DOCKETED	
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Project Title:	Battery Energy Storage Systems
TN #:	254711
Document Title:	CEC Staff Workshop On Battery Energy Storage System Safety February 23, 2024
Description:	Powerpoint Presentation for the February 23, 2024 CEC Staff workshop on Battery Energy Storage System Safety
Filer:	susan fleming
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	2/27/2024 4:30:24 PM
Docketed Date:	2/27/2024

California Energy Commission

CEC Staff Workshop on Battery Energy Storage System Safety

February 23, 2024

Housekeeping

- Questions may be submitted using the Q&A function in Zoom
- Questions will be answered, time permitting at the end of panel discussions
- Questions and comments can be submitted to the CEC Docket, 24-BSS-01, and can be submitted till 5:00pm Monday April, 1, 2024
- Link to the e-Commenting page will be provided in the chat

Opening Remarks

- Chair David Hochschild, California Energy Commission

- President Alice Reynolds, California Public Utilities Commission

Battery Energy Storage Systems

Staff Safety Workshop

David Erne, Deputy Director, Energy Assessments Division
February 23, 2024

Agenda

- Current and Future Landscape
- Panels
  - Siting and Permitting
  - Design, Manufacturing, Operations and Safety
  - Safety Standards
  - Case Study on Safety Practices
- Closing Remarks

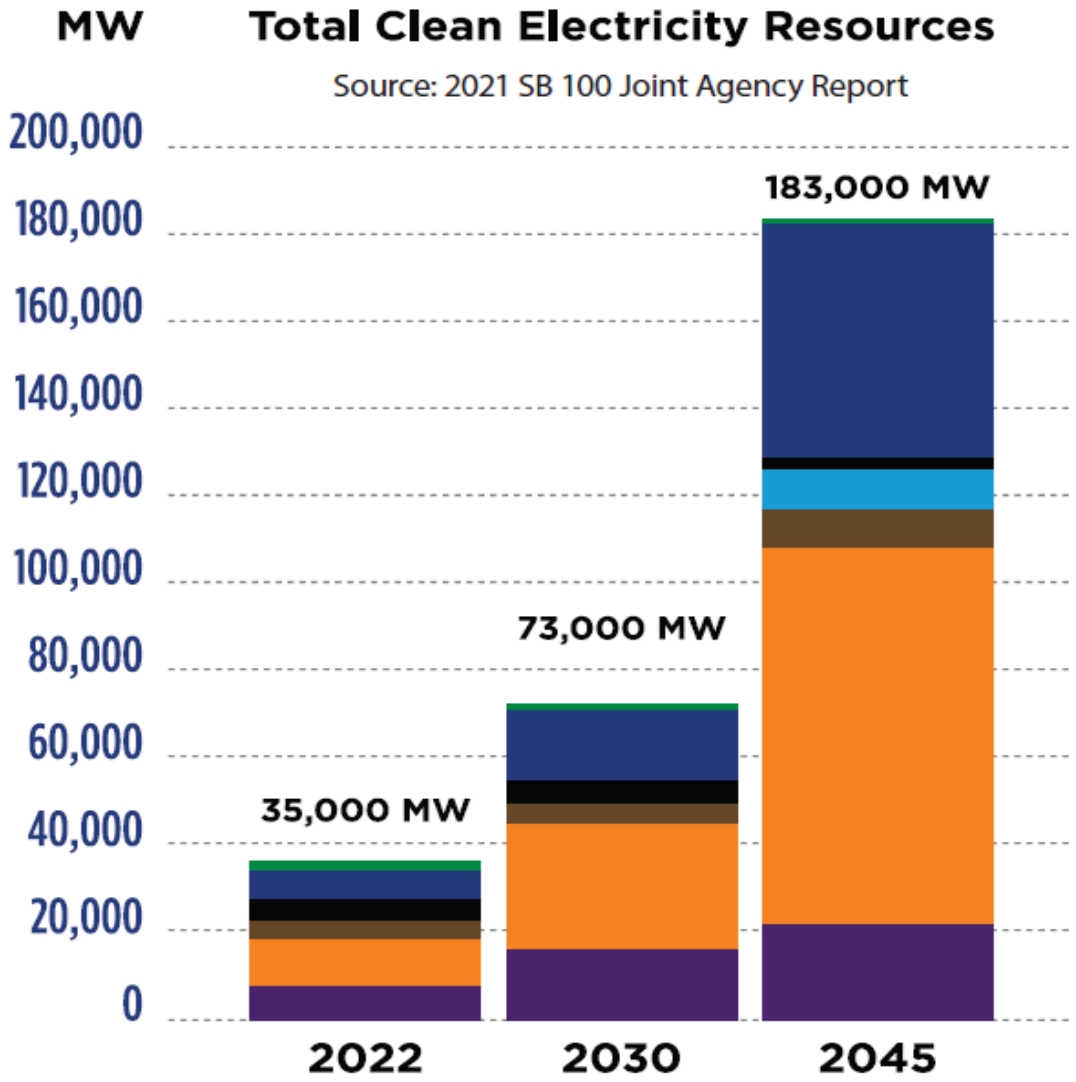
To provide 100% clean electricity by 2045,

California will build an unprecedented amount of new utility-scale clean energy resources

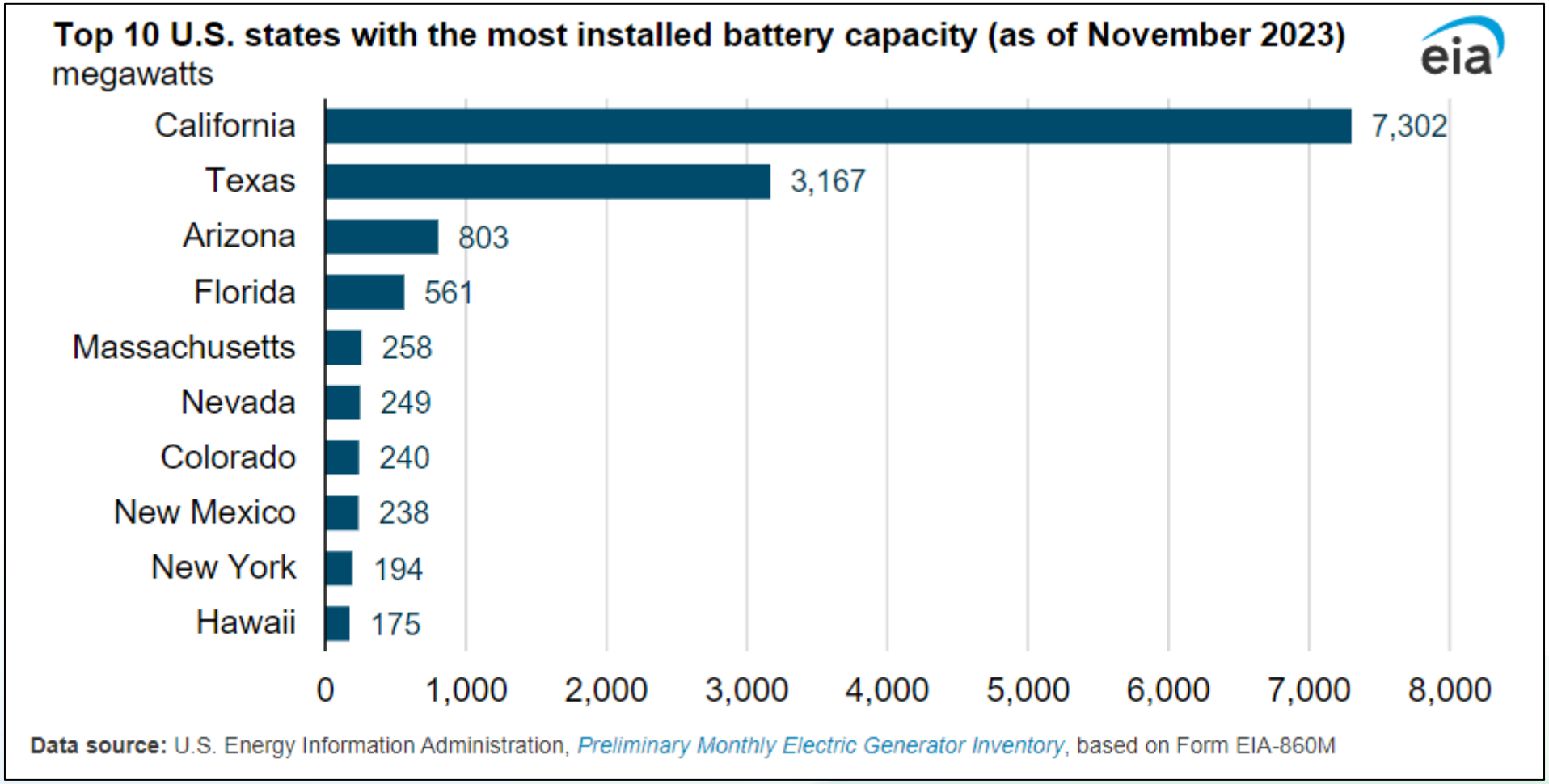
Totals represent new and existing resources. The 2021 SB 100 Joint Agency Report projects the need for 148,000 MW of new resources by 2045.

In addition, California also expects new capacity from energy efficiency, customer solar and demand response.

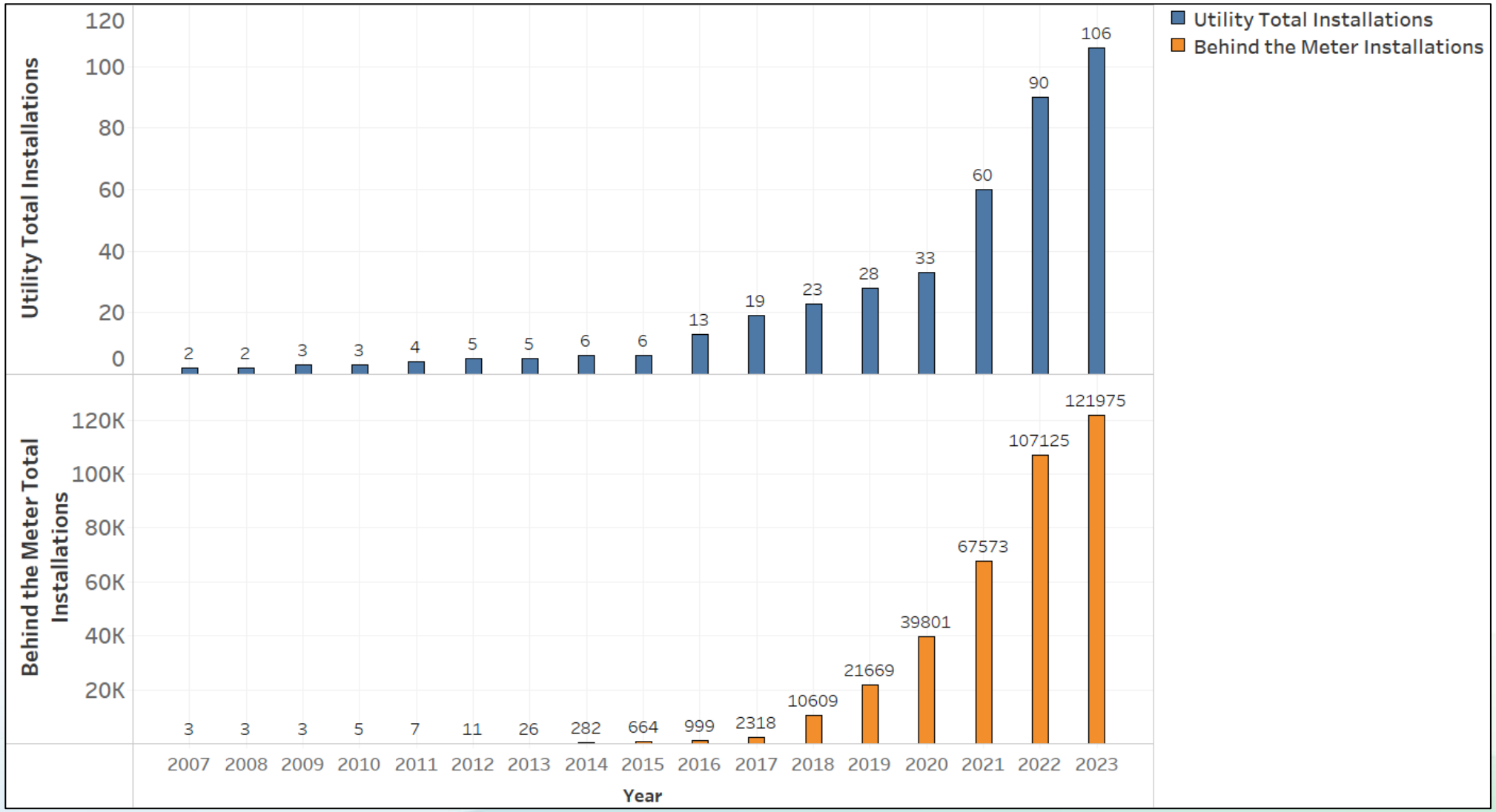
- Biomass
- Battery Storage
- Geothermal
- Offshore Wind
- Long Duration Energy Storage
- Utility-Scale Solar
- Wind



California Leads Nationally on Energy Storage

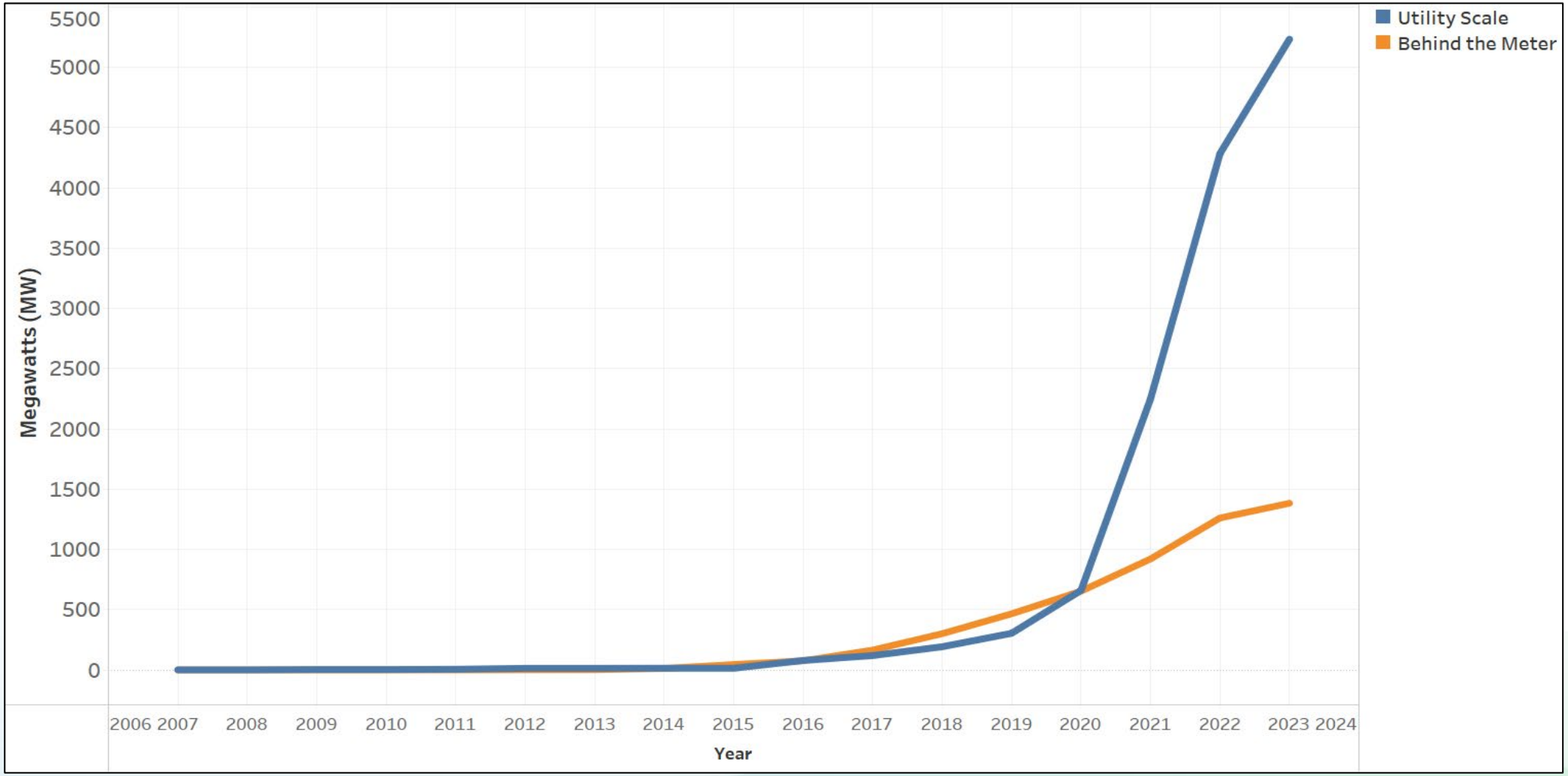


Growing Number of Storage Projects Statewide



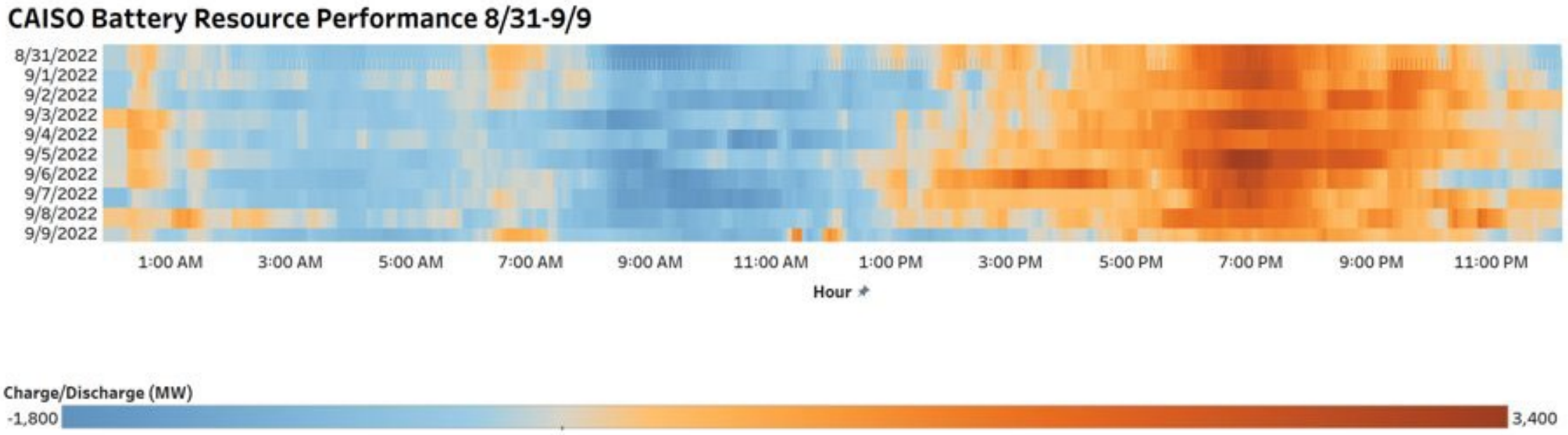
Source: CEC data (July 2023)

Creating a Valuable Grid Resource



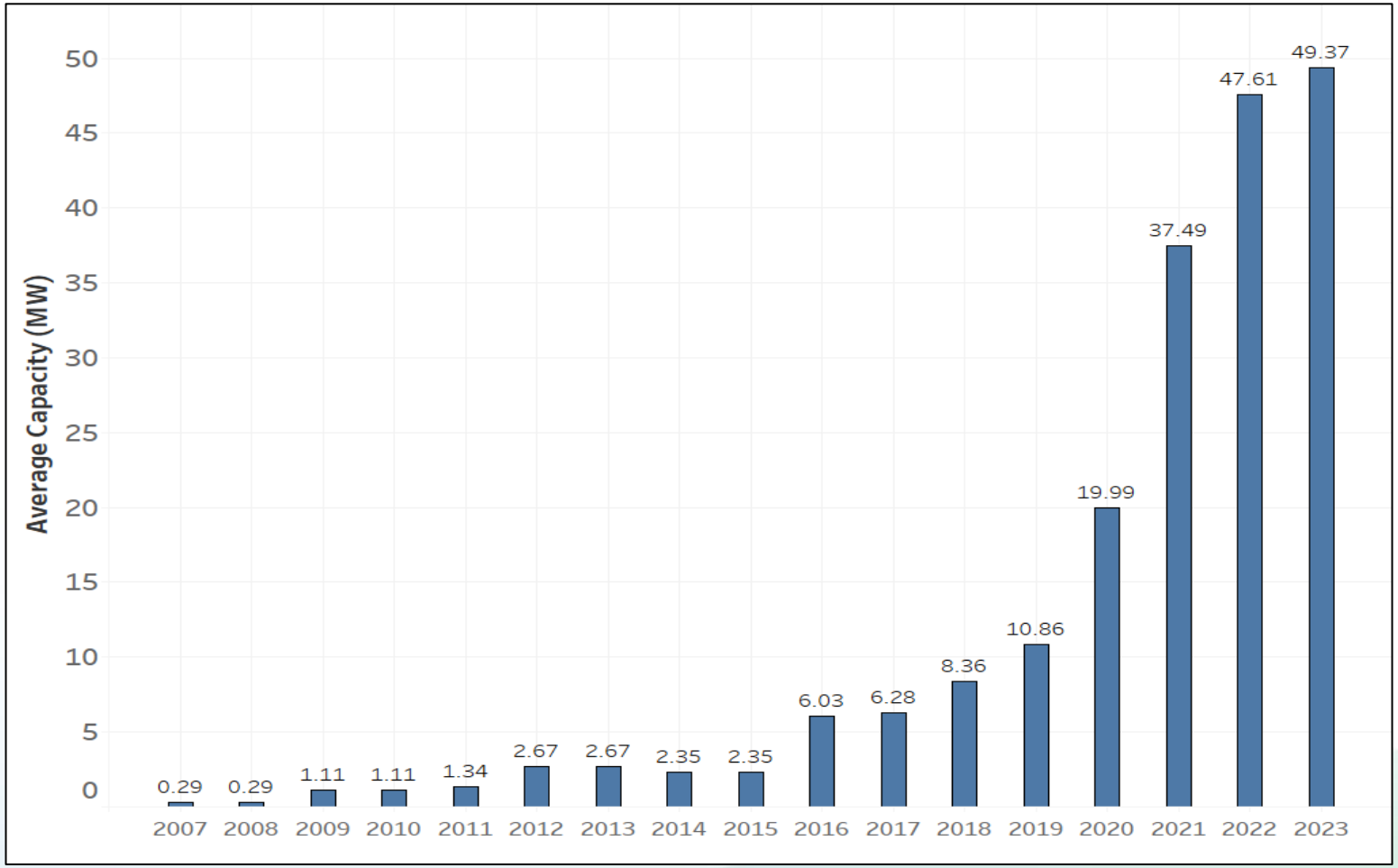
Source: CEC data (July 2023)

Storage Plays a Critical Grid Role



Source: CEC Analysis of CAISO data

Average Project Size Increasing



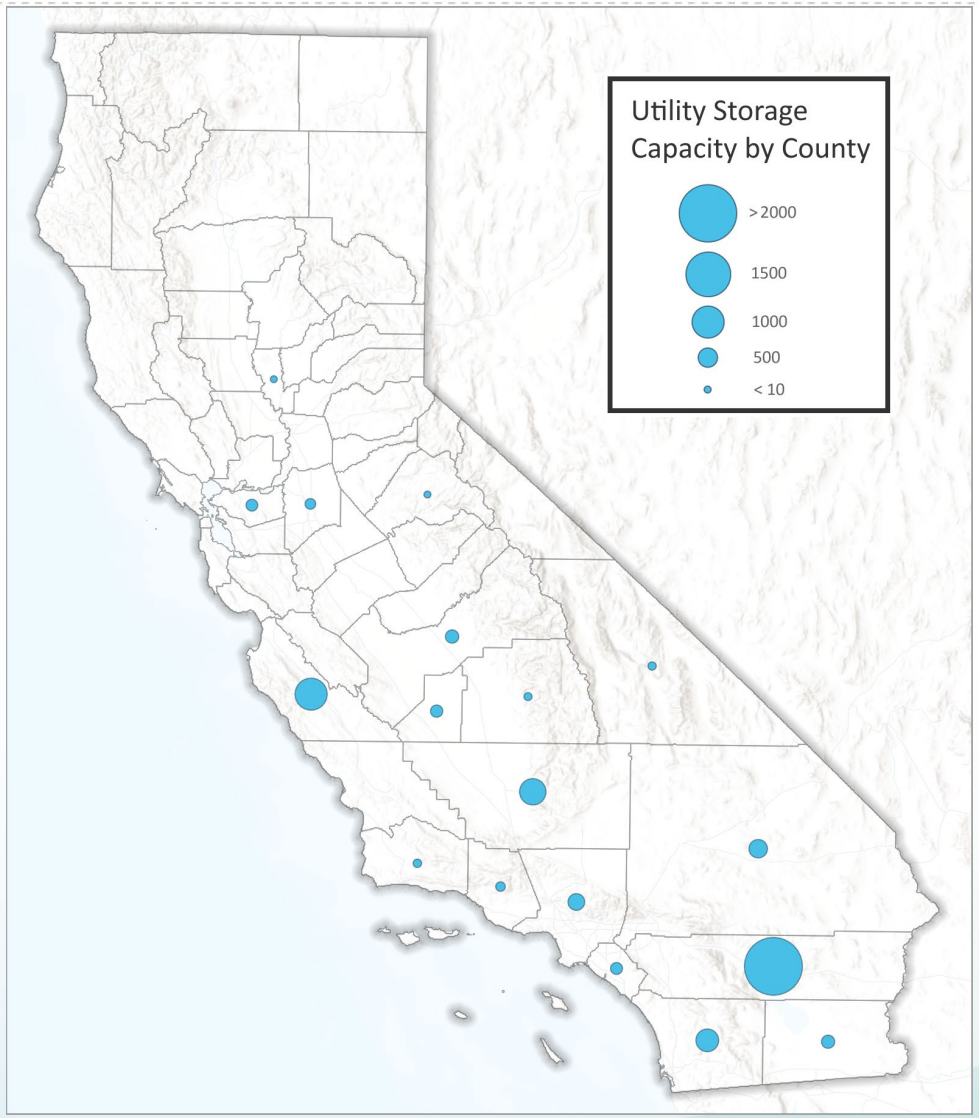
Source: CEC data (July 2023)

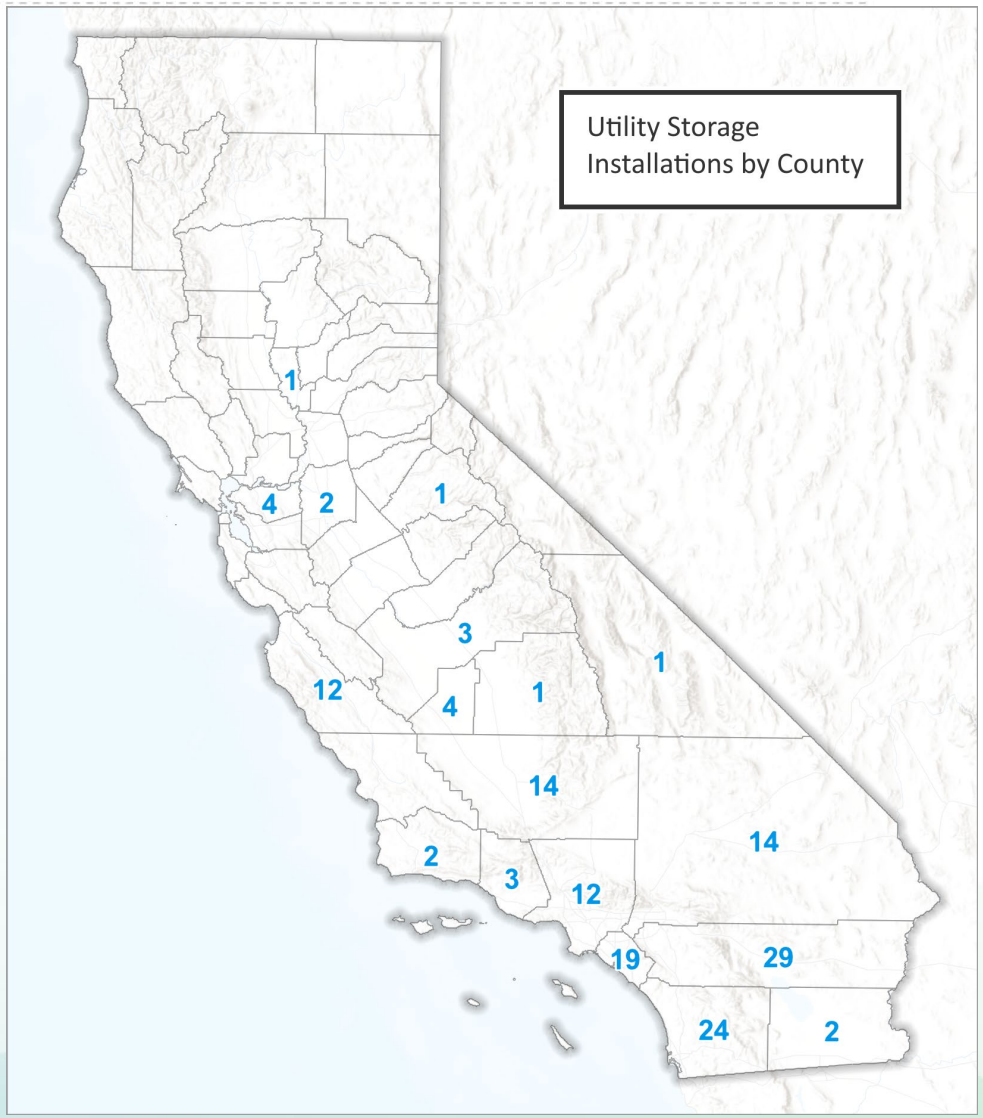
Utility-Scale Installed Capacity

Installed Utility-Scale Energy Storage	Capacity (MW)
Southern California Edison	2,895.1
Pacific Gas & Electric	1,492.5
San Diego Gas & Electric	815.5
Los Angeles Department of Water and Power	22.4
City of Anaheim	3.4
Anza	2.7
City of Glendale	2.0
Total Utility-Scale Storage (July 2023)	**5,233.6**

Source: CEC data

Some Counties Have Larger Growth





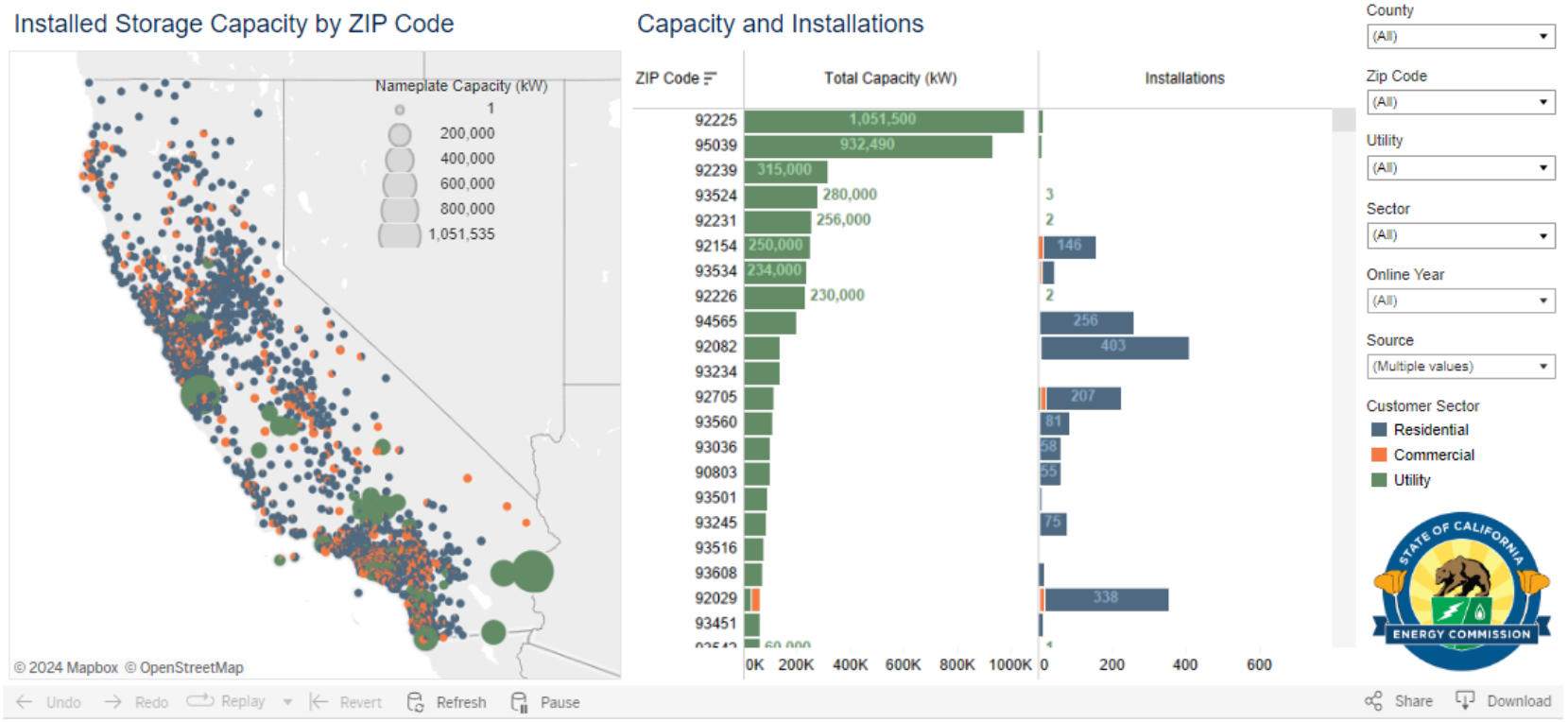
Source: CEC data (July 2023)

Track Energy Storage on the CEC Dashboard

California Energy Storage System Survey

Statewide Energy Storage Capacity: **6,617 MW**

Customer Sector	Total Capacity (MW)	Installations	Average Capacity (kW)
Residential	843	119,483	7
Commercial	540	2,492	217
Utility	5,234	106	49,373
Total	6,617	122,081	54



https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/california-energy-storage-system-survey

Thank You!

Integrated Resource Planning and Battery Energy Storage

California Public Utilities Commission (CPUC) – Energy Division

Molly Sterkel,
Electric Planning and Market Design

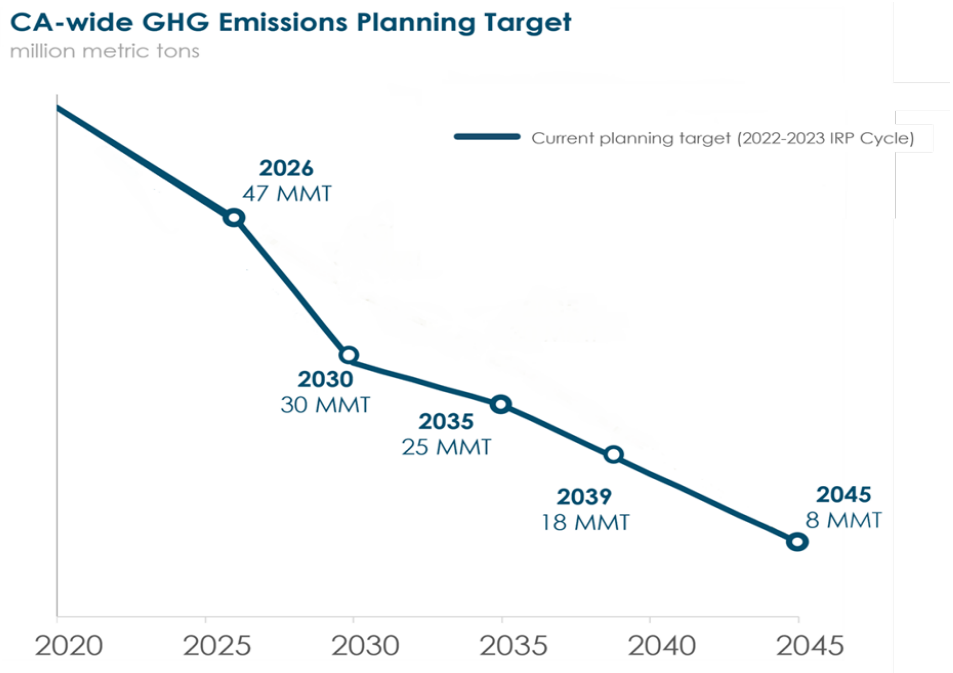
February 23, 2024

Westside Canal Project, 131 MW, SDG&E, Imperial Valley

California Public Utilities Commission

CPUC & Electricity Resource Planning

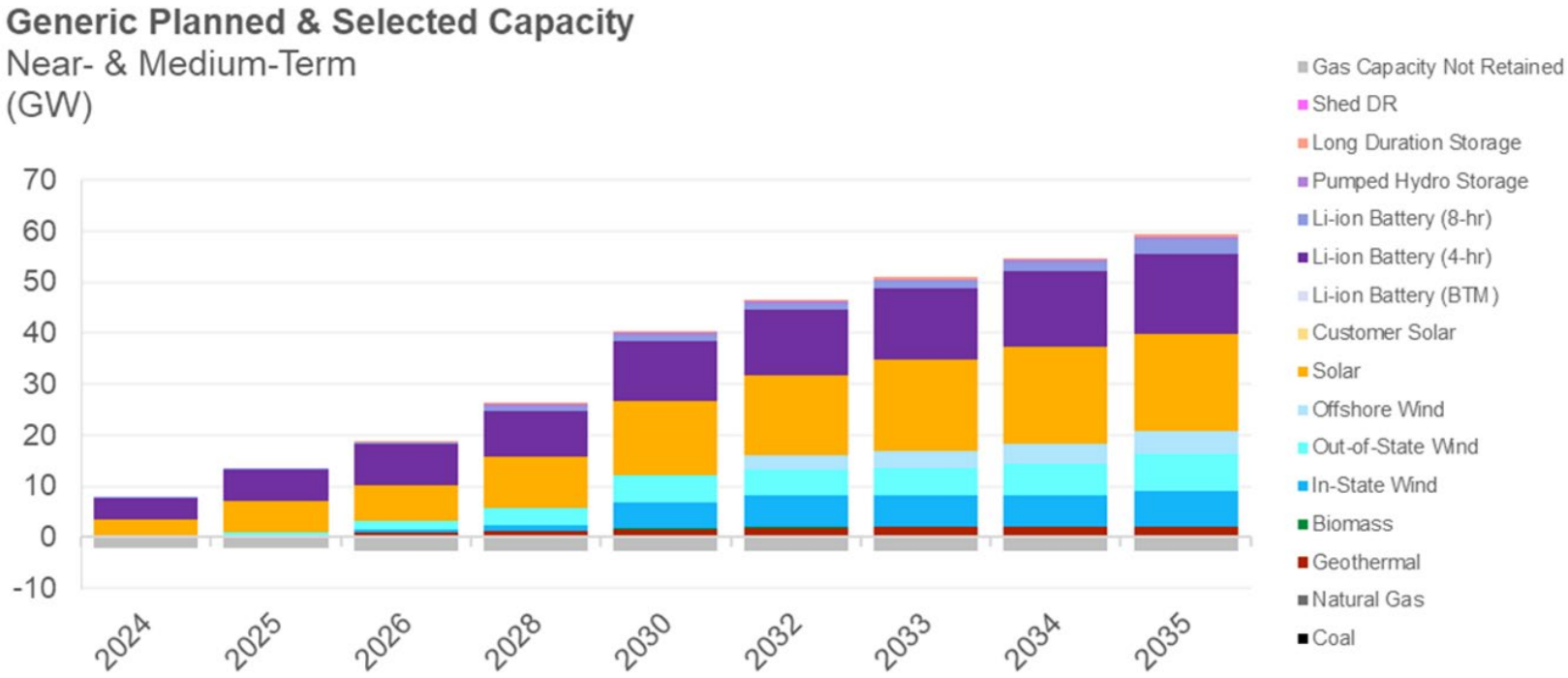
- CPUC established the **Integrated Resource Planning** process for setting electricity resource planning targets for CPUC-Jurisdictional Load Serving Entities in CAISO
  - Consistent with SB 350 (2015) and SB 100 (2018)
  - Designed as a multi-step analytical planning process with input from load-serving entities and stakeholders
- IRP intends to achieve a resource portfolio that achieves:
  - Reliability
  - Greenhouse Gas Emission (GHG) reductions and clean energy procurement
  - Least cost
- Most recently adopted IRP "Preferred System Plan" plans for a portfolio that could reduce GHGs by 58% in 2035 compared to 2020 levels



Source: CPUC February 2024 Preferred System Plan Portfolio, https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/long-term-procurement-planning/2022-irp-cycle-events-and-materials

New Resource Buildout in Preferred System Plan Portfolio

- In Feb 2024, CPUC adopted a Preferred System Plan Portfolio of expected resources, that expects 55 GW of new clean energy resources will be built by 2035.
- Storage installed capacity estimates are shown in **purple**:
  - 22 GW by 2030
  - 32 GW by 2035



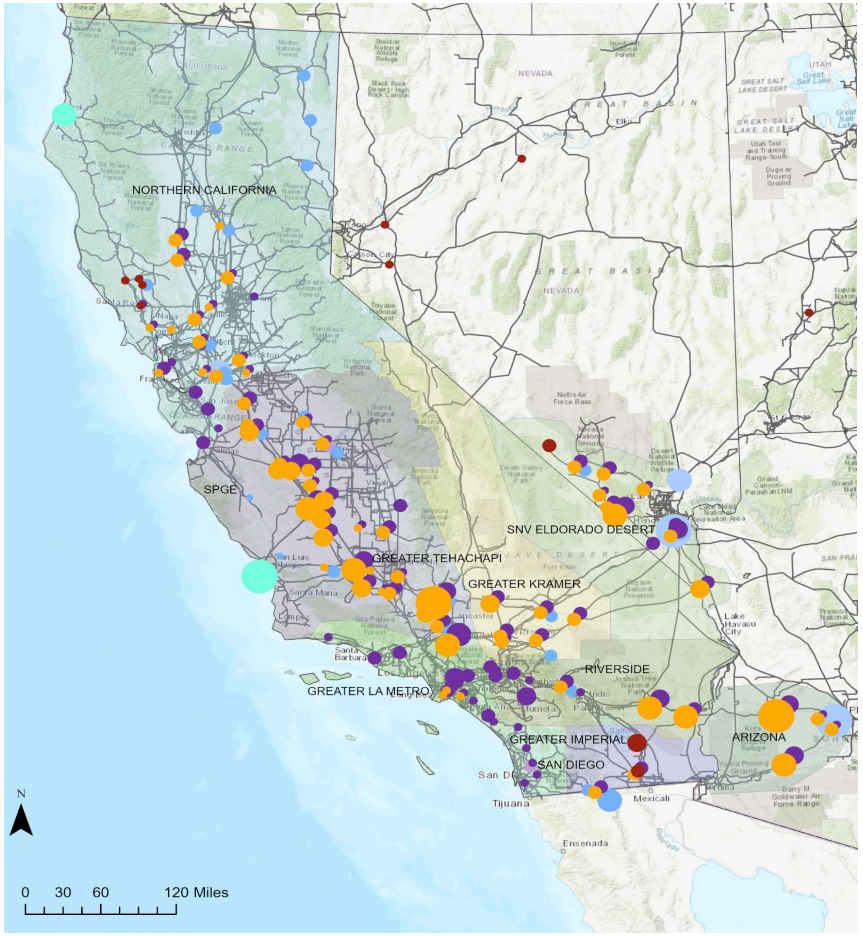
Note: All GW numbers in nameplate.

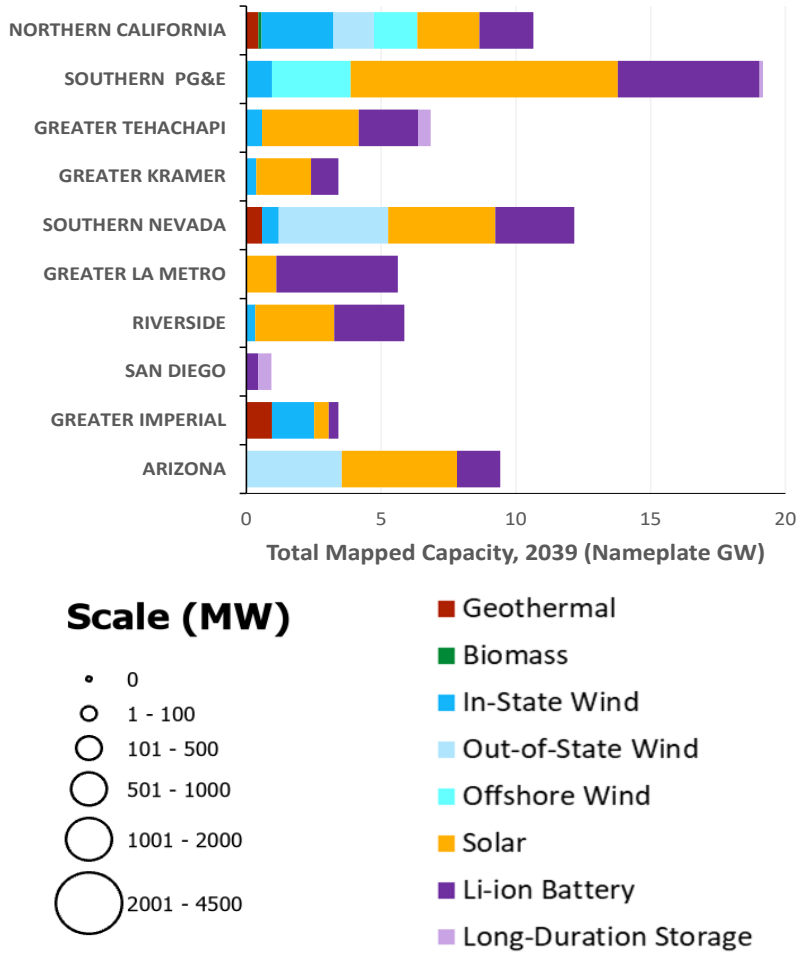
Source: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/2023-irp-cycle-events-and-materials/2024-01-12-presentation-summarizing-updated-servm-and-resolve-analysis.pdf

Modeled Potential Locations for Future Clean Energy Resources for Transmission Planning

CPUC transmits IRP resource portfolios to the CAISO for use in its annual Transmission Planning Process (TPP) to identify future transmission need.

2024-25 TPP Base Case Portfolio (2039) Busbar Mapping Results





Source: 24-25 TPP Base Case Portfolio Busbar Mapping Dashboard

IRP Procurement Orders from 2019-2023

- CPUC jurisdictional entities are required to bring online **18.8 GW of new net qualifying capacity** (NQC) of new clean energy resources between 2021 and 2028.
- IRP Procurement Orders divide procurement responsibility by expected load served and allow LSE flexibility in where and what to contract.
- **Over 7 GW of new NQC (=14 GW nameplate) has come online within CAISO between 2020-2023**, which includes:
  - Storage & hybrid solar/storage
  - Wind, geothermal, & other clean energy

Note: The IRP Procurement orders are NQC – the resulting new build will be significantly higher in nameplate.

CPUC Orders	Total
D.19-11-016 Applies to 25 LSEs since 18/43 LSEs opted out.	**3,300 MW**
D.21-06-035 (MTR) Applies to all CPUC-jurisdictional LSEs. No opt-outs allowed.	**11,500 MW**
D.23-02-040 (Supplemental MTR) Applies to all CPUC-jurisdictional LSEs. No opt-outs allowed.	**4,000 MW**
Cumulative Procurement Ordered	**18,800 MW**

Note: All MWs are in CPUC NQC, not nameplate

Current Installed wholesale BESS Capacity ~ Over 7 GW thru end of 2023

CAISO Stand-alone and Hybrid Storage

Online Date	Megawatt (MW)	# of CAISO Resources
Pre-2021	222	12
2021	1,800	31
2022	2,286	33
2023	2,744	41
Total	**7,055**	**117**

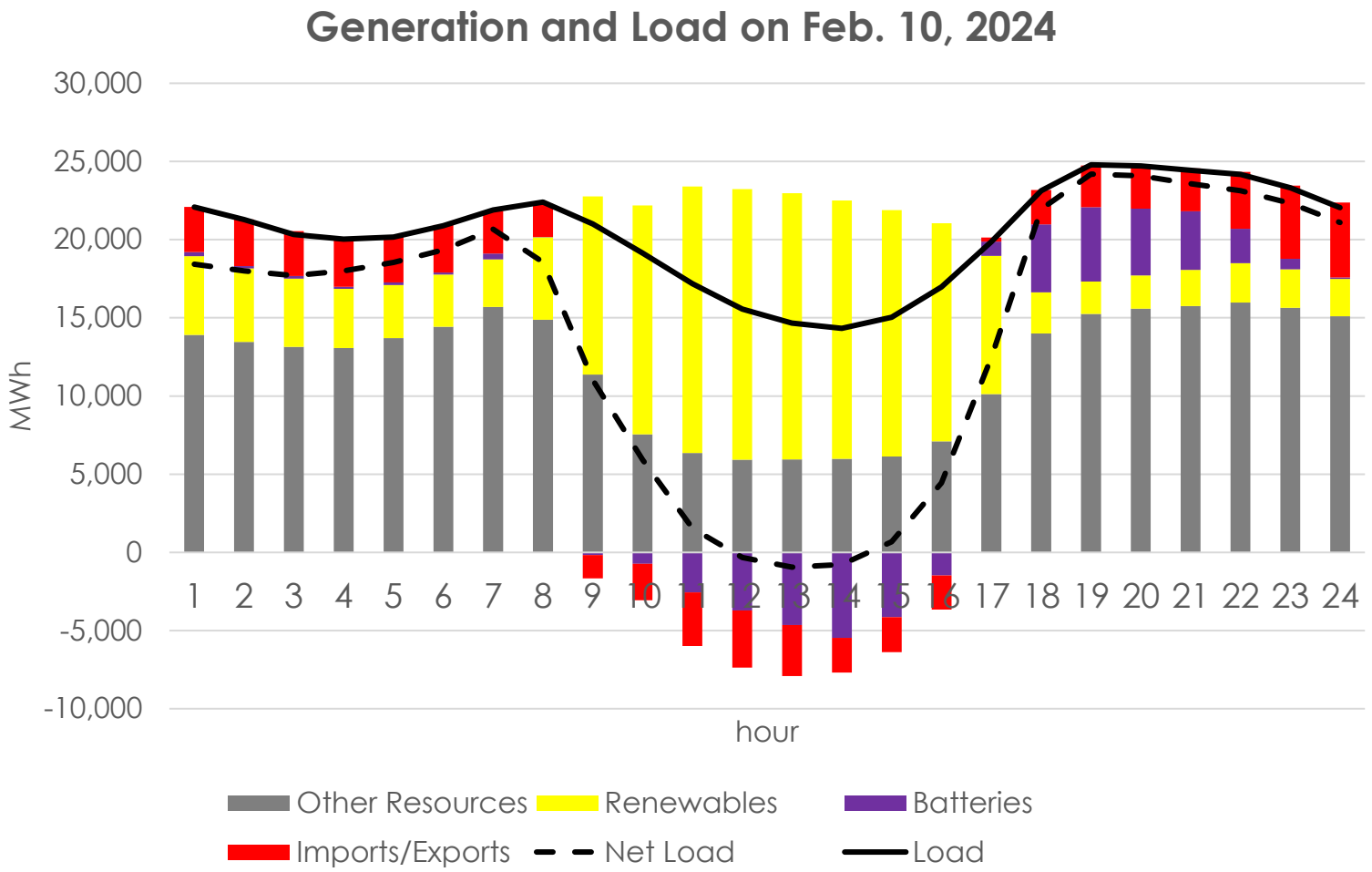
CPUC – Jurisdictional Entities have an estimated ~8,000 MW of additional storage projects in contract expected to come online by 2028.

REV Renewables, 200 MW, Diablo Energy Storage project, Pittsburg, CA

Sample Day: Recent CAISO Battery Performance

- Batteries provide significant energy on a daily basis, for example over 5,000 MW at 7 PM on Feb 10, 2024.

- Sample day shows renewables in yellow, storage in purple bars
  - Positive bars are batteries serving CAISO load during evening peak
  - Negative bars are batteries being charged during daytime by extra renewable energy



Renewables represent solar, wind, geothermal, biomass, biogas and small hydro
Other Resources represent nuclear, natural gas and large hydro
Net load represents electric load net of wind and solar
Source data: Today's Outlook at www.caiso.com

Tracking Energy Development (TED) Task Force

- Joint interagency effort between the CEC, CPUC, CAISO and GO-Biz
- Provide project development support for new energy projects to come online in the near-term
- Identify challenges that may impact clean energy development and coordinate actions to address those barriers

For more information: see www.cpuc.ca.gov/trackingenergy

California Public Utilities Commission

California Energy Commission

CEC Staff Workshop on Battery Energy Storage System Safety

Eric Knight, Manager, Siting & Environmental Branch

February 23, 2024

CEC Authority

June 30, 2022

- Governor Newsom Signs Assembly Bill 205

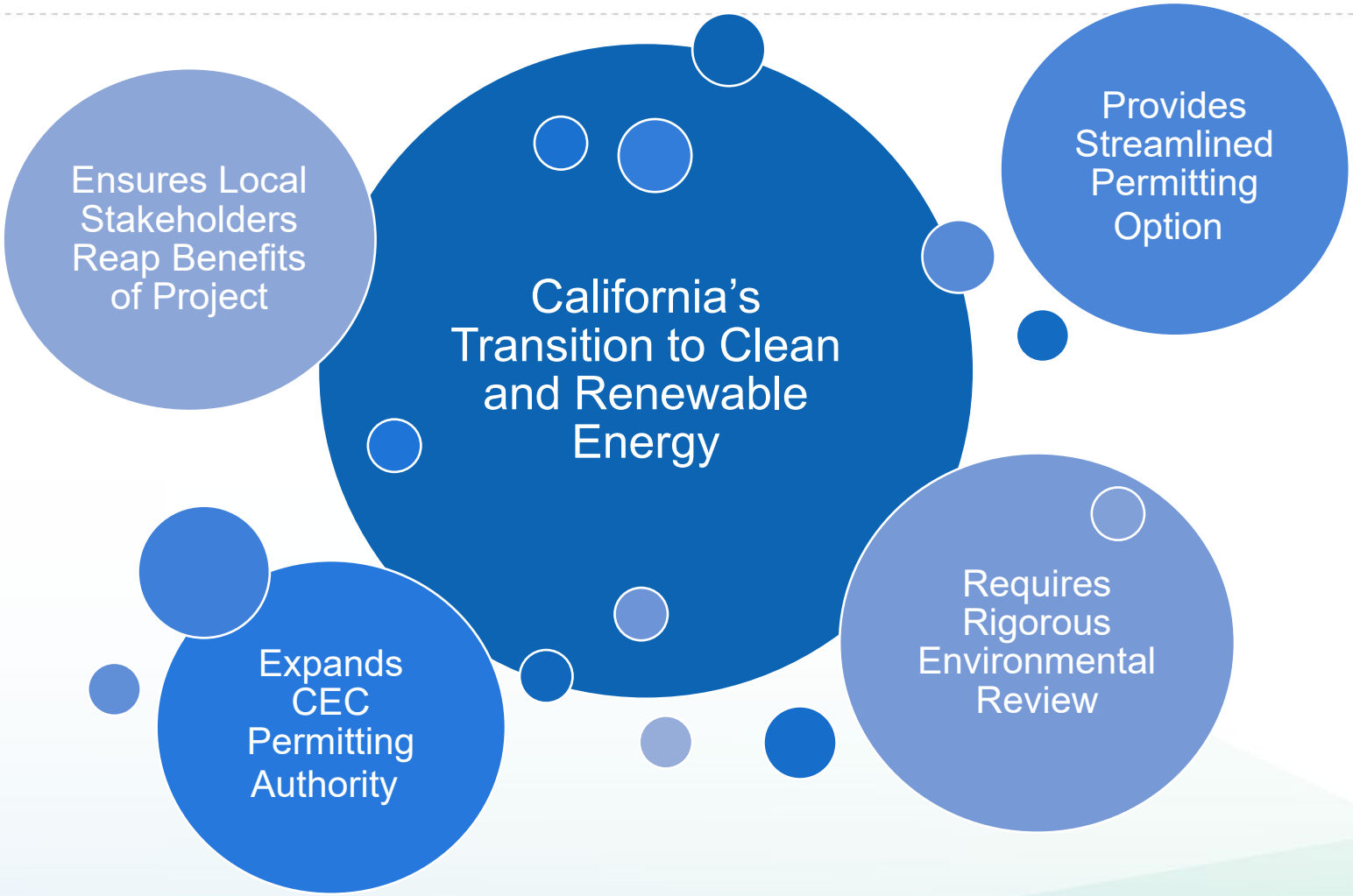
October 12, 2022

- CEC Adopts Emergency Regulations

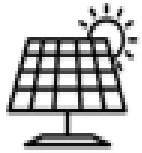
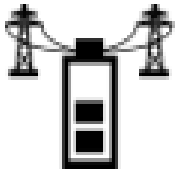
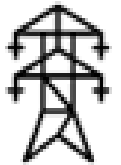
October 24, 2022

- Office of Administrative Law Approves the Emergency Regulations

Opt-In Certification Intent



Eligible Facilities

Solar photovoltaic power plant of at least 50 MW 	Terrestrial wind power plant of at least 50 MW 	Energy storage system of at least 200 MWh 
Non-fossil-fueled thermal power plant of at least 50 MW (i.e., jurisdictional facility) 	Manufacturing/assembly facility for renewable energy/energy storage systems or components with at least $250 million investment 	Transmission from an eligible power plant or energy storage system to the first point of interconnection 

Opt-In Coordination Plans

Source: CDFW

Source: State Water Board

Source: DTSC

Opt-In Process Outline

Pre-Filing Meeting

- 30 Days Prior to Filing
- Docket Established
- Application and Fees Submitted

Data Completeness Review

- 30 Days to Conduct Application Completeness Review
- Additional Information can be Requested
- Application Shared with Local Government, Other Public Agencies, and Native American Tribes

CEQA ++ Environmental Review

- 270 Days to Conduct Environmental Review (once application deemed complete)
- CEC Required Process Milestones

270 Day Process Milestones

- **Notice of EIR Preparation** *(Day 3)*
- **Invite Tribal Consultation** *(Day 5)*
- **Informational/Scoping Meeting** *(Day 30)*
- **Discovery Request Due** *(30 Day Turnaround)*

30 Days

150 Days

- **Draft EIR and Notice of Availability Published** *(Day 150)*
- **Draft EIR Meeting** *(30 – 60 Days from published date)*
- **Draft EIR Public Comment** *(60 Days from published date)*

- **Final EIR** *(By Day 240)*
- **CEC Business Meeting Decision** *(By Day 270)*
- **Partner Agencies Applicable Permit Decisions** *(By Day 360)*

270 Days

CEC Findings Required to Approve Opt-In Projects

- Project Provides an Overall Net Positive Economic Benefit to the Local Government
- Applicant Signed a Community Benefits Agreement
- Applicant Paying Prevailing Wage to Skilled and Trained Workforce
- Project Complies with Applicable Laws, Ordinances, Regulations, and Standards or Required for Public Convenience or Necessity
- Significant effects of the project will be avoided or mitigated, or statement of overriding considerations for significant effects found infeasible to avoid or mitigate

CEC Website

- Alphabetical List of Power Plants
  - Dockets
  - Subscriptions
- Opt-in Fact Sheet (coming soon)
- Opt-in FAQ
- Opt-in Process Timeline

Thank You

Eric Knight, Manager, Siting and Environmental Branch
Siting, Transmission, and Environmental Protection Division

STEPsiting@energy.ca.gov

Lunch Break

BESS Safety Workshop

Lunch Break

Return at 1:00 PM

Lumen
ENERGY STRATEGY

Overview of Current State of BESS Safety Practices in Design and Operations

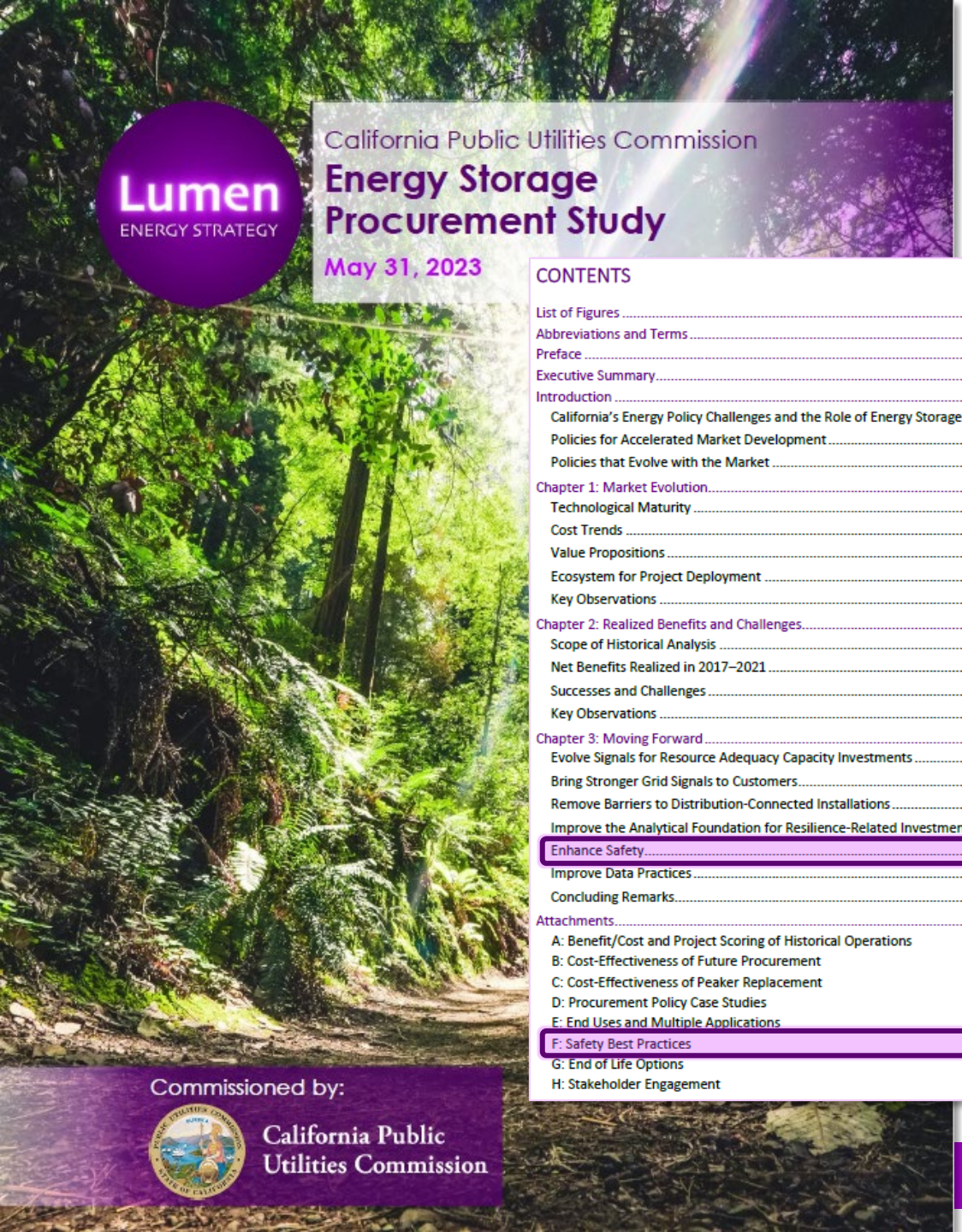
Findings from the 2023 CPUC Energy Storage Procurement Study

Prepared for:

California Energy Commission Staff Workshop on Battery Energy Storage system (BESS) Safety

February 23, 2024

Photo by Eric Ward on Unsplash



CONTENTS

Recommendations on policy efforts going forward

Enhance Safety

Expanded safety-related initiatives can help mitigate harm to people and improve emergency response to a safety event. They also have the potential to facilitate fast and high-quality local permitting review and to minimize outages of storage resources and any co-located generation or critical facilities.

With recognition that safety is a multi-agency issue and the CPUC, CEC, and local agencies will need to work closely together, our recommendations to the CPUC are to:

- **Form a storage safety collaborative:** The CPUC Energy Division and Safety and Enforcement Division to build upon their coordination with the CEC to form a safety collaborative with the purposes to (a) define roles and responsibilities in the context of a multi-agency risk management plan, (b) promote two-way knowledge exchange with local authorities and emergency responders on installation characteristics, possible risk factors including vulnerabilities to local environmental conditions, and the effectiveness of mitigations, (c) facilitate rapid absorption and integration of safety best practices into local laws, building and fire codes, site-specific emergency plans, inspection checklists, permitting processes overall and (d) identify and implement measures to minimize storage and any co-located resource outages and recovery periods following a safety event. Importantly, all safety collaborative meetings and materials should be transparent and available to the public.
- **Explore the safety-reliability link:** The CPUC and utilities to consider development of a safety and reliability score in the utilities' least-cost best-fit resource evaluations, based on guidance from the safety collaborative and/or developer guarantees or remedies for a safety-related event.
- **Develop guidance materials for local agencies to build from:** The CPUC and the CEC to consider development of training webinars and guidebooks for local governments such as model (boilerplate) law for storage system requirements, a model permit application, a model inspection checklist, and information on how battery system safety is incorporated into state fire and building codes.

ATTACHMENT F: SAFETY BEST PRACTICES[1]

Due to the market readiness and scalability, installations of stationary lithium-ion battery energy storage systems are ramping up quickly to play a major role in California's clean energy portfolio. California's dependence on this technology is expected to grow from just over 2,500 MW at the end of 2021 to potentially tens of gigawatts by 2045. As installations accelerate, so does the urgency to address safety.

Main Report and Attachment F available here:
https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/energy-storage

Case studies & observed impacts


Image credit: Jay Armstrong

Kahuku Wind Farm (HI)

Complete destruction of 10 MWh system + warehouse, major response effort, 30 MW wind farm > 1 year outage

2012


Image credit: Performance Improvement Int'l

Elden Substation (AZ)

Responder chemical exposure, major response effort, complete destruction of 1.5 MWh system

2013 2014 2015


Image credit: National Fire Protection Association

Franklin Facility (WI)

Property destruction, major response effort

2016 2017 2018


Image credit: DNV GL

McMicken System (AZ)

4 responders severely injured from explosion + 5 other responders under hospital supervision, complete destruction of 2 MWh system

2019 2020


Image credit: KION 46 News Channel

Elkhorn (CA)

Gas release into community, road closures and shelter-in-place

2021 **2022**

1 square mile evacuation, major response effort, destruction of property and building, cleanup

Warehouse in Morris (IL)


Image credit: ABC7 Chicago

Likely minimal damage to system, reliability impacts unknown

Grand Ridge System (IL)


Image credit: LaSalle County Emergency Management Agency

1% of system destroyed, 2 month delay in energization testing

Victorian Big Battery (AU)

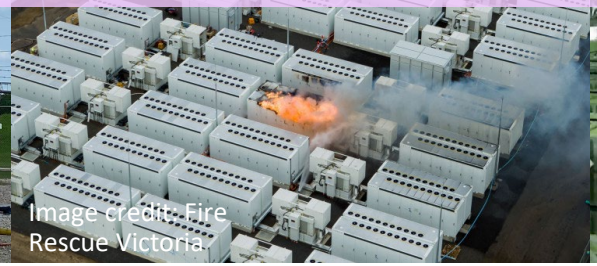


Image credit: Fire Rescue Victoria

7% of system destroyed, 1,200 MWh system on outage for almost a year

Moss 300 (CA)


Image credit: Vistra Corp.

400 MWh on outage for 5 months

Moss 100 (CA)


Image credit: Vistra Corp.

Relatively minor event, but another event in Sept 2023 caused road closures and shelter-in-place

Valley Center (CA)


Image credit: Terra-Gen

Knowledge barriers pose a systematic problem

BESS in its built and natural environment

Image credit: Tesla.

Energy storage safety is a complex risk management issue that involves many parties

Case studies tend to present knowable (manageable) risks, but lack of communication & coordination channels to properly manage those risks

One recommended policy action is to form an ongoing safety collaborative

Reduce hidden areas and blind spots, so we can prepare and manage the risk appropriately as a larger community

- Start with fundamentals in each area of expertise, then explore how risks can interact in the overall BESS installation and electricity grid
- For example, does everyone understand the difference between fire and thermal runaway?

Resources for local authorities and community leaders are critical

Another recommended policy action is to develop guidance materials for local authorities and community leaders

Resources needed: accessible, understandable, vetted, and California-specific

Model codes, law, permit application, inspection checklist; training materials

With guidance on where/how to tailor to the local built and natural environment

With access to the safety collaborative to connect to a network of experts and resources

- Product-neutral (no sales pitches)
- Provides clarity on common misperceptions

Clockwise from top: Desert Peak Energy Storage, image credit: NextEra; e-bike, image credit: Getty Images; storage in multi-family garage, image credit: PNNL/Off the Grid Design; F-150 charging, image credit: PG&E/Ford.

The local dilemma

Examples of California local communities slowing BESS development to address safety concerns

Solano County

Similar to Menifee, in January 2024, adopted a 45-day moratorium with option to extend for 2 years; a 300 MW project is at the center of local opposition

Petaluma

Community groups demand full environmental impact reports on a 200 MW project and a 300 MW project

City of Menifee

In October 2021, adopted a 45-day moratorium on utility-scale BESS with an option to extend for 2 years, then extended it for 10 months 15 days (through most of 2022)

Morro Bay

A community-driven initiative to block a 600 MW installation at the former power plant site is now on the November 2024 ballot

Local authorities and community leaders are under pressure as BESS installations ramp up quickly

- For most, likely don't have the staff, resources, and/or operating capacity to become experts this quickly

A logical reaction is to slow down local approval process

We also don't want communities to rush the process and become overconfident/over-reliant on partial mitigations

- E.g., fire suppression systems are not a cure-all

A centralized knowledge exchange can help improve the local process by supporting:

- Rapid integration of safety best practices in local rules and procedures
- A high-quality siting and local review process
- Faster, more efficient, local approvals communities have confidence in
- In NY, this is part of the state's strategy to reduce soft costs of energy storage deployment

Emerging codes and standards, best practices

The DOE, national labs, and more than a dozen standards development organizations are at the center of the evolution of national codes and standards over the last 7+ years

ES SAFETY COLLABORATIVE

FALL 2022 Highlights

The NFPA 855 2023 revision has been approved and released. Available for viewing now. Advance orders for published version accepted.

UL 1973, 9540 and 9540A are undergoing revisions via their STP process. Since these have a material correlation with NFPA 855 and the IFC standards, these UL standards should be followed closely.

The 2024 ICC IFC has completed alignment of energy storage requirements with NFPA 855 standards. Work by the FCAC committees on the 2027 revisions will begin shortly.

The International Electrotechnical Commission (IEC) has 12 electrical energy storage standards projects under development. Known as (and identifiable as ES standards) under IEC TS 62933-x-y labels, these will play a more important role in global ES requirements in the decade ahead. Three of the important projects are highlighted in this report.

CODES AND STANDARDS UPDATE
FALL REPORT 2022

The goal of the DOE OE Energy Storage System Safety Roadmap is to foster confidence in the safety and reliability of energy storage systems. There are three interrelated objectives to support the realization of that goal: 1) research, 2) codes and standards (C/S), and 3) communication/coordination. The C/S objective is "To apply research and development to support efforts focused on ensuring that codes and standards are available to enable the safe implementation of energy storage systems in a comprehensive, technology agnostic, and science-based manner."

The following activities support that objective and realization of the goal:

1. Review and assess C/S which affect the design, installation, and operation of energy storage systems (ESS)
2. Identify gaps in knowledge that require research and analysis to provide data for technical committee inputs
3. Identify areas in C/S that are potentially in need of revision or enhancement and can benefit from activities conducted under research and development
4. Develop input for new or revisions to existing C/S through individual stakeholders, facilitated task forces, or through laboratory staff supporting these efforts

The purpose of this Codes and Standards Update is to support these objectives by providing information on efforts being conducted by U.S. standards developing organizations (SDOs) and other entities that include focus on ESS safety.

The information is organized by SDO relative to the scope of each document in relation to how it fits into the ESS paradigm. The categories are color coded as codes and standards that apply as follows: 1 Built Environment; 2 Complete ESS; 3 ESS Installation; 4 ESS Components; and 5 Reference Items.

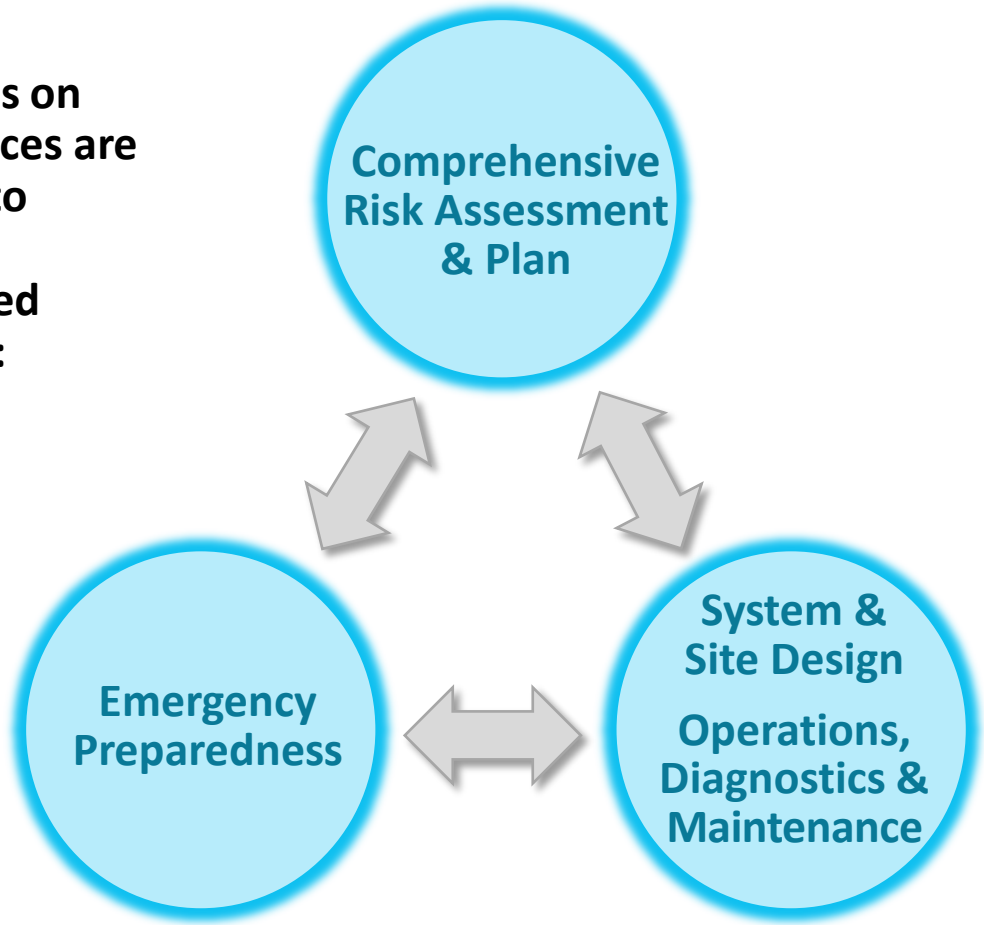
Changes in current activity from the prior edition are shown in italics. Time-sensitive items (e.g., those having an upcoming schedule/due date) are shown as **highlighted, bold, and underlined**.

To subscribe to the ES Safety Collaborative and receive ongoing ESS safety communications visit https://public.govdelivery.com/accounts/USDOESNLEC/signup/30707.

DOE's Energy Storage Safety Collaborative:
www.sandia.gov/energystoragesafety

- *National perspective*
- *Foundation for more tailored state-level resources*

Our study conclusions on best practices are divided into following inter-related categories:



Risk assessment

Achievements

- Consideration of underlying battery chemistry and technology
- Codes and standards for individual components and assembly of components
- Risks of complete energy storage system: UL 9540A
- Electrical, fire, and building codes for entire built environment
  - Additional review under CEQA

Challenges & Emerging Practices

- Location or site-specific factors
- Need for 24/7 real-time situational awareness—even with the batteries offline (outage as a failure mode)
- Secondary risks to reliability and ratepayer costs
- Risks of installations out-of-date with current best practices
- Need for proactive communication of identified risks to all parties involved

Emergency preparedness

A mitigation strategy that assumes a fire and thermal runaway propagation situation; focused on protecting people, communities, and environment in real-time

Achievements

- Site designs with situational awareness tools, egress, access, water, structural integrity, physical buffers
  - Design with input from responders
- Emergency training and coordination; emergency response plans
  - Types of possible failures and hazards, how to identify them and assess the overall situation, and what course of action to take in different situations

Challenges & Emerging Practices

- Need for knowledge exchange among regulators, local authorities and responders, battery system owners and supervisors
  - Including state and county fire departments, local permitting authorities
  - *See* NYSERDA's training webinars, guidebook, and boilerplate law/permit/inspection documents for local authorities; linkages to state fire code; technical assistance for local authorities
- Emergency response plans for each installation
  - Beyond materials safety data sheets
- Process for quick recovery of capacity on outage

Systems and site design

Achievements

- Shift to lithium-iron-phosphate (LFP) battery chemistry
- Operational fail-safes
- Physical and thermal barriers
- Monitoring and situational awareness equipment
- Fire suppression and response system AND water supply and access
- Total system fire and building standards
- Installation quality control

Challenges & Emerging Practices

- (follow gaps in risk assessment)
- Enhanced design to also meet reliability objectives
  - Additional physical separation
  - Implications of hybrid configurations
  - Specific safety/reliability requirements incorporated into procurements
- Options for installations out-of-date with current codes and standards
  - Run status quo, or force retrofit vs. retire decision?
- Coordination and communication with responders
  - Ultimately written into state/city fire code

Operations, diagnostics, and maintenance

Achievements

- Ability to monitor and isolate each individual cell
- Systems and procedures appropriately tuned to relationship between operating practices and degradation
  - Thermal runaway as a function of temp and SOC (Sandia)
  - Degradation as a function of charge ramp and depth; consequences of aggressive charge/discharge and deep cycling (South Korea)
- Various maintenance and inspection guidelines, in coordination with fire safety authorities

Challenges & Emerging Practices

- 24/7 situational awareness
  - E.g., temperature, moisture, dust, other environmental conditions, gas monitoring, cell degradation
- "Single integrator" of multiple management and control systems
  - Systems need to talk to each other: battery management system, power control system, energy management system, site management system (Sandia/PNNL)
  - Also use data from situational awareness equipment
  - Supervisor with access to all information
- Predictive maintenance using machine learning

Helpful resources

2023 *CPUC Energy Storage Procurement Study*
https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/energy-storage
—*Attachment F: Safety Best Practices* incl. case studies and 3 pages of references
—Flows to recommended policy actions in Chapter 3 of Main Report

Look out for the upcoming 2nd study
—Does not analyze safety specifically, but may have important info. and context
—Looks at current operating practices of large CAISO-participating batteries, incl. outage patterns and de-rates by month and hour, during grid stress events
—Managing state of charge and battery degradation in operations has a relationship to managing safety risk; important for a safety collaborative that explores the safety-reliability link (recommended policy action in the 2023 report)
—Also provides some analysis and discussion highlighting the importance and scalability of smaller customer-sited and distribution connected installations

EPRI's BESS Failure Event Database
A good starting point for case study research and to keep an eye on new events
https://storagewiki.epri.com/index.php/BESS_Failure_Event_Database

DOE's Energy Storage Safety Collaborative
Essential to understanding the latest national and international codes and standards & their evolution over time
https://www.sandia.gov/energystoragesafety/

Many resources from NY State and NY City
For several years NYS and NYC have publicly navigated through a wide range of energy storage safety-related issues; their journey and resulting products provide valuable guidance for other jurisdictions. This list is not exhaustive:
City University of New York: https://nysolarmap.com/solarplusstorage/
NYSERDA: https://nysolarmap.com/solarplusstorage/
NYC DOT: https://www.nyc.gov/html/dot/html/bicyclists/ebikes.shtml

Key safety experts I follow:

Dr. Paul Christensen
Professor of Pure & Applied Electrochemistry, Founding Dir. Lithiumionsafety Ltd
Why I follow: Tracks and comments on incidents; knowledge-sharing and myth-busting devotee; experienced in safety lab tests and investigations; analyzes lifecycle, recycling, and environmental impacts; active safety speaker and trainer
LinkedIn: https://www.linkedin.com/in/paul-christensen-a2bb6b82/

Emma Sutcliffe
Firefighter, Co-founder of EVfiresafe.com
Why I follow: Systematically researches and reviews EV incidents; knowledge-sharing and myth-busting devotee; experienced firefighter; EV, electrification, and charging specialist; active safety speaker and trainer
LinkedIn: https://www.linkedin.com/in/emma-sutcliffe-41634235/

Paul Rogers
Retired FDNY Lieutenant specializing in HazMat, Co-founder of ESRG
Why I follow: Translator of key information from BESS industry into resources for emergency, local, and state communities; contributor to NFPA 855; contributor to BESS safety advancements in NY; active safety speaker and trainer
LinkedIn: https://www.linkedin.com/in/paul-rogers-943b264/

Matthew Paiss
Retired San Jose Fire Captain, technical advisor to PNNL
Why I follow: Translator of key information from BESS industry into resources for emergency, local, and state communities; contributor to a wide range of renewable energy and BESS codes and standards; training in renewable energy and fire science; experience in CA; active safety speaker and trainer
LinkedIn: https://www.linkedin.com/in/mattpaiss/

Photo by Zach Reiner on Unsplash

Break

BESS Safety Workshop

Break

Return at 2:45 PM

Operation and Maintenance Standards for Energy Storage Systems

Nika Kjensli

Electric Safety and Reliability Branch

Safety and Enforcement Division

February 23, 2024

California Public Utilities Commission

Table of Contents

Overview of the Electric Safety and Reliability Branch

Who is the Electric Safety and Reliability Branch?

- The Electric Safety and Reliability Branch (ESRB) is part of the Safety and Enforcement Division (SED) of the CPUC (https://www.cpuc.ca.gov/regulatory-services/safety/electric-safety-and-reliability-branch).

- The mission of ESRB is to enforce state statutes, CPUC rules and regulations and General Orders regarding the safety and reliability of electric facilities, communication facilities, and power plants that are within the jurisdiction of the CPUC.

- Through audits, inspections and investigations of safety incidents and/or system problems, ESRB works to ensure that these facilities are operated and maintained in a safe and reliable manner to protect and promote public health and safety.

Understanding ESRB – General Orders

ESRB enforces the following CPUC General Orders (GO):

- **GO 95:** *Rules for Overhead Electric Line Construction for Electric and Communications facilities*
- **GO 128:** *Rules for Construction of Underground Electric Supply and Communication Systems*
- **GO 165:** *Inspection Requirements for Electric Distribution and Transmission Facilities*
- **GO 166:** *Standards for Operation, Reliability and Safety During Emergencies and Disasters*
- **GO 167-B:** *Enforcement of Maintenance and Operation Standards for Electric Generating Facilities*
- **GO 174:** *Rules for Electric Utility Substations*

GO 167-B: Operation and Maintenance Standards for Electric Generating Facilities

GO 167-B: implements and enforces standards for the maintenance and operation of electric generating facilities and power plants (aka Generating Assets).

- Generating Assets includes thermal, fossil, and renewable facilities.
- Generating Asset as defined by GO 167-B does not include:
    - nuclear generating facilities
    - qualifying facilities and/or cogeneration facilities
    - a facility owned by a local publicly owned electric utility
    - a facility at a public agency that is used to generate electricity for water or wastewater treatment
    - a facility owned by a city and county operating as a public utility
    - an onsite generating unit used to exclusively serve that customer's load
- Generating Assets smaller than one megawatt are also exempt from enforcement of the standards of GO 167-B.

GO 167-B: Operation and Maintenance Standards for Electric Generating Facilities

Relevant sections of GO 167-B that are applicable to Energy Storage Systems (ESS) include:

- ***Section 5 – Generator Logbook Standards (Thermal Energy):*** requires Generating Asset Owners (GAOs) to maintain facility logbooks in conformance with GO 167-B logbook standards.
- ***Section 7 – Generator Maintenance Standards:*** requires all GAO's generating asset maintenance practices and policies to comply with the maintenance standards of GO 167-B.
- ***Section 8 – Generator Operation Standards:*** requires all GAOs to operate their generating assets in compliance with the operation standards of GO 167-B.
- ***Section 11 – Audits, Inspections and Investigations:*** establishes that generating asset audits, inspections and/or investigations by SED are routine and requires cooperation with SED and Commission staff during these processes and investigations.
- GO 167-B: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-and-enforcement-division/documents/go-167-b.pdf

Senate Bills 1383 and 38

Senate Bill (SB) 1383

- Senate Bill 1383 (Hueso, 2022), pertains to electric storage facilities (i.e. energy storage systems).
- Requires the Commission to “implement and enforce standards for the maintenance and operation of facilities for the storage of electricity owned by an electrical corporation or located in the state.”
- Also requires the California Independent System Operator (CAISO) to “maintain records of storage facility outages and to provide those records to the commission on a daily basis.”
- Due to our mission to enforce GO 167-B, ESRB has been tasked with implementing SB 1383.

Senate Bill (SB) 38

- Senate Bill 38 (Laird, 2023), pertains to battery energy storage facilities.
- Requires each battery energy storage facility located in the state and subject to the requirements above to have an emergency response and emergency action plan that covers the premises of the battery energy storage facility.
- Requires the owner or operator of the facility to develop a plan and coordinate with the local emergency management agencies, unified program agencies and local first response agencies.
- In developing the emergency response and evacuation plan, the owner and operator of the BESS facility shall:
  - Coordinate with local emergency management agencies and other first response agencies;
  - Submit the emergency response and evacuation plan to the county and city where the facility is located.

Implementation Process & Proposed Changes

Implementation Process – SB 1383

ESRB reviewed GO 167-B in its entirety to identify areas and sections that should be updated to include references to energy storage systems. ESRB's proposed updates to GO 167-B to comply with the requirements of SB 1383 include:

1. Adding new definitions for both Energy Storage Systems (ESS) and Energy Storage System Owner (ESSO).
2. Updating the language throughout GO 167-B to include references to ESS.
3. Updating and revising GO 167-B and sections relevant to ESS (Sections 4, 6, and 7).
4. Adding references to ESS to the following appendices of GO 167-B:
   - Appendix A: *General Duty Standards for Operations and Maintenance*
   - Appendix B: *Generator Logbook Standards (Thermal Energy)*
   - Appendix D: *Maintenance Standards for Generating Asset Owners*
   - Appendix E: *Operation Standards for Generating Asset Owners*

Updates and Revisions to GO 167-B

ESRB also expanded the list of organizations, agencies, associations, industries and codes in the table in Appendix E to include those with standards and regulations specifically applicable to ESS. Some of these additions include:

- California Building Code
- California Electrical Code
- California Fire Code
- California Mechanical Code
- International Building Code
- International Electrotechnical Commission
- International Fire Code
- National Electric Safety Code
- Sandia National Laboratories

Updates and Revisions to GO 167-B

Samples of applicable codes and standards for ESS systems include:

Agency	Code, Standard, Regulation
OSHA	OSHA 29CF1910 – Occupational Safety and Health Standards Commissioning, and Performance Testing Standards
NFPA	68 – Standard on Explosion Protection by Deflagration Venting 69 – Standard on Explosion Prevention Systems 72 - National Fire Alarm and Signaling Codes 853, Standard for the Installation of Stationary Fuel Cell Power Systems (2020) 855 –Standards for the Installation of Stationary Energy Storage Systems 1660 – Standard for Pre-Incident Planning
UL	1642 – Standard for Lithium Batteries 1741 – Standard for Inverters, Converters, Controllers, and Interconnection System Equipment for Use with Distributed Energy Resources 1973 – Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail Applications 9540 – Standards for Energy Storage Systems and Equipment 9540A – Test Methods for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
IEEE	1547 Standard for Interconnection and Interoperability of DERs w Associated Electrical Power System Interfaces 2030.2.1-2019 Guide for Design, Operation, and Maintenance of BESS
CA Codes	California Fire Code California Mechanical Code California Electric Code
IEC	62619 Safety Requirements for Secondary Lithium Cells and Batteries for use in Industrial Applications
ISO	55000 Asset Management Standards 13374 on Condition Monitoring and Diagnostics of Machines

Implementation Process – SB 38

For SB 38 implementation:

1. ESRB will issue a document request as part of its pre-audit data request for the battery energy storage facility's emergency response and emergency action plan to ensure compliance with SB 38 and GO 167-B (e.g. Operating standards 6 and 20).
    - The request and review of these documents will become part of our routine document review for all battery energy storage systems during our audits.
2. During the on-site audit or inspection, ESRB will confirm that the facility has an emergency response and action plan in place and is in compliance with its stated plan.

Next Steps

Next Steps – Timeline

Late Feb / early March	ESRB will issue a proposal for Operation and Maintenance Standards for Energy Storage Systems and revisions to GO 167-B to implement SB 1383.
Early March	ESRB will hold a workshop with interested stakeholders to give an overview of its proposal.
Early April	Stakeholder comments on ESRB's revisions to GO 167-B and proposal for SB 1383 implementation will be due.
April / May	Ongoing stakeholder discussions, comments, and revisions to the SB 1383 proposal will take place. This schedule may include another workshop/meeting if warranted.
June - July	A draft resolution of ESRB's revisions to GO 167—B and SB 1383 proposal will be issued.
July	A final resolution will be up for the Commission to approve.

Next Steps – How to Get Involved

1. Make sure you are on the Integrated Resource Planning (IRP) or Resource Adequacy (RA) Proceedings service lists.

2. Plan to attend the March Workshop.

3. Share Your Thoughts, Knowledge, and Expertise.

Questions?

GO167@cpuc.ca.gov

Thank you!

California Public Utilities Commission

Closing Remarks

Elizabeth Huber, California Energy Commission

Thank You!