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Re: Joint Agency Target 2030 Scoping Plan Workshop

I. Introduction

Pacific Gas and Electric Company (PG&E) appreciates the opportunity to provide comments on the recent "2030 Target Scoping Plan" workshop. PG&E strongly supports California's clean energy goals, including the Governor's recent Executive Order proposing a 2030 greenhouse gas (GHG) reduction goal of 40% below 1990 levels. We look forward to working with the California Air Resources Board (ARB), the Legislature, and concerned stakeholders next year to craft legislation to codify the Governor's 2030 GHG reduction goal. Earlier this year, PG&E also supported Senate Bill 350, which serves as a roadmap for implementing the clean energy policies that the Governor announced in his inaugural address.

Our customers have invested and will continue to invest in the state's clean energy future. PG&E has made significant contributions to the state's progress in reducing GHG emissions through procuring renewable generation, funding energy efficiency incentives, supporting distributed energy resources, investing in key infrastructure projects and leak reduction technologies, and promoting the large-scale deployment of electric vehicle charging and natural gas fueling infrastructure. As a result of these endeavors, PG&E's current electric portfolio is more than 50% carbon free and our electricity emissions rate is approximately one-third the national average.

Moving forward, we believe the best path to achieving the state's long-range environmental goals is through policies that optimize sustainable and cost-effective GHG emissions reductions. By achieving these goals in a way that manages costs for Californians, we can ensure that our state continues to make substantive progress and creates model programs others will want to follow.

PG&E believes that California's utilities are uniquely positioned to help the state meet its long-term GHG reduction goals. Through promoting incremental renewable investment, energy efficiency, demand response, energy storage, and the large-scale deployment of electric vehicle charging stations and natural gas fueling infrastructure, the utilities play a critical role in decarbonizing the electric, natural gas, and transportation sectors. However, every sector of the economy must contribute to California's pursuit of aggressive GHG reduction goals. GHG reduction policies must take a multi-sector approach, recognize cross-sector emission shifts, and allocate costs equitably among all market participants.

With this in mind, PG&E provides comments on the following topics in response to the October 1 joint agency workshop:

- Economic Analysis
- Electrification
- Role of Natural Gas

II. Economic Analysis

Cost Effectiveness

PG&E is concerned that the workshop presentation did not list maximizing overall cost-effectiveness of California's GHG programs as an objective of Assembly Bill (AB) 32 (see slide 7).[1] AB 32 directs ARB to achieve the "maximum technologically feasible and cost-effective reductions in greenhouse gas emissions" eight separate times within the 17-page bill. Furthermore, AB 32 directs ARB to consider cost-effectiveness when designing and implementing GHG reduction programs. It is PG&E's top priority, on behalf of our nearly 16 million customers, to ensure energy affordability remains a primary objective of all AB 32 measures. We strongly support California's commitment to GHG reductions and believe these goals can be achieved without imposing unnecessary costs on Californians.

Advisory Group

PG&E strongly supports the agencies' commitment to ensuring California's GHG reduction programs are informed by robust analytics. PG&E also supports ARB's proposal to convene a third-party Economic and Technology Advancement Advisory Committee to advise during the assessment of economic impacts associated with AB 32 programs.

Modeling Efforts

While PG&E encourages the use of models to evaluate the cost-effectiveness of carbon regulations and policies, we understand that changes in model design, assumptions, and inputs can have a significant impact on the results. For these reasons, PG&E is concerned about the agencies' sole reliance on E3's PATHWAYS Model. This stock rollover model produces results based on user-defined inputs regarding technology deployment, rather than allowing the model to select technology pathways needed to meet specific GHG reduction constraints. This modeling methodology provides some insight into possible technological pathways that could potentially lead to the deep GHG reductions. However, the model is unable to provide the least-

[1] http://www.arb.ca.gov/cc/scopingplan/meetings/10_1_15slides/2015slides.pdf

cost, most-optimal pathway towards our GHG reduction goals. In addition, the PATHWAYS results do not currently indicate which policies would best achieve the desired levels of technology penetration. For example, multiple regulatory structures and programs can result in the same technology mix, but would likely impose very different costs on Californians.

Therefore, PG&E recommends the agencies employ multiple models when evaluating potential paths to 2030 and beyond. PG&E also recommends that ARB run sensitivities on a range of assumptions and inputs to best understand the interrelationships between individual programs and design elements within each program. While any number of program combinations can lead to achieving California's ambitious GHG reduction goals, the economic analysis must be able to point to the most cost-effective path forward.

PG&E is also concerned that the agencies made no mention in their workshop about modeling expected cap-and-trade market prices. The price per tonne of emissions abatement through direct measures relative to the expected cap-and-trade market price is a key indicator of cost-effectiveness. Transparency in the expected differential between the cost of a potential direct measure and the market price is needed for policy makers to make rational decisions about the tradeoffs between direct measures and market-based mechanisms.

PG&E would also encourage the agencies to conduct future modeling activities in a transparent manner and allow stakeholders the opportunity to comment on input assumptions in advance of conducting model runs, rather than simply presenting completed results in a workshop or other forum. While this approach may prove more time consuming, it will be an essential part of designing effective GHG reduction policies that may be in place for the next 15 years.

Use of Market-based Mechanisms

PG&E would like to see the 2030 Target Scoping Plan rely more on the successful carbon market ARB carefully created and less on direct measures. Direct emission-abatement measures within a system that has an upper limit (cap) on emissions will not necessarily change the total amount of emissions from within that system. Within a capped system, direct measures change only how the emission reductions are achieved, who pays for those reductions, and at what cost. Through the Scoping Plan, the agencies should clearly articulate the purpose and potential impacts (e.g., GHG reductions, cost, etc.) of each direct measure as well as the objective that, when achieved, will indicate that the measure is no longer warranted given the market signal provided by the cap-and-trade market.

There is broad consensus among environmental economists that market-based mechanisms that put a price on GHG emissions provide the most cost-effective path to lowering those emissions. Market-based mechanisms are ideally suited to respond automatically to unexpected changes in the market (including technology development and costs) to provide rational incentives for

compliance entities to invest in least-cost abatement opportunities in real-time. PG&E strongly believes that maintaining a diverse portfolio of technologies is essential for California to achieve its clean energy goals in a way that is most cost effective for our customers. Technology and size-specific mandated procurement programs limit PG&E's ability to provide a diverse, competitively-priced portfolio.

PG&E views the successful linkage with Québec and pending linkage with Ontario as critical first steps towards a global solution, as well as the state's engagement with others in the WECC as part of Clean Power Plan (CPP) implementation dialogues. An effective post-2020 GHG policy will help California continue to forge partnerships with other states and jurisdictions. A larger and more diverse cap-and-trade market could enhance the prospects for efficient market outcomes, eventually leading to lower-cost emissions reduction opportunities, and reduce the risk of emissions "leakage." Moving forward, it is important to recognize that California's major economic sectors operate in markets that extend well beyond our borders. Whether and how surrounding states and regions move forward could impact California's ability to meet its long-term goals in an affordable manner.

There is also a growing consensus that high quality carbon offsets can provide the most cost-effective emissions abatement within a market system. Therefore, PG&E restates its support for the inclusion of offsets in the cap-and-trade market and encourages they be included in the Scoping Plan's economic analysis. PG&E also encourages the ARB to remain vigilant in providing adequate offsets to the market while preserving the flexibility required for the market to make use of the full complement of offsets allowed.

PG&E also supports the continued use of allowance allocations for the benefit of customers of local distribution companies to ensure that the costs of transitioning to a lower-GHG-intensive economy are shared equitably between geographic regions, socio-economic classes, and economic sectors.

PG&E looks forward to continuing its engagement with ARB to identify models, evaluate the possible pathways, and create solutions that will lead to deep reductions in California's GHG emissions in a manner the way that is most beneficial for all Californians. A greater focus on the cost-effectiveness of AB 32 will not only benefit the state, but it will also provide a pathway to accomplishing the most ambitious goal of AB 32, which is to "facilitate the development of integrated and cost-effective regional, national, and international greenhouse gas reduction programs."

III. Electrification

Customer Electric Vehicle Adoption

PG&E shares the administration's vision for widespread deployment of electric vehicles (EVs). PG&E is committed to working with the agencies to accelerate EV infrastructure deployment and customer education programs in support of the Governor's zero emission vehicle (ZEV) goals. This includes deployment of sufficient EV infrastructure by the year 2020 to support one million EVs, and deployment of over 1.5 million EVs on California roads by 2025.

Achieving California's 2020 and 2025 goals for EV infrastructure and EV adoption will be challenging. Many of the early EV service equipment suppliers have gone bankrupt[2] and it appears unlikely that market participants will be able to deploy EV infrastructure at the scale and pace necessary to meet the state's goals. Although California leads the nation in the number of EVs, with approximately 120,000 on the road as of January 1, 2015, that number is less than one-tenth of the Governor's 2025 goal.[3] Likewise, California currently has only about 6,200 EV charging stations at public facilities, workplaces, and multi-unit dwellings (MUD), far less than the number needed to support the Governor's goals.[4] Under these circumstances, California's bold EV and climate goals can only be achieved with dramatic acceleration of EV deployment that relies upon collaboration among all stakeholders, utilities and non-utilities alike.

PG&E supports the agencies' mention of the utilities' EV infrastructure investment plans on slide 65 as part of the strategies to achieve California's "2020 goals." We would note that these investments should be part of the state's "vision for 2030 and 2050" as well (slide 71). While new vehicle technologies are quickly becoming competitive with traditional internal combustion engine vehicles, the build-out of non-residential charging infrastructure has not kept pace with the targets set by the Governor's 2013 ZEV action plan. PG&E and other California utilities' proposals will make meaningful contributions toward achieving the state's goal to have sufficient infrastructure in place by 2020 to support one million ZEVs.

Investments in fueling infrastructure for EVs and other alternatives go hand-in-hand with state incentives aimed at increasing adoption of clean vehicle technologies. Further, as the state plans its vision for 2030 and 2050, close coordination with utilities will be critical for the integration of alternative fueling infrastructure.

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[2] See, e.g., http://www.businessinsider.com/better-place-to-file-for-bankruptcy-2013-5; http://www.huffingtonpost.com/2013/10/13/electric-car-charger_n_4086326.html.
[3] http://www.pevcollaborative.org/sites/all/themes/pev/files/CPEV_annual_report_web.pdf
[4] 6,200 Charging stations in California is based on PG&E proprietary data provided by PlugShare. Data available upon request.

Employee EV Adoption

In addition to our filings at the California Public Utilities Commission (CPUC), PG&E has taken steps to further promote the adoption of EVs within our workforce. Our successful employee EV incentive program offers a $2,000 rebate, funded by shareholder dollars, to employees who purchase a qualified electric vehicle. Since PG&E began this program in late 2014, over 700 employees have purchased a new electric vehicle with PG&E's assistance, totaling $1.2 million in shareholder-funded rebates. PG&E has also worked with vehicle suppliers and dealerships to offer additional discounts and financing options for employees purchasing EVs, and will continue to seek new opportunities for discounts to promote EV ownership among employees.

As a member of DOE's "Workplace Charging Challenge" and California's "Drive the Dream 2015 EV fleet coalition," PG&E has 511 workplace chargers in place as of August 2015 and 1,000 additional sites planned through 2019.

Fleet EV Adoption

PG&E's commitment to electrification of transportation also extends to our own fleet of work trucks where we work tirelessly with industry partners to bring electric drive technology closer to the levels of commercial readiness needed for widespread adoption. To date, over 340 "trouble trucks" with electric jobsite power have been deployed within our fleet. These trucks use battery power at the jobsite to power hydraulics (booms and digger derricks), lighting, tool circuits and cabin conditioning. PG&E currently operates approximately 1,400 plug-in electric and electric hybrid vehicles, one of the largest fleets of plug-ins in the nation. We currently dedicate about 15 percent of our fleet budget to plug-in electric technology, many times the five-year industry average of 1.7 percent.

On October 15, 2015, PG&E announced plans to invest one-third of its annual fleet purchases in EVs and plug-in hybrid vehicles (PHEVs) over the next five years, totaling more than $100 million. The $100 million commitment will add more than 750 plug-in electric units to PG&E's fleet. Through his leadership on the executive committee of the Edison Electric Institute, our CEO, Tony Earley, has secured commitments from other utilities across the country to dedicate 5% of their vehicle procurement budgets to electric-drive technologies.

PG&E's next electric drive innovation is range extended, electric drive, class 5&6 work trucks, with power export capabilities for grid support during planned and unplanned system outages. This technology was recently put to the test in response to California's catastrophic fire season, delivering around-the-clock support and uninterrupted power supply to evacuation camps, powering lighting and emergency kitchen infrastructure as well as charging evacuee cell phones, laptops, and other critical equipment. PG&E currently has 11 prototypes in operation or under development to further enhance prototypes through component rightsizing (engine downsizing),

reduction of parasitic loads (solid state HVAC), light weighting, battery performance improvements, etc.

Electrification of Natural Gas End Uses

Slide 26 of the workshop presentation mentions the agencies' interest in "electrifying end uses that are primarily natural gas today (water heating, space heating)." Before developing programs aimed at promoting fuel switching, PG&E recommends that the state conduct research to better understand the life-cycle GHG reductions, cost effectiveness, and other benefits of fuel switching. In addition, we suggest that the state should explore scenarios in which the natural gas system is significantly decarbonized as an alternative to the electrification of natural gas end uses.

If detailed analysis and consideration of economy-wide low carbon pathways demonstrates that end use electrification is an appropriate tool, utility energy efficiency programs can offer a valuable framework for moving the market due to partnership, marketing, technical capabilities, etc. However, this would require changes to energy efficiency cost-effectiveness policy rules as well as changes to codes and standards. PG&E notes that the current application of the CPUC's three-pronged energy efficiency test may limit customers' ability to switch fuels. Specifically, current CPUC policy requires that all fuel switching projects/measures/programs complete and satisfy the following requirements (simplified here):

1. Must not increase source BTU consumption.
2. Must be cost effective (by demonstrating a Total Resource Cost and Program Administrator Cost each greater than 1.0).
3. Must not adversely affect the environment.

While this test may prove necessary in some situations, it can also result in PG&E denying an incentive to a customer interested in switching fuels. This issue also impacts new construction programs because PG&E is required to perform this test when the baseline equipment is of a different fuel source. Again, this can result in failure to provide an incentive for more efficient equipment.

IV. Role of Natural Gas

Transportation Opportunities

Natural gas is a strong candidate for reducing emissions in the transportation sector because it is a readily available, affordable alternative fuel that can be used in transportation applications that are otherwise difficult to electrify, including heavy duty and marine. According to the Low

Carbon Fuel Standard's (LCFS) calculation of carbon intensities, compressed natural gas has carbon intensity over 20% lower than diesel (~78 gCO_2e/MJ vs ~100 gCO_2e/MJ).[5] Displacing diesel and bunker fuel not only results in GHG reductions, but it can also provide other significant co-benefits. Certification data indicate that CNG and LNG used in natural gas engines typically reduce NOx levels by about 14-50%,[6] depending on the application. Recent research from the University of Riverside's Center for Environmental Research and Technology (UCR-CERT)[7] indicates that the emissions from a natural gas engine in a drayage application could yield up to a 70% NOx reduction. Additionally, the use of these fuels eliminates diesel particulate matter (DPM), which is of increasing concern to air pollution control districts and is considered a carcinogen by ARB.

Fuel[1]	Engine	GHGs gCO2e/MJ		Criteria Pollutants
		lifecycle	tailpipe	NOx
ULSD	--	98	74	--
CNG	New	78	56	-14-70%
LNG	New	94	56	-14-70%
1. All vehicles assumed to be trucks. The ranges represent data reported for various duty cycles and vehicle types, but all are based on heavy-duty vehicles.				

Currently, PG&E operates 32 natural gas fueling stations that average over 230,000 public fueling transactions a year. An additional fueling station in Manteca is slated to open in 2017. This fueling infrastructure also serves as a strategic asset for natural gas pipeline backup and augmentation for enhanced system reliability. Looking ahead, PG&E is evaluating how to best support the emerging renewable and liquid natural gas supply streams, and looking further out, hydrogen production that uses natural gas as a feedstock.

Renewable Natural Gas

Slide 69 from the workshop presentation suggests the state's interest in exploring opportunities for expanding the use of renewable natural gas (RNG). PG&E would support efforts to study how RNG can be produced and delivered safely and cost effectively to customers. We are very interested in partnering with the state and other stakeholders on pilot programs and strategies to bring down the costs of this fuel stock. Given the broader societal benefits of RNG, PG&E

[5] Page 66 of http://www.arb.ca.gov/regact/2015/lcfs2015/finalregorderlcfs.pdf
[6] Based on evaluation of certification data provided to EPA and CARB.
[7] Based on information presented at a California Natural Gas Vehicle Partnership meeting in September 2013, slide deck available upon request. The project funded by SCAQMD is entitled *In-Use Emissions Testing of Modern On-Road Heavy-Duty Vehicles* and was performed by UC Riverside's Center for Environmental Research and Technology.

believes that the associated development costs should be funded through dedicated RD&D programs. We would encourage the state to avoid any mandates that only apply to a subset of core gas customers. Instead, PG&E supports state funding for RNG projects through the Greenhouse Gas Reduction Fund (GGRF) or other sources. This could lower the costs of RNG and make it more competitive with current natural gas commodity costs, potentially leading to market development and adoption across the state.

During the course of the October 1 workshop, the agencies discussed two different types of RNG: 1) biomass and 2) power-to-gas (P2G).

While production of RNG presents a potential pathway for utilizing the available biomass feedstock, challenges remain:

- Availability of feedstock and transport to processing sites
- Capital cost and financing
- Technology issues
- Operational issues
- Gas purity concerns
- Lower heating values
- High cost of final product

Due to the constraints and issues detailed above, the cost of producing RNG from biomass is significantly higher than natural gas. For example, landfill gas for pipeline injection is estimated to have a price range of $10-13/MMBTU[8], while biogas from dairy digesters or syngas from gasification can be significantly more expensive, rising as high as $25/MMBTU[9]. In contrast, natural gas prices at PG&E Citygate, which serves Northern California, are approximate $3/MMBTU.[10]

P2G includes production of hydrogen from renewable electricity, and then either conversion to methane or direct utilization of the hydrogen as a fuel source. This is a new technology that still has significant challenges associated with it, as detailed below:

- Cost of electricity
- Capital cost and financing
- Technology issues
- Operational issues

[8] SoCalGas website: https://www.socalgas.com/innovation/power-generation/green-technologies/biogas/
[9] "Economic Feasibility of Dairy Digester Clusters in California: A Case Study", California Dairy Campaign, June 2013 and "Decarbonizing Pipeline Gas to Help Meet California's 2050 Greenhouse Gas Reduction Goal", E3, January 2015
[10] Natural Gas Weekly Update, http://www.eia.gov/naturalgas/weekly/archive/2015/10_08/index.cfm

- High cost of final product

While this technology is still being tested, especially in the area of pipeline injection, a recent study by E3 for SoCalGas approximated a cost range of $25-140/MMBTU[9]. The broad price range is another indication of the challenges associated with this potential pathway for renewable gas.

RNG certainly has the potential to serve as a pathway for California to achieve its climate goals. However, a number of issues related to cost effectiveness, technology, operation, and financing still need to be addressed on a significant scale. While PG&E ardently supports California's push towards a low carbon future, it firmly believes that the costs of such broad societal benefits should be borne by a society as whole and not just a subset of utility customers.

V. Conclusion

Climate change is a global problem that needs a global solution. California can and should provide leadership to create GHG reductions programs for the rest of the world to replicate. The development of a thorough and thoughtful 2030 Target Scoping Plan is crucial to putting our state on a path to meet the Governor's call for reducing GHG emissions in California to 40 percent below 1990 levels by 2030. Thank you for considering PG&E's feedback on the Target 2030 Scoping Plan Workshop.

Sincerely,

/s/

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