Docket No.: R.23-01-007
Date: June 30, 2023
Commissioner: Douglas
ALJ: Seybert
Witness: Rao Konidena

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Implementing Senate Bill 846 Concerning Potential Extension of Diablo Canyon Power Plant Operations	R.23-01-007 (Filed January 14, 2023)

OPENING TESTIMONY OF RAO KONIDENA ON BEHALF OF SAN LUIS OBISPO MOTHERS FOR PEACE ON PHASE 1 TRACK 2 ISSUES

Rao Konidena on behalf of SLOMFP
c/o
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VERIFICATION

The statements in the foregoing document are true and correct to the best of my knowledge. The facts presented in the forgoing document are true and correct to the best of my knowledge, and the opinions expressed therein are based on my best professional judgment.

I declare under penalty of perjury under the laws of the state of California that the foregoing is true and correct. Executed on June 30, 2023, in Rosevill e, Minneso ta.

Rao Konidena

Rao Konidena

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Q. Please state your name, employer, title, and business address.

A. My name is Rao Konidena. I am the President of Rakon Energy LLC. My business address is Roseville, MN, 55113.

Q. On whose behalf are you testifying in this proceeding?

A. I am testifying on behalf of San Luis Obispo Mothers for Peace ("SLOMFP").

Q. Please describe your current position and provide your education and professional experience related to this testimony.

A. I have been an independent energy consultant for the past five years, primarily focusing on wholesale market practices and policy. Before that, I was employed by Midcontinent Independent System Operator ("MISO") from September 2003 through May 2018. I started as an Applications Engineer for Planning, where I ran Loss of Load Expectation ("LOLE") studies used in the Planning Reserve Margin Requirement. I gained familiarity with MISO's Planning Resource Auction and Module E Capacity Tracking (MECT) tool in various roles at MISO. Specifically, in the Resource Forecasting department, I used peak demand and annual energy data from the MECT to run the resource forecasting model called the Electric Generation Expansion Analysis System (EGEAS), which is an Integrated Resource Planning software tool.

Before leaving MISO, my title was Principal Advisor in Transmission Asset Management. In that role, I was part of an internal subject matter expert team providing technical support to the legal team on how MISO should respond to the Federal Energy Regulatory Commission's Order 841, which compensates Electric Storage Resources and the Notice Of Proposed Rulemaking on aggregations of Distributed Energy Resources.

My CV is attached at the end of this testimony.

Q. Please describe the purpose of your testimony.

A. My testimony focuses on four areas:

- First, my testimony focuses on the reliability issues with and without the Diablo Canyon Power Plant and points out the deficiencies in the methodology and assumptions of the California Energy Commission's March 2023 report (Attachment D to the ALJ's April 20, 2023 Ruling).
- Second, I propose reasonable operating reserve requirements study for the California ISO to target and relative cost of meeting reliability goals and reserve requirements.
- Third, I comment on the merits of the methods currently used to assess and procure the resources that could serve as alternatives to the operation of the Diablo Canyon units and suggest improvements.
- Fourth, I conclude how the continued operation of the Diablo Canyon units impedes the development of other low or zero-carbon alternatives to enhance California's power supply.

Section A – Reliability Issues With and Without DCPP

Q. Would the retirement of DCPP as planned have an adverse impact on the local reliability of San Luis Obispo?

A. No, because according to Pacific Gas & Electric (PG&E), DCPP does not serve local load, and DCPP's generation is exported to the Los Padres division. Previously, PG&E stated[1] there is no need to replace DCPP to maintain system reliability.

[1] "**PG&E's analysis indicates that there is no need to replace Diablo Canyon in order to maintain system reliability**. (Transcript Vol. 6 at 957-958.)" Page 8, DECISION APPROVING RETIREMENT OF DIABLO CANYON NUCLEAR POWER PLANT, https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M205/K090/205090240.PDF

Q. What are the specific conclusions of the California Energy Commission report that raise concerns for you?

A. I am concerned that the CEC has concluded[2] that a DCPP extension is required without vetting the operating reserve assumptions in the report. Specifically, CEC justifies the need for DCPP extension by attributing[3] 4,000 MW to wildfire risk, equivalent to the loss of 4,000 MW of transmission capacity due to the 2021 Bootleg fire in Oregon. But the actual loss of import capacity into CAISO was[4] 3,000 MW due to the Bootleg fire. The loss of 3,000 MW of import capacity into CAISO and 4,000 MW into California due to the 2021 Bootleg fire are operational issues, not resource planning issues. DCPP cannot solve an operational grid issue. Even if DCPP is extended, it won't solve California and CAISO's operational problems.

Q. Even if DCPP is extended, does California face reliability risk?

A. Yes, California will continue to face reliability risk even if DCPP is extended because new renewable resources, demand response, and imports into California

[2] "Based on CEC's analysis, the CEC staff recommends that CEC determine that it is **prudent for the state to pursue extension of DCPP**. This determination is driven by the risk that sufficient electricity resources may not be built in time to reach the ordered procurement and to address potential grid demands in extreme heat events associated with climate change." Abstract, Erne, David, Mark Kootstra. 2023. Final Draft Diablo Canyon Nuclear Power Plant Extension – CEC Analysis of Need to Support Reliability. California Energy Commission. Publication Number: CEC-200-2023-004.

[3] "the current RA planning standard may be insufficient to protect against a coincident wildfire risk during the peak period. CEC used the equivalent of a loss of **4,000 MW of transmission capacity**, which is equivalent to the **amount of transmission capacity lost to the state as a result of the Bootleg wildfire in Oregon in 2021**." Page 22, March 2023 CEC report. Publication Number: CEC-200-2023-004.

[4] "The fire resulted in **a loss of 3,000 megawatts of imported electricity** to the California Independent System Operator territory and **4,000 megawatts of overall import capacity to the state**" Page 1, March 2023 CEC report. Publication Number: CEC-200-2023-004.

are flexible. Depending on California's balancing needs, these resources can be curtailed, but DCPP cannot. DCPP is inflexible. As a result, California will continue to face an operational risk of shedding firm load unless California shifts its focus to contingency reserves and increases its resource portfolio that provides contingency reserves.

Q. Explain the differences between operating reserves, contingency reserves and planning reserves.

A. **Operating reserves** comprise regulating, spinning, and non-spinning reserves at CAISO. **Contingency reserves** are spinning and non-spinning reserves.

Regulating reserves or Regulation Up and Regulation Down are part of ancillary services at CAISO. To maintain the frequency at 60 Hz, if a resource can reduce its output, it provides Regulation Down ancillary service. On the other hand, if a resource is asked to increase its output to maintain the system frequency, it provides a Regulation Up service. Regulating reserves are maintained to comply with NERC standard BAL-001, a Control Performance Standard.

Spinning reserves are typically available within seconds because they are online resources. Resources providing spinning reserves include hydro units, batteries, and natural gas plants. **Non-spinning reserves** are offline but can quickly become online within 10 minutes if the CAISO dispatcher requires them to respond to a need on the system. Resources that can provide non-spinning reserves include demand response, diesel generator sets, and other resources that can start in 1-2 hours.

Spinning and non-spinning reserves are collectively called Contingency reserves because they are deployed[5] if a capacity emergency occurs due to the loss of a large generating unit or a major transmission line.

Planning reserves are needed to meet the 1-day in 10-year Loss of Load Expectation (LOLE) reliability standard. One day in 10 years translates into 2.4 hours in one year approximately. To be considered reliable, CAISO should not lose the firm load more than 2.4 hours in a year. That is the purpose of running a planning reserve margin requirements study.

Operating and planning reserves are needed to maintain the system's reliability, but they serve different time horizons. Operating reserves ensure sufficient resources in the operating horizon (seconds – hours) and planning reserves ensure sufficient resources are available in the planning horizon (greater than 2 weeks).

Focusing on the DCPP extension by increasing the planning reserve margin from 17% to 26% is not solving the operating reserves problem, especially since PG&E's analysis[6] shows that Public Safety Power Shutoffs have declined significantly. Hence there is the likelihood of reliability risk in the operating horizon, which is not solved by the DCPP extension

Q. What roles do operating reserves, contingency reserves and planning reserves play in protecting the grid from shortages?

A. The role of **regulating reserves** in protecting the grid from shortages is related to frequency. Regulating reserves helps maintain system frequency at 60 Hz, which avoids blackouts. Under-frequency load shed is another standard to avoid

[5] Source – CAISO Reliability Coordinator Procedure No. RC0410, Version 3.4, Effective Date 4/1/2023 available at http://www.caiso.com/Documents/RC0410.pdf

[6] Source – Slide 5, https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-and-enforcement-division/psps/pge-2022-psps-post-season-workshop-deck.pdf

situations where the frequency is below a certain threshold. Under frequency load shed NERC standard was developed after the 1996 blackout in Arizona, resulting in the Western Interconnection separating into four separate islands when under frequency load-shedding relays tripped.

CAISO operators in the control room typically know how much **operating reserves** are available to them daily because NERC Balancing Authority (BAL) standard BAL-002 requires each Balancing Authority (e.g., CAISO) must maintain a level of operating reserves to balance the system in real-time.

CAISO has operating reserve requirements for day-ahead and real-time markets. These requirements ensure that operating reserves are deployed for capacity emergencies – this is the operating reserves role in preventing shortages.

In the day ahead, the CAISO operating reserve is the maximum value of 3 parameters – 1) 6.3 % of load forecast, 2) the most severe single contingency (currently one Diablo Canyon unit at 1150 MW[7]), and 3) 15% of forecasted solar production.

To illustrate how much operating reserves CAISO carried on a day-ahead basis, 29,263 MW is the forecasted peak demand for June 14, 2023. And 14,888 MW is current solar production at 10:15 PST on June 13. So, CAISO would maintain an operating reserve of 2233 MW in the day ahead, which is the maximum value of the 1843 MW load forecast, 1150 MW single contingency, and 2233 MW solar production. If DCPP is extended, CAISO will carry NERC standard mandated operating reserves of approximately 2233 MW, and planning reserves of 26%. The latter accounts for the 2022 wildfire risk event.

[7] Source - http://www.caiso.com/Documents/ISO-Planning-Standards-Effective-Feb22023.pdf

In real-time[8], CAISO operating reserve requirements are calculated by taking the maximum value of 1) 3% of load forecast, 2) the most severe single contingency, and 3) 3% of forecasted solar production.

If **regulating reserves** role in preventing shortages is focused on maintaining system frequency in seconds and minutes, the **operating reserves** role is focused on deploying both online and offline resources in minutes and hours to meet sudden balancing demands on the transmission system. The **planning reserves** role is to ensure there are enough resources beyond 2 weeks.

Q. Please describe the kinds of events that might cause shortages and the different types of reserves role in avoiding shortages.

A. The loss of a large generating unit or loss of high voltage transmission lines that bring imports from Oregon are major outages that cause shortages. Similar to the Public Safety Power Shutoffs (PSPS) event notification time of 48 hours before power is turned off when PG&E issues a "Watch" notice and follows up with another Watch notice 24 hours before power is turned off, and then, issues a "Warning" notice 4-1 hours before power is shut off due to wildfires – CAISO must issue Energy Emergency Alerts before shedding firm load for the transmission customers.

Because of this advance notice, the CAISO operator can dispatch non-spinning resources should a need arise due to the loss of a major generating unit. If wildfires are likely and loss of high voltage transmission lines that bring imports from Oregon is imminent, the CAISO operator will get at least several hours' notice. Depending on the severity of wildfires, and the location, the CAISO operator can deploy contingency reserves to avoid load shed. This reserve

[8] Source – CAISO, 2021 Annual Report on Market Issues and Performance, Page 172.

deployment is why batteries and other flexible resources must be actively interconnected in the transmission system.

To prevent capacity shortages beyond 2 weeks, we need planning reserves. But we don't know with a high degree of confidence that wildfires will result in loss of imports 2 weeks from now. Hence, California and CAISO need to focus on time horizons with higher confidence, like the operating horizon.

Q. Why is extending DCPP not a viable reliability alternative to California's increasing renewable energy nameplate capacity?

A. The 1,000 MW reduction in the contingency reserve requirement[9] due to the wildfire risk during the 3 month period (February – May 2023) illustrates the risk is reduced even with a slow development cycle[10] during the beginning of the year. The implication here is, with additional resources there would be further reduction in the contingency reserve requirement.

Q. Did CAISO conduct a transmission system assessment without DCPP?

[9] Page 12, February Joint Agency report – "Despite the identified contingency resources, a **large shortfall of 5,000 MW** remained as of 2022 in the event of coincident events." Page 10, May Joint Agency report – "if there is a coincident fire that affects transmission, the state could face an **additional 3,000 - 4,000 MW loss** of resources"

[10] "The first quarter of 2023 was a particularly slow period of time for new development, in part due to the annual cycle of development that focuses on bringing projects online in time for summer, and in part due to the extraordinary storms in the early part of 2023 that delayed construction for many projects." Page 4, Kootstra, Mark and Nathan Barcic (CPUC). 2023. *Joint Agency Reliability Planning Assessment* California Energy Commission. Publication Number: CEC-200-2023-007.

A. Yes, CAISO conducted[11] a "grid reliability assessment" and found no impacts on the transmission system due to the DCPP retirement. But if DCPP is extended, there could be transmission system impacts on the CAISO system.

Q. Is it your opinion that extending DCPP for an additional 5 to 10 years would not increase reliability?

A. That's correct. In my opinion, extending the DCPP for an additional 5 to 10 years is not solving the reliability problem California is facing. Because California is experiencing specific capacity shortages in only a limited set of hours in the summer months, not year around, this capacity shortage is more of an operating reserves problem rather than a planning reserves problem. Hence the DCPP extension is not necessarily solving the exact issue at hand.

Q. In Pacific Gas & Electric's (PG&E) opinion, what happens if DCPP is extended beyond 2025?

A. PG&E stated[12] that continued operation of DCPP beyond 2025 would increase the over-generation situation resulting in curtailment of additional renewable generation. This is because California has excess solar generation in mid-day resulting in solar energy curtailment. Extending DCPP beyond 2025 would

[11] "This study determined that there was **no material mid- or long-term transmission system impacts associated with the absence of Diablo Canyon**." CAISO 2012-13 Transmission Plan, March 20, 2013, Board Approved, Page 162, http://www.caiso.com/Documents/BoardApproved2012-2013TransmissionPlan.pdf

[12] "PG&E believes that the continued operation of **Diablo Canyon beyond 2025** would **exacerbate over-generation, requiring curtailment of renewable generation**." Page 8, DECISION APPROVING RETIREMENT OF DIABLO CANYON NUCLEAR POWER PLANT https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M205/K090/205090240.PDF

increase this solar energy curtailment[13]. As CAISO states[14], "Curtailing renewables is counterintuitive to California's environmental and economic goals." Hence, if DCPP is extended, CAISO might have to curtail renewable energy manually, increasing the likelihood of California not meeting[15] its climate goals.

Q. Is extending DCPP one of CAISO's solutions to the renewable energy curtailment challenges that California faces?

A. No, CAISO mentions[16] Energy Storage, Demand Response, Time Of Use Rates, Western Energy Imbalance Market, Regional coordination, Electric Vehicles, Flexible Resources and **Minimum generation** as solutions to minimize oversupply and reduce renewable energy curtailment. The CEC should note that CAISO is already considering reducing "**minimum operating levels for existing generators**" to make room for renewable energy production. To illustrate the

[13] Wind and solar energy curtailments are relatively less in July-September months compared to February-April months, according to CAISO data posted here - http://www.caiso.com/informed/Pages/ManagingOversupply.aspx

[14] Page 2, CAISO Curtailment Fast Facts, "Finally, if market-based solutions haven't cleared the surplus of electricity that could be generated, **the last resort is for the ISO to manually intervene**, which is called an "exceptional dispatch." In this scenario, ISO grid operators call on specific renewable plants to reduce output to prevent or relieve conditions that risk grid reliability. The exceptional dispatch order is considered a "manual" curtailment, because **the ISO operators must manually intervene**. **This is not preferred, because it does not ensure the lowest cost resources are called upon to serve Californians, and in many cases, it reduces the output of renewable plants**." https://www.caiso.com/documents/curtailmentfastfacts.pdf

[15] California Climate Commitment, "SB 1020 creates clean energy targets of 90% by 2035 and 95% by 2040, advancing the state's trajectory to 100% clean energy by 2045." https://www.gov.ca.gov/wp-content/uploads/2022/09/Fact-Sheet-California-Climate-Commitment.pdf?emrc=1ff9ee

[16] Page 3, CAISO Curtailment Fast Facts.

current oversupply situation, CAISO stated[17] that on March 11, 2017, CAISO curtailed more than 30% of renewable energy for an hour. DCPP extension will exacerbate the oversupply situation in the future and lead to higher renewable energy curtailment, which could lead to unintended consequences of California not meeting its climate goals.

Q. Why is it relevant for the CEC to dig deep into the operating reserves assumption?

A. There are multiple numbers from the July 2022 CEC report[18] that indicate varying amounts of operating reserves, specifically contingency reserves, that do not align with the conclusions of the CEC's March 2023 report.[19] Additionally, since the Bootleg fire occurred in 2021, if the CEC had been concerned about the wildfire risk, the July 2022 report would have included the loss of 3,000 – 4,000 MW transmission imports. But CEC didn't. Hence the current capacity shortages appear to be operational in nature, not planning.

Q. What changed between July 2022, when CEC staff conducted their "Summer Stack Analysis for 2022-2026," and March 2023, when staff released their "Diablo Canyon Power Plant Extension – CEC Analysis of Need to Support Reliability"?

[17] Page 2, Ibid, "**On March 11, 2017, the ISO observed solar curtailment exceeding 30 percent of the solar production for an hour**."

[18] Staff Paper - Revised Summer Stack Analysis for 2022-2026

[19] Attachment D to ALJ's April 20, 2023 Ruling in the instant proceeding.

A. In the July 2022 report, CEC states[20] that California requires contingency reserves in the range of 900 – 3,300 MW during the 2024-2026 window. Later in the same report, CEC states[21] a need for 1,700 – 3,300 MW during that 3-year window in September. Contingency reserves[22] are a subset of operating reserves. Hence CEC staff identified a need for more operating reserves, not planning reserves, in the summer of 2022.

Q. According to CAISO, what is the capacity shortfall in 2025-26 and 2032?

A. According to a CAISO analysis released[23] in February 2023, California has a capacity shortfall of 1,029 MW in 2025, 1,146 MW in 2026, and 509 MW in 2032. These capacity shortfall numbers total 2,684 MW, not the 3,300 MW identified in the July 2022 CEC report. So, capacity improved by 616 MW in the 6 months (July 2022 – February 2023). Hence it is reasonable to expect new renewable capacity additions if DCPP is retired as planned.

Q. Can contingency reserves address the capacity shortfalls in 2025-26?

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[20] "There could be a need for between **900 MW and 3,300 MW of contingency resources between 2024 and 2026**." Page 8, July 2022, Staff Paper - Revised Summer Stack Analysis for 2022-2026.

[21] "There is also likely to be a continued need for some **contingency resources between 2024 and 2026** ranging between **1,700 MW and 3,300 MW** during **September** if utilities meet and do not exceed their obligations under D.21-06-035." Page 24, Ibid

[22] According to CAISO, "The minimum required contingency reserve is generally 6% of load." http://www.caiso.com/Documents/maintaining-operating-reserves-fact-sheet.pdf CAISO's peak load in 2022 was 52,061 MW, hence **contingency reserves is** 6% of 52,061 = **3,124 MW**.

[23] The capacity shortfall in 2025 is 1,029 MW, in 2026 is 1,146 MW and in 2032 is 509 MW. http://www.caiso.com/Documents/Jan2-2023-Letter-CaliforniaEnergyCommissionViceChair-CAISOReliabilityModeling.pdf

A. Yes, the CEC report states[24] that additional procurement CPUC is considering will keep resource shortfalls "*within the reach of contingency reserves*."

Q. Have the joint agencies collectively identified additional contingency reserves that could be deployed in the event of an extreme event such as wildfire?

A. Yes, the joint agencies have identified[25] 2,000 MW of additional contingency reserves incremental to the CAISO contingency reserve requirement of 3,000 MW. Hence the total contingency reserves available during extreme events is at least 5,000 MW.

Q. What action did the California Public Utilities Commission (CPUC) take based on reports of capacity shortages from CEC and CAISO?

A. The CPUC released a procurement order[26] on February 23, 2023, ordering California load serving entities to procure 2,000 MW in 2026 and 2,000 MW in 2027 in addition to the 11,500 MW procurement ordered in June 2021.

Q. Did the CEC report include the 4,000 MW of additional Net Qualifying Capacity from the February 2023 CPUC procurement order?

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[24] "the level of shortfalls after the additional procurement may be within reach of the contingency resources." Page 22, March 2023 CEC report. Publication Number: CEC-200-2023-004.

[25] "**The energy agencies had identified 2,000 MW of additional contingency resources** — including voluntary and compensated customer load reductions, imports from other balancing authorities, and additional thermal generation — that could be employed in an extreme event above the 1-in-10 Loss of Load Expectation (LOLE)." Kootstra, Mark, and Nathan Barcic (CPUC). 2023. *Joint Agency Reliability Planning Assessment*. California Energy Commission. Publication Number: CEC-200-2023-002.

[26] "The CPUC ordered utilities to procure an additional 4,000 MW of Net Qualifying Capacity in addition to the 11,500 MW ordered in June 2021." https://www.cpuc.ca.gov/news-and-updates/all-news/cpuc-augments-historic-clean-energy-procurement-goals-to-ensure-electric-reliability-2023

A. No, it does not appear[27] that the CEC report from March included the 4,000 MW. But CEC acknowledges[28] that the 4,000 MW procurement could eliminate any resource shortfalls.

Q. Did CAISO include the 4,000 MW of additional Net Qualifying Capacity from the February 2023 CPUC procurement order?

A. No, the CAISO also did not include[29] the 4,000 MW of additional NQC from the February 2023 CPUC procurement order.

Q. What supporting data suggests California faces more of an operating reserves problem, not a planning reserves problem?

A. The North American Electric Reliability Corporation (NERC) conducts a Long Term Reliability Assessment (LTRA) annually in December. NERC's 2022 LTRA suggests[30] that on a probabilistic assessment, the California region faces capacity shortfalls during a specific window of 3 hours during summer months, not the entire year. This probabilistic assessment from NERC suggests the CEC should be modeling solutions to address capacity shortfalls in that specific

[27] "This analysis **does not consider the additional 4,000 MW** of NQC order adopted by the CPUC on February 23, 2023" March 2023 CEC report.

[28] "While not included in this analysis, the CPUC will consider ordering additional procurement of 4,000 MW NQC total split equally across 2026 and 2027. **This procurement could eliminate any shortfall through 2032 under the current planning standard."** March 2023 CEC report.

[29] "Similar to the study presented in this report, the **California ISO study did not** include the February 23, 2023, CPUC procurement order for an additional 4,000 MW of NQC." March 2023 CEC report.

[30] "The highest risk for loss of load is in the **months of July through September during the hours of 4:00–7:00 p.m**. This time period corresponds to the **three hours** after forecasted demand peaks each day in in California" Page 93, https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2022.pdf

window of 3 hours during summer months rather than a blunt tool of 4,000 MW of transmission imports solution, which only the DCPP extension can fix.

Q. What additional data suggests extending DCPP is not addressing the historical operational issues?

A. Historical operational data[31] from the CAISO's Department of Market Monitoring suggests peak solar generation during mid-day, forced outages, and load forecast errors are leading causes for operating reserve requirements, and extending DCPP to address these operational issues is expensive[32].

Q. Can a nuclear plant like Diablo Canyon provide operating reserves?

A. No, DCPP cannot provide operating reserves[33] because nuclear plants cannot be made available within 10 minutes of being dispatched by the CAISO operator. As the NERC LTRA 2022 points out, the loss of load risk arises in the 3-hour duration in peak summer months. To address the loss of load risk due to wildfires

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[31] "Figure 2.11 shows the hourly frequency of negative 5-minute prices in the last four years. The figure illustrates that the majority of negative prices during 2021 generally occurred during **mid-day hours when solar generation was highest**."
Page 104, Also See footnote 20, "The planning reserve margin reflects operating reserve requirements and **additional capacity that may be needed to cover forced outages and potential load forecast error**." 2021 Annual Report on Market Issues and Performance, Department of Market Monitoring, http://www.caiso.com/Documents/2021-Annual-Report-on-Market-Issues-Performance.pdf

[32] **"Extending DCPP to cover forced outages and load forecast errors is expensive."**
Page 16, Ibid

[33] "**Nuclear units** have historically been built for base load and therefore usually **do not provide operating reserves**." https://www.nrel.gov/docs/fy11osti/51978.pdf
Also, "because **nuclear power plants were not intended to modulate output to meet time-varying demand**" https://www.energy.gov/eere/analysis/articles/demand-response-and-energy-storage-integration-study

in that 3-hour window, California needs resources that can provide operating reserves, not planning reserves.

Q. In Pacific Gas & Electric's (PG&E) opinion, can DCPP ramp up and down to meet daily variations in load?

A. PG&E said[34] operating DCPP as a flexible resource instead of a baseload resource is both a "speculative and unrealistic assumption."

Q. Can pumped hydro storage operate as a flexible resource?

A. Yes, California is home[35] to approximately 4,000 MW of pumped hydro storage. These pumped hydro units can provide the flexibility to balance the California grid during operating reserves need. However, some pumped hydro units may require transmission improvements[36] to pump the water up the reservoir, as the 2008 PG&E presentation indicates for Helms Pumped Storage Plant. Since there is a 4,000 MW pumped storage capability sitting in California that has no supply chain impacts or interconnection delays and is independent of the loss of imports from the wildfire risk, the CEC and CPUC should ask CAISO to evaluate the

[34] DECISION APPROVING RETIREMENT OF DIABLO CANYON NUCLEAR POWER PLANT, Page 12, "**PG&E points out that this is a speculative and unrealistic assumption, and would make Diablo Canyon even less cost effective**:" https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M205/K090/205090240.PDF

[35] Mathias, John, Collin Doughty, and Linda Kelly. 2016. *Bulk Energy Storage in California*. California Energy Commission. Publication Number: CEC-200-2016-006. Page 12, "The state has **seven existing pumped storage facilities with a total capacity of 3,967 MW**, including projects at Lake Hodges, Castaic Lake, **Helms**, San Luis Reservoir, O'Neill Forebay, Big Creek, and Oroville." https://www.energy.ca.gov/sites/default/files/2021-06/CEC-200-2016-006.pdf

[36] PG&E presentation from Northwest Wind Integration Forum Workshop, October 17, 2008, "Helms Pumped Storage Plant", Slide 8, "**PG&E has plan to construct a new 150 mile long 500 kV transmission line** to, among other things, **restore Helms' pumping flexibility**" https://www.nwcouncil.org/sites/default/files/ManhoYeung_1.pdf

transmission improvements needed to leverage California's pumped storage capabilities fully.

Q. Are there recent examples of nuclear plant shutdowns in organized markets similar to CAISO that didn't cause reliability concerns?

A. In the past 25 years (1998-2023), 6 nuclear plants have retired without any reliability issues. The 1,036 MW Indian Point in New York in 2021 is the most recent[37] nuclear power plant shutdown in an organized market – New York Independent System Operator (NYISO). Next, an example[38] from the Midcontinent Independent System Operator (MISO) region is the 601 MW Duane Arnold nuclear plant's 2020 retirement in Iowa. The grid operator found no reliability issues with this nuclear plant retirement. Third example is the 679 MW Pilgrim May 2019 retirement[39] in Massachusetts, ISO-New England. All these 3 nuclear plant retirements occurred during the 2019-2021 time period.

The remaining 3 nuclear plant retirements occurred in 1998, and 2013 respectively. The 556 MW Kewaunee nuclear unit retired in Wisconsin in 2013, and MISO did not find[40] any reliability issues. Neither the Public Service Of Commission Wisconsin nor MISO increased the Planning Reserve Margin

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[37] EIA, "New York's Indian Point nuclear power plant closes after 59 years of operation", April 30, 2021 https://www.eia.gov/todayinenergy/detail.php?id=47776

[38] EIA, "U.S. nuclear electricity generation continues to decline as more reactors retire", April 8, 2022 - https://www.eia.gov/todayinenergy/detail.php?id=51978

[39] "The Independent System Operator of the New England grid (**ISO-NE**) has said that it expects **Pilgrim's retirement will have no effect on system reliability** this summer." https://www.eia.gov/dashboard/newengland/commentary/20190613

[40] "After the Midwest Independent System Operator (MISO) found **the planned shutdown** of the Kewaunee Power Station in Carlton, Wisconsin **would not hurt the regional electrical grid**, Dominion Resources Inc. said it would proceed with plans to decommission and shut down the nuclear plant." https://www.utilitydive.com/news/after-miso-review-dominion-to-shut-down-wis-nuclear-plant/101816/

Requirement for Wisconsin load serving entities due to Kewaunee nuclear plant retirement.

Closer to DCPP, 2,254 MW - San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 ceased operations[41] in 2013. Lastly, 2080 MW - Zion units 1 and 2 in Illinois were permanently shut down[42] in 1998 without any reliability impacts to Midwest grid.

Q. Did the shutdown of nuclear plants in Germany cause reliability problems?

A. No. Germany recently shut down[43] its last 3 nuclear plants without facing any reliability problems.

Q. Did CAISO designate DCPP as a Reliability Must Run (RMR) unit?

A. No, CAISO did not designate DCPP as an RMR unit. Hence DCPP is not needed to maintain the reliability of the CAISO transmission system.

Q. In summary, is extending DCPP necessary to maintain system reliability, and what is missing from the CEC analysis?

A. In summary, a) Even if DCPP is extended, it won't solve California and CAISO's operational problems. b) PG&E stated there is no need to replace DCPP to maintain system reliability because DCPP cannot operate as a flexible resource, and CEC should realize that California is dealing with an operating reserve, not a

[41] "Units 2 and 3 permanently ceased operations in June 2013", https://www.nrc.gov/info-finder/decommissioning/power-reactor/san-onofre-unit-1.html

[42] Zion Units 1 & 2 - https://www.nrc.gov/info-finder/decommissioning/power-reactor/zion-nuclear-power-station-units-1-2.html

[43] NPR News article, "Germany begins powering down its last three nuclear plants", https://www.npr.org/2023/04/15/1170244609/germany-begins-powering-down-nuclear-plants

planning reserve problem. c) The 4,000 CPUC Procurement target is missing from the CEC and the CAISO calculations. d) NERC's Long Term Reliability Assessment indicates an operating reserves problem on the horizon. e) Recent examples if nuclear plant retirements did not cause reliability issues.

Section B – CAISO Operating Reserve Requirements Study Proposal

Q. What concerns do you have with the reserve requirements for the CAISO to target?

A. First, as a Balancing Authority responsible for balancing transmission system needs with operating reserves procurement even during natural disasters such as wildfires[44], the CAISO must run an Operating Reserve Requirements Study that considers the 4,000 MW from February 2023 CPUC procurement order. This CAISO study must verify whether 2,000 MW in 2025 and 2,000 MW in 2026 from the CPUC procurement order would meet the shortfall[45] of 1,029 MW and 1,146 MW in 2025 and 2026, respectively.

[44] "The ISO is the largest of about 38 **balancing authorities** in the western interconnection, handling over two-thirds of the electric load in the West through the Western Imbalance Energy Market (Western EIM). **A balancing authority is responsible for operating a transmission control area**. It matches generation with load and maintains consistent electric frequency of the grid, even during **extreme weather conditions or natural disasters**." http://www.caiso.com/about/Pages/OurBusiness/The-ISO-grid.aspx

[45] Table 1 - All Capacity Values in MW, http://www.caiso.com/Documents/Jan2-2023-Letter-CaliforniaEnergyCommissionViceChair-CAISOReliabilityModeling.pdf

Second, the CAISO's probabilistic production cost modeling software PLEXOS[46] must model[47] the interactive effects of each variable's uncertainty, unlike the CAISO analysis released in February 2023.

Q. Is CAISO's plan to meet reserve requirements with the DCPP extension feasible?

A. No, because CAISO is overbuilding 4,105 MW of capacity to meet reserve requirements by adding 2,280 MW due to DCPP extension[48] **AND** by not including the 4,000 MW CPUC procurements in 2025-26 when the shortfall is only 2,175 MW (adding 1,029 MW and 1,146 MW in 2025 and 2026).

Q. How should CAISO avoid overbuilding capacity in the PLEXOS software?

A. Since the CEC is concerned about the loss of imports from Oregon due to wildfire risks, CAISO should model the historical import profile of transmission interconnection in the PLEXOS software to accurately account for the import uncertainty instead of artificially attributing[49] 4,000 MW for "coincidental wildfire risk."

Q. Didn't the CEC report assume imports into California?

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[46] "The ISO's probabilistic production cost modeling analysis, conducted using the PLEXOS software tool" http://www.caiso.com/Documents/Jan2-2023-Letter-CaliforniaEnergyCommissionViceChair-CAISOReliabilityModeling.pdf

[47] Referring to the CAISO report, CEC report states CAISO analysis type "is different from the analysis presented in this report, which **does not directly incorporate the interactive effects between the uncertainty of each input that is captured by a probabilistic production cost model**." Page 24, March 2023 CEC report.

[48] "**DCPP Units 1 and 2** are assumed to be **offline by 2025**, resulting in **2,280 MW of capacity reduction** to the supply stack" Page 18, March 2023 CEC report.

[49] Table 1: System Conditions Defined, Page 17, March 2023 CEC report.

A. Yes, the CEC report assumed[50] a static value of 5,500 MW[51] every hour instead of dynamic values that change every hour, as seen by the CAISO operator. A static import value artificially inflates the need for capacity, whereas a dynamic value shows the realistic need for capacity.

Q. Do imports count towards DCPP replacement capacity requirements?

A. No, according[52] to the DECISION OF ALJ FITCH, imports do not count towards DCPP replacement capacity requirements. Imports only count as a "bridge" for 3 years until replacement capacity is online.

Q. What other data suggests CAISO will be overbuilding capacity if 4,000 MW is attributed to coincidental wildfire risk outside the analytical process?

[50] "**Standard imports are set to 5,500 MW in every hour**. The 5,500 MW of fixed RA imports was set in consultation with California ISO and CPUC." Page 18, March 2023 CEC Report.

[51] Joint Agency **staff** had **updated** the Resource Adequacy RA **imports for September from 5,500 MW to 6,000 MW** in **the June 2023 report**. "Staff also reevaluated imports. Staff updated the average RA imports in the stack to ~6,000 MW during September, compared to the 5,500 MW used in the February report." Page 10, Kootstra, Mark and Nathan Barcic (CPUC). 2023. *Joint Agency Reliability Planning Assessment* California Energy Commission. Publication Number: CEC-200-2023-007.

[52] DECISION ORDERING SUPPLEMENTAL MID-TERM RELIABILITY PROCUREMENT (2026-2027) AND TRANSMITTING ELECTRIC RESOURCE PORTFOLIOS TO CALIFORNIA INDEPENDENT SYSTEM OPERATOR FOR 2023-2024 TRANSMISSION PLANNING PROCESS, Page 89, Order #8, "For enhanced reliability purposes and compliance with the generic capacity requirements of Decision (D.) 21-06-035 or this order, but **not for the Diablo Canyon replacement capacity** or long lead-time resource procurement required in D.21-06-035, a **load serving entity may contract for imported energy as a bridge** until the online date of a new compliance resource, from any resource and with any counterparty, for a period of **not more than three years**. The bridge contract for imported energy must meet resource adequacy requirements at the time the contract is executed." https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M502/K956/502956567.PDF

A. CAISO conducts annually Local Capacity Requirement (LCR) to calculate the minimum capacity needed within each local area to meet the reliability standard. According to CAISO[53], Diablo Canyon is not located in a local capacity requirement area. Hence there are no local capacity requirements that require 4,000 MW leading to overbuilding of capacity.

Q. Are there alternatives to DCPP's cost that achieve reasonable reliability goals and reserve requirements?

A. Yes, there are alternatives to DCPP's extension sitting in the CAISO generator interconnection queue waiting to be studied. The county of San Luis Obispo alone has 2,700 MW of energy storage in various CAISO study stages, with 2,000 MW online by 2024. The May 2023 Joint Agency report[54] also notes an additional 347 MW of "New Batteries Nameplate" compared to the February report. If DCPP is extended, the 2,700 MW of energy storage in San Luis Obispo would likely be "mothballed" to balance the generation within CAISO.

Q. Does the DECISION OF ALJ FITCH allow for contracting energy storage projects to replace DCPP capacity?

A. Yes, the DECISION OF ALJ FITCH allows for California LSEs to procure energy storage projects to meet the 4,000 MW requirement under certain conditions[55].

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[53] CAISO 2015-16 Transmission Plan, March 28, 2016 Board Approved, Page 300, http://www.caiso.com/Documents/Board-Approved2015-2016TransmissionPlan.pdf

[54] Table 4, Page 11, Kootstra, Mark and Nathan Barcic (CPUC). 2023. *Joint Agency Reliability Planning Assessment* California Energy Commission. Publication Number: CEC-200-2023-007.

[55] DECISION ORDERING SUPPLEMENTAL MID-TERM RELIABILITY PROCUREMENT (2026-2027) AND TRANSMITTING ELECTRIC RESOURCE PORTFOLIOS TO CALIFORNIA INDEPENDENT SYSTEM OPERATOR FOR 2023-

Q. What are the restrictions on energy storage projects for counting towards Net Qualifying Capacity (NQC)?

A. According to the CEC staff FAQ[56] referenced by the ALJ FITCH, the energy resource from which storage is charging must be located within the CAISO, and the charging should occur before the 5-hour discharging window.

Q. How does CAISO's interconnection reform negate the capacity need for DCPP extension?

A. The CEC is aware[57] of CAISO's interconnection reform process, and when new renewable capacity is added from the interconnection queue, that capacity will obviate the need for DCPP extension. Additionally, FERC is working on a

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2024 TRANSMISSION PLANNING PROCESS, Page 84, Conclusions of Law #11, "**Energy and storage contracts** to comply with the D.21-06-035 category of resources **to replace Diablo Canyon capacity** should be able to be procured separately, but must be contracted by the LSE that is claiming them for compliance purposes. Energy-only contracts may also be used, but only if they can **demonstrate by engineering assessment that the energy delivered will be sufficient to charge the batteries and discharge** according to the D.21-06-035 and staff FAQ document requirements" https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M502/K956/502956567.PDF

[56] See FAQ 1.4.14, "The LSE would need to show via the engineering assessment that sufficient energy will be **provided specifically in CAISO** to charge the storage resource **prior to** the required daily availability period for **5 hours of discharge**." https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/d2106035_faqv4_20230104-comparison-to-v3.pdf

[57] "The California ISO also initiated its **Interconnection Process Enhancements initiative** to address the complexity of managing high volumes of projects in the queue." Page 12, March 2023 CEC report.

proposal[58] to reform the grid operator interconnection process, including the CAISO queue.

Q. Does the DECISION OF ALJ FITCH require California Investor Owned Utilities (IOUs) to expedite transmission interconnection?

A. Yes, in addition to the Federal regulator's focus on generator interconnections, the DECISION OF ALJ FITCH requires[59] California IOUs to speed up transmission interconnections to integrate renewables.

Q. What about permitting delays?

A. The CEC report asserts[60] permitting delays as one of the drivers behind clean energy project delays. But a close examination[61] of CEC's assertion behind the permitting delays indicates energy storage project permitting, specifically the recent battery fires as the leading cause. If the CEC is concerned about the Moss Landing Energy Storage Facility September 4, 2021, fire incident, the main cause

[58] See "FERC close to final interconnection rule, interregional transfer proposal: Chairman Phillips" https://www.utilitydive.com/news/ferc-interconnection-reform-interregional-transfer-capacity-phillips/648850/

[59] DECISION ORDERING SUPPLEMENTAL MID-TERM RELIABILITY PROCUREMENT (2026-2027) AND TRANSMITTING ELECTRIC RESOURCE PORTFOLIOS TO CALIFORNIA INDEPENDENT SYSTEM OPERATOR FOR 2023-2024 TRANSMISSION PLANNING PROCESS, Page 86, Conclusions of Law #23, "The **IOUs should expedite transmission interconnection** and associated network upgrades to the greatest extent possible to **bring new electricity resources** online." https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M502/K956/502956567.PDF

[60] "**projects under development are experiencing delays** from supply chain disruptions, an overwhelmed interconnection queue, and **permitting delays**." Page 15, March 2023 CEC report.

[61] "While land-use permits have always been a potential construction project delay, the **most significant emerging issue is permitting energy storage**. Recent **energy storage fires are resulting in closer scrutiny of storage projects** to ensure they meet fire code." Page 13, March 2023 CEC report.

was a faulty heat suppression system, not battery modules[62]. A faulty heat suppression system failure is not a permitting delay.

Q. Why does the inclusion of third party demand response in the CEC analysis matter?

A. Inclusion of third party demand response in the CEC analysis matters because California saw[63] 4,800 MW of response from customers during past grid emergencies. So, there is potential for 4,800 MW of demand response if modeled by the CAISO and included in the CEC analysis.

Q. Compared to 4,800 MW seen during past grid emergencies, how much demand response is assumed in the CEC report?

A. The March 2023 CEC report assumes[64] a range of 1,159 – 1,202 MW for demand response capacity from July through September. But CEC assumes no growth[65] in

[62] "**we do not believe that the battery modules were the source of smoke**." Findings and Corrective Actions - Moss Landing Phase I FINAL.pdf https://vistra.app.box.com/s/1aezfypko93vz5jm9nn9tckphtjkgzvb

[63] "Ralph Cavanagh, co-director of the climate and clean energy program at the Natural Resources Defense Council — another Diablo Canyon opponent — echoed this point at last week's Senate hearing. During grid emergencies in 2020 and 2021, he said, "the governor's office organized energy-efficiency and demand-response campaigns that **cut our electricity use during peak hours by 4,800 megawatts, double the capacity of Diablo Canyon, in less than three months**." https://www.canarymedia.com/articles/nuclear/california-faces-big-power-challenges-even-if-diablo-canyon-stays-open

[64] Table 2: 2023 Aggregated DR Numbers Reported by IOUs, Page 18, March 2023 CEC report.

[65] "The DR numbers, in Table 2: 2023 Aggregated DR Numbers Reported by IOUs, **are assumed fixed to 2032** because the **IOUs do not forecast** or report DR numbers out to a 10-year horizon." Page 18, March 2023 CEC report.

demand response in the next 10 years due to a lack of forecasts from California IOUs.

Q. Is demand response a viable option if imports into California are restricted due to wildfires?

A. Yes, because the NERC report states[66] that 1,748 MW of DR was deployed during the Bootleg fire.

Q. Is demand response constrained by import restrictions outlined in the DECISION OF ALJ FITCH[67] and hence not an option for DCPP replacement capacity?

A. No, demand response is not constrained by import restrictions because it is "local" to the California IOUs. Hence demand response is a viable alternative to DCPP replacement capacity.

Q. What type of Demand Response has restrictions?

[66] "While no firm load was shed, one entity did use their **demand response program to lower their load by 1,748 MW** prior to escalating to an EEA-3." Page 6, https://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/NERC_SOR_2022.pdf

[67] DECISION ORDERING SUPPLEMENTAL MID-TERM RELIABILITY PROCUREMENT (2026-2027) AND TRANSMITTING ELECTRIC RESOURCE PORTFOLIOS TO CALIFORNIA INDEPENDENT SYSTEM OPERATOR FOR 2023-2024 TRANSMISSION PLANNING PROCESS, Page 89, Order #8, "For enhanced reliability purposes and compliance with the generic capacity requirements of Decision (D.) 21-06-035 or this order, but **not for the Diablo Canyon replacement capacity** or long lead-time resource procurement required in D.21-06-035, a **load serving entity may contract for imported energy as a bridge** until the online date of a new compliance resource, from any resource and with any counterparty, for a period of not more than three years. The bridge contract for imported energy must meet resource adequacy requirements at the time the contract is executed." https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M502/K651/502651263.PDF

A. A demand response program that is dependent on behind-the-meter batteries is not eligible[68] to be considered a viable option for DCPP replacement capacity.

Q. How does aggregation of distributed energy resources help with the capacity needs caused by DCPP retirement?

A. As the March 2023 CEC report indicates[69], the CEC incentivizes clean and efficient distributed energy resources in the Distributed Electricity Backup Assets (DEBA) Program. For example, in their CEC comments, Sunrun and Leap assert[70] that 150 MW of Demand Side Grid Support (DSGS) can be online before 2023 summer.

Q. What is the effective date for CAISO to implement its FERC mandated Order 2222 market participation model for aggregated distributed energy resources?

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[68] See FAQ 1.4.11, "Staff see a likely exception here for demand response (DR) for which it is generally not applicable to require a generation component, **unless they are DR or permanent load shift resources that are significantly reliant on behind-the-meter batteries** or other forms of storage that are charging from the grid, which **staff does not believe would be compliant with the Diablo Canyon replacement category**." https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/d2106035_faqv4_20230104-comparison-to-v3.pdf

[69] "**Distributed Electricity Backup Assets (DEBA) Program** provides incentives for the construction of **clean and efficient distributed energy resources**. The CEC is developing the program, and it will fund the deployment of new zero- or low-emission technologies such as fuel cells and energy storage at existing or new facilities." Page 14, March 2023 CEC report.

[70] "The Joint Parties currently have visibility into approximately **150 MWs of dispatchable demand response capacity** across the IOU and POU territories that could be brought to the state **ahead of summer 2023**", Sunrun and Leap Revised Proposal - DER Program Design, TN # 249330, https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=22-RENEW-01

A. The effective date[71] for CAISO's FERC Order 2222 proposal is no later than November 1, 2024. The reliability benefit from Aggregated DERs must be accounted for in the CAISO's Operating Reserve Requirements Study.

Q. In summary, what should be the scope of the CAISO Operating Reserve Requirements Study?

A. The scope of the CAISO Operating Reserve Requirements Study should a) include 2,700 MW of energy storage in San Luis Obispo sitting in the CAISO queue, b) explore how much of the 4,800 MW of demand response can count towards operating reserves, and c) model the reliability benefits of Aggregated DERs.

Section C – There Are Viable Alternatives to DCPP Extension

Q. What concerns do you have with the merits of the methods currently used to assess and procure the resources that could serve as alternatives to the operation of the Diablo Canyon units?

A. The CEC report lumps standalone batteries, hybrid configurations such as solar plus batteries, and 8-hour batteries as long lead-time resources in the nameplate capacity estimates for ordered capacity[72]. However, the CEC under-estimating growth in long lead-time resources, especially in years 2027 and 2028, and as a result, discounts the benefits of long lead-time resources as viable alternatives to the Diablo Canyon units. The technological advancements in Long Duration

[71] "We find that CAISO has shown good cause for its request to extend the effective date for the Tariff revisions associated with Distributed Energy Resource Aggregations with Distributed Curtailment Resources to no later than **November 1, 2024**" Paragraph 31, FERC Docket # ER21-2455, 183 FERC ¶ 61,119 https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20230518-3044&optimized=false

[72] Table 4: Estimated Ordered Resources in MW Nameplate Capacity, March 2023 CEC Report.

Energy Storage (LDES) are missing from the CEC MW Nameplate Capacity forecasts. For example, Hydrostor, an LDES developer, proposed a minimum procurement[73] of 605 MW.

Q. Are hybrid (solar plus storage) projects viable alternatives to DCPP extension?

A. Yes, as the Joint Agency May report[74] notes, there is an increase in 391 MW of "New Hybrid Nameplate" capacity since the February report. This increase shows that hybrid projects are a viable alternative to the DCPP extension. Conversely, if DCPP is extended, this progress of New Hybrid Nameplate addition could stall.

Q. What transmission innovations can help with the capacity needs caused by DCPP retirement?

A. The CEC report also does not consider technological advancements in transmission technologies that would increase the amount of Net Qualifying Capacity from higher penetrations of renewables. For example, High Temperature Superconducting transmission technologies can increase the rating of existing transmission lines by 5-10 times.

[73] DECISION ORDERING SUPPLEMENTAL MID-TERM RELIABILITY PROCUREMENT (2026-2027) AND TRANSMITTING ELECTRIC RESOURCE PORTFOLIOS TO CALIFORNIA INDEPENDENT SYSTEM OPERATOR FOR 2023-2024 TRANSMISSION PLANNING PROCESS, Page 89 "Hydrostor also supports the proposal and suggests a minimum of 605 MW of long duration energy storage be procured."
https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M502/K651/502651263.PDF

[74] Table 4, Page 11, Kootstra, Mark and Nathan Barcic (CPUC). 2023. *Joint Agency Reliability Planning Assessment* California Energy Commission. Publication Number: CEC-200-2023-007.

Q. How should the commercial availability of High Temperature Superconducting transmission factor into the renewable interconnection concerns raised by the CEC?

A. VEIR[75], a Superconducting transmission company, plans to commercialize its technology by 2027. The CEC report must allow for increased renewable integration and its impact on available Net Qualifying Capacity from innovative companies like VEIR.

Q. How does the CEC report account for long lead-time resources such as 8-hour batteries?

A. The CEC report assumes long lead-time resources such as 8-hour batteries would contractually arrive in 2028. According to CEC staff analysis based on CPUC procurement data, 1,283 MW of long lead-time resources in the form of batteries are assumed to be online in 2028.

Q. Is this 1,283 MW of battery capacity in addition to the 4,000 MW procurement ordered by the CPUC?

A. Yes, according[76] to the DECISION OF ALJ FITCH, long lead-time resources such as 8-hour batteries have until June 1, 2028, AND are in addition to the 4,000 MW required in 2025-26.

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[75] https://veir.com/ "**High Temperature Superconducting cable can operate at up to 10x the current of conventional wire** while maintaining superconductivity. Higher current allows for lower voltage and smaller rights-of-way."

[76] DECISION ORDERING SUPPLEMENTAL MID-TERM RELIABILITY PROCUREMENT (2026-2027) AND TRANSMITTING ELECTRIC RESOURCE PORTFOLIOS TO CALIFORNIA INDEPENDENT SYSTEM OPERATOR FOR 2023-2024 TRANSMISSION PLANNING PROCESS, Page 87, Order #2, "The **long lead-time resources** required by D.21-06-035 may be brought online **by June 1, 2028**, such that the total NQC of all LSEs adds to 2,000 MW in **each of the years 2026, 2027, and 2028**."
https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M502/K956/502956567.PDF

Q. In summary, what are viable alternatives to DCPP extension?

A. Long duration energy storage, new hybrid resources, high temperature super conducting cables that increase the transmission capacity, and long lead-time resources are viable alternatives to DCPP extension. The CEC report shouldn't underestimate these alternatives because these are flexible resources compared to inflexible DCPP.

Section D – Continued Operation of DCPP Comes at the Expense of Zero Carbon Alternatives

Q. What final concerns do you have with the continued operation of the Diablo Canyon units?

A. The continued operation of DCPP could come at the expense of other low or zero-carbon alternative pathways for California to meet[77] an 85% reduction in Green House Gases (GHG) by 2045.

Q. How does the continued operation of the Diablo Canyon units impede the development of other low or zero-carbon alternative ways to enhance California's power supply?

A. The CEC is concerned about "long-lead-time resources" arrival in 2028 as another reason for DCPP extension. But a recent study[78] that included modeling of August 2020 heatwave conditions suggests Off Shore Wind and geothermal

[77] https://www.gov.ca.gov/2022/11/16/california-releases-worlds-first-plan-to-achieve-net-zero-carbon-pollution/

[78] "The study incorporated many years of weather data and exercised the system through various stress conditions (such as retiring some in-state gas, low hydro availability, west-wide coal retirements, and **mimicking the August 2020 heatwave conditions**)." https://gridlab.org/california-2030-study/

energy could reduce the supply chain risk[79] that CEC is concerned[80] about and reduce the reliance on solar and long-lead-time resources such as 8-hour batteries. Hence, the continued operation of DCPP could delay the development of zero-carbon alternatives such as Off Shore Wind and geothermal energy.

Q. Did the CEC analysis include the CPUC-driven sensitivity that CAISO modeled in its transmission plan for 4,400 MW of Off Shore Wind at Diablo Canyon?

A. No, CEC analysis shows 0 MW for Off Shore Wind (OSW) but CAISO 2021-2022 Transmission Planning report shows transmission upgrades due to OSW at Diablo.

Q. Does the DECISION OF ALJ FITCH direct the CPUC to include an assessment of transmission needs for integrating Off Shore Wind?

A. Yes, the DECISION OF ALJ FITCH directs[81] CPUC to seek CAISO to run a sensitivity case in its Transmission Planning Process (TPP) that analyses the

[79] "A more diverse portfolio with **offshore wind and geothermal can reduce the risk of supply chain constraints as well as siting and permitting challenges** that may worsen with high-enough solar, onshore wind, or storage resource build-out rates, suggesting it's worth increasing these resources' role despite their relative lack of technological maturity." https://energyinnovation.org/wp-content/uploads/2022/05/Achieving-An-Equitable-And-Reliable-85-Percent-Clean-Electricity-System-By-2030-In-California.pdf

[80] "The pace of new, clean-energy resource development is impacted by three issues: **supply chain disruptions, interconnection delays, and permitting delays**. These issues are posing risks to getting new resources on-line, particularly when current build rates are unprecedented and must increase to meet authorized procurement." Page 3, March 2023 CEC report.

[81] DECISION ORDERING SUPPLEMENTAL MID-TERM RELIABILITY PROCUREMENT (2026-2027) AND TRANSMITTING ELECTRIC RESOURCE PORTFOLIOS TO CALIFORNIA INDEPENDENT SYSTEM OPERATOR FOR 2023-2024 TRANSMISSION PLANNING PROCESS, Page 86, Conclusions of Law #20, "The Commission should seek CAISO TPP analysis of one sensitivity case in this TPP cycle: a case that **tests the transmission needs of a significant amount of offshore**

impacts of Off Shore Wind on the CAISO transmission system. This CAISO TPP sensitivity case[82] would compare 13.4 GW of Off Shore Wind by 2025 against the base case of 4.7 GW.

Q. Can Off Shore Wind help with the capacity needs caused by DCPP retirement?

A. Off Shore Wind has a higher capacity factor[83] than On Shore Wind. And multiple CPUC studies[84] suggest higher Effective Load Carrying Capability (ELCC) percentages for Off Shore Wind in the 3 months when the loss of load risk is higher, suggesting a delay in DCPP retirement could delay California's progress towards interconnecting Off Shore Wind.

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wind."
https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M502/K956/502956567.PDF

[82] DECISION ORDERING SUPPLEMENTAL MID-TERM RELIABILITY PROCUREMENT (2026-2027) AND TRANSMITTING ELECTRIC RESOURCE PORTFOLIOS TO CALIFORNIA INDEPENDENT SYSTEM OPERATOR FOR 2023-2024 TRANSMISSION PLANNING PROCESS, Page 3, "A portfolio of 75 GW nameplate of new resources in 2035 that is designed to refine and update transmission capability and upgrade assumptions relevant to offshore wind resources, such that **offshore wind is 13.4 GW by 2035 as compared to 4.7 GW in the base case**."

[83] "**Offshore wind** tends to operate at a **higher capacity factor** than onshore wind because of stronger and less variable wind speeds." See "Developers plan to add 6 gigawatts of U.S. offshore wind capacity through 2029", June 30, 2022, https://www.eia.gov/todayinenergy/detail.php?id=52940

[84] CPUC study suggests **higher ELCC (56%) for OSW in July-Sep months** when there is a higher risk of loss of load. See Table 1, "Regional Wind Effective Load Carrying Capability Study Results for 2024" CPUC, June 1, 2022, https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M482/K148/482148586.PDF
A revised report prepared for CPUC in January 2023 suggests **OSW has 48% ELCC**. See, Table 1, https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/20230210_irp_e3_astrape_updated_incremental_elcc_study.pdf

Q. What transmission impacts due to DCPP retirements did CEC fail to consider?

A. Anticipating DCPP retirements, the CAISO Board has approved transmission projects to address the voltage problems in the Central California area. These transmission projects[85] could be delayed or canceled, leading to additional impacts on CAISO's transmission system. The CEC has failed to consider these transmission impacts in its analysis.

Q. What impact would the extension of DCPP have on the Pacific Transmission Expansion (PTE) project?

A. The Pacific Transmission Expansion (PTE) project includes a Voltage Source Converter at the Diablo Canyon 500 kV switchyard[86]. This project could be delayed leading to voltage problems if DCPP is not retired as scheduled.

Q. In addition to long lead-time resources such as 8-hour batteries and Off Shore Wind, which Zero Carbon alternative suffers if the DCPP extension is granted?

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[85] According to CAISO 2021-2022 Transmission Plan released on March 17, 2022, "**High voltages were observed on 500 kV system** in Central California after **Diablo Canyon Nuclear Power Plant retires.** To mitigate the voltage issues, in the 2018-2019 transmission planning process, it was proposed to **install dynamic reactive support on the Round Mountain and Gates 500 kV Substations**. These projects were approved and planned to be implemented in 2024." http://www.caiso.com/InitiativeDocuments/ISOBoardApproved-2021-2022TransmissionPlan.pdf

[86] "The proposed project includes the **Voltage Source Converter** (VSC) stations as in the following: one 2,000 MW, 500 kV DC/500 kV AC converter station located at the northern terminus of the project at **Diablo Canyon 500 kV switchyard**" CAISO 2021-2022 Transmission Plan released on March 17, 2022, http://www.caiso.com/InitiativeDocuments/ISOBoardApproved-2021-2022TransmissionPlan.pdf

A. It is unclear what happens to more than 1,000 MW of Geothermal capacity[87] assumed to be online in 2028 if the DCPP extension is granted.

Q. Is there a potential for other transmission project delays due to the DCPP extension?

A. Yes, due to the planned retirement of DCPP in 2025, high voltages were identified at Diablo, Gates, and Midway 500 kV buses. CAISO has indicated[88] a need for a 500 kV Static Synchronous Compensator (STATCOM) at Orchard 500 kV Substation adjacent to Gates 500 kV Substation. This 500 kV STATCOM could be delayed or canceled due to the DCPP extension.

Q. Can you summarize your conclusions?

A. The continued operation of the Diablo Canyon units impedes the development of other low or zero-carbon alternatives to enhance California's power supply because the transmission projects needed to integrate OSW could be delayed. The 1,000 MW of geothermal capacity could be delayed. Additionally, CAISO Board-approved transmission projects such as Pacific Transmission Expansion could be delayed because the transmission system must be re-configured to accommodate the power flows from the DCPP extension. Finally, the DCPP extension could

[87] Table 4: Estimated Ordered Resources in MW Nameplate Capacity, Page 19, March 2023 CEC report.

[88] See "In early 2020, LS Power Grid California, LLC (LSPGC or Project Sponsor) was selected by the CAISO to procure, install, and operate two (2) +/-424 MVar Static Synchronous Compensator (STATCOM) blocks at the CAISO approved Orchard 500 kV Substation adjacent to Gates 500 kV Substation. The new 500 kV STATCOM (Project or Gates DRS) is proposed to resolve high voltages identified at Diablo, Gates and Midway 500 kV buses, following the planned retirement of the Diablo Canyon Nuclear Power Plant (DCPP) in 2025."
https://www.wecc.org/Reliability/TransCo_LSPGC_Gates_DRS_Project_AffectedSystemslStudyReport_5-23-2022.pdf

have a ripple effect in delaying other planned transmission projects creating a reliability risk in the future.

Q. Does this conclude your testimony?

A. Yes, it does.

Attachment A

RAO KONIDENA

ENERGY MARKET EXPERTISE IN DISTRIBUTED ENERGY RESOURCES

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Rao Konidena is an independent energy consultant. He worked at the Midcontinent Independent System Operator (MISO) for 15 years. Before he left MISO, he was the Principal Advisor for Policy Studies, working on energy storage and distributed energy resources. At MISO, Rao worked in management and non-management roles around resource adequacy, economic planning, business management, and policy functions.

Rao is the President of the Finnish American Chamber of Commerce – Minnesota (FACC-MN) and sits on the Board of Ever Green Energy and Minnesota Solar Energy Industries Association (MnSEIA).

EXPERIENCE

RAKON ENERGY LLC, Roseville, MN
President & Chief Executive Officer (CEO) May 2018 – Present

Providing consulting services related to Federal and state energy policies focusing on energy storage and distributed energy resources

- Consumer advocates and non-profit organizations have engaged the expertise of Rakon Energy to provide an opinion on whether Non-Transmission Alternatives were sufficiently modeled in transmission line Certificate of Need proceedings.
- A renewable energy developer engaged Rakon Energy to provide MISO expertise for their renewable energy project portfolio in various stages and study cycles of the Generator Interconnection Queue and the capacity credit impact from MISO's seasonal capacity construct.
- An Independent Power Producer engaged Rakon's services to understand MISO's seasonal resource adequacy construct and its impact on Power Purchase Agreement negotiations with a MISO utility.
- An aggregator engaged Rakon Energy as part of the team to represent their interests at RTO stakeholder committees on FERC Order 2222.
- Rakon Energy was part of the team engaged by a technology company to represent their interests at the PJM RTO. Another similar company hired Rao to navigate MISO's market rules for data center interconnection.
- Advanced Energy Economy and the Natural Resources Defense Council's Sustainable FERC Project engaged Rakon to monitor MISO's FERC Order 2222 implementation process.
- The Commonwealth of Pennsylvania's Office of Consumer Advocate engaged Rakon Energy LLC to support OCA's response to the questions posed by the Pennsylvania Public Utility Commission's Secretary in the policy proceeding - Utilization of Storage Resources as Electric Distribution Assets.
- A prominent solar advocacy group currently engaged Rao for expert testimony work in Nevada and Minnesota IOUs IRP filing.
- He submitted comments to Minnesota and Colorado Public Utilities Commission on Integrated Distribution Planning dockets.
- He has provided expert testimony support for Environmental Law and Policy Center (ELPC) at the Public Service Commission of Wisconsin (PSCW) on the MISO Multi-Value Project (MVP) line in Wisconsin.
- He provided affidavit support for the Office of the People's Counsel of the District of Columbia (OPC-DC) at the Federal Energy Regulatory Commission (FERC) on PJM's Reserves Pricing Proposal and municipal utilities in Wisconsin and Missouri at FERC on MISO's Resource Adequacy construct.
- He provided advocacy support for Energy Storage Association (ESA) at MISO on FERC Order 841 Compliance.
- He provided training as part of the Tuatara team on DERs to Colombia's grid operator XM and the ESTA International team on energy storage benefits to Mexican regulator CRE.

Advisor, Volunteer, Pro-Bono assignments

https://rakonenergy.com/

- Rao presented on Distributed Energy Resources (DER) and peer-reviewed Demand Side Management and DER plans for Central American regulators, as part of NARUC International Peer Review.
- Rao presented and shared best practices around the impact of provisioning ancillary services. At an Eastern Africa regional workshop organized by the United States Energy Agency (USEA), the United States Agency for International Development (USAID) and the Power Africa initiative.

MIDCONTINENT INDEPENDENT SYSTEM OPERATOR (MISO), Eagan, MN
Principal Advisor, Policy Studies Aug 2015 – May 2018

- Recognized as an expert on all thing's energy storage and distributed energy resources from an economic transmission planning perspective
- Project manager for long term independent load forecast and demand response/energy efficiency/distributed generation potential study.
- MISO representative on Department of Energy (DOE) US DRIVE Grid Interaction Technical Team

Senior Manager, Transmission Asset Management Operations Feb 2013 – July 2015
- He engaged the division lead in the development of strategic initiatives and operating plans.
- Rao chaired the Economic Modeling Framework Working Group of international Grid operators GO-15.

Manager, Resource Forecasting (started at Engineer II) Sep 2003 – Jan 2013
- ***Main Accomplishments***
  - In this role, I directed the Demand Response & Energy Efficiency potential study for MISO, with the support of Global Energy Partners consultants.
  - Directed the MISO Energy Storage Study identifying the economic potential for grid-scale energy storage in MISO footprint, providing strategic consulting services to investor-owned utilities, public power utilities, asset owners, and investors.
- ***Regulatory Experience***
  - Responsible for analytical assessments that meet MISO's Federal Energy regulatory compliance obligations as well as our Transmission Owners (e.g., FERC Market-based rates).
  - Responsible for supporting state regulators and MISO Board of Directors with technical analysis related to policy drivers.

PWRSOLUTIONS, Inc., Dallas, TX (Consulting) May 2001 – August 2003
Student Intern and Electrical Engineer
- Rao executed generator interconnection studies for Independent Power Producers (IPPs) clients.
- Analyzed future generator and transmission needs in the Eastern Interconnection.

EDUCATION

THE UNIVERSITY OF MINNESOTA, Minneapolis, Minnesota
Carlson School of Management
Master of Business Administration, Global Executive Program May 2011
Emphases: Strategic Management, International Business

- Responsible for all financial aspects of marketing mobile charging services for Electric vehicles in the Singapore market.

UNIVERSITY OF TEXAS AT ARLINGTON, Arlington, Texas
Energy Systems Research Center (ESRC)
Master of Science in **Electrical Engineering** May 2002

- Master's Thesis in Economic Analysis of Distributed Generation (Photovoltaics (P.V.) and Fuel Cells)

BLOG POSTING, PUBLICATIONS & PRESENTATIONS

1. Co-Author for a graduate level textbook titled "Modern Electricity Systems: Engineering, Operations, and Policy to address Human and Environmental Needs". Release date - August 2022 with Wiley.
2. **He has authored multiple publications in Electricity Journal, Renewable Energy World (blog), and other peer-reviewed industry journals.**

BOARD & VOLUNTEER ACTIVITIES

- Board of Directors, Ever Green Energy. Sep 2019 – present
- Board of Directors, Minnesota Solar Energy Industries Association. Sep 2020 – Sep 2023.
- President, Finnish American Chamber of Commerce – Minnesota (FACC-MN). Jan 2016 - present