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To Mr. Ingram,

Pacific Gas and Electric Company (PG&E) appreciates the opportunity to provide feedback on the Air Resources Board's (ARB) Revised Proposed Short-Lived Climate Pollutant Reduction Strategy (Revised Strategy).

I. INTRODUCTION

These comments supplement and reiterate input PG&E provided on the Short-Lived Climate Pollutant (SLCP) Concept Paper,¹ Draft SLCP Strategy,² and the Proposed SLCP Strategy.³ As stated previously, PG&E strongly supports California's clean energy goals, including the methane emission targets enshrined into law with the passage of Senate Bill (SB) 1383 (Lara, Chapter 395, Statutes of 2016). PG&E has made significant contributions to the state's progress in reducing GHG emissions, including procuring renewable generation, investing in both electric and natural gas energy efficiency, and reducing methane emissions through improvements to PG&E's gas pipeline infrastructure. PG&E remains committed to the development of bioenergy, and as of January 2017, PG&E's bioenergy portfolio (from biomass, digester gas, landfill gas, and municipal solid waste) consists of 30 contracts representing ~500MW of bioenergy capacity.

¹ Matthew Plummer. June 2015. Pacific Gas and Electric Company's Comments on the Air Resources Board Short-Lived Climate Pollutant Reduction Strategy (Pacific Gas and Electric Company). Website: <http://www.arb.ca.gov/lists/com-attach/57-slcprstrategy-ws-VCQFZARgAw9SNwRr.pdf>

² Matthew Plummer. October 2015. Pacific Gas and Electric Company Comments on the Draft Air Resources Board Short-lived Climate Pollutant Reduction Strategy (Pacific Gas and Electric Company). Website: <http://www.arb.ca.gov/lists/com-attach/130-slcpdraftstrategy-ws-B3dcPQNnWVVQNVU6.pdf>

³ Nathan Bengtsson. May 2016. Pacific Gas and Electric Company Comments on the Air Resources Board Proposed Short-lived Climate Pollutant Reduction Strategy (Pacific Gas and Electric Company). Website: <https://www.arb.ca.gov/lists/com-attach/23-slcpr2016-AHBQMVUxWFQLbgNs.pdf>

PG&E still believes that the best path to achieving the state’s long-range environmental goals—including SLCP-focused reductions—is through an integrated and flexible policy framework that optimizes sustainable and cost-effective GHG reductions across all programs and sectors.

PG&E provides the following comments in response to the Revised Strategy and looks forward to working with ARB to develop the final SLCP Strategy.

II. SECTOR-SPECIFIC TARGETS

The Revised Strategy incorporates the broad pollutant targets set forth in SB 1383 for statewide reductions of 40 percent below 2013 levels by 2030 for methane and hydrofluorocarbon gases (HFCs) and 50 percent below 2013 levels by 2030 for anthropogenic black carbon. Within the statewide 40 percent methane reduction target, the Revised Strategy includes a sector-specific target for the oil and gas industry of 40 percent reductions below current levels by 2025 and 45 percent reductions by 2030, matching federal goals for the entire nation.⁴ While the overall pollutant targets are written into law, sector-specific targets within California are not mandated. PG&E recognizes the critical importance of reducing SLCPs, but as PG&E has previously stated, these targets must be technically feasible, transparent, based on sound analytics, and backed by measures that are cost-effective to adopt. These points are expanded on below.

ARB should work with stakeholders from the gas industry to develop an achievable methane emissions reduction target for gas systems

ARB should work with stakeholders from the gas industry to develop an achievable methane target for gas systems. ARB’s proposed methane emissions reduction target for the oil and gas sector is based on US EPA Oil and Natural Gas Sector proposed emissions standards, which may not be appropriate for California given that federal rules would not cover the same sources as California’s initiatives.⁵

Furthermore, reductions are expected to be delivered by programs still under development in California. For one, ARB expects methane reductions in the oil and gas sector from the Leak Abatement Order Instituting Rulemaking (OIR) at the CPUC. However, it has not been determined what amount of reductions will be achieved from the best practices adopted by the rulemaking. While PG&E is committed to using best practices to drive reductions, reviewing annual leak reports to target additional cost-effective actions, and to continuing research and development to identify and mitigate super methane emitters, the SLCP Strategy must recognize that deviations in the efficacy of the applicable program measures will affect the achievability of the sector-wide goal.

Similarly, the ARB’s Oil and Gas Rule proposes methane reduction estimates for the oil and gas sector, but considerable uncertainty remains regarding whether these reductions will be

⁴ Air Resources Board. November 2016. Revised Proposed Short-Lived Climate Pollutant Strategy, p. 78

⁵ See Matthew Plummer. October 2015. Pacific Gas and Electric Company Comments on the Draft Air Resources Board Short-lived Climate Pollutant Reduction Strategy (Pacific Gas and Electric Company). Website: <http://www.arb.ca.gov/lists/com-attach/130-slcpdraftstrategy-ws-B3dcPQNnWVVQNVU6.pdf>

achievable. The Revised Strategy also refers to the Division of Oil, Gas and Geothermal Resources' (DOGGR) pending underground storage regulations as part of the framework; however, the purpose of these regulations is to minimize the potential for future large leaks, not necessarily to reduce current levels of emissions. DOGGR has not included any emissions reduction estimates as part of its pending rulemaking.

While PG&E supports the goals of all the measures cited by the Revised Strategy and has been an active participant in developing said measures, PG&E reiterates the need for more analysis to establish a meaningful gas sector target. ARB should include an examination of emission reductions from each of the regulations referenced in the Revised Strategy's framework as well as their cost-effectiveness and technical potential *before* sector-specific emission targets are set.

Identifying alternative programs and measures that could support methane reductions is essential to reach targets

As mentioned above, the Revised Strategy does not quantify emission reductions expected from each of the measures identified. The Revised Strategy should provide a comprehensive discussion of how the referenced measures will collectively contribute to methane reduction targets and determine potential shortfalls. Identifying alternative measures to achieve methane reductions both within and external to the natural gas sector (such as from oil production or livestock operations) will ensure that the overall methane reduction goal can be met at an optimal cost should the measures identified by the programs under development for the gas sector not deliver expected reductions.

III. BIOENERGY

PG&E was the first utility in California and third in the nation to accept renewable biomethane into its pipeline system. PG&E remains committed to working with bioenergy developers and views renewable natural gas (RNG) as one of the pathways for California to achieve its climate goals. PG&E provided comments^{1,2} regarding the discussion of bioenergy in the previous versions of the Proposed SLCP Strategy and reiterates some key points below.

Challenges remain for further development of RNG

While the passage of SB 1383 and AB 2313 (Williams, Chapter 571, Statutes of 2016) demonstrate the state's commitment to developing policies to encourage infrastructure development and procurement of biomethane, many barriers remain. In order to significantly increase the sustainable production and use of renewable gas, several issues must still be addressed:

- **High fixed costs of RNG:** State funding and incentives will be critical to help support initial infrastructure investments. It is therefore important to understand the magnitude of costs that need to be defrayed in order for this funding and incentives to be effective. A real-world example comes from a recently announced biogas plant that will capture methane from swine waste via anaerobic digestion. The project has a

capital cost of \$100 million for 2.5 million MMBtu per year. Realizing the benefits of RNG requires addressing these high upfront costs.

- Interconnection costs: The Revised Strategy correctly notes that interconnection costs remain a barrier to entry and can be a lengthy and costly process. PG&E is working to improve its biomethane interconnection process to help address this hurdle. However it should be noted that project location, gas quality and ongoing pipeline activities are key variables impacting the time and expense necessary to ensure project safety and compliance. It is therefore critical for ARB to consider these variables in the economic analysis.
- **Gas Quality:** The quality of biomethane to be injected into common carrier pipelines is of continued importance and needs to align with the existing standards established by ARB, the Office of Environmental Health Hazard Assessment and the CPUC. From an operational perspective, a natural gas distribution company cannot guarantee that blending will occur inside the pipeline due to seasonal demand changes and the dynamics of customer hookups and disconnects. Maintaining quality before gas is injected into the pipeline will enable the utility to manage its risk to customers, employees, and the general public, especially if the customer is being served by a one-way feed or static line. PG&E supports standards for minimizing the risk of health, safety, and reliability issues and highlights the reasons biomethane projects must meet these standards below:
 - Health: Maintaining consistent gas quality ensures proper use of end-use equipment and manages risk associated with constituents-of-concern being introduced to breathable air.
 - Safety: Excess siloxanes can cause malfunctions in equipment, and incomplete combustion or flame-lifting in end-use appliances.⁶
 - Reliability: Siloxanes can cause malfunctions in equipment. Additionally, reducing heating value causes reliability concerns for end-users.⁷
- **Distributed nature of RNG:** Figure 11 in the Revised Strategy confirms how dispersed dairies are in California.⁸ Similar geographic dispersion is the case for all RNG feedstocks. Traditional transportation of feedstock ultimately adds more lifecycle emissions to RNG and is counter to the state’s climate goals. Therefore, efforts need to be focused on how to cost-effectively develop RNG to scale to reduce per-unit costs and reduce lifecycle emissions of RNG. In this vein, PG&E is in favor of using Compressed

⁶ Nitin Nair. “Impact of Siloxane Impurities on the Performance of an Engine Operating on Renewable Natural Gas”. American Chemical Society Publications. 2012. Website: <http://pubs.acs.org/doi/abs/10.1021/ie302751n>

⁷ Nitin Nair. “Effect of Siloxanes Contained in Natural Gas on the Operation of a Residential Furnace.” American Chemical Society Publications. 2012. Website: <http://pubs.acs.org/doi/abs/10.1021/ie400449y>

⁸ Air Resources Board. November 2016. Revised Proposed Short-Lived Climate Pollutant Strategy, Figure 11, p. 107

Natural Gas (CNG) trucks to transport feedstock such as manure to centralized digesters, which would reduce lifecycle emissions and increase demand for lower-carbon transportation fuel. These trucks could eventually run on RNG, further lowering emissions and increasing demand.⁹

- **RNG development efforts should be technology agnostic:** Given the high cost of RNG as noted above, incentives and Low Carbon Fuel Standard (LCFS) pathways should remain technology agnostic as much as possible. It would be disadvantageous to presuppose the development of a singular, new, and cost-effective process. PG&E supports fostering a competitive environment that enables the development of multiple technologies capable of providing renewable gas at the lowest cost. Technology, fuel or geography-specific mandates create additional costs and administrative burden to customers.
 - To avoid inadvertently excluding new technologies (such as syngas and power-to-gas), the definition of “biomethane” across all state programs, statutes and regulations should be reconciled and standardized to the broadest definition. Bioenergy, biogas and biomethane are slightly different terms and their use in different policies could be conflicting and unintentionally prohibiting.

In conclusion, successful biomethane injection still faces a number of fundamental engineering and planning challenges, which will require the partnership of utilities, project developers and the state to overcome.

Opportunities for RNG revenue streams

1. Transportation

PG&E supports the use of transportation-related crediting mechanisms to help the economics of RNG projects. As part of SB 1383, ARB was directed to develop an LCFS pilot financial mechanism for dairy-related projects. PG&E supports ARB’s methodology but notes some areas for improvement below:

- Sustainable Carbon Intensity (CI) targets will need to be created for dairy-related bioenergy projects. Current dairy biogas CI targets are extremely negative compared to other renewable energy feedstocks, such as wastewater treatment plants. PG&E observes that these CIs, which are based on one or two specific dairy digester projects, might level out in the long term as more dairies are interconnected with different supply chains, locations, feedstock mix, etc. It may be more prudent to complete a sensitivity analysis using a variety of CIs.

⁹ Economic Feasibility of Dairy Digester Clusters in California: A Case Study. June 2013. Website: <http://nebula.wsimg.com/ba2e94d765674b8b93db6eb820f06977?AccessKeyId=EF637043B65EBCDC33C0&disposition=0&alloworigin=1>

- ARB's analysis of Net Present Value (NPV) of centralized and decentralized dairy digesters is dependent on the LCFS market and RIN credit market from the federal Renewable Fuel Standard (RFS). Since the RFS is a federal program, it faces uncertainty under the new administration, which adds volatility to the RIN credit market. PG&E recommends that a risk-adjusted approach be utilized in calculating potential revenues to account for this volatility.

The Revised Strategy also discusses woody biomass and the roles it can play in producing clean fuels for transportation.¹⁰ However there is currently no LCFS value for woody biomass to bio-CNG. Developing a pathway in the Greenhouse Gasses, Regulated Emissions and Energy in Transportation (GREET) model for LCFS credits for biomethane produced from woody biomass would be a large incentive for developers to invest in technology to turn woody biomass into transportation fuels. PG&E is supportive of exploring opportunities for gasification of woody biomass into RNG for transportation and other uses.

2. Other potential revenue streams

In addition to revenue opportunities through biogas for transportation purposes, more diverse revenue streams will add more stability to dairy and waste biogas projects, providing for more potential investors. The Revised Strategy identifies soil amendments as beneficial products that could lead to additional revenue sources. PG&E supports ARB and other state agencies' efforts to further the development of soil amendment markets and other potential revenue streams.

Establish broad-based stakeholder working groups

SB 1383 requires ARB to work with stakeholders to identify and address technical, market, regulatory and other challenges and barriers to the development of dairy methane emissions reduction projects. PG&E is interested in partnering with the state and other stakeholders to address barriers to dairy bioenergy projects, as well as other various feedstock-to-bioenergy projects. In addition, PG&E already proactively engages with many bioenergy stakeholders through the Biomass Working Group. To the extent there are common barriers and issues across industries, PG&E supports leveraging existing forums and any lessons learned.

IV. ECONOMIC ASSESSMENT

PG&E appreciates ARB's work on the economic assessment of the new measures identified in the Revised Strategy. PG&E would like to offer the following comments and potential areas for improvement on the Dairy Pathways Analysis included in Appendix F of the Revised Strategy.

¹⁰ Air Resources Board. November 2016. Revised Proposed Short-Lived Climate Pollutant Strategy, p. 51-55

- Pipeline interconnection costs: The pipeline interconnection costs cited by ARB are too low. PG&E recommends that ARB consult with California utilities to incorporate up-to-date and accurate interconnection assumptions for its analysis. As noted earlier, interconnection costs will likely vary widely by facility location, depending on proximity to pipelines with adequate capacity to accept additional gas and technical ratings.
- Pipeline costs: The pipeline costs cited in ARB’s scenarios are too low. This figure is important as it would significantly impact cost estimates for Pathway 2, which includes 55 miles of additional transmission pipeline and 200 miles of additional distribution pipeline.
- Conditioning and upgrading costs: The biomethane conditioning and upgrading costs cited in ARB’s scenarios may be too low. Internal estimates of large-scale biogas facilities show higher conditioning and upgrading costs than cited.
- Electricity generation assumptions: ARB’s analysis assumes 100 percent methane usage for electricity generation per cow, which is overly optimistic. 60-75 percent¹¹ methane usage would be a more conservative and realistic assumption.

As noted in the Revised Strategy, there is a wide range of potential costs and savings, uncertainty in how the measures will be met, and uncertainty for how costs in bioenergy literature translate in the California context. In conjunction with state agencies, ARB has stated it will continue to work closely with stakeholders and manufacturers to evaluate the feasibility and costs of existing and developing technologies to determine the best approaches to meeting the SLCP reduction targets.¹² The economic assessment work done by ARB will be used as the foundation for new regulations and measures by ARB and other state agencies in the forthcoming years. Therefore, PG&E urges ARB to continue to refine and update its economic analyses.

V. CONCLUSION

Thank you for the opportunity to provide feedback on ARB’s Revised SLCP Strategy. PG&E looks forward to participating in ongoing discussions with ARB. Please feel free to contact me if you have any questions or concerns.

Sincerely,

/s/

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¹¹ Ken Krich. “Biomethane from Dairy Waste: A Sourcebook for the Production and Use of Renewable Natural Gas in California”. Sustainable Conservation. July 2005. Website: http://suscon.org/pdfs/cowpower/biomethaneSourcebook/Full_Report.pdf

¹² Air Resources Board. November 2016. Revised Proposed Short-Lived Climate Pollutant Strategy, p. 107

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