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February 1, 2021

To: Supervisor Hilda L. Solis, Chair
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From: Fesia A. Davenport
Chief Executive Officer

REPORT BACK ON LOS ANGELES COUNTY'S ENERGY RESILIENCY POLICY AND THE IMPACT ON DISADVANTAGED COMMUNITIES (ITEM NO. 70-B, AGENDA OF SEPTEMBER 15, 2020)

BACKGROUND

On September 15, 2020, the Board of Supervisors (Board) approved an amended motion requesting a report on the resiliency of the County of Los Angeles' (County) energy sector, with a focus on disadvantaged communities. To prepare this report, the Chief Executive Office (CEO) engaged with the California Public Utilities Commission (CPUC), California Energy Commission (CEC), Southern California Edison (SCE), Clean Power Alliance (CPA), Southern California Gas Company (SoCalGas), and the Electric Power Research Institute (EPRI). The CEO also consulted with the departments of Public Works (DPW), Regional Planning (DRP), and Internal Services (ISD).

ENERGY SECTOR OVERVIEW

While our existing energy system functions to meet our economic, social, and environmental needs, it is in many places aging, inefficient, and vulnerable to disruptions. The system's reliance on fossil fuels produces greenhouse gas emissions, air pollution, negative land use impacts, public health impacts, and resilience issues.

The energy network is governed and managed by a complex set of agencies and providers, with the most oversight coming from the State of California (State) and Federal regulatory agencies such as the CPUC, CEC, California Air Resources Board, California Independent System Operator, Western Energy Coordinating Council, Federal Energy Regulatory Commission, U.S. Environmental Protection Agency, and the U.S. Department of Energy.

The County has relatively little control over the region's energy system. DRP oversees land use planning in the unincorporated portions of the County and thus, has a role in the siting of energy facilities. The Department of Public Health is responsible for ensuring that industrial facilities, including energy production facilities, operate in a manner that is protective of the public's health. DPW manages building codes for the unincorporated County, including the electrical code. ISD operates some generating resources, provides backup power to some critical electrical circuits for County facilities, and manages the Southern California Regional Energy Network. The County is also a founding member of CPA, which oversees the community choice energy program for 32 jurisdictions in Los Angeles and Ventura counties. The OurCounty Sustainability Plan outlined several goals related to energy, which are aligned with the County's commitment to the Paris Climate Agreement.

POWER OUTAGES

Information from SCE points to equipment failure as the cause of the outage in East Los Angeles, as referenced in the Board motion. This type of equipment failure is unrelated to the source of electricity or the share of renewable energy. Equipment failures can be caused by aging equipment, shocks from high-wind events, or issues related to high temperatures, which are increasing in frequency, duration, and intensity due to climate change.

A State analysis examined the source of the outages seen across the State in August 2020. A primary driver was the widespread and significantly increased demand for electricity during a climate-change-induced extreme heat storm that occurred across the entire western United States, thereby limiting the ability to move power from one part of the grid to another. The demand for electricity throughout the western grid far exceeded resource planning targets which, as the report points out, need to be updated to reflect the increased likelihood of such heat storms and a changing energy resource mix.

Outages caused by Public Safety Power Shutoff events occur when weather conditions require electric power lines to be de-energized to reduce the risk of wildfire caused by electric equipment. Given that climate change is driving an increase in wildfires, electric utilities are improving their systems to reduce the frequency and duration of such events.

CURRENT AND PROJECTED VULNERABILITIES

The resilience of the energy system is under examination by energy experts at the regional, State, and Federal levels. The State's Fourth Climate Change Assessment documented how the energy sector will be substantially affected by changing wind and precipitation patterns, wildfire, and extreme heat. The CPUC has initiated a multi-year process to require the State's investor-owned utilities, such as SCE, to hold substantive community engagement processes to inform the development of climate vulnerability assessments. The regulatory process includes a dedicated focus on community engagement, particularly in disadvantaged communities. SCE, which delivers energy to much of Los Angeles County, will submit its

assessment in 2022. That assessment will inform SCE's investment recommendations that will be submitted to the CPUC in 2023. SoCalGas will submit its assessment in 2025, and those will inform its investment recommendations that will be presented to the CPUC in 2026. The long timelines of these assessments demonstrate the complexity of the interactions between our energy system, our changing climate, and impacts on vulnerable communities. Meanwhile, the State continues to reduce greenhouse gas emissions. The CPUC approach also demonstrates that energy regulators have prioritized deep community engagement as essential to managing a resilient energy system. Similarly, the energy goals in the OurCounty Sustainability Plan were co-created with hundreds of organizations. The CEO's Chief Sustainability Office is currently conducting a climate vulnerability assessment using this model of community engagement while identifying vulnerabilities in energy and other sectors.

One key vulnerability emphasized in existing analyses is the aging infrastructure of the energy storage and delivery systems. As utilities and regulators consider the significant capital investments needed to upgrade these systems, consideration must also be given to the health and safety impacts of those systems, particularly with regard to impacts on low-income communities, communities of color, and in the context of our climate and resiliency goals.

TECHNOLOGY AND POLICY RESILIENCE SOLUTIONS

Pursuing our climate goals while also safely delivering reliable energy will require investing in new infrastructure and technologies. For example, to harness renewable forms of energy, such as solar, we can leverage the growing battery storage sector. The Rocky Mountain Institute found that investments in battery technology and manufacturing have the potential to substantially shift how energy systems are organized by 2030. There are existing programs in the County that are using battery technology to increase resilience for both critical facilities and disadvantaged communities. CPA has invested hundreds of millions of dollars in battery storage and is well ahead of State targets. CPA is also offering a program to its member jurisdictions to install battery backup systems at critical facilities at no cost.

In addition to technology, new policy solutions will be needed to ensure equitable access to clean energy and other benefits. For example, a report from Gridworks Inc., highlighted that as demand for natural gas declines, there is potential to burden low-income communities with much higher costs due to increasing infrastructure costs for natural gas, while higher income customers reduce or entirely cease their gas consumption. The report recommends the creation of a strategy to ensure that low-income communities are empowered by the transition away from gas. A recent EPRI report examined building and transporting electrification in the context of California's climate goals and found a significant opportunity to achieve reductions in ozone and particulate matter pollution, which disproportionately burdens disadvantaged communities. Public health experts have also noted that the burning of natural gas creates significant indoor air pollution exposures, especially in low-income communities.

CONCLUSION

Fundamentally, one of the energy sector's largest risks is climate change itself. Stagnating action to reduce greenhouse gas emissions only exacerbates the strain that our energy system is facing. This is why the State continues to pursue aggressive policies to reduce fossil fuel use and cut greenhouse gas emissions while simultaneously preparing our infrastructure and communities to be more resilient. Additionally, equity in energy resilience will require intentional engagement with disadvantaged communities in order to holistically address topics such as exposure to pollution, affordability, and workforce development. Given the County's limited role in the energy system, partnership will be essential, and the County can provide thought leadership, especially considering its public health role.

Please see the attachment for additional information and resources that speak to these and other resilience questions, including cybersecurity.

Should you have any questions concerning this matter, please contact me or Gary Gero, Chief Sustainability Officer, at (213) 974-1160 or ggero@ceo.lacounty.gov.

FAD:JMN:TJM
GG:KTP:jg

Attachment

c: Executive Office, Board of Supervisors
County Counsel
Internal Services
Public Works
Regional Planning

ADDITIONAL INFORMATION ON ENERGY EQUITY AND RESILIENCE

This attachment provides key findings from technical reports and other resources relevant to the Board of Supervisors' (Board) motion on the topics of cybersecurity, natural gas, equity and health, electric grid reliability, resource adequacy, energy utility climate vulnerability assessments, microgrids, building decarbonization, renewables integration, Public Safety Power Shutoffs, and jobs in clean energy.

Cybersecurity

Utilities, state governments, the Federal government, and academia are addressing and preparing for cybersecurity risks in the country's energy system. The California Public Utilities Commission (CPUC) has risk assessment standards that guide utilities in evaluating and addressing risks to their infrastructure, including cybersecurity risks, in their required risk assessment mitigation reports. One such report from Southern California Edison (SCE) and additional resources related to cybersecurity in the electric grid are shown below:

- 2018 Risk Assessment Mitigation Phase Report, SCE[i]
- Critical Infrastructure Protection - Actions Needed to Address Significant Cybersecurity Risks Facing the Electric Grid, U.S. Government Accountability Office, August 2019[ii]
- Improving the Cybersecurity of the Electric Distribution Grid, Institute for Energy and the Environment, Vermont Law School, April 2019[iii]
- Electric Grid Cybersecurity, Congressional Research Service, September 2018[iv]
- Cybersecurity White Paper, MIT Energy Initiative, January 2017[v]

Natural Gas

Natural gas power generation remains a sizeable share of the electricity resource mix in Los Angeles County and across the State of California (State). Meeting the regional and State climate goals requires significantly lowering reliance on fossil fuels, like natural gas, that emit greenhouse gases. Managing that transition will require detailed planning, and research is underway to examine how best to undertake that transition in a way that maintains affordability and availability of energy.

A key vulnerability emphasized in existing analyses is the aging infrastructure of the energy storage and delivery system. As an example, the U.S. Pipeline and Hazardous Materials Safety Administration data show that California is tied with West Virginia as the State with the highest average age of active gas mains at 41.9 years. The cost of replacing an active gas line varies, estimated at $1 to $5 million per mile according to the U.S. Department of Energy. California's aged natural gas infrastructure has had devastating human health and property impacts. Examples include the explosion in San Bruno in 2010, which killed eight people and destroyed 35 homes. Also, the nation's largest gas leak occurred at the Aliso Canyon natural gas storage facility in Porter Ranch

in years 2015-16, and this leak forced more than 10,000 people from their homes and sickened hundreds. In January 2020, the Board sent a five-signature letter to Governor Newsom requesting an expedited closure of the Aliso Canyon gas storage facility and consideration of the feasibility of closing the Playa Del Rey gas storage facility. Closure of these storage facilities will require a concerted effort to reduce the region's demand for natural gas for energy generation, buildings, and transportation. As utilities and regulators consider the significant capital investments needed to upgrade these gas systems, consideration must also be given to the health and safety impacts of those systems, particularly with regard to impacts on low-income communities and communities of color, and in the context of our climate and resiliency goals.

- The Challenge of Retail Gas in California's Low-Carbon Future, California Energy Commission (CEC), 2020[vi]
    - This study examined several scenarios to meet California's 2050 climate goals and found that building electrification was likely the lower cost, lower risk approach when compared to a high renewable natural gas scenario. It identified that, in any scenario, demand for natural gas is expected to decrease, creating a pressing need to plan for that transition.

- A New Approach to America's Rapidly Aging Gas Infrastructure, Rocky Mountain Institute, 2020[vii]
    - This report points to rapidly increasing investments in replacing natural gas infrastructure (assets with lifetimes longer than mid-century greenhouse gas reduction commitments). Age of natural gas pipelines is one of the driving factors in the increasing costs. California is tied with West Virginia as the State with the highest average age of active gas mains—41.9 years.

- California's Gas System in Transition, Gridworks Inc., 2019[viii]
    - This report finds that a transition away from natural gas must be proactively managed to protect the last customers left on the gas system. Doing so would avoid leaving those customers with increasing infrastructure costs, which would otherwise result in unacceptably high consumer rates. The report calls for the development of a comprehensive strategy to ensure that disadvantaged communities are empowered by the transition away from gas.

- Case Studies of Natural Gas Sector Resilience, ICF International, 2020[ix]
    - This report examined a series of natural disasters to identify resilience strategies and opportunities related to natural gas. The case studies centered on hurricanes impacting the Gulf states and the 2017 and 2018 wildfires in California. The report identified that the natural gas infrastructure below ground experienced only some interruptions during these events relative to above ground energy system infrastructure. It also identified opportunities to expand the use of technology and greater subdivision of natural gas systems to limit the extent of service isolation during disasters.

Equity and Health

Our electricity system, when it uses fossil fuels like natural gas, produces both greenhouse gases and criteria air pollutants. In addition, the burning of natural gas inside buildings for heating and cooking produces substantially more nitrous oxides than the pollution created while burning natural gas for electricity generation. See Figure 1 for California-specific data.

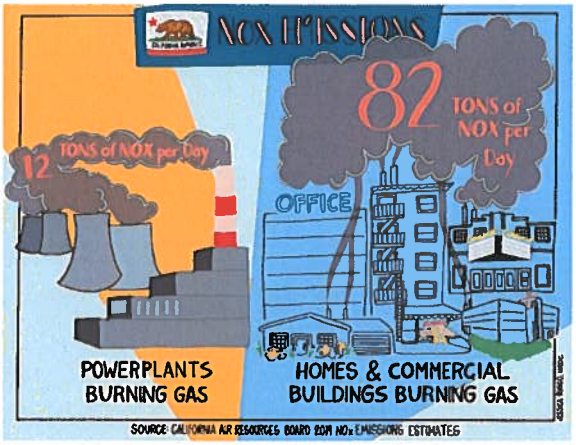

Figure 1: California Nitrous Oxides Emissions (Natural Resources Defense Council 2020)

To directly address inequities in the energy system, the CPUC has several programs specifically focused on disadvantaged communities. The Self-Generation Incentive Program has a $10 million equity resilience budget focused on resiliency pilots in specified disadvantaged communities. This program pairs battery solar with storage to extend the resiliency of communities in case of power outages. See the 2019 report[x] establishing the program for additional details on the program, referred to as Decision 19-09-027.

In November 2020, the CPUC approved the Clean Power Alliance (CPA) "Power Share" program, which will provide eligible customers in disadvantaged communities with 100 percent renewable energy at a 20 percent discount on their total electric bills. The program will supply approximately 15 megawatts of new renewable energy sited locally within disadvantaged communities in CPA and SCE service territories.

Reliability

When the California State Legislature passed Senate Bill (SB) 100, it set a goal of meeting all of the State's retail electricity needs from renewable sources by year 2045. SB 100 also required a report from the CEC, California Air Resources Board (CARB), and CPUC examining, among other things, the electricity system's reliability under the mandates of SB 100. That report is due in January 2021. Information regarding that joint report is available here.[xi]

In January 2020, the CPUC issued an Order Instituting Rulemaking (OIR) to respond to past and prospective events that together will require changes to certain policies, processes, and rules that govern the natural gas utilities in California. With respect to past events, several operational issues in Southern California, including the Aliso Canyon leak, prompted the CPUC to reconsider the reliability and compliance standards for gas public utilities. Over the next 25 years, state and municipal laws concerning greenhouse gas emissions will result in the replacement of gas-fueled technologies and, in turn, reduce the demand for natural gas. Workshops have already been held and a set of CPUC staff recommendations have been formed. One notable recommendation includes creating and adopting a standard definition of "reliability" in the context of natural gas regulation. Information regarding the OIR is available here.[xii]

California's Fourth Climate Change Assessment (Fourth Assessment) examined many aspects of the energy sector and climate change. It included an assessment of grid vulnerability across the County due to more extreme heat.[xiii] It found that based on current substation load factors, an additional 0.9-1.1 gigawatts (GW) of delivery system capacity will be needed by 2060 to maintain reliable operations, some of which may be met more cost-effectively via distributed energy resources than via new substations and/or transmission lines. Another report for the Fourth Assessment found that reductions in natural gas demand more than offset any climate-driven increases in electricity consumption in this context.[xiv] Additionally, the Fourth Assessment identified some pathways to enhance the resilience of the natural gas system in this report.[xv]

Additional resources on the reliability of electricity, especially considering the higher share of renewables and increasing electrification of buildings and transportation, are below.

- Deep Decarbonization in a High Renewables Future, CEC, 2018[xvi]
    - This report analyzed several scenarios with increasing levels of electrification. The analysis found that the High Electrification scenario is the lower-cost and lower-risk mitigation scenario, subject to uncertainties in building retrofit costs as well as implementation challenges.

- Cost-effective decarbonization of California's power sector by 2030 with the aid of battery storage, Lawrence Berkeley National Laboratory, 2019[xvii]
    - The report found that, even if renewable energy and storage costs do not decline further, a carbon-free generation share of 80 percent can be achieved by 2030 in California at a total system cost lower than the cost in a baseline scenario of no-additional-clean energy scenario. The findings suggest that power-sector decarbonization could catalyze electrification-based decarbonization across other economic sectors such as transportation, buildings, and industry.

- The National Potential for Load Flexibility, The Brattle Group, 2019[xviii]
    - This report found that a portfolio of load flexibility programs could triple existing demand response capability, approaching 200 GW (20 percent of system peak) by 2030. Moreover, the transition to a fully decarbonized and

electrified economy is expected to create substantial fluctuations in power supply and load, emphasizing the value of load flexibility.

- Decision 19-11-016 Requiring Electric System Reliability Procurement for 2021-2023, CPUC, 2019[xix]
    - This recent CPUC decision requires an additional 3,300 megawatts (MW) of energy resources by 2023 to help with reliability. Of those resources, 50 percent are due by 2021. These resources must be "preferred resources," which can include storage. In the decision, CPUC takes several steps to address the potential for electricity system resource adequacy shortages beginning in 2021, in a manner that keeps the electricity sector on a path to the 2030 greenhouse gas emissions goals articulated in SB 350, SB 100, and Commission Decision (D.) 18-02-018.

- EPIC Final Report – Test Smart Inverter Enhanced Capabilities Vehicle to Home, Pacific Gas and Electric (PG&E), 2018[xx]
    - Vehicle to grid and vehicle to home (V2H) applications could potentially tap into thousands of MW worth of battery storage inside electric vehicles to help unlock additional grid benefits and resiliency benefits for customers.
    - In summary, the project demonstrated the technically feasibility of V2H in a variety of configurations, as well as its ability, when purchased and installed by a customer, to cost-effectively respond to a demand response event from a program administrator standpoint.

- Turning Down the Gas in California, Union of Concerned Scientists, 2018[xxi]
    - This Union of Concerned Scientists analysis found that no additional natural gas generation capacity is needed by 2030 to keep the State's grid reliable.

Resource Adequacy

As the regulatory body over investor-owned utilities, CPUC has set rules around how much "excess" energy a utility must have on hand to meet unexpected demand or unexpected loss of generation, no matter the circumstances. That is a simplified definition of the term "resource adequacy," which in many ways governs the way that utilities plan and purchase power to meet their needs. The resource adequacy program guides "resource procurement and promotes infrastructure investment by requiring that utilities procure capacity so that capacity is available" when and where needed. The CPUC's resource adequacy program requires both annual and monthly filings from the utilities and has several open decision-making processes around these requirements. Some of the regulatory documents relevant to the Board motion are listed below.

- CPUC Resource Adequacy Program Website [xxii]
- CPUC Decision Adopting Local Capacity Requirements [xxiii]
- CPUC Resource Adequacy Track 3 (R.19-11-009)[xxiv] and Track 3 Scoping Memo[xxv]

- CPUC Integrated Resource Plan[xxvi]
    - Final Decision Requiring Electric System Reliability Procurement for 2021-2023 (D.19-11-016)[xxvii]

Energy Utility Climate Vulnerability Assessments

The energy sector, much like other sectors across the economy, is already facing the impacts of climate change today and is working to assess vulnerabilities in the system that will worsen over the next decades and century. The state agencies overseeing energy have undertaken several initiatives and regulatory efforts to address this pressing issue. Below are several actions underway that address how California utilities are learning to manage climate risks.

The CPUC has specifically moved to require climate vulnerability assessments from utilities, and also has required that those assessments work intentionally with disadvantaged communities. Information on that decision can be found in their regulatory documents issued in September 2020.[xxviii] This decision requires energy utilities to file with the CPUC vulnerability assessments on a schedule aligned with existing CPUC regulatory requirements. The timeline below (Figure 2) shows when the State's utilities must meet the milestones in order to inform their General Rate Case regulatory process. The figure is part of an ICF International white paper on the process, which summarizes the current status of the CPUC decision, known as the Adaptation OIR.[xxix] The mid/long-term assessments must focus on climate risks to utility operations, services, and assets; provide options for dealing with vulnerabilities; describe climate risk to assets under third-party contracts of 15 years or longer for power, capacity, or reliability; and plan for 20-30 years. Uniquely, this rulemaking process also requires in-depth engagement with disadvantaged communities and the creation of a community engagement plan, which must be submitted to and approved by the CPUC prior to a utility creating the vulnerability assessment.

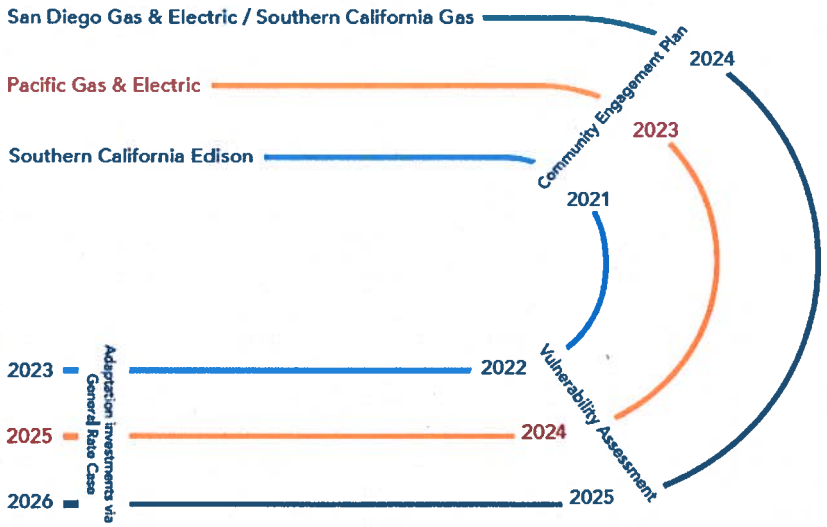

Figure 2: Timeline of CPUC Climate Change Adaptation Cycle Requirements by Utility (ICF 2020)

The 2018 Risk Assessment Mitigation Phase (RAMP) Report covers multiple risk assessment areas, including physical security, wildfire, and climate change.[xxx] In Chapter 12, "Climate Change," SCE discusses ongoing efforts to examine the near-, medium-, and long-term vulnerabilities and impacts of climate change and extreme weather events. In the near term, SCE's analysis focused on the risk associated with additional energy procurement under extreme heat events. In the Appendix to this chapter, SCE included a high-level vulnerability assessment. This document evaluates the long-term risk posed by climate change from now until 2050.

California is not the only State working on undertaking climate vulnerability assessments for electric utilities. ConEdison, the energy utility for New York City, already completed a climate vulnerability study in December 2019.[xxxi]

The California Independent System Operator (CAISO), CPUC, and CEC jointly issued a preliminary root cause analysis for the rotating outage event that occurred in mid-August 2020, as discussed in the report.[xxxii] This analysis identified five state-level policy recommendations to avoid similar rotating outage events:

1) Update the resource and reliability planning targets to better account for heat storms and other extreme events resulting from climate change and the changing electricity resource mix during critical hours of grid need;
2) Ensure that the generation and storage projects that are currently under construction in California are completed by their targeted online dates;
3) Expedite the regulatory and procurement processes to develop additional resources that can be online by 2021, most likely demand response and other flexible resources;
4) Coordinate additional procurement by publicly-owned utilities; and
5) Enhance CAISO market practices to ensure they accurately reflect the actual balance of supply and demand during stressed operating conditions.

Additional state-level information on summer 2020's electricity load and resources can be found in this report by CAISO.[xxxiii]

Microgrids

The CEC defines a microgrid as an independent electric grid with on-site energy generation or storage (or both) that can operate both while connected to, and when disconnected or "islanded," from the larger utility grid. Microgrids can serve as climate resilience tools when used to provide emergency power, and can be powered by fossil fuels or by renewable sources. When powered by renewable sources, they can both mitigate and adapt to climate change, often while lowering energy costs. A recent CEC study highlights an example of a low-carbon community microgrid serving the tribal community of Blue Lake Rancheria, which is an internationally recognized model. It serves a six-building campus and an American Red Cross shelter facility in Humboldt County, which faces frequent power interruptions.[xxxiv] The microgrid saves the tribe about $200,000 in energy costs annually and successfully delivers backup power.

Building Decarbonization

In 2019, the CEO reported to the Board on the various approaches used throughout the country for building decarbonization in response to Item No. 12 of the August 13, 2019 Board agenda. That report identified national trends on building decarbonization, but was not focused on energy resilience.[xxxv] To date, 40 cities in California have adopted code changes to reduce or eliminate the use of gas in buildings. Since that report was issued, a research effort by FM3 to survey California voters on their attitudes towards building decarbonization was conducted.[xxxvi] They found that 70 percent of voters preferred to have their homes powered by renewable electricity rather than gas, and that decarbonization was broadly popular. When asked about goals that building decarbonization policies should address, 80 percent of Los Angeles County resident respondents ranked reducing the risk of gas leaks, fires, and explosions as extremely or very important, the highest of any other regions in the State. Again, higher than any other part of the State, 87 percent of Los Angeles County resident respondents ranked improving energy efficiency as extremely or very important.

Below are additional resources that address building decarbonization in the context of resilience.

- The Hidden Battery – Opportunities in Electric Water Heating, The Brattle Group, 2016[xxxvii]
    - This report explores the opportunities in using electric water heating to act as batteries to help balance the electric grid. Recent technological advancements have enabled "grid interactive water heaters" to be controlled over very short time intervals and with near instantaneous response, allowing them to provide frequency regulation and other grid balancing services that are highly valuable in markets with rapid fluctuations in supply.

- Electrification for Climate Resiliency, Sierra Club, 2019[xxxviii]
    - This report points out that modern all-electric homes are more resilient during power outages than mixed-fuel homes. For example, heat pump water heaters can use solar energy and store that heat for 24 hours, which could be used during a power outage. All-electric homes with heat pumps can be pre-cooled or pre-heated when abundant solar energy is available. It also highlights U.S. Pipeline Hazardous Materials Association's data showing that over the past five years, there was a gas pipeline incident that killed one person and sent another to the hospital, and/or caused a fire and/or explosion roughly every four days.[xxxix] Climate change may worsen those outcomes.

- Decarbonization of Heating Energy Use in California Buildings, Synapse Energy Economics, 2018[xl]
    - Synapse reported that electrification in California can reduce electric system costs when paired with efficiency and much of the additional load is

shifted to off-peak hours when clean energy is plentiful. Smart use of electric heat would spread infrastructure costs over more units of electricity sales. Electrification would help absorb surplus renewable energy during periods of low demand, helping achieve California's goal of a 100 percent carbon-free grid in an affordable manner. The report illustrates the benefits of shifting load to achieve affordability and climate goals together.

- PG&E Support Letter to State and Local Government Policies that Promote All-Electric New Construction, PG&E 2020[xli]
    - PG&E, one of the State's largest investor-owned utilities, submitted a letter to CEC urging support for an all-electric 2022 Title 24 building energy code. PG&E fully expects to meet the needs of its customers under an all-electric building code.

- Rhetoric vs Reality: The Myth of "Renewable Natural Gas" for Building Decarbonization, Earthjustice, 2020[xlii]
    - This report finds that due to the limited supply and the high cost of biogas and synthetic gas, and the associated pollution and health impacts, the small and costly amount of renewable natural gas available should be used to decarbonize sectors where there are few or no lower-cost mitigation solutions. The report suggested that buildings would not meet that criterion.

- Residential Building Electrification in California, E3, 2019[xliii]
    - This report finds that electrification of buildings is essential to reduce greenhouse gas emissions from buildings both in the near term and long term. Electrification can lead to consumer capital cost savings, bills savings, and lifecycle savings in many circumstances. It identifies the most substantial near-term opportunities for consumer cost savings for low-rise residential building electrification. The report explores options for all-electric new construction as well as high efficiency air source heat pumps for homes where air conditioning can be replaced with heat pumps.

- The Economics of Electrifying Buildings, Rocky Mountain Institute, 2018[xliv]
    - This report includes an analysis of the Los Angeles region by building type, addressing both capital costs and net lifecycle costs. It found that if the additional load from greater electrification is concentrated during off-peak hours, it would more efficiently utilize existing grid infrastructure and could absorb energy during periods of surplus generation, thereby reducing system costs and putting downward pressure on electricity rates for all customers.

- Health Effects from Gas Stove Pollution, Rocky Mountain Institute, 2020[xlv]
    - This report reviews evidence that gas stoves lead to unhealthy levels of indoor air pollution, and decarbonizing indoor cooking can protect the health of vulnerable populations. It is organized around eight key points, including

well-documented risks to respiratory health from gas stove pollution that shows children and lower-income households are at higher risk of exposure and of adverse health effects, and that, while improved ventilation is critical, electric cooking is a cleaner household cooking option.

Renewables Integration

As the energy system increasingly relies on renewable energy, studies have examined whether this expansion of renewables will be able to meet energy demands while also delivering on other policy goals, such as resilience and environmental justice.

- Renewable Electricity Futures Study, National Renewable Energy Laboratory, 2012[xlvi]
    - This study found that renewable electricity generation from commercially available technologies, in combination with a more flexible electric system, is more than adequate to supply 80 percent of total U.S. electricity generation in 2050, while meeting electricity demand on an hourly basis in every region of the country. Electricity supply and demand can be balanced in every hour of the year, in each region, with nearly 80 percent of electricity from renewable resources, including nearly 50 percent from variable renewable generation, according to simulations of 2050 power system operations.

- LA100: The Los Angeles 100% Renewable Energy Study, National Renewable Energy Laboratory and the Los Angeles Department of Water and Power (LADWP)[xlvii]
    - LADWP has partnered with the National Renewable Energy Laboratory to conduct a comprehensive study of its goal to meet all LADWP's energy needs with renewable energy. The study will have an environmental justice focus and will include input from an advisory committee. The study's scope includes assessing how clean energy can benefit all communities, along with reliability under extreme conditions like wildfires. Study results are slated for release in 2021.

Public Safety Power Shutoffs

Public Safety Power Shutoffs (PSPS) are events where power is temporarily turned off to specific areas in response to certain weather events, such as high winds during wildfire season, in an effort to lower the risk that electric infrastructure would cause or contribute to a wildfire. These events, sometimes referred to as de-energization, can be very disruptive, especially to communities where a high risk of wildfire exists. According to the CPUC, California experienced, on average, 8,000 wildfires per year between 2013 to the end of 2019. During that time, the State's three large energy companies conducted 33 de-energizations. These events reflect the increasing intensity and frequency of wildfires in California, which is largely a result of our changing climate.[xlviii]

The CPUC adopts and updates the state guidelines governing the implementation of PSPS events. CPUC guidelines on PSPS events address issues like minimizing impacts on customers, requiring utilities to pay special attention to customers with access and functional needs, and notifying customers prior to PSPS events. The CPUC also requires utilities to submit post-event reports. Utilities are required to submit PSPS plans to the CPUC. SCE's plan may be found here. [xlix]

PSPS events have impacted communities in Los Angeles County, including in 2020. There were ten PSPS events in SCE territory during 2020; eight of the events included customers in Los Angeles County according to the information provided in the post-event reports posted by the CPUC. Post-event reports include information about the scope of the community impact, highlight community concerns, and detail the type of conditions that led to a utility's decision to de-energize. Given the substantial impact of PSPS events, SCE provides information to the public regarding wildfire and PSPS in various forms, such as through their Wildfire and PSPS Fact Sheet website.[l]

SCE's 2020-2022 Wildfire Mitigation Plan includes: an expansion of overhead inspections; additional system hardening; vegetation management; greater situational awareness, such as weather stations and high-definition cameras; and the continuation of PSPS events, as needed, to protect life and property. SCE plans to invest $3.8 billion to implement its current Wildfire Mitigation Plan and is in a multi-year process that will result in substantial additional spending,[li] [lii] subject to CPUC approval. SCE will be submitting its next plan to the CPUC in February 2021. SCE has several customer programs to assist with preparing for PSPS events, including a program for free backup battery and solar panel to qualifying customers dependent on medical equipment.[liii]

Jobs in Clean Energy

There is no standard or generally accepted definition of the term "green jobs," thereby making studies or reports on this topic inconsistent and inherently subjective. This makes it difficult to compare jobs in these fields to other sectors and results in a lack of reliable data on this topic, a point that was made by the State Building and Construction Trades Council in a recent report.[liv] For these reasons, the OurCounty Sustainability Plan intentionally avoids the term "green jobs" in its discussion of workforce and economic development efforts to support implementation of the plan.

Even so, jobs in the clean energy sector are often considered green jobs in the limited literature on this topic. A recent report by a national environmental justice organization highlights the necessity of including underrepresented groups in climate-change-related career opportunities, such as clean energy.[lv] The Los Angeles Cleantech Incubator has analyzed its recent Transportation Electrification Partnership Stimulus Proposal, which urged Congress to pass $150 billion to support zero emission vehicle manufacturing, innovation, and infrastructure. That analysis found that the proposal would result in 370,000 jobs in California and 2.3 million new jobs nationally.[lvi] Those figures include, but

are not limited to, electricity infrastructure jobs. A new report from Next 10 also highlighted the opportunities for new jobs in green stimulus spending along with opportunities in private investment, noting that California captured 51 percent of USA's total $6 billion in clean tech venture capital investment in 2019, including companies that focused on geothermal, smart grid, and hydroelectric technologies.[lvii]

The literature related to clean energy jobs has expanded when considered as part of the broader topic of high-road jobs. In 2017, the state legislature requested a report on the need for increased career technical education, job training, and workforce development resources to help industry, workers, and communities transition to economic changes related to meeting the statewide greenhouse gas emissions reduction goals. That report issued in 2020 recommended a focus on high-road jobs, which includes consideration of the quality of jobs and the pathways to accessing them.[lviii] The report considered all sectors of the economy in the State's Scoping Plan for meeting climate goals, including energy.

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[i] http://www3.sce.com/sscc/law/dis/dbattach5e.nsf/0/B2ADFEF6506791E9882583460074389A/$FILE/I.18-11-006%20SCE%202018%20RAMP%20Report.pdf
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