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OVERSIGHT HEARING

Powering Through: Electricity Reliability as California Transitions to a Zero-Carbon Future

1021 O Street, Room 1200
Tuesday, August 29, 2023
9:30 a.m.

“... the pace of change is overtaking the reliability needs of the [electrical grid] system. Unless reliability and resilience are appropriately prioritized, current trends indicate the potential for more frequent and more serious long duration reliability disruptions...” – testimony of James B. Robb, president and C.E.O. of the North American Electric Reliability Corporation before the U.S. Senate Committee on Energy and Natural Resources (June 1, 2023).

In recent years, California has experienced challenges maintaining enough energy supply on the electric grid during widespread extreme heat events. These electricity reliability challenges have been further complicated as the state undergoes a period of transition towards a zero-carbon future. The most acute predicaments have been during the evening hours when demand for electricity remains high (and may peak for the day) largely due to continued need to run air conditioners to keep cool, along with other electricity demands. Managing the electric grid during these late hours of the afternoon and evening can be made more difficult by the new mix of generation resources supplying electricity to the electric grid.

State policies to advance renewable energy and to meet a zero-carbon future require increasing percentages of renewable energy, including those that are variable, particularly solar and wind, which may not be producing during the peak hours. The deployment of distributed energy resources can help reduce the demands on the electric grid, but can also contribute to the peak demand as the energy is no longer

generating and these customers must rely on the electric grid (for example rooftop solar without battery storage). Additionally, local and state policies to mitigate climate emissions are driving towards increasing electricity demand – quite literally – as the transportation sector is increasingly required to shift away from fossil fuels to cleaner carbon sources, especially electricity-fueled vehicles, while additional policies shift building operations from natural gas and other fossil fuels towards electrification. Moreover, California has policies that authorize local governments who elect, and in more limited, but significant cases, private companies, the ability to procure electricity resources, known as community choice aggregators (CCAs) and electric service providers (ESPs), respectively. CCAs and ESPs serve as competitors to procurement by investor-owned electric utilities (IOUs) whose service territories account for roughly 75 percent of the state with the remaining served by publicly owned utilities (POUs) and smaller electric cooperatives. The fragmentation of procurement by a mix of entities managing procurement decisions for their given load provides more local and customer decision-making, but also creates challenges towards a seamless transition to meeting the state’s renewable energy and zero-carbon energy resource goals while ensuring electricity reliability.

While California is clearly in the midst of an energy transition, how is the state powering through? How long and uncertain should we expect this transition to be, and what is the game-plan for ensuring reliability as we advance towards a zero-carbon energy future?

Today’s hearing will focus on oversight of the state energy agencies – the California Public Utilities Commission (CPUC) and California Energy Commission (CEC), as well as, the state’s largest electric grid operator, the California Independent System Operator (CAISO), and the Department of Water Resource (DWR) who has more recently been tasked through budget policy and appropriations actions with specific energy-related duties. Members of the committee will hear the latest updates on actions of the past couple of years to help shore-up electricity reliability. This includes an unprecedented multi-billion dollar investment in energy resources, including new programs administered by the CEC and DWR, the efforts to advance energy resources in lieu of extending the operations of the Diablo Canyon Nuclear Power Plant, but also authorizing the extension of the plant, and the continuing efforts of the CEC in improving demand forecasts, the CPUC in load and procurement planning and ensuring resource adequacy, and the CAISO in its efforts to manage the electric grid.

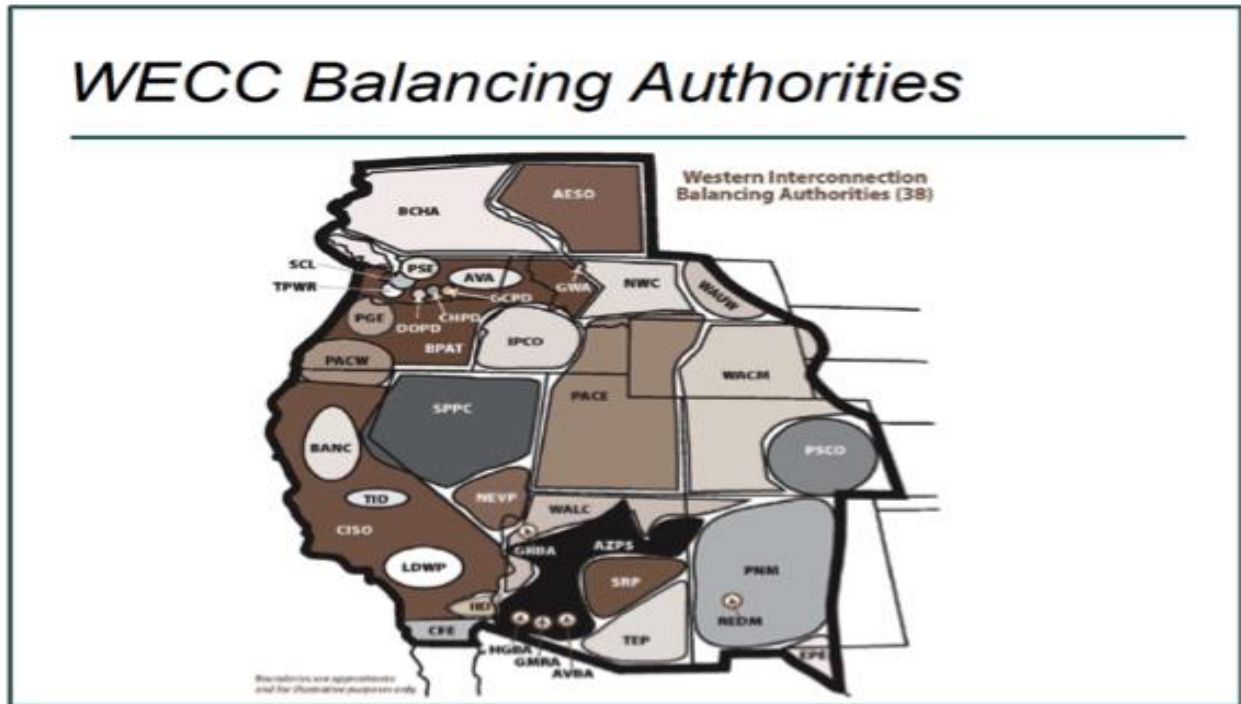
BACKGROUND

Californians rely on electricity to power not only lights, but also: air conditioning, refrigeration for food and medicine (including vaccines), to filter and pump water supply, to maintain connectivity and communications, to operate traffic signals, and medical equipment to sustain life, and many other purposes. In short, electricity has become an essential service to support modern life. Therefore, any unexpected (and even expected) loss of power can pose inconveniences, challenges, and potential harm, though in most cases, the duration and frequency of the outage generally contributes most to the level of impacts. Residents and businesses may often be unaware of the cause of an outage, as causes can vary from planned and unplanned maintenance, equipment failure, preventative safety measures, vehicles crashing into utility poles, impacts from weather and fires, as well as, constrained or inadequate generation supply or transmission. These causes can be at the local distribution circuit or substation, the transmission line, or more widespread on the electric grid. However, today's hearing is focused on the reliability of the bulk power system with a specific focus on the need to ensure sufficient energy supply to meet demand.

Balancing Authorities (BA). A “balancing authority” is an entity responsible for managing the transmission of high-voltage electricity across long-distance transmission lines. Maintaining the electric grid necessitates the need to balance supply and demand in real-time (24 hours, 7 days a week), otherwise the entire system is at risk of shutting down. A BA has several ways to maintain the balance of supply and demand, from turning on or off generators, to encouraging conservation, to importing or exporting excess electricity to or from their neighboring BAs, or if needed, voltage reductions (referred to as “brown outs”), and rotating outages where each set of distribution feeders is interrupted for a limited time (usually 20-30 minutes) and then they are put back in service and another set is interrupted, rotating outages among individual distribution lines.

The CAISO oversees the largest BA in California, overseeing management of the electric grid for 80 percent of the state. (In addition to its BA responsibilities, the CAISO also oversees the wholesale electricity market.) Other BAs in California, include: Los Angeles Department of Water and Power, Balancing Authority of Northern California (which includes Sacramento Municipal Utility District), Turlock Irrigation District, and Imperial Irrigation District. Unlike the CAISO, most of these BAs are vertically integrated publicly owned electric utilities who operate their own electric grids, balancing supply and demand for their own electric load.

There are 38 separate BAs operating across the interconnected western United States (known as the Western Interconnect, or WECC), as shown below:



When electric grid interruptions or disturbances are unplanned, uncontrolled, and spread over a wide area of the system, they are referred to as “cascading blackouts.” These blackouts cannot be restrained from spreading beyond a particular area and can cause widespread, and extended duration disruption. Such a disruption occurred in 2011 in the southwest resulting in the loss of power to nearly seven million people over 9+ hours. The San Diego-Tijuana region was particularly hard hit, as the loss of power paralyzed the region with snarled traffic, immovable trains, inability to pump at gas stations, and many other impacts.

Recent history with controlled and limited disruptions and supply constraints. The more recent events in California since August 2020 have been challenges with constrained supply during very limited hours and days in the late summer when extreme heat has affected a wide area, particularly in the evenings as solar resources decline but demand continues to peak. These events have largely occurred in the late summer months. However, this year, we experienced unexpected events last month.

- *Summer 2020 - Western United States Heatwave.* From August 14 through August 19, 2020, the western United States suffered an intense and prolonged heatwave affecting many areas across the Western Interconnection (the electrical grid in the western portion of the country, roughly from the Rockies

and Great Plains to the western shore). During this time, Death Valley set a record for the hottest temperature ever recorded on Earth – 130 degrees Fahrenheit on August 16! The heatwave resulted in temperatures 10-20 degrees higher than normal, including higher than normal overnight temperatures. Electric generation and transmission capacity was strained to keep up with the increased electricity demand – setting a peak demand record in the Western Interconnection of just over 162,000 megawatts (MW) on August 18, 2020. Many BAs were forced to declare energy emergencies as they were unable to meet their load obligations, including the CAISO and five BAs outside California. Within the CAISO, utilities were forced to shed load – via rotating outages – to help balance the electric grid. The outages ranged from 8 minutes to 2.5 hour durations, depending the utility, while affected customers experienced between 8 minutes to 20 minute outages.

- *Summer 2021 – Bootleg Fire Impacts Transmission.* On July 9, 2021, in the midst of a western heat wave, the Bootleg Fire in southern Oregon compromised a transmission line coming into California, dramatically reducing the amount of electricity coming into the state from the Pacific Northwest, an important source of imports for California. As California relies on imported electricity to meet anywhere between 20-30 percent of its power needs, the loss of this asset on top of the forecasted heatwave led to very tight electric grid conditions from July 9-11, 2021. Due to the contingency measures put in place following the 2020 heat event, no rotating outages were called.
- *Summer 2022 – 10-Day Labor Day Weekend Heatwave.* Over the Labor Day Weekend 2022 and extending beyond (August 31-September 9), California experienced another record heat wave, with temperatures throughout the state exceeding triple digits. On September 6, 2022, CAISO’s system demand exceeded 52,000 MW, setting an all-time record. (For context the peak in 2020 was 47,121 MW; for 2021 it was 43,982 MW.) Tuesday, September 6th was marked by extremely tight electric grid conditions. In an unprecedented action, the Governor authorized the use of a statewide wireless emergency alert (WEA) sent at 5:48 p.m. to 27 million Californians by the Office of Emergency Services as a last ditch effort to prevent the need to call rotating outages. The text alert likely contributed to almost 1,200 MW of demand reduction in five minutes. However, the effectiveness can wear as the public becomes wary of their use, as can be the case for other uses of emergency alerts or calls for conservation. Moreover, their performance can be difficult to accurately measure as other factors and conditions may contribute to the

load reduction. Additionally, other measures authorized for the September 2022 heat event by two executive orders helped reduce demand for electricity by suspending various air quality restrictions that authorized the use of some natural gas power plants, ships at port that switched from shore power to burning bunker fuel, and customer-side diesel and natural gas generators.

- *July 2023 CAISO Issues Electric Grid Emergency Alerts.* On July 20th, the CAISO issued energy emergency alert (EEA1) and on July 25th and 26th, the CAISO issued energy emergency alert watches for the electric grid. These were unexpected alerts warning that energy supply could be constrained on the electric grid. The CAISO restricted maintenance operations warning utilities and generators to not take electric grid assets offline. CAISO has not issued a public document examining the conditions that propelled the need for the unexpected emergency alerts. As a result, there is more to be learned about what transpired and what needs to be addressed to prevent future events.

Recent budget and other energy “insurance” actions. The Legislature, in collaboration with the Newsom Administration, adopted several measures throughout 2022, in addition to previously adopted measures, to continue to help shore-up California’s electricity supply against the impacts from extreme events. These measures are noted in the table with additional details provided below. (Important note: Not included are CPUC procurement orders and other state budget funding to support development of new energy resources, such as long-duration storage, offshore wind, geothermal, and hydrogen. Also not detailed are the plethora of transmission-related efforts to streamline and expedite transmission and interconnection build-outs and approvals to support achieving the state’s clean energy targets and reliability needs.)

Program	Agency	State Budget/Ratepayer Funding	Status
Electricity Supply Strategy Reliability Reserve Program	DWR	\$2.37 billion State Budget	Contracts underway
Demand Side Grid Support Program	CEC	\$295 million State Budget	Launched August 2022
Distributed Electric Backup Assets Program	CEC	\$700 million State Budget	In Development
Diablo Canyon Nuclear PowerPlant	CPUC and Various	Ratepayer and \$1.4 billion State Budget	Licensing is being pursued; initial federal funding approved, active CPUC proceeding.

Clean Energy Reliability Investment Plan	CEC	~\$1 billion State Budget	Plan developed and adopted. \$100 million budgeted (including \$32 million for DWR central procurement mechanism).
Emergency Load Reduction Program	CPUC	~\$186 million in 2022 and 2023 (intended as five year program) Ratepayer	Launched in 2021.
Smart Thermostat Incentive Program	CPUC	\$22.5 million Ratepayer	Launched in 2022

Electricity Supply Strategic Reliability Reserve Program (ESSRRP) at the DWR (funded at \$2.3 billion). In June 2022, Budget Trailer Bills, AB 205 (Committee on Budget, Chapter 61, Statutes of 2022), AB 178 (Ting, Chapter 45, Statutes of 2022), and AB 180 (Ting, Chapter 44, Statutes of 2022), were signed into law. These three pieces of legislation collectively established the ESSRRP and set forth new responsibilities and activities by DWR, funded by the newly established Electricity Supply Reliability Reserve Fund (ESSRF), and separate from the State Water Project. DWR established temporary energy resources and created a new deputy director-level division with 25 staff – the Division of Statewide Water and Energy – which oversees the ESSRRP along with the State Power Augmentation Program which was developed in July 2021 in response to executive order direction to quickly deploy 120 MW of new generation. Under the ESSRRP, DWR acts as contingency insurance to help maintain electricity reliability. As part of the program, DWR contracts directly with power facilities and also enters into agreements with the state’s large electric IOUs to reimburse for the value of imported firm energy resources to support summer reliability.

DWR secured 1,646 MW from imported energy for summer 2022 with a maximum budget of \$150 million. In response to Governor Newsom’s Emergency Proclamation issued July 2021, DWR secured contracts to procure, install, and license four temporary natural gas turbine generator units totaling 120 MW at existing power generation sites located in the Cities of Roseville (two units owned by Roseville) and Yuba City (two units owned by Calpine). These units were operational on September 22, 2021, and during the September 2022 heat wave, as such, they are expected to receive ESSRF payments. Current agreements allow the units to remain available for operation until the end of 2023. DWR is also in varying stages of contract discussions and execution for other resources, including a gas plant owned by California State University at Channel Islands and Enchanted Rock Electric LLC for three separate plants operating in local publicly owned utilities service territories within the San Joaquin Valley (City of Lodi, Modesto

Irrigation District, and Turlock Irrigation District). Additionally, DWR has recently entered into contracts for capacity from three natural gas plants subject to the once-through-cooling regulations by the State Water Resources Control Board (SWRCB) – AES Alamitos, AES Huntington Beach, and Ormond. The SWRCB has recently voted to extend the compliance dates for these facilities to adhere to the regulations (as proposed by the Statewide Advisory Committee on Cooling Water Intake Structures). As such, the plants could be available on standby for extreme events beginning in 2024. DWR has also entered into an agreement with Pacific Gas & Electric as the owner and operator of the Diablo Canyon Nuclear Power Plant to secure necessary funding for fuel purchases and management to maintain the option of extending the use of the facility (hinged on extended licensing) beyond the current retirement dates.

Demand Side Grid Support (DSGS) Program at the CEC (\$295 million). Provides customer performance incentives (with not penalties) to reduce net electricity load during extreme events. In the summer of 2022, utilities began enrolling participants in the program, which pays customers to reduce their energy usage during summer peak evening hours (May to October) when the electric grid is strained. The program is intended to help reduce the risk of rotating outages. The CEC has reported enrolling over 300 MW for the program.

Distributed Energy Backup Assets (DEBA) Program at the CEC (\$700 million). Provides incentives for certain distributed energy resources that can be used to support the state’s electrical grid during extreme events. The program is intended to fund zero- or low-emissions technologies such as fuel cells and energy storage at both existing energy facilities and new facilities. The CEC is still developing the program, recently hosting a public workshop to develop program guidelines.

Diablo Canyon Nuclear Power Plant operations extended through 2030. SB 846 (Dodd, Chapter 239, Statutes of 2022) authorized the extension of the Diablo Canyon Power Plant (DCPP)—which was scheduled to retire by 2025—through 2030. Diablo Canyon is California’s last remaining operating nuclear power plant, and the state has identified it as a valuable near-term source of zero-carbon energy during the transition to greater renewable resources. While the legislation authorized an extension, DCPP still has to receive required permits at the local, state, and federal levels in order to continue operations, and satisfy the various requirements detailed in SB 846.

Clean Energy Reliability Investment Plan (CERIP) to support investments that address near- and mid-term reliability (\$1 billion). SB 846 also included legislative

intent to provide a total of \$1 billion from the General Fund from 2023-24 through 2025-26—\$100 million in 2023-24, \$400 million in 2024-25, and \$500 million in 2025-26—to support the CERIP, which CEC recently updated. The legislation required the plan to support investments that address near- and mid-term reliability needs and the state’s greenhouse gas (GHG) and clean energy goals. The plan adopted by the CEC incorporates a combination of planning and enabling structures to support clean energy deployment and augmenting for extreme events for the first year \$100 million funding. Of this amount, \$32 million is directed to DWR to stand up a central procurement mechanism. While this funding was adopted in the state budget, AB 102 (Ting, Chapter 38, Statutes of 2023), the budget language is likely not sufficient for the implementation of the central procurement mechanism.

Emergency Load Reduction Program (ELRP). The ELRP is a five-year pilot program designed to pay electricity consumers for reducing energy consumption or increasing electricity supply during periods of electrical grid emergencies. The purpose of the ELRP pilot is to offer a new tool for the electric grid operator and electric IOUs for reducing energy consumption during a grid emergency to reduce the risk of electricity outages when the available energy supply is not sufficient to satisfy the anticipated electricity demand.

New Smart Thermostat Incentive Program. Provides incentives to install smart thermostats in hot climate zones. The smart thermostats allow customers to reduce air conditioning usage a few degrees during critical times and get paid for the energy savings, with special protection for low-income customers.

Existing Reliability and Procurement Processes

The budget policy and appropriation actions are intended to augment the existing demand forecasting, energy resource planning, energy procurement, and additional efforts already underway as part of the state’s ongoing efforts to address electricity reliability. These includes programs to direct procurement and resource adequacy of the state’s electric IOUs, CCAs, and ESPS. Currently, there are currently 25 CCAs and 18 ESPs serving load in the state, per the *CPUC’s June 2023 CCA and ESP Formation Status Report*.

Integrated Energy Policy Report (IEPR). The IEPR provides a cohesive approach to identifying and solving the state’s pressing energy needs and issues. The report, which is crafted in collaboration with a range of stakeholders, develops and implements energy plans and policies. SB 1389 (Bowen and Sher, Chapter 568, Statutes of 2002) required the CEC to conduct assessments and forecasts of all

aspects of energy industry supply, production, transportation, delivery and distribution, demand, and prices. The CEC is then required to use these assessments and forecasts to “develop energy policies that conserve resources, protect the environment, ensure energy reliability, enhance the state's economy, and protect public health and safety.” The CEC adopts an IEPR every two years and an update every other year.

Resource adequacy (RA). Following the California energy crisis of 2000-01, the California Legislature enacted legislation to prevent future incidents of widespread blackouts and rolling brownouts due to lack of electric generating capacity. Among the reforms adopted in response to the crisis was the adoption of Public Utilities Code §380 as an effort to better ensure reliability of electric supply. The statute directs the CPUC, in consultation with the CAISO, to establish RA requirements for all load-serving entities (LSEs), including electric IOUs, ESPs, and now includes CCAs, which did not exist at the time of the crisis.

The current RA program consists of system, local, and flexible requirements for each month of a compliance year. In October of each year, LSEs must demonstrate that they have procured 90 percent of their system RA obligations for the five summer months (May-September) of the following year, as well as 100 percent of their local requirements, and 90 percent of their flexible requirements for each month of the coming compliance year. The CPUC has recently adopted changes to RA, including increasing the planning reserve margin from 15 percent to 17 percent by 2024 for all LSEs and in the case of electric IOUs upwards of 20-22 percent.

Cost Allocation Mechanism. Current law ensures the costs associated with the RA program are recovered on a nonbypassable basis, a process called the Cost Allocation Mechanism (CAM). The CAM is a regulatory process for allocating capacity costs of utility procurement across all benefitting customers. The CAM was conceived in a 2004 CPUC decision, adopted in a 2006 CPUC decision (D.06-07-029), affected by changes in law (SB 695, Kehoe, Chapter 337, Statutes of 2009), and continues to be adapted to new issues and circumstances. The CAM is a fixture of the CPUC’s Long Term Procurement policy and is based on the principle that costs and benefits of new generation should be shared by all benefitting customers within an electric IOU’s service territory. The mechanism for CAM is a one-way tool; it exists for the IOUs to purchase resources on behalf of all who rely on the electric grid, including customers of ESPS and CCAs. CAM allows the IOUs to spread costs of generation resources to the other LSEs.

CAISO backstop procurement. If California RA rules fail to provide sufficient resources, the CAISO is compelled to utilize centralized backstop procurement mechanisms in order to maintain electric system reliability. Centralized backstop procurement is whereby the CAISO contracts with a generator to address the shortfall. Under Federal Energy Regulatory Commission (FERC) rules, the CAISO, like all other BAs, must ensure system reliability or face penalties by FERC. The CAISO has two mechanisms for centralized backstop procurement: Reliability Must Run (RMR) and Capacity Procurement Mechanism (CPM). A resource receiving RMR designation must continue to operate and is compensated by a rate set by the CAISO, per FERC approved tariffs. RMR contracts can be expensive relative to procurement through the CPUC process, especially considering their limited operating parameters. CPM can be used for resources that may be needed in the following year and where the resource is at risk of retirement. Like RMR contracts, CPM contracts are also often at a higher price relative to generation procured through the CPUC process. These costs are generally shouldered by ratepayers in the insufficient Local Capacity Area or by all ratepayers of the LSE(s) lacking the adequate RA.

SB 100 (De León, Chapter 312, Statutes of 2018). SB 100 established the state's target to meet 100 percent of the state's electricity retail load with renewable and zero-carbon resources by 2045. SB 1020 (Laird, Chapter 361, Statutes of 2022) established interim goals to meeting the SB 100 target, specifically requiring 90 percent of retail sales by 2035, 95 percent by 2040 to be met with renewable and zero-carbon energy resources. SB 100 Joint Agency Report evaluates the challenges and opportunities in implementing SB 100. It includes an initial assessment of the additional energy resources and the resource building rates needed to achieve 100 percent clean electricity, along with the associated costs. It uses a computer model to analyze these factors under various conditions and technologies. The report is scheduled to be updated every four years. The first report issued on March 2021 identified preliminarily that on average the state may need six gigawatts of new renewable and energy storage annually to meet the SB 100 goals.

Integrated Resource Planning (IRP). SB 350 (De León, Chapter 547, Statutes of 2015) required each LSE—meaning an IOU, ESP, or CCA—to file a biennial IRP for approval or certification by the CPUC. The CPUC combines all LSEs' IRPs to ensure the state is on its path to meet its clean energy procurement goals. POUs are required to file their own IRPs with the CEC. The goal of the IRP is a two-year planning process to ensure that LSEs are meeting targets that allow the electricity sector to contribute to California's economy-wide GHG emissions reductions goals

that helps to reduce overall costs. The effort is intended to forecast needs on a 10-year horizon. In this regard, the IRP is a forward-looking activity. Whereas the requirements to meet renewable energy standards is a compliance activity to review whether LSEs and POU's have satisfied their three-year compliance obligation under the Renewable Portfolio Standard (RPS) requirements to meet an increasing share of its retail load with eligible renewable energy resources, until achieving 60 percent by 2035. As part of the IRP process, the CPUC has issued several procurement orders on LSEs (summarized in the table below) to address near-term and mid-term procurement needs.

CPUC IRP Procurement Order	Total MW	Time Horizon (Calendar Years)
D. 19-11-016	3,300 MW	2021-2023
D. 21-06-035 Mid-Term Reliability (MTR)	11,500 MW	2023-2028
D. 23-02-040 Supplemental	4,000 MW	2026-2027
Cumulative Procurement	18,800 MW	2021-2028

Need for a state dashboard to measure progress. The combination of the above actions, as well as others not mentioned, demonstrates that California is taking a plethora of unprecedented actions, including investing billions of dollars of funding from the State Budget and electric ratepayers to address procurement and reliability needs. Yet, it's difficult to measure our progress towards addressing reliability as we advance towards a zero-carbon future, beyond an understanding of whether rotating outages are issued or whether particular resources are deployed. Additionally, the current tightening of the RA market with requirements for RA planning reserve margins increasing, the state procuring resources to serve as insurance, and limited imports (particularly the limited out-of-state hydropower resources due to the drought conditions in the northwest and Canada) is likely further increasing prices for all ratepayers. Furthermore, the pace of retirement of traditional resources (including natural gas plants), policies to advance renewable and zero-carbon energy, as well as electrification, and extreme weather events all work towards further challenging the ability to maintain reliability. Does the state have a game-plan to better coordinate these efforts and to assure Californians that electricity reliability (and affordability) are at the fore-front of our efforts to achieve our zero-carbon goals?