WYOMING ENERGY AUTHORITY

September 9, 2020

California Air Resources Board
1001 I Street
Sacramento
California 95814

Re: Comments on Draft Report entitled "Achieving Carbon Neutrality in California: PATHWAYS Scenarios Development for the California Air Resources Board" (Energy+Environmental Economics, Aug. 2020)

Dear California Air Resources Board:

The Wyoming Energy Authority (WEA) is pleased to submit these comments on the referenced report (Report). On July 1, 2020, the Wyoming Infrastructure Authority merged with the Wyoming Pipeline Authority to create WEA. WEA serves as a unifying organization for Wyoming's energy industries and is also the new home of State Energy Office. WEA's mission is to advance Wyoming's energy strategy by driving data, technology, and infrastructure investments. WEA's vision is to support and promote Wyoming's energy sector by implementing the state's energy strategy; delivering positive economic impact and jobs for Wyoming; fostering an environment for the sustainability and growth of Wyoming's economy; and ensuring Wyoming continues to power the nation.

Background

The State of Wyoming is vitally interested in CARB's ongoing efforts to establish carbon neutrality policies. Wyoming produces prodigious amounts of both fossil and renewable energy. Wyoming produces fifteen times more energy than it consumes, which means it is the largest net energy supplier among the states.[1] Wyoming sends almost three-fifths of the electricity it generates out of state, and several major interstate projects are in development here to transmit even more electricity to western population centers.[2]

Wyoming supplies energy to California. California's leadership on these topics generally also means that whatever decisions California makes are likely to be influential throughout the region and the rest of the United States. Thus, this proceeding will almost certainly impact Wyoming's energy markets, and thus Wyoming's economy.

The State of Wyoming is a leader in low-carbon energy technologies. Wyoming Governor Gordon has emphasized that the end goal should be reducing atmospheric concentrations of

[1] Wyoming State Energy Profile (U.S. Energy Information Administration, Feb. 20, 2020) (available at https://www.eia.gov/state/analysis.php?sid=WY).
[2] Id.

carbon dioxide (CO_2) as opposed to penalizing the use of any specific fuel without considering the climate impacts of that policy decision.[3] For example, through technologies such as Bioenergy with Carbon Capture and Storage (BECCS) – which the University of Wyoming (UW) is researching, as discussed below – coal-fired power plant equipped with carbon capture utilization & storage (CCUS) technology can remove CO_2 from the atmosphere while providing reliable, cost-effective baseload electricity.

Wyoming is confident that it can help California achieve its carbon neutrality goals in the decades ahead. It can do so through both renewable energy and lower-carbon fossil energy achieved through technologies such CCUS. Wyoming's leadership on CCUS is notable on several fronts. Wyoming is:

- ✓ One of the only states that has enacted legislation related to CCUS projects – e.g., Wyoming law defines who owns the pore space, a critical aspect of such projects. Wyoming is also one of the only states with existing CCUS-related infrastructure, such as carbon dioxide (CO_2) pipelines.

- ✓ Wyoming is the only state in the Nation to enact a law that creates a low-carbon/CCUS-based standard for coal-fired power plants that are regulated as public utilities. The law – H.B. 200 – was enacted earlier this year and is related to prior legislative enactments related to Wyoming's coal fleet (e.g., S.F. 159).

- ✓ Now only the second state in the Nation to be granted primacy from the U.S. Environmental Protection Agency (EPA) for implementation of the CO_2 injection regulations under the Class VI of the Safe Drinking Water Act's Underground Injection Control program. EPA announced this decision just last week.

- ✓ An international leader in many aspects of CCUS technology. Researchers at UW, for example, are currently funded by the U.S. Department of Energy (DOE) to advance a potential large-scale integrated CO_2 storage project in Gillette, Wyoming.[4] Several years ago, comparable geologic assessments were conducted at another site in the state.[5] UW is part of the Montana State University-led WAFERx project, which is funded by the National Science Foundation to evaluate the feasibility of the widespread adoption of BECCS in the Upper Missouri River Basin.[6]

[3] See https://www.wyofile.com/can-mark-gordon-save-coal-and-stop-climate-change/.
[4] See https://www.uwyo.edu/cegr/research-projects/carbonsafe-p2-dryfork.html.
[5] See https://www.uwyo.edu/cegr/research-projects/project-wy-cusp.html.
[6] See https://waferx.montana.edu/the_project.html.

- ✓ Home to the Wyoming Integrated Test Center, where researchers test the utilization and management of CO_2 that is sourced from a coal-fired power plant.[7]

Comments

We support the Report's many references to CCS/CCUS. Wyoming envisions the day when low- or decarbonized fossil energy projects are sited here, with the resulting energy exported to states such as California. For a variety of reasons – e.g., lower population density, reduced seismic risks, existing CCUS infrastructure, existing projects, CCUS-related laws, etc. – Wyoming is poised to support the build-out of a CCUS industry that supports the carbon neutral requirements and goals of states in the region.

On September 3, 2020, Wyoming Governor Gordon announced that DOE had completed a CCUS study for several Wyoming coal-fired power plants.[8] The study's coal was to evaluate the potential opportunities for retrofitting existing coal-fired power plants in Wyoming with CCUS technology, the economic impact, and the CO_2 emission reductions compared to alternatives. The study compared CCUS use to an alternative case in the most recent PacifiCorp 2019 integrated resource plan (IRP). The results showed CCUS retrofits provided the following potential benefits:

- Reduced CO_2 emissions by 37% (100 million metric tons) more than the 2019 IRP preferred portfolio (henceforth referred to as Baseline IRP);
- Produced avoided costs for CO_2 emissions that are $24 per ton ($21.5/metric ton) less expensive than the Baseline IRP;
- Reduced the amount ratepayers could pay by approximately 10% less per month than the Baseline IRP;
- Lifted Wyoming employment benefits up to 5 times higher than employment benefits from implementing the Baseline IRP; and
- Produced higher local and state revenue from property, sale, severance, and other associated coal taxes as well as higher federal royalty payments.

[7] See https://www.wyomingitc.org/about/.

[8] https://governor.wyo.gov/media/news-releases/2020-news-releases/us-department-of-energy-and-state-of-wyoming-partner-on-study-showing-poten.

Financing CCUS projects in Wyoming and elsewhere is anticipated to be facilitated under the amended federal section 45Q tax credit.[9]

Carbon Dioxide Removal (CDR) will require that the CO_2 be utilized, stored and/or otherwise managed. The Report's scenarios revolve around scenarios that, in turn, envision varying amounts of CDR. It is important to keep in mind that once CO_2 is removed from the atmosphere – particularly when Negative Emissions Technologies are deployed -- something must be done with it. Here again, and just as with CCUS generally, deployment of such technologies in Wyoming should benefit California because of Wyoming's many favorable CO_2 management attributes.[10]

We support additional research related to the hydrogen economy. The Report's Zero Carbon Energy Scenario envisions the deployment at scale of hydrogen and synthetic natural gas while making use of existing natural gas pipelines to the extent possible. The Report also notes the potential storage of hydrogen in geologic formations. UW researchers would welcome the chance to collaborate with CARB and other colleagues in California on whether such a build-out of hydrogen infrastructure in Wyoming could be done technically, economically and safely.

We agree that in the electricity sector, dispatchable generation will continue to be needed – and believe that coal with CCS/CCUS should qualify. With respect to electricity generation, the Report states (p. 54) (emphasis added):

> **While renewable energy generation can displace the majority of emissions in the electric sector, these studies have shown that, due to reliability concerns, some form of dispatchable generation also referred to as "firm capacity" is needed to maintain system reliability.** Some of this firm capacity can be provided by geothermal energy but economic access to large amounts of geothermal energy is expected to be quite limited. Biofuels such as biomethane can displace remaining emissions from gas generation as a low or zero carbon dispatchable fuel, at an incremental cost, while fulfilling the firm capacity need. However, biomass for biofuels is needed across all sectors to meet decarbonization goals, and its availability in 2045 may be limited.
>
> Other potentially promising options exist that can meet the need for firm capacity (or dispatchable generation). These include, but are not limited to, long-duration energy storage (Spector, 2020) and advanced zero carbon

[9] 26 U.S. § 45Q (2019). Revised guidance to implement this tax incentive should be finalized by the Internal Revenue Service in the coming months.

[10] The Report acknowledges, for example, that "land-based CDR solutions in California are likely to be limited." *Report, p. 4.*

> fuels to burn in existing or new turbines. In addition to biomethane, these could also include hydrogen and synthetic natural gas. **Other dispatchable generation options include gas with CCS**, and advanced nuclear power technologies such as small modular reactors and molten salt reactors. However, the development of such dispatchable generation options and fuel production processes remains uncertain and has yet to be demonstrated at commercial scale. Furthermore, California has prohibited the development of new nuclear facilities absent the existence of a federal nuclear waste repository. Thus, advanced nuclear technologies, while potentially promising as a zero-carbon resource, are not assumed in this study.

We agree that firm capacity is needed to maintain reliability of the electric system. We believe that fossil generation equipped with CCS/CCUS that otherwise meets all applicable federal and state GHG emission standards should qualify, including coal-fired power plants. Unfortunately, throughout the region and in Wyoming, many of these facilities are slated for closure in the years ahead, thereby closing the door on the deployment of CCS/CCUS technology in this industrial sector. Thus, it is imperative for CARB to communicate sooner rather than later to regulated parties, the public and others about the critical role that CCS/CCUS technologies are expected to play in the decades ahead to meet carbon neutrality requirements.

Specifically with respect to gas with CCS, we believe it important for CARB to continue to envision a role for the fossil-based version of that resource. The Report states (pp. 55-56) (emphasis added):

> Levels of electrification by scenario increase in the following order: High CDR, Balanced and Zero Carbon Energy. Figure 20: Electric highlights that, across all scenarios, there is a heavy reliance on variable renewables, amounting to at least 80% of total generation. **The remaining generation across all scenarios, 15-20%, are from a combination of large hydro resources (including imports), some geothermal capacity and some form of dispatchable gas. Depending on the scenario, the dispatchable gas used is either fossil based, i.e. natural gas (High CDR scenario) or biomass based i.e. biomethane (Balanced and Zero Carbon Energy scenarios).** In the absence of other technologies highlighted in the previous section, the firm capacity need is met by a combination of geothermal and dispatchable gas generation. Here, dispatchable biomethane enables the Balanced and Zero Carbon Energy scenarios to achieve zero emissions electricity generation, **while the High CDR scenario still has 10 million metric tons of CO2 emitted from natural gas generation in 2045.** All scenarios comply with SB 100 providing at least 100% of electricity retail sales with zero carbon resources, which reflects at least 95% of generation from zero emissions resources.

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For cost and reliability reasons alone, we deem it imperative for CARB to maintain gas with CCS/CCUS as an option, as reflected in the August 31, 2020 "2021 Senate Bill 100 (SB 100) Joint-Agency Report, Modeling Framework and Scenarios Overview" (available at https://www.energy.ca.gov/event/workshop/2020-09/senate-bill-100-draft-results-workshop) in the related SB 100 implementation process that is also underway.

SB 100 uses the phrase "zero-carbon resources," which the joint agencies have interpreted to mean resource that satisfy either or both of the following criteria: (1) meets the requirements for RPS-eligibility set forth in the most recent RPS Eligibility Guidebook; or (2) has zero onsite greenhouse gas emissions. As to the latter, in the SB 100 implementation process, the joint agencies have taken the position that a "Generic Firm Dispatchable [Zero-carbon] Resource" "could represent several technologies, such as gas with carbon capture and sequestration technologies."[11] We agree.

With respect to a "Generic Firm Baseload Resource [Zero-carbon] Resource, the joint agencies have taken the position that this resource "could represent several technologies, such as imports of emerging nuclear generation technologies …."[12] Unfortunately, the joint agencies in that proceeding have decided to exclude coal-fired generation with CCS because "it is incompatible with the state's environmental and public health priorities."[13] If coal-fired power plants in Wyoming can technically, economically and safely deploy CCS/CCUS technologies – either as retrofits or new builds –that meet all applicable GHG emission standards, we believe that the resulting electricity should qualify in California.

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We appreciate the opportunity to submit these comments.

Dr. Glen Murrell
Executive Director

[11] "2021 Senate Bill 100 (SB 100) Joint-Agency Report, Modeling Framework and Scenarios Overview," p.3.
[12] Id.
[13] Id. p. 4.