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(Submitted electronically as Comment to LCFS Public Workshop)

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California Air Resources Board
1001 I Street
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Subject: Comments in Response to the Air Resources Board, Low Carbon Fuel Standard Public Workshop to Discuss Potential Regulation Revisions

Dear Mr. Corey, Ms. Sahota, and Mr. Soni:

Oxy Low Carbon Ventures ("Oxy") appreciates this opportunity to provide comments in response to the California Air Resources Board's ("CARB") Low Carbon Fuel Standard Public Workshop to Discuss Potential Regulation Revisions, held October 14-15, 2020.

Oxy is advancing innovative technologies and business solutions that provide the low-carbon energy, power, and products we all need. These efforts are critical to help reduce emissions globally, and we are working across industries to develop projects that capture and remove CO_2 emissions from the atmosphere and industrial sources worldwide.

I. The Governor's Executive Order and Implications for Carbon Capture and Sequestration Technologies

Carbon capture and sequestration ("CCS") technologies will remain critical to enabling California to meet its goals under AB32, SB100, Governor Newsome's Executive Order N-79-20, and other state policies and initiatives.

The Governor's executive order ("Order") states that it shall be a goal of the State that 100 percent of in-state sales of new passenger cars and trucks will be zero-emission by 2035, and 100 percent of medium- and heavy-duty vehicles in the State will be zero-emission by 2045 (everywhere feasible). The Order also directs CARB to develop and propose regulations requiring increasing numbers of new zero-emission passenger, truck, medium- and heavy-duty vehicles sold in the State to progress towards the targets set by the Governor. The Order instructs

the Governor's Office of Business and Economic Development, in consultation with a number of State agencies, including CARB and the private sector, to develop a Zero-Emissions Vehicle Market Development Strategy by January 31, 2021 (to be updated every three years thereafter).

The Order additionally directs the California Environmental Protection Agency and the California Natural Resources Agency, in consultation with other state, local, and federal agencies, to expedite regulatory processes to repurpose and transition upstream and downstream oil production facilities while supporting community participation, labor standards, and protection of public health, safety, and the environment. The order recognizes the importance of environmental justice considerations.

While the Order mandates phasing out the sale of new internal combustion vehicles, it is likely that the inventory of pre-owned passenger vehicles on California roads will remain a significant part of California's transportation mix for some time. Carbon Capture, Utilization, and Storage ("CCUS") can help California meet its climate goals by offering low carbon transportation fuels to power the remaining internal combustion transportation vehicles and offer zero carbon electricity to power electric vehicles while allowing for a transitionary period from internal combustion vehicles to zero-emission vehicles ("ZEVs").

A. Internal Combustion Vehicles Will Remain Part of California's Transportation Mix Beyond 2035

The Governor's Order is part of California's continuing efforts to address greenhouse gas emissions by further decarbonizing one of the largest contributors: vehicle emissions from the transportation sector. Even after state agencies develop a Zero-Emissions Vehicle Market Development Strategy, data compiled by the United States Department of Transportation shows that there will be a transitionary period during which an inventory of internal combustion vehicles will remain in use on California roads.

According to the Bureau of Transportation Statistics ("BTS"), the average age of all light vehicles on the road in the United States was 11.6 years in 2016 (more recent data has yet to be included in a BTS report).[1] This is up from 8.4 years in 1995. In July 2020, IHS Markit reported that the average age of vehicles on the road was 11.9 years, with an average scrappage rate of 5.1% in 2019 (scrappage is the measure of vehicles exiting the active population).[2] Assuming that California's vehicle ownership experience is comparable to the United States as a whole, a significant number of internal combustion vehicles will remain in use on California roads for at

[1] National Transportation Statistics, United States Department of Transportation, Bureau of Transportation Statistics (2018) Table 1-26. Median Age of Automobiles and Trucks in Operation in the United States (data is obtained from R.L. Polk Co., a private enterprise that purchases state registration data to maintain a database of operational vehicles. Its data represent a near census of registered vehicles in the United States, and the age estimate should be considered very reliable.), available at https://www.bts.gov/sites/bts.dot.gov/files/docs/browse-statistical-products-and-data/national-transportation-statistics/223001/ntsentire2018q4.pdf, last accessed Nov. 3, 2020.

[2] Average Age of Cars and Light Trucks in the U.S. Approaches 12 Years, According to IHS Markit (July 28, 2020), available at, https://news.ihsmarkit.com/prviewer/release_only/slug/bizwire-2020-7-28-average-age-of-cars-and-light-trucks-in-the-us-approaches-12-years-according-to-ihs-markit, last accessed Nov. 3, 2020.

least a decade. Factoring in the scrappage rate of 5.1% per year, there will still be some 2030 model vehicles in use on California roads in 2050.

To achieve its goal that 100 percent of in-state sales of new passenger cars and trucks will be zero-emission by 2035 while decarbonizing emissions from the remaining internal combustion vehicles on the roads, California needs to use every option at its disposal. A prime example is retaining and even further incentivizing CCUS Projects, including oil production coupled with CCUS, which can result in low and even negative carbon intensity ("CI") transportation fuel. These transportation fuels may include petroleum-based fuels that can be part of the transportation fuel mix as California scopes out a plan for meeting the Governor's Order and while the state economy transitions away from petroleum fuels. This is also expected to help ease the economic burden on Californians that currently rely on gasoline and diesel fueled vehicles.

B. CCUS is Essential for Decarbonization

Two complementary options provide the fastest pathways to decarbonization of the transportation sector, which is the ultimate ambition of the Governor's Order. First, low carbon intensity fuels produced using innovative methods will provide an important fuel alternative for Californians who do not transition to ZEVs until after 2035. Crude oil produced with innovative methods using CCUS can be carbon-neutral and even carbon-negative.[3] Such fuels will provide an important and essential bridge during California's transition away from petroleum-based fuels.[4]

Second, electricity production linked with CCUS can supply carbon free power to electric vehicle charging stations. A significant percentage of ZEVs will be powered by electricity using both personal and publicly available charging stations.[5] Renewable resources will provide an important source of power for electric vehicles. Zero-carbon resources, such as natural gas combined-cycle power plants joined with CCUS, can provide power for electric vehicles, facilitate decarbonization of the California grid (and beyond), provide clean firm[6] energy to address the challenges of intermittent energy generation from renewable sources, and provide an important bridge while energy storage issues are resolved.

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[3] International Energy Agency, "Storing CO_2 through Enhanced Oil Recovery", 2015, Paris, France. https://www.iea.org/reports/storing-co2-through-enhanced-oil-recovery, last accessed, Nov. 4, 2020.

[4] In 2011, California Council on Science and Technology (CCST) issued its "California's Energy Future—The View to 2050 Summary Report," which found CCS to be an important strategy for achieving the state's GHG reduction targets under several scenarios. In 2017, CARB's "California's 2017 Climate Change Scoping Plan" found that CCS "offers a potential new, long-term path for reducing GHGs for large stationary sources."

[5] Electricity power is expected to be the predominant energy source for ZEVs consistent with Governor Brown's 2018 Order intended to spur the construction and installation of 200 hydrogen fueling stations and 250,000 zero-emission vehicle chargers by 2025. Executive Order B-48-18. January 26, 2018. https://www.ca.gov/archive/gov39/2018/01/26/governor-browntakes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/index.html.

[6] The U.S. EIA defines firm power as "power or power-producing capacity, intended to be available at all times during the period covered by a guaranteed commitment to deliver, even under adverse conditions." Clean firm generation includes firm power resources that are low- or zero-emissions, including nuclear, geothermal, biomass, hydro, NGCC-CCS, hydrogen and other carbon free fuels using net-zero processes.

II. LCFS Comments

A. Low Carbon Intensity Fuels Using Innovative Methods

The Low Carbon Fuel Standard ("LCFS") currently provides for credits to be generated for crude oil that has been produced or transported using innovative methods and delivered to California refineries for processing. *17 CCR 95489(a)*. Five innovative methods are listed, including CCUS where carbon capture takes place onsite at a crude oil production or transport facility. *17 CCR 95489(a)(1)(A)2*. The captured CO_2 may then be transported to another location for injection and sequestration.

CARB is considering revising the LCFS innovative crude provisions to provide:

> "Carbon capture must take place on equipment supplying steam, heat, or electricity (behind the meter) to crude oil production or transport facilities. The credit will be prorated based on the fraction of steam, heat, or electricity supplied to the crude oil production or transport facilities. Projects using CCS are subject to the provisions of section 95490."

We suggest that CARB not revise the LCFS innovative crude provision to specify certain pieces of equipment. Including the language as proposed could unnecessarily limit the types of projects that might qualify under the LCFS. Rather, we believe that the LCFS provisions for using innovative methods should be designed and interpreted to promote those technologies and processes that are truly innovative. Consistent with this approach, the LCFS provisions should be broadly interpreted to incentivize producers to capture CO_2 emissions wherever they may occur in crude oil production or transportation.

We recommend that CARB look for opportunities to expand the universe of projects that are eligible to generate credits for the LCFS market. One opportunity is revising the LCFS to recognize that fuel produced using CO_2 and CCUS can also be innovative. The innovation in this case is combining EOR with CCUS to produce low-carbon or zero-net-carbon fuels. For example, while CO_2 has been used in enhanced oil recovery ("EOR") for some time, the innovation in this instance is combining EOR with CCUS and California's Permanence Certification requirements to ensure that CO_2 is safely, securely and permanently stored.

B. Direct Air Capture

Direct air capture ("DAC") is widely recognized as an important component of any effort to address greenhouse gas emissions that have already contributed to the historically high atmospheric CO_2 concentrations.[7] In addition, DAC provides a way to mitigate emissions from

[7] NOAA reports that the global average atmospheric carbon dioxide in 2019 was 409.8 parts per million, with a range of uncertainty of plus or minus 0.1 ppm. Carbon dioxide levels in 2019 were higher than at any point in at least the past 800,000 years. Between 2009-18, the growth rate in the concentration of CO_2 in the atmosphere has been 2.3 ppm per year.

industry sectors that are difficult-to-decarbonize. DAC technology also incentivizes broader deployment of zero carbon and renewable electricity, which in our opinion will be widely used to power DAC facilities through the use of power purchase agreements ("PPAs"). CARB has indicated that it is considering additional eligibility conditions for direct air capture.

The LCFS has been extremely influential in incentivizing companies and investors to explore DAC projects across the United States and the world. DAC projects will need sequestration sites with permanence certifications and, to provide the maximum climate benefit, power from zero-carbon or renewable energy. Companies are pursuing projects where those elements are already in place, such as in rural West Texas, where high-quality sequestration sites are already available and where conditions are favorable for the installation of additional zero-carbon and renewable energy resources. As these and other projects are deployed, investors will become more comfortable with the DAC technology, and costs will decline.[8] Future DAC projects, some of which we anticipate will be sited in California, will benefit from the efforts of these initial projects.

CARB recognizes the potential for DAC and the LCFS recognizes that a project proponent that employs DAC to remove CO_2 from the atmosphere and geologically sequesters the CO_2 is eligible to submit project applications and, if approved, receive CCS credits, in accordance with the CCS Protocol. *17 CCR 95490(a)(2).* Credits associated with a DAC project need not be prorated based on volumes delivered to California. *17 CCR 95490(b)(3).*

The LCFS does not place any restrictions on the location of the sequestration site that will receive the CO_2 removed by the DAC. Similarly, the LCFS does not require a DAC project to use behind-the-meter power, and use of zero-carbon or renewable power from the grid is not restricted. Ensuring that the LCFS does not include restrictions on sequestration site locations or on the use of zero-carbon or renewable power from the grid is critical to broader deployment of DAC technology.

While there are a variety of geographic locations likely to satisfy the requirements of CARB's CCS Protocol and receive Permanence Certification, including in California, a number of West Texas and southeastern New Mexico sequestration sites benefit from advanced characterization and existing infrastructure. To be eligible to generate LCFS credits, the first large-scale DAC projects must be linked to a site that can receive, or has received, a Permanence Certification. It would be optimal for a DAC project to be connected to a pipeline network that could route the captured CO_2 to multiple certified sequestration sites. This will help ensure reliability, as other sequestration sites will be able to receive CO_2 even when periodic maintenance activities may result in downtime at a particular sequestration site.

[8] Models for predicting technological improvement and costs include Wright's Law, Moore's Law, Goddard's Law and others. Wright's Law postulates that cost decreases at a rate that depends on cumulative production. Moore's Law refers to the generalized statement that the cost of a given technology decreases exponentially with time. Goddard's Law argues that progress is driven purely by economies of scale. A 2013 research paper found that each of these (and other formulations) arrive at similar results, i.e., that the costs of a technology decreases with broader deployment over time. Nagy B, Farmer JD, Bui QM, Trancik JE (2013) Statistical Basis for Predicting Technological Progress. PLOS ONE 8(2): e52669. https://doi.org/10.1371/journal.pone.0052669, last accessed, Nov. 4, 2020. Similarly, DAC Project costs are expected to decrease in accordance with Wright's Law with broader deployment.

To provide the maximum climate benefit, it is important for DAC projects to utilize zero-carbon or renewable power. However, the ability to access these power sources in an efficient and cost effective manner hinges upon flexibility in the siting of the power projects. Locations for these clean energy sources depend upon numerous factors; this is particularly true for renewable facilities, which must be sited where the natural resources and terrain are best suited for these types of projects. Other location considerations include proximity of existing power transmission infrastructure, land availability, and other environmental factors. Balancing these factors is best achieved when a DAC project is able to be optimally located while using PPAs from renewable or zero-carbon electricity projects, also optimally located. We believe the PPAs used to secure zero-carbon or renewable resources must demonstrate that displaced carbon-intense resources are not being rerouted, or shuffled, to other parts of the grid. The result is that electricity for DAC projects may be generated at one location, the DAC project sited at a second location, and the CO_2 captured by DAC sequestered at one or more additional locations. In summary, it is critical that DAC projects be eligible to generate full LCFS credits regardless of the location of the supporting infrastructure, so long as it is identifiable and verifiable.

III. Direct Air Capture Advance Credits

Innovative climate solutions require the type of forward-thinking climate policy California has developed. Including climate mitigation strategies like DAC in the LCFS is an example of this innovation. DAC is the only technology that captures CO_2 from the atmosphere where it can then be permanently, safely and securely sequestered. Unlike CO_2 captured at the source, DAC will reduce CO_2 that has already been emitted and is currently contributing to global warming.

On October 15, 2020, Oxy presented a proposal at the LCFS Workshop titled "Advancing Credits for DAC." Under this proposal, DAC projects that meet CARB requirements, including submitting and gaining application approval and meeting a financial assurance demonstration, could generate LCFS credits during construction. Shifting LCFS credit generation to the construction phase will result in more DAC projects being developed and enable California to meet its climate goals faster and remain a leader in climate and energy policy. Advance credits would be restored over the life of the project and expressly dedicated to the California LCFS market. Oxy's analysis found that the anticipated impact on the LCFS market attributable to Direct Air Capture advance credits would be small. Each DAC would generate, at most, LCFS credits equal to approximately 4% of the market, and only during the construction phase.

Advance credits are needed to address the unique technological and market challenges faced by DAC projects. The combination of using DAC first-of-a kind technology and relying exclusively on LCFS market pricing is perceived to be high risk by potential investors. The alternate choice of investing in an established technology that produces a commodity product with a low CI that generates revenue and would receive a potential increase in value from LCFS credits generated from selling the fuels into the California market is perceived to be low risk.

Advancing credits for upcoming DAC projects allows a project pathway using a first-of-its-kind technology to compete with a fuel pathway that utilizes established technologies to produce commodity fuels for the California market for outside investment capital. Shifting credits for

DAC projects to the construction phase addresses the inherent differences between commodity markets and carbon markets, which traditionally stifle investment in large-scale climate mitigation technologies.

Oxy's proposal incentivizes the deployment of DAC technology as it transitions from pilot scale to commercial scale. As such, broader DAC project deployment will decrease upfront investment costs over time, consistent with established prediction models (*supra* footnote 8). Reductions in cost over time will help ensure that DAC deployment continues at scale to provide its essential contribution to climate goals.

The credits advanced will be dedicated to the California LCFS marketplace. This will provide stability and further cost controls for the California LCFS marketplace and ensure credits are available well into the future, even while other states and regions adopt programs similar to California's. Credits will be financially assured by DAC projects similar to the current mechanisms relied upon by the CCS Protocol. This will provide important financial security for the California LCFS market.

The Advancing Credits for DAC proposal will incentivize the DAC projects that will provide continuing benefits for California's programs to address climate change beyond the transportation sector. Even after California completes its transition from petroleum fuels, the current elevated CO_2 concentrations in the atmosphere will remain. DAC will reduce these elevated CO_2 concentrations after that transition. The Advancing Credits for DAC proposal is a key to getting results and getting them in a timely manner consistent with California's climate goals.

We welcome the opportunity to discuss our comments with CARB either virtually or in person (assuming such an option becomes available).

Best regards,

William H. Barrett
Commercial Director