquid and gaseous fuel options, including renewable hydrogen,

[11] Uden, S., Dargusch, P. & Greig, C. (2021). Cutting through the noise on negative emissions. *Joule*. https://www.sciencedirect.com/science/article/abs/pii/S2542435121003019

[12] Kammen, D.M., Matlock, T., Pastor, M. et al. (2021). Accelerating the Timeline for Climate Action in California. https://arxiv.org/abs/2103.07801.

[13] Governor's Forest Management Task Force. (2021). "California's Wildfire and Forest Resilience Action Plan." https://www.fire.ca.gov/media/ps4p2vck/californiawildfireandforestresilienceactionplan.pdf

[14] California Air Resources Board. (2021). Staff Recommendations: San Joaquin Valley Agricultural Burning Assessment. https://ww2.arb.ca.gov/sites/default/files/2021-02/Staff_Recommendations_SJV_Ag_Burn.pdf

[15] Baker, S., Stolaroff, J.K, Peridas, G. et al. (2020). "Getting to Neutral: Options for Negative Carbon Emissions in California". Lawrence Livermore National Laboratory. https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf

renewable natural gas, sustainable aviation fuels, renewable diesel, synthetic hydrocarbons, and more.[16] Converting biomass into hydrogen for use in fuel cells can support grid decarbonization. CO_2 from DAC could be used in transportation fuels[17] or to permanently store legacy CO_2 underground.

The EPIC Program can act as the state's initial down payment on engineered CDR, to match with potential federal investments to develop CCS technology. **We recommend that EPIC 4 Investment Plan allocate $100 million over the initial 5-year investment period to support engineered CDR pathways**, including site appraisals, environmental impact studies, feasibility studies, and early-mover projects.

- **Initiative #7: CEC should consider implementation of transportation and industrial sector hydrogen use cases** in addition to grid reliability use cases developed in the EPIC Plan's Green Hydrogen Roadmap and Strategic Plan. California's transportation sector is the state's largest source of emissions, and hydrogen has the potential to support deep decarbonization in this sector. In addition, hard-to-abate sources in the manufacturing sector could also be addressed with hydrogen. Limiting the use cases to grid reliability may also preclude promising pathways to scale production and lower the cost of hydrogen, such as via hydrogen hubs.[18]

- **Initiative #7: CEC should expand its definition of green hydrogen considered under the Green Hydrogen Roadmap and Interim Strategic Plan.** As identified by LLNL, California's abundance of biomass residues, that are otherwise open burned in fields or landfilled, present a highly promising source of renewable or green hydrogen. However, the Interim Plan currently relies upon the definition of green electrolytic hydrogen under SB 1369: "hydrogen gas produced through electrolysis and does not include hydrogen gas manufactured using steam reforming or any other conversion technology that produces hydrogen from a fossil fuel feedstock".[19] We read this as to prohibit hydrogen produced from eligible organic waste feedstocks via methods such as steam methane reforming, autothermal reforming, methane pyrolysis of renewable gas, or thermochemical conversion of biomass. Expanding the definition of green hydrogen considered under the Interim Plan would be inclusive of other renewable sources, technology-neutral, and aligned with ongoing state efforts to reduce the risk of catastrophic wildfire, short-lived climate pollutant emissions, improve air quality, and contribute to community resilience.

[16] Joint Institute for Wood Products Innovation. (2020). "Literature Review and Evaluation of Research Gaps to Support Wood Products Innovation". https://bof.fire.ca.gov/media/9688/full-12-a-jiwpi_formattedv12_3_05_2020.pdf

[17] Project AtmosFUEL – Carbon Engineering and LanzaTech UK partnership, Direct Air Capture to sustainable aviation fuel in the United Kingdom. https://carbonengineering.com/news-updates/ce-lanzatech-jet-fuel/

[18] The federal administration's bipartisan infrastructure package includes $8 billion to establish a program that supports the development of at least four regional clean hydrogen hubs. Congressional Infrastructure Bill. H.R. 3684. Pages 1551 - 1554. https://drive.google.com/file/d/1XmTwQj4sk3IU5W5_QqOQBXcGJ_P8790H/view

[19] California Energy Commission. Electric Program Investment Charge Interim Investment Plan 2021. Page A-41.

Conclusion

We support the CEC and their continued efforts to develop the EPIC 4 Investment Plan. However, our view is that the Draft Initiatives in their current form miss proven, important mitigation technologies in engineered carbon dioxide removal. Comprehensive IPCC[20] and IEA[21] reports routinely highlight the non-negotiable role for BECCS and DAC in achieving a well below 2°C future. California has favorable attributes to demonstrate and scale these technologies for global benefit, and can also unlock a series of environmental and social co-benefits as a result, including the ability to reduce the risk of wildfire.

We would be happy to answer any questions or provide further information as required.[22]

Respectfully submitted,

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[20] Intergovernmental Panel on Climate Change. (2018). "Special Report on Global Warming of 1.5°C". https://www.ipcc.ch/sr15/

[21] International Energy Agency. (2021). "Net Zero by 2050: A Roadmap for the Global Energy Sector". https://iea.blob.core.windows.net/assets/beceb956-0dcf-4d73-89fe-1310e3046d68/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf

[22] If CEC staff are interested in further discussion or a briefing, please direct correspondence to Amanda DeMarco (amanda@csgcalifornia.com), who can assist with questions or requests.