DATA ACCESS *for a* DECARBONIZED GRID

Policy Solutions to Improve Energy Data Access and Drive the Clean and Resilient Grid of the Future

FEBRUARY 2021
Policy Report

Climate Change and Business *Research Initiative*

Berkeley Law | Center for Law, Energy, & the Environment

UCLA School of Law Emmett Institute on Climate Change & the Environment

BANK OF AMERICA

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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.

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The Center for Law, Energy & the Environment (CLEE) channels the expertise and creativity of the Berkeley Law community into pragmatic policy solutions to environmental and energy challenges. CLEE works with government, business and the nonprofit sector to help solve urgent problems requiring innovative, often interdisciplinary approaches. Drawing on the combined expertise of faculty, staff and students across University of California, Berkeley, CLEE strives to translate empirical findings into smart public policy solutions to better environmental and energy governance systems.

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INTRODUCTION

California's electricity infrastructure is entering a period of profound change. From a policy perspective, the state is moving toward goals of 60 percent renewable electricity by 2030 and 100 percent zero-carbon power by 2045, while state and local governments are striving to electrify more buildings and vehicles. At the same time, climate change is destabilizing these efforts, as extreme heat waves and record-setting wildfires are leading to electricity demand spikes, public safety power shutoffs, and questions about the reliability and resilience of an increasingly renewable-powered grid.

As a result, stakeholders throughout the electrical grid are turning to flexible technologies that can balance supply and demand, increase efficiency, and provide greater reliability in real time.[1] Examples range from the development of advanced algorithms that reduce grid strain and energy costs by shifting aggregate electricity demand at public electric vehicle charging facilities from peak to off-peak periods; to the allocation of hundreds of millions of dollars to fund incentives for residents, small businesses, and agencies in low-income and disadvantaged communities to invest in energy resilience technologies like battery storage.[2] These responses are amplifying existing trends of residents and businesses adopting more small-scale, distributed generation (like rooftop solar) and storage technologies.

As the grid becomes more defined by flexible, distributed assets that generate, store, and consume power closer to when and where it is used—such as smart buildings, battery storage, and vehicle-grid integration—grid planners and stakeholders will need improved access to data about our energy system in order to deploy and operate them efficiently and effectively. The data can include information from the performance of generation assets to individual customer use and billing data. But significant questions remain about how to access, protect, and manage the data. State energy regulators, utilities, and developers of distributed energy resources must resolve long-standing issues around customer privacy, grid security, communication between data systems, and regulatory capacity in a rapidly evolving field.

To address these challenges, UC Berkeley School of Law's Center for Law, Energy and the Environment (CLEE) and UCLA School of Law's Emmett Institute on Climate Change and the Environment convened leaders from state and local government, utilities, and data management firms in August 2020 to identify top-priority policy solutions. This policy report outlines the vision these stakeholders discussed for California's energy data framework of the future; key barriers limiting progress toward that vision; and actionable solutions to overcome those barriers. Top barriers and solutions include:

BARRIER #1: PRIVACY AND SECURITY RULES AND CONCERNS IMPACT THE FLOW OF DATA

Solutions

- **The California Energy Commission and Public Utilities Commission** could create a definitive guide to the legal and regulatory framework for data privacy and security
- **The California Energy Commission, Public Utilities Commission, Independent System Operator, and Governor's Office of Planning and Research**, possibly with state legislative direction, could create a forum for stakeholders to achieve consensus on ways to resolve security and privacy concerns affecting data access
- **The California Public Utilities Commission** could re-examine the 15/15 rule for customer data aggregation (which sets numerical minimums for data-sharing) to consider an approach based on differential privacy (which can protect sensitive data regardless of sample size)
- **The California Public Utilities Commission** could enhance the scope of its 2011 privacy decision (which sets many of the current terms for collection, use, and disclosure of customer energy usage data) to expand customer data rights with regard to billing data and other customer-specific information, thereby facilitating more flexible grid applications

BARRIER #2: UTILITY OPERATING FRAMEWORKS, INCLUDING REGULATORY REQUIREMENTS AND INCENTIVES, CAN CREATE LIMITS ON CAPACITY TO SHARE AND INVEST IN DATA EXCHANGES

Solutions

- **The California Public Utilities Commission** could adopt performance-based regulation that rewards effective data-sharing
- **The California Public Utilities Commission** could expand upon existing regulatory proceedings or initiate a new proceeding to identify objectives, use cases, and cost considerations and direct achievement of specific related targets for progress in data exchange

BARRIER #3: ORGANIZATIONAL PRIORITIES, REQUIREMENTS, AND CAPACITY CAN IMPACT PROGRESS ON DATA PRIORITIES

Solutions

- **The California Energy Commission and Public Utilities Commission** could enhance enforcement of existing requirements for data exchange and usage
- **The state legislature** could appropriate funds for the California Energy Commission and California Public Utilities Commission to hire and retain more energy data experts
- **Electric utilities** could continue to modernize their information technology systems and expand internal staff capacity

I.

OVERVIEW: ENERGY AND GRID DATA FOR RESILIENT DECARBONIZATION

A. CALIFORNIA'S RESILIENT DECARBONIZATION NEED IS URGENT

As California progresses toward its targets of 60 percent renewable energy by 2030 and 100 percent zero-carbon energy by 2045, the looming and present risks of climate change threaten the energy grid itself, and stakeholders across the state's electrical system—including communities, businesses, utilities, and grid operators—have begun to raise questions around the reliability and resilience of a decarbonized grid. In December 2020, state energy regulators issued a report finding that the state's 100 percent zero-carbon target is achievable, although significant questions remain regarding system reliability and the integration of emerging technologies including storage and load flexibility.[3] Record wildfires in 2017, 2018, and 2020—some caused by a mix of vulnerable grid infrastructure and excessively hot, dry, and windy conditions—have burned millions of acres, cost hundreds of lives, and forced evacuation of communities throughout the state. Utilities have begun to implement wildfire mitigation and safety measures in the form of grid hardening, vegetation management, and advanced monitoring practices, as well as through public safety power shutoffs (PSPS) to proactively de-energize portions of the grid during periods of especially high fire risk. In 2019, shutoffs affecting millions of Californians may have helped to reduce utility-caused fires, but they also impacted business and residential service throughout the state, at times for extensive periods. These shutoffs were of particular concern for some older and medically vulnerable Californians.[4] The threat of future massive wildfire seasons and shutoffs raises concerns about the reliability of future energy supplies.

As an additional example of climate-related reliability concerns, August 2020 brought a period of extreme heat, which eventually triggered substantial fires and contributed to rolling blackouts throughout California as grid managers struggled to meet electricity demand.[5] Greater deployment of intermittent wind and solar resources—essential for the state's climate efforts—adds complexity to grid planning and reliability in the face of these types of events.[6] In their preliminary analysis of the blackouts, leaders at the California Public Utilities Commission (CPUC), California Independent System Operator (CAISO), and California Energy Commission (CEC) highlighted increased procurement of distributed energy resources like demand response and flexible assets as key steps for maintaining grid reliability in the future.[7] (In November 2020, the Public Utilities Commission proposed a rulemaking to take near-term reliability actions including communications, flexible pricing, electric vehicle, and storage measures.[8]) As the climate continues to warm and California continues to electrify buildings and vehicles, peak energy demand will continue to grow.[9] The need to integrate distributed resources and load management technologies—which are heavily reliant on the efficient flow of energy data to operate efficiently and effectively—will rise accordingly.

B. A DIVERSE SET OF TECHNOLOGIES CAN ADDRESS THE CHALLENGE

While the rapid transition to a resilient, decarbonized grid presents a daunting policy and economic challenge, a number of existing and emerging technologies are available to serve the needs of a flexible and reliable system. Categorizing these technologies is a valuable first step for understanding the types of data these technologies and grid operators rely on for effective operation, and in turn the challenges facing greater access to those data:

- **Transmission and distribution grid technology,** which includes electrical system elements primarily controlled or controllable by grid operators, utilities, and power providers. These technologies include but are not limited to:
    - **Distribution grid infrastructure.** Advanced distribution line sensors can detect high winds and strain on lines to mitigate wildfire risk; forecasting algorithms can predict generation and demand; neighborhood area networks can aggregate usage data to inform grid operator activities; and smart sensors and automated substation technology can use grid performance information to facilitate load balancing and safety actions, each maximizing grid efficiency and reliability.[10]
    - **Smart meters.** Smart meters provide grid operators and utilities with visibility into real-time customer usage data, facilitating advanced billing and grid monitoring by grid operators (including outage locations) and consumption management by customers.
- **Grid-connected and customer technology,** which includes facilities, buildings, vehicles, and appliances that interact with the grid by providing distributed energy, storing energy, and modulating

production and consumption to balance the grid's supply and demand and minimize strain on distribution and transmission assets. Individual customers/facilities typically own and control these applications.

    - **Distributed energy resources (DERs).** Residential, commercial, and community-scale behind-the-meter DERs provide zero-carbon energy close to the point of use, reducing greenhouse gas emissions, functioning with energy storage and microgrids to boost local resilience, and limiting reliance on long-distance transmission lines. Smart inverters (and the power control systems that drive them), which allow distributed solar and other sources to modulate their activity in response to system fluctuations, maximize grid efficiency and reliability and facilitate aggregation of smaller resources.[11] Distributed solar provides approximately 15 percent of all renewable energy in California, which topped one third of total retail electricity sales in 2020.[12]
    - **Large-scale front-of-meter renewable energy and storage assets.** These assets provide the bulk of the zero carbon power and energy storage needed for grid decarbonization, and rely on granular load data for efficient deployment.
    - **Building and appliance load management.** The transition to electrified heat, hot water, and cooking systems in buildings throughout the state will add significant amounts of new demand to the electrical grid but will also afford substantial new opportunities for grid management and flexibility.[13] Electrified systems and smart appliances, linked to the grid via smart meters, can adjust their power consumption to help balance supply and demand, reduce strain at peak hours, reduce total energy costs, and maintain reliability for a grid increasingly reliant on intermittent renewable sources. These applications can also include vehicle-grid integration, which manages electric vehicle charging to capture excess supply and minimize usage when system demand is highest.[14]

- **Distributed energy storage.** Energy storage technology, including batteries as well as flywheels, fuel cells, and pumped hydropower, boosts grid resilience while supporting decarbonization by storing intermittent renewable energy and dispatching it during high-demand periods or during outages. Distributed and residential energy storage can maintain service to communities and essential services during planned or emergency system outages, in both cases supporting the reliability and efficiency of a low-carbon grid.[15]

In addition to these core categories of physical technology that support resilient grid decarbonization, two other types of non-hardware grid technology play key roles throughout the modern grid:

- **Grid software** builds the market interface between the bulk energy system and the customer, provides the ability to validate energy data at the level of distributed resources, and determines the effectiveness of customer-controlled load management efforts. Especially important is decision-support software that provides devices and appliances with a framework for how to interact with the grid, creating a financial value for the technology's grid services and facilitating resource dedication and planning. For example, many utilities are developing software to interact directly with DER providers to optimize operation, benefit the grid, and lower emissions (i.e., distributed energy resource management systems). The Green Button Connect platform and utility integrated capacity analysis (ICA) maps, leading efforts to provide customer usage and grid structure data to third parties, are other key examples in this category.
- **Financial technology** including swaps, hedges, and other financial instruments allow developers to fund assets, including many of the technologies identified above, whose value to the grid is based on real-time supply/demand imbalances and data applications, rather than on consistent long-term cash flows that can be funded via traditional debt instruments.

These technologies have the potential to transform the way the electrical grid functions by improving resilience and enabling decarbonization. The ways in which they generate, share, and rely on energy data can inform the policy solutions that drive improved data access.

C. EFFECTIVE AND EFFICIENT TECHNOLOGY DEPLOYMENT RELIES ON ACCESS TO A RANGE OF DATA TYPES

Participants at the August 2020 convening also emphasized the importance of classifying energy data types in order to develop policies to increase data access. Different data are needed to design the grid and to operate it; grid planners use planning data for long-term investment decisions and grid operators use operational data in real time to balance supply with demand. The grid of the future will shift away from the current system of just-in-time supply from a discrete set of utility-scale resources to a system composed of distributed storage and generation nodes, including energy stored in buildings and vehicles. The customers and developers seeking to provide these distributed energy resource services will need access to grid and operational data to enable them to provide services that are appropriate for the location and responsive to grid needs. Producers, consumers, and grid managers will need information about distributed applications such as battery charge levels, car use schedules, and building cooling needs in order to determine when to produce or consume power most efficiently—giving data architecture a time dimension as well as a geographic dimension. Ancillary data, including information on land uses, real estate assets, and vehicle types, can also provide key support for decision-making. Within this framework, participants emphasized three core data types:

- **Grid-level data,** including real-time information on the status of distribution and transmission equipment, loads by circuit and substation, and generation assets; energy tariff and transmission planning data; data on environmental factors for long-term climate risk and adaptation planning; and aggregated information on customer demographics and program participation to inform the design of utility and regulator incentives. Examples of grid data include:

    - **Basic grid structure data** that depict the locations of substations, transformers, distribution lines, and other assets (as well as current load and capacity at points throughout the system), shared through utility ICA maps that inform investment by DER developers.[16]

    - **System planning data** used to identify forecasted investments to meet grid needs and model DER interfaces, from supply reliability and historic grid conditions to capital investment figures and planned resiliency projects.[17]

    - **Regulatory compliance data** such as utility expenditure requests and renewables and DER procurement, which inform decisions on distribution system performance, compensation, rates.[18]

    - **Market efficiency data** that allow grid managers to evaluate the need and capacity for investment in resilient technologies and the system's ability to achieve consumer, environmental, and efficiency goals, from long-term grid studies to DER cost and capacity information.[19]

    - **Grid operations data** including real-time grid sensing and measurement device information, customer smart meter readings, DER capacity, circuit capacity, and power quality.[20]

- **Customer-level data,** which include energy use and billing data (including the line items of customer bills, account numbers, and residential and commercial addresses down to the unit level for multi-tenant buildings); what rate applies to a given customer (including machine-readable rate information); and voltage, current, and other technical data from smart meters.

- **DER performance data,** which inform grid operators about the actual energy production levels, cost, and capacity of distributed renewable and storage assets—intermittent and limited-capacity resources that will play an increasingly central role in the grid and will be deployed to shape electrical loads to match demand. The data can include the locational benefits to the grid of DER deployment in a specific location and the cost of interconnecting new DERs to the grid.[21]

D. ENERGY DATA ACCESS IS A GROWING PRIORITY FOR CALIFORNIA POLICYMAKERS

California legislators and regulators have taken steps over the last several decades to increase generation of and access to energy data. Beginning in 2009, Senate Bill 17 (Padilla, Chapter 327) required utilities deploying advanced metering infrastructure (AMI) to provide customers with access to their data and to enable third party access with the consent of customers.[22] In 2011, the CPUC finalized a comprehensive privacy and data access rulemaking that directed the utilities to submit applications detailing how customers could delegate their advanced meter data to a third party electronically.[23] Most recently, Assembly Bill 802 (Williams, Chapter 590, Statutes of 2015) directed the Energy Commission to create an energy benchmarking program based on mandatory utility collection and aggregation of energy use data for all large commercial and multifamily residential buildings.[24] The commission collects the data to create the energy use benchmark to develop energy demand forecasts, inform building owners' decisions about energy use through peer comparison, and inform the public about energy consumption.[25] Commission regulations require utilities to provide building owners or authorized third parties with energy performance data for their properties upon request; direct building owners to request the energy use data on an annual basis for the purpose of being publicly benchmarked; and allow the commission to make building energy use data (including building profile information, total energy use, energy use types, peak demand, and total greenhouse gas emissions) publicly available.[26] Prior legislation (Senate Bill 1476 [Padilla, Chapter 497, Statutes of 2010]) prohibited utilities from disclosing individual customers' energy consumption data without obtaining consent or removing all identifying information.[27]

In its role as manager of many state energy efficiency and customer incentive programs, the California Public Utilities Commission adopted measures to prevent dissemination of customer energy data to unauthorized third-parties (with exceptions that facilitate research and development while protecting privacy) and require utilities to report on smart grid applications.[28] The AB 802 benchmarking program established a baseline energy data disclosure protocol for California building owners and utilities, and authorized the Energy Commission to create a state energy use database that could form the backbone of a public energy data disclosure platform.

The Legislature has also taken a more direct approach to driving building-based flexibility solutions, which will rapidly accelerate the need for more and better data. In 2019, Senate Bill 49 (Skinner, Chapter 697) directed the California Energy Commission to adopt appliance energy efficiency standards that incorporate demand flexibility, and in 2020 the Energy Commission released research and development funds to establish a flexible load research and development hub, which will support market adoption of advanced flexible demand technologies and other DERs.[29] Under Assembly Bill 3232 (Friedman, Chapter 373, Statutes of 2018), the Energy Commission is assessing the feasibility of reducing GHG emissions in all residential and commercial buildings 40 percent below 1990 levels by 2030.[30]

Finally, the state has taken multiple steps to develop standards and rules for physical grid security. Assembly Bill 327 (Perea, Chapter 611, Statutes of 2013) directed electric utilities to develop plans to identify optimal DER deployment locations, initiating the Public Utilities Commission's Distribution Resources Plan proceeding and the development of a range of grid information-sharing processes, including utility ICA maps.[31] Senate Bill 699 (Hill, Chapter 550, Statutes of 2014) directed the Public Utilities Commission to adopt rules addressing physical risks to grid assets, resulting in a 2019 commission decision requiring electric utilities to identify high-priority grid assets and develop plans (as well as review and maintenance processes) to improve security and response to physical attacks.[32] Utility security plans must include measures to prevent, respond to, and recover from physical attacks, from cameras and fencing to backup generation and spare equipment; undergo third-party and CPUC review; and include ongoing maintenance and overhaul every five years. The decision also addresses emergency preparedness requirements for grid infrastructure, as directed by Assembly Bill 1650 (Portantino, Chapter 472, Statutes of 2012).[33] Utilities' final security plans, which may have significant implications for the availability of information on the shape and structure of the grid, are expected in 2021.

Energy Data Initiatives in Other States

States around the country with a range of energy regulatory structures are developing centralized and standardized approaches to energy data generation and sharing, primarily focused on customer data applications. As California legislators, regulators, and utilities consider new approaches to accelerate data access, these examples could serve as models.

In March 2020, the **NEW YORK** Public Service Commission initiated a comprehensive energy data access proceeding to address market development, efficiency, and privacy and cybersecurity concerns through the development of a "clearly defined data access framework."[34] Through the proceeding, commission staff proposed a statewide data access framework that would serve as a "single source for data access" including a standard guide for framework application and definitions of key terms, a risk management certification for cybersecurity and privacy requirements, customer consent and opt-out requirements, and data quality and integrity standards.[35] A proposed single, statewide integrated energy data resource (IEDR) would collect, integrate, analyze, and manage the data in one location, to be managed by a third-party program manager with oversight by state energy regulators.[36] While the commission has yet to implement these proposals, they represent potential examples of state-level standardization and platform creation.

Other states developing centralized, standardized data platforms include:

TEXAS: The Smart Meter Texas program, a regulator-endorsed collaboration among five electric utilities, facilitates customer and third-party access to energy data in a standardized format, with recent public utilities commission determination that advanced metering systems must provide on-demand data reads.[37]

NEW HAMPSHIRE: Senate Bill 284, enacted in 2019, established a statewide multi-use energy data platform to facilitate access for utilities, customers, and qualified third parties, and directed the state public utilities commission to undertake a rulemaking (currently underway) to set governance, data accuracy and security, and third-party access standards.[38]

OHIO: The state public utilities commission organized an energy data stakeholder workgroup, which in late 2019 issued a report calling for standard privacy protocols and methodologies for third-party access to customer data including the Green Button Connect platform.[39]

Some states are also leading efforts to develop grid data platforms similar to California utilities' ICA maps.[40] In **MINNESOTA**, state law requires utilities to identify optimal DER interconnection points and necessary grid upgrades, and a recent public utilities commission ruling clarified that this includes information on the location and capacity of individual distribution lines.[41] New York's electric utilities have developed hosting capacity maps with a focus on distributed solar resource deployment. These state efforts, including California's, highlight the need for data validation in development of grid structure data resources, particularly to avoid publication of data that may limit development by suggesting more restrictive grid capacity than actually exists.[42]

E. EMERGING ENERGY DATA APPLICATIONS PRESENT GRID SECURITY AND CUSTOMER PRIVACY AND SECURITY CONCERNS

Generation, collection, and use of the energy data types identified earlier is essential for a resilient, decarbonized grid to operate with maximum resource and cost efficiency. But it also raises a set of concerns around privacy and security. These concerns fall into three related but distinct categories:

- **Customer privacy** concerns associated with the unauthorized disclosure or misuse of personal identifying information (PII), such as contact information or account numbers of residents or businesses that are associated with particular electric meters.
- **Cybersecurity** concerns associated with the risk of managing utility IT systems or electrical grid operations on digital platforms, including communications with third-party providers, which could be vulnerable to risk of hacking, and cyberattacks that could disrupt certain services or damage grid assets.
- **Physical security** concerns associated with disclosure of the location or security status of grid assets, which could be vulnerable to disabling physical attacks. Physical security concerns are exclusively related to grid-level data.

For example, a grid reliant on the continuous flow of operations data from remote sensors at switches and transformers, and on the ability to make real-time changes in power flows, could be vulnerable to disruption by attackers with the ability to infiltrate digital exchanges to slow, misdirect, or falsify data. Recent, highly public cyberattacks against energy infrastructure in the US and Ukraine have raised concerns about grid security, and in some cases resulted in blackouts.[43] Similarly, individual customers could be vulnerable to unauthorized disclosure of PII through digitization of billing data, or "snooping" into habits and household patterns inferred by analyzing smart meter usage data.[44] While California has a greater than 80% smart meter penetration rate, customer concerns related to privacy, data-mining, and government or third-party control of appliances may limit uptake of efficient technologies.[45] The U.S. Department of Energy's DataGuard and privacy program, which seeks to standardize privacy enforcement, as well as safeguards contained in California legislation including AB 802 and SB 1476, can help address these concerns.[46]

Moreover, participants at the August 2020 convening emphasized the importance of distinguishing between the types of data security concern. Customer privacy protections are vital, and adherence to privacy policies and data anonymization/aggregation protocols can be essential to limit harm to individuals as well as potential public safety concerns from large-scale breaches. Customer privacy breaches, however, typically do not present a direct threat to grid operation and efficiency like cybersecurity and physical security concerns.[47] And while these grid-level security threats present significant risks to system safety, they also target data and infrastructure primarily within utility and grid operator control. As a result, they may be more readily addressed by strict data protocols and regulatory oversight. Although these risks may be related to one another, they are nonetheless distinct, with different sets of stakeholders involved, and may merit distinct solutions.

II.

VISION

Participants at the August 2020 convening discussed ideas for a future state framework for energy data access to support a resilient and decarbonized grid based on a system that is dynamic, accessible to authorized persons or entities, and available for state, regional, local, and tribal government decision-making.

In particular, this system would be:

- **Comprehensive.** The energy data system would include all grid-level, customer-level, and DER performance data necessary to facilitate system-wide planning; DER sales, grid integration, and operations; and individual customer decision-making.
- **Standardized.** Data would be generated and shared via common application programming interfaces (APIs) and in machine-readable formats to the maximum extent feasible, to allow participants at all levels to process the data without spending time and resources on manual data translation or transfer. Consistency of data access methods and formats between California's various utilities was particularly important to the expert group.
- **Consent-driven and anonymized.** Individual customers would have the right to control their data and consent to its being shared. Their personal information could be disassociated from usage and other data except for essential applications.
- **Reliable.** Energy data would be available promptly upon authorized request, in contrast to some existing programs, such as some utilities' implementations of Green Button Connect, which can suffer from delays or periods of unavailability. Bug and error tracking systems would allow users to report problems and see instant responses.
- **Real-time and long-term.** The system would incorporate both real-time grid and customer data necessary to support load flexibility and grid safety applications, and long-term aggregated supply and performance data necessary to support power purchase agreement

transactions for new generation assets and hedging transactions that finance load management investments.

- **Integrated with other relevant data platforms and decision-making processes.** Energy data would be capable of seamlessly interacting with energy and environmental data essential to informing resilient grid development priorities, including data on climate mitigation and adaptation, transit and transportation electrification potential, and transmission grid development needs and opportunities. (The multi-agency analysis of the August 2020 blackouts highlighted the need for integrated demand forecasting, transmission planning, and climate scenario analysis.[48]) It would also be available to integrate into relevant state, local, tribal, and private decision-making processes, from CPUC regulation and Rule 21 interconnection decisions to land-use planning and building retrofitters' outreach efforts.

This combination of characteristics would facilitate a number of crucial capacities for the grid of the future, including real-time load management to ensure reliable and efficient supply; real-time safety protocols to minimize wildfire and other risks; long-term infrastructure investment planning and financing arrangements to fund it; individual decision-making and marketing/outreach efforts on efficiency investments; shifting of load based on dynamic price signals; protection of customer-identifying and security-essential information; and policy initiatives at the state, regional, and local levels to support and accelerate these efforts. Local and tribal governments would have access to data necessary to shape investments in resilience and transportation electrification. And utilities would focus more on facilitating customer and developer access through well documented platforms and responsive technical support.

By integrating operational and planning data, such a system could both draw in the customers and enable the capital mobilization needed to rapidly scale up investment in demand response and load management technologies. And it would allow public and private actors to build climate risk projections into grid planning processes and investment decision-making, to map multiple future grid scenarios that address a range of potential needs. A single, one-stop-shop data platform (potentially hosted by the Energy Commission, building on its AB 802 program) could support these functions—and the Public Utilities Commission considered the concept at least as early as 2012—but may not be necessary to achieve it.[49]

III.

BARRIERS AND PRIORITY POLICY SOLUTIONS

Participants at the August 2020 convening identified a range of barriers to achieving this vision for resilient decarbonization energy data access and use, including concern over privacy and security issues, the inherent limitations of current utility business models, a lack of consistency between utilities' IT systems, and limited personnel and information technology capacity. These barriers focused on three core themes:

- **Privacy and security rules and concerns** that impact the flow of data through restrictive requirements and heighten concern for risk and liability.
- **Utility operating frameworks**, including regulatory requirements and incentives, which can create limits on capacity for data sharing.
- **Organizational priorities, requirements, and capacity limitations** among utilities and regulators that can impact progress on data access priorities.

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

A. PRIVACY AND SECURITY RULES AND CONCERNS IMPACT THE FLOW OF DATA

The central privacy and security concerns that shape energy data frameworks—protection of customer privacy, cybersecurity, and physical security—can also restrict access. Participants agreed that confusion around the distinctions among the different issues can be particularly problematic: customer privacy concerns may be conflated with grid security concerns, when they often arise in distinct scenarios and are amenable to distinct solutions; both issues can overlap with trade secret issues, which utilities and DER providers may elevate but are commercial rather than public in nature. The amount of data privacy customers actually want can vary, leading utilities and regulators to apply a more broadly protective standard out of an abundance of caution. Third parties seeking customer data also may not consistently narrow the amount of data sought to solely that which is needed for the services they provide, and enforcement protocols for control/destruction of data after use may not be clear.

Physical and cyber grid security risks also impact the flow of data: Information regarding the location, design, and capacity of key distribution infrastructure can raise concerns over security and resilience to physical and cyberattacks, and Federal Energy Regulatory Commission (as well as CPUC) requirements limit public disclosure of this critical energy/electric infrastructure information (CEII).[50] This same information can be critical for DER providers seeking to deploy load managing technologies, which rely on granular knowledge of load and capacity throughout the grid. Concerns around physical security of grid assets also contributed to delayed publication of updated utility ICA maps, which help developers determine where DERs can be located without need for grid upgrades or modifications. In a 2018 ruling, the Public Utilities Commission required utilities to make the maps available via registration-restricted portals (instead of user non-disclosure agreements), emphasizing that the need to redact or restrict access to CEII must be proven with granular specificity, weighing public benefit against potential risk.[51]

In addition, confusion over what legal requirements actually apply to California energy data, including CPUC regulation, state law, and Federal Energy Regulatory Commission rules, compounds the challenge. And those rules that clearly do apply—such as the CPUC's 15/15 rule that sets numerical minimums for aggregated customer information—may meet some needs but be counterproductive to others.

Solution: The California Energy Commission and Public Utilities Commission could create a definitive guide to the legal and regulatory framework for data privacy and security.

Lack of clarity on the application of federal, state, and utility data privacy and security requirements can lead energy data stakeholders to take an overly risk-averse approach to sharing grid and customer data. Participants suggested that a definitive guide to applicable legal and regulatory requirements would be particularly helpful to local and tribal governments, which often have limited information and expertise on energy data issues. The Energy Commission and the Public Utilities Commission could prepare or commission a regulatory guide to help these governments, small DER providers, and state regulators understand how data generation and sharing are limited by current law and policy. The guide could cover such issues as:

- **Federally designated CEII** and Federal Energy Regulatory Commission regulations designed to prohibit unauthorized disclosure.[52]
- **The California Information Practices Act** and limitations on agency disclosure of individuals' information.[53]
- **The California Public Records Act** and exceptions for confidential information related to utility systems development.[54]

- **Senate Bill 1476** and limitations on utility disclosure of customer data.[55]
- **Other state law requirements for confidentiality of data**, including Public Utilities Code section 583.[56]
- **Public Utilities Commission Decisions 11-07-056 and 14-05-16** and requirements for notice of collection and disclosure of customer data, customer access to data, and use and disclosure of data.[57]
- **The Public Utilities Commission's 15/15 rule**, its regulatory status, and its real-world application.[58]
- **Public Utilities Commission Decision 19-01-018** and requirements for electric utilities to identify and prepare physical security plans for critical grid assets.

Solution: The California Energy Commission, Public Utilities Commission, Independent System Operator, and Governor's Office of Planning and Research could create a forum for stakeholders to achieve consensus on security and privacy issues, potentially with direction from the state legislature.

In addition to increased clarity about applicable requirements, stakeholders need a regular, public forum for energy regulators, utilities, DER providers, local and tribal governments, consumer advocates, data security experts, and climate change planners to establish firm priorities between privacy/security goals and appropriate flows of data to support DER applications. The forum could allow a broader group of stakeholders to gain insight into investor-owned and public utilities' system configurations and security needs (whereas many currently feel that decisions are made in a 'black box'), increase understanding of the use cases and actual data needs of DER providers, and help utilities to better coordinate decision-making. It could also help participants identify and adopt best practices (and address risks) from the tech sector.

In particular, this conversation could focus on the substantive goals of achieving a clean and resilient grid and include the voices of community and environmental stakeholders not often involved in energy data decision-making. The forum could also include third-party civil society groups, such as the Institute of Electrical and Electronics Engineers or the Linux Foundation, which have experience developing independent energy data platforms and standards, and can offer clarity on best practices without a direct stake in a given decision or proceeding. These participants could be particularly instructive in:

- Setting clear requirements for data quality and validation (expanding on the CPUC's requirement for "reasonably accurate and complete" data[59]) and appropriate requirements for customer authentication and authorization, which are vital components of data security;
- Crafting standards that ensure liability and penalties are adequate but do not hinder progress;

- Integrating differential privacy principles into data protection regimes; and
- Structuring a potential consolidated energy data platform, similar to the Integrated Energy Data Resource currently under consideration in New York.[60]

Existing forums for this discussion include the Energy Commission-led Integrated Energy Policy Report (IEPR) process, which makes consensus state policy recommendations on energy efficiency, reliability, and decarbonization, among other issues;[61] and the Office of Planning and Research-led Integrated Climate Adaptation and Resiliency Program (ICARP), whose Technical Advisory Council facilitates climate adaptation policy development among state and local governments.[62] However, participants emphasized that this forum may ultimately need regulatory authority to make even consensus rules apply. Thus, legislation creating this forum could either direct regulatory action by CEC or CPUC based on decisions made in the forum or explicitly direct the regulators to return their recommendations to the legislature for future codification in law.

Solution: The California Public Utilities Commission could re-examine the 15/15 rule for customer data aggregation to consider an approach based on differential privacy.

The Public Utilities Commission follows a "15/15" rule for the public release of aggregated customer energy data, in which all reports containing aggregated customer data must include at least 15 customers' data, and no individual customer's data may represent more than 15 percent of a given customer class within the sample.[63] Participants emphasized that while the rule was properly intended to protect individual account information, in practice—with the availability of modern software and anonymization capabilities—it may prove too restrictive, limiting utilities' and DER providers' ability to work with smaller, more granular datasets. The Public Utilities Commission could explore whether to adopt a new data aggregation rule based on differential privacy principles, which protect sensitive underlying data by introducing small amounts of distortion or inaccuracy into a dataset, delivering statistically accurate results on the relevant metrics while obscuring sensitive identifying information.[64] Requiring utilities, DER providers, and data servicers to use differential privacy systems, which have advanced significantly since the CPUC adopted the 15/15 rule, could preserve privacy while facilitating better data access.[65] This will be particularly valuable as providers move to install more solar, storage, and electric vehicle resources at multifamily residential buildings, which pose more complex data privacy concerns. Any new approach should ensure large customers with broad security implications (such as the military) are protected from individual identification, and take into account the appropriate amount of cost relative to system and customer benefit.

Solution: The Public Utilities Commission could enhance the scope of its 2011 privacy decision to expand customer data rights with regard to billing data and other customer-specific information.

The Public Utilities Commission's 2011 privacy decision, which sets many of the terms for collection, use, and disclosure of customer energy data, focused narrowly on advanced metering infrastructure usage data, which are central to the flexible functions of a clean and resilient grid.[66] However, participants indicated that the decision's rules concerning usage data (i.e., kilowatt-hour values over time) leave significant gaps and uncertainties about the treatment of non-usage data that is becoming increasingly important to distributed energy resources of all types. As the market for DERs has evolved significantly over the past decade, the 2011 privacy decision's focus on usage data is leading to confusion and differing interpretations of how to manage non-usage customer data. Billing data and information necessary to participate in Independent System Operator demand response programs are the subject of ongoing, unresolved disputes over utilities' proprietary data and the obligation to make such information portable. For example, registered demand response providers have access to more customer data (such as billing information) than do other DER providers, such as pure solar and energy efficiency providers. The Public Utilities Commission could revisit and expand the 2011 decision to systematically classify all types of customer data (such as billing information) for their accessibility/portability, determine whether utilities should create different data sets based on data required for certain DER applications, and grant customers clearer rights to share a more complete set of their data with third parties for any type of DER. In October 2020, the commission issued a ruling in an ongoing proceeding which held that expanding the utilities' "Click-Through" data-sharing programs (which cover not only usage data but also billing and account information) to DERs other than demand response providers was out-of-scope for the current proceeding, suggesting a holistic expansion of the 2011 privacy decision could encompass these programs as well.[67]

B. UTILITY OPERATING FRAMEWORKS, INCLUDING REGULATORY REQUIREMENTS AND INCENTIVES, CAN CREATE LIMITS ON CAPACITY TO SHARE AND INVEST IN DATA EXCHANGES

Current utility operating frameworks can present obstacles to investments and technologies for optimal energy data flows that are needed to support decarbonization. Some participants felt that the traditional rate-of-return model for investor-owned utilities, which primarily rewards (and provides shareholder value from) large-scale investments in generation and transmission infrastructure, does not create strong incentives for increasing the efficiency of existing assets—the fundamental benefit of advanced energy data use. At the same time, utilities also must balance investment decisions among multiple priorities and regulatory requirements and maintain affordability for their customers, while some data-driven DERs may represent a form of competition. In addition, rules like must-offer obligations implemented by the California Independent System Operator, which support competition in resource adequacy by requiring all resource adequacy-qualifying resources to be offered into the market, may not fit the business model for data-reliant demand response applications. Since some demand response applications are only needed sporadically, they need increased flexibility in offer obligations as compared to traditional generation supply resources and even other flexible resources.[68]

Solution: The California Public Utilities Commission could adopt performance-based regulation that rewards effective data-sharing.

Investor-owned utilities justify rates and revenue in large part based on the capital cost of major generation and transmission infrastructure investments, with potentially limited financial incentives to invest in flexible grid assets or in supporting the grid, customer, and DER performance data that support them. Some participants emphasized that in order to develop an optimally efficient decarbonized grid, utilities should have an incentive structure that also rewards investments in data sharing and management. The Public Utilities Commission could introduce performance-based regulation that links utility returns and shareholder value to resilient decarbonization performance goals, including goals for data generation, sharing, and adherence to privacy and security best practices. Data-sharing performance metrics could include total number of completed data-sharing authorizations; percentage of data-sharing attempts that are successful; average and maximum data delivery time following customer authorization; Green Button Connect system availability; and number of complaints received, among others. Regulation could particularly reward data-sharing performance and best practice in the context of other programs (e.g., energy efficiency incentives) to ensure that data progress is directly linked to achievement of substantive targets.

Performance standards should reflect customer demand, simplicity and comprehensibility, and affordability priorities to ensure that utilities' investments accord with market and consumer needs over the full decarbonization timeline. Commission leaders could look to recent moves toward performance-based ratemaking in Hawaii, Colorado, and other states for examples of resilience-focused regulation.[69] This shift will become increasingly valuable as California begins its transition to a fully electric vehicle market by 2035, which could place significant strain on existing grid assets but also offer the opportunity for aggregated flexibility and load management (as well as the potential for lower electricity rates system-wide).[70]

As an alternative mechanism to realign incentives toward greater sharing of data, state energy leaders could consider the creation of an independent distribution system operator (DSO) function to manage of load and capacity in the distribution grid. A DSO responsible for sharing of data between utilities, individual customers, and DER developers would reduce disincentives to share data by eliminating potential competition concerns among service providers and by centralizing privacy/security management capacities and functions. The Public Utilities Commission could consider authorizing community choice aggregators or other independent entities to take on DSO functions, particularly if performance-based regulations do not create the desired data-sharing incentives.

Solution: The California Public Utilities Commission could expand on existing regulatory proceedings or initiate a new proceeding to identify objectives, use cases, and cost considerations and direct achievement of specific related targets for progress in data exchange.

While reforming investor-owned utility financial incentives could facilitate a significant increase in advanced energy data investments, participants suggested that on certain high-priority data issues the Public Utilities Commission could exercise its rulemaking authority to drive immediate action. The commission could expand an existing proceeding or initiate a targeted proceeding to address these issues, including matters such as:

- Identifying overarching objectives, needs and use-cases, cost, and timing considerations for customer data access;
- Requirements for bug/error reporting, tracking, and response;
- Performance improvements for the Green Button Connect data access system;
- Confirming data access obligations and requirements for third parties;
- Best-fit options for new data anonymization methods; and
- Planning, outreach, and privacy protocols for multifamily building data-sharing.

Such a proceeding could not only facilitate progress on these key immediate-term priorities, but also potentially inform the multi-stakeholder data forum described above.

C. ORGANIZATIONAL PRIORITIES, REQUIREMENTS, AND CAPACITY CAN IMPACT PROGRESS ON DATA PRIORITIES

Participants perceived that utility and energy regulator staff responsible for major energy data decisions often face concerns when engaging with and facilitating third-party access to customer and grid data. The potential risk of exposing private information or grid security data, including concern over liability, can outweigh the benefit of using data to increase efficiency of investments and dispatch, leading decision-makers to default to inaction. In addition, existing regulations developed to ensure safe interconnection and operation of renewable energy can result in barriers to utilizing data to streamline the integration of renewable energy, unlock all potential value streams it can provide the grid, and ensure the safety and reliability of the electric system. (Examples include CPUC Rule 21 for interconnections and FERC's Wholesale Distribution Access Tariff.[71]) Moreover, a lack of agency staff fully devoted to energy data issues limits regulators' grasp of the data already in the system and the regulations already in place. Participants highlighted the California Solar Initiative as an example of the benefits that can accrue when state agencies focus on evolving and facilitating data access: while some early data sets published under the program were incomplete or lower-quality when first launched in 2010, the Energy Commission and Public Utilities Commission were able to refine them over time into a world resource for distributed generation data that has helped facilitate a dramatic market transformation in the industry.[72]

Solution: The California Energy Commission and California Public Utilities Commission could enhance enforcement of existing requirements for data exchange.

Participants described multiple instances of failure by some utilities to meet data sharing and management requirements or targets set by the Energy Commission and Public Utilities Commission, with inadequate commission tracking and enforcement compounding the problems. Examples included flaws in Green Button Connect data access platforms, imposition of additional terms and conditions for access, delayed registration applications, and slow-moving proceedings on applications to improve the platforms; intermittent access to home area networks and Integrated Capacity Analysis maps; and frequent data system outages which were only corrected after substantial and costly advocacy from outside parties.[73] Participants also noted examples of utilities minimizing provision of excess data or time-limiting access to data, citing conflicts with third parties' needs. While many of these instances arose in early iterations of data exchange platforms as utilities gained understanding of third parties' needs and capacities, some continue. Public Utilities Commission data management requirements can go unmet, slowing much-needed progress. (Utility performance metrics websites were identified as a helpful step in maintaining data access, when consistently operating.[74]) The Energy Commission and Public Utilities Commission could create new, high-level data management positions to enforce existing rules and coordinate and demonstrate the importance of enforcement activities. The Energy Commission and Public Utilities Commission could also add new data-focused staff to enhance scrutiny of utility operations and periodically review their IT platforms, as well as third-party data access practices and adherence to customer authorization/data minimization requirements. In addition, the Public Utilities Commission could consider increased use of enforcement tools like citations that are more efficient than traditional adjudicatory regulatory mechanisms.

Solution: The state legislature could appropriate funds for the California Energy Commission and California Public Utilities Commission to hire and retain more energy data experts.

Participants emphasized that recent legislation and regulatory decisions on data privacy and generation—including AB 802's building energy benchmarking program and SB 1476's privacy requirements—have had the effect of giving state regulators increasing levels of responsibility for data sharing and management.

The benefits of greater data centralization and uniform rules of access are counter-balanced, however, by the challenge of handling the massive quantities of data generated by the modern grid. Shifting from a passive or reactive role to an active data management role requires new hiring and organizational adjustment at the Energy Commission and Public Utilities Commission, including the creation and/or expansion of divisions focused entirely on energy data.

In addition, multiple state processes to modernize and decarbonize the grid expressly rely on fluid and efficient information-sharing between these two agencies. Examples include the Energy Commission's assessment of electric vehicle charging infrastructure needs under Assembly Bill 2127 (Ting, Chapter 365, Statutes of 2018), which requires Public Utilities Commission data on grid capacity and ICA maps; and the Public Utilities Commission's development of long-term grid scenarios in the Integrated Resource Plan process, which relies on Energy Commission projections of future demand and Integrated Energy Policy Report analyses.[75] The accuracy of these assessments—increasingly essential in light of emerging state policies such as the target of 100 percent zero-emission passenger vehicle sales by 2035—relies on open lines of communication between the agencies, and experienced staff committed to issuing and handling data requests.

The legislature could appropriate funds for these positions (and for increased compensation to retain talent) to ensure that data management expertise is built in-house at the agencies, rather than at outside consultants; and that staff have capacity to focus on sharing data and expertise with counterparts at sister agencies, facilitating regulatory, technology deployment, benchmarking, and research and development goals.

Solution: Electric utilities can continue to modernize their information technology systems and expand internal staff capacity.

Electric utilities are responsible for some of the most complex, high-risk, and data-intensive infrastructure in the state—increasingly resembling information technology companies more than their traditional role as managers of physical infrastructure. Yet participants noted that in many cases their IT systems are outdated or unmatched to the data management task of the grid of the future, with particular implications for bug tracking and interoperability. At the same time, some third parties' requirements that consumer interactions occur entirely on third-party websites and platforms can add difficulty to utilities' authentication and authorization responsibilities. Utilities also face challenges in identifying and implementing solutions for future third-party and customer needs that continue to evolve, given the mismatch between the multi-year process required for substantial updates to a utility IT system and the rapid technological development of DERs. With authorization and guidance from the Public Utilities Commission and/or Energy Commission, utilities could be enabled to invest in IT systems for broad data needs on cooperative timelines, to ensure that they can exchange data in formats that function for technology and data firms, that they can respond appropriately to user and customer concerns and feedback, and that the data remain secure and appropriately protected. Utilities could also expand their IT teams (with regulatory authorization) to ensure these new investments and customer response capacities are fully staffed.

CONCLUSION

As California moves to increase electrical grid resilience in the face of climate risks while reducing greenhouse gas emissions, regulators, utilities, and technology providers will need unimpeded access to the energy data needed to support resilient decarbonization technologies. Record-setting wildfires, continuing extreme weather conditions, and potential public safety power shutoffs highlight both the urgency of this need and the scale of the challenge. State leaders can take near-term policy steps to facilitate effective and efficient deployment of these technologies while protecting customer privacy and grid security.

REFERENCES

All URLS last accessed October 6, 2020; some may be paywall-restricted.

1. For more information on policy priorities to advance these technologies, see Ted Lamm and Ethan N. Elkind, Clean and Resilient: Policy Solutions for California's Grid of the Future, Center for Law, Energy & the Environment (June 2020), available at https://www.law.berkeley.edu/research/clee/research/climate/california-climate-action/clean-and-resilient/.

2. See Douglas Black et al., California Energy Commission (CEC), Smart Charging of Electric Vehicles and Driver Engagement for Demand Management and Participation in Electricity Markets (2019), available at https://ww2.energy.ca.gov/2019publications/CEC-500-2019-036/CEC-500-2019-036.pdf; California Public Utilities Commission (CPUC), D.19-09-027 (September 18, 2019), available at https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M313/K975/313975481.PDF; Senate Bill 700 (Wiener, Chapter 839, Statutes of 2018), Cal. Pub. Util. Code § 379.6.

3. California Department of Forestry and Fire Protection (Cal Fire), "2017 Incident Archive" (webpage), available at https://www.fire.ca.gov/incidents/2017/; "2018 Incident Archive" (webpage), available at https://www.fire.ca.gov/incidents/2018/; "2020 Incident Archive" (webpage), available at https://www.fire.ca.gov/incidents/2020/. See Pacific Gas & Electric Co., "PG&E Submits Comprehensive, Multi-Party Settlement Agreement to CPUC Related to 2017 and 2018 Wildfires" (press release) (December 17, 2019), available at https://www.pge.com/en/about/newsroom/newsdetails/index.page?title=20191217_pge_submits_comprehensive_multi-party_settlement_agreement_to_cpuc_related_to_2017_and_2018_wildfires.

4. Senate Bill 100 (De León, Chapter 312, Statutes of 2018); Cal. Pub. Util. Code §§ 399.11, 454.53; see CEC, California Public Utilities Commission (CPUC), and California Air Resources Board (CARB), Draft 2021 SB 100 Joint Agency Report (December 2020), pp. 109-115, available at https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=19-SB-100.

5. See Proposed Decision Adopting De-Energization (Public Safety Power Shut-off) Guidelines (Phase 1 Guidelines), CPUC R. 18-12-005 (May 30, 2019), p. 8, available at http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M296/K234/296234220.PDF; Thomas Fuller, "For the Most Vulnerable, California Blackouts 'Can Be Life or Death,'" New York Times (October 10, 2019), available at https://www.nytimes.com/2019/10/10/us/ california-power-outage.html. Senate Bill 901 (Dodd, Chapter 626, Statutes of 2018) required electric utilities to prepare wildfire mitigation plans including protocols for PSPS to minimize risk of utility-caused wildfires. Cal. Pub. Util. Code § 8386(c)(6). See also CPUC Resolution ESRB-8 (July 12, 2018), which set requirements for utility PSPS.

6. See California Independent System Operator (CAISO), "Stage 3 Emergency Declared; rotating power outages have been initiated to maintain grid stability" (press release) (August 14, 2020), available at http://www.caiso.com/Documents/Stage-3-Emergency-Declared-Rotating-Power-Outages-Initiated-Maintain-Grid-Stability.pdf; Ivan Penn, "California Expresses Frustration as Blackouts Enter 4th Day," New York Times (August 17, 2020), available at https://www.nytimes.com/2020/08/17/business/energy-environment/california-blackout-electric-grid.html. A state analysis identified resource adequacy and planning processes and day-ahead energy market practices inadequate to meet climate change-driven extreme heat waves as the primary cause. CAISO, CPUC, and CEC, Final Root Cause Analysis: Mid-August 2020 Extreme Heat Wave (January 13, 2021), http://www.caiso.com/Documents/Final-Root-Cause-Analysis-Mid-August-2020-Extreme-Heat-Wave.pdf.

7. Kavya Balaraman, "California regulators plan post-mortem to examine cause of rolling blackouts," Utility Dive (August 21, 2020), available at https://www.utilitydive.com/news/california-post-mortem-rolling-blackouts/583923/.

8. CAISO, CPUC, and CEC, Preliminary Root Cause Analysis, supra, pp. 65-68; see also CPUC President Marybel Batjer et al., Letter to Governor Gavin Newsom (August 19, 2020), available at https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/News_Room/NewsUpdates/2020/Joint%20Response%20to%20Governor%20Newsom%20Letter%20August192020.pdf.

9. CPUC, Order Instituting Rulemaking to Establish Policies, Processes, and Rules to Ensure Reliable Electric Service in California in the Event of an Extreme Weather Event in 2021 (Proposed Decision), available at https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M349/K862/349862998.PDF.

10. CEC, Final 2019 Integrated Energy Policy Report (January 2020), p. 201, available at https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=19-IEPR-01; Maximillian Aufhammer et al., "Climate change is projected to have severe impacts on the frequency and intensity of peak electricity demand across the United States," Proceedings of the National Academy of Sciences 114:1886-1891 (2016), available at https://www.pnas.org/content/pnas/114/8/1886.full.pdf.

11. See, e.g., Dmitry Baimel et al., "Smart Grid Communication Technologies," Journal of Power and Energy Engineering 4, 1-8 (2016), available at https://www.scirp.org/journal/paperinformation.aspx?paperid=69361; Ari Vanrenen, "PG&E Tests and Demonstrates New Technologies on Electric Grid to Increase Safety, Further Mitigate Wildfire Risk," PG&E Currents Blog (August 25, 2020), available at https://www.pgecurrents.com/2020/08/25/pge-tests-and-demonstrates-new-technologies-on-electric-grid-to-increase-safety-further-mitigate-wildfire-risk/.

12. See, e.g., Bryan Lidic and Sara Baldwin, Interstate Renewable Energy Council, Making the Grid Smarter (January 2019), available at https://irecusa.org/publications/making-the-grid-smarter-state-primer-on-adopting-the-new-ieee-standard-1547-2018-for-distributed-energy-resources/.

13. CEC, Tracking Progress: Renewable Energy (2019), available at https://www.energy.ca.gov/sites/default/files/2019-12/renewable_ada.pdf. The landmark California Solar Initiative helped to deliver over 1 million rooftop installations through 2019, a model for incentives and investment that could potentially serve as a useful precedent for future data applications.

14. See, e.g., Gridworks, California's Gas System in Transition (September 2019), available at https://gridworks.org/wp-content/uploads/2019/09/CA_Gas_System_in_Transition.pdf.

15. See CEC, Tracking Progress: Zero-Emission Vehicles and Infrastructure (2018), available at https://www.energy.ca.gov/sites/default/files/2019-12/Zero-Emission_Vehicles_and_Infrastructure_ada.pdf.

16. See CEC, Tracking Progress: Energy Storage (2018), available at https://www.energy.ca.gov/sites/default/files/2019-12/energy_storage_ada.pdf; California Independent System Operator, California Vehicle-Grid Integration (VGI) Roadmap: Enabling Vehicle-Based Grid Services (February 2014), available at https://www.caiso.com/Documents/Vehicle-GridIntegrationRoadmap.pdf. For cost comparisons of battery storage and other energy sources, see Lazard, Levelized Cost of Storage Analysis 5.0 (November 2019), available at https://www.lazard.com/media/451087/lazards-levelized-cost-of-storage-version-50-vf.pdf.

17. E.g., Robert Walton, "California IOUs provide solar developers with map to grow renewables," Utility Dive (January 8, 2019), available at https://www.utilitydive.com/news/california-ious-provide-solar-developers-with-map-to-grow-renewables/545507/.

18. Aram Shumavon et al., Data and the Electricity Grid: A Roadmap for Using System Data to Build a Plug & Play Grid (2016), Gridworks, pp. 3-5, available at http://gridworks.org/wp-content/uploads/2016/10/MTS-System-Data-Paper.pdf; Electric Power Research Institute, The Integrated Grid: Realizing the Full Value of Central and Distributed Energy Resources (2014), p. 17, available at https://www.energy.gov/sites/prod/files/2015/03/f20/EPRI%20Integrated%20Grid021014.pdf.

19. Shumavon et al., Data and the Electricity Grid, supra, p. 3; Herman K. Trabish, "True Value: To get tomorrow's grid, DER grid services must be compensated right today," Utility Dive, published 01 October 2018, available at https://www.utilitydive.com/news/true-value-to-get-to-tomorrows-grid-der-grid-services-must-be-compensate/533410/

20. Shumavon et al., Data and the Electricity Grid, supra, pp. 3-5.

21. Id.

22. Anna J. Valdberg and Matthew Dwyer, Locational Net Benefit Analysis Working Group Final Report (R. 14-08-013) (March 8, 2017), p. 4, available at https://gridworks.org/wp-content/uploads/2018/11/Locational-Net-Benefit-Analysis-Working-Group-Final-Report.pdf; Shumavon et al., Data and the Electricity Grid, supra, p. 5.

23. Cal. Pub. Util. Code §§ 8360 et seq.

24. CPUC, Decision adopting rules to protect the privacy and security of the electricity usage data of the customers of Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company, D.11-07-056 (July 28, 2011), available at https://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/140369.pdf.

25. Cal. Pub. Res. Code § 25402.10.

26. CEC, "Building Energy Benchmarking Program" (webpage), available at https://www.energy.ca.gov/programs-and-topics/programs/building-energy-benchmarking-program; CEC, "Energy Data Collection Rulemaking" (webpage), available at https://www.energy.ca.gov/rules-and-regulations/energy-suppliers-reporting/clean-energy-and-pollution-reduction-act-sb-350/energy-data-collection-rulemaking.

27. 20 Cal. Code Regs. §§ 1680, 1682-83.

28. Padilla, Chapter 497, Statutes of 2010; Cal. Pub. Util. Code §§ 8380-8381.

29. CPUC, Decision adopting rules to provide access to energy usage and usage-related data while protecting privacy of personal data, D.14-05-016 (May 1, 2014), available at https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M090/K845/90845985.PDF; CPUC, D.11-07-056.

30. Cal. Pub. Res. Code § 25402(f). See https://www.energy.ca.gov/solicitations/2020-08/flexible-load-research-and-deployment-hub for information on CEC's grant program for flexibility resources.

31. Cal. Pub. Res. Code § 25403, available at https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB3232

32. Cal. Pub. Util. Code § 769; see CPUC R.14-08-013, available at https://www.cpuc.ca.gov/General.aspx?id=5071.

33. Cal. Pub. Util. Code § 364; CPUC D.19-01-018 (January 22, 2019), available at https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M260/K335/260335905.PDF. Docket R.15-06-009 is available at https://www.cpuc.ca.gov/General.aspx?id=6442453847.

34. Cal. Pub. Util. Code § 768.6.

35. New York State Public Service Commission (NYPSC), Order Instituting Proceeding on Motion of the Commission Regarding Strategic Use of Energy Related Data, Case 20-M-0082 (March 19, 2020), available at http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=20-M-0082.

36. New York State Department of Public Service (NYDPS), Department of Public Service Staff Whitepaper Regarding a Data Access Framework, Case 20-M-0082 (May 29, 2020), available at http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=20-M-0082.

37. NYDPS, Department of Public Service Staff Whitepaper Recommendation to Implement an Integrated Energy Data Resource, Case 20-M-0082 (May 29, 2020), available at http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=20-M-0082.

38. Smart Meter Texas, "About Us" (webpage), available at https://www.smartmetertexas.com/aboutus; Robert Walton, "Texas regulators approve new smart meter rules, limiting access to real-time data," Utility Dive (April 16, 2020), available at https://www.utilitydive.com/news/texas-regulators-approve-new-smart-meter-rules-limiting-access-to-real-tim/576093/; Texas Public Utilities Commission, Order Adopting Amendments to §§ 25.5, 25.130, and 25.133 as Approved at the April 17, 2020 Open Meeting (Project No. 48525), available at https://www.puc.texas.gov/agency/rulesnlaws/subrules/electric/25.133/48525adt.pdf.

39. N.H. R.S.A. §§ 378:50-54; N.H. Public Utilities Commission, Development of a Statewide, Multi-Use Online Energy Data Platform, DE 19-197, available at https://www.puc.nh.gov/Regulatory/Docketbk/2019/19-197.html.

40. EnerNex, Data and Modern Grid Workgroup: Final Report (December 13, 2019), available at http://dis.puc.state.oh.us/TiffToPDf/A1001001A19L13B21127H01616.pdf.

41. For an overview of leading state efforts, see Sky Stanfield and Stephanie Safdi, Interstate Renewable Energy Council, Optimizing the Grid: A Regulator's Guide to Hosting Capacity Analyses for Distributed Energy Resources (December 2017), available at https://irecusa.org/wp-content/uploads/2017/12/Optimizing-the-Grid_121517_FINAL.pdf.

42. Minn. Stat. § 216B.2425; Minn. Pub. Util. Commission, Order Accepting Report and Setting Further Requirements (Docket No. E-002/M-19-685) (July 31, 2020), available at https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={C06CA673-0000-C714-93E9-DFED768388A6}&documentTitle=20207-165472-01.

43. See Yochi Zakai, "Validation Is Critical to Making Hosting Capacity Analysis a Clean Energy Game Changer," Interstate Renewable Energy Council (June 12, 2020), available at https://irecusa.org/2020/06/validation-is-critical-to-making-hosting-capacity-analysis-a-clean-energy-game-changer/.

44. See U.S. Department of Homeland Security, "Alert (AA20-049A), Ransomware Impacting Pipeline Operations" (February 18, 2020), available at https://us-cert.cisa.gov/ncas/alerts/aa20-049a; Rebecca Smith, "Cyberattacks Raise Alarm for U.S. Power Grid," The Wall Street Journal (December 30, 2016, available at https://www.wsj.com/articles/cyberattacks-raise-alarms-for-u-s-power-grid-1483120708; James Rundle and Kim S. Nash, "Ransomware Attack Exposes Poor Energy-Sector Cybersecurity," The Wall Street Journal, (February 24, 2020), available at https://www.wsj.com/articles/ransomware-attack-exposes-poor-energy-sector-cybersecurity-11582540200.

45. Michael Murray and Jim Hawley, Mission:data, Got Data: The Value of Energy Data Access to Consumers (January 2016), pp. 20-21, available at https://gridworks.org/wp-content/uploads/2017/01/Gridworks_DataAccessReport.pdf

46. U.S. Energy Information Administration, "Nearly half of all U.S. electricity consumers have smart meters," (December 6, 2017), available at https://www.eia.gov/todayinenergy/detail.php?id=34012; G. Le Ray and P. Pinson, "The ethical smart grid: Enabling a fruitful and long-lasting relationship between utilities and consumers," Energy Policy 140 (May 2020), p. 2, available at https://www.sciencedirect.com/science/article/abs/pii/S0301421520300185.

47. If enacted into law, the Energy Cybersecurity Act of 2019 would require the U.S. Department of Energy to develop programs to identify energy sector vulnerabilities, eliminate them, and further bolster the sector's resilience. S. 2333 (116th Cong.), available at https://www.congress.gov/bill/116th-congress/senate-bill/2333/text.

48. See Murray and Hawley, Got Data, supra.

49. CAISO, CPUC, and CEC, Preliminary Root Cause Analysis, supra, pp. 68-69.

50. See Audrey Lee and Maria Zafar, CPUC, Energy Data Center: Briefing Paper (September 2012), p. 9, available at https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/EnergyDataCenterFinal.pdf

51. See CPUC, Security and Resilience for California Electric Distribution Infrastructure: Regulatory and Industry Response to SB 699 (January 2018), pp. 46-52, available at https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/Safety/Risk_Assessment/physicalsecurity/Final%20CPUC_Physical_Security_White_Paper_January_2018(1).pdf.

52. See CPUC, Administrative Law Judge's Ruling Resolving Confidentiality Claims Raised by Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company as to Distribution System Planning Data Ordered by Decision (D.) 17-09-026 and D.18-12-004 (December 17, 2018), available at https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M251/K163/251163640.PDF. For an overview of disputes regarding ICA maps and CEII, see Response of the Joint Parties to Joint Petition of Pacific Gas and Electric Company, San Diego Gas & Electric Company, and Southern California Edison Company for Modification of D.10-12-048 and Resolution E-4414 to Protect the Physical Security and Cybersecurity of Electric Distribution and Transmission Facilities (January 9, 2019), pp. 2-7, available at https://clean-coalition.org/wp-content/uploads/2019/01/R.08-08-009-Joint-Parties-Response-to-Joint-IOUs-Pet-Mod-re-PV-RAM-maps-Final.pdf.

53. See 16 U.S.C.§ 8240-1; 18 C.F.R. § 388.113. "Critical electric infrastructure information" is defined as information related to physical or virtual grid assets "the incapacity or destruction of which would negatively affect national security, economic security, public health or safety, or any combination of such matters." "Critical energy infrastructure information" is defined as "specific engineering, vulnerability, or detailed design information about proposed or existing critical infrastructure" that relates details about production, generation, or transmission of energy and could be useful in planning an attack on critical infrastructure." Id. See also Federal Energy Regulatory Commission (FERC), Order No. 833 (November 17, 2016), available at https://ferc.gov/sites/default/files/2020-06/Order-833.pdf; FERC, "Critical Energy/Electric Infrastructure Information (CEII)" (webpage), available at https://www.ferc.gov/enforcement-legal/ceii. See CPUC, Security and Resilience for California Electric Distribution Infrastructure, supra, p. 51, for a list of applicable CEII requirements.

54. Cal. Civ. Code §§ 1798 et seq.

55. Cal. Pub. Util. Code § 6254(e).

56. Cal. Pub. Util. Code §§ 8380-8381.

57. See, e.g., Cal. Pub. Util. Code §§ 392, 394.4(a)

58. See CPUC D.11-07-056 and D.14-05-016, supra.

59. See CPUC D.97-10.031.

60. CPUC D.11-07-056, p. 144; Murray and Hawley, Got Data, supra, pp. 30-31.

61. See Murray and Hawley, Got Data, supra, p. 23 (discussing limitations on utility liability for privacy breaches); NYDPS, Whitepaper Recommendation to Implement an Integrated Energy Data Resource, supra, pp. 24-26.

62. See CEC, Final 2019 Integrated Energy Policy Report, available at https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2019-integrated-energy-policy-report; Cal. Pub. Res. Code §§ 25300 et seq.

63. Cal. Pub. Res. Code §§ 71350, 71358

64. See Lee and Zafar, Energy Data Center: Briefing Paper, supra, p. 9; see also CPUC D.97-10.031; 4 Colo. Code Regs. 723-3 Part 3, § 3031(b) (defining 15/15 requirements).

65. See Microsoft, Differential Privacy for Everyone (2012), available at https://download.microsoft.com/download/D/1/F/D1F0DFF5-8BA9-4BDF-8924-7816932F6825/Differential_Privacy_for_Everyone.pdf.

66. The California Energy Commission, Lawrence Berkeley National Laboratory, and Kevala (a grid analytics firm) are developing differential privacy and anonymization techniques to address cybersecurity needs. See https://dst.lbl.gov/security/project/ceds-privacy/ for more information.

67. CPUC D.11-07-056, pp. 130-163; Cal. Pub. Util. Code §§ 8380-8381.

68. CPUC A.18-11-015, Assigned Commissioner's First Amended Scoping Memo and Ruling (October 23, 2020), available at https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M349/K264/349264753.PDF.

69. See CAISO, Resource Adequacy Enhancements: Third Revised Straw Proposal (December 20, 2019), p. 77, available at http://www.caiso.com/InitiativeDocuments/ThirdRevisedStrawProposal-ResourceAdequacyEnhancements.pdf.

70. Hawaii Public Utilities Commission, Decision and Order No. 36326 (May 23, 2019), available at https://puc.hawaii.gov/wp-content/uploads/2019/05/DO-36326.05-23-2019.pdf; Colo. Stat. § 40-3-117.

71. In September 2020, Governor Newsom issued Executive Order N-79-20, which directed the California Air Resources Board to develop regulations to achieve a target of 100 percent new zero-emission vehicle sales by 2035, and directed CARB, CEC, CPUC, and other agencies to develop accelerated charging infrastructure plans. See https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf. See Max Baumhefner, "Electric Vehicles are Driving Rates Down," NRDC Expert Blog (July 1, 2020), available at https://www.nrdc.org/experts/max-baumhefner/electric-vehicles-are-driving-rates-down.

72. For a discussion of Rule 21 and potential reforms, see Lamm and Elkind, Clean and Resilient, supra, pp. 10, 13.

73. See CPUC, 2019 California Solar Initiative Annual Program Assessment (June 2019), pp. 60-61, available at https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy/Energy_Programs/Demand_Side_Management/2019-CSI-APA.pdf. Visit www.californiadgstats.ca.gov to access the data.

74. See generally Mission:data, Energy Data Portability: Assessing Utility Performance and Preventing "Evil Nudges," pp. 7-12, available at http://www.missiondata.io/s/Energy-Data-Portability.pdf; CPUC, D.13-09-025, A.18-11-015; Paul Doherty, "PG&E Updates Data Portal to Reflect Increased Distributed Energy Resources Integration Capacity," PG&E Currents blog (May 11, 2020), available at https://www.pgecurrents.com/2020/05/11/pge-updates-data-portal-to-reflect-increased-distributed-energy-resources-integration-capacity/.

75. See, e.g., Southern California Edison's performance metrics page at https://www.sce.com/PerformanceMetrics.

76. Cal. Pub. Res. Code § 25229.

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