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RE: Pacific Gas and Electric Comments on the Scenario Concepts Technical Workshop for the 2022 Scoping Plan Update

Pacific Gas and Electric Company (PG&E) appreciates this opportunity to comment on the California Air Resources Board (CARB)'s August 17, 2021 Scenario Concepts Technical Workshop. PG&E supports ongoing transparency in the Scoping Plan Update process and recommends additional technical workshops on the modeling assumptions and initial results after the chosen scenarios are run. PG&E's more detailed comments on the August workshop are provided below.

General Comments

At the next scenarios workshop, PG&E encourages CARB to outline its plan for utilizing model results to develop the policy recommendations that will become the scoping plan scenario. Much of the first scenarios workshop was focused on technology input assumptions rather than policies (which was the main organizing structure of the scenarios and the 2017 Scoping Plan). Along these lines, there was almost no discussion of several of CARB's major climate policies: the Cap-and-Trade program and the Low Carbon Fuel Standard. An important question to be answered at the next workshop is how does CARB plan to use pathways scenario results to inform its preferred suite of policies?

Comments on Scenario Design Options

A. <u>Carbon Neutrality Timeframe</u>

As the State considers accelerating its climate objectives, it will be important to consider the roles of and requirements for the State's electric and natural gas infrastructure. Large modifications, upgrades, etc. to these systems require substantial future planning, often over the span of decades. CARB should also keep in mind the long planning horizons necessary for electrification of the transportation sector when considering the feasibility of accelerating current goals.

B. Role of Engineered Carbon Removal

PG&E believes that CARB should model options that include carbon capture and sequestration (CCS) which can remove all carbon from industrial process emissions, combustion in difficult to electrify applications, and to compensate for refrigerant and other non-CO2 emissions.

Policy signals are needed to further the advancement of such technologies. For example, we need to continue developing carbon capture technologies that can effectively and efficiently remove carbon that is present in relatively low concentration in flue gas (e.g., compared to large amounts of inert nitrogen).

In addition, CARB's modeling should take into account that the carbon captured from fossil fuel combustion and industrial emissions doesn't have to only be sequestered, it can be transformed into other valuable products such as renewable natural gas (if combined with hydrogen), used as an additive in carbon fibers / cement, etc. We should continue to develop alternative solutions for our products that start off with a lower carbon footprint. For example, for cement, using a feedstock that doesn't inherently have carbon dioxide in it. If captured carbon can be utilized to create other products, this could help offset some of the costs to capture and transport the carbon. Thus, CARB should explicitly include carbon capture, *utilization*, and sequestration (CCUS) in its modeling scenarios, not just CCS.

PG&E recommends, to reach carbon neutrality by 2035, option B should include CCUS and carbon removal from the atmosphere. Also, we recommend prioritizing CCUS as a proactive approach to capture the carbon before it's emitted into the atmosphere. Developing direct air capture can occur in parallel.

Further, PG&E recommends, to reach carbon neutrality by 2045, option C should include CCUS and carbon removal from the atmosphere. This is assuming that this will pair with other carbon reduction solutions like using biomass to create renewable fuels.

C. Carbon Free Electricity Grid

PG&E recommends scenario options that are technology agnostic and allow for generation fueled by hydrogen, renewable natural gas, biomass, and fossil natural gas combined with carbon capture and storage and direct air capture. PG&E anticipates that decarbonized gas-fueled generation resources will be required in the long run to ensure reliability while meeting the state's decarbonization goals with a cost-effective generation portfolio.

For all options that CARB selects there needs to be an assessment of cost/rate impact and feasibility of implementing the options within the specified timeframes – i.e. can the necessary megawatts of new resources sufficient to ensure grid reliability be built by 2035 and at what cost? Without incorporating feasibility and cost impacts, the model results will not be actionable. PG&E also supports the comments submitted by other California utilities with respect to the necessity of incorporating reliability, affordability and feasibility analysis in the creation of scenario options and the ultimate selection of a preferred pathway.

D. Vehicle Fleet Electrification

Regardless of the specific transportation goals set in this Scoping Plan Update, PG&E encourages CARB to recognize that the charging infrastructure needed to meet each vehicle segments' charging needs will be substantial and varied in type. This will require coordination among all market players and proactive planning and investment for the necessary infrastructure.

PG&E offers the following comments on the specific options to potentially be modeled:

- Option A – PG&E recognizes the need for aggressive action, especially in light of the most recent Intergovernmental Panel on Climate Change (IPCC) report. However, it is unclear if vehicle providers have the manufacturing capability to meet the proposed 100% ZEV sales for light duty by 2025 and 100% ZEV sales for all MHD vehicles by 2030. Therefore, it may not be a useful exercise to model that scenario.
- Option B – PG&E supports this option for modeling with recommendations for slight modifications. PG&E recommends modeling 100% light-duty ZEV sales in 2030 and splitting out the MHD 100% ZEV sales by segment. It may be feasible for some medium and heavy-duty segments to have 100% ZEV sales by 2030 and should be pushed to meet that ambitious target (e.g. school buses, delivery vans). However, it is highly unlikely that all MHD vehicles segments (e.g. Class 8 trucks) would have enough options and manufacturing capacity to meet a 100% ZEV sales target in 2030, and therefore that segment should have a sales target date in a later year.
- Option C – PG&E also supports this option for modeling. As stated in comments on Option B, it is likely infeasible for all MHD vehicle segments to meet the 100% ZEV sales in 2035 but it could still be useful to model the costs and impacts of having a singular target for MHD vehicles. This option could also be modified to have varying sales target years for different medium and heavy-duty segments.
- Option D – PG&E does not think modeling 100% light duty ZEV sales in 2040 is necessary given California's more aggressive ambitions and objectives and the current trajectory of the market as a result. It could be useful to understand the impact of having the medium and heavy duty 100% ZEV sales target in 2040.

PG&E supports modeling the 100% ZEV sales by 2030 for transit buses that is proposed in all options. PG&E also recognizes the need for aggressive electrification in the offroad sector, but it is not clear what that means practically for modeling and requests further details from CARB on how this could be included.

E. Residential and Commercial Building Decarbonization

PG&E believes that California needs bold policies and regulatory changes to successfully reach building decarbonization goals. As such, PG&E supports the inclusion of specific target dates as it helps to lay the groundwork for market shifts and gives PG&E the ability to plan ahead more effectively.

For example, having a clear deadline for all electric new construction that is at least a few years in the future gives PG&E the ability to prepare for this in a strategic way. A specific date will also appropriately shift the appliance market since consumers and producers will be aware of the upcoming shift and can plan accordingly.

It may also be useful to include the recently adopted 2022 Energy Code (Title 24, Part 6) in the options considered. It requires many buildings to adopt electric heat pump systems for space conditioning and/or water heating and requires many dual fuel buildings to include "electric ready" features.

Of the options presented by CARB for this sector, option D is the least desirable because it extends the time under which the gas system could be expanded due to new construction. Reducing the cost of the gas system is essential for making the transition to electrification affordable and fair. To reduce the cost of the gas system, retrofit electrification must help to avoid or decrease gas system spend that would otherwise have to take place.

As California moves to a deep decarbonization future, targeted retrofit electrification has the potential to play an important role in making sure that vulnerable customers are not left behind. While the Scoping Plan modeling may not be able to analyze and quantify the barriers to such electrification, we encourage CARB to leverage relevant studies from the California Energy Commission (CEC), such as the AB 3232 building decarbonization report and incorporate these findings into the Scoping Plans' analysis.

F. Industry: Manufacturing, Construction, and Agriculture

Industries that are hard or impossible to electrify should gear towards hydrogen as their fuel source in the long run. This keeps important industry (and related tax dollars and employment) in the state while completely decarbonizing their energy fuel. RNG could be a possible fuel source as well but there is only a limited RNG supply potential and it is unclear how long RNG will continue to be directed to the transportation market due to the value of LCFS and RIN credits, although this will decrease over time.

Given the challenges for such industries to electrify, options B, C, and D as presented by CARB seem the most reasonable to achieve, while minimizing leakage and allowing for progress towards adoption of hydrogen as an industrial gaseous fuel source.

G. Short-Lived Climate Pollutant: Methane

Biogas captured from dairies and landfills can be utilized for many potential end-uses. Using biogas for local electricity generation can be economical, but the electric grid in California is increasingly being dominated by renewable electricity sources such as solar and wind. These generation sources are not only 100% GHG free but also air pollution free, and very cheap (as low as $0.04 to $0.10 per kWh[1]). Also, while biogas is GHG free in carbon accounting terms, burning raw biogas still does generate CO2 emissions, as well as particulate emissions like NOx and SOx.

With California's aggressive renewable energy policies, the use of renewable energy generation will continue to rise. Solar and wind are generally preferred to biogas, geothermal and small hydro to fulfill renewable energy obligations. These resources, while powerful, are also intermittent, offering new challenges to managing the electric grid. With more intermittent renewables in the energy mix, sources of energy that are flexible and storable become more and more valuable. Renewable gas in a natural gas system can be easily stored and can ramp to meet changing demands on the electric grid. By upgrading and injecting the biogas into natural gas pipelines, biogas takes on the most valuable properties of natural gas as a generator of electricity as well as a direct energy carrier in the new, renewable grid.

In addition to the role of biogas, CARB's workshop presentation asked for input on what the long-term operations for dairies in the state would be?

The largest dairies will have enough concentrated cows (and manure) to provide a consistent stream of biomass to a nearby anaerobic digester to create biogas, and if further processed, biomethane, for injection into a nearby natural gas pipeline. During the anaerobic digestion process, another product, called digestate, is produce that can be used as an additive in soil. Converting cow manure and other agricultural wastes to renewable and useful energy source helps to reduce greenhouse gas emissions by capturing methane that would otherwise have been emitted into the atmosphere.

PG&E recognizes that further developments are needed to reduce the environmental impacts from dairies on surrounding communities as well as increase their efficiency. This includes reducing the cost of transporting manure from smaller dairies to a centralized biogas plant (e.g., reduce water content, partial processing onsite to create an

[1] Dudley, D. (2018, January 13). Renewable Energy Will Be Consistently Cheaper Than Fossil Fuels By 2020. Retrieved from Forbes: https://www.forbes.com/sites/dominicdudley/2018/01/13/renewable-energy-cost-effective-fossil-fuels-2020/#425e78374ff2

energy dense material, etc.) or reducing the capital costs and size of such facilities to reduce the need for aggregation. In addition, anaerobic digesters are typically operated by agricultural or dairy farmers where their core business is not fuel production. They are susceptible to preventable mistakes related to bacteria management or digester operations. The State should develop standards that can help guide these operators into more efficient, and environmentally neutral operation.

To reach carbon neutrality by 2035 and by 2045, options B and C to include biomass derived fuels from landfills and dairies – can facilitate the transition. Biomass can be considered a renewable source of energy due to regrowth and carbon capture of plant matter, continuous production of human or animal waste, and the displacement of fossil fuels.

H. Woody Biomass and Solid Biomass Waste

PG&E believes that biomass should play a role in producing energy. Currently, 24 biomass power plants operate in California for a total power of more than 600 MW[2]. These power plants were built in the early 80's through support from Public Utilities Regulatory Policy Act (PURPA) Standard Offer Contracts[3]. They have recently struggled to compete with other renewable electricity sources and to comply with air quality regulations[4]. In 2016, SB 859 rescued these biomass facilities by assigning about $900M provided through grants and contracts[5]. However, these facilities are old and inefficient and need to be replaced. There is an opportunity for new, cleaner technologies to be deployed in the next 5 to 10 years that can utilize this waste stream.

In terms of the volume of available biomass, the CEC updated its biomass potential assessment and estimated an overall technical potential of 35 Million Bone Dry Ton (BDT)/year[6]. This number includes Municipal Waste and manure that can be processed through bio-digestion. If you exclude the Municipal Waste and manure numbers for a conservative estimation, the technical potential for thermal processing becomes 13 Million BDT/year. The Department of Energy estimated in 2015 the potential of biomass in the United States of 3.9 Quad[7] corresponding to about 650 million BDT per year. Its projection was to reach 1 billion BDT by 2030 as illustrated in the table below.

[2] http://biomassmagazine.com/plants/listplants/biomass/US/
[3] https://www.ferc.gov/industries/electric/gen-info/qual-fac/what-is.asp
[4] http://www.latimes.com/business/la-fi-biomass-closing-20160101-story.html
[5] https://www.planetizen.com/node/88408/cap-and-trade-bill-boosts-californias-struggling-biomass-facilities
[6] https://biomass.ucdavis.edu/wp-content/uploads/CA_Biomass_Resource_2013Data_CBC_Task3_DRAFT.pdf
[7] https://www.energy.gov/sites/prod/files/2016/12/f34/2016_billion_ton_report_12.2.16_0.pdf

Table 1: Potential Forest, Agricultural, and Waste Biomass Available at $60 per Dry Ton or Less[7]

Feedstock	2017	2022	2030	2040
	Million dry tons			
Currently used resources				
Forestry resources	154	154	154	154
Agricultural resources	144	144	144	144
Waste resources	68	68	68	68
Total currently used	**365**	**365**	**365**	**365**
Potential: Base-case scenario				
Forestry resources (all timberland)[a, b]	103	109	97	97
Forestry resources (no federal timberland)[a, b]	84	88	77	80
Agricultural residues	104	123	149	176
Energy crops[c]		78	239	411
Waste resources[d]	137	139	140	142
Total base-case scenario potential (all timberland)	**343**	**449**	**625**	**826**
Total base-case scenario (currently used + potential)	***709***	***814***	***991***	***1,192***
Potential: High-yield scenario				
Forestry resources (all timberland)[b, e]	95	99	87	76
Forestry resources (no federal timberland)[b, e]	78	81	71	66
Agricultural residues	105	135	174	200
Energy crops[c,f]		110	380	736
Waste resources[d]	137	139	140	142
Total high-yield scenario potential (all timberland)	**337**	**483**	**782**	**1,154**
Total high-yield scenario (currently used + potential)	***702***	***848***	***1,147***	***1,520***

It is not yet clear what will be the best path for utilizing all of this biomass waste. We need to continue finding novel ways to create value from biomass and this may be dependent on the type of biomass and the geographic location. For example, if the sourced biomass is near a natural gas pipeline, it could be converted and upgraded into renewable natural gas for injection into the gas grid. Options B and C allow for use of biomass-derived fuels and should be included in CARB's scenarios.

I. <u>Petroleum Fuels</u>

PG&E does not have any recommendations on the options for potential timeframes for oil and gas extraction and petroleum refining to ramp down in California. However, PG&E does recommend including the ability to produce renewable fuels from waste biomass in-state at converted refineries. As noted above, there is a large volume of biomass potential and we can use the opportunity to retrofit refining facilities to produce renewable fuels from waste biomass feedstock instead of petroleum.

PG&E appreciates the opportunity to provide these comments on the questions and options presented in the August workshop. We look forward to forthcoming workshops to further define the scenarios and reiterate the need for additional workshops to share the initial results from modeling prior to additional refinements.

Please feel free to contact me if you have any questions or concerns.

Sincerely,

/s/

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