COMMENTS ON CALIFORNIA'S PLANS TO ACHIEVE CARBON NEUTRALITY BY 2045

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The CARB staff presented their approach to achieving 40 percent emission reductions by 2030 and carbon neutrality by 2045. The draft scenario overview referred to four scenarios: where Alternative 1 had no reliance on engineered carbon removal, Alternatives 2 to 4, (2) had including engineered carbon removal, (3) emerging fossil fuel alternatives, and (4) utilizing existing and emerging technologies, in line with recent agency reports (AB 74 carbon neutrality in transportation, SB 100 zero-carbon electricity grid).

In the Staff's request for stakeholder feedback, they asked for comments on whether different scenarios be considered and are there technology and fuel options not presented that should be considered in the modeling?

Most plans began to recognize the need to remove carbon dioxide from the air as part of the final solution for the long term in addition to wind/solar options. It is also apparent that the recent climate change talks did not produce the reduction results desired and necessary with countries such as India falling short on their commitments. So Alternatives 2 – 4 therefore become very relevant to be considered as an alternative to removing carbon dioxide from the air.

The following comments concerning carbon capture, utilization and sequestration (CCUS) options are provided in response to the above request:

1. The plan should not be limited to growing biomass solely in California. Oak Ridge National Laboratory has looked at the amount of biomass being available nationally and published “The Billion Ton Biomass” report. The report identifies >300 million tons per year from wastes and residues and >400 million tons per year from dedicated biomass production, e. g. poplar trees on marginal lands. SG H2 Energy is developing the largest green hydrogen production facility in Lancaster, CA to use wastes and reduce carbon and importantly methane emissions which is a very potent polluting element. There are many other systems also being developed for carbon dioxide reductions from waste.
2. ORNL is currently exploring biomass gasification to renewable natural gas (RNG) in connection with Poplar tree sources that could then be transported with natural gas by natural gas pipeline nationally. A mixture of 10% RNG with 90% NG could be considered which would represent a lesser need for existing pipeline modifications and permit the use of lower cost natural gas. This plan would require a bookkeeping option as the RNG gas produced in Kentucky might not actually reach California but would be attributable to the State's goals. With the production of RNG with CCUS, carbon dioxide would actually be removed from the air which is becoming a more recognizable strategy than removing carbon dioxide from the air.
3. An approach within the State of California should be to consider City-Gate plants that would coproduce electricity with hydrogen storage for base load operation and the production of hydrogen for fueling hydrogen fuel cell vehicles. Such an option would minimize electric transmission distances but also permit the hydrogen to be compressed to 14,000 psi for transportation to city hydrogen stations with some liquefaction considered for fueling large trucks, busses and trains. The latter is more costly but maybe necessary to fuel such large vehicles. By shipping high pressure hydrogen, a more economic approach is possible to meet target prices at the station of $3 to 5/kg for passenger vehicles.
4. Mitsubishi turbines is developing a 3100 F hydrogen turbine that should be available by the 2030s. They are providing such a 400 MW turbine system to LADWP to be installed in Utah with transmission to California. Solid Oxide Fuel Cells are also being developed and demonstrated today and in this period for consideration as the preferred operating systems. Both of these high technology options need to be considered with the ability to recover water from the turbine exhausts and fuel cells. The alternative approach of using Solar/Wind will require the electrolysis of water which will be difficult to do in a State with a water crisis. The turbine and fuel cell approaches may actually be able to provide water to the State.
5. The location of CCUS sites should closely follow the plan laid out in: “An Action Plan for Carbon Capture and Storage in California: Opportunities, Challenges and Solutions, October 2020” This was a report produced by Energy Future Initiative (headed by Ernest Moniz (previous Secretary of Energy), Stanford Precourt Institute for Energy and Stanford Earth. It purports to present “a clean technology pathway well suited for rapidly reducing emissions from economically vital sectors in California ---- .” and “ California has opportunities to advance its decarbonization and economic goals by leveraging CCUS due to its sizable geologic storage resources; its need for clean firm electricity generation as the renewable energy profile grows; the need for decarbonized transportation fuels such as hydrogen; ----”.

The report also finds: “adding NGCCs with CCS retrofit to a renewables-dominated grid is a cost-effective way for California to meet SB100 objectives. Adding NGCC-CCS lowers the overall system costs by avoiding the need to overbuild renewable generation and energy storage to meet reliability requirements. Adding some NGCC-CCS also has benefit of reducing land use requirements for renewable generation.” page 43. “Facilities that are co-located directly above a potential storage resource account for up to 5.6 MtCO2yr. Of emissions” (page 43).

1. By considering a 10% RNG/90%NG gas mixture with CCUS, carbon dioxide is actually being removed from the air. And it should be a more cost-effective approach than considering removing carbon dioxide from the air to achieve eventual carbon dioxide reductions that will be necessary.

While the State plan includes Alternatives 2 to 4, the results of current efforts seem to produce a Solar/Wind dominant option which the above argues against. Therefore, it is recommended that the above be included to possibly identify a lower cost, better system utilization and more attractive environmental option including water conservation be evaluated as part of Alternatives 2 to 4.

References:

USDOE (2016). 2016 Billion-ton Report: Advancing Domestic Resources for a Thriving Bioeconomy, Volume 1: Economic Availability of Feedstocks. M. Langholtz, B. Stokes and L. Eaton. Oak Ridge, TN, Oak Ridge National Laboratory: 448. https://bioenergykdf.net/billionton2016/overview

An Action Plan for Carbon Capture and Storage in California: Opportunities, Challenges & Solutions, Stanford Center for Carbon Storage, 2020.