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October 21, 2021

Ms. Liane Randolph, Chair
California Air Resources Board
1001 I Street
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Subject: Comments to the September 30, 2021 Public Workshop: Public Workshop: 2022 Scoping Plan Update - Scenario Inputs Technical Workshop

Dear Chair Randolph:

Oxy Low Carbon Ventures ("OLCV") appreciates this opportunity to provide comments to the California Air Resources Board's ("CARB") Public Workshop: Public Workshop: 2022 Scoping Plan Update - Scenario Inputs Technical Workshop held September 30, 2021.

OLCV and its affiliates are leading efforts to deploy carbon capture and sequestration ("CCS") and direct air capture ("DAC") projects. The OLCV "CARB-1" project to store biogenic carbon dioxide ("CO_{2}") in accordance with the Carbon Capture and Sequestration Protocol ("CCS Protocol") under the Low Carbon Fuel Standard ("LCFS") is currently undergoing CARB staff review. In a separate but related effort, OLCV is working on a first of its kind large scale DAC project that will remove and permanently store carbon dioxide from the atmosphere – directly addressing the 409.8 parts per million of CO_2 already in the atmosphere.

California has long been synonymous with effective climate policy and is at the leading edge of global efforts to address climate change. Beginning in 2001, California has proposed and adopted progressively more ambitious goals to address economywide emissions. This includes the California Global Warming Solutions Act of 2006 [Assembly Bill 32 ("AB 32")], which created a comprehensive, multi-year program to reduce greenhouse gas ("GHG") emissions in California and requires CARB to develop a Scoping Plan that describes the approach California will take to reduce GHGs. The resultant Scoping Plans have included a suite of policies to help the State achieve its GHG targets.

<u>The Four Alternatives Presented at the Workshop are Comprehensive and Appropriate</u>

At the September 30, 2021 Workshop, input assumptions for the PATHWAYS model were presented. In addition, a table summarizing the proposed PATHWAYS scenario modeling assumptions was made available online. OLCV has reviewed the Workshop information and the separately provided table and views the sectors described and the four alternatives summarized as sufficiently comprehensive and appropriate for the PATHWAYS modeling exercise. Each alternative would model the results of the alternatives described. For example, Alternative 1 describes an aggressive schedule to carbon neutrality by 2035 and includes assumptions that include the electricity sector achieving zero metric tons of CO_2 emissions by 2035 with no

combustion-based generation resources and no engineered carbon dioxide removal ("CDR") from the atmosphere occurring. Alternative 2 also describes an aggressive approach but in the electricity sector includes renewable and zero carbon resources (which would include CCS) as well as rapid deployment at scale of CDR. Alternatives 3 and 4 could be viewed as less aggressive but still achieve carbon neutrality by 2045.

While there are likely dozens, if not hundreds, of permutations on these basic modeling scenario alternatives that could be developed, these four alternatives capture an appropriate range of options to enable CARB and process stakeholders to examine likely challenges in reaching carbon neutrality by 2035 or 2045.

Engineered Carbon Dioxide Removal Technologies are Essential to Reducing CO_2 in the Atmosphere

DAC is CDR using engineered solutions to capture CO_2 from the atmosphere and permanently store it in a secure geologic storage site. Large-scale DAC projects that can capture significant quantities of CO_2 from the atmosphere (e.g., greater than 500,000 MT/year) are complex projects that include capture equipment, a sequestration site and energy. The first DAC project will require investments in excess of $1 billion dollars to build the capture facility and the transportation system necessary to deliver CO_2 to a secure geologic storage site. In addition, DAC projects must secure renewable or zero-carbon energy resources to provide the energy necessary to power the DAC equipment. Consequently, DAC will not only remove CO2 from the atmosphere but will support continued deployment of renewable and zero carbon energy resources.

Capital and operational costs for capturing CO_2 from the atmosphere have been recently estimated for the technology developed by Carbon Engineering ("CE").[1] OLCV is the exclusive United States licensee for CE's DAC technology and, as mentioned earlier, is working on a first of its kind large scale DAC project that will remove and permanently store $CO_2$from the atmosphere – directly addressing the 409.8 parts per million of CO_2already in the atmosphere. OLCV plans to construct and operate large scale (500,000 Metric Tons ("MT") CO2/year or greater) DAC and related sequestration projects.

On a levelized basis, the cost range for DAC construction and operation is estimated at $94 to $232/t-CO2.[2] The first DAC projects will have a construction and start-up period of three to four years. Construction and permitting of the sequestration site may proceed in parallel. Projects developing renewable and/or zero carbon energy resources may also proceed in parallel. OLCV believes that with the proper incentives, several large-scale DAC projects with the capacity to remove several million MT of CO2/ year could be deployed by 2030.

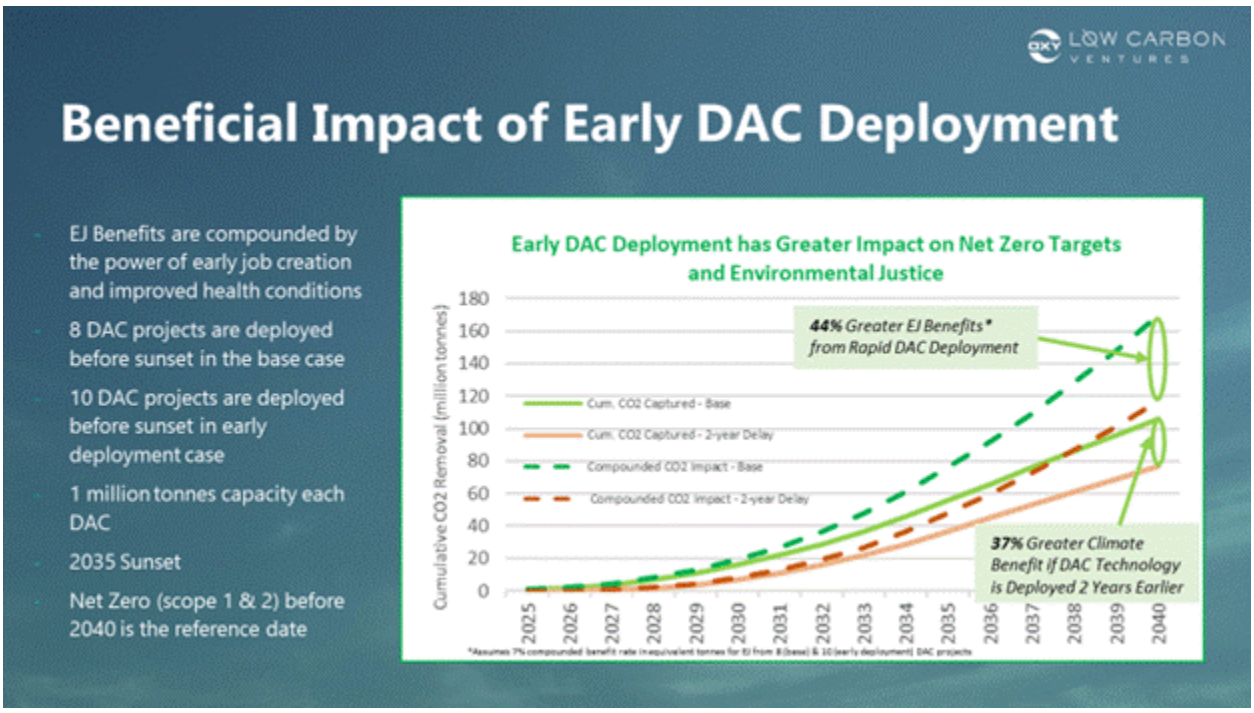
[1] Keith et al., A Process for Capturing CO2 from the Atmosphere, Joule (2018), https://doi.org/10.1016/j.joule.2018.05.006, last accessed on October 20, 2021 (also provided as an attachment).
[2] *Id*. at 1, 16-19.

However, given the cost and timelines associated with DAC projects, and the critical role DAC will play in helping California achieve carbon neutrality by 2035 or 2045, we continue to advocate for CARB to adopt rules or guidance that allows qualified DAC projects to generate credits during construction. OLCV presented the Advancing Credits for DAC option at CARB's October 14, 2020, Low Carbon Fuel Standard Public Workshop to Discuss Potential Regulation Revisions. Adoption of the Advancing Credits for DAC proposal would expedite deployment of large-scale projects – with each project able to remove as much as 1,000,000 MT-CO2/year. OLCV estimates that were the Advancing Credits for DAC proposal adopted, that four to five DAC projects could be on-line or at least under construction by 2030.

A More Rapid Deployment of CDR Improves Cumulative CO_2 Reductions

Taking appropriate steps to more rapidly deploy CDR will have corresponding benefits for California's carbon neutrality goals. Much as early investment in an IRA reaps greater benefits over time, so does early deployment of CDR. OLCV has analyzed scenarios and determined that deploying DAC projects two years earlier than otherwise can realize a 27% improvement in the cumulative CO_2 removed from the atmosphere by 2040. The results are illustrated in Figure One.

Figure One: Time Value of Rapid DAC Deployment



The 2022 Scoping Process provides an opportunity for CARB to speed the deployment of CDR through the parallel adoption of regulatory revisions or guidelines that allow the generation of credits during the DAC project construction phase. These credits would be dedicated to the LCFS

market, paid back over time, and secured through financial assurance instruments. The more rapidly the DAC projects (and CCS) can be deployed, while not sacrificing environmental safeguards, the more rapidly CO_2 in the atmosphere and emitted at sources can be reduced. If the first DAC project can be on-line in 2025, at least 500,000 MT of CO_2 can start being permanently removed from the atmosphere. Bringing additional DACs on-line over the ensuing ten years means that up to 10,000,000 MT/year of CO_2 can be permanently removed from the atmosphere by 2035.

Conversely, a slower development cycle, even one where one DAC every two years is brought on-line, will mean millions of tons of CO_2 will remain in the atmosphere. There is broad recognition in the scientific community that CDR technologies must play a significant role in reducing emissions, particularly emissions from past industrial activities, and achieving net-zero emissions. For example, Rhodium group analysis indicates that for the US to reach net-zero emissions by 2045 between 560 and 1,850 million metric tons of CO_2 will need to be removed by DAC technology and then permanently stored underground annually.[3]

Technologies that capture CO_2 at anthropogenic sources will also be needed over the coming decades. While California's efforts are accelerating a transition away from fossil fuels as an energy source, projections forecast that California will continue to require some proportion of its energy to be supplied from natural gas combined cycle power plants. These plants are reliable sources of firm dispatchable energy on demand to consumers, regardless of whether the sun is shining or the wind is blowing, and can act as a compliment to further renewable energy deployment. Deploying CCS to capture and sequester CO_2 from these sources will reduce GHG emissions to the atmosphere and enable California to manage its transition to renewable and zero-carbon energy. We strongly support inclusion of renewables portfolio standard ("RPS") - eligible and zero-carbon generation resources for the electricity generation sector in alternatives 2, 3 and 4.

California could foster broader deployment of CDR and carbon capture technologies by making small refinements to existing policies and regulations, while continuing to uphold the highest environmental standards. We welcome further engagement on these issues.

<u>Environmental Justice Considerations</u>

Stakeholders in the scoping plan process include representatives of environmental justice communities. OLCV recognizes these are important voices that must be heard, listened to, and considered in developing the scoping plan and project development in and outside California. Among the environmental justice voices, we have heard a concern that CDR and carbon capture technologies will prolong the California's transition from fossil fuel energy. This is an important consideration, in addition to ensuring CDR and CCS projects improve – not worsen – air quality in impacted communities, which is a current topic of academic and NGO research.

[3] Larsen et al., Capturing Leadership Policies for the US to Advance Direct Air Capture Technology, (2019), https://rhg.com/research/capturing-leadership-policies-for-the-us-to-advance-direct-air-capture-technology/

We believe CDR and CCS projects will both speed California's transition from fossil fuel energy sources and temper any economic impacts that may occur, particularly in communities with jobs that will be impacted by a transition away from fossil energy, given these workers have many of the same skills required to develop carbon capture, removal, and storage projects.

First, California has already been extremely successful in creating one of the most comprehensive and responsive climate policy landscapes in the world. This wide-ranging strategy has resulted in policy innovations that run the gamut from direct regulations to inclusive interagency climate actions to a multijurisdictional carbon market.[4] For example, these policy innovations have enabled California to meet or exceed its 2020 emission reduction goals in 2018.[5] California's success has proven that effective state policies can meet challenging targets. Given its successful track record, continuing to recognize and provide engineered carbon removal technologies pathways to generating LCFS credits will result in additional projects that will speed California's transition from fossil fuel energy sources.

In addition, CDR and CCS projects can take advantage of infrastructure already available in the state. Transportation infrastructure and geologic formations currently used for oil production can be repurposed for CO_2 sequestration. Repurposing the infrastructure and sequestration site management needs will create continuing employment opportunities and generate economic benefits for those communities.

We have also heard concerns that CO_2 captured from the atmosphere or anthropogenic sources could be used to prolong the life of oil fields. While it is true, the CO_2 is used in enhanced oil recovery, such use requires a significant capital investment in equipment to manage CO_2 that returns to the surface with any oil or water produced. Equipment includes gas handling and recompression facilities that require the investment in the range of $15 million to $100 million. California oil producers are unlikely to make such investments in CO_2 if carbon capture can generate sufficient revenue.

CDR and CCS projects use proven scalable technologies. CARB has existing regulations and protocols in place to ensure projects can safely, securely and permanently sequester CO_2. However, CDR and CCS projects developers should be encouraged to site projects appropriately and engage local communities early on in the planning and permitting process.

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[4] Aimee Barnes and others, Learning From California's Ambitious Climate Policy (Center for American Progress, April 16, 2021), available at https://www.americanprogress.org/issues/green/reports/2021/04/16/498242/learning-californias-ambitious-climate-policy/.

[5] State of California Air Resources Board, "Climate pollutants fall below 1990 levels for the first time," Press release, July 11, 2018, available at https://ww2.arb.ca.gov/news/climate-pollutants-fall-below-1990-levels-first-time.

Thank you for your consideration of our comments and we do look forward to actively participating with CARB throughout the 2022 Scoping Plan process.

Best regards,

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Myles Culhane
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cc: Clerk of the Board
Air Resources Board
1001 I Street
Sacramento, CA 95814

Attachment: Keith et al., A Process for Capturing CO2 from the Atmosphere, Joule (2018).