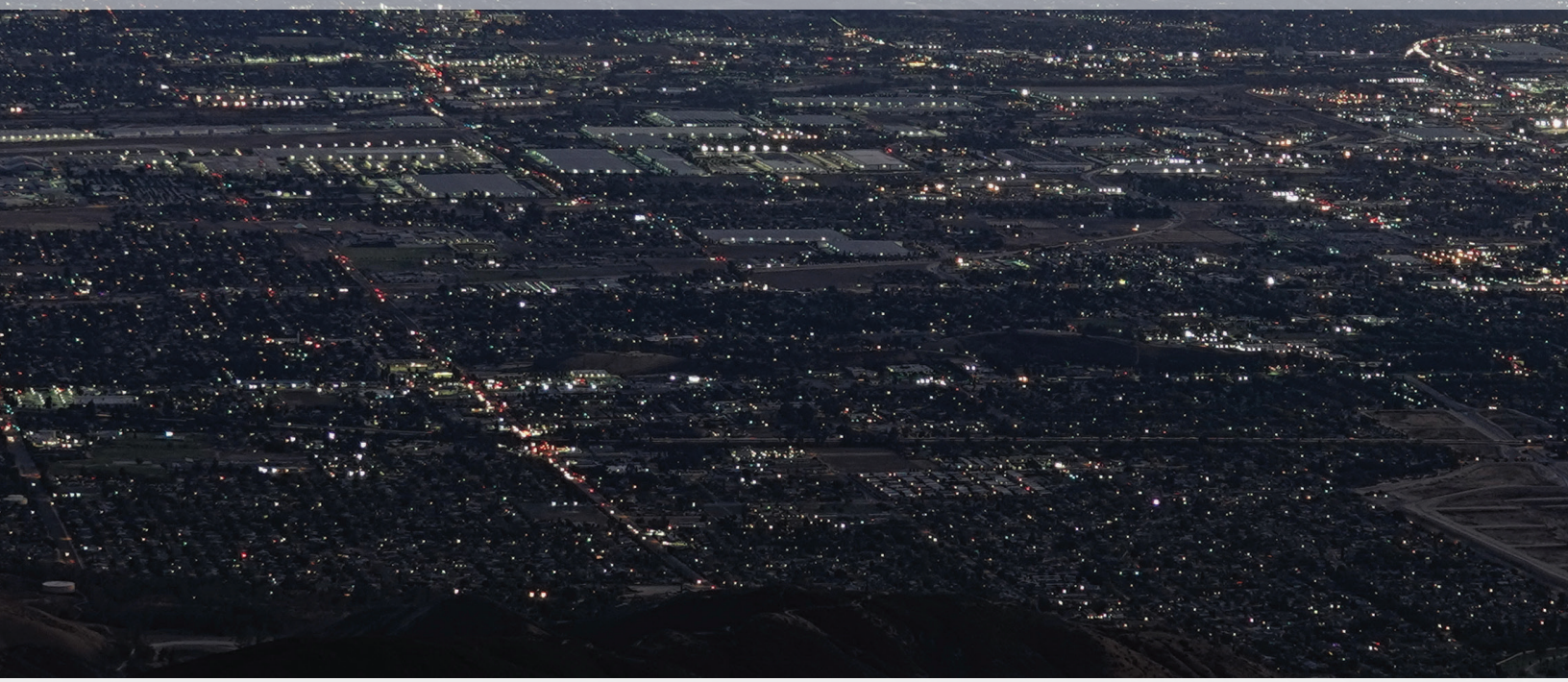
CLEAN AND RESILIENT

Policy Solutions for California's Grid of the Future

JUNE 2020



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About this Report

This policy report is part of a series on how specific sectors of the business community can drive key climate change solutions and how policymakers can facilitate those solutions. Each report results from workshop convenings that include expert representatives from the business, academic, policy, and environmental sectors. The convenings and resulting policy reports are sponsored by Bank of America and produced by a partnership of UC Berkeley School of Law's Center for Law, Energy & the Environment (CLEE) and UCLA School of Law's Emmett Institute on Climate Change and the Environment.

Authorship

Ted Lamm | Climate Law and Policy Fellow, CLEE

Ethan N. Elkind | Director, Climate Change and Business Program, CLEE and UCLA School of Law's Emmett Institute on Climate Change and the Environment

Additional contributions to the report were made by Jordan Diamond of UC Berkeley School of Law and Sean Hecht and Cara Horowitz of UCLA School of Law.

Acknowledgments

The UC organizers thank Nick Chaset (CEO, East Bay Community Energy), Evan Johnson (Climate Policy Advisor, Governor's Office of Planning and Research), Forest Kaser (Resiliency and Microgrids Supervisor, California Public Utilities Commission), Andrew McAllister (Commissioner, California Energy Commission), Linda Parks (Supervisor, Ventura County), Cliff Rechtschaffen (Commissioner, California Public Utilities Commission), Ed Smeloff (Senior Director for Grid Integration, VoteSolar), Sky Stanfield (Partner, Shute, Mihaly & Weinberger), Mad Stano (Program Director, California Environmental Justice Alliance), Geof Syphers (CEO, Sonoma Clean Power), and Michael Wara (Director, Climate and Energy Program, Stanford Woods Institute for the Environment) for their participation in the April 2020 convening that informed this analysis and their contributions to this report.

This report and its recommendations are solely a product of UC Berkeley and UCLA Schools of Law and do not necessarily reflect the views of all individual convening participants, reviewers, or Bank of America.

CLEE thanks David Liebman (Energy and Sustainability Manager, Sonoma County Junior College District) for his thoughtful assistance. CLEE also thanks Joseph Grib (JD Candidate, UC Berkeley School of Law) for his research assistance. Finally, the authors and organizers are grateful to Bank of America for its generous sponsorship of the Climate Change and Business Research Initiative. We would specifically like to thank Anne Finucane, Vice Chair at Bank of America, for her commitment to this work.

Design

Layout **Odd Moxie**

Template **Studio Clear**

Photography Licensed from **Adobe Stock**

INTRODUCTION & EXECUTIVE SUMMARY

California's electrical grid stands at a pivotal moment. Utilities, grid operators, and communities face heightened risks from climate change, most prominently due to increasingly frequent and destructive wildfires, as well as threats like extreme heat events and sea level rise. These impacts jeopardize the state's energy infrastructure, prompting preventive shutoffs that threaten community safety.[1] At the same time, the state is committed to meeting ambitious climate mitigation targets, including obtaining 60 percent of its electricity from renewable sources and reducing greenhouse gas emissions 40 percent below 1990 levels, both by 2030—as well as goals of 100 percent zero-carbon power and carbon neutrality by 2045.[2] To meet these goals, California will need to accelerate electrification of buildings and transportation, as well as increase the deployment and use of intermittent solar and wind energy sources, adding more strain to the grid. These dual challenges also present California energy leaders with a dynamic group of opportunities to boost reliability and community resilience while mitigating climate-warming emissions.

A number of established and emerging technologies can simultaneously solve for both decarbonization and reliability, such as distributed renewable generation (i.e. smaller-scale technologies connected to the distribution grid close to demand centers), energy storage, microgrids, vehicle-grid integration, and building performance and load flexibility. But integrating these technologies at sufficient scale, while also promoting equity and affordability for all Californians, will require heightened coordination across state agencies, local governments, utilities, and technology providers. How can state, utility, and local leaders plan and deploy an electrical grid that will meet state clean energy, equity, and community reliability needs while serving an increasing number of electrified buildings and vehicles in a warming climate?

To address these challenges, UC Berkeley School of Law's Center for Law, Energy & the Environment (CLEE) and UCLA School of Law's Emmett Institute on Climate Change and the Environment convened leaders in April 2020 from state and local government, advocacy, and academia for an expert convening designed to identify top-priority policy solutions. This policy brief outlines the vision these stakeholders described for California's clean and resilient grid of the future; the key barriers limiting progress toward that vision; and actionable solutions to overcome those barriers. Top barriers and solutions include:

Barrier #1: The cost and scale of the transition to a decarbonized, resilient grid

The state legislature could:

- Direct the California Public Utilities Commission to advance performance-based regulation focused on local needs for clean, resilient energy.
- Direct the California Public Utilities Commission and Energy Commission to encourage utility and public investment in low-carbon resilience infrastructure in light of emerging priorities and changing risks.
- Leverage funding outside the rate base to finance resilience investments.
- Accelerate electrical market regionalization to reduce costs of decarbonization.
- Restructure low-income ratepayer assistance programs to guarantee affordability in the face of increasing costs from resilience and decarbonization investments.

The California Public Utilities Commission could:

- Update the Rule 21 process to include cost-sharing for grid upgrades.
- Update regulations to allow utilities and CCAs to develop community and regional markets for energy and grid services.
- Restructure and expand low-income ratepayer assistance programs to guarantee affordability in the face of increasing costs from resilience and decarbonization investments.

The California Energy Commission could:

- Support utilities and CCAs in developing community and regional markets for energy and grid services.

Barrier #2: The slow, top-down nature of current regulatory processes

The state legislature could:

- Direct the California Public Utilities Commission, Energy Commission, Independent System Operator, and Air Resources Board to institute a new collaborative research and planning process focused on resilient decarbonization.
- Permit targeted relaxation of Bagley-Keene open meeting requirements within this 'grid of the future' planning process to facilitate greater inter-agency coordination.
- Appropriate funds for increased compensation for California Public Utilities Commission and Energy Commission staff and more regional offices.
- Split the California Public Utilities Commission's energy and non-energy capacities to allow dedicated focus on pressing energy needs.

The California Public Utilities Commission could:

- Update the Rule 21 interconnection process to limit the scope of review and create a rebuttable presumption of approval.
- Update Rules 2 and 21 to streamline microgrid installations.
- Update resource adequacy requirements to increase flexibility, along with the California Independent System Operator.
- Restructure rate cases and integrated resource planning to lower the cost of participation.

The California Independent System Operator could:

- Update resource adequacy requirements to increase flexibility, along with the California Public Utilities Commission.

Barrier #3: The inadequacy of current data-generation and sharing mechanisms

The state legislature could:

- Appropriate funds for local governments, CCAs, and the California Energy Commission to develop new grid data collection and management capacities.

The California Energy Commission could:

- Initiate a regulatory process to identify data necessary to achieve the clean and resilient grid transition and share the data in agreed formats on a single platform.

The Governor's Office of Planning and Research and the Governor's Military Council could:

- Convene a body to assess the strength of security and customer privacy claims in order to improve secure energy data access.

The rest of this report offers more details on these barriers and solutions, along with an overview of the issues facing grid resilience and decarbonization.

I. OVERVIEW: CALIFORNIA'S CLEAN AND RESILIENT GRID NEEDS

A. Wildfires and other climate risks threaten the stability of the grid

The existing and future threats of climate change will place immense strain on the state's electrical grid. In the record 2017 and 2018 wildfire seasons, over 17,000 wildfires burned in excess of 3.5 million acres, destroying nearly 35,000 structures, altering or eliminating sensitive habitats, forcing hundreds of thousands of evacuations, and taking nearly 150 lives.[3] In addition to their immense human and natural cost, these wildfires also pose a direct threat to poles, substations, and other infrastructure that constitute California's electrical grid, totaling hundreds of millions to billions of dollars. Extreme storm surge events, coastal erosion extreme precipitation events and earlier snowmelt, and extreme heat events will further strain grid resources.[5]

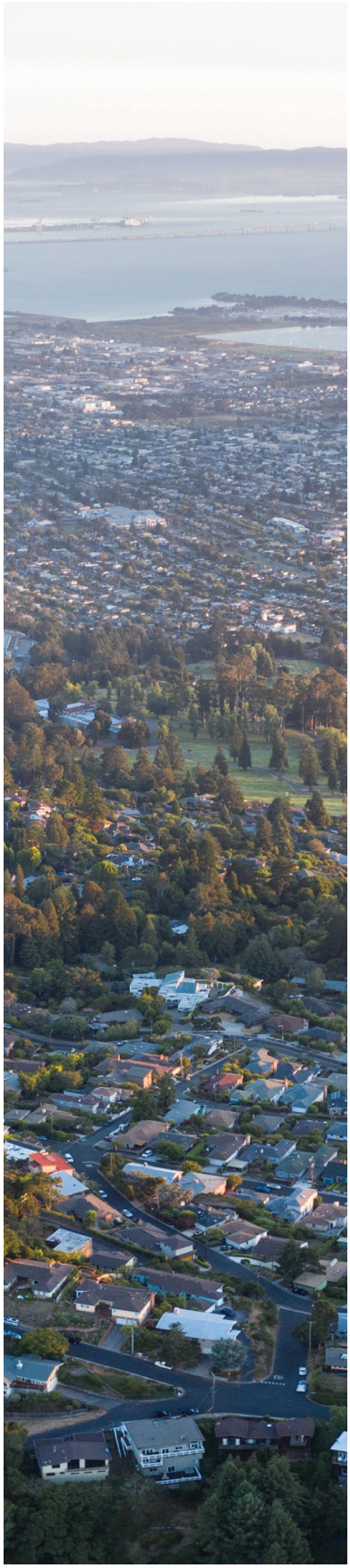
In some instances the electrical grid is also the trigger of these catastrophic events, presenting massive liability risks for electric utilities.[6] After grid equipment owned by Pacific Gas & Electric (PG&E), California's largest electric utility, was found to have sparked 2017 and 2018 fires in northern California, the utility faced tens of billions of dollars in potential liability, eventually entering into settlement agreements totaling over $25 billion, and pleading guilty to criminal charges in connection with the 2018 Camp Fire.[7] This liability, and the risk of future similar liability, contributed to PG&E's 2019 bankruptcy filing.[8]

B. Public safety power shutoffs mitigate fire risk but raise new concerns

To limit wildfire risk, California's electric utilities have begun to institute public safety power shutoffs (PSPS), proactive "de-energization" events at times of high fire risk. Senate Bill 901 (Dodd, Chapter 626, Statutes of 2018) required electric utilities to prepare wildfire mitigation plans including protocols for "deenergizing portions of the electrical distribution system" to minimize risk of utility-caused wildfires.[9] While these events may be necessary to prevent potentially catastrophic fires, the California Public Utilities Commission has recognized that they can pose a distinct set of risks to "providers of essential services (e.g., hospitals, prisons, public safety agencies, telecommunications utilities, and water districts) and customers who are especially vulnerable to power interruptions (e.g., customers who rely on medical-life support equipment)."[10] Facing high winds and dry conditions in the fall of 2019, the state's three investor-owned electrical utilities initiated PSPS for millions of California residents and businesses, some affecting dozens of counties for days at a time.[11] These events may continue in widespread fashion for 10 years as the utilities work to upgrade old, risky equipment.[12]

C. Emission reduction and renewable energy goals add complexity and urgency

Even as it faces these significant threats to the stability of the electrical grid, California is pursuing long-established goals to reduce greenhouse gas emissions, including through decarbonization of the electricity supply. California's Renewables Portfolio Standard (RPS), first introduced in 2002, requires investor-owned utilities to procure a minimum of 60 percent of their power from renewable sources by 2030.[13] Pursuant to this target and the state's greenhouse gas emission reduction goals, the California Public Utilities Commission has required electrical load-serving entities to prepare 2030 integrated resource plans (IRPs) that address their proportional share of statewide emission portfolios of 46 and 38 million metric



tons.[14] The legislature has also declared a state policy of 100 percent "zero-carbon" energy by 2045; while the California Public Utilities Commission, Energy Commission, and Air Resources Board are required to develop plans to achieve this goal, it is not formally governed by the current RPS or IRP processes, which run through 2030.[15] Greater integration of intermittent wind and solar sources is changing the way the grid operates, and while California is on track to meet its 60 percent renewable target, more flexible electricity generation, storage, demand management, and distributed resource options will be needed to adequately balance supply and demand.[16]

Complicating the electricity decarbonization picture, climate change will cause and accompany shifts in energy demand. The California Energy Commission forecasts statewide electricity consumption increases of greater than 10,000 gigawatt-hours by 2030 in all scenarios.[17] Increasing overall temperatures, building and vehicle electrification, and greater penetration of air conditioning will contribute to this net increase in annual electricity consumption around the state in the coming decades.[18] For example, the state could experience a 35 percent increase in peak demand by 2060, which could exceed grid generation and transmission capacity and lead to service disruptions in summer months.[19] This increase and shift in demand will exacerbate the challenge of balancing supply and demand while integrating renewable energy sources into the grid, possibly placing disruptive strain on already-taxed infrastructure. Energy efficiency and building performance and load management have the potential to mitigate a significant portion of this strain, but only through adequate investment in necessary building infrastructure and data management capabilities. Under Assembly Bill 3232 (Friedman, Chapter 373, Statutes of 2018), the California Energy Commission is evaluating strategies to reduce building greenhouse gas emissions 40 percent below 1990 levels by 2030, including through load management strategies.[20]

D. Technologies and policies emerge to meet the dual challenge

A range of promising technologies has the potential to increase both clean energy integration and grid reliability and community resilience in the face of these climate change-related risks and mandates. These include:

- **Microgrids.** The California Public Utilities Code defines a microgrid as an interconnected energy system "within a clearly defined electrical boundary that can act as a single, controllable entity, and can connect to, disconnect from, or run in parallel with, larger portions of the electrical grid," these isolatable resources can withstand grid disturbances and maintain electrical supply to critical infrastructure.[21] During a PSPS event, a microgrid can enter "island" mode to continue serving power to local demand outside the high wind area, while nearby transmission lines, substations, or distribution lines are de-energized to limit fire risk. Microgrids that obtain power from distributed renewable generation and energy storage can support decarbonization and reliability goals at the same time. While questions remain around equitable public policies and sustainable business models for microgrids, specific applications such as for medical centers, campuses, military bases, and remote communities appear most promising.[22]
- **Distributed renewable generation.** California has long led the nation in distributed (i.e., non-utility scale) solar energy installations, with over 1 million projects providing over 9,000 megawatts of generation capacity.[23] These residential, commercial, and community-scale installations can serve multiple clean and resilient grid goals: reducing greenhouse gas emissions by decreasing the need for fossil-fuel energy sources; reducing the need for new transmission infrastructure to transmit power from utility-scale generation; supporting energy resilience at the source by providing power directly to a home or business during an outage event (so long as the system is connected to energy storage); and providing power to microgrids.

- **Energy storage.** Energy storage serves an essential function for a resilient grid that includes more renewables and microgrids. By storing energy produced by intermittent wind and solar sources during low-demand periods, technologies like batteries, flywheels, fuel cells, and pumped hydropower can later provide it during high-demand periods for use at individual homes, within islanded microgrids, and to the broader grid. This demand-balancing function helps to maximize efficiency of grid investments by reducing the need for both incremental renewable sources to cover peak demand and fossil fuel sources to cover low-sun, low-wind periods. Storage also improves overall reliability during PSPS by lengthening the time individual facilities and communities can receive power off-grid, as well as community safety and resilience by increasing the ability to provide power to essential services.[24]
- **Vehicle-grid integration.** Through communication between an electric vehicle battery and the grid, vehicle-grid integration (VGI) facilitates managed charging of electric vehicles, targeting midday peak solar generation hours when supply can exceed demand and avoiding low-light hours when renewable supply is lowest. This capacity can be crucial to support a grid increasingly supplied by intermittent sources. (Advanced vehicle-to-grid (V2G) technology can also discharge the stored power to the grid or to a vehicle owner's home when necessary.) If implemented at scale, this technology can facilitate more integration of zero-carbon solar and wind energy sources into the state grid while supporting community resilience and microgrids.[25]
- **Building performance and load flexibility.** Increasingly energy-efficient and electrified buildings (including building-wide heating and hot water systems and all-electric appliances), coupled with grid communication technologies, can similarly manage demand to assist with grid balancing and facilitate renewable energy integration. This grid management capacity, coupled with local investments in distributed generation, energy storage, and substation monitoring, can provide substantial resilience benefits where the full islanding capabilities of a microgrid are not necessary.

California legislators and regulators have begun an aggressive push to support these technologies. Senate Bill 1339 (Stern, Chapter 566, Statutes of 2018) directed the California Public Utilities Commission to develop utility tariffs, service standards, interconnection standards, and methods to reduce barriers to deployment for microgrids.[26] The commission's Self-Generation Incentive Program (SGIP) provides rebates and incentives for installation of distributed generation systems, and recent legislation and commission decisions have directed those incentives to fund greenhouse gas emissions-reducing storage projects and investments for "equity resilience" customers in high-fire or high-PSPS risk areas who face medical risks or qualify as low-income, as well as critical facilities in those areas.[27] (The challenge of finding interested customers who meet these eligibility criteria, as well as COVID-19 related delays, have slowed early uptake in the equity program, although the commission's launch of SGIP "eligibility maps" may help accelerate it.[28]) California's first-in-the-nation energy storage mandate and public utilities commission rules have rapidly accelerated battery storage deployment and helped reduce costs.[29] And the California Energy Commission's Title 24 building energy efficiency standards require new residential construction to include rooftop or community solar installations.[30]

In addition to these technology-oriented laws and regulations, California legislators have recently enacted a slate of new laws designed to improve community energy resilience and safety in the face of wildfires and PSPS. These include, for example:

- **Senate Bill 167** (Dodd, Chapter 403, Statutes of 2019), which requires electric utilities to include PSPS protocols in their wildfire mitigation plans.[31]
- **Senate Bill 560** (McGuire, Chapter 410, Statutes of 2019), which requires electric utilities to conduct comprehensive community notification prior to PSPS.[32]

- **Assembly Bill 1144** (Friedman, Chapter 394, Statutes of 2019), which requires the California Public Utilities Commission to direct 10 percent of SGIP funds to critical facilities that support resilience during PSPS.[33]

These are just a few examples of recent grid resilience-related legislation, reflecting the extent to which California policymakers are attempting to address new risks. A more complete list of measures is included at Appendix A.

E. Lower-income communities face particular barriers to energy resilience

Underscoring each of these developments is the issue of energy equity and environmental justice. Californians pay some of the nation's highest electricity rates, which are partly mitigated by the state's energy efficiency codes and mild climate.[34] While many lower-income Californians are eligible for energy bill assistance and home retrofit incentives, they are still more likely to face disproportionately high energy burdens, in part due to greater exposure to extreme high temperatures.[35] These residents have also historically been less likely to benefit from investments in energy efficiency, distributed generation, and electric vehicles, although state leaders have begun increasingly to target benefits to address equity concerns.[36] At the same time, lower-income Californians are likely to suffer more dramatic impacts from wildfire events and from PSPS.[37] As a result of these combined factors, the Californians most in need of energy resilience investments are often those least able to afford them.

II. VISION

To address these priorities, participants at the April 2020 Berkeley Law convening first outlined a vision for California's ideal low-carbon, resilient grid of the future that can both maximize emission reduction and minimize wildfire and widespread shutoff risks. Core elements of this vision included:

- A state-level **regulatory structure that supports balanced, bottom-up solutions and enhanced coordination** among state and local leaders, including long-term resource planning that relies increasingly on statistical availability of sources to build scale in the use of distributed resources; access to out-of-state renewable energy resources to reduce prices and balance the grid; and recognition of grid reliability and resilience as public goods.
- A **diverse and interacting suite of clean technologies** including distributed renewable generation, microgrids, energy storage, vehicle-grid integration, demand management, and grid-interactive buildings and appliances to manage load and maximize efficiency.
- **Modernized data collection, storage, and sharing systems** to support these technologies, manage the grid, and optimize resource planning and operations, including customer-facing data access to facilitate community involvement through Community Choice Aggregators (CCAs) or other institutions.
- **Resilience to, and minimized exacerbation of, compounding climate risks**, including wildfire, extreme heat, flood, and sea-level rise; and resilience to the human health and economic risks associated with widespread power shutoffs.
- **Energy affordability and access** for all low-income and disadvantaged Californians, based on community-led investments and workforce solutions that support broader equity and environmental justice goals.

This vision reflects the complex and interconnected nature of the dual resilience and decarbonization challenge. It also highlights the fact that many of the most promising solutions to this challenge, if supported with the right policies, can drive progress toward both goals.

III. BARRIERS AND PRIORITY POLICY SOLUTIONS

Participants identified a range of barriers to achieving the ideal clean, reliable, and resilient grid of the future, ranging from the sheer scale of wildfire resilience needs to the operational and budget challenges imposed by the coronavirus crisis. These challenges fall into three primary groups:

- The cost and scale of the transition to a decarbonized, reliable, resilient grid;
- The slow, top-down nature of current regulatory processes; and
- The inadequacy of current data-generation and sharing mechanisms.

This section describes those barriers in detail and highlights the top-priority policy solutions participants identified to overcome them.

Barrier: Cost and scale of the transition to a decarbonized, resilient grid could exceed capacity

Convening participants emphasized that while the technologies needed to transition to a clean, reliable, and resilient grid are becoming increasingly established and cost-competitive, the cost and scale of that transition could exceed the capacities of local and state government, electric utilities, and CCAs. This problem risks pitting reliability and decarbonization against energy affordability for all Californians, particularly given the short timeline on which the state needs to achieve its dual goals.

A number of elements contribute to the cost and scale problem, many of them inherent to the challenge of transitioning a system built on decades-old equipment to address new risks. But participants highlighted a number of other aspects of the problem, including:

- **Infrastructure financing limitations.** Deterioration of investor-owned utilities' credit quality, the limited size and diverse number of CCAs, and challenges raising state revenue sources inhibit the state's ability to support a low-risk business environment for appropriate-scale investment in both established and emerging technologies.
- **Outdated cost structures.** Investor-owned utilities' cost recovery structures and shareholder return incentives, premised on a historical model of rate-based investment in major generation and transmission assets, inadequately protect customers and ratepayers in light of the extent to which they bear the burden of new climate and resilience risks.
- **Lack of regional cooperation.** The lack of a regional wholesale electricity market and rules that do not fully credit service providers for emission reductions generated out-of-state drive up the cost of decarbonization.
- **Inequitable energy burdens.** Low-income and disadvantaged customers already pay disproportionately high amounts of their income toward energy costs, while facing disproportionately high food, housing, and medical insecurity.

- **Liability risks.** The increasingly severe financial risks associated with owning and managing electrical transmission and distribution infrastructure threaten the stability and investment capacity of investor-owned utilities and public power agencies.
- **Workforce needs.** The existing capacity and structure of the energy efficiency and building trades may be inadequate to meet the need for a rapid transition, particularly in an economic downturn.

Solution: The legislature could direct the California Public Utilities Commission to advance performance-based regulation.

The traditional utility ratemaking structure involved review and justification of rates based on the capital cost of investment in generation and transmission infrastructure, which gave utilities incentives to build new assets rather than purchase services from third parties or focus specifically on local resilience needs. Ratemaking has evolved from this historic structure but still does not fully reflect the need for multi-party investment in the distributed technologies needed to drive a clean, resilient grid. To prioritize these needs, the legislature could direct the California Public Utilities Commission to introduce performance-based regulation for investor-owned utilities, tying their returns to performance on resilience, decarbonization, affordability, equity, and safety metrics. By explicitly linking utilities' revenues to these key desired outcomes, the commission could ensure they are advanced to the greatest possible degree. For relevant examples of performance-based ratemaking, legislators and commission leaders could look to the Hawaii Public Utilities Commission, which recently instituted an order directing revenue adjustment based on outcomes including greenhouse gas emission reduction, transportation electrification, and resilience, in addition to traditional concerns.[38] Legislators could look to Colorado's recent law directing performance-based ratemaking, which included a similar focus on new decarbonization and resilience needs, among many other states that have some form of law focused on performance-based regulation.[39]

Solution: The legislature could direct the California Public Utilities Commission and California Energy Commission to encourage utility and public investment in low-carbon resilience infrastructure in light of emerging priorities and changing risks.

Utilities' traditional, regulator-approved return on equity, based on long-term infrastructure investments, may not adequately prioritize the public value and necessity of grid decarbonization and resilience investments. Allowing the same shareholder return on these priority investments as on traditional investments increases rates for ratepayers who are ultimately responsible for funding them, raising significant affordability and equity questions given the unusually urgent need for investments in resilience and decarbonization. To ensure that key infrastructure is deployed at sufficient speed and scale while protecting ratepayers, regulators may need to consider alternative investment and ownership models for these investments. The legislature could direct the California Public Utilities Commission to conduct a formal review of investor-owned utilities' return on equity to evaluate which asset types in the grid of the future may require a reduced return on equity, which may lend themselves to public ownership (to be financed by public debt or equity), and which could be developed, owned, and operated by independent third parties. Leaders at the Public Utilities Commission could work with leaders at the Energy Commission to identify public safety and economic benefits of distributed resilience investments to support this analysis. For the public ownership category, legislators could consider the ownership model of electric co-ops, which provide service at long-term cost without distribution of surplus revenues to shareholders, meaning they could offer a more affordable path for investment in crucial resilience infrastructure.[40]

Solution: The legislature could leverage funding outside the rate base to finance resilience investments.

To finance resilience assets that are particularly urgent and do not fit in utilities' investment and ownership strategies, the legislature could consider a bond measure or allocation of tax dollars with funds dedicated to major distributed resource investments. (In light of the elimination of a potential climate resilience bond due to the budget impacts of the COVID-19 pandemic, these grid resilience funds may need to be linked to other COVID-19 and economic stimulus-related measures.[41]) Local resilience infrastructure with community-level applications will generate significant statewide benefit in terms of wildfire risk reduction and grid reliability services. State leaders could focus investment first in low-income and high-fire risk communities. New York's NY Prize competition, which provided $40 million in state funding to help develop at least ten community microgrids, also offers a compelling model for use of state funds to leverage investments in emerging technology.[42]

Solution: The legislature could accelerate grid regionalization to reduce costs of decarbonization.

Participants emphasized the potential value of a regional, multi-state electrical wholesale market to advance decarbonization goals by reducing renewable energy costs through reduced system redundancies as well as economies of scale for diverse new clean energy technologies. Access to a larger electricity market including energy resources throughout the West would allow California utilities and CCAs to secure additional diverse, utility-scale renewable generation that is necessary to support a decarbonized grid. Senate Bill 350 (De León, Chapter 547, Statutes of 2015) declared the legislature's intent to shift to a regional electricity market and directed the California Independent System Operator to study its potential benefits and impacts, and the resulting study identified regionalization benefits in the form of ratepayer savings, reduced greenhouse gas emissions, job creation, enhanced grid reliability, and increased incomes in disadvantaged communities.[43] The Independent System Operator has begun to consider expanding its regional energy imbalance market to achieve some of these goals, but to date there has been no statewide legal commitment.[44] Building off the steps the Independent System Operator has already taken, the legislature could formally commit to the process of planning and transitioning to a more robust regional model for the wholesale electric market.

Solution: The California Public Utilities Commission could update the Rule 21 process to include cost-sharing for grid upgrades.

California Public Utilities Commission Rule 21 governs interconnection of distributed energy resources to the electrical grid, setting rules for integration for many of the resources that will be necessary to achieve grid decarbonization and resilience.[45] When a new distributed resource interconnection will require an upgrade to grid infrastructure (for capacity or safety reasons), the applicant is typically responsible for the full cost of that upgrade. This front-loading of costs can often discourage deployment of new technologies, placing additional burdens on first movers even though benefits may be shared widely by the utility and other customers in the future. The commission could update Rule 21 to include a cost-sharing mechanism for these upgrades, requiring first movers to pay only an appropriate share of costs and utilities to allocate the remaining costs among later beneficiaries of the grid upgrade (both applicants and ratepayers). This step would eliminate a significant disincentive to proactive installations, reducing costs and accelerating technology uptake as well as grid strengthening for improved reliability. As an alternative, the commission or the state legislature could enact a new mandate that utilities proactively undertake these investments and recover costs from interconnection applicants over time, similar to a proactive upgrade-reimbursement approach that New York regulators and utilities have begun to implement.[46]

Solution: The California Public Utilities Commission and Energy Commission could allow and support utilities and CCAs to develop community and regional markets for energy and grid services.

Distribution system operators (DSOs) can manage the local distribution grid to encourage the cost-effective use of flexible distributed generation and demand-response assets. By operating at a more granular, distribution system-level than transmission system operators such as the California Independent System Operator, which balances bulk system generation based on transmission constraints, DSOs offer the opportunity to maximize the efficient use of distributed resources and support the value proposition of integrating more new technologies.[47] Introducing new DSO capacities into the California grid could provide a much-needed boost to key resilient and low-carbon grid technologies, allowing communities and regions to get the most economic and energy value out of their investments. To support this innovation and maximize the community-scale grid benefits of distributed generation, building load management, and storage assets, the California Public Utilities Commission could issue regulations to expressly allow CCAs to implement and coordinate with DSO functions. The Energy Commission could provide technical assistance to support these functions, particularly as they relate to building and data-focused applications.

Solution: The California Public Utilities Commission and state legislators could restructure and expand low-income ratepayer assistance programs to guarantee affordability in the face of increasing costs from resilience and decarbonization investments.

The California Alternative Rates for Energy program (CARE), Family Electric Rate Assistance program (FERA), and Low-Income Home Energy Assistance Program (LIHEAP) provide lower-income Californians with financial assistance to pay energy bills. These programs variously provide bill discounts of up to 35 percent or one-time bill payments, but crucially they do not guarantee affordability. For low-income customers facing extremely high energy burdens in areas like the San Joaquin Valley, these programs may still be inadequate to make energy affordable, particularly as utilities and communities begin to invest in essential, but expensive, clean and resilient grid technologies. To address this pressing equity issue, the California Public Utilities Commission could restructure CARE, FERA, and LIHEAP to guarantee customer affordability—instead of providing limited subsidies—using a non-volumetric, need-centered basis. The Clean Power Alliance, a Southern California CCA, offers subsidized rates for CARE- and FERA-qualified and medical baseline customers in service area communities that have committed to 100 percent clean energy, allowing them to participate in the 100 percent clean power option without facing the associated rate premium.[48] The alliance achieves this by analyzing these households' energy demand to determine the additional renewable procurement required to bring them to 100 percent renewable; assessing the cost of that procurement; and socializing that cost across the bills of standard ratepayers. To ensure an affordable transition for lower-income Californians, leaders at the California Public Utilities Commission and in the legislature could consider a similar initiative to spread the cost of resilience investments across non-subsidized ratepayers around the state.

Barrier: Slow, top-down regulatory processes are unsuited to meet the rapidly evolving challenge

Participants described state-level regulatory processes that encourage a slow, top-down approach that is not ideally suited to meet the rapidly evolving, distributed nature of the decarbonization and resilience challenge. While the energy regulators tasked with meeting the state's ambitious goals—including the California Public Utilities Commission, Energy Commission, and Independent System Operator—have made admirable progress, their

processes and structures are not always designed to solve this type of challenge with the necessary speed and scale. Key aspects of this barrier include:

- **Deliberative and iterative processes.** Rate-setting, grid planning, and other processes designed for the longer time horizon of investor-owned utilities' historical infrastructure investments (and to satisfy legally required due process standards) limit state and local leaders' ability to timely plan for and respond to shifts in demand, technology, and risk.
- **Adversarial investment processes.** Existing processes task investor-owned utilities with forming investment plans and place the burden on advocates to challenge their adequacy to meet environmental, resilience, and ratepayer goals, slowing progress.
- **Adversarial interconnection processes.** Grid interconnection processes for distributed resources under California Public Utilities Commission Rule 21 place the burden of proof on applicants and require investor-owned utilities to assess specific technologies, limiting integration of new clean and resilient installations.
- **Inflexible resource adequacy planning.** Existing structures and rules to define and procure adequate resources limit opportunities to address local resilience and decarbonization needs.
- **Burdensome local approvals.** Land-use, inspection, and construction permitting processes can slow deployment.
- **Staffing limitations.** Key state energy regulators' staffing structures and turnover limit capacity to address the challenge with the speed and nuance it demands.
- **Lack of a natural gas phase-down plan.** While many state decarbonization goals rely on a phase-out of at least some of the natural gas infrastructure, the lack of a clear and comprehensive plan limits incumbents' incentives to invest accordingly (although a recently initiated Public Utilities Commission proceeding will begin to address this issue[49]).

Solution: The legislature could direct the California Public Utilities Commission, Energy Commission, Independent System Operator, and Air Resources Board to institute a new collaborative research and planning process focused on resilient decarbonization.

To help key state energy regulators overcome the mismatch between their existing regulatory processes and the needs of a clean and resilient grid, the legislature could create a new "grid of the future" planning process involving leaders from each agency. Topics could include accelerating integration of distributed generation and microgrids, ramping up building performance and load management technologies to support resilient decarbonization, mechanisms to develop new markets, and allocation of state incentives and subsidies with an equity and resilience focus, and planning system reliability over multiple time horizons. The existing integrated resource planning process (which requires utilities to develop plans for meeting renewable energy and other goals) and Integrated Energy Policy Report process (in which the California Energy Commission prepares a statewide energy forecast, with input from other agencies) could serve as models for this new process.[50]

Solution: The legislature could permit targeted relaxation of Bagley-Keene requirements within this 'grid of the future' planning process.

Participants noted that the Bagley-Keene Act, which sets strict open meeting and public process requirements for state agency deliberations, can in some cases restrict the ability of leaders at state energy agencies from engaging in fact-finding and making decisions at the pace necessary to rapidly achieve grid resilience and decarbonization.[51] State legislative leaders could relax public notice and comment requirements—for example through a specific

expansion of the "special meeting" exception—to facilitate rapid interagency coordination on time-sensitive issues addressed by the grid planning process.[52]

Solution: The California Public Utilities Commission could update Rule 21 interconnection processes to accelerate distributed generation and storage deployment.

The Rule 21 process generally involves utility review of customer applications for interconnection, with utilities afforded significant latitude in their decision-making. In recent years, the legislature has updated Rule 21 to provide expedited dispute resolution (in cases where a customer disputes a utility's rejection of an application) and the California Public Utilities Commission instituted a rulemaking to streamline Rule 21 processes.[53] But participants identified updates to the process that are needed to speed interconnections and reduce barriers for applicants:

- Create a regulatory presumption of approval, with the burden of proof on the utility to demonstrate that an application will violate safety or capacity needs (whereas the current process effectively places the burden of proof on applicants).
- Limit utilities' review to the anticipated impact on grid safety and capacity (ensuring the focus is entirely on these issues).
- Require utilities to proactively propose alternatives to customer applications (rather than issuing simple rejections).

Each of these reforms would help applicants bring more applications and have more success in obtaining approval of interconnections while protecting utilities' grid safety and reliability concerns. They could build on other streamlining measures that commission staff have already proposed, such as requiring expedited utility sign-off and development of pre-approved interconnection designs.[54]

Solution: The California Public Utilities Commission could update Rule 2 and Rule 21 to streamline microgrid installations.

California Public Utilities Commission Rule 2 governs, among other things, requirements for adding new meters when installing a new independent system such as a microgrid.[55] Rule 21 adds separate requirements for advanced meter telemetry when installing renewable energy or storage applications. For an applicant building a clean microgrid that incorporates solar and/or storage technology, this overlap requires management of two parallel application processes, often handled by separate utility teams, creating significant administrative and cost burdens and in some cases leading to two separate meter installations. The Public Utilities Commission could update this legacy system by requiring utilities to develop combined Rule 2/21 application processes for clean microgrids with a single, streamlined application including technical requirements for islanding systems and for renewable/storage telemetry. Alternatively, the Commission could institute a new clean microgrid-specific rule to govern all applications that include both technologies. In addition to reducing microgrid installation barriers, this system could incorporate requirements and guidelines for the two-way communication that is necessary for microgrids to provide grid-balancing services.

Solution: The California Public Utilities Commission and Independent System Operator could update resource adequacy requirements to increase flexibility.

The California Public Utilities Commission (together with the California Independent System Operator) is responsible for setting resource adequacy requirements for load-serving entities that ensure reliability "while advancing, to the extent possible" state clean energy and emission

reduction goals.[56] The commission and the California Independent System Operator resource adequacy calculation methodology (Effective Load Carrying Capability or ELCC) incorporates both the total generating capacity of an energy resource and the ability of the electrical grid to use that additional capacity to meet peak requirements.[57] The current methodology for allowing battery storage to participate as resource adequacy support is based on a four-hour duration for energy delivery. This market structure may support some installations that help balance current grid-wide supply and demand but provides insufficient incentive for investments that can be essential to support community resilience. The Independent System Operator and Public Utilities Commission could update these requirements to allow greater flexibility for the deployment of battery storage, for example by setting tiers that offer additional resource adequacy credit for incrementally greater storage durations (with a step-down to reflect diminishing marginal benefits as deployment increases). This change could facilitate entry of more long-duration storage assets onto the grid, increasing resilience and supporting a wider market for the technology.

Solution: The California Public Utilities Commission could restructure rate cases and integrated resource planning to lower the cost of participation.

California Public Utilities Commission rate cases and integrated resource planning are typically comprehensive processes by design, allowing utilities and the agency to address a host of related issues in a single proceeding. However, this structure requires advocates and other stakeholders to participate in long, complex processes that entail significant staff time, legal review, procedural compliance, and associated costs. This burden can strain resources and discourage participation for nonprofit and community advocates, when many of these stakeholders are needed to provide essential input on local grid resilience needs and opportunities. The commission could consider steps to facilitate more involvement from these voices, such as supporting limited, issue-specific intervenor status for community resilience issues or exploring methods to break proceedings into smaller pieces.

Solution: The legislature could appropriate funds for increased compensation for California Public Utilities Commission and Energy Commission staff, while the agencies could support more internal advancement opportunities and flexible working arrangements.

Participants noted that California Public Utilities Commission and Energy Commission staff turnover can disrupt long-term grid planning processes and in some cases is driven by more competitive salaries in the private sector and lack of opportunities for internal advancement. In addition, the cost of living in or near San Francisco, where the Public Utilities Commission is headquartered, is a challenge for many staff. The legislature could ease this strain and help the agencies retain more experienced staff by appropriating funds for increased compensation and benefits, while the agencies could undertake proactive efforts to increase internal advancement opportunities and support more flexible working arrangements. The legislature could also consider expanding regional offices to attract and retain a wider range of staff throughout the state. While increasing compensation is undoubtedly challenging in a time of significant budget constraints, the ability of these staff to accelerate grid resilience efforts will pay near- and long-term dividends for public health and crisis response needs that are becoming increasingly essential.

Solution: The legislature could split the California Public Utilities Commission's energy and non-energy capacities to allow dedicated focus on pressing energy needs.

Some participants felt that the broad scope of the California Public Utilities Commission's jurisdiction, including both energy and non-energy (telecommunications, water, rail,

transportation) capacities can detract from the agency's ability to make progress on increasingly complex and rapid-response grid resilience questions. To allow commissioners and key staff to focus entirely on these issues—and to focus more interaction with leaders at the Energy Commission and Independent System Operator—the legislature could consider restructuring the Public Utilities Commission so that a group of commissioners are dedicated exclusively to energy matters, helping them build greater expertise and affording them some more flexibility to participate in the updated processes described above.

Barrier: Inadequate data-generation and data-sharing inhibit the transition

Finally, participants cited inadequate data-collection, management, and sharing mechanisms that inhibit the transition to modern grid management systems. Advanced data-generation and resource-grid communication will be necessary to integrate and maximize the efficiency of essential renewable, distributed, and demand-side technologies. For example, technologies like building load management rely directly on the ability of a grid manager to communicate with individual and aggregated building energy systems and appliances while technology providers and regulators will need access to detailed consumer data in order to target investments. Key drivers of the current lack of data include:

- **Lack of a data-sharing mandate.** Without an enforceable legal or regulatory mandate to share necessary grid data in a consistent and secure manner, investor-owned utilities have not produced data at a pace and scale sufficient to drive investment. While the California Energy Commission has begun statewide building energy data collection under Assembly Bill 802 (Williams, Chapter 590, Statutes of 2015), a wider range of data will likely be necessary for resilience applications.
- **Underinvestment in data infrastructure.** Outdated IT and data management systems result in slow, piecemeal, and unreadable data distributions to advocates and regulators.
- **Cybersecurity and data privacy risks.** Utilities and customers are often unwilling to share information necessary to achieve transition, and their claims can be hard to assess.

Solution: The California Energy Commission could initiate a regulatory process to identify data necessary to achieve the clean and resilient grid transition and work with the California Public Utilities Commission, municipal utilities and CCAs to direct utilities and other relevant entities to collect and share the data in agreed formats on a single platform.

As the primary state regulator responsible for energy data collection and management (across both publicly owned utilities, investor-owned utilities, rural electric co-ops, and CCAs), the California Energy Commission could initiate a new regulatory process focused on data needs to support the technologies necessary for the transition to a clean and resilient grid. Under AB 802, the commission already conducts an energy consumption disclosure and benchmarking program for large commercial and residential buildings.[58] The commission could expand its AB 802 data collection regulations to encompass all energy use information relevant for emerging resilient technologies, in particular for emerging technologies such as building-side load management systems. The legislature could enhance this authority by specifying categories of resilience data (in an open-ended manner to ensure adaptability to future technologies) and by adding smaller residential and commercial buildings to the commission's purview. The commission could add this resilience-focused data to the current AB 802 benchmarking database it is building, or it could work with the Public Utilities Commission, utilities, CCAs, and advocates on a separate data transfer platform, with similar security and customer anonymization terms and data formats for consistency and machine-readability. (The Public Utilities Commission's distribution resource plan proceeding, which requires investor-owned utilities to make distribution system planning data available via public online maps, has begun

part of this process.[59]) The commissions could then jointly require utilities to provide all relevant and available data following these protocols, with the Energy Commission acting as a central data repository to support resilient technology deployment.

Solution: The legislature could appropriate funds for local governments, CCAs, and the California Energy Commission to develop new grid data collection and management capacities.

In addition to gaining access to better customer and grid data, many local governments and/or CCAs need to build organizational and technical capacity to analyze the data and facilitate communication with utilities and state energy agencies. While these local bodies are the closest to essential facilities and vulnerable residents whose energy needs will be prioritized in developing resilience investment plans, they also may lack the staff and funds to effectively manage the data that inform those needs. Utilities and state regulatory leaders will largely rely on local actors to communicate these needs, share data with distribution providers, and manage some of the microgrid, building load management, and distributed technologies that will support resilience. To ensure that new resilience-related data collected by utilities is used efficiently, the legislature could appropriate funds to local public health, emergency services, and planning departments to hire dedicated staff and upgrade IT systems, working with CCAs in applicable jurisdictions. To address the most urgent needs, the legislature could focus first on jurisdictions in high fire-risk areas and with high concentrations of low-income and medical baseline residents. Legislative leaders could consult with leaders in the Energy Commission's AB 802 program to identify top jurisdictions as well as the appropriate data management systems.

Solution: The Governor's Office of Planning and Research could convene a body to review confidentiality, physical asset security, and cybersecurity claims to facilitate access to secure energy data.

Participants noted that while security and customer privacy concerns around utility data are often legitimate, utilities' claims often fall into an informational "black box." The substantial need for confidentiality regarding the location and nature of critical grid assets, which have significant physical security implications, may conflict with the integration of new data-dependent grid technologies, which raise a range of potential questions around cybersecurity and customer data. But without a neutral arbiter or agreed set of standards for such claims, regulators and advocates are forced to defer to utilities' judgments, potentially slowing the exchange of valuable data to an unnecessary degree. The Governor's Office of Planning and Research could convene the Governor's Military Council, the California Department of Technology, the California Energy Commission, the California Public Utilities Commission, utility experts, and ratepayer advocates to review types of utility data and claims of physical asset security-, cybersecurity- and privacy-based confidentiality and develop authoritative guidance on what is legitimately confidential. This guidance could inform subsequent confidentiality disputes in Public Utilities Commission proceedings and Energy Commission rules on data disclosure.

IV. CONCLUSION

The recent California wildfires caused by, and jeopardizing, the state's electrical grid illustrate in stark and urgent terms the need to meet the challenge of a changing climate by building a more resilient, decarbonized electricity system. Failure to act promptly will place more residents in harm's way while undermining the support for the necessary technological and policy changes required to meet the moment. Fortunately, a suite of proven, market-ready technologies can address the challenge. In response, the state will need to update its processes for allocating costs, decision-making and data access, among others. These steps will help California facilitate a rapid deployment of a low-carbon, equitable and resilient electricity grid.

APPENDIX A – SELECT GRID DECARBONIZATION AND RESILIENCE LEGISLATION

Enacted Legislation

- **Assembly Bill 1054** (Holden, Chapter 79, Statutes of 2019) 2019) created a state- and utility-funded wildfire recovery fund available to utilities responsible for wildfires if they are found to have acted reasonably.
- **Assembly Bill 1144** (Friedman, Chapter 394, Statutes of 2019), which requires the CPUC to direct 10 percent of SGIP funds to critical facilities that support resilience during PSPS.
- **Senate Bill 700** (Wiener, Chapter 839, Statutes of 2018) extended SGIP through 2024 and required eligible storage projects to reduce GHG emissions and deploy renewable fuels.
- **Senate Bill 1339** (Stern, Chapter 566, Statutes of 2018) required the CPUC to undertake a microgrid proceeding to develop utility tariffs, service standards, methods to reduce barriers to deployment, and Rule 21 standards, and to form a working group to codify standards to meet CPUC and CAISO requirements.
- **Senate Bill 90** (Nielsen, Chapter 400, Statutes of 2019) required each electric utility to include a description of where and how the utility considered underground electrical distribution in areas with the highest wildfire risk.
- **Senate Bill 155** (Bradford, Chapter 401, Statutes of 2019) required the CPUC to review annual compliance of retail sellers procuring renewable energy resources and following the portfolio standard requirements, and to provide recommendations if the sellers may be at risk of not satisfying requirements.
- **Senate Bill 160** (Jackson, Chapter 402, Statutes of 2019) required counties to integrate cultural competence into emergency plans and provide a forum for community engagement in geographically diverse locations with culturally diverse communities.
- **Senate Bill 167** (Dodd, Chapter 403, Statutes of 2019) requires electric utilities to develop wildfire mitigation plans that include protocols for medical baseline residents during PSPS and authorizes them to provide financial assistance.
- **Senate Bill 209** (Dodd, Chapter 405, Statutes of 2019) created the Wildfire Forecast and Threat Intelligence Integration Center, "the state's integrated central organizing hub for wildfire forecasting, weather information, and threat intelligence gathering, analysis, and dissemination and to coordinate wildfire threat intelligence and data sharing."
- **Senate Bill 247** (Dodd, Chapter 406, Statutes of 2019) established the Wildfire Safety Division within the CPUC to oversee utility compliance with wildfire safety requirements.
- **Senate Bill 520** (Hertzberg, Chapter 408, Statutes of 2019) designated electric utilities as the provider of last resort in their service territory (unless the CPUC designates otherwise), requiring them to provide power when a customer's other load-serving entity fails to provide, or is denied, service.
- **Senate Bill 566** (McGuire, Chapter 410, Statutes of 2019) required electric utilities to develop protocols for instances when transmission de-energization will impact dependent customers/entities, and provide advance notice to public safety offices, first responders, and health care facilities prior to a PSPS.

Pending Legislation

- **Assembly Bill 1915** (Chu, 2020) would require the CPUC to set rules for PSPS and determine whether a utility complied with those rules after a PSPS event, including reimbursement of customer losses if the utility failed to do so.
- **Senate Bill 378** (Wiener, 2020) would require the CPUC to establish a utility compensation process for customers and local governments affected by PSPS.
- **Senate Bill 801** (Glazer, 2020) would require utilities to deploy backup power or provide financial assistance for backup power to medical baseline customers.
- **Senate Bill 1215** (Stern, 2020) would establish a Local Government Deenergization Event Resiliency Fund to fund energy resiliency projects for vulnerable populations, including microgrids.
- **Senate Bill 1240** (Skinner, 2020) would require the CEC and CAISO to add a local government/third party participation element to the IEPR planning process, focusing on grid reliability, renewables integration, and increased efficiency and demand management.
- **Senate Bill 1314** (Dodd, 2020) would require SGC to develop a grant program for local governments to develop community energy resilience plans.

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51. Cal. Govt. Code §§ 11120-11132 et seq.
52. Cal. Govt. Code § 11125.4.
53. See Assembly Bill 2861 (Ting, Chapter 672, Statutes of 2016) (creating expedited dispute resolution); Resolution ALJ-347 (October 12, 2017) (adopting procedures for dispute resolution); Order Instituting Rulemaking to Consider Streamlining Interconnection of Distributed Energy Resources and Improvements to Rule 21, R. 17-07-007 (July 21, 2017), available at https://www.cpuc.ca.gov/General.aspx?id=6442455170.
54. See CPUC, Short-Term Actions to Accelerate the Deployment of Microgrids and Related Resiliency Solutions: CPUC Staff Proposal (January 21, 2019), available at http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M324/K963/324963031.PDF.
55. See, e.g., San Diego Gas & Electric Co., Electric Rule 2: Description of Service, available at https://www.sdge.com/sites/default/files/elec_elec-rules_erule2.pdf.
56. Cal. Pub. Util. Code § 380.

57. For a description of ELCC, see CAISO, Delivery Assessment Methodology (April 24, 2019), available at http://www.caiso.com/Documents/IssuePaper-GenerationDeliverabilityAssessment.pdf. See also CPUC Energy Division, "2019-20 IRP: Preliminary Results" (October 4, 2019), p. 40, available at https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/ElectPowerProcurementGeneration/irp/2018/2019%20IRP%20Preliminary%20Results%2020191004.pdf; Kevin Carden and Nick Wintermantel, Energy Storage Capacity Value on the CAISO System, Astrapé Consulting (November 20, 2019), available at https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/ElectPowerProcurementGeneration/irp/2018/2019-20%20IRP%20Astrape%20Battery%20ELCC%20Analysis.pdf; Nick Schlag et al., "Moving beyond 'rules of thumb' for smart, cost effective storage deployment," Utility Dive (April 30, 2019), available at https://www.utilitydive.com/news/moving-beyond-rules-of-thumb-for-smart-cost-effective-storage-deployment/553674/.

58. Cal. Pub. Res. Code §§ 25301-25303, 25402.10; 20 Cal. Code Regs. §§ 1680 et seq.

59. CPUC R. 14-08-13, available at https://www.cpuc.ca.gov/General.aspx?id=5071.

Center for Law, Energy & the Environment (CLEE)
UC Berkeley School of Law
390 Simon Hall
Berkeley, CA 94720-7200
clee.berkeley.edu

Emmett Institute on Climate Change and the Environment
UCLA School of Law
405 Hilgard Avenue
Los Angeles, CA 90095
law.ucla.edu/emmett

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