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SoCalGas Comments on Building Decarbonization Workshop

Additional submitted attachment is included below.

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California Energy Commission
Dockets Office, MS-4
1516 Ninth Street
Sacramento, CA 95814-5512

Subject: Comments on the 2019 Joint Agency Workshop on Building Decarbonization, Docket # 19-IEPR-06

Southern California Gas Company (SoCalGas) appreciates the opportunity to comment on the California Energy Commission (CEC) and California Public Utilities Commission (CPUC) joint agency Building Decarbonization Workshop held on April 8, 2019 (Workshop), conducted as part of the CEC's 2019 Integrated Energy Policy Report (IEPR) and the CPUC's Building Decarbonization Order Instituting Rulemaking (OIR) (R. 19-01-011) proceedings.

We thank both the CEC and the CPUC for the opportunity to participate in the Workshop as a panelist to discuss "The Big Picture" of building decarbonization. Notably, SoCalGas effectively discussed the big picture as it pertains to opportunities for balanced energy solutions that include all resources available, including Renewable Natural Gas (RNG) and hydrogen, rather than eliminating one energy delivery system for over-reliance on another. The focus should be on decarbonizing both gas and electric supplies, not just the electric supply. SoCalGas also discussed the California Air Resources Board's (CARB) scoping plan as it pertains to reducing Short Lived Climate Pollutants (SLCPs), noting that methane capture is a key strategy in achieving GHG reductions from the agricultural and waste sectors in order to achieve our ambitious climate change goals. SoCalGas further noted that current law (Senate Bill (SB) 1383) requires a 40% reduction in methane from all waste sources.[1] Capturing the methane and delivering RNG to the pipeline is the most viable solution to help achieve SB 1383 requirements. SoCalGas also reiterated the Company's goal to become the cleanest natural gas utility in North America, delivering 5% RNG on our system by 2022 and 20% RNG by 2030. We believe a balanced and diversified approach to decarbonizing buildings should be pursued—to utilize renewable gas, instead of solely pursuing building electrification.

Despite our participation, and the docket subject—building decarbonization—the entire Workshop was focused on building electrification, not decarbonization. And despite many

[1] Senate Bill (SB) 1383 requires a 40% reduction of methane emissions by 2030. SB 1383 text available at: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB1383

speakers' claims of supporting a technology-neutral approach, presentations and discussion centered around electric technology only. Eleven of the twelve panelists selected by the Workshop organizers focused their presentations on the singular solution to reduce greenhouse gas (GHG) emissions from existing buildings through use of electric technology only. Also, even though the Workshop was in southern California, which is home for a majority of Californians, the majority of panelists were from northern Californian jurisdictions and organizations. One commenter from the Utility Workers Union Local 132 aptly pointed out that "what works for NorCal doesn't work for us down here." He was also concerned about the overwhelming support by panelists of electrification policies because the "cost of living [in southern California] was real." The CEC and CPUC should convene panelists with more diverse backgrounds, ideas, and solutions from different geographical locations to promote a more balanced discussion that will equitably inform the public and policy makers.

Last year's Final 2018 IEPR Update made the unsupported claim that "there is a growing consensus that building electrification is the most viable and predictable path to zero-emission buildings" and that "this consensus is due to the availability of off the shelf, highly efficient electric technologies (such as heat pumps) and the continued reduction of emission intensities in the electricity sector."[2] The claim of a "consensus" is unsubstantiated; it seems that the partial views of hundreds of pro-electrification advocates' submission to the record has been substituted for a consensus of Californians, the majority of which are not in favor of all-electric solutions. Building electrification is not mandated by statute, whereas an inquiry into the best ways to achieve building decarbonization is in fact mandated by law (AB 3232[3]). Any workshop that addresses only a single solution to reduce total GHG emissions from the building sector should not be considered to be in compliance with the legal mandates giving rise to this proceeding. In addition, Workshop remarks from CEC Commissioner Andrew McAllister and CPUC President Michael Picker stating buildings must be electrified, as well as a public social media post,[4] are concerning to the extent they suggest a pre-formed bias against other building decarbonization solutions. We ask the CEC to convene unbiased voices that will inform this year's IEPR proceeding and include balanced and inclusive recommendations that look at all opportunities available to reduce GHG emissions from buildings.

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[2] 2018 Final IEPR Update, P. 21. Available at https://efiling.energy.ca.gov/getdocument.aspx?tn=227391

[3] AB 3232. Text available at: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB3232

[4] Tweet by CPUC President Michael Picker on April 8, 2019. "As I said when we opened a proceeding to address building #decarbonization (https://bit.ly/2UFdjdK), modeling tells us that 100% #renewable electricity alone isn't enough to help us meet our #GHG goals; we also must electrify our homes & buildings to reduce fossil fuel usage." Available at https://twitter.com/PickerCPUC/status/1115316057575546880

Our position on balanced energy solutions was communicated to the CEC in last year's IEPR Update proceeding[5,6,7] and, more recently, in our opening and reply comments to the CPUC's Building Decarbonization OIR proceeding (see Attachments 1 and 2, Opening and Reply Comments, respectively). A singular focus on electrification poses a greater risk to the achievement of the State's climate goals because it fails to address crucial questions about organic methane, the need for longer term and large-scale energy storage off the electric system, and the role existing natural gas assets can play in providing storage while strengthening the reliability and resiliency of our energy system and maintaining affordability and consumer choice. Additionally, the real cost of electrification for today's world has not been fully addressed. For example, issues like how electric utilities recover the costs for the recent wildfires remains unresolved. A recent San Francisco Chronical article[8] speculates that utility costs could double as a result of the fires.

Additionally, cited "building electrification" studies, such as an E3 study may include generation and transmission costs related to increased renewable generation and increased electric demand, but fail to include costs related to distribution system upgrades necessitated by increased demand and use. And such studies are model based studies, not ground up technology-based studies that demonstrate how to actually achieve emission reduction goals in the State's climate plans. Further, what are the separate infrastructure and procurement costs associated with transportation electrification versus building electrification? Importantly, while solar or wind resources may be relatively less expensive over time, the infrastructure to deliver electricity is not, especially if the infrastructure needs to be undergrounded. If the goal is to make significant strides to combat climate change, a multifaceted approach that considers all pathways to lower the carbon intensity of residential and commercial buildings is best, especially if there are more cost-effective and less disruptive ways to achieve the same goal.

In this year's IEPR proceeding, the CEC must include recommendations that will address the State's climate goals while maintaining reliability, resiliency, affordability, and consumer choice. This will require thinking more broadly about renewable energy and supporting an integrated and holistic approach to reducing GHG emissions in the building sector. Fixating on a one-track solution, such as electrifying all end uses, can lead to missing real solutions to address climate change. The options implemented by the State to address GHG emissions from the

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[5] SoCalGas Comments on the Final 2018 IEPR Update. Available at https://efiling.energy.ca.gov/GetDocument.aspx?tn=226490&DocumentContentId=57268
[6] SoCalGas Comments on the Draft 2018 IEPR Update. Available at https://efiling.energy.ca.gov/GetDocument.aspx?tn=225796&DocumentContentId=56469
[7] SoCalGas Comments on the 2018 IEPR Update Commissioner Workshop on Achieving Zero Emission Buildings. Available at https://efiling.energy.ca.gov/GetDocument.aspx?tn=224017&DocumentContentId=54244
[8] https://www.sfchronicle.com/business/article/California-electricity-rates-could-surge-50-13757757.php

building sector should not cause significant uncertainty and burden for workers, their families, and the millions of residents and businesses that depend on a reliable and affordable energy supply for their homes and businesses. The solutions should be approachable (in both cost and use) to encourage acceptance and adoption by consumers.[9] Any energy solution must factor in choice and affordability, so people can continue to work and live in California, and businesses can remain here.[10]

Additionally, relying on a single source of energy is not a prudent strategy as an-all electric pathway puts the reliability and resiliency of the State's energy delivery system at risk. Research released by the CEC in 2018 found that gas assets and service disruptions are far less vulnerable than electric infrastructure to widespread service disruptions caused by wildfires, extreme heat, sea-level rise, flooding, and other extreme climate-driven events.[11] SoCalGas commissioned a consulting firm, ICF, to investigate and document the lessons learned from the impacts of various natural disasters throughout the country on utility and transportation infrastructure.[12] The case studies highlighted concerns with an over-reliance on any single energy source and demonstrated that utilizing a diverse energy delivery system contributes to greater reliability and community resilience and enhances public safety. The case studies also found that natural gas infrastructure and services were relatively resilient to recent hurricanes and wildfires. Both studies stress the need for the State to pursue balanced energy policies that are inclusive of a diverse energy portfolio that include multiple fuels and technologies. This point was passionately raised by Diane Moss during public comment at the Workshop, where she described how she lost her home during the Woolsey Fire in November 2018 and stressed how "resiliency is important, and diversification is a matter of life and death." The threat of wildfires is only expected to increase and become more severe; in the face of increased climate risk, our local communities must have reliable and resilient energy infrastructure. The CEC should support policies that advance decarbonizing the gas delivery system, not just the electric delivery system, as well as develop hydrogen powered fuel cell technologies and other diverse distributed energy solutions to keep communities resilient against natural disasters rather than focusing

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[9] Rapid consumer adoption will be key to the success of any policy. We have learned from the transportation sector (zero-emissions vehicles) that the more we depend on consumer behavior change, the more the targets are at risk.

[10] The Los Angeles area is the largest manufacturing region in the United States, and California has the fifth largest economy in the world.

[11] CEC. Regional Workshops held on January 24, 2019. Potential Impacts and Adaptation Options for Electricity and Natural Gas Systems from Climate Vulnerability in San Diego Area. Slide deck available at: http://www.climateassessment.ca.gov/events/docs/20190124-Slides_ICF.pdf

[12] SoCalGas Study Offers Lessons in Resiliency Planning to Help Communities and Utilities Prepare for Disasters. Available at: https://www.sempra.com/newsroom/press-releases/socalgas-study-offers-lessonsresiliency-planning-help-communities-and

solely on building electrification policies that put the safety and resiliency of a community at risk.

SoCalGas recently released a broad, inclusive and integrated plan to help achieve California's climate goals in a paper titled *California's Clean Energy Future: Imagine the Possibilities* (Attachment 3). [13] The plan embraces an all-of-the-above approach to fight climate change, keeps energy affordability as a key focus, calls for developing long-term renewable energy storage using existing infrastructure, and can aid in promoting rapid consumer adoption. SoCalGas' plan is supported by a recent study developed by the Energy Futures Initiative (EFI) (*Optionality, Flexibility & Innovation: Pathways for Deep Decarbonization in California*) which analyzes the ways California can meet its aggressive 2030 low-carbon energy goals; and it outlines the innovation-focused agenda needed for mid-century deep decarbonization of existing buildings.[14] The report was led by EFI founder and Chief Executive Officer Ernest J. Moniz, former U.S. Secretary of Energy under President Barack Obama. The EFI report notes:

> …clean fuels (e.g. RNG, hydrogen, biofuels) are critical clean energy pathways due to the enormous value of fuels to flexible operations of energy systems. Fuels that are durable, storable, and easily transportable play a fundamental role in ensuring that all sectors can operate at the scale, timing, frequency, and levels of reliability that are required to meet social, economic and stakeholder needs."[15] Further, "[p]olicies that affect natural gas in some sectors (e.g., building electrification) may have unintended impacts on other sectors that consume and rely on natural gas. These impacts include price volatility; relatively higher infrastructure costs for those sectors that have limited near-term options for decarbonization; and reduced resource availability.[16]

The report emphasizes that there is no "silver bullet," that all energy infrastructure should be utilized, and that renewable gas and hydrogen will have to be part of California's long-term future to achieve mid-century goals. This report accentuates the need for the State to pursue a building decarbonization strategy that allows the State to maintain a diverse portfolio of energy options. SoCalGas encourages the CEC to explore all options to achieve the State's climate change goals while prioritizing reliability, resiliency, affordability, and consumer choice.

In addition to the electric-technology-only bias of the Workshop, we are also concerned with the numerous inaccuracies presented at the Workshop, including:

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[13] https://www.socalgas.com/vision
[14] *Optionality, Flexibility, & Innovation. Pathways for Deep Decarbonization in California.* Summary for Policy Makers. Available at: https://static1.squarespace.com/static/58ec123cb3db2bd94e057628/t/5cadebd04cd61c00017a563b/1554901977873/EFI+California+Summary+DE+PM.pdf
[15] Ibid. at xii.
[16] Ibid. at xiii.

1. Claims that cooking with natural gas leads to worse indoor air quality.

2. Inaccuracies in the Building Decarbonization Coalition's presentation.
   a. Slide 8, Gas Infrastructure Costs Lacks the Context of the Cost of Electrifying Existing Buildings.

   b. Slide 9, Impacts of Residential Appliance Electrification Assumes There Will be no RNG Supply.

   c. Slide 14, NOx in California Inventory is Missing Emissions from Heavy-Duty Trucks for Context.

3. Natural Gas System Reliability Concerns.

1. Claims that cooking with natural gas leads to worse indoor air quality.

At previous IEPR workshops, and again during the April 8 Building Decarbonization Workshop, a couple of panelists and public commenters incorrectly stated that cooking with natural gas creates poor indoor air quality. This is not an accurate claim, as it misrepresents the fact that all heat sources can create indoor air pollution during cooking.[17] It is the emissions from the food being cooked, and not from burner or heat source operations, that represent the chief source of concern with respect to indoor air quality.[18] A study by the CEC states that

> …exposure to pollutants from natural gas can result from three general scenarios:
> - Improper or ineffective venting of exhaust gases from appliances required to be vented;
> - Using cooking burners without venting or with ineffective venting; and
> - Using illegal vent-free heaters or fireplaces.[19]

In addition, according to CARB, "[t]he act of cooking itself, whether with gas or electric stovetop burners or ovens, can also generate elevated levels of most of these pollutants, due to heating oil, fat, and other food ingredients, especially at high temperatures … and [s]tudies have

[17] Nasim Mullen et al. "Impact of Natural Gas Appliances on Pollutant Levels in California Homes" Lawrence Berkeley National Laboratory, 2012
[18] California Air Resources Board. January 2006. *Residential Cook Exposure Study Final Report.* Retrieved from https://www.arb.ca.gov/research/indoor/cooking/cooking.htm
[19] California Energy Commission. October 2017. *Emissions, Indoor Air Quality Impacts, and Mitigation of Air Pollutants from Natural Gas Appliances.* Retrieved from http://www.energy.ca.gov/2017publications/CEC-500-2017-034/CEC-500-2017-034.pdf

revealed that home air pollutant levels can exceed health-based standards when people are cooking in kitchens with poor ventilation."[20] Without proper ventilation, cooking indoors with *either* electric or natural gas appliances can create air quality concerns. SoCalGas is committed to customer safety and following all California building code regulations and combustion appliance safety protocols. There are also claims that the combustion of natural gas is a significant source of carbon dioxide and is contributing to climate change; however, if we replace the amount of fossil-based natural gas with renewable natural gas as we propose, we zero-out net carbon emissions because the carbon emissions are offset by the carbon entrapped by the organic material's growth process. The CEC should not be swayed by misinterpretations made by pro-electrification advocates falsely claiming that use of natural gas stoves for cooking is toxic to health, and the CEC should continue to support research that accurately assesses causes of poor indoor air quality.

2. Inaccuracies in the Building Decarbonization Coalition's presentation.

There were a number of inaccuracies in the Building Decarbonization Coalition's presentation, specifically on slides 8, 9, and 14, that SoCalGas refutes.

a. Slide 8, Gas Infrastructure Costs lacks the context of the cost of electrifying existing buildings.

The Building Decarbonization Coalition's presentation calls out gas distribution connection costs but fails to include the real costs of electrification. Additionally, these gas-related costs do not apply to existing buildings. Full electric-related costs include ancillary systems, including ducting, wiring extension, and electric panel upgrades for increased amperage needs in homes. In March 2018, the California Building Industry Association (CBIA) asked Navigant Consulting to study the potential costs customers could incur from switching from a mixed-fuel home to an all-electric one.[21] In Phase I of the study, Navigant looked at existing single-family homes in several Southern California locations. They found that "[s]witching to all-electric appliances would cost California consumers over $7,200 and increase energy costs by up to $388 per year."[22,23]

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[20] California Air Resources Board Website. "Cooking and Range Hoods." Retrieved on 6/13/2018 from https://www.arb.ca.gov/research/indoor/cooking/cooking_range_hoods.htm
[21] Navigant Consulting. April 19, 2018. *The Cost of Residential Appliance Electrification, Phase 1 Report- Existing Single-Family Homes.*
[22] This analysis does not include the cost of necessary infrastructure upgrades to the local and statewide electricity grid to accommodate the additional load on the system.
[23] Navigant Consulting. California Building Industry Association. April 2018. *The Cost of Residential Appliance Electrification, Phase I Report, Existing Single-Family Homes.*

To achieve a 2% decrease in statewide GHGs emissions from residential buildings[24] (which account for 6% of current total state GHG emissions),[25] homeowners would need to pay about $2,600 to purchase and install new electric appliances as well as about $4,600 to upgrade their home's wiring and electric panels to handle the additional electrical load. In addition, the net annual increase in utility costs from increased electrical consumption is up to $388 per home. The homeowners' $613-877 combined annual cost increase represents about 1-2% of median household income for California customers. This would result in an annual cost increase of $4.3-6.1 billion across California's seven million single-family homes. This is a significant amount of money that most Californians would not be able to afford. This projection does not even include the additional burden of disruption and unexpected expenses from construction (e.g., asbestos abatement) to accommodate an all-electric home. Berkeley City Councilwoman Kate Harrison shared her personal distress of going through the retrofit process herself during the Workshop. This retrofit process is lamented by many, including the most "climate activist bona fides."[26] We need solutions that are scalable, affordable and, most importantly, adoptable to achieve the State's climate goals.

b. Slide 9, Impacts of Residential Appliance Electrification Assumes There Will Be No RNG Supply.

This slide assumes no displacement of traditional natural gas by a renewable resource. While it is true that there are no State mandates to lower the carbon content of heating fuels, the Commission has an opportunity to address this issue. SB 1440[27] was passed last year and is awaiting implementation at the CPUC. SB 1440, if implemented, would use the same approach as the renewable electricity portfolio standard (RPS) by requiring gas utilities to purchase renewable gas. A study released by Navigant Consulting[28] last year demonstrated that a achieving a statewide throughput of 16% renewable gas would achieve the same GHG reductions as electrifying 100% of all California buildings by 2030 – at a 50% electric RPS. With the new 60% RPS requirement (under SB100), less than 20% renewable gas statewide would achieve 100% building electrification climate outcomes by 2030. SoCalGas believes that decarbonizing energy supply is more adoptable, expedient and more cost effective than relying on end use appliance changeover. We have announced a commitment to achieve 20% RNG for gas delivery by 2030. If this were applied statewide, and to all buyers of gas, California would realize the GHG reduction equivalent of 100% building electrification by 2030.

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[24] Ibid.
[25] CARB Website. Available at https://www.arb.ca.gov/cc/inventory/data/data.htm.
[26] https://www.greentechmedia.com/articles/read/what-does-it-take-to-electrify-everything-in-your-home#gs.6ibmu1
[27] SB 1440. Text available at: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1440
[28] Navigant Consulting, Inc. Analysis of the Role of Gas for a Low-Carbon Future. Available at: https://www.socalgas.com/1443741887279/SoCalGas_Renewable_Gas_Final-Report.pdf

The CPUC could use SB 1440 to direct gas corporations to purchase biomethane and other forms of renewable gas, instead of traditional natural gas. This would allow California home owners and renters the choice of keeping their existing appliances or choosing electric alternatives without jeopardizing the State's climate change goals. It is a win-win for the State because GHG emissions are reduced via a seamless solution. We implore the CEC to support the implementation of a technology-neutral approach to building decarbonization by utilizing an opportunity to be responsive to legislation passed last year.

c. Slide 14, California NOx Inventory Fails to Include Emissions from the Heavy-Duty Transportation Sector for Context.

This slide fails to include nitrogen oxide (NOx) emissions from the heavy-duty transportation sector. Heavy duty diesel trucks emit 420 tons per day of NOx in the State.[29] This is almost twice as much as the NOx emissions from buildings and light-duty vehicles *combined*. The Building Decarbonization Coalition's slide fails to provide an accurate and honest assessment of NOx emissions in the State. The key to addressing NOx emissions reductions is an accelerated transition to near-zero heavy-duty trucks. Combining RNG with low- and ultra-low-NOx engines provides the best opportunity for California to achieve its air quality and climate change goals in the on-road, heavy-duty transportation sectors in the near term.[30] Additionally, when renewable gas is produced from waste resources—including organic sources of methane from dairy manure and food and green waste—it can have a net-negative carbon intensity.[31]

3. Natural Gas System Reliability Concerns.

At the start of the workshop, Senator Henry Stern expressed concerns regarding natural gas system reliability caused by recent pipeline outages and, based thereon, his desire to see an electrification future. First, SoCalGas is currently working to methodically and safely increase the operational capabilities of our pipeline system. The SoCalGas system was designed to have sufficient resiliency to allow this sort of work to proceed without impacting customers. However, this resiliency continues to be hindered, as it comes from our underground natural gas

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[29] CARB. 2016 State Implementation Plan Emission Projection Data https://www.arb.ca.gov/app/emsinv/2017/emssumcat_query.php?F_YR=2012&F_DIV=-4&F_SEASON=A&SP=SIP105ADJ&F_AREA=CA#7

[30] Gladstein, Neandross, and Associates. May 2016. *Game Changer: Next Generation Heavy-duty Natural Gas Engines Fueled By Renewable Natural Gas.* Available at: https://www.gladstein.org/gna_whitepapers/game-changer-next-generation-heavy-duty-natural-gas-engines-fueled-by-renewable-natural-gas/

[31] CARB Website. LCFS Pathway Certified Carbon Intensities. Available at: https://www.arb.ca.gov/fuels/lcfs/fuelpathways/pathwaytable.htm

storage facilities, the largest of which is currently restricted by state regulators. Second, this statement misses the mark as electric outages (planned and unplanned) frequently occur. In recent years, electric utilities have been intentionally turning off electricity in high fire threat areas to protect communities and reduce wildfire risk.

The SoCalGas natural gas system has been forced by regulators to operate with historic impediments. Specifically, the Aliso Canyon storage facility continues to be constrained by regulators—even though it has completed the comprehensive safety review ordered by SB 380,[32] has received the required regulatory determinations that the field and its operational wells are safe to operate, and the operational wells now operate consistent with the State's new safety requirements. The SoCalGas system is designed to meet demand utilizing underground natural gas storage in conjunction with the pipeline supply system to operate reliably and affordably. Although one component impacting the system's current capacity is the transmission pipeline outages, the other critical and more readily addressed component is storage operating constraints resulting from CPUC-imposed restrictions on the use of Aliso Canyon.[33] Today, system reliability and affordability could be safely enhanced through removal or modification of these restrictions, especially in light of the Division of Oil, Gas, and Geothermal Resources (DOGGR) and the CPUC deeming Aliso Canyon safe to resume injection.[34]

[32] Senate Bill 380. Text available at: http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB380

[33] These restrictions include limits on inventory and limiting withdrawals from the facility to a "last resort."

[34] SB 380 Findings and Concurrence Regarding The Safety of the Aliso Canyon Gas Storage Facility, available at: https://www.conservation.ca.gov/dog/Documents/Aliso/OpenLettertoSoCalGasandPublic.pdf

Conclusion

SoCalGas provides these comments to help move California towards meeting our aggressive climate goals in a thoughtful, reasoned, studied, and cost-effective way. We believe that we can decarbonize buildings by decarbonizing both electricity and natural gas supplies—not just electrifying end uses. We look forward to participating in additional workshops that thoughtfully consider different options for building decarbonization and their effects on customers and communities.

Sincerely,

George Minter
Regional Vice President, External Affairs & Environmental Strategy
Southern California Gas Company

ATTACHMENT 1
CPUC Building Decarbonization OIR Opening Comments

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking Regarding Building Decarbonization.	Rulemaking 19.01.011 (Filed on January 31, 2019)

OPENING COMMENTS OF SOUTHERN CALIFORNIA GAS COMPANY (U 904 G) ON ORDER INSTITUTING RULEMAKING REGARDING BUILDING DECARBONIZATION

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March 11, 2019

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking Regarding Building Decarbonization.	Rulemaking 19-01-011 (Filed on January 31, 2019)

OPENING COMMENTS OF SOUTHERN CALIFORNIA GAS COMPANY (U 904 G) ON ORDER INSTITUTING RULEMAKING REGARDING BUILDING DECARBONIZATION

Pursuant to the Order Instituting Rulemaking Regarding Building Decarbonization filed by the California Public Utilities Commission (Commission), Southern California Gas Company (SoCalGas) hereby submits its opening comments on the Order Instituting Rulemaking (OIR).

I. INTRODUCTION AND GENERAL DISCUSSION

SoCalGas appreciates the opportunity to participate in this proceeding which will explore options to promote and bolster the State's efforts to curb greenhouse gas (GHG) emissions. SoCalGas supports such efforts and has long been a leader in developing emerging technology and energy efficiency (EE) programs that deliver meaningful GHG emissions reductions. We are proud of the advances we have made through our programs and partnerships with equipment manufacturers and our customers, and we recognize the multifaceted challenges presented in achieving mandated GHG emissions reduction targets by 2030 and achieving carbon neutrality by 2045.

Californians currently rely on a diverse energy system that is reliable, resilient, and strives to remain affordable while maintaining consumer choice. In this OIR, we look forward to working with the Commission as it looks at how to address the State's climate goals while maintaining reliability, resiliency, affordability, and consumer choice. This will require thinking more broadly about renewable energy and supporting an integrated and holistic approach to reducing GHG emissions in the building sector. Fixating on a one-track solution, such as electrifying end uses, can lead to missing real solutions to address climate change. We should support an inclusive energy strategy that objectively considers all options and encourages and

allows for current and future innovation. We should not simply assume that all energy solutions to achieve carbon neutrality are known to us today.

The options implemented should not cause significant uncertainty and burden for workers, their families, and the millions of residents and businesses that depend on a reliable and affordable energy supply for their homes and businesses. The solutions should be approachable (in both cost and use) so as to encourage acceptance and adoption by consumers.[1] Any energy solution must factor in choice and affordability, so people can continue to work and live in California, and businesses can remain here.[2]

In order to have any meaningful impact on global GHG emissions, California's energy solutions must demonstrate results that can be adopted by other states and countries.[3] California emits less than 1% of global GHG emissions; thus, reducing California's GHG emissions alone will not be enough.[4] As we address ways to advance carbon neutrality, it will be important to consider solutions that can be adopted by others in the United States and around the world.[5]

With this in mind, and that the "initial scope of this proceeding is designed to be inclusive of *any* alternatives that could lead to the reduction of [GHG] emissions associated with

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[1] Rapid consumer adoption will be key to the success of any policy. We have learned from the transportation sector (zero-emissions vehicles) that the more we depend on consumer behavior change, the more the targets are at risk.

[2] The Los Angeles area is the largest manufacturing region in the United States, and California has the fifth largest economy in the world.

[3] California has set aggressive targets, spurring technology development, and set new standards for buildings. Many, if not most, of the steps we take in the energy and environmental arena ripple benefits across the country and beyond. However, there are many uniquely Californian characteristics that can make replicating California policy challenging for other states and regions. For example, Californians benefit from the availability of solar, while other regions have not adopted renewable portfolio standards due in part to the lack of available renewable resources. If other states and countries cannot generate the same level of renewables in the electric sector, then a push towards a siloed solution of electrifying buildings will not be an effective strategy to reduce GHGs in other regions.

[4] California Energy Commission using data from http://www.globalcarbonatlas.org (last updated December 2018).

[5] Similarly, we must absorb lessons from around the world. Germany spent more than $600 billion on green energy subsidies and infrastructure investments, but will likely miss its 2020 target of reducing GHG emissions by 40% over 1990 levels due to its rush to convert its electricity supply to renewable resources without adequate planning, resulting in the need to turn to coal-fired plants to provide reliability. In 2017, more than one-third of Germany's energy supply came from coal. Germany: Nikolewski, Rob, "Is California going the way of Germany when it comes to energy?" The San Diego Union-Tribune, November 11, 2018.

energy use in buildings,"[6] we propose that the Commission thoughtfully consider all options that will contribute to achieving the State's climate goals, including renewable gas (RG). RG, including biomethane, hydrogen, and methanated renewable hydrogen, can be used to remove carbon from other sectors of the economy[7] while reducing GHG emissions from the building sector.[8] It also allows the existing natural gas infrastructure to be utilized.[9] As an additional benefit, consumers do not have to bear the costs of replacing appliances, retrofitting homes, etc.

Utilizing RG supports energy reliability and resiliency while keeping consumer costs down,[10] and moreover enables consumer choice—which cannot be undervalued. About 90% of residential energy consumers in Southern California use natural gas for space and water heating.[11] Our customers expressly prefer a choice in how they heat their homes and cook their food.[12] When the Commission issued a proposal to direct SoCalGas to implement a moratorium

[6] OIR at 2 (emphasis added).
[7] While this proceeding pertains specifically to the building sector, we must still consider solutions that address all sectors. Residential and commercial buildings account for 7% and 5%, respectively, of GHG emissions in California. The transportation sector accounts for 41%; the industrial sector accounts for 23%; the electricity sector accounts for 16%; and the agriculture sector accounts for 8%.
[8] RG helps us reduce fugitive emissions by harnessing our waste streams, effectively converting emissions into fuel. The largest source of methane emissions in California (more than 80%) is agriculture, dairies, landfills, and waste water. We can capture this waste; convert it into biogas using anaerobic digestion; process the biogas to make it pipeline ready; inject it into existing pipelines; and use the fuel where natural gas is used. RG can also be made from the woody biomass that is removed from forests to reduce the risk of catastrophic wildfires.
[9] Because the underground infrastructure is resilient to wildfires and other extreme climate and weather events, such as wind storms, microgrids supported by RG could be deployed in high-risk areas.
[10] As a rule of thumb, $3.00 per MMBtu, close to generally prevailing natural gas commodity prices, is equivalent to about $0.01 per kWh. Therefore, forcing customers to switch to electric end-uses could increase their energy costs several times over.
[11] California Energy Commission (CEC, "2009 California Residential Appliance Saturation Study: Executive Summary," Table ES-3: Natural Gas UEC and Appliance Saturation Summaries by Utility, October 2010.
[12] California Reports Show Homeowners Prefer NatGas Over Electrification. Available at: https://www.naturalgasintel.com/articles/114152-california-reports-show-homeowners-prefer-natgas-over-electrification

on new commercial and industrial natural gas connections in Los Angeles County,[13] parties[14, 15] vociferously opposed the Commission's proposal and underscored the harm that would be done to the economy if the moratorium were implemented.

Removing natural gas from homes would impose a significant burden on consumers in terms of cost, choice, and convenience, and could result in serious unintended consequences, including driving opposition to any climate change goals related to buildings; this is unnecessary because the same environmental benefits can be achieved without imposing those burdens on customers. Increasing use of RG to displace traditional natural gas can support the maintenance of a safe and reliable energy system, promote a robust California economy, and make significant progress towards California's climate and air quality goals.[16] With this in mind, SoCalGas just recently announced its commitment, regulatory authority permitting, to displace 5% of traditional natural gas in its pipelines with RG by 2022 and 20% by 2030. SoCalGas also recently filed a request with the Commission to allow customers to purchase renewable natural gas for their homes and businesses. Replacing less than 20% of traditional natural gas with renewable natural gas achieves the same emissions reductions as overhauling *all* of California's buildings to be electric-only, *at a significantly lower cost*. This is one part of the solution to attain the State's climate goals, and we look forward to exploring others in this proceeding.

II. SPECIFIC QUESTIONS FROM THE SCOPING RULING

1) Do you agree or disagree with the organization of the proceeding into the four proposed categories (Implementing SB 1477, Potential Pilot Programs for Decarbonization of New Construction in Areas Damaged by Wildfires, Coordinating with

[13] CPUC Draft Resolution G-3536, Emergency Order Direction Southern California Gas Company to Implement a Moratorium on New Natural Gas Service Connections. Available at: http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M201/K367/201367863.PDF

[14] Los Angeles County, American Gas Association, LA County Business Community Coalition, Bloom Energy, California Manufacturers and Technology Association, Biz Fed LA County, PTG Water & Energy, Californians for Affordable and Reliable Energy, California Council for Environmental and Economic Balance, Clean Energy, and Honeybird Restaurant

[15] Los Angeles Business Journal. January 5, 2018. *Business Opposition Mounts to Proposed Moratorium on New Natural Gas Hookups*. Available at: http://labusinessjournal.com/news/2018/jan/05/business-opposition-mounts-proposed-moratorium-new/

[16] To this end, SoCalGas recently filed its "Green Tariff" Application, A.19-02-015, seeking authority to allow customers the option to purchase RG. The voluntary program would provide customers with carbon neutrality options and helps the environment by repurposing methane from waste that otherwise would vent to atmosphere, and its implementation costs would be paid for by customers who choose to enroll in it.

Title 24 Building Standards and Title 20 Appliance Standards, and Building Decarbonization Policy Development)? Explain your reasoning.

SoCalGas agrees with organizing the proceeding into the four proposed categories. In order to best inform the discussions, and to allow sufficient time for the many considerations that are implicated in this proceeding as well as allow robust public participation, we further recommend that the Commission split the OIR into two distinct phases: the first phase should focus on implementing the statutory requirements of Senate Bill (SB) 1477, and the second phase should focus on the remaining three categories while prioritizing building decarbonization policy. By prioritizing building decarbonization policy, the Commission can establish an informed opinion that will help drive the process of rebuilding areas that were damaged by wildfires according to Title 20 and 24 building standards. Additionally, the findings and determinations made regarding building decarbonization policy will likely have broader implications on the overall resiliency and reliability of California's energy infrastructure, the economy, the cost of home ownership, and utility rates. As such, the building decarbonization policy development should not be rushed and will benefit from allowing time to obtain significant input from stakeholders as both the public and private sectors likely will be impacted by the policies that are adopted.

SoCalGas asks the Commission to invest the appropriate time and resources to conduct scientific and fact-based studies along with thorough cost analyses when developing building carbon neutrality policies and recommends this category not be fast-tracked as the impacts will be felt by all Californians. It is imperative that there is sufficient time to conduct studies and develop a robust record to inform policy development in this proceeding.

2) How should the Commission go about determining the administrative structure for the SB 1477 BUILD and TECH programs, from among the options listed in the statute?

The Commission should leverage the current structure it has in place for most of its ratepayer-funded demand-side management programs (e.g., energy efficiency, demand response, solar thermal, etc.) to allow the local investor owned utilities (IOUs) to administer the Building Initiative for Low Emissions Development (BUILD) and Technology and Equipment for Clean Heating (TECH) programs. This approach has served ratepayers, the Commission, and California well, as programs utilizing it have generally achieved established goals in a cost-

effective manner within budget.[17] The Commission has actively pushed integration across demand-side management (DSM) programs, whether through an integrated DSM (IDSM) approach or through an integrated distributed energy resources (IDER) approach. In both cases, the local utility is the cornerstone of the administrative model given the need to coordinate with system planning and operations. Many of the technologies likely to be adopted for the BUILD and TECH programs are those that qualify for existing energy efficiency, solar thermal, and demand response programs. It thus will be critical to integrate the BUILD and TECH programs into the existing programs to provide a comprehensive IDSM or IDER approach. SoCalGas serves as a resource aggregator on behalf of our customers. The American Council for an Energy-Efficient Economy (ACEEE) recently recognized SoCalGas' integrated partnership model with the Los Angeles Department of Water and Power (LADWP) whereby programs are joined in a single package to provide gas, electric, and water incentives to offer comprehensive efficiency solutions to customers in a seamless and integrated manner.[18] SoCalGas has similar partnerships with other local electric utilities, water utilities, governmental agencies, and air quality districts throughout our service territory. This model has been highly successful for all participating utilities and, more importantly, a benefit for customers.

These and similar existing relationships can be utilized by SoCalGas and the other utilities to assure that their respective portions of the $50 million in annual SB 1477 funding are leveraged with existing programs and resource platforms designed to increase customer participation, the comprehensiveness of that participation, and the overall success of the program in order to provide meaningful energy efficiency and emission-reduction benefits for customers.

3) If the Commission chooses a third-party administrator, what process should it use to select the administrator?

For the reasons stated in response to Question 2, a third-party administrator is not the best option to administer the BUILD and TECH programs. Familiarity with their own systems,

[17] See, e.g., Energy Efficiency Portfolio Report, California Public Utilities Commission, March 2018, available at:
http://www.cpuc.ca.gov/uploadedfiles/cpucwebsite/content/about_us/organization/divisions/office_of_governmental_affairs/legislation/2018/13-15%20energy%20efficiency%20report_final.pdf

[18] *See* The New Leaders of the Pack: ACEEE's Fourth National Review of Exemplary Energy Efficiency Programs, ACEEE, January 2019, at 112. Available at:
https://aceee.org/sites/default/files/publications/researchreports/u1901.pdf

operations, and existing programs will allow IOUs to attain synergies that will lead to efficiencies that a third-party administrator cannot realize.

Nevertheless, if the Commission determines that a third-party administrator is best suited to these tasks, then a third-party administrator(s) should be procured via a competitive solicitation process. The solicitation process should be governed by a group that consists of relevant stakeholders, namely the participating utilities and the CPUC's Energy Division. Additionally, there should be a series of workshops to allow those stakeholders to provide input to inform the solicitation process. If a third-party is selected to administer the program(s), then they must work closely with the utilities and their existing demand-side management programs in order for the programs to be integrated and most effective. The utilities should be a key partner in all steps to ensure that proposed goals are reasonable and rolled out efficiently. The utility staff will be composed of engineers and experts who will prepare analysis, review documentation and make assessments and recommendations as deemed necessary.

4) How should the Commission establish the budget for each program? What portion of the budget should be reserved for program evaluation? How should the program evaluator be selected?

Senate Bill 1477 prescribes a combined annual budget of $50 million across the participating California gas utilities. SoCalGas believes the BUILD program should be allocated a higher percentage of the budget than the TECH program because the BUILD program represents a better opportunity to drive benefits that likely will be realized sooner to accomplish the stated legislative goals. The BUILD program provides incentives to community and home builders throughout California, including those in disadvantaged communities. A larger investment in the BUILD program will allow these builders to receive incentives quickly to build more efficient homes that have a lower carbon footprint. The BUILD program also aligns more closely with the Commission's ratepayer-funded and utility-administered energy efficiency programs, which can thus be leveraged and integrated in order to further maximize program goals.

Unlike the BUILD program, which provides quick and direct incentives to those who will actually build more energy-efficient homes, the TECH program focuses on education and training. Based on SoCalGas' experience, the impact and effectiveness of programs with similar parameters have proven to be difficult to measure. Moreover, the TECH program seems less

likely than the BUILD program to have a quick impact on achieving California's aggressive energy goals in the near future. Based on the foregoing evaluations, SoCalGas proposes at least 75% of the annual budget be allocated to the BUILD program.

SoCalGas agrees that program evaluation is imperative to measure the impact and cost-effectiveness of the programs. Therefore, the Commission should set aside a portion of the budget towards this effort.[19] The program evaluation should be done by an independent consultant selected through a competitive solicitation process. Similar to the process outlined above for a third-party administrator, SoCalGas believes it will be important that a series of workshops be conducted to allow for stakeholder input to help inform the solicitation and selection process.

5) What program design parameters should be established by the Commission independent of the program administrator, and which aspects should it allow the selected program administrator to develop on behalf of the Commission?

For example:

a) Technology eligibility criteria

b) Process for evaluating new technologies

c) Guidelines and evaluation metrics

d) Criteria for scoring and selecting projects

As discussed above, the utilities are best positioned to administer the BUILD and TECH programs. Under that construct, the Commission should participate in program oversight and performance measurement as needed, as well as establish critical guidelines for program implementation. For example, the Commission should, as part of this proceeding, work with the utilities to establish the following parameters:

- Guidelines on eligible technology categories;
- Overarching program goals and objectives;
- Budget allocation between the BUILD and TECH programs;
- Budget allocation among the funding gas utilities;

[19] The Commission could refer to its ratepayer-funded energy efficiency programs as a guideline for determining the evaluation budget.

- Develop standardized metrics;
- Establish program evaluation criteria; and
- Conduct program evaluation.

For each of these above areas, the Commission should promote input from stakeholders, namely the participating utilities. Some of the criteria may be different across the two programs. For example, the BUILD program may not require a lot of involvement and oversight as it is an incentive program. Beyond the areas suggested above, the program design should largely be left to each utility administrator. Program design includes eligibility criteria, outreach plans, incentive rates, marketing efforts, and partner integration and program leveraging. The ability of each of these design criteria to be adaptive and flexible to local geographic, demographic, and economic conditions will be critical for success of the programs.

6) Should the Commission consider proposals for new rate designs as part of the design and implementation of the BUILD and TECH programs?

SoCalGas does not have sufficient information at this time to provide meaningful comments on this question. We appreciate the opportunity to comment on this in the future after additional information becomes available.

7) What goals should the Commission set for building decarbonization?

California's relevant energy goals are focused on technology-neutral emissions reductions intended to achieve climate stabilization. The long-term goal is total, economy-wide carbon neutrality by 2045.[20] The short-term goal, as established by Assembly Bill (AB) 3232 (2018), is a 40% reduction of GHGs from the building sector by 2030.

How these legislative goals can best be achieved will be explored and considered in depth in this proceeding. The options to consider are numerous and SoCalGas believes they must be vetted thoroughly before anything is determined. The following is a non-exhaustive list of the most important considerations in achieving the State's climate goals.

Goal #1 – **Maintain Energy Reliability.** The Commission should consider a multifaceted approach to lowering the carbon intensity of buildings in order to maintain energy

[20] Executive Order B-55-18 To Achieve Carbon Neutrality, available at: https://www.gov.ca.gov/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf.

reliability in our State. In order to best do this, the Commission should not mandate or incentivize one technology or fuel source over others, but rather objectively consider all options and ultimately utilize a combination thereof. This is reflected in the Commission's guiding principle for Building Decarbonization Policy Development that it should "avoid picking technology winners and encourage competition among technologies, vendors, and approaches."[21] We must explore all viable options and foster policies that will encourage the development of innovative technologies and new ideas in order to achieve long-term compliance with State goals.[22] We should not assume that all energy solutions to achieve carbon neutrality are known and in existence today. The Commission should consider carbon neutrality options from a holistic (i.e., cross-sector) and integrated energy system perspective. The solution to addressing climate change is going to be multifaceted because many sectors of the economy are interconnected. California produces about 1% of the world's GHGs and should contribute to meaningful climate solutions by creating ideas that are scalable and exportable on a global basis. For example, RG has synergistic GHG reductions in the building, industrial, agriculture, transportation and electric generation sectors. The synergy is accomplished two ways: 1) by capturing methane emissions from biogenic sources that would normally vent to atmosphere and injecting them into the gas grid for all end-uses, displacing traditional natural gas, and 2) taking excess renewable electricity and producing hydrogen[23] via electrolysis ("Power-to-Gas"[24]) that

[21] See *Order Instituting Rulemaking Regarding Building Decarbonization* issued on January 31, 2019 at 16.

[22] The Commission's interest in exploring pilot programs represents an important opportunity to collaborate on the advancement of a variety of new technologies. SoCalGas has had programs and partnerships such as Research, Development & Demonstration (RD&D) projects in collaboration with the California Energy Commission, Department of Energy, Southern California Air Quality Management District, natural laboratories, start-up companies, and customers. These efforts have resulted in advances in the areas of low-NOx engines, natural gas vehicles, waste-to-energy, energy storage, and distributed renewable hydrogen generation. This experience renders us well-equipped to meet the challenges of achieving the State's carbon neutrality goals.

[23] Hydrogen is a zero-emission fuel that can reduce emissions in the transportation sector. Some percentage of hydrogen can be injected into the natural gas stream to decarbonize it. Hydrogen's significance as an energy storage technique is growing globally. The United Kingdom currently is experimenting with allowing up to 20% green hydrogen to be injected into its gas network. The University of California system, which plans to be carbon neutral by 2025, has announced that renewable natural gas and hydrogen will play a significant role in achieving their goal.

[24] Today we dump excess electricity or pay other states like Arizona to take it from us. Batteries can store some excess energy but do not help with long-term storage needs. Power-to-Gas involves combining excess renewable electricity with a small amount of water and running it through electrolysis, which

can be stored, injected into the natural gas grid, used in a fuel cell[25] or a fuel cell electric vehicle, or converted to methane for end uses, thereby also displacing traditional natural gas. This concept creates flexibility in the energy system and is an extremely adaptive method to address climate risks.

RG created from capturing agricultural manure and waste, wastewater treatment plants, landfills and diverted organic waste facilities exists extensively in Europe and is growing here in the United States. Dairy, food, and green waste is considered a carbon-neutral, and in some cases carbon-negative, energy source by the California Air Resources Board (CARB). By developing and incentivizing at scale, the production of RG will support cost reductions from economies of scale, bring down the cost of the fuel, and create jobs in California.

Goal #2 – <u>Affordable Solutions</u>. The affordability impacts of carbon neutrality in the building sector should be considered in a broad context. For example, how will building decarbonization affect homeownership and homelessness, including Governor Newsom's goal of addressing affordable housing?[26] If electrification of all energy end uses, such as space and water heating, is pursued, how much new electric generation, transmission and distribution infrastructure will be required to realize the goal, and what will the ongoing maintenance, safety, and environmental costs be for new electric infrastructure? The cost impacts of the different technologies and fuels will be different, and all must be considered relative to each other. At the least, the Commission should look at the energy bill impacts from different fuel options; the difference in cost between in-state RG versus out-of-state RG; and upfront installation and

converts electrical energy into chemical energy and splits the molecules into pure hydrogen and oxygen. The oxygen can be used in other applications, and the hydrogen case can be used as a fuel or stored in existing pipelines. Or, hydrogen can be combined with carbon dioxide and run through methanation to create renewable methane. UC Irvine is using Power-to-Gas to increase its renewable energy use from 3.5% to 35%. University of California Irvine (UCI) and SoCalGas research presented at UCI's International Colloquium on Environmentally Preferred Advanced Generation (ICEPAG) on March 30, 2017.

[25] Unlike batteries, fuel cells do not merely store energy; they also generate it. When hydrogen-rich fuel such as clean natural gas or renewable biogas enter the fuel stack in a fuel cell, they react electrochemically with oxygen (i.e., ambient air) to produce electric current, heat, and water. While a typical battery has a fixed supply of energy, fuel cells continue to generate electricity as long as fuel is supplied.

[26] OIR at 11. The Commission should take into consideration the impact of the policies determined in this proceeding on Governor Newsom's goals of addressing affordable housing. Building decarbonization comes with costs, and there may be unintended consequences, e.g., low income and disadvantaged communities may have additional expenses that they can ill afford thrust upon them.

replacement costs of new equipment, appliances, controls, and/or associated appurtenances associated with the building and utility. For example, residential batteries may have a 10-year life and thus would need to be replaced 5-10 times over the life of a home; this should be accorded due weight. The Commission should make every effort to reduce the cost impacts of new policies on homeowners, businesses, and other ratepayers. The Commission, with the help of stakeholder input, should also consider the implications of carbon reduction strategies on affordability of energy to the most vulnerable customers, who require the most safeguarding.

Goal #3 – Consumer Choice and Adoptability. The impacts of implementing new building carbon neutrality policies on California residents may be significant. If the goals are to be met, consumer choice must be an option. It should not be assumed that customers will accept potentially drastic changes to their current energy choice(s) or end-use equipment. Appropriate thought must be given to minimizing costly and jarring transitions while still making progress towards the State's climate goals. Additionally, the Commission should consider the speed of adoptability of any option, especially where physical changes are required, from the sheer logistics of dealing with millions of buildings.

Goal #4 – Resiliency: Not Relying on A Single Source of Energy. Currently, dual-fuel homes provide their occupants with options which become especially important when there are electricity outages. You can still cook, have hot water or even have backup power from a natural gas fueled generator. Research[27] released by the California Energy Commission (CEC) in 2018 found that gas assets and service disruptions are far less vulnerable than electric infrastructure to widespread service disruptions caused by wildfires, extreme heat, sea-level rise, flooding, and other extreme climate-driven events. Additionally, SoCalGas commissioned a consulting firm, ICF, to investigate and document the lessons learned from the impacts of various natural disasters throughout the country on utility and transportation infrastructure.[28] The case studies highlighted concerns with an over-reliance on any single energy source and demonstrated that utilizing a diverse energy delivery system contributes to greater reliability and community

[27] CEC. Regional Workshops held on January 24, 2019. Potential Impacts and Adaptation Options for Electricity and Natural Gas Systems from Climate Vulnerability in San Diego Area. Slide deck available at: http://www.climateassessment.ca.gov/events/docs/20190124-Slides_ICF.pdf

[28] SoCalGas Study Offers Lessons in Resiliency Planning to Help Communities and Utilities Prepare for Disasters. Available at: https://www.sempra.com/newsroom/press-releases/socalgas-study-offers-lessons-resiliency-planning-help-communities-and

resilience and enhances public safety. The case studies also found that natural gas infrastructure and services were relatively resilient to recent hurricanes and wildfires. Both the CEC and ICF studies stress the need for the State to pursue balanced energy policies that are inclusive of a diverse energy portfolio that include multiple fuels and technologies.

For sensitive customers, such as those residents and businesses in high-risk fire areas, it may be prudent to develop microgrid solutions that rely on RG to keep power on during intentional outages. Commercial buildings that need reliable energy for critical equipment (e.g., hospitals) may choose to invest in highly efficient combined heat and power systems that are independent of the electric grid to support their needs. Allowing for such flexibility should be considered.

Goal #5 – <u>Optimize All Carbon Neutral and Carbon Negative Options, Including RG</u>. If the intent is to make significant strides to combat climate change while continuing to prioritize reliability and resiliency of the energy grid, affordability, and consumer choice, the Commission should pursue strategies that incorporate carbon neutral and carbon negative options, including RG.[29] Doing so will accelerate accomplishment of the State's carbon neutrality goals,[30] provide a diversified mix of fuel resources available to accomplish these goals, maintain lower costs for customers, and allow for consumer choice.

With this in mind, just recently SoCalGas announced its commitment, regulatory authority permitting, to displace 5% of traditional natural gas in its pipelines with RG by 2022 and 20% by 2030. SoCalGas also recently filed a request with the Commission to allow customers to purchase renewable natural gas for their homes and businesses. The hope is that these activities will accelerate the development of in-state renewable gas projects and achieve significant emissions reductions. Replacing less than 20% of natural gas with renewable natural gas achieves the same emissions reductions as overhauling *all* of California's buildings to be electric-only, *at a significantly lower cost*. This solution avoids a mandate to change out millions of appliances and spend money to replace existing infrastructure.

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[29] For example, the use of RG from captured methane from dairies, food and green waste is considered carbon negative.

[30] In addition, there are emerging technologies that can either remove carbon from natural gas prior to use (methane pyrolysis) or capture and use the carbon dioxide (CO2) typically produced when natural gas is used. CO2 can be used to form $C_1 – C_x$ hydrocarbons that are used in a variety of structural materials. When carbon capture and utilization technologies are applied to RG resources, carbon-negative cycles can be created.

Energy leaders in other parts of the world, particularly in Europe and Canada, are also looking at RG as a means to make the gas supply carbon neutral. France has adopted a renewable gas standard that calls for RG to make up at least 30% of natural gas consumption by 2030. Énergir, a Canadian natural gas utility, is working towards efforts to have a fully developed RG marketplace by 2020 and has a target to distribute 5% RG by 2025. In 2018, SoCalGas announced a collaboration with several utilities in Europe and Canada to advance the development of policies and technologies to support making natural gas supplies carbon neutral. "The development of [RG] is a real challenge for the energy transition and has a key role to play in the context of the low carbon strategy. The signing of this partnership agreement at the World Gas Conference reflects our shared desire to develop green gas and associated technologies and facilitate its production and injection into natural gas networks," said Christophe Wagner, International Director for French utility GRDF.[31]

Internationally, the United Nations Climate Change Council and the World Green Building Council have set goals for buildings to achieve net zero emissions by 2050.[32,33] In Europe, in order to attain this goal, countries are looking at both renewable electricity and RG to deliver the energy needs of the building sector. California also should consider RG as an option to help achieve the State's climate goals, especially given extensive RG delivery capability and the very high market penetration of natural gas use in residential buildings. As we transition to low-carbon energy, gas and electric systems should work in harmony to provide reliability and resiliency affordably. RG is an essential part of the solution.

8) What other specific initiatives should the Commission examine to further the goals outlined in the question above?

Some items for the Commission to consider that would advance building carbon neutrality goals include:

[31] Press release by SoCalGas, Energir, GRDF and GRTgaz. Available at: https://www.prnewswire.com/news-releases/socalgas-energir-grdf-and-grtgaz-announce-collaboration-on-low-carbon-and-renewable-gas-initiatives-during-world-gas-conference-300674664.html
[32] Twitter. UN Climate Change. Available at https://twitter.com/UNFCCC/status/1004664904719224833
[33] World Green Building Council. June 2018. *World Green Building Council Calls on Companies Across the World to Make their Buildings Net Zero Carbon.* Retrieved from http://www.worldgbc.org/news-media/world-green-building-council-calls-companies-across-world-make-their-buildings-net-zero.

- Broad public engagement on critical policy changes that are likely to result in significant impacts;
- An integrated and holistic solution that leverages existing utility infrastructure;
- Resiliency of energy grid, reliance on multiple versus single technologies, including, e.g., distributed self-generation using high efficiency fuel cells;
- Cost of implementing policy – including impacts to homeowners/renters, low-income communities, businesses, and utility rates; and
- Economic implications of a statewide policy on different regions - how building carbon neutrality policies impact different regions in California, like San Francisco versus the San Joaquin Valley, and considering implications to low-income communities and the growing senior population.

Regarding the Commission's interest in exploring pilot programs to help make carbon neutral homes in areas impacted by wildfires, SoCalGas supports this effort. Wildfires are not a one-time occurrence, nor are wildfires the only type of disaster that could impact buildings. For this reason, SoCalGas suggests that the Commission's policies should be broad enough to help address carbon neutrality in areas impacted by any catastrophic event. Further, SoCalGas recommends that education and consumer protection be a primary goal. As noted in Decision Adopting Net Metering Consumer Protection Measures Including Solar Information Packet, D.18-09-044, it is important to ensure that residential customers receive accurate information to make informed decisions about their energy options. Particularly, consumers must be protected against aggressive and unscrupulous sales tactics.[34] For these reasons, SoCalGas believes that a Decarbonization Information Packet, similar to that used in the Net Energy Metering proceeding,[35] should be developed by stakeholders and approved by the Commission for distribution.

SoCalGas suggests that an approved information package should be agnostic regarding technology and fuel. At minimum, it should list all available energy options, associated costs, and corresponding estimated GHG reductions. Educating consumers about their energy options so they can make the choices that best suit their needs is important. For example, per Resolution

[34] http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M230/K892/230892616.PDF
[35] D.18-09-044 at Appendix A.

ESRB-8, electric utilities may proactively shut down power to limit the impact or damage of power lines to communities when the utilities are aware of dangerous conditions.[36] As a result, communities may be left without power for an undetermined amount of time. Because consumers will be affected differently, and because consumers best know their energy needs, they should be made aware of their options,[37] including the existence of clean gas technologies capable of reducing GHGs, such as low-emission space and water heater equipment.

Estimated costs should not only focus on the initial cost of the GHG-reducing technology or project. In accordance with SB 1477 § 1, projects are to receive incentives only if they result in utility bill savings for the building occupant.[38] More clearly, estimated costs and benefits must reflect expected bill savings. Therefore, the information package must provide accurate cost information to help customers make informed decisions. Lastly, technologies or projects that are unable to reduce GHG emissions should be ineligible to receive incentives. That said, since it is also the intent of SB 1477 to help market transformation of new or emerging technologies, all technologies should be evaluated for GHG reductions prior to their participation in the program(s). SoCalGas believes that accurate information should be the priority of this program for all customers, not only those impacted by catastrophic events. Therefore, a Decarbonization Information Package with energy options, illustration of cost and benefit impacts, and associated GHG reductions is a necessary tool for evaluating participating technologies.

[36] R.18-12-005 at 2.
[37] Along with its "Green Tariff" Application, A.19-02-015, seeking authority to allow customers the option to purchase RG, SoCalGas filed over 30 letters of support from the business community. These letters demonstrate the curiosity of consumers to know their options and exercise choice in their consumption of energy.
[38] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB1477

III. CONCLUSION

SoCalGas is committed to do its part to advance the State's climate goals while prioritizing the reliability and resiliency of our energy, affordability and choice for consumers. We look forward to participating in this proceeding.

Respectfully submitted on behalf of SoCalGas,

By: ***/s/ Avisha A. Patel***
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March 11, 2019

ATTACHMENT 2
CPUC Building Decarbonization OIR Reply Comments

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking Regarding Building Decarbonization.	Rulemaking 19-01-011 (Filed on January 31, 2019)

REPLY COMMENTS OF SOUTHERN CALIFORNIA GAS COMPANY (U 904 G) ON ORDER INSTITUTING RULEMAKING REGARDING BUILDING DECARBONIZATION

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March 26, 2019

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking Regarding Building Decarbonization.	Rulemaking 19-01-011 (Filed on January 31, 2019)

REPLY COMMENTS OF SOUTHERN CALIFORNIA GAS COMPANY (U 904 G) ON ORDER INSTITUTING RULEMAKING REGARDING BUILDING DECARBONIZATION

Pursuant to the Order Instituting Rulemaking Regarding Building Decarbonization filed by the California Public Utilities Commission (Commission), Southern California Gas Company (SoCalGas) hereby submits its reply comments on the Order Instituting Rulemaking (OIR).

I. INTRODUCTION AND SUMMARY OF KEY COMMENTS

SoCalGas supports a building decarbonization strategy that allows the State to maintain a diverse portfolio of energy options. Californians currently rely on a balanced energy system that is reliable, resilient, and strives to remain affordable while providing consumer choice. SoCalGas encourages the Commission and parties to support an integrated and holistic approach to reducing greenhouse gas (GHG) emissions in the building sector to promote and sustain these values currently embodied in California's energy portfolio. While it may be easy to fixate on a one-track approach, such as electrifying end uses, California should support an inclusive energy strategy that objectively considers all options and encourages current and future innovation to achieve and sustain GHG emissions reductions in the long run. Building decarbonization solutions should be practical in terms of cost and adoption to effectuate consumer acceptance, and furthermore create a framework that is scalable and exportable.

II. BALANCED AND CLEAN ENERGY SOLUTIONS FOR THE FUTURE

California's energy policy goals are focused on emissions reductions to achieve climate stabilization. The long-term goal is total, economy-wide carbon neutrality by 2045.[1] California's

[1] Executive Order B-55-18, a*vailable at:*

goal for buildings is to reduce GHG emissions from the State's residential and commercial building stock by at least 40% by 2030.[2] The method to attain this goal is not, however, a mandated single solution, such as building electrification. To achieve our State's GHG emissions reduction goals, SoCalGas agrees with the many parties advocating that the Commission develop rules, policies, and procedures that consider a balanced, multifaceted approach that will ensure Californians have access to clean, safe, reliable, and affordable energy well beyond 2045.

Southwest Gas notes that "a balanced mix of energy solutions promotes energy certainty, innovation, leveraging of energy markets, and customer choice."[3] The Coalition for Renewable Natural Gas (RNG Coalition) points out that "[Renewable Natural Gas (RNG)], by virtue of the fact that it can be stored over long time periods and dispatched, makes it a complementary and necessary resource, especially when paired with other forms of renewable power derived from intermittent resources. A truly diverse energy portfolio of decarbonization technologies should include and take advantage of the environmental and economic benefits associated with increased utilization of RNG."[4] The California Public Advocates Office (Cal PA) agrees:

> [A]nother pathway to achieve building decarbonization is through the expansion of the supply of renewable natural gas to meet part of building gas demand. Results from a study commissioned by the [California Energy Commission] CEC, *Deep Decarbonization in a High Renewables Future*, indicate that achieving a 100 percent zero-carbon generation mix is cost prohibitive without reliance on nuclear, carbon capture and sequestration (CCS), low cost abundant biofuels, or new forms of low-cost long duration energy storage…. Given the findings from these studies, the Public Advocates Office recommends that the Commission examine the potential of renewable gas as part of building decarbonization strategy to meet the State's GHG emissions reduction goals.[5]

In this proceeding, the Commission's primary objective must be to examine all options to achieve the State's climate goals and factor in other relevant priorities, including energy reliability and resiliency, affordability, and consumer choice.

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https://www.gov.ca.gov/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf

[2] Assembly Bill 3232, *available at*: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB3232

[3] Southwest Gas' Opening Comments at 5.

[4] RNG Coalition's Opening Comments at 6.

[5] Cal PA's Opening Comments at 12-13.

III. A DIVERSE PORTFOLIO OF SOLUTIONS BEST ACHIEVES SHORT- AND LONG-TERM CLIMATE GOALS

Southern California Edison (SCE) references their Clean Power and Electrification Pathway as a "blueprint for California to reduce GHG emissions" by electrifying roughly one-third of space- and water-heating in buildings by 2030.[6] SoCalGas believes SCE's proposal jeopardizes reliability and resiliency, usurps customer choice, and imposes unnecessary costs.[7] The Commission's goal in this proceeding should be to maintain an inclusive approach to lower the carbon intensity of buildings—one that is technology neutral, welcomes all ideas, considers all forms of energy, prioritizes the reliability and resiliency of California's energy portfolio, encourages and allows for current and future innovation, and factors in the cost and affordability of energy. This includes thinking more broadly about other forms of renewable energy, such as renewable gas (RG), which comprises renewable natural gas (RNG), syngas derived from the gasification of forest and agricultural waste, and hydrogen.

RG is a clear and practical choice to help California achieve the goals of Senate Bill (SB) 1383 because it addresses more than 80 percent of California's methane emissions, which come from agriculture, dairies, landfills and waste water.[8] We can capture those emissions (preventing them from going into our atmosphere) and convert them to RG to heat our homes and cook our food. SoCalGas recently announced our vision to be the cleanest natural gas utility in North America. We are taking a bold step to help address fugitive methane emissions from the waste and agriculture sector by planning to replace 20 percent of our traditional natural gas supply with RNG by 2030.[9] In order to leverage and increase the benefits of these efforts, the Commission should examine the potential of RNG as part of the building decarbonization strategy to meet the State's GHG emissions reduction goals. Switching out the fuel we use in buildings with a renewable option, rather than switching out infrastructure, results in less disruption to ratepayers and "assures Californians' access

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[6] SCE's Opening Comments at 6.

[7] Additionally, electrification is not a solution to addressing other building emissions. As Energy Solutions noted in their opening comments, "The scope of building decarbonization should include the full set of building emissions that are feasible to account for" and that includes "all on-site fugitive emissions from refrigerants..." Energy Solutions' Opening Comments at 4.

[8] See 2016 Methane Emissions, *California Greenhouse Gas Emission Inventory - 2018*, California Air Resources Board (CARB), *available at:* https://www.arb.ca.gov/cc/inventory/data/data.htm

[9] See *SoCalGas Announces Vision to Be Cleanest Natural Gas Utility in North America*, SoCalGas (March 6, 2019), *available at:* https://www.socalgas.com/energy-vision

to safe and reliable utility infrastructure and services" in accordance with the Commission's mission.[10] A number of other parties to this proceeding, including Cal PA,[11] the California Hydrogen Business Council (CHBC),[12] the Environmental Defense Fund (EDF),[13] Pacific Gas and Electric Company (PG&E),[14] and Southwest Gas,[15] also support exploring the potential of renewable fuels like RNG or hydrogen to assist us in reducing our reliance on fossil-based natural gas and achieve the State's climate goals.

Consumers want choice. SoCalGas not only wants to preserve that choice, but also wants to offer their customers the option to purchase RNG as part of their natural gas service. SoCalGas agrees with EDF that the Commission should broadly consider how its building decarbonization efforts may coordinate with voluntary tariff offerings. In fact, SoCalGas has already sought authority to offer a voluntary RNG tariff to customers beginning in 2020.[16] SoCalGas also agrees with EDF that building decarbonization through fuel substitution, such as the addition of RNG and hydrogen, should be explicitly included within the scope of this proceeding.[17] Retaining existing gas equipment and replacing traditional gas with carbon-neutral renewable gas is a more cost-effective option in the long run for many customers and has the added benefit of not requiring any change on their part.

Additionally, SoCalGas supports the production and use of hydrogen in California. Hydrogen as an energy source has favorable emissions characteristics because it does not contain carbon or produce carbon dioxide (CO_2) when it is consumed. Hydrogen energy and storage technologies from renewable sources can play a critical role in supporting California's grid reliability and the integration of increasing levels of renewable energy onto the regional electric grid, thereby assisting to meet California's ambitious GHG emissions goals. Power-to-Gas (P2G) technology is a way to store energy through renewable hydrogen produced from renewable electricity using a process known as electrolysis. This green electrolytic hydrogen is a carbon-free

[10] See the CPUC Mission Statement, *available at* http://www.cpuc.ca.gov/general.aspx?id=1034
[11] Cal PA's Opening Comments at 2.
[12] CHBC's Opening Comments at 3-4.
[13] EDF's Opening Comments at 13 ("The Commission should consider the role of biomethane, hydrogen, or other alternatives to fossil gas when electrification is not technically or economically feasible...") *Id*.
[14] PG&E's Opening Comments at 8-10.
[15] Southwest Gas' Opening Comments at 5.
[16] Green Tariff Application (A).19-02-015.
[17] EDF's Opening Comments at 4.

source of energy that can be used to decarbonize multiple sectors of the economy, including power generation, energy storage, transportation, and residential and commercial heating. P2G technology has the potential to address system reliability challenges that the California Independent System Operator (CAISO) faces with the large-scale integration of solar photovoltaic (PV) generation on the electric grid (also known as the "duck curve").[18] The rapid rise of solar and wind generation has created challenges with managing the electric grid. Solar and wind production frequently exceeds electrical demand, and there is limited ability to store this surplus energy optimally.[19] In the absence of a comprehensive energy storage solution, CAISO curtails these renewable sources, resulting in missed opportunities to utilize these valuable renewable energy resources. P2G prevents curtailment of high penetrations of variable renewable generation by making use of surplus renewable electricity, which otherwise would be wasted, by storing it for later use as needed in any of several applications. Battery technology offers storage solutions measured in hours, whereas hydrogen storage of electricity is measured in years. As California is faced with an increasingly urgent need to deploy utility-scale energy storage solutions to support intermittent renewable power generation, P2G must be evaluated rigorously for its potential to serve as a large-scale storage option and for its potential to help decarbonize the fuel we use in buildings via hydrogen-blending.

With the appropriate regulatory, technical and financial frameworks, California can scale up the production of RG to achieve the State's GHG emissions reduction goals. Just as government investment and financial incentives helped drive down the price of solar PV and wind generation, this proceeding could be a catalyst for stimulating investments in RG feedstocks and hydrogen production technologies which could drive down the costs of RG production.

As noted by RNG Coalition in opening comments, "[c]apture and conversion of methane from society's waste streams and redeeming it for productive end-use epitomizes sustainability."[20] Resource sufficiency is not an issue. According to a UC Davis research report, almost 100 billion cubic feet per year (Bcf/y) of anaerobically digested RNG is available in California today.[21] If the

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[18] See *Fast Facts: What the duck curve tells us about managing a green grid*, California ISO, *available at:* https://www.caiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf

[19] See *Impacts of Renewable Energy on Grid Operations,* California Independent System Operator (May 2017) at 1, *available at:* https://www.caiso.com/Documents/CurtailmentFastFacts.pdf

[20] RNG Coalition's Opening Comments at 7.

[21] See *The Feasibility of Renewable Natural Gas as a Large-Scale, Low Carbon Substitute,* UC Davis Institute of Transportation Studies (June 2016) at ix, *available at*: https://steps.ucdavis.edu/wp-content/uploads/2017/05/2016-UCD-ITS-RR-16-20.pdf

State wants to consider gasification of dead trees and agricultural by-products, that in-state RNG availability assessment could increase by another 100 Bcf/y[22] to 200 Bcf/y. If we consider out-of-state supplies, there could be another 1 trillion cubic feet per year (Tcf/y) available.[23] With both in-state and out-of-state supplies, gas corporations could achieve the projected statewide core procurement load of 540 Bcf by 2030;[24] this does not even count hydrogen produced from electrolysis, steam-methane reformation of biomethane, or traditional natural gas using carbon capture and utilization[25]—all of which can help the State achieve carbon neutrality by 2045.

Utilization of these in-state and out-of-state RG feedstocks is the most practical way to help the State achieve its GHG emissions reduction goals and decarbonize the fuel we use in buildings. The Commission should consider developing policies in this OIR that will further advance the deployment and adoption of diverse renewable energy solutions that will continue to provide Californians reliable, resilient, and clean energy beyond 2045. The Commission's actions in this proceeding will influence the energy supply of the future; therefore, we ask the Commission to make sound, sensible decisions that would not break the promise of hydrogen as a fuel of the future and expand the use of RG to address methane emissions from the agriculture and waste sectors, and the 140 million dead trees in our forests.[26] As noted by the National Fuel Cell Research Center (NFCRC), "[t]he development of the renewable gas market is an important goal to enable the broadest future [for] building decarbonization, while addressing the limits of lithium-ion [i.e., battery] technology. The Guiding Principle of Market Transformation can only be achieved ultimately [by] investing in renewable gas sources."[27]

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[22] See Philip Sheehy and Jeff Rosenfeld, *Design Principles for a Renewable Gas Standard*, ICF (2017) at 8, *available at:* https://www.icf.com/-/media/files/icf/white-paper/2017/icf_whitepaper_design_principles.pdf

[23] *Id*. at 10.

[24] See *2018 California Gas Report*, California Gas and Electric Utilities at 18, *available at:* https://www.socalgas.com/regulatory/documents/cgr/2018_California_Gas_Report.pdf (297 Bcf/y for SoCalGas and 243 Bcf/y for PG&E in 2030).

[25] See *Next Generation Black Carbon Production*, Monolith, *available at:* https://monolithmaterials.com/innovative-technology/

[26] See Umair Irfan, *California Has 149 Million Dead Trees Ready to Ignite like a Matchbox*, Vox (February 15, 2019), *available at:* https://www.vox.com/2019/2/13/18221822/california-149-million-dead-trees-wildfire

[27] NFCRC's Opening Comments at 10.

IV. MAXIMIZING BENEFITS FROM EXISTING INFRASTRUCTURE PROMOTES AFFORDABILITY

SoCalGas owns and operates an integrated gas transmission system consisting of pipeline and storage facilities. Using our network of transmission pipelines and four interconnected storage fields, we deliver natural gas to nearly 6 million residential and business customers. The gas transmission system extends from the Colorado River on the east of SoCalGas' approximately 20,000-square mile service territory to the Pacific Coast on the west, and from Tulare County to the north to the United States/Mexico border to the south, supporting over 21 million consumers in southern California. The existing natural gas transmission and distribution infrastructure can be used to transport RG safely and reliably. Leveraging current natural gas infrastructure has the added benefit of promoting economic development and energy reliability in California by supporting the development of new renewable energy sources.

Pursuing electrification-only policies could result in unintended economic consequences. If the amount of gas we deliver through our pipes declines, the fixed costs associated with maintaining and operating our system would be spread over fewer customers and could result in higher rates for customers who continue to use gas. This concern was raised by numerous parties in opening comments, including PG&E[28] and the Coalition of California Utility Employees (CUE).[29] CUE detailed some of the "unintended consequences," such as fewer gas customers paying for existing required infrastructure. CUE also notes two problems: (1) a "smaller pool of customers will have to foot the whole cost by paying more … [which] will adversely impact millions of homes and businesses that depend on gas for space heating, water heating and cooking," and (2) "[t]he revenue won't be enough to cover the costs to pay workers to maintain the system."[30] For this reason, CUE cautions that the Commission "must conduct a robust analysis of impacts from building decarbonization on existing natural gas infrastructure safety, maintenance and maintenance costs, energy reliability, impacts on rates, impacts of higher prices on consumers and industry, and impacts on workers."[31] We concur with these parties on this point.

There may be other consequences to forcing a single solution, especially if it is not adopted by customers. For example, if new mandates are issued and natural gas-fueled appliances are no

[28] PG&E's Opening Comments at 9-10.
[29] CUE's Opening Comments at 2-5.
[30] *Id*. at 3.
[31] *Id*. at 2.

longer available for purchase in California, customers could find simple workarounds, e.g., driving to a neighboring state or repairing the appliance so they can continue to use natural gas to cook their food and heat their home. Similarly, penalties for having natural gas appliances (either actual or *de facto* penalties by way of electric incentives) and limited natural gas distribution service could cause home value/pricing issues when two classes of homes are effectively created (i.e., those with gas, and those without). The State is readily aware of the difficulty in decommissioning or retiring energy assets (e.g., a single nuclear plant). The widescale decommissioning of all the natural gas assets (and their related in-home counterparts) could have an undiscernible effect. Even more, customers would have to pay to decommission a well-functioning, reliable, and affordable energy delivery system while also paying the additional electric transmission and distribution costs that building electrification will add to already-high electric rates.

The National Resources Defense Council (NRDC), Sierra Club, CHBC, and others express concern about stranded investments in the gas system and making unproductive investments that may not ultimately help the State meet its climate goals.[32] However, their singular focus on electrification is a greater risk to the achievement of the State's climate goals because it fails to address crucial questions about energy storage and ignores the role existing assets can play in providing such storage while preserving reliability, resiliency, affordability, and consumer choice.

Ultimately the Commission is tasked with exploring all strategies that support a cost-effective, equitable and viable clean energy future. The Commission should adopt policies that protect customers, not burden them. The question of who should pay for "stranded" gas assets can be avoided by shifting our mindset to consider ways we can continue to utilize the existing pipeline system to deliver renewable energy (such as RG). This is a proposal the Commission must explore in this proceeding.

V. SUSTAINABILITY REQUIRES CONSUMER ADOPTION, WHICH IN TURN REQUIRES CHOICE AND AFFORDABILITY

Without consumer adoption, building decarbonization policies cannot succeed. Homeowners, apartment owners and developers are crucial to a successful program focused on reducing GHG emissions from residential buildings. The Commission should give serious consideration to both the direct and indirect effects of its new policies on the single largest investment people will make over their lifetime (i.e., their home). Customers should have cost-effective options and must be able to

[32] NRDC/Sierra Club's Opening Comments at 4-5 and CHBC's Opening Comments at 7.

choose which technologies or fuels provide the best solutions for their family. Southwest Gas correctly notes the importance that "solutions ultimately adopted to help accomplish the State's goals toward carbon neutrality are effective, adoptable, scalable, and affordable, while also promoting and maintaining energy reliability, resiliency and consumer choice."[33] The Wild Tree Foundation correctly points out that California "emits only a small fraction of global GHG emissions;" thus, for a building decarbonization program to be meaningful, it must be a model that can be exported and "replicated around the country and the world."[34] The Association of Bay Area Governments on behalf of BayREN agrees: "New technologies should be evaluated based on their ability to maximize reductions in greenhouse gas emissions *and the scalability of the technology.*"[35]

Palo Alto's heat pump incentive program is a good example of how difficult it can be to get people to adopt new technologies. The City of Palo Alto "has offered a rebate of up to $1500 per heat pump water heater since mid-2016. Since the program launch, the uptake rate of this rebate is at about 0.1 % per year among single family homes."[36] Even a city with one of the highest median home-sale prices in the nation and home to a large number of forward-thinking technology companies, including Hewlett Packard, Tesla, Apple, Facebook and PayPal, has been challenged by consumer adoption. If the City of Palo Alto had instead used this incentive money on RNG, they could have decarbonized 3,750 homes for one year. The point is simple: there is more than one way to achieve building decarbonization. Several commenting parties note the pitfalls of complex regulatory schemes and subsidizing markets, but these characterizations do not make sense.[37]

RG not only can be a carbon negative fuel; it also has the distinct advantage of providing climate stabilization benefits without requiring consumer adoption of new appliances or costly home conversions. Consumers can keep their appliances of choice and would not be forced to adopt technologies that are not sensible for their homes or families. Building decarbonization using RG is a win-win for both homeowners and the State. As one party notes in comments, "[i]f RNG and other viable technologies are provided a level playing field on which to participate and compete, the

[33] Southwest Gas' Opening Comments at 2.
[34] Wild Tree's Opening Comments at 3.
[35] BayREN's Opening Comments at 6 [emphasis added].
[36] City of Palo Alto's Opening Comments at 4.
[37] CHBC's Opening Comments at 3.

overarching program will *minimize consumer costs* and ensure the most optimal path toward achieving the State's greenhouse gas reduction goals."[38]

Several other parties recognize the vital role cost and affordability play in sustainability and fairness. The County of Los Angeles, on behalf of the Southern California Regional Energy Network (SoCalREN), explains that another guiding principle in this case should include "cost impacts" for any new rules or policies that may significantly impact customers within disadvantaged communities or low-to-moderate income households.[39] SoCalREN emphasizes the need to be mindful of "any undue cost burdens that these new policies, rules and procedures may place among those most underserved."[40] The California Housing Partnership points out that "[a]ffordable housing property owners also have limited resources available at their disposal to install measures that don't bring in high savings."[41]

Another critical component to sustainability is that the solutions reached in this proceeding must guarantee resiliency and reliability because energy is required every minute of every day. Reliability and resiliency must not be compromised in State energy planning efforts. The NFCRC notes that "[r]esiliency and reliability should be simultaneously achieved by introducing new technologies for building decarbonization."[42] Citing the 2019 IEPR Update Scoping Order, NFCRC notes there are "differing vulnerabilities to the natural gas and electricity sectors" and "flexible and adaptive strategies to increase the state's resilience to multiple stressors from climate change on the energy system, with particular attention to vulnerable populations."[43]

VI. DIFFERENT PROGRAM ADMINISTRATORS ARE REQUIRED FOR DIFFERENT PROGRAMS

Multiple parties offer suggestions for third-party administrators, and SCE suggests that an electric IOU would be appropriate. As part of its evaluation, the Commission should take into consideration the success and/or failures of the numerous programs and/or projects managed by different entities. The primary focus on selecting the appropriate program administrator should be to safeguard ratepayer investments and ensure programs are designed, implemented, and administered

[38] RNG Coalition's Opening Comments at 8 [emphasis added].
[39] SoCalREN's Opening Comments at 2.
[40] *Id*. at 3.
[41] California Housing Partnership's Opening Comments at 6.
[42] NFCRC's Opening Comments at 9.
[43] *Id.* at 9-10, citing *2019 Draft Scoping Order for the 2019 Integrated Energy Policy Report*, California Energy Commission, (February 14, 2019) at 4.

to the best interest of ratepayers and the State's climate goals. At minimum, the program administrator should be a reputable entity subject to the CPUC's Rules of Practice and Procedure.

SoCalGas believes the BUILD program is best suited to be administered locally, while the TECH program may benefit from a single statewide administrator. Home builders and developers, who are the intended recipients of the incentives provided by the BUILD program, largely operate on a regional basis, which enables coordination with municipal planning departments, local utilities, and local agencies. They also are adept at working with utility planning departments for meter sets and line extensions as well as energy efficiency programs which promote more efficient home design and zero net energy buildings. For the BUILD program to be successful, it must leverage existing utility energy efficiency programs at the local level to magnify the available incentives and amplify the energy savings and emissions reductions.

The TECH program has a different target, primarily the identification of barriers for high-efficient technology adoption and working with manufacturers and retailers to overcome these barriers. This program may be more suitable as a statewide approach; however, coordination with local utility energy efficiency programs will still be critical for successful implementation of the program. In this regard, SoCalGas agrees with Southwest Gas that the individual utilities are best positioned to administer the BUILD and TECH programs prescribed in SB1477. Southwest Gas notes that it is most familiar with its customers, procedures and existing programs, and is best situated to administer the new programs most effectively within its own service territory. The same holds true for SoCalGas and the other funding gas corporations.

Cal PA errs in its assessment of the intent of the SB1477 program. Cal PA states that "[t]he programs should not be administered by a gas corporation because of the inherent conflicts of interest in programs designed to switch customers away from using natural gas." This assumes SB1477 is about switching customers away from natural gas, which it is not. The intent of SB1477 is to focus on incentivizing technologies that are more efficient than those that are currently contained in Title 24, Part 6 building efficiency standards. This includes gas, electricity, propane, and other fuels. The narrow view that this is a program intended to switch building technologies from natural gas to electric is not only incorrect, but such a singular view could prevent California from achieving its emissions reduction goals. Instead, the Commission should look to implement a fuel-neutral program that focuses on multiple energy sources and technologies covered by the legislation to improve energy efficiency and reduce GHG emissions. Other parties have the right

approach. The California Municipal Utilities Association (CMUA) requests that "the Commission promote a broad and inclusive approach to evaluating technology opportunities."[44] Only a broad approach will establish a framework by which California will achieve its ambitious goals in a thoughtful and cost-effective manner. Furthermore, the Commission should be mindful of the source of these funds, namely natural gas ratepayers, and pursue a program that conforms to the long-standing practice that gas ratepayers receive the benefits of the programs they are funding.

Cal PA's contention regarding a conflict of interest is an unsupported generalization. SoCalGas supports California's efforts to decarbonize its energy system. This should be done in a thoughtful, cost-effective manner that provides all Californians an energy system that is resilient, reliable, and provides affordable energy options for customers. Cal PA seems to presume that an electric utility would have no conflict of interest in this matter; however, an electric utility could utilize Cal PA's narrow view of SB1477 as an opportunity to build electric load, not taking into account overall GHG reductions, nor mindful of the ramifications of increased energy costs for customers, nor considering the potential negative consequences of an energy system that lacks resiliency.

SCE appropriately acknowledges the $200 million allocated to the BUILD and TECH programs over the implementation period is a first step in the funding needed to improve California's clean energy infrastructure. While SCE notes its accomplishments in its opening comments on successfully running Commission-approved programs, SoCalGas has implemented programs through partnerships that have been critical to their success. The ability to partner with stakeholders, local governments, electric utilities, water agencies, air quality districts, and numerous other entities will increase the likelihood of the success of these programs. As noted in opening comments, SoCalGas has been nationally recognized for its ability to bring together like-minded partners to leverage additional funding and magnify the effects of incentive programs and services for customers. The Commission will need that ability to ensure success in these programs. The Commission can rely on SoCalGas' commitment to bringing these full resources to bear in this effort.

[44] CMUA's Opening Comments at 2.

VII. FUEL AND TECHNOLOGY NEUTRALITY IS CRITICAL FOR CALIFORNIA'S ENERGY POLICY

SoCalGas agrees with EDF that the Commission should broadly consider how its building decarbonization efforts may coordinate with voluntary tariff offerings. SoCalGas has already sought authority to offer a voluntary RNG tariff to customers beginning in 2020.[45] SoCalGas also agrees with EDF that building decarbonization through fuel substitution, such as the addition of RG, should be explicitly included within the scope of this proceeding[46] because retaining existing gas equipment and replacing traditional gas with carbon-neutral renewable gas is a more cost-effective option in the long run for many customers and has the added benefit of not requiring any change on their part.

Other parties also recognize the importance of a technology-neutral approach. The NFCRC notes that "[l]imiting the program focus only on certain technologies could limit program effectiveness in reducing GHG emissions."[47] NFCRC cites research by the University of California, Irvine that electric heat pumps may actually *increase* GHG emissions.[48] Along the same lines, SoCalGas agrees with NFCRC's point that "[f]uel cells decarbonize buildings and do so while providing always-on reliable power," which is critical for vital industries like healthcare providers, data centers, and advanced manufacturing.[49] Comments provided by the California Efficiency and Demand Management Council (Council) note the goal of this proceeding should be to "lay the groundwork for a thriving marketplace of new technologies, appliances, and strategies that industry can implement to achieve the Commission's and state's long-term [] emissions goals."[50]

VIII. OTHER CONSIDERATIONS

A. The cost to ratepayers matters and must guide the Commission in this proceeding

While the BayREN advocates that metrics should diminish the importance of costs and instead focus on GHG reduction potential,[51] this is not a fair proposal for many Californians. Over a third of SoCalGas' customers qualify for California Alternate Rates for Energy (CARE), which provides a 20% rate discount for eligible customers. For these customers, cost matters and the Commission must ensure customers have carbon-neutral options that do not require appliance

[45] Green Tariff Application A.19-02-015.
[46] EDF's Opening Comments at 4.
[47] NFCRC's Opening Comments at 4.
[48] *Id*.
[49] *Id.* at 7.
[50] Council's Opening Comments at 7.
[51] BayREN's Opening Comments at 6-8.

replacement and expensive panel and wiring upgrades. In the case of renters or non-owners who also pay utility bills, the Commission must carefully consider the consequences of policies that involve, either directly or indirectly, the transfer of funds from one customer group to another that could result in disproportionate economic impacts.

NFCRC explicitly notes, and it is self-evident, that "[d]ecarbonization is not synonymous with electrification."[52] Nevertheless, some parties focus on electrification as the exclusive method for decarbonization without even acknowledging the important role carbon-neutral RG can play in decarbonizing buildings. Similarly, while some parties discuss the importance of prioritizing incentives for low-income and disadvantaged communities, they do not address the issue of unintended consequences from an equity, jobs, consumer prices and energy affordability perspective. CUE's comments address this issue in a manner that the Commission should carefully consider in order to avoid negative impacts on housing costs and jobs: decarbonization policies should not replace good middle-class jobs with poverty-wage, dead-end jobs.[53]

SoCalGas agrees with NRDC and Sierra Club that, as a guiding principle to ensure fair competition among technologies, strategies should be identified in this proceeding that will *most economically* reduce GHG emissions in line with the statewide goal of achieving carbon neutrality by 2045. This includes the need for large amounts of electricity storage in a renewable electricity scenario and the singular role that the natural gas pipeline system can play in providing long-term storage at the terra-watt level. The existing gas infrastructure, in which we have already invested significant resources, is a great resource for fully realizing renewable and carbon-neutral energy initiatives. The current system can transmit and distribute RG without costly upgrades.

B. Despite some parties' statements, there is no current consensus on how to solve GHG in California

In opening comments, NRDC and Sierra Club reference the CEC's 2018 Integrated Energy Policy Report (IEPR) Update, which identifies building decarbonization as the next clean energy policy priority for California to achieve its climate goals. NRDC and Sierra Club note "[t]he IEPR concludes that due to the availability of 'off-the-shelf, highly efficient electric technologies (such as heat pumps) and the continued reduction of emission intensities in the electricity sector,' there is 'a

[52] NFCRC's Opening Comments at 6.
[53] CUE's Opening Comments at 5.

growing consensus that building electrification is the most viable and predictable path to zero-emission buildings.'"[54] SoCalGas respectfully disagrees. It is unclear how "consensus" has been measured and, moreover, it is inconsistent with feedback received from natural gas-users.[55] The Commission should not be swayed by the broad recommendation made by the CEC and should make policy decisions that are based on science and are analyzed and vetted for cost and economic impact before they are adopted.

IX. CONCLUSION

SoCalGas encourages the Commission to explore all options to achieve the State's climate change goals while prioritizing the reliability and resiliency of our energy, affordability, and consumer choice. The policies determined in this proceeding will likely create a blueprint for California's energy future and influence GHG emissions reduction policies adopted across the country and around the world; thus, every viable option must be examined before determining the best path forward. We look forward to participating in this proceeding.

Respectfully submitted on behalf of SoCalGas,

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[54] NRDC/Sierra Club's Opening Comments at 2.

[55] See *CBIA Announces Findings on High Cost of Electrifying Homes and Californians Preference for Natural Gas*, Press Release, California Building Industry Association, (April 23, 2018) *available at:* http://www.biabuild.com/latest-news/2018/4/24/cbia-announces-findings-on-high-cost-of-electrifying-homes-and-californians-preference-for-natural-gas

ATTACHMENT 3
SoCalGas
California's Clean Energy Future: Imagine the Possibilities

California's Clean Energy Future

Imagine the Possibilities

SoCalGas

A Sempra Energy utility

What's Inside

Introduction

California has set its boldest goal yet.

California has led the way in setting goals to reduce greenhouse gas (GHG) emissions and in getting consumers to be more energy efficient. In fact, California's energy efficiency efforts—which began in the 1970s—have been a significant factor in the state's per capita electricity use remaining relatively flat over the last 40 years.

Landmark legislation passed in 2006, known as AB 32, set into law requirements for California to reduce its GHG emissions, mandating the state reduce its GHG emissions to 1990 levels by 2020. California accomplished this goal four years ahead of schedule in large part because of investments in wind and solar technologies, aggressive energy efficiency goals, and the movement away from coal to natural gas.

In the fall of 2018, California set its sights on achieving an even more ambitious goal: carbon neutrality and 100 percent clean energy by 2045. Making this vision a reality will not be easy. As Governor Brown put it, 100 percent clean energy and carbon neutrality by 2045: "[puts] California on a path to meet the goals of Paris [Climate Accord] and beyond. It will not be easy. It will not be immediate. But it must be done."

For many, California is a test case to determine whether it's possible to drastically cut GHG emissions while still enjoying robust economic growth. It's a venture on which California is staking its leadership, and other states are watching closely to inform future policy decisions. To have any meaningful impact on global GHG emissions, California—which emits less than 1 percent of global GHG emissions—will need to develop scalable solutions that can work and are likely to be adopted by California energy consumers, as well as other regions of the country and around the world.

There is no clear path today to reach California's carbon neutral vision. The state's investment in solar and wind technologies has made them price competitive and is a proof point of renewable energy innovation. Similar policies and investments have led to advances and adoptability in battery technology. But solar, wind, and batteries alone will not get California where it wants to go.

A more inclusive approach is going to be needed—one that is technology-neutral, welcomes all ideas, considers all forms of energy, and that encourages and allows for innovation. Any energy solution will also need to factor in cost: for people to be able to work and live here and businesses to remain, California must find a way to achieve the state's ambitious climate goals that is affordable.

Such an approach requires California to think more broadly about other forms of renewable energy, such as renewable natural gas (RNG). We will also need to learn from and collaborate with others in the U.S. and abroad to advance other forms of energy, such as hydrogen, to further "decarbonize" our energy streams. These ideas, along with technology-neutral policies that allow for the advancement of nascent and future innovations, are what will be needed for California to realize its carbon-neutral vision.

SoCalGas is focused on becoming the cleanest natural gas utility in North America, and is committed to 20% RNG being delivered in our system by 2030.

California's Energy Landscape

Answering Three Fundamental Questions

California has reduced its GHG emissions by 11 percent[1] since the passage of the landmark Global Warming Solutions Act of 2006 (AB 32). These results were fueled by innovation on a number of fronts:

Energy Efficiency

The state pioneered demand response and energy efficiency as a central strategy to reduce its carbon footprint. Per capita energy use has remained flat since the 1970s due to California's energy efficiency programs. Energy use in the rest of the U.S., by contrast, has increased by about 33 percent.[2] Legislation passed in 2015, known as the Clean Energy and Pollution Reduction Act (SB 350), set California on an even more ambitious path, requiring the state to double its energy efficiency savings by 2030—a mandate equivalent to avoiding the annual electricity use of 12 million households and the natural gas consumption of more than 3 million homes.[3]

Renewable Electric Generation

The Renewable Portfolio Standard (RPS), along with the use of natural gas instead of coal as a base fuel, has helped to reduce the GHG footprint of California's electricity sector. From 2007 to 2015, California's consumption of coal-generated electric power dropped 96 percent—the steepest percentage decrease of any state.[4] Still, coal has not yet been eliminated as a source of electricity in the state. California also has reduced its use of nuclear power. The state's last operating nuclear power plant is slated to close in August 2025.

Through policies, investments and incentives, the state has built the largest solar market in the nation. Wind energy projects totaling at least 5,454 megawatts (MW) of capacity are operating in California today[5], providing enough electricity to power more than 2 million California households.[6] This represents more than a tripling of wind energy capacity since California's RPS law was adopted in 2002. Today, 20 percent of California's total in-state generation comes from solar and wind.

Natural gas has enabled the growth in renewable generation by addressing intermittency issues and ensuring a continuous power supply when renewable sources go down. For long-term reliability, most policymakers understand that natural gas will need to continue to play a role.

Transportation

The transportation sector continues to be California's biggest emissions challenge and opportunity. Since 2006, the state has reduced emissions from the sector by nearly 10 percent.[7] California introduced the Low Carbon Fuel Standard (LCFS) during the same period, establishing the most stringent fuel standards in the U.S. Despite these efforts, emissions from the transportation sector increased 2 percent from 2015 to 2016, in line with post-recession economic growth.[8]

Much of the state's strategy to reduce on-road emissions has centered on the transition to electric vehicles, but consumer adoption has been slower than anticipated. As of May 2017, only 300,000 zero emissions vehicles (ZEVs) and plug-in hybrids (PHEVs) had been sold in California.[9] Governor Brown challenged California to do more, by issuing Executive Order B-48-18. It set a target of 5 million ZEVs on California roads by 2030, supported by a network of new electric charging and hydrogen fueling stations.

On the economic front, California's Gross Domestic Product (GDP) during this same period increased by almost 16.5 percent, from $1.97 trillion to $2.3 trillion.[10] Californians, however, have not reaped all of the benefits. By a number of other important measures, quality of life in California is not keeping pace with the state's GDP: Housing prices continue to climb—with only 3 in 10 Californians able to afford a median-priced home.[11] Rent prices have increased 18 percent since 2006—with California renters paying almost 50 percent more than the U.S. median price.[12] Even with California's leading efficiency efforts, residents in the state still pay some of the highest electricity rates in the nation. In November 2018, households in the South Coast Basin paid 18.4 cents/kWh for electricity—37 percent more than the national average.[13]

Californians are also experiencing a growing chasm in income disparity, according to the U.S. Census Bureau's 2017 American Community Survey. California has the fourth highest level of income inequality in the nation and ranks second in terms of the rate in which income inequality is growing.[14]

Energy policy directly relates to many of these costs and presents state policymakers with a challenge of addressing competing (although not mutually exclusive) priorities—environmental leadership, economic growth at the macro level and the cost of living for average California families.

Extending California's Leadership

Today, the state is looking to expand its leadership—accelerating its climate goals by mandating emissions reductions to 40 percent below 1990 levels by 2030 (SB 32), committing to achieve 100 percent clean energy by 2045 (SB 100) and aspiring to achieve economy-wide carbon neutrality in the same timeframe (Executive Order B-55-18).

For many, California is a test case for the rest of the country—an experiment to determine whether it's possible to drastically cut GHG emissions while still enjoying robust economic growth. It's a venture on which California is staking its leadership, and other states are watching closely to inform their future policy decisions

Success will depend on addressing three fundamental challenges to expanding the state's use of renewable energy:

01 How will we store it? Addressing intermittency

The solution to California's renewable future is not as simple as generating more solar and wind power and adding them to the grid. Wind and solar are intermittent forms of energy—they do not provide a reliable, continuous power supply—and, most importantly, the power they generate is not always available when people need it most.

In fact, California today produces excess wind and solar power that cannot be used. To avoid overloading the grid, California either pays other states to take the excess renewable electricity or curtails production—exactly when wind and solar are most available. California is wasting a lot of energy. The California Independent System Operator (CAISO), which is responsible for managing the state's electricity grid, reported curtailments of the state's solar and wind generation more than doubled from 2015 to 2017.[15]

This energy waste is expected to grow: CAISO estimates that by 2025, California will be wasting between 3,300 to 7,800 GWh/year generated by solar and wind due to storage constraints. That equates to 4 percent to 11 percent of all the electricity used in Los Angeles County every year.[16] Put in another context, that's enough energy to power L.A. County for more than a month.

As the RPS requirement climbs to 50 percent and above, these curtailments are likely to increase even more sharply. Renewable storage is the foundation of our 2045 goal to source all of the state's electricity from renewable sources. Batteries, while a part of the solution, cannot solve the intermittency challenge alone. Batteries only hold and discharge energy for short periods (four to six hours).

To achieve dramatic GHG reductions, we must dramatically shift our thinking and foster an environment that fuels breakthrough innovation.

02 How will we pay for it? Addressing affordability

Expanding renewable energy in any form will be more expensive than relying solely on traditional energy sources. California will need to make smart decisions so that the pursuit of the state's climate goals does not undermine efforts to address another important priority—namely, affordable living.

The real cost of living is already too high for too many Californians. According to The United Way's 2018 *The Real Cost of Living Report*, nearly 40 percent of California households are rent burdened and spend more than 30 percent of their income on housing. After housing, utility bills are Californians' next biggest financial concern. This is particularly an issue for low-income families, who spend 20 percent or more of their monthly income on energy costs.[17]

It is true that the state's investments in the wind and solar markets have driven down the costs of wind turbines and solar panels. Between 2009 and 2017, the price of solar panels per watt declined by 75 percent[18] while the price of wind turbines per watt declined by 50 percent.[19] That, however, has not equated to lower electricity costs: During roughly that same period, the price of electricity in California increased 24 percent.[20]

California is not an anomaly. The price of electricity soared in other places where significant quantities of renewables were deployed—a 51 percent increase in Germany during its expansion of solar and wind energy from 2006 to 2016;[21] and more than a 100 percent price jump in Denmark since it began deploying renewables (mostly wind) in 1995.[22]

A large portion of the future cost challenge ties back to storage. A recent Black & Veatch analysis, found that without gas-fired generation or significant curtailment, achieving 100 percent renewable electricity in California will require about 25,000 GWh of capacity to store energy for weeks or months. Current technologies are not able to store energy for extended periods at this scale. The cost of battery storage in California will likely be very high—$2.5 trillion by one estimate.

California for All

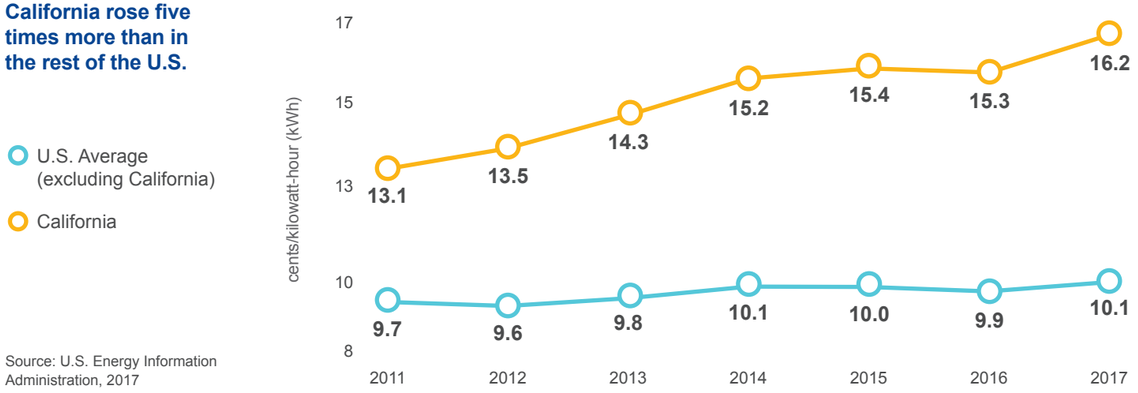
Enacting energy policy that works for every Californian.

California's high cost of living is the most important issue facing the state, according to a public poll conducted by the University of Southern California's (USC) Dornsife Center for Economic and Social Research and the Los Angeles Times.[23] It is also one of the primary reasons people are leaving the state.[24] The state's GDP growth paints a picture of financial stability, however, it presents a misleading view. Today, many Californians are struggling to make ends meet—escalating costs for housing, healthcare, education, utilities and food are making it difficult for them to cover the costs of their most basic needs.

As California's leaders look to the future and set policy to reach the 2045 climate goals, it is critical to look beyond the limited economic indicator of GDP and consider affordability as a key factor in policy decisions. For Californians on a fixed income, an increase in a monthly utility bill could literally put them out of house and home.

Achievement of the state's environmental goals should not come at the price of deepening the state's affordability crisis and widening income disparity levels. Developing a clean, renewable and affordable energy system should guide California's policies to meet the 2045 climate goals. If California is an unaffordable place to live, we not only burden our residents, but we are limiting our future and our ability to keep the California dream alive.

Electricity prices in California rose five times more than in the rest of the U.S.



Source: U.S. Energy Information Administration, 2017

> **These aren't merely policy problems, they are moral imperatives. And so long as they persist, each and every one of us is diminished."**
>
> **Gavin Newsom,**
>
> Inaugural Address; January 7, 2019

California's Affordability Crisis: Why Energy Policy Cannot Be Addressed in a Vacuum

1/3 of California households can't pay for their basic needs[25]

In 2016, health spending grew 1.5 percentage points **faster** than the economy[33]

People spent **12% more** on health-related costs in 2018 than 2016[34]

Health spending is projected to grow at a rate of **5.5% per year** from 2017-2026[35]

On a given night, **130,000** Californians are homeless[36]

California accounts for **25%** of the entire nation's homeless population[37]

Since 2016, California experienced a **larger increase** in homelessness than any other state[38]

California has the **highest** effective poverty rate in the nation[32]

Nearly **40%** of California households are rent burdened[26]

75% of Californians cannot afford to buy a typical home in Los Angeles County[27]

1 in 5 Californians pay **more than half** of their income on housing[28]

It fluctuates, but Californians pay up to **45%** more for their electricity than other states[29]

Low-income families spend **20%** of their income or more on energy costs[30]

Californians pay the **2nd-highest** gasoline prices in the nation.[31]

With a path to 2030 in sight, the road to California's 2045 goals is less clear. The total expense of reaching the 2045 target, as well as the full implications to California's consumers, is unknown. What is certain is that the decisions California makes today will have far-reaching consequences across many facets of Californians' daily lives. Success will depend on remaining open to all technologies and resources that can help create a realistic and affordable path to carbon neutrality.

03 How will we get people to adopt it? Addressing consumer behavior

To meet the 2045 goals, California must change consumer thinking and behavior to increase energy conservation, shift energy use to different times of the day and embrace clean vehicles.

To date, California's Clean Vehicle Rebate Project has distributed nearly $525 million in rebates for electric vehicles.[39] Despite policy efforts and investments, emissions from cars and trucks, already California's biggest source of GHGs, have increased over the last several years.

The increase in vehicle emissions has been attributed to a combination of low gas prices, a growing economy, consumers' preference for roomier, less-efficient vehicles and a slower-than-anticipated transition to electric models.[40] As of May 2017, only 300,000 ZEVs and plug-in hybrids (PHEVs) have been sold in California.[41] That number represents just over 1 percent of the nearly 25.5 million automobiles on California's roads.[42]

One lesson from the slow adoption of ZEVs in the transportation sector is that the more California's GHG reduction targets rely on consumer behavior change, the more these targets are at risk. Preserving choice, providing affordable options and minimizing disruption to people's daily lives are all important strategies to inspire consumer adoption.

How we innovate matters.

As California policymakers set the path to achieve carbon neutrality in less than three decades, storage, affordability and consumer adoption should weigh significantly in the conversation. California has the fifth-largest economy in the world,[43] even though its carbon footprint is quite small (less than 1 percent of global GHG emissions[44]). To lead on the global stage—beyond setting an example—California will need to develop scalable solutions that can work and are likely to be adopted both here in California and elsewhere.

A Cautionary Tale: Germany's Rush to Renewables

Germany is considered in many ways to be a leader in addressing climate change and reducing harmful emissions. In 2010, German leaders made the bold declaration that they would dramatically increase renewable energy sources with the country's Energiewende policy. The aggressive move to have renewable energy sources represent 80 percent of gross electricity consumption by 2050 went well beyond legislation passed by the European Union.

Why is it then that GHG emissions in Germany have not decreased for the last nine years and emissions from the transportation sector have not fallen since 1990?

The short answer is the government decided to shut down all nuclear power in the country by 2022 and moved to a renewable energy future before its infrastructure was ready.[45]

With renewable sources such as wind and solar, spikes of supply and demand are often out of sync. On a sunny or windy day, more than enough energy may be produced when most people are away at work or school, but by the time families return home and turn on their lights, dishwasher and air conditioning, the sun has set, the wind has died down and the energy generated during the day has not been stored.

In these instances, Germany has had to turn to coal plants to provide reliability. In fact, more than one-third of the country's energy supply in 2017 came from coal. The situation is likely to be exacerbated as the country phases out nuclear power.

Despite spending more than $600 billion on green energy subsidies and infrastructure investments (costs which have passed on to residential customers who pay the highest electricity rates in the EU—about 130 percent more than California consumers pay today), Germany is going to miss its 2020 target of reducing CO_2 emissions by 40 percent over 1990s values. Officials admit the country will reach 32 percent at best.

Achieving Environmental Goals 2030 and Beyond

Achieving carbon neutrality in less than three decades will require:

- Building a reliable and resilient infrastructure with utility-scale, seasonal storage for wind and solar power;
- Inspiring rapid consumer adoption with scalable and affordable energy options;
- Setting technology-neutral policies that will drive innovation to reduce GHG emissions.

California's carbon-neutral future depends on leaders in the private and public sectors embracing and developing diverse technology solutions, bolstered by policies that foster innovation. If California limits its options, it limits its future. Creating an integrated, multi-faceted strategy will provide the innovation necessary to realize California's bold vision and facilitate national and global adoption.

A more integrated energy system will be needed, where the natural gas and electric systems work together to achieve maximum emissions reductions and reliability. It will also need to draw on the collective power of natural gas, renewable natural gas, wind, solar, hydroelectricity, batteries, and Power-to-Gas—as well as yet-to-be-developed technologies—to meet the state's energy demands, while reducing GHG emissions and minimizing disruption and costs for Californians.

Today, there are technologies that have been tested and proven in other parts of the world that are untapped here in California. Complementing the state's robust build-out of wind and solar generation, these technologies will help maintain a reliable, resilient and renewable energy system. They also do not require consumers to change out existing infrastructure.

Leaders in the private and public sectors have the opportunity to work together and re-imagine how our energy infrastructure can operate as one integrated system.

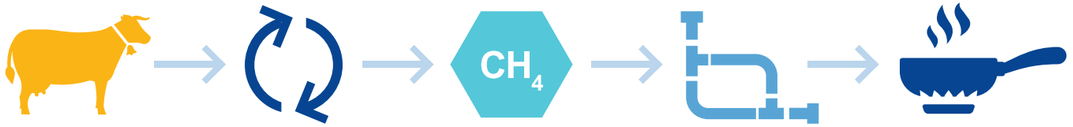
Reducing Our Waste

Renewable Natural Gas (RNG)

For every methane molecule we take out of the atmosphere, it's the equivalent of removing 25 molecules of carbon dioxide (CO_2).[46] Today, more than 80 percent of California's methane emissions come from daily human life activities that create waste.[47]

Renewable natural gas gives us a way to mitigate and reduce emissions from the state's largest methane emitters.

Here's How RNG Works



Capture waste from dairies, farms and landfills

Convert it into biogas, using anaerobic digestion

Process the biogas to make it pipeline-ready (biomethane)

Inject the biomethane into the pipeline for future use

Use it to fuel clean trucks, our homes, businesses and meet other natural gas needs

Natural gas is essentially methane (CH_4)—an organic, naturally occurring gas that comes from decomposing matter. You can procure natural gas from the ground through drilling under-ground (thermogenic) sources or, like electricity, you can generate it from renewable, above-ground (biogenic) sources.

Methane is a natural byproduct of our farms, our kitchens, and our toilets. In other words, you produce methane every day. The largest sources of methane emissions in California—more than 80 percent—come from agriculture, dairies, landfills and waste water.[48] We can capture those emissions, prevent them from going into our atmosphere, and convert them to renewable natural gas to fuel our homes and vehicles.

RNG is created by re-purposing the methane that otherwise would be escaping into the atmosphere. This means its overall impact on the climate is carbon-neutral or even carbon-negative. For example, when a clean heavy-duty truck is fueled with RNG created from a dairy, more carbon is removed from the atmosphere than is emitted from the tailpipe.[49]

In addition to reducing the carbon content of our natural gas supply, RNG gives us a clear and practical path to help California achieve the goals set in the Short-Lived Climate Pollutants Reduction Plan (SB 1383), by targeting the state's largest methane emitters. Reducing methane emissions represents a significant portion of the California Air Resources Board's Scoping Plan to achieve the state's GHG reduction goals.[50]

Driving Down Emissions Through Efficient, Distributed Generation

Electricity is an inefficient form of energy—it loses power as it travels over distance. Most of California's solar fields, wind farms and power plants are located far from major population centers. We end up having to generate a lot more electricity to make up for the power that is lost over transmission and distribution lines.

Distributed generation helps to address this challenge—it is small-scale electric generation located in the community where the energy is used. The most familiar example of distributed generation is rooftop solar panels (photovoltaic systems).

Twenty years ago, opponents of solar claimed it would never be viable in California—that the costs would be too prohibitive. After the state invested and created incentives, California finds itself in the situation where distributed solar generation is a growing and critical part of the state's energy mix. California has similar opportunity with other forms of distributed generation. In fact, these technologies can enable renewable generation and make cleaner electricity:

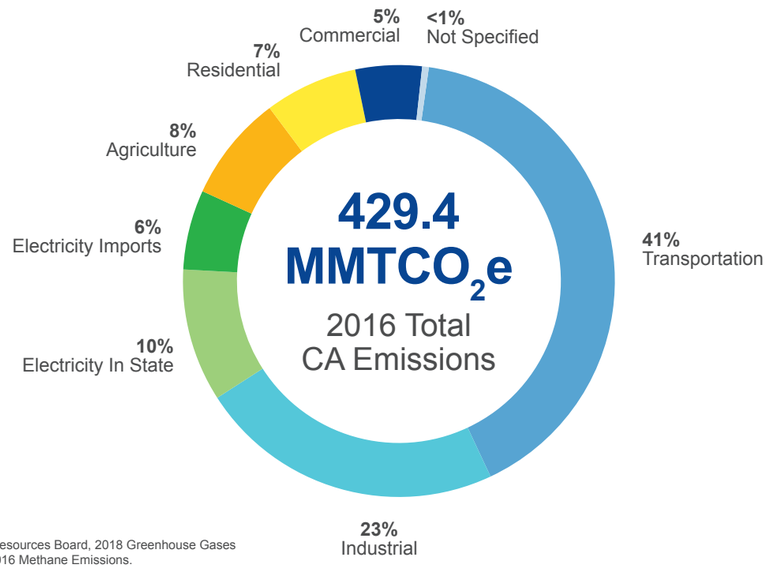
Fuel Cells - A battery stores electricity, but a fuel cell can generate it. Similar to a battery, a fuel cell is comprised of many individual cells that are grouped together to form a fuel cell stack. When a hydrogen-rich fuel such as clean natural gas or renewable natural gas enters the fuel cell stack, it reacts electrochemically with oxygen (i.e. ambient air) to produce electric current, heat and water. While a typical battery has a fixed supply of energy, fuel cells continuously generate electricity as long as fuel is supplied. Fuel cells can help to mitigate California's fire risk as well—by supplying power in backcountry locations using natural gas where available, or hydrogen created through power-to-gas technology.

Combined Heat and Power (Co-Generation) - Distributed co-generation sources use steam turbines, natural gas-fired fuel cells, micro turbines or reciprocating engines to turn generators. The hot exhaust is then used for space or water heating, or to drive an absorptive chiller for cooling such as air-conditioning. The technology can run on renewable natural gas or low-carbon fuels to further reduce emissions.

Waste-to-Energy - When municipal solid waste and natural waste such as sewage sludge, food waste and animal manure decompose, they discharge a methane-containing gas that can be collected and used as fuel in gas turbines or micro turbines to produce electricity as a distributed energy resource. This power can be used in lieu of grid power at the waste source (a treatment plant, farm or dairy).

Focusing Our Efforts

Understanding the opportunities to reduce California's carbon footprint begins with understanding the overall landscape of the state's GHG emissions. The transportation sector is the largest contributor to California's GHG emissions, contributing 41 percent of the total. Next is the industrial sector at 23 percent, followed by electricity at 16 percent, and several sectors with relatively smaller contributions, including residential buildings and commercial buildings at 7 percent and 5 percent respectively.



Source: California Air Resources Board, 2018 Greenhouse Gases Emissions Inventory, 2016 Methane Emissions.

Some state leaders are pushing to transition California's energy supply to a single source: renewable electricity. This strategy is perhaps most prominent in discussions around decarbonizing California's building sector, which receives a disproportionate amount of attention given that the sector represents 12 percent of the state's total emissions,[51] and that it would require replacing existing infrastructure in millions of California homes and businesses. But that doesn't need to happen.

A 2018 study by Navigant Consulting shows that there is no need to electrify California's building sector to meet state climate goals. The study concludes that California "should address the role of renewable gas as part of its low-carbon building strategy."

Adding less than 20 percent renewable gas to California's gas supply by 2030 can achieve the same outcome as electrifying the entire building sector; while continuing to allow consumer choice to meet their energy needs, as well as avoiding future building and appliance change-out mandates.

Importantly, the study finds that reducing the carbon content of the gas supply by adding renewable gas to displace traditional gas can be significantly less costly, and is far more cost effective in reducing GHGs, than building electrification.

A balanced mix of both in- and out-of-state resources (reflecting today's reality with both renewable electricity and renewable gas) is three times more cost effective in reducing GHGs than any electrification pathway.

Achieve the same GHG reductions as overhauling 100 percent of California's buildings to all electricity with

<20% RNG

Sourced from the likely mix of in- and out-of-state feedstocks,

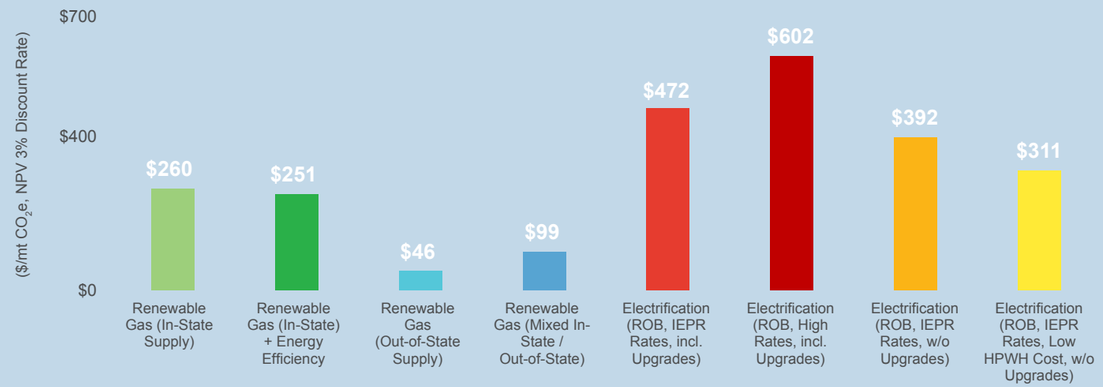
RNG is significantly more cost effective

Source: Analysis conducted by Navigant Consulting based on its 2018 report, "Gas Strategies for a Low-Carbon California Future." The analysis from the original published report has been updated to reflect the 2030 60 percent RPS goal established in SB 100.

RNG Is More Cost-Effective

A new study demonstrates how California can reduce building sector emissions without significant disruption to consumers.[52]

Cost Effectiveness, 2018-2030



ROB = Replace on Burnout IEPR = Integrated Energy Policy Report HPWH = Heat Pump Water Heater

Reducing Emissions Today

CR&R Environmental provides a view into what's possible.

CR&R, one of the largest waste and recycling companies in Southern California, has successfully put RNG to work. They've built what is believed to be the world's largest and most automated anaerobic digester, which allows them to produce RNG from organic waste.

The RNG CR&R produces is injected into the SoCalGas system and used to fuel approximately 400 of their waste hauling trucks. Converting just one of CR&R's trash trucks from diesel to natural gas is the pollution reduction equivalent of taking 325 cars off the road, which means CR&R's fleet of RNG trucks is reducing GHG emissions by the same amount as taking approximately 130,000 cars off the road!

This story is one example of the 40 RNG projects occurring right now in California. RNG also allows for waste products to be converted into new revenue streams, boosting the economy of regions of the state—like the San Joaquin Valley—where there are feedstock opportunities.

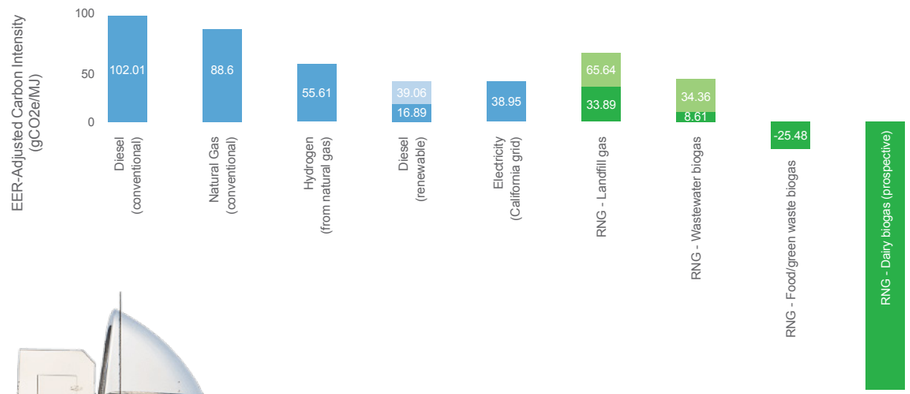
Near-zero-emissions natural gas engines reduce NOx emissions up to 90 percent and GHG emissions up to 80 percent compared to diesel.[53]

CR&R's RNG is fueling 400 waste trucks. That's the equivalent of taking 130,000 cars off the road.[54]

RNG as a transportation fuel has a negative carbon intensity

- By switching to renewable natural gas, we can reduce vehicle GHG emissions by 80 percent.[55]
- Renewable natural gas gives us a way to prevent emissions from biogenic sources from going into the atmosphere, by capturing and converting them into a renewable fuel to power our vehicles.
- Renewable natural gas produced from food and green waste has a negative carbon intensity. That means it's not just carbon-neutral, it actually takes carbon out of the air.[56]

Carbon Intensity Rating of Key Transportation Fuels



The natural gas truck will meet California's ambitious 2045 targets decades before any other technology.

Source: California Air Resources Board (ARB), LCFS Fuel Pathways Table, February 2017. Adjusted for heavy-duty truck applications.

Decarbonizing Agriculture: RNG – From Poop to Power

"

If cows were a country, they would be in the top five emitters in the world."

In one succinct statement, Microsoft founder Bill Gates[57] illustrated the scope of the environmental challenge and opportunity to reduce emissions from animal agriculture. In California alone, livestock and dairies represent 8 percent of the state's GHG emissions, and more than half—55 percent—of the state's methane emissions.[58]

In October 2018, Renewable Dairy Fuels opened the nation's largest dairy renewable natural gas plant, in Jasper County, Indiana. The operation collects dairy waste from 16,000 milking cows on four farms, turning 945 tons of cow manure each day into fuel for transportation, delivered through Northern Indiana Public Service Company's (NIPSCO) natural gas pipeline system.[59]

In early 2019, renewable natural gas produced at a digester facility built by Calgren Dairy Fuels in Pixley, California began flowing into SoCalGas pipelines. Calgren's facility, known as a dairy digester pipeline cluster, will eventually collect biogas from anaerobic digesters at 12 Tulare County dairies, then clean it to produce pipeline-quality renewable natural gas. This is the first such dairy digester pipeline cluster in California, and is expected to be the largest dairy biogas operation in the U.S. when Calgren adds nine additional dairies later in 2019. The facility will capture the methane produced from the manure of more than 75,000 cows, preventing about 130,000 tons of GHGs from entering the atmosphere each year—the annual equivalent of taking more than 25,000 passenger cars off the road. SoCalGas will be capable of adding up to 2.26 billion cubic feet of renewable natural gas each year to its pipeline system from the facility.

These are examples of the many renewable natural gas projects happening across the country. With current regulation and incentives, it's estimated that California has about 100 billion cubic feet (Bcf) of renewable natural gas supply.[60] Outside of California's borders, the U.S. is producing 1 trillion cubic feet (Tcf) of renewable natural gas. That number is expected to increase tenfold by 2030.[61]

By investing in in-state renewable natural gas projects and expanding feedstocks to include out-of-state sources, California can make significant progress in achieving the goals set in the Air Resource Board's Short-Lived Climate Pollutants Plan. It will also provide California residents with a cost-effective way to power their homes, businesses and cars with a clean-burning, renewable fuel.

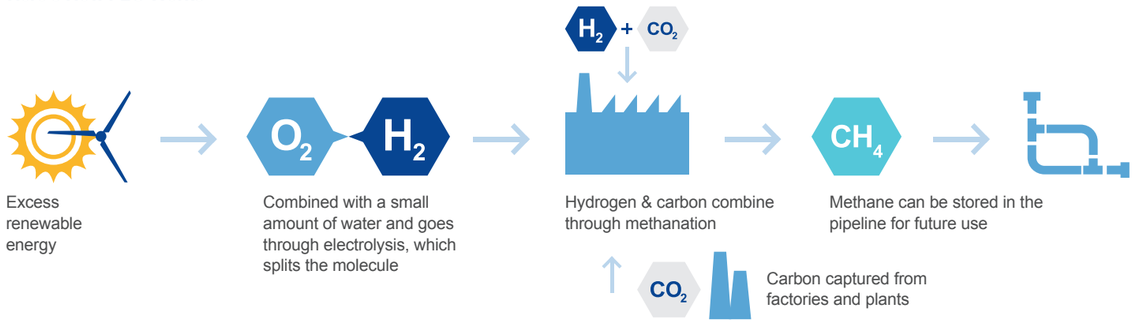
Utilizing Current Infrastructure

Power-to-Gas (P2G) Technology

Today, when excess electricity is generated from solar and wind, California either has to dump it or pay other states like Arizona to take it from us. While batteries can help store some of this excess energy, they will not solve the storage problem alone, especially for long-term storage needs.

Rather than wasting the energy batteries cannot store, we can convert it into renewable gases using a process called “Power-to-Gas.” Through this process, we can use our existing natural gas infrastructure to store the renewable energy and make it available where and when people need it.

Here’s How P2G Works



Excess renewable energy

Combined with a small amount of water and goes through electrolysis, which splits the molecule

Hydrogen & carbon combine through methanation

Methane can be stored in the pipeline for future use

Carbon captured from factories and plants

Power-to-Gas works by taking excess electricity generated from solar and wind, combining it with a small amount of water and running it through electrolysis. The electrolysis process converts the electrical energy into chemical energy and splits the molecules into pure hydrogen and oxygen.

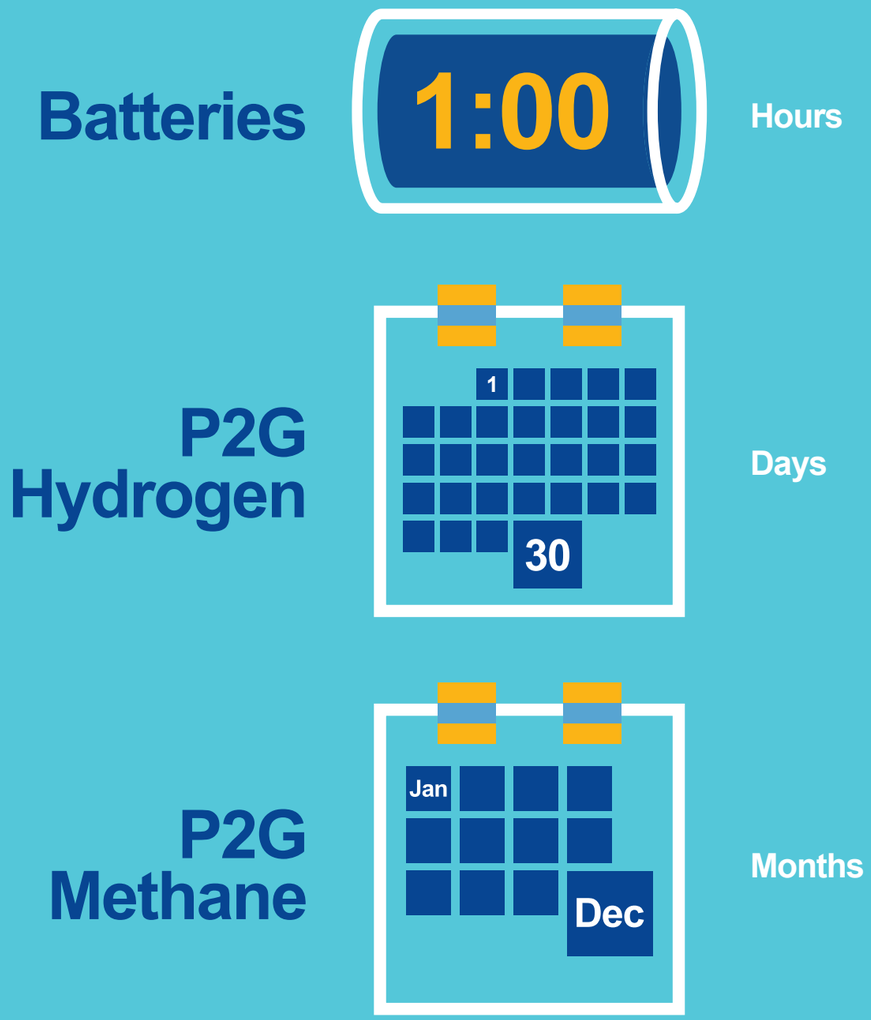
The oxygen can be sold and used for other applications—such as healthcare. The hydrogen gas can be used as a fuel or some of it can be stored in existing pipelines. Additionally, the hydrogen can be combined with CO_2 and run through the process of methanation to create renewable methane. The clean, renewable methane produced through the Power-to-Gas process can be stored in the existing pipeline system for use when people need it. That means infrastructure is already in place to store and deliver the renewable energy at any time of day, during any season.

We can use the hydrogen produced through electrolysis in the Power-to-Gas process to fuel power plants and for other industrial applications, such as metal refining and fertilizer production. Hydrogen is also a zero-emissions fuel that can help reduce emissions from the millions of cars and trucks on California’s roads. Some percentage of hydrogen also can be injected into the natural gas stream to further reduce the carbon content of the natural gas supply.

The renewable gas produced through methanation in the Power-to-Gas process can be delivered to Californians through the existing pipeline infrastructure and used for cooking, as well as for space and water heating. And, as a fuel for mobile generators, renewable gas supports system reliability during emergency situations. It can also be used as a transportation fuel.

Comparing Storage Technologies

Power-to-Gas provides large-scale, multi-day and seasonal grid storage.



Hydrogen is a scalable solution to address long-term energy storage needs and help meet the goals set in SB 100.

Reality Check: The Real Impact of 100% Renewable Electricity

When SB 100 was signed by Governor Brown, it challenged the California Energy System to transform to 100 percent clean energy by 2045. To date, state leaders have focused on electrification to achieve this transformation—policies aimed at transitioning home appliances, equipment and vehicles to electricity, and decarbonizing electricity sources through increased wind and solar power generation. Implementation of SB 100, however, could create unintended economic hardships and actually increase GHG emissions.

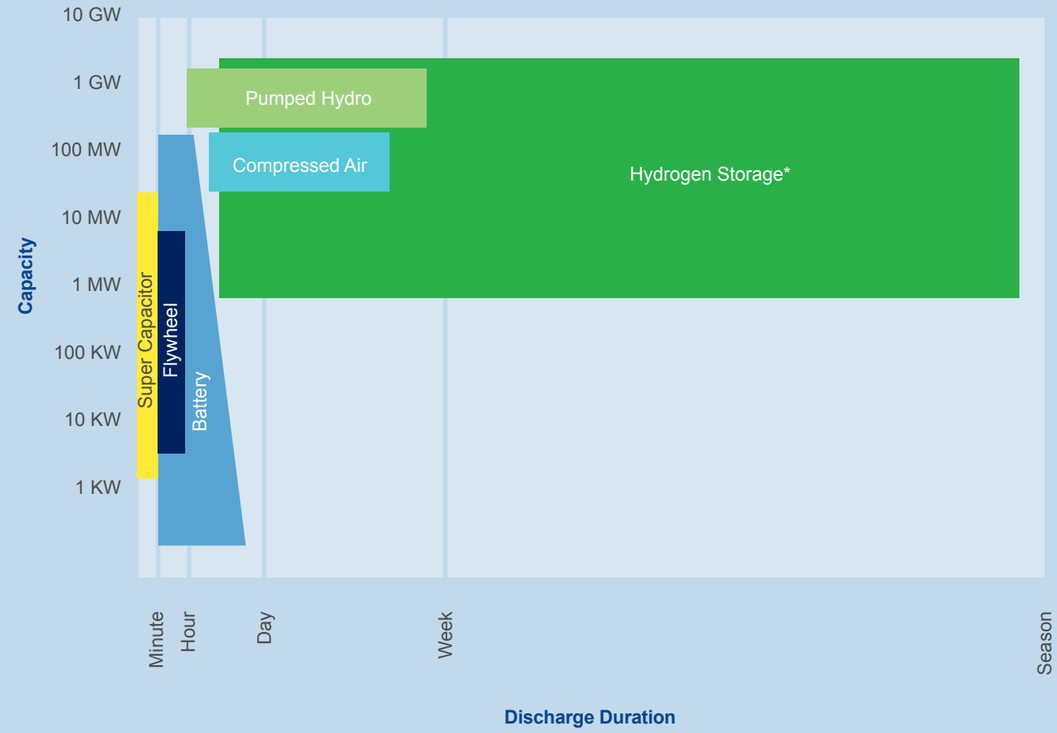
An analysis conducted by Black & Veatch underscores the potential impact of 100 percent renewable electricity on California, based on several scenarios with high-level assumptions to facilitate qualitative discussions. The findings indicated a significant cost elevation and technical challenges associated with 100 percent renewable electricity.

All scenarios in the analysis indicate that 100 percent renewable electricity requires a significant increase in renewable capacity, storage and transmission build-out beyond California's current infrastructure. When specifically looking at wind, solar and energy storage, California needs nearly a six-fold increase beyond current wind and solar capacity at a cost of approximately $135 billion. Additionally, there are land availability issues associated with battery storage. Assuming a horizontal build-out, land required for energy storage and solar panels would be approximately 1,600 square miles, which is four times the size of the City of Los Angeles. Cost and land availability are only two variables; we must also look at the technological aspects. Current battery storage technology is limited, only allowing for a few weeks of storage. Extended storage capability is needed to ensure reliability and resiliency to meet variable demand loads at various times of day and across seasons.

The analysis also warns of potential unintended consequences of an all-electric strategy. The electrification-only pathway will increase the cost of electricity, which will in turn increase the cost of electrical vehicle (EV) ownership. The increased EV cost will drive up the sales of gasoline vehicles based on affordability, which will likely increase emissions from the transportation sector.

This reality check on the unintended consequences of using a single source for energy generation highlights the importance and the need for a robust balanced energy policy in California. If infrastructure cost combined with increased residential usage costs occur because of electrification, we may solve one problem, but create another: that is, making energy costs unaffordable for many Californian residents and businesses.

Comparison of Energy Storage Alternatives



*As hydrogen or synthetic methane
Source: IEA Energy Technology Roadmap, Hydrogen and Fuel Cells

The UK's First Practical Demonstration of Hydrogen

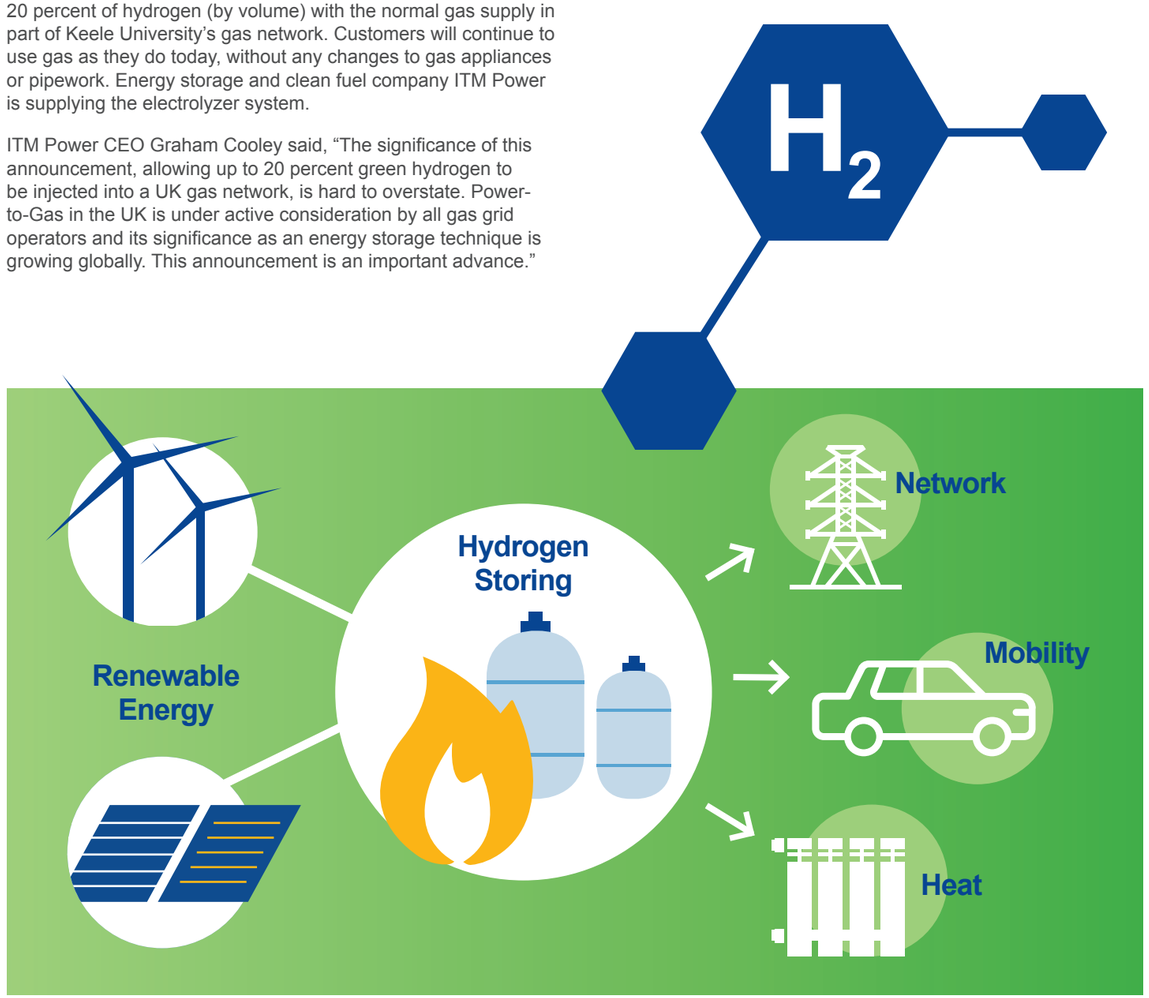
Britain explores Power-to-Gas and green hydrogen to reduce emissions.

A groundbreaking trial that could help Britain dramatically cut its carbon emissions and open the door to a low-carbon hydrogen economy was recently approved by the Health & Safety Executive (HSE).[62] The United Kingdom's HyDeploy project will inject hydrogen into an existing natural gas network.

In a year-long pilot due to start in 2019, HyDeploy will blend up to 20 percent of hydrogen (by volume) with the normal gas supply in part of Keele University's gas network. Customers will continue to use gas as they do today, without any changes to gas appliances or pipework. Energy storage and clean fuel company ITM Power is supplying the electrolyzer system.

ITM Power CEO Graham Cooley said, "The significance of this announcement, allowing up to 20 percent green hydrogen to be injected into a UK gas network, is hard to overstate. Power-to-Gas in the UK is under active consideration by all gas grid operators and its significance as an energy storage technique is growing globally. This announcement is an important advance."

Announced in November 2018 and backed by Ofgem's Network Innovation Competition, the £7 million project is being led by gas network Cadent, in partnership with Northern Gas Networks, Keele University and a consortium of technical experts.



> **"Battery storage may feel like a headline act in the transition. But ultimately it will play second fiddle to hydrogen."**

Francis O'Sullivan,
Head of Research at the MIT Energy Initiative

UC Leads the Way to Carbon Neutrality

The University of California recently announced ambitious plans to be carbon neutral by 2025—and renewable natural gas and hydrogen will play a significant role in achieving its goal.

As part of its strategy, UC has set a target for at least 40 percent of the natural gas combusted on-site at each campus and health location to be fueled by biogas by 2025.[63]

The UC system is already a consumer of biogas at multiple campuses. For example, UC San Diego purchases biogas credits from a sewage treatment plant on Point Loma, about ten miles away. Biogas from the plant is injected into the natural gas pipeline system on Point Loma where it displaces conventional gas; UC San Diego then draws conventional gas to power a fuel cell. The credits allow the fuel cell to qualify as a renewable energy source, earning valuable financial treatment under California policy.

UC also is a leader in pioneering Power-to-Gas technology. Research conducted at the University of California Irvine (UCI) and funded by SoCalGas demonstrated in 2017 that the campus micro-grid could increase the portion of renewable energy it uses, from 3.5 percent to 35 percent, by implementing a Power-to-Gas strategy.[64]

Using Power-to-Gas, UCI demonstrated it could increase its renewable energy use from 3.5 percent to 35 percent.

The study used data from the UCI campus micro-grid, which includes solar panels that produce about 4 megawatts of peak power. Simulations showed that by storing excess solar power on sunny days and using an electrolyzer to produce renewable hydrogen, the micro-grid could support an additional 30 megawatts of solar panels.

“The ability to increase the mix of renewables on campus by tenfold is truly significant,” said Jack Brouwer, professor of mechanical & aerospace engineering and civil & environmental engineering at UCI and associate director of the Advanced Power & Energy Program (APEP). “With Power-to-Gas technology, you don’t need to stop renewable power generation when demand is low. Instead, the excess electricity can be used to make hydrogen that can be integrated into existing natural gas pipeline infrastructure and stored for later use. The Southern California Gas Company system alone is made up of over 100,000 miles of pipeline. This study suggests that we could leverage that installed infrastructure for storage and significantly increase the amount of renewable power generation deployed in California.”

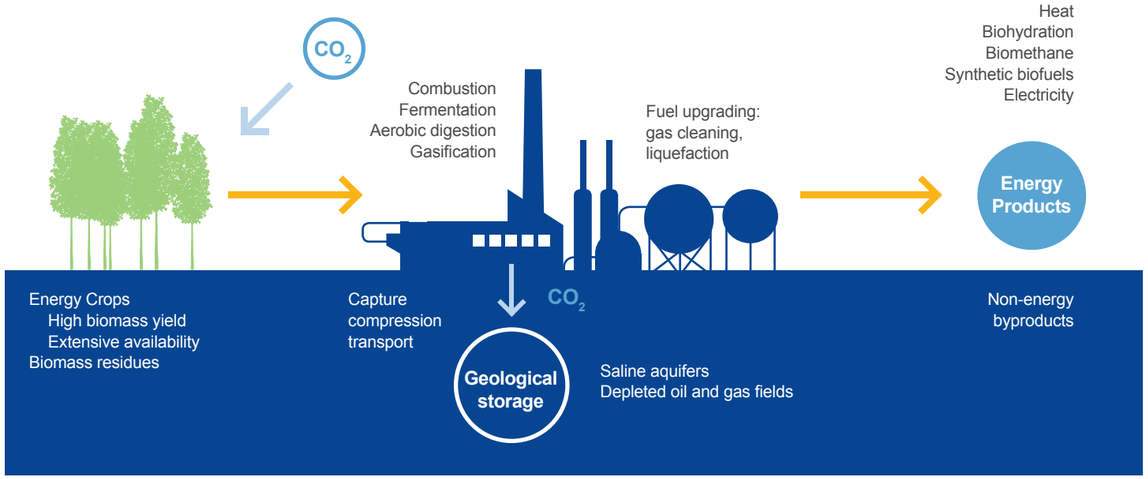
Capturing and Using Carbon

Carbon Capture and Utilization (CCU)

Carbon is the building block of life. Many of the products we use every day—our computers and smart phones, our cars and the plastic Tupperware in our kitchens—are made with carbon.

With CCU, we can take the carbon dioxide (CO_2) released from industrial processes, capture it and recycle it as a raw material to produce these products. The carbon can also be combined with hydrogen to form renewable gas to fuel homes, businesses and vehicles.

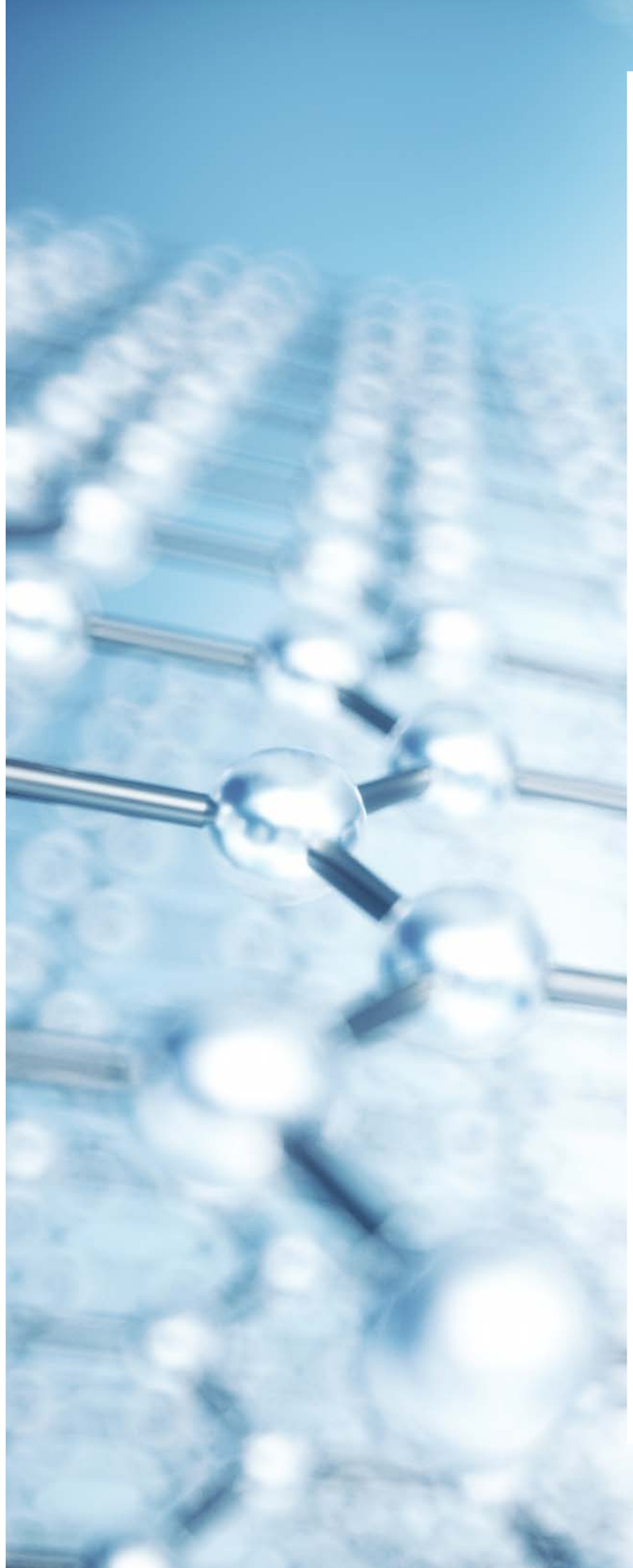
Here's How CCU Works



CCU is a simple concept: Gas and particle waste produced from industrial sources like power plants, steel making or other factories is first captured. The carbon from that waste is then extracted using chemical processes and reused as the raw material for new products. Reusing this carbon not only decreases CO_2 emissions into the atmosphere, but also decreases fossil fuel use.

Many CCU technology companies are beyond the development stage and in the market growing their businesses. One California-based company is making plastics from captured carbon instead of petroleum. A Canadian company is using carbon captured from power plants to make stronger concrete. And a German company uses waste CO_2 to make polymers. According to the Global CO_2 Initiative, the market for products made from CO_2 could be more than $800 billion and use 7 billion metric tons of CO_2 per year by 2030—the equivalent of approximately 15 percent of current annual global CO_2 emissions.

CCU technologies follow the sustainability principles of reduce, repurpose and recycle—they simply recycle the carbon in fossil fuels: Once the fuel releases energy, the waste is saved to be reused where it is needed, and the use of fossil carbon is reduced. CCU will become an increasingly important strategy for California to achieve carbon neutrality.



Carbon to Value

An innovative process technology is producing clean hydrogen and solid carbon.

The potential of hydrogen as a transportation fuel is great, based on its ability to power zero-emission fuel cell electric vehicles (FCEVs), its fast filling time and high efficiency. But sourcing the hydrogen has been a barrier to the market really taking off.

Today, almost all of the world's hydrogen is produced from natural gas through the process of steam methane reforming—in this process, methane reacts with steam under pressure in the presence of a catalyst to produce hydrogen and carbon dioxide (CO_2), a greenhouse gas.

John Hu, West Virginia University's Statler Chair Engineering Professor, recently invented a technology to convert natural gas into CO_2-free hydrogen and solid carbon. A commercialization team has received funding from the U.S. Department of Energy to further develop the innovative new process technology.

The objective of the team—which includes, C4-MCP, LLC (C4), a Santa Monica-based technology start-up, West Virginia University, Pacific Northwest National Laboratory, and SoCalGas—is to bring to market cost-effective ways to drive down emissions from hydrogen production, ultimately making hydrogen fueled cars and trucks cost-competitive with conventional gasoline and diesel vehicles.

In addition to CO_2-free hydrogen, the other by-product of the innovative process technology is solid carbon, which can be used as a raw material to manufacture a number of products we use every day, from the batteries in our computers, to the tires on our cars, to the inks in our printers.

"The research will lead to transformative advancement in science and engineering, in addressing not only climate change issues but also energy inefficiency issues in natural gas conversion to value-added products," said Hu.

It's just one example of many research projects underway today that showcase the tremendous environmental and economic potential of CCU technologies.

It's Time to Put California on the Map

Countries around the world are embracing an inclusive energy strategy that uses all resources available to reduce emissions, increase renewable energy and solve intermittency issues with long-term storage through Power-to-Gas technologies.

Canada

2018 marked the opening of North America's first Power-to-Gas energy storage facility using hydrogen. The Markham Energy Storage Facility is now providing regulation services under contract to the Independent Electricity System Operator (IESO) of Ontario, Canada.

United States

Renewable Dairy Fuels (RDF) is producing renewable natural gas from dairy waste and delivering renewable natural gas into the NIPSCO natural gas pipeline system to be used as transportation fuel. The facility is located in Jasper County, Indiana, and is now the largest dairy project of its kind in the country.

United Kingdom

Cadent and Northern Gas Network's HyDeploy pilot will kick off in 2019, blending to 20 percent of hydrogen (by volume) with the normal gas supply in part of Keele University's gas network.

France

- Construction on France's first industrial-scale Power-to-Gas demonstrator, Jupiter 1000, began last year at Fos-sur-Mer. Led by GRTgaz, the project is designed to convert surplus electricity generated by wind farms in the surrounding region into green hydrogen and methane syngas. The demonstrator will have a total generating capacity of 1 Megawatt electric (MWe).
- The "Les Hauts de France" project, an ambitious Power-to-Gas project, aims to build five massive hydrogen production units (100 MW each) over a five-year period.
- French hydrogen specialist HDF Energy has launched the Centrale électrique de l'Ouest guyanais (CEOG) project, which promises to be one of the world's largest solar-plus-storage power plants.
- French utility Engie plans to switch all of its gas operations to biogas and renewable hydrogen by 2050, making it 100 percent green.

Denmark

Denmark could be the first European country to become independent of natural gas and cover its consumption entirely through gas produced from food waste, industrial waste and agricultural by-products.

Germany

- The German grid operators TenneT, Gasunie Deutschland and Thyssengas have put forward detailed plans for coupling the electricity and gas grids and advancing the energy transition. The three grid operators are planning to build a power-to-gas pilot plant in Lower Saxony. With an output of 100 megawatts, it will be the largest of its kind in Germany.
- Major German power and gas grid firms Amprion and Open Grid Europe (OGE) are jointly building large Power-to-Gas plants in the next decade.

India

India plans to build 5,000 compressed biogas plants over the next four years to curb oil imports and improve farm incomes. The move is in line with the government's target of reducing crude oil imports by 10 percent by 2022.

Africa

The Africa Biogas Partnership Programme (ABPP)—a partnership between Hivos and SNV—is working to construct 100,000 biogas plants in Ethiopia, Kenya, Tanzania, Uganda, and Burkina Faso providing about half a million people access to a sustainable source of energy.

Australia

The Australian government is providing half the funding for the country's largest facility to produce hydrogen using solar and wind energy. The project is being run by gas pipeline company Jemena, which plans to build a 500 kilowatt electrolyzer in western Sydney that will use solar and wind power to split water into hydrogen and oxygen.

The Case for

An Integrated Approach

Preserves Consumer Choice

Today, Californians enjoy a choice of energy sources for their homes and businesses, including gas, electricity and propane. Millions of Californians use natural gas in their homes. In SoCalGas' service territory, roughly 90 percent of the homes use natural gas because it's an efficient, reliable and affordable option for home and water heating, drying clothes and cooking.[65] Energy users should have a choice of which appliances and energy to use in their daily lives, especially if it can be done in an environmentally friendly way.

Minimizes Disruption & Cost

An inclusive, integrated pathway that includes natural gas and renewable natural gas as a continuing source of energy to meet the state's energy needs is minimally disruptive to consumers. By replacing less than 20 percent of California's natural gas supply with renewable natural gas, California can achieve the same GHG reductions as electrifying 100 percent of the state's buildings.[66] The implications are profound: consumers do not need do anything—no mandates to switch out appliances, no need for costly upgrades to homeowners' electrical panels. Mandating electrification would require millions of people to retrofit their homes and replace their natural gas appliances, costing the average family $19,000.[67]

Promotes System Resiliency

Resiliency in the energy system is critical. By maintaining a diverse energy portfolio, California can minimize interruptions in energy supply caused by climate change impacts, such as increased wildfires. Communities over-reliant on the electric grid risk losing critical tools needed for emergency response. Natural gas gives communities the resiliency to respond to nature's worst disasters.

Strengthens California's Economy

The Los Angeles area is the largest manufacturing region in the United States. Many industrial processes, from manufacturing steel to producing fertilizer, cannot be electrified. If those jobs are to remain in the state, California will need to create policies that allow energy options for these businesses and industries. An inclusive approach that does not limit current energy options, is technology neutral, expands nascent technologies, allows for innovation and factors in costs will help keep these industries and their associated jobs in the state.

90%

of homes in SoCalGas' service territory use natural gas

<10%

of voters would choose an all-electric home

80%

of voters oppose prohibiting the use of gas appliances

2/3

of voters oppose eliminating natural gas

Sources: California Energy Commission (2009) "California Residential Appliance Saturation Study."
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Working together, we can create

measurable progress toward a carbon-neutral future

To achieve a dramatic decrease in GHG emissions, leaders in California's private and public sectors must dramatically shift their thinking and foster an environment that will fuel breakthrough innovation. We need to use all technologies available to us today and should not close the door on potential technology pathways that may lead to exponential emissions reductions in the future.

Creating a clean, decarbonized and sustainable energy future requires an inclusive technology strategy if California is going to meet its climate goals and maintain system resiliency. Implementing a balanced energy approach allows California to minimize disruption, manage cost and preserve consumer choice.

Our Vision

To become the cleanest natural gas utility in North America

Our Commitments

2022

5% RNG being delivered in our system

2030

20% RNG being delivered in our system

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