August 16, 2021

California Air Resources Board
1001 I Street, Sacramento, CA 95814

RE: Response to 2022 Scoping Plan Update - Engineered Carbon Removal Technical Workshop

Dear CARB members:

Thank you for the opportunity to comment on the CARB and California Natural Resources Agency Public Workshop: 2022 Scoping Plan Update – Engineered Carbon Removal Technical Workshop.

The purpose of this comment/position paper is to illustrate the importance of Carbon Capture and Utilization (CCU) in carbon management planning. The workshop extensively explored Carbon Capture and Sequestration (CCS). However, the only discussion on CCU was enhanced oil recovery (EOR). The limited view of CCU obscures the importance of utilizing captured carbon in the fuels and materials on which society will depend for the foreseeable future.

As California leads the country in a transition from fossil fuels, its policies and programs for reducing CO_2 in the atmosphere must include carbon recycling. The nation cannot move away from its dependency on petroleum and natural gas—the feedstock for carbon-based products—without developing the technology to recycle carbon. Carbon recycling can be done using unavoidable industrial waste gas, municipal solid waste, municipal and agricultural wet waste, other organic waste materials, and as the grid is greened, carbon dioxide from the air.

Coal is not used in an appreciable way as a feedstock for carbon-based products. Rather, it is used for power and heat and therefore can be retired. Clean, renewable electricity can replace coal. Gasoline engines can be replaced with more efficient electric motors and so fossil carbon-based gasoline for powering the light-duty fleet will not be needed in the longer run.

Where is carbon truly needed in the economy? The aviation sector will need energy-dense hydrocarbon fuels in the form of sustainable aviation fuel (SAF) for many decades to come. Because weight is a primary concern in aviation, there is an intrinsic technical barrier to the electrification of long-haul flights without major breakthroughs in battery technologies that are not anticipated today. While the industry is investing in the development of hydrogen-powered flight, this is acknowledged to be a very long-term option.[1]

[1] https://www.bloomberg.com/news/articles/2021-03-30/airbus-touts-sustainable-fuel-after-year-of-hydrogen-evangelism

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If our goal is to replace petroleum and natural gas, the feedstock for carbon-based materials will need to be produced from an alternative carbon source. While the chemical manufacturing sector may be outside of CARB's mission, CCU is part of the solution to replace petroleum and natural gas as the source of carbon in chemicals and materials.

The Environmental Justice Advisory Committee members were vocal in their strong unease about CCUS. Two specific concerns were raised. One concern is that CCUS is extending the life of the fossil fuel industry but not solving the carbon problem. The concern is understandable considering at least one application of CCS, blue hydrogen. A recent scholarly article notes "the use of blue hydrogen appears difficult to justify on climate grounds."[2] The other concern was risks to the health and safety of communities where industrial plants are located.

Recycling carbon addresses these concerns. It provides a means for retiring petroleum and natural gas by creating an alternative source of carbon feedstocks for materials and aviation fuels. Done correctly, carbon recycling via gas fermentation captures and converts gases into intermediates that can be chemically transformed into sustainable aviation fuel, polymers, and other carbon-based chemicals cleanly, safely, and with minimal waste. This form of carbon recycling from industrial facilities can capture gases prior to combustion (such as flaring or secondary use in boilers for power, heat and steam) and thus avoid the resulting air pollution. This type of carbon capture and utilization can provide tangible, near-term pollution reduction in frontline communities, while helping key employers clean up their operations and become more sustainable. Carbon capture and utilization is not about extending the use of fossil fuels; it replaces those fuels with sustainable alternatives.

During the workshop, several presenters expressed the need for a carbon (CO_2) drawdown through CO_2 sequestration. But a drawdown using sequestration is not enough. We must be able to supply carbon-based materials that will be needed in the economy, and this is best done by recycling carbon that has already served a primary use. Recycling carbon can and should include carbon capture from the air, as well as carbon used from CO_2 point sources, waste gases, and other organic waste. The U.S. must develop the technology to use waste CO_2 and other organic carbon to produce the carbon-based materials that are essential, and will remain essential, in the economy to allow the U.S. to transition away from natural gas and petroleum for the carbon raw material used today. Carbon utilization holds the promise of creating essential products from waste carbon, thus turning carbon pollution into an opportunity.

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[2] Howarth, R.W.; Jacobson, M. Z. *Energy Sci Eng*. **2021**;00:1–12. DOI: 10.1002/ese3.956

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