Rulemaking No.:	20-11-003
Exhibit No.:	
Witness:	
ALJ:	Stevens
Commissioner:	Batjer

Order Instituting Rulemaking to Establish Policies, Processes, and Rules to Ensure Reliable Electric Service in California in the Event of an Extreme Weather Event in 2021	Rulemaking 20-11-003

OPENING TESTIMONY OF JEFF BILLINTON
ON BEHALF OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION

January 11, 2021

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R.20-11-00

I. INTRODUCTION

Q1. What is your name and by whom are you employed?

A1. My name is Jeff Billinton. I am employed by the California Independent System Operator Corporation (CAISO), 250 Outcropping Way, Folsom, California as the Director of Transmission Infrastructure Planning.

Q2. Please describe your educational and professional background.

A2. I received a Bachelor of Science degree in Electrical Engineering at the University of Saskatchewan, Canada.

I have over 30 years of experience in the electric utility industry in distribution and transmission system design, construction, operations, and planning.

Q3. What is the purpose of your testimony?

A3. The purpose of my testimony is to demonstrate the need for additional energy supply or decreased demand to adequately prepare for summer 2021. I explain the analysis the CAISO conducted to determine what the planning reserve margin should be for June through October 2021. I also explain why the planning reserve margin should be maintained across both the peak load hours and the hours in the early evening when summer demands remain high and solar output is de minimus. Based on this analysis, I recommend the Commission adopt a 17.5% planning reserve margin for June through October 2021. A 17.5% planning reserve margin is less than the 20% planning reserve margin the CAISO initially proposed in its November 30, 2020 comments, as explained further below.

I also explain the CAISO's resource "stack analysis," which provides an assessment of the available, existing and planned, supply resources ability to meet the summer 2021 system needs with a planning reserve margin of 17.5%, both at the peak and net peak periods of the day.

Separately, Dr. Karl Meeusen provides testimony explaining the need for the Commission to increase the existing planning reserve margin for the months of June through October 2021 as part of its annual resource adequacy program. Dr. Meeusen's testimony explains how increasing the planning reserve margin will ensure new resources coming online are incremental and do not simply replace other existing generation under contract. Dr. Meeusen also explains how the CAISO's backstop procurement mechanisms interact with the planning reserve margin to ensure resources necessary to meet system requirements can be procured in a timely manner.

Q4. What are your recommendations in this proceeding?

A4. I recommend increasing the planning reserve margin to 17.5% for the months of June through October 2021 and applying the increased planning reserve margin to both the gross system peak demand and to the most critical hour after peak, when solar production is very low or zero.

II. NEED FOR AN INCREASED PLANNING RESERVE MARGIN

Q5. Why are you recommending increasing the planning reserve margin?

A5. The Commission established the current 15% planning reserve margin in 2006. The Commission applies the planning reserve margin to the 1-in-2 monthly peak demand forecast taken from the CEC's hourly forecast. It intended to cover operating reserve requirements, which are about six percent under reliability standard BAL-002-WECC-2a, with the remaining nine percent accounting for forced outages and higher than average load.

This construct is inconsistent with the performance of the evolving resource fleet and changing climate conditions. An updated planning reserve margin is necessary to ensure the State can continue to operate the electric grid reliably without having to shed load during heat events.

To maintain reliability, the CAISO must comply with several North American Electric Reliability Corporation (NERC) and Western Electricity Coordinating Council (WECC) standards in real-time. BAL-002-WECC-2a requires the CAISO to carry approximately six percent of expected load as contingency reserves. The contingency reserves required under BAL-002-WECC-2a cannot be used for operational needs other than contingencies, unless the CAISO is in an energy emergency alert condition. In addition, the CAISO needs unloaded capacity to meet operational needs like frequency response and regulation under BAL-003-2 and BAL-001-2. The planning reserve margin must account for a six percent contingency reserve requirement consistent with NERC and WECC standards.

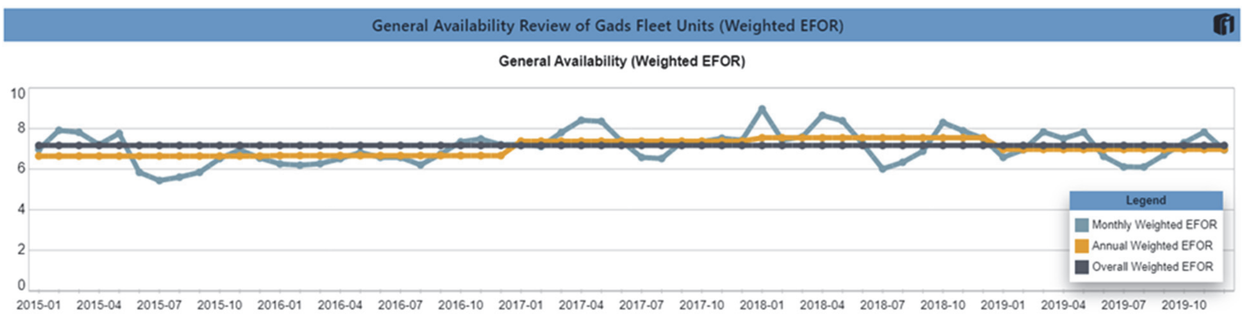
The planning reserve margin must also account for variability in the demand forecast. The CAISO is not proposing to change the base 1-in-2 demand forecast to which the planning reserve margin would be applied. However, to account for variations from the demand forecast, the CAISO compared the California Energy Commission's (CEC) 1-in-2 demand forecast that is currently used in establishing resource adequacy requirements to the CEC's 1-in-5 demand forecast. The 1-in-5 demand forecast is roughly four percent higher than the 1-in-2 demand forecast.[1] I recommend that four percent be used to account for variations in the demand forecast, but recognize the assumptions may need to be revisited in the future to consider whether allowance for 1-in-5 is truly sufficient in the long term.

The current 15% planning reserve margin would then leave an implied forced outage rate of 5%. However, the CAISO has observed forced outage rates that exceed this amount.

[1] California Energy Commission, 2019 Integrated Energy Policy Report (IEPR) mid managed 2019-2030 forecast, comparing 1-in-2 (Form 1.5b) and 1-in-5 (Form 1.5c) Net Electricity Peak Demand by Agency and Balancing Authority (MW) for the Total CAISO Coincident Peak.

NERC Generator Availability Data System (GADS) supports a finding that forced outage rates exceed those currently accounted for in the planning reserve margin. The GADS data show a forced outage rate of approximately 7.2% based on the weighted equivalent forced outage rate (WEFOR), which measures the probability that a group of units will not meet their generating requirements because of forced outages or forced derates. This is illustrated in Figure 1.[2]

Figure 1 – NERC GADS 2015-2019 Weighted EFOR



The outage data for specific resource types and sizes for the GADS fleet are illustrated in the GADS generating unit statistical brochures.

The GADS forced outage rate is a reasonable industry accepted measure of expected forced outages and I recommend that a 7.5% forced outage rate be used to allow for a more appropriate amount of expected forced outages.

Therefore, allowing for contingency reserve requirements, demand variability, and forced outage rates will require a planning reserve margin of 17.5% that would be applied to the same base 1-in-2 load forecast.

[2] NERC - General Availability Review (Weighted EFOR) Dashboard, www.nerc.com/pa/RAPA/Pages/GeneralAvailabilityReview.aspx

Q6. Why do you recommend applying the planning reserve margin to both the current peak load hour and most critical hour after peak hour?

A6. Consistent with current practice, the 17.5% planning reserve margin should apply to the peak hour. The current practice assumes resources available at the demand peak will be available during other hours of the day as well. Given increasing variable and intermittent resources, this assumption is no longer accurate, especially with solar resources generating at predictably lower levels during evening hours.

To address this concern, the Commission should apply the 17.5% planning reserve margin to the most critical hour after peak, when demand is still relatively high, but solar resource generation is below its net qualifying capacity value and output is rapidly declining. The Preliminary Root Cause Analysis (PRCA) prepared by the Commission, the CAISO, and the CEC specifically points to the net demand peak period—the peak of demand net of solar and wind generation resources—as an especially challenging period for grid operations during the August 2020 heat storm.[3] Significant renewable penetration has "shifted" the peak to later in the day and "[o]n hot days, load later in the day may still be high, after the gross peak has passed, because of air conditioning demand and other load that was being served by behind-the-meter solar comes back on the system."[4]

The CAISO's stack analysis, described in more detail in Section III, demonstrates the need to consider the most critical post-solar hour. The CAISO's stack analysis considers forecast demand and solar output profiles during the net demand peak period. The CAISO conducted the stack analysis on the hour that ends (HE) at 8 p.m. Pacific Daylight Time (PDT),[5] because solar generation is at or near zero by the end of the hour,

[3] *See* PRCA, p. 6-7. http://www.caiso.com/Documents/Preliminary-Root-Cause-Analysis-Rotating-Outages-August-2020.pdf.
[4] PRCA, p. 79.
[5] Referred to as "hour ending" (HE) 8 p.m.

but the demand remains relatively high compared to the peak.[6] Table 1 below shows this relationship. In July and August, the load for HE 8 p.m. PDT is only about 1,000 MW lower than the monthly peak, which occurs an hour or two earlier. For June, September, and October, the difference is much smaller.

Table 1: Comparison of June-October 2021 Peak Demand and Load for HE 8 p.m. PDT

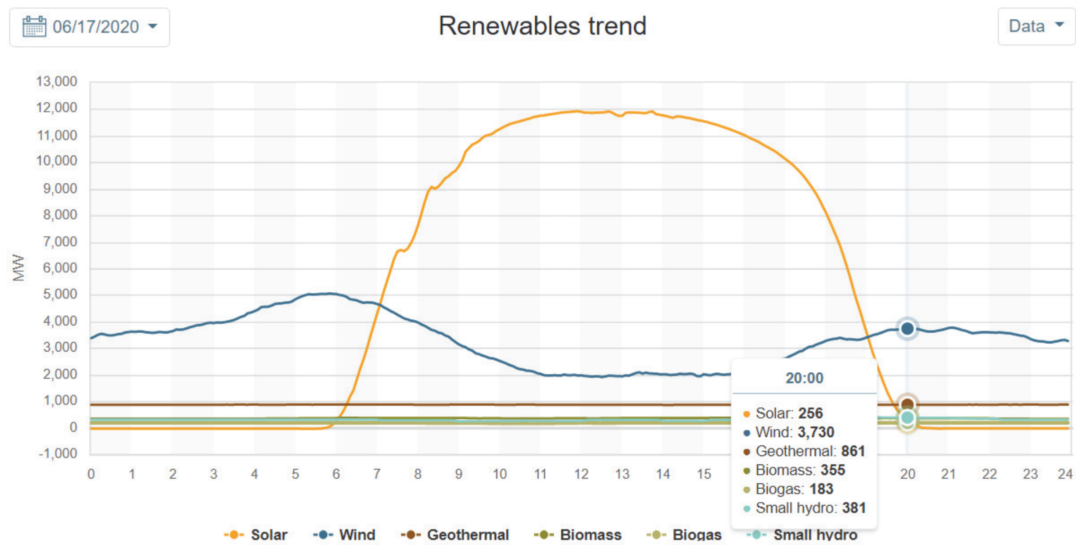
Month	Peak demand (MW)	Peak demand hour ending (PDT)	HE 8 p.m. PDT demand	Difference between Peak hour demand and HE 8 p.m. PDT demand ([B] - [D])
[A]	[B]	[C]	[D]	[E]
June	41,421	7 p.m.	41,104	317
July	44,485	6 p.m.	43,306	1,179
August	44,679	6 p.m.	43,644	1,035
September	45,184	7 p.m.	44,861	323
October	37,271	8 p.m.	37,271	0

Figure 2 below shows five individual days of actual renewable generation in the CAISO market from June through October 2020. Each figure shows that solar generation declines from a peak production of approximately 10,000 MW (or more) to less than 300 MW by 8:00 p.m. PDT.

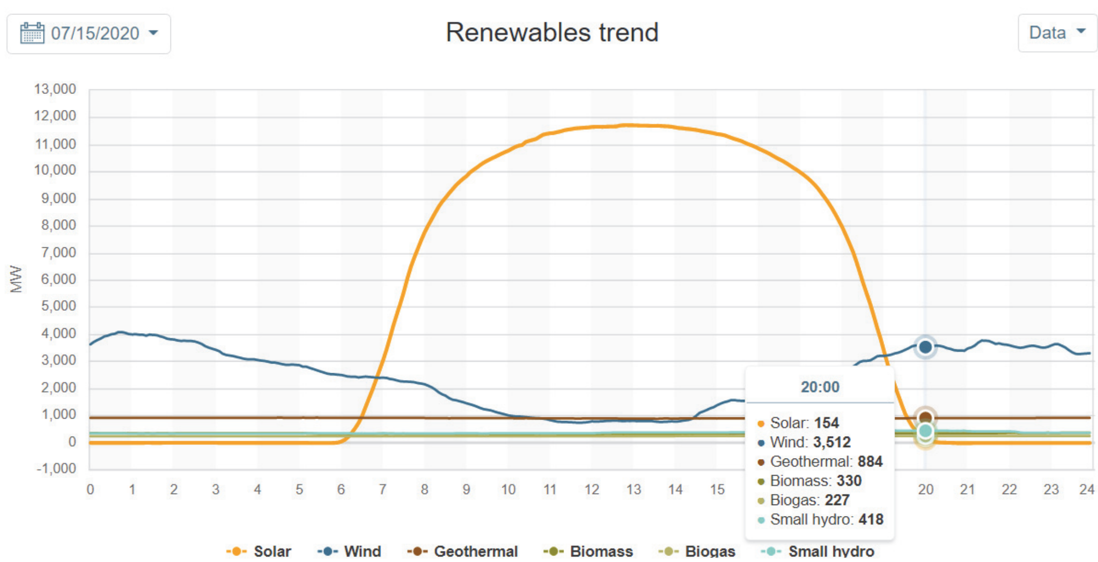
[6] The net demand peak does not always occur between 7 p.m. and 8 p.m. PDT. All times throughout this testimony are noted in PDT.

Figure 2: Mid-Month Snapshots of Renewable Generation in CAISO Footprint

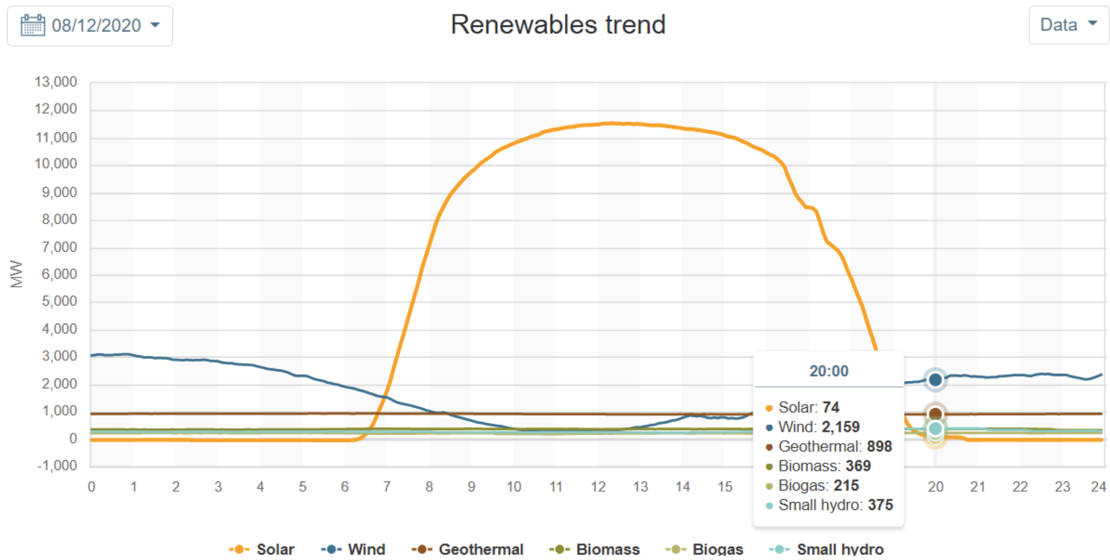
June 2020



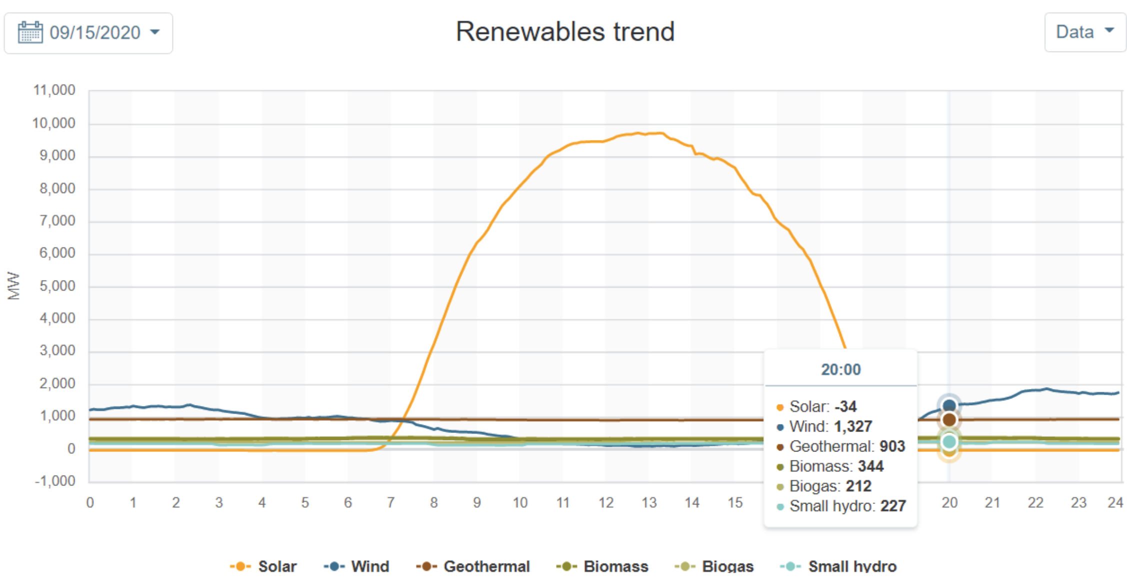
July 2020



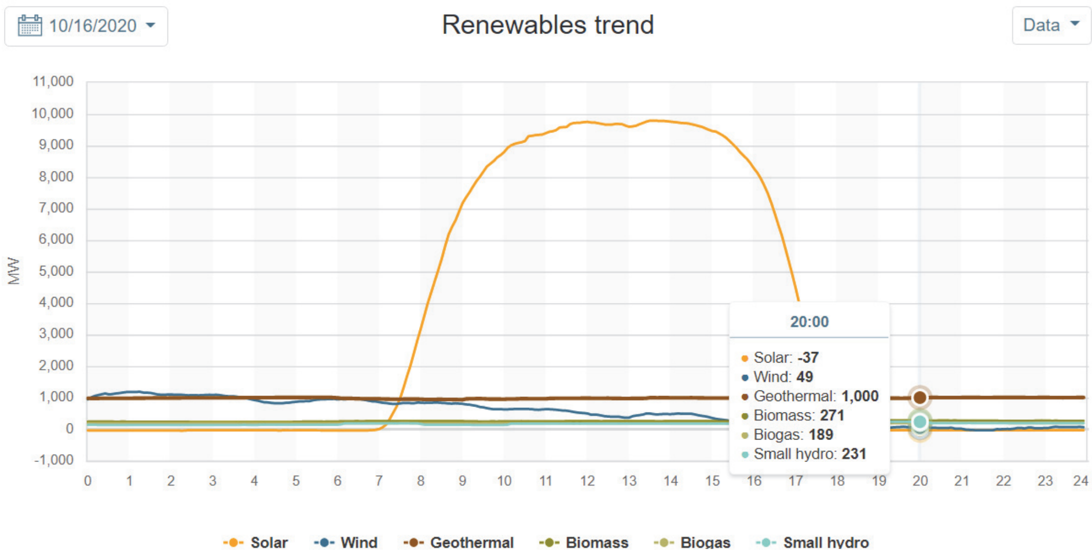
August 2020



September 2020



October 2020



The material drop in solar generation at this later critical hour, combined with little or no reduction in load level, necessitates consideration of the critical hour as well as the peak hour.

Q7: Please explain why the CAISO reduced its planning reserve margin recommendation from 20% to 17.5%.

A7. The 20% planning reserve margin recommendation was based in part CAISO data showing forced outage rates at or above ten percent during peak periods. Further review of forced outage rates during peak demand conditions, including in the PRCA, shows that the ten percent forced outage rate observed in the CAISO's original comments is likely an upper bound as the original assessment was at a daily granularity where some outages may be non-coincident both with other outages and peak load.

III. CAISO STACK ANALYSIS

Q8. Please describe the CAISO's resource stack analysis and the conclusions and recommendations you draw from it.

A8. The CAISO prepared a resource stack analysis to assess the ability of existing and planned resources to meet summer 2021 system needs, as described in response to Questions 5 and 6. The CAISO's stack analysis analyzes whether existing and planned resources will be sufficient to serve load, while maintaining sufficient reserves to meet reliability standards requirements. The stack analyses also takes into account for load forecast variability and generation forced outage rates, as described in response to Question 5. Finally, the analysis reviews the resource stack during the most critical hour after peak for each month from June through October 2021.

Traditionally, load and resource assessments such as the CAISO's stack analysis have focused on determining whether sufficient resources exist to meet load and reserve requirements at the peak load hour. As discussed in Question 6 however, with the proliferation of solar resources, both behind-the-meter and grid-connected, the most critical hours the CAISO typically faces now are after the peak load period when load is still relatively high, but intermittent resource generation is below its capacity value and output is rapidly declining. The CAISO conducted its analysis on the hour that ends at HE 8 p.m. PDT because solar generation is at or near zero by the end of the hour, but the load remains relatively high compared to the peak.

The CAISO stack analysis assumes there is no solar generation during the most critical hour. This assumption is reasonable because there is minimal solar output at 8 p.m., if not over the whole hour, in each of the summer months. For all other resources except demand response, the analysis reflects the 2021 net qualifying capacity (NQC) values available for each month. New and recently authorized resources are included for the months they are expected to be online. The stack analysis also includes Commission-credited historical 2020 investor owned utility demand response by month and without a planning reserve margin gross up.[7] Finally, the CAISO's stack analysis assumes resource

[7] The CAISO recognizes that the Commission may continue to credit demand response resources with a 15% planning reserve margin gross up in 2021. Including the planning reserve margin gross up would reduce the shortfall included in the CAISO's stack analysis. For example, the September 2021 shortfall would fall by 214 MW, from 2,194 MW to 1,980 MW based on the 1225 MW of credited DR and the 17.5% planning reserve margin gross.

adequacy import levels based on the historical monthly average from 2015 through 2020. The total resource stack is compared to the California Energy Commission's (CEC's) 2019 Integrated Energy Policy Report (IEPR) mid-mid managed 2021 hourly demand forecast based on 1-in-2 for the CAISO footprint, plus a 17.5% margin.[8]

Figure 3 below shows the resource stack for June through October 2021 compared with HE 8 p.m. PDT load plus a 17.5% planning reserve margin.

Figure 3: June – October 2021 Resource Stack vs. Load for HE 8 p.m. PDT
17.5% Planning Reserve Margin Level

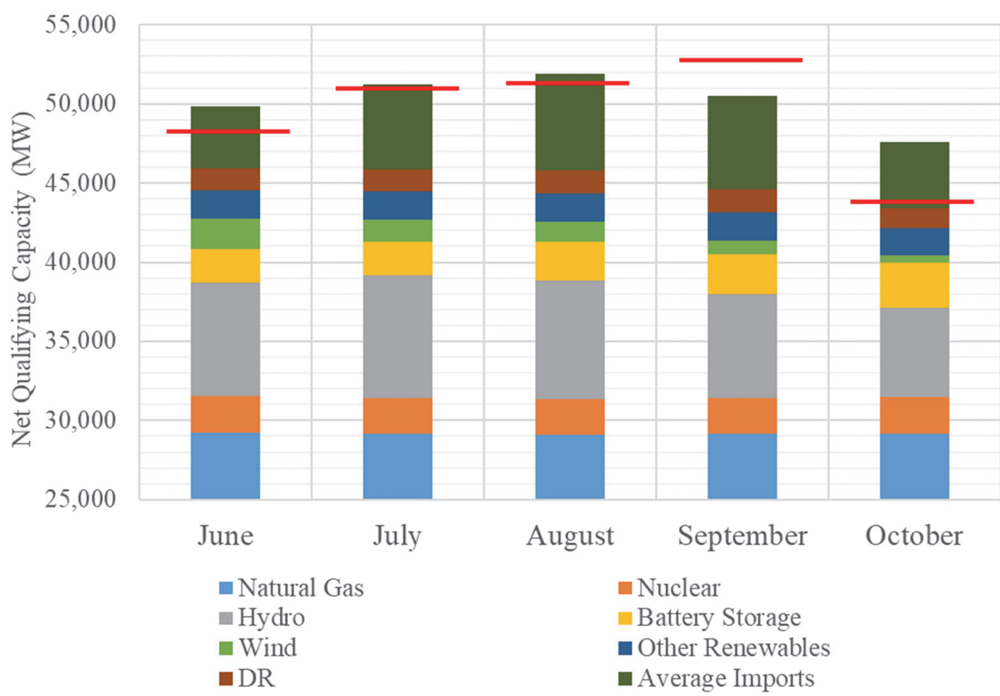


Table 2 below provides the numerical comparison between the total resource stack versus the same load and planning reserve margin. The table also includes a 15% planning margin applied to the load for HE 8 p.m. PDT.

[8] Note that the CEC IEPR data is in Pacific Standard Time, which does not reflect daylight saving.

Table 2: Comparison of 2021 Total Resource Stack and Load for HE 8 p.m. PDT 15% and 17.5% Planning Reserve Margin Levels

Month	Total resource stack with average RA imports (MW)	15% PRM plus load for HE 8 p.m. PDT	17.5% PRM plus load for HE 8 p.m. PDT	Total resource stack minus 15% PRM plus load ([B] - [C])	Total resource stack minus 17.5% PRM plus load ([B] - [D])
[A]	[B]	[C]	[D]	[E]	[F]
June	49,855	47,270	48,297	2,585	1,557
July	51,241	49,802	50,885	1,439	357
August	51,921	50,191	51,282	1,730	639
September	50,518	51,591	52,712	(1,073)	(2,194)
October	47,601	42,861	43,793	4,740	3,808

The results show a distinct difference between the five months. For June and October, the 17.5% margin level (shown as horizontal red lines in Figure 3) is below the total resource stack. This signals that for June and October there may be sufficient net qualifying capacity (NQC) available for procurement to satisfy the 17.5% planning reserve margin. In other words, for these two months load serving entities may be able to contract with existing resources to sufficiently respond to the most critical hour after peak.

For July and August the 17.5% margin level is relatively close to the total stack. This signals that for July and August almost all of the existing and planned resources available for procurement to are required to satisfy the 17.5% planning reserve margin.

However, the resource stack for September falls below the 17.5% margin level for HE 8 p.m. PDT as shown on Figure 3. This means there is insufficient capacity to meet the requirement even when including all of the resources on the NQC list, new resources expected online by summer 2021, plus an average level of resource adequacy imports. For September, the shortfall between the total resource capacity and the load plus 17.5%

planning reserve margin is approximately 2,200 MW (shown as a negative value in Table 2, column [F]).

To test the reasonableness of conclusions in its analysis, the CAISO also conducted a sensitivity study using the maximum contracted resource adequacy import showings over the past five years, instead of the average contracted import capacity used in the preceding analysis. The maximum resource adequacy import showing over any summer month over the last 5 years was during September 2020, at approximately 8,500 MW. Assuming resource adequacy imports at 8,500 MW, the resource stack would only produce an 18% planning reserve margin for September, only marginally higher than the 17.5% margin the CAISO found necessary to meet BAL-002-WECC-2a requirements on a forecast basis.

IV. CONCLUSION

Q9. Please summarize your recommendations.

A9. I recommend the Commission adopt a 17.5% planning reserve margin for June through October 2021 and that the planning reserve margin should be maintained across both the peak load hours and the hours in the early evening when summer demands remain high and solar output is de minimus.

Q10. Does this conclude your testimony?

A10. Yes, it does.