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CEERT Electric System Reliability and the Need for a Strategic Reliability Reserve

Additional submitted attachment is included below.

CALIFORNIA ELECTRIC SYSTEM RELIABILITY AND THE NEED FOR A STRATEGIC RELIABILITY RESERVE

On August 14 and 15, 2020, the California Independent System Operator (CAISO) instituted rotating electricity outages in the midst of an extreme heat wave throughout the West. The following summer, on July 9, Governor Gavin Newsom issued an emergency proclamation to free up additional energy capacity amid a major heat wave and the Bootleg Fire in Southern Oregon, which threatened regional power transmission.

In response to these events the Legislature enacted AB 205 in 2022 which established the Strategic Reliability Reserve (SRR) program. The purpose of the SRR was to assure there would be sufficient contingency energy resources available during extreme weather events to maintain system reliability. AB 205 was structured to fund a diverse set of demand-side and supply-side resources to protect the state from outages that could be triggered by extreme weather events and other risks such as wildfires.

AB 205 established three new programs: the Demand Side and Grid Support (DSGS) program, the Distributed Energy Back-up Assets (DEBA) program and the Electricity Supply Strategic Reliability Reserve Program (ESSRRP). Authorized funding for the programs was $314 million, $595 million and $2.4 billion, respectively.

Following the passage of AB 205, California experienced a severe heat wave in early September 2022 that drove power demand to the highest levels ever experienced.[1] The combination of the activation of demand response programs to reduce electricity consumption by large power users, increasing electricity imports from neighboring states and voluntary energy conservation by millions of consumers avoided rotating power outages.

For the summer of 2024, according to the California Independent System Operator (CAISO), supply through the ESRRP and emergency assistance from transmission interties totals around 3,450 megawatts (MW).[2] Enrollment data for the DSGS program for the summer of 2024 is not yet available. However, according to Advanced Energy United and others the DSGS program enrolled 315 MW of contingency reserves for the summer of 2022.[3] The DEBA program, which provides funding for the development of

[1] Peak demand reached 52,061 MW at 4:57. A level 3 Energy Emergency Alert was issued at 545 pm indicating that there may be a need for rotating power outages.
[2] 2024 Summer Loads and Resources Assessment, California ISO, May 2024, Page 27.
[3] Letter from Advanced Energy United and 23 other organizations to Senator President pro Tempore Mike McGuire, Assembly Speaker Robert Rivas, Senator Scott Weiner and Assemblymember Jesse Gabriel, June 4, 2024.

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clean distributed energy assets that can serve as on-call emergency supplies, has been put on hold and will not be part of the SRR in 2024.[4]

CEERT believes it is time for a thorough reassessment of the SRR with a view to its long-term usefulness in assuring electric system reliability. A reassessment should start with determining the magnitude of the reliability need that can reasonably be met through contingency resources as well as the types of resources that can most effectively support grid reliability during extreme weather events.

As the summer of 2024 begins there have been several reliability assessments that have been conducted by the CAISO, the CPUC and the CEC and made available to policy makers. The following is a review of these assessments that can help inform the design of the SRR program.

CAISO 2024 Summer Loads and Resources Assessment

On May 8, 2024 the CAISO released its annual Summer Loads and Resources Assessment (Summer Assessment). The Summer Assessment concluded that resources available for the summer of 2024 exceed forecasted electric demand and reserve requirements, and meet target reliability levels.

The CAISO reported that 1,746 MW of new battery capacity had been added from September 2023 through March 2024 and that an additional 3,199 MW of battery capacity were expected to be on-line by June 30, 2024. In addition, there were 321 MW of hybrid solar plus battery systems connected to the grid during the same period with another 490 MW expected by the end of June.[5] The combination of the existing and expected new resources were studied by the CAISO in two distinct and separate analyses of summer reliability.

The first CAISO reliability analysis was a probabilistic study of the CPUC Preferred System Plan which was adopted in February 2024.[6] The analysis found there were no expected capacity shortfalls during the summer of 2024. The study indicated a surplus of 2,550 MW beyond what was needed to meet the "one day every 10 years loss-of-load expectation (LOLE)" planning target. However, the probabilistic analysis did not take into account extreme weather events and emergency conditions such as wildfires.

[4] The May budget revise eliminates funding for the program for the upcoming budget year with the possibility that funding would be restored in the 2025-2026 budget.
[5] CAISO Summer Assessment, Page 1.
[6] The probabilistic utilizes 500 full year hourly chronological simulations to capture a wide range of system conditions in load, solar and wind generation, and generation resource outages.

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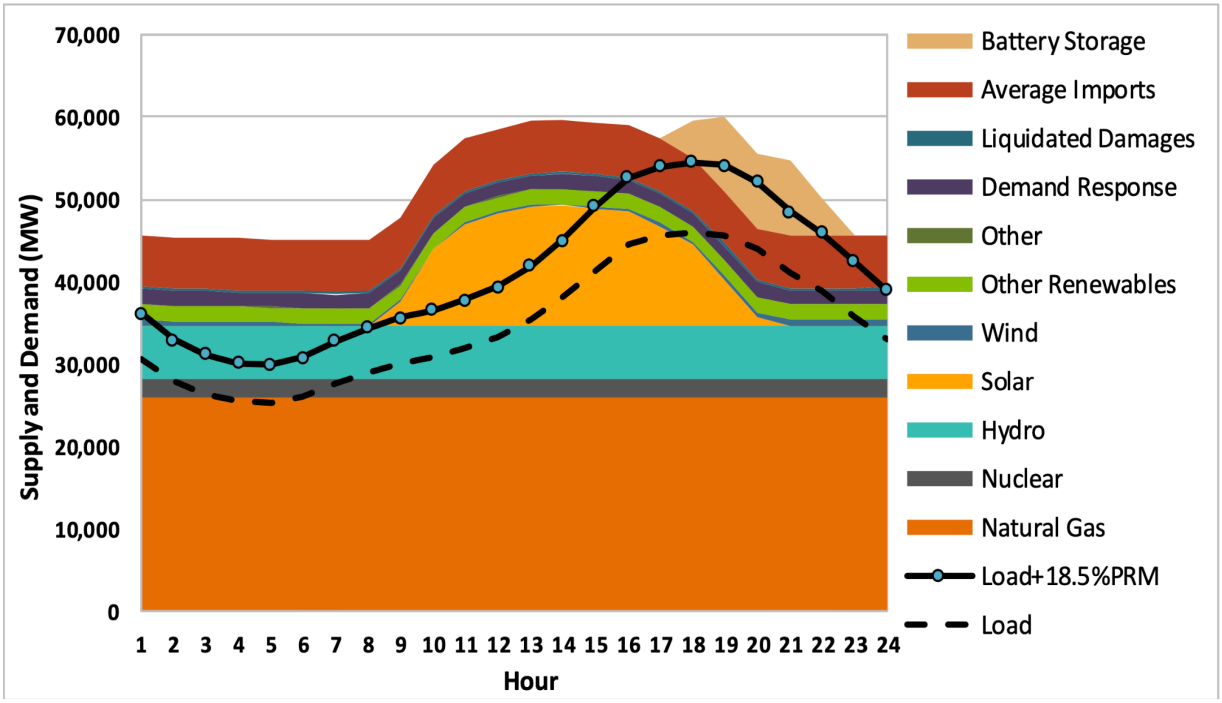
The second CAISO reliability analysis was a multi-hour stack analysis for peak days during the summer including an 18.5 percent reserve margin.[7] The stack analysis showed that expected resources are sufficient to meet demand plus an 18.5 percent reserve margin for all summer months in 2024. The analysis shows there is a surplus of at least 3,438 MW over the 18.5 percent reserve margin during peak hours in September. The figure below provides a visualization of the stack analysis for September.

CAISO Stack Analysis for Peak Day in September 2024



The CAISO also provides a monthly key statistics report on its website that includes the amount of battery resources available for dispatch. As of May 1, 2024 there was 8,635 MW of battery capacity on the CAISO system, an increase of 7,188 MW since January 1, 2024.[8] This growth strongly suggest that development of new power capacity is on track for California.

[7] The 18.5 percent reserve margin is a CAISO metric calculated to maintain operating and regulation reserves under stressed system conditions, taking into account load forecast uncertainty and resource forced outage rates.
[8] CAISO Key Statistics Reports for April, 2024 and December, 2023.

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CPUC Mid- to Long-Term Probabilistic Reliability Assessment

On May 8, 2024 the CEC issued the Joint Agency Reliability Planning Assessment (Report).[9] The Report includes a Mid- to Long-Term Probabilistic Reliability Assessment (Reliability Assessment) carried out by the CPUC and a Stack Analysis carried out by the CEC.

The purpose of the CPUC Reliability Assessment was to determine if the 2023 Preferred System Portfolio (PSP) which guides resource procurement by Load Serving Entities (LSEs) and transmission planning by the CAISO meets reliability standards through 2035. A secondary purpose was to evaluate the importance of the Diablo Canyon Power Plant in meeting reliability in the mid-term.

The CPUC models loss-of-load probability using twenty-three years of historical weather conditions applied to loads and resources including relationships between temperature, load, wind, and solar output. The model also includes twenty-three years of hydroelectric power availability data.

To assess the reliability of the 2023 PSP, the CPUC first established a baseline portfolio. This baseline portfolio assumed that the Southern California once-through-cooling (OTC) thermal units would be offline as of the end of 2023.[10] It also assumed that the two nuclear reactors at the Diablo Canyon Power Plant (DCPP) would cease operating in 2024 and 2025.[11] The baseline portfolio included existing and in-development resources from November 2022 LSE resource plans which were reported to the CPUC as part of its Integrated Resource Planning process.

To create the 2023 PSP for reliability modeling, the CPUC added resources identified by LSEs as planned resource but not yet in development. In addition, the CPUC added resources that were needed to achieve the greenhouse gas planning target of 25 million metric tons of emissions by 2035. The table below depicts the Preferred System Portfolio by resource type for 2026, 2030 and 2035.

[9] The Joint Agency Reliability Planning Assessment Report covers the requirements of SB 846 and SB 1020.

[10] The OTC thermal units include Alamitos Units 3, 4 and 5, Huntington Beach Unit 2 and Ormond Beach Units 1 and 2 for a total of 2,859 MW.

[11] SB 846 authorized the continued operation of the units of DCPP through 2029 and 2030. Nonetheless, they are still modeled as offline by the CPUC staff.

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CPUC Preferred System Portfolio

Year	2024	2026		2030		2035	
Gas retention	No unannounced retirements	No unannounced retirements	-3364 MW add'l retired	No unannounced retirements	-5515 MW add'l retired	No unannounced retirements	-5903 MW add'l retired
25 MMT by 2035 LSE Plan							
Battery Storage	12,613	17,689	17,689	22,287	22,287	28,216	28,216
Biomass	713	794	794	873	853	864	852
BTMPV	16,827	19,252	19,252	24,492	24,492	31,023	31,023
CC	17,536	17,536	15,747	17,536	14,280	17,536	13,898
Coal	480	-	-	-	-	-	-
Cogen	1,938	1,957	1,185	1,957	557	940	551
CT	8,204	8,204	7,401	8,204	7,345	8,204	7,345
DR	2,822	2,804	2,804	2,851	2,851	2,851	2,851
Geothermal	1,440	2,393	2,393	2,826	2,826	2,922	2,922
Hydro	5,995	6,003	6,003	6,003	6,003	6,003	6,003
ICE	259	259	259	259	259	259	259
Nuclear	2,935	635	635	635	635	635	635
Offshore Wind	-	-	-	1,580	1,580	4,531	4,531
PSH	1,483	1,940	1,940	1,952	1,952	1,952	1,952
Solar	20,304	24,577	24,577	34,249	34,215	38,456	38,422
Steam	-	-	-	-	-	-	-
Wind	8,038	10,284	10,284	15,002	15,002	15,736	15,736

The CPUC probabilistic modeling of the 2023 PSP showed that it is very reliable, greatly exceeding the 0.1 days/yr LOLE standard in 2026, 2030, and 2035 even without the DCPP.[12] With the DCPP included in the portfolio there were zero expected outages in any year across the 300 samples that were run, meaning the loss of load probability was so low it could not be measured.

The CPUC then stress tested the PSP. Assuming a 40 percent reduction in resource additions in the PSP, the CPUC found that LOLE in 2025 and 2026 still remains two orders of magnitude below the 0.1 LOLE target. Even in the extreme case of statewide power imports being reduced to zero, the PSP meets the 0.1 LOLE standard.[13] In sum, the CPUC found the planned electric system to be very reliable, particularly with the Diablo Canyon Power Plant on line.

CEC Stack Analysis

The CEC stack analysis evaluates the anticipated resource supply by hour against the forecasted demand for the peak days in July, August and September. The analysis stacks the resources expected to be available in each hour and compares the total against the projected demand for each hour plus a 17 percent reserve margin. The

[12] LOLE was estimate at 0.009 in 2026, 0.002 in 2030 and 0.053 in 2035 as modeled using the production cost model, Strategic Energy Risk Valuation Model (SERVM).
[13] Imports could be reduced to zero in the event of a catastrophic fire near the California-Oregon Intertie.

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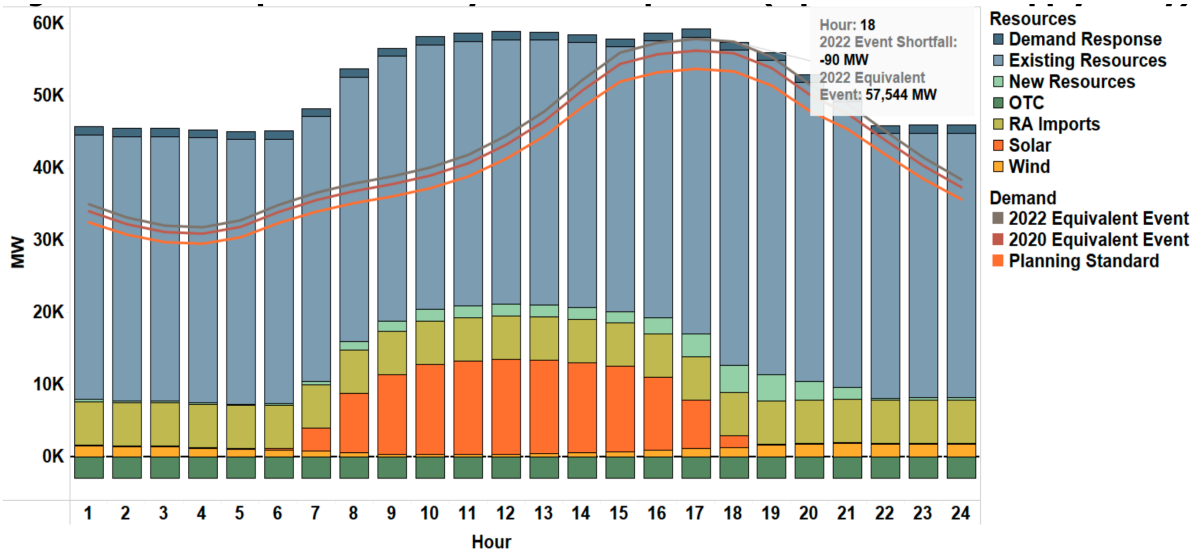
analysis goes on to compares the supply stack to demand during extreme weather events experienced in August 2020 and September 2022. The CEC analysis then adds on another layer to the extreme weather, assuming a potential transmission disruption caused by a wildfire.

This stack analysis identifies the maximum hourly shortfall for each scenario. The CEC intends the stack analysis to be used primarily for understanding the amount of contingency resources that might be needed to support grid reliability during extreme events.[14] However, the CEC stack analysis could also imply that the reliability standard used to measure the resource adequacy of the power system may be deficient.

The selected extreme events can be translated into reserve margins. Planning an electric system to withstand the 2020 weather event would require a reserve margin of 22.5%. The reserve margin would need to be set at 26.0% to plan for the equivalent of the 2022 weather event. Determining the cost of elevating the planning standard beyond the 1-10 LOLE was beyond the scope of the CEC stack analysis.

In attempting to determine the amount of contingency reserves that will be needed in the near term the CEC ran resource shortfall scenarios to account for possible supply chain, interconnection and permitting delays. A no shortfall scenario was compared to one where 20 percent of the resources were delayed for a year and a second one with a 40 percent shortfall in bringing new resources on line. The figure below illustrates the CEC stack analysis.

CEC Stack Analysis Comparing Loads During Normal and Extreme Weather



[14] See Joint Agencies Reliability Report, Page 35.

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The CEC stack analysis shows that there would be an 90 MW shortfall if all planned resources come on line this summer and there is a repeat of the September 2022 weather event. The shortfall increases to 842 MW if 20 percent of the planned resources are delayed beyond this summer and 1,593 MW if 40 percent of the resources are delayed. These quantities might be interpreted as suggesting an amount of contingency resources needed in the SRR.

The CEC stack analysis also hypothesized that a repeat of the September 2022 weather event could coincide with a wildfire that reduces California's import capacity by as much as 4,000 MW. The possibility of such coincident extreme events suggests that the size of the SRR might need to be around 4,842 MW, if 20 percent of planned resources were delayed from coming on line for the summer of 2024.[15]

Wildfire Risk and Grid Reliability

The risk of a major grid disruption caused by wildfires came to the fore with the Bootleg Fire in July, 2021 and the derate of the California Oregon Intertie for several days because of the intense amount of smoke.

The Bootleg Fire was the third largest wildfire recorded in Oregon's history. It began on July 6, 2021 and by the time it was extinguished in early August it had burned over 413,000 acres. It moved very rapidly through Klamath County, Oregon, where a section of the California-Oregon interties is located. Extreme fire behavior was driven by high temperatures, high winds and exceptionally dry fuels.[16] From July 8 through July 13, 2021 smoke impacted the operation of the California Oregon Intertie.

On July 11, 2021 Los Angeles Times reporter Sammy Roth wrote a widely read story on the wildfire's impact. Temperatures in Southern California and the Central Valley at the time were elevated, similar to the temperatures experienced in August 2020 when rolling blackouts were implemented by the CAISO.

On July 8, 2021 the CAISO anticipated having to schedule most of the state's available power resources the following day given the possibility that power imports would be limited because of the Bootleg Fire.[17] In fact, dispatching power on July 9 was a challenge for the CAISO. The figure below shows that diminishing imports occurred in

[15] The CEC stack analysis shows a 6,400 MW shortfall in 2034 with a repeat of the 2022 extreme weather event. The shortfall increases to 10,400 MW if the extreme weather events coincides with the loss of 4,000 MW of import capability.

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[16] 2021 Pacific Northwest Wildfire Summary, Bootleg Fire, U.S. Forest Service, Pacific Northwest Region, September 2022

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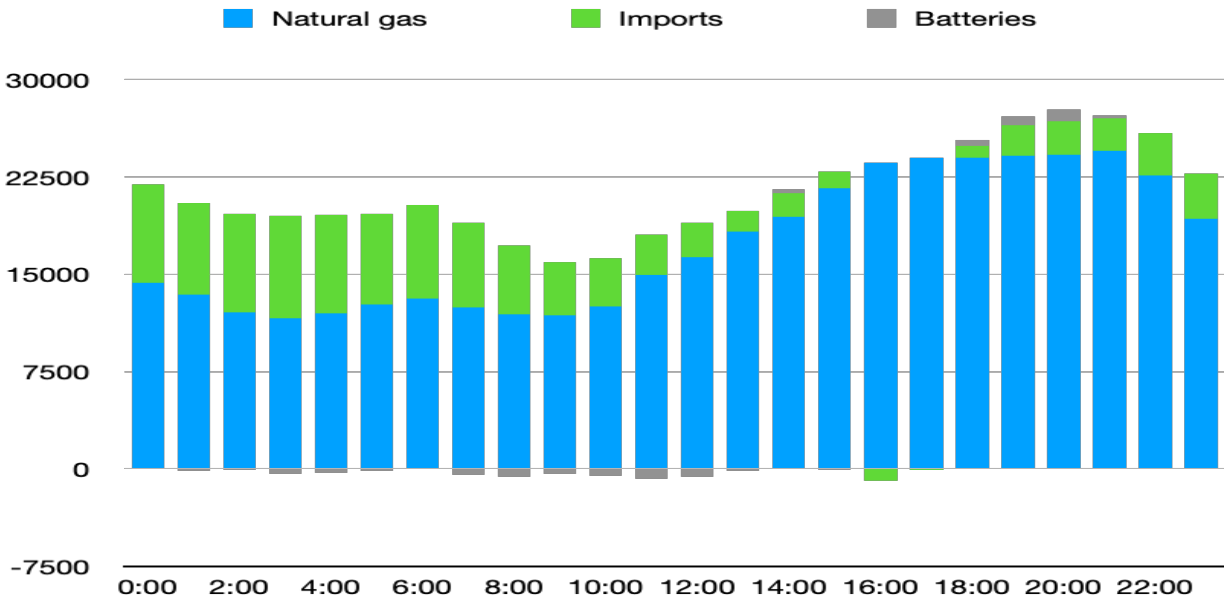
the afternoon of July 9 as several lines of the intertie were derated because of smokey conditions.

July 9, 2021 Hourly CAISO Dispatch of Resources



The figure shows imports declining in the afternoon and zeroing out for two hours beginning around 4 pm. According to the LA Times, Gov. Gavin Newsom issued an emergency proclamation around 4:30 pm, allowing fossil-fueled power plants to exceed air pollution standards and suspending limits on the operation of portable generators. Imports from other parts of the Western Interconnect began picking up around 6 pm and rolling blackouts were avoided. By 9 pm the CAISO's emergency alert was over.

Batteries played a small but not insignificant role in keeping the lights on, by discharging from 6 pm through 9 pm with a peak discharge of 866 MW at 8 pm as the sun was setting.[18] By Saturday, July 10 the LA Times reports the crisis began easing with more wind generation and older gas-fired power plants coming back on line. The table below compares the demand for power during five key days of the Bootleg Fire with the demand that occurred on September 6, 2022, the highest day of demand ever on the CAISO system.

[18] There are now more than 10 times the amount of battery capacity on the CAISO system at there was in July 2021.

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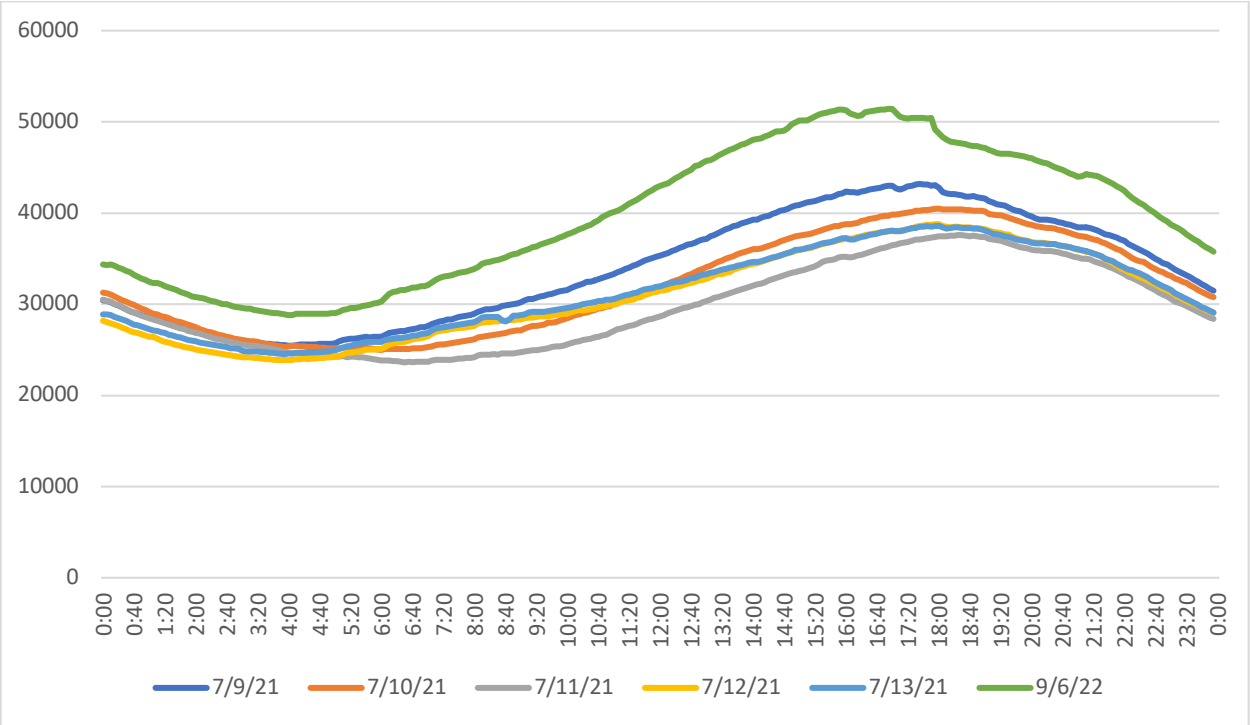
Demand During the July 2021 Bootleg Fire Compared to Sept. 6 2022



Because of hot weather the demand for power was elevated during the five days in July 2021 when imports over the California-Oregon Intertie were curtailed. However, the level of power demand never came close to approaching the extreme level that occurred on September 6, 2022.

Current production cost models used for electric system reliability planning have not explicitly included wildfires in calculating loss of load probability. However, the impact of the Bootleg Fire strongly suggests a need to improve probabilistic modeling tools. Events like the Bootleg Fire are low probability but highly impactful events. Similarly, extreme heat events like the one that occurred in September, 2022 are rare. However, they may be becoming more frequents due to climate change.

Production cost models, like SERVM, PLEXOS and others can be improved so that system-wide disruptions from wildfires can be appropriately factored into reliability planning.

The CEC stack analysis attempts to the fill the gap in traditional reliability planning through an ad hoc approach to quickly assess worst-case scenarios for the California's

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electric system.[19] While the stack analysis has been helpful as an heuristic device it is not a sophisticated or particularly effective tool for cost-effective resource planning.

The CEC stack analysis was the planning tool that was relied upon to support the recommendation that South Coast OTC power plants be placed into the Strategic Reliability Reserved and they be available for operation through 2026.[20]

As noted above, California, over the past year, has improved electric system reliability by adding a significant amount of new battery storage systems. At a press event, Governor Newsom indicated that there will be over 10 GW of battery capacity available later this summer.[21]

Batteries are proving to be a versatile and flexible tool for managing the electric grid. They are capable of responding quickly to changes in grid conditions, shifting load from times of abundance to times of relative scarcity and providing essential ancillary services . Ancillary services include voltage support, reactive power compensation, and black start capability. These services are needed to maintain the reliability and stability of the grid.

NEED FOR A STRATEGIC RELIABILITY RESERVE

The need for a Strategic Reliability Reserve program should be analyzed in the context of other contingency resources that are available to meet extreme weather events. The December, 2023 Joint Agencies Reliability Planning Assessment provides a framework for analyzing contingency resources available to mitigate extreme weather events.[22]

The table below lists contingency resources that were available for the summer of 2023. For 2023 the CAISO was able to manage the electric system without having to rely on contingency resources. Still, it can be argued, that having almost 2.5 GW of contingency resources through a variety of mechanisms was reasonable. Most of the resources do not require standby payments and are only compensated if they are used. In 2023 SRR resources accounted for approximately 19% of the total contingency resources available in 2023.

[19] The CEC Stack Analysis was first used in 2021 in response to the August 2020 blackouts. The first iterations focused on the implications of solar power production dropping off in late evening and the impact of droughts on hydroelectric capacity. Later revisions eliminated the drought derate and adopted a generic estimate for imports rather than contracted resource out-of-state adequacy values.
[20] Craig, Hannah. 2022. Summer Stack Analysis for 2022-2026. California Energy Commission. Publication Number: CEC-200-2021-006-REV. https://efiling.energy.ca.gov/GetDocument.aspx?tn=244116.
[21] https://www.politico.com/newsletters/california-climate/2024/04/25/check-out-californias-batteries-00154503
[22] Joint Reliability Planning Assessment – Fourth Quarterly Report, 12/1/2023, CEC-200-2023-15

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Contingency Resources Available for Summer 2023

Contingency Resource	Available MWs – September 2023
Electricity Supply Strategic Reliability Reserve Program	148
Demand Side Grid Support Program	315
Distributed Electric Backup Assets Program	0
CPUC Ratepayer Programs – Emergency Load Response Program, Smart Thermostats etc.	434
Imports Beyond Stack	825
Capacity at Co-gen or Gas Units above Resource Adequacy	86
Balancing Authority Emergency Transfers	500
Thermal Resources Beyond Gen Limits	60
Thermal Resources Beyond Gen Limits Needing 202c Federal Power Act exemption	25
Total	**2,444**

With the addition of 2,859 MW of South Coast once-through-cooling thermal power plants for the summer of 2024 the amount of contingency resources has more than doubled. The OTC power plants require 24 hours or longer of advance notice in order to startand power up to reach full capacity. They are the least flexible resource available to the CAISO for use in emergency situations.

The table below provides information about the size and age of the OTC power plants.

Capacity and Age of Once-Through-Cooling Plants

Unit Name	Capacity (MW)	Age (Years)
Alamitos Units 3, 4 and 5	1141	63
Huntington Beach Unit 2	227	66
Ormond Beach Units 1 and 2	1491	53 and 51
Total	2859	

SRR resources require a standby payment or other incentive to assure their availability when needed. The annual standby payments for the OTC power plants at Alamitos, Huntington Beach and Ormond Beach total $321.65 million or $112,500 per megawatt-year.[23] These values for standby capacity can be used as a starting benchmark for evaluating the amount of cost-effective capacity could be included in the SRR going forward.

[23] The payments for Alamitos and Huntington Beach are $8.98 per kW-month during the seven off-peak months and $10.95 per kW-month for the five on-peak months. For Ormond Beach the payments are $8.82/kw-month and $10.95/kw-month for the on-peak and off-peak months.

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CONCLUSIONS

Reliability for the Summer of 2024

1. The outlook for electric system reliability in the summer of 2024 is much improved over previous years. The CAISO estimates that there will be a surplus of 2,550 megawatts of capacity above and beyond what is needed to meet the reliability standard of less than one reliability event every ten years. It should be noted that a reliability event does not mean the CAISO will implement rotating outages but indicates the need to call upon contingency reserves.

2. The resources that are planned to be available for the summer of 2024 are sufficient to withstand an equivalent extreme heat wave as occurred during the summer of 2022 with a need to call upon approximately 90 megawatts of contingency reserves.

Reliability Beyond the Summer of 2024

3. With the nuclear units at the Diablo Canyon Power Plant available through 2029 and 2030 the risk to electric system reliability is negligible during typical elevated weather conditions. The CPUC production cost modeling found zero cases out of 300 model runs where resources would be inadequate to meet electric system load.

Worst Case Scenario

4. The CEC stack analysis hypothesized that there could be a capacity shortfall of 4,842 megawatts if there was an equivalent 2022 heat wave event and a coincident loss of 4,000 megawatts of import capability due to a wildfire and a 20% reduction in the amount of new capacity expected to come on line by June 30, 2024.

5. The CEC stack analysis indicates that the system will be reliable through 2032 based on the 1-in-10 planning standard even with delays in procurement that have been scheduled through 2028. The CPUC has not yet ordered procurement beyond 2028.

6. The CEC estimates a worst case scenario shortfall of 10,400 MW in 2034 in the event of a coincident occurrence of an equivalent 2022 heat wave and the loss of 4,000 MW of import capacity due to a wildfire. The worst case scenario assumes no new resource procurement after 2028.

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Wildfire Risk to Imports

7. The Bootleg Fire in July 2021 reduced import capacity by as much as 4,000 MW for several days after July 9. While weather conditions were elevated there was no need for the CAISO to implement rotating outages. Since the wildfire event, California has added significant additional battery capacity to the grid that should reduce the risk of limitations on imports.

Need for Contingency Resources

8. No probabilistic assessment has been conducted to determine the magnitude of the need for contingency resources. Policy makers have relied on the CEC ad hoc stack analysis for making year-by-year decisions on budgeting for contingency resources.

9. California will pay $112,500 per megawatt-year for standby availability at the Alamitos, Huntington Beach and Ormond Beach power plants through December 2026 under contracts executed by the Department of Water Resources.

RECOMMENDATIONS

1. The CAISO and the state energy agencies should monitor and report on the performance of the battery storage fleet in meeting electric system reliability during normal and emergency events for the summer of 2024.

2. The CAISO and the state energy agencies should assess whether the reliability standard of one event in ten years is the appropriate standard for continued use in planning the California electric system.

3. The CEC should lessen the State's reliance on its ad hoc stack analysis for the purposes on budgeting for contingency resources. Research is needed to better understand the frequency of extreme weather events resulting from climate change and its incorporation into probabilistic reliability studies.

4. The state energy agencies should support measures to increase customer load flexibility to better respond to extreme weather events and lessen the need for supply-side contingency resources.

5. The state energy agencies should investigate the need for ongoing support for the Strategic Reliability Reserve in terms of the amount of standby capacity that is economically justified based on the risk of rotating power outages.

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6. Priority funding for the Strategic Reliability Reserve should be provided to clean energy resources including demand response measures, sources of firm renewable energy and the use of current and additional distributed energy storage.

7. The Department of Water Resources should investigate opportunities for the amendment of contracts for standby capacity at the Alamitos, Huntington Beach and Ormond Beach to minimize or eliminate their need to use fossil fuels and enable the properties to be used for other beneficial purposes.

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