Memorandum

To: ISO Board of Governors

From: Neil Millar, Vice President, Infrastructure & Operation Planning

Date: May 12, 2021

Re: **Briefing on 2021 Summer Loads and Resources Assessment**

This memorandum does not require Board action.

INTRODUCTION

The ISO's 2021 Summer Loads and Resources Assessment presents the expected supply and demand conditions for the 2021 summer peak demand period. This annual assessment helps the ISO, industry participants, and other key stakeholders in planning and preparing grid operation for the upcoming summer season. This briefing provides the ISO Board of Governors with results and information on the following topics that are included in this year's assessment:

- Forecast of ISO peak demand for 2021;
- Discussion of current hydro conditions and expectations for the summer power supply;
- Generation additions and retirements;
- Results of stochastic and deterministic Assessments of capacity margins in the ISO system under diverse operating conditions and scenarios; and
- An update on the status of the Aliso Canyon gas storage facility.

Summary

The ISO anticipates supply conditions in 2021 to be better than 2020, but continues to see potential challenges in meeting demand during extreme heatwaves affecting a substantial portion of the Western Interconnection causing simultaneously high loads across the West and reducing the availability of imports into the ISO balancing authority area. Improvements to supply conditions in 2021 are largely driven by the addition of new resources coming online as early as this summer. However, while forecasted load levels remain virtually unchanged under normal conditions, a second year of significantly lower than normal hydro conditions and an increased possibility of extreme weather events indicate the ISO may still face challenges in meeting load this summer.

Recent data from NOAA[1] confirms that conditions in the West are getting hotter and drier.

Capacity shortfalls this summer may be mitigated by additional extraordinary measures accessed under extreme or emergency conditions to minimize the risk of actual firm load shedding. Since September 2020 the ISO has been working to enhance its operational procedures to prepare to operate reliably this summer including the ability to access these extraordinary measures. The ISO will continue to find and act on such opportunities as available and necessary, but is guardedly optimistic regarding its operations this summer given the measures already taken, including the greater coordination with the State and regional entities. Conservation during extreme events will continue to be critical to avoid shedding load. The ISO and the State entities have taken significant measures to inform consumers in a timely manner through the Flex Alert campaign to conserve energy when requested to avoid outages.

Additional findings for the 2021 Assessment include:

- Forecasted peak 1-in-2 and 1-in-5 demand relatively unchanged from 2020, however, the 1-in-10 demand is significantly greater;
- Hydro conditions are below normal for the second consecutive year;
- The net of resource additions and retirements is an increase of approximately 2,000 MW on a net qualifying capacity basis. In total, 3,880 MW of generation participating in the ISO market were added with a net increase of dispatchable capacity of 1,570 MW, of which 1,493 is from battery energy storage systems; and,
- The risk associated with ongoing Aliso Canyon related gas restrictions remain about the same as last summer and SoCalGas should be able to meet the forecasted summer peak day gas demand.

Each of these findings is discussed in greater detail below.

Peak Demand Forecast

The 2021 1-in-2 summer peak demand forecast, derived from the 50th percentile of the historical weather data from weather stations across the ISO, is 45,835 MW. The 1-in-2 and 1-in-5 forecast levels are virtually unchanged for 2021, however the 1-in-10 forecast is significantly higher than the 2020 forecast. The higher loads associated with a 1-in-10 weather event are attributable to including last year's extreme weather events in the historical weather database that is used to develop the range of load forecasts. This changed the high temperature end of the weather distribution profile such that the probability of the historical extreme heat events are now within the range of a 1-in-10 weather event. The ISO 2021 1-in-10 peak demand forecast is 50,968 MW – 11 percent higher than the 1-in-2 forecast level, a significant increase from the 6 percent

[1] https://www.noaa.gov/news/new-us-climate-normals-are-here-what-do-they-tell-us-about-climate-change

incrementally higher demand that the 2020 1-in-10 demand forecast was over the 1-in-2 forecast.

In monitoring the impact to peak demands due to COVID-19 during 2020, minimal to no load reductions to daily summer peak demand levels were observed during warmer weather. The ISO forecast models utilize the economic growth projections from Moody's Analytics, which contain their projections of the continuing economic impacts due to COVID-19. With the significant unknowns in how the COVID-19 pandemic will continue to impact society and how the various electric sectors use energy, no attempt was made to predict potential ongoing impacts to loads due to COVID-19 beyond the impact the forecast model attributes to changes in economic growth associated with the forecast from Moody's.

Hydro Conditions

Energy supplies from California hydro facilities will be significantly lower than normal during 2021. California is in a second consecutive year of below normal precipitation statewide. Snow water content for 2021 peaked at 60 percent of normal, similar to the 63 percent level for 2020, but to date, 2021 runoff from snowmelt has occurred earlier than in 2020, which was earlier than normal itself, and the average water levels of large reservoirs for 2021 is at 70 percent of normal compared to 2020 levels of 101 percent of normal. The ISO used Northwest River Forecast Center projections as an indication of potential imports into California from the Northwest, and The Dalles Dam on the Columbia River is generally used as a representative indicator. The current April to September reservoir storage projection at The Dalles Dam on the Columbia River is 89 percent of average.

Available Generation

The ISO projects system capacity of 49,583 MW in June, 50,734 MW in July, 50,010 MW in August, and 47,385 MW in September for summer 2021. The decline of available capacity from July to September derives from the diminishing effective load carrying capability of solar and hydro generation.

From June 1, 2020 to September 1, 2021, approximately 3,961 MW[2] of installed capacity is expected to reach commercial operation: 1,613 MW is dispatchable and 2,348 MW is non-dispatchable.[3] During the same period, 81 MW of generation capacity will retire or mothball: 43 MW is dispatchable and 38 MW is non-dispatchable. The net of additions and retirements is an increase of 3,880 MW, with a net increase of

[2] New resource capacity was developed from the ISO Master File and the New Resource Implementation process to determine the anticipated commercial operation date of new resources expected to come online within the 2021 Assessment study period. The amounts were based on known information as of 3/24/2021. New resources from this process were cross checked against resources known by the CPUC to be sure all resources the CPUC is expecting were accounted for.

[3] Non-dispatchable resources are technologies that are dependent on a variable fuel source and are modeled in PLEXOS as energy production profiles based on historical generation patterns. Non-dispatchable technologies include biofuels, geothermal, wind, solar, run-of-river hydro, and non-dispatchable natural gas.

dispatchable capacity of 1,570 MW. While delays in expected new resource additions yet to achieve their commercial operation date is not anticipated, a delay in a significant amount of this capacity could impact the results of the 2021 Assessment.

Of the new resource capacity coming online, 1,493 MW is from battery energy storage systems coming online by 9/1/2021. While not providing new energy generation, battery energy storage systems enable surplus energy generated during periods of high solar production and energy generated during periods of lower energy prices to be stored and provided to meet system needs during the net peak period when solar production ramps down and is no longer available. Battery energy storage systems are able to provide system capacity, ancillary service and flexible capacity.

Assessment of Reserve Margins

Stochastic Modeling Analysis

The ISO developed a stochastic production simulation model to assess hourly operating conditions given the ISO's diverse resource mix of thermal generation, variable renewable resources and more recently, batter energy storage resources. The model runs 2,000 unique randomly generated scenarios of forecasted hourly load and renewable generation to assess the ISO's resource adequacy in system capacity, ancillary service, and flexible capacity on an hourly basis.

The ISO performed base case and sensitivity analyses, modeling the system under conditions where imports are more favorable (base case), and modeling the system under conditions where imports are limited to the amounts typically procured to meet requirements of the resource adequacy program (sensitivity case).

Table 1 compares the probabilities of an ISO system capacity shortfall of the base case and the sensitivity case, revealing the criticality of net imports to the ISO during system peak hours at high load conditions. The 2021 results are an improvement in system supply conditions over 2020. However, if the ISO is limited to the more conservative net import levels of the sensitivity case, the probability of having to shed firm load to maintain required operating reserves is significantly increased. This indicates that the ISO will be at the greatest operational risk during weather events resulting in simultaneous high loads across the West. Of particular concern would be a widespread late summer heatwave that affects a substantial portion of the Western Interconnection, resulting in low imports concurrent with the diminishing effective load carrying capability of solar resources and the wane of hydro generation.

Table 1

Probabilities for System Capacity Shortages

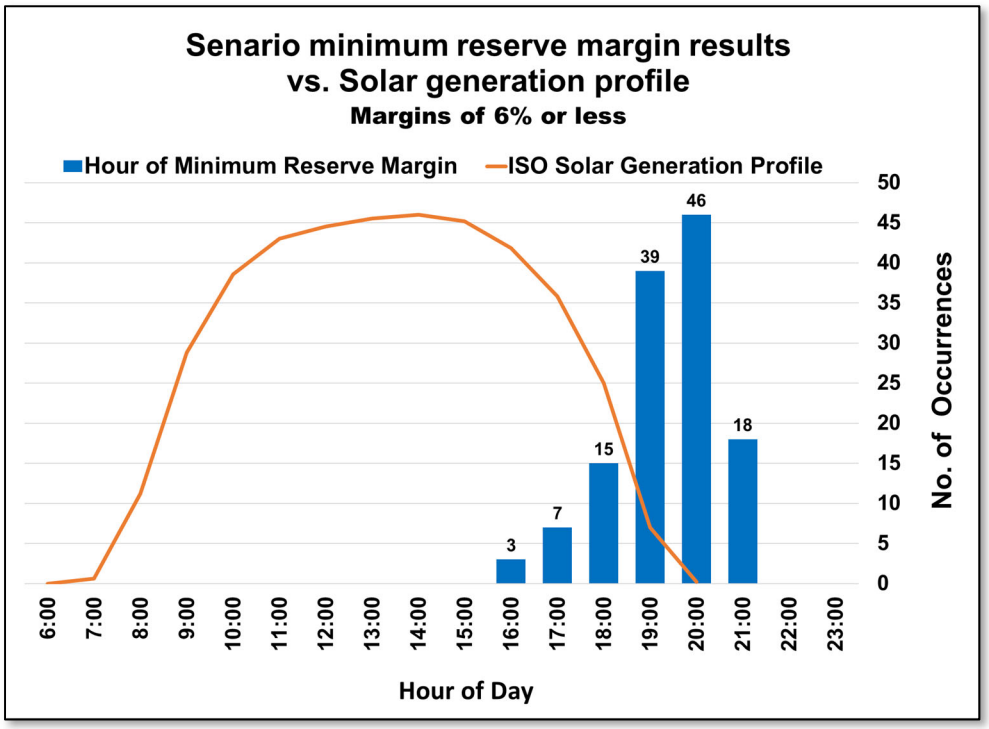
Result	Base Case	Sensitivity Case
Stage 2	6.4%	14.1%
Stage 3	4.8%	12.5%
Unserved energy	4.6%	12.4%

The extraordinary measures the ISO has been working on to enhance its operational procedures are not captured in the production simulation modeling. As a result, actions by the ISO in coordination with the State and regional entities have the ability to decrease the probability of having to shed firm load during extreme operating condition.

The probabilities for operating at the stage 2 and 3 emergency conditions are based on the minimum reserve margins within each of the model's 2,000 scenarios. The minimum reserve margin is used to show the likelihood of reaching various levels of low operating reserves for at least one hour over the summer period. *Figure 1* shows the base case distribution of the minimum reserve margins, for samples with reserves of 6% or less, over the hours of the day that they occurred. The hours of solar generation anticipated during the 2021 summer peak day is shown to demonstrate that 80 percent of the minimum reserve margins occurred during the ISO's daily peak hours ending 19:00 to 21:00 – the hours of little to no production from solar resources. *Figure 1* demonstrates that resource adequacy levels are most challenged in the post-solar window, as reductions in the gas fleet have not yet been offset by sufficient new energy storage resources to compensate for the loss of capacity available in that window.

Figure 1

Hours of greatest risk
Samples with reserves of 6% or less
(Stage 2 emergency)



Deterministic Stack Analysis

In the course of assessing adequate resource procurement targets and minimum resource needs under the California Public Utilities Commission's resource adequacy program, the ISO performed a deterministic stack analysis. In addition to the stochastic modeling described above, the ISO deterministic stack analysis is included to provide an additional perspective on the amount of capacity the ISO is expecting to be available for summer 2021 and the level of reliability that is anticipated under various load levels and import conditions.

Figure 2 shows the result of the deterministic stack analysis for the month of September, 2021, at 8 pm, the month and hour of the greatest supply risk. The amount of new resources shown in *Figure 2* are based on a CPUC presentation[4] that shows 2,388 MW of expected new capacity coming online between August 1 2020 and August 1, 2021.

[4] https://www.google.com/url?client=internal-element-cse&cx=001779225245372747843:e2wnztai65q&q=https://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx%3Fid%3D6442466860&sa=U&ved=2ahUKEwjWzYWMgKfwAhXjFDQIHeV-AyAQFjAAegQIARAB&usg=AOvVaw0ZSlD_aBQW-I1GlJ_Zjqle

The 2,388 was adjusted to 2,230 by removing the solar resource capacity not associated with a storage component to account for the 8 pm time of day when solar generation is not available. The three bars of stacked resources portray three scenarios of progressively increasing resource amounts. Moving from left to right, the first bar represents resources similar to the stochastic sensitivity case, where imports are limited to the average of the last six-years of RA imports[5] procured by the load serving entities to meet their collective RA obligations. The middle bar represents an increase in the RA import level to 8,500 MW, the highest amount procured for the month of September over the last 6 years. The bar on the right further increases the level of imports from the middle bar by assuming an additional 1,000 MW of non-RA economic imports during the peak period. As with the stochastic sensitivity results, *Figure 2* demonstrates the importance of imports above typical RA import levels for meeting 1-in-2 and higher peak demand conditions during late summer.

- The bar on the left shows that if the system is limited to imports of 5,921 MW the 15% planning reserve margin (PRM) associated with 1-in-2 load cannot be met in September.

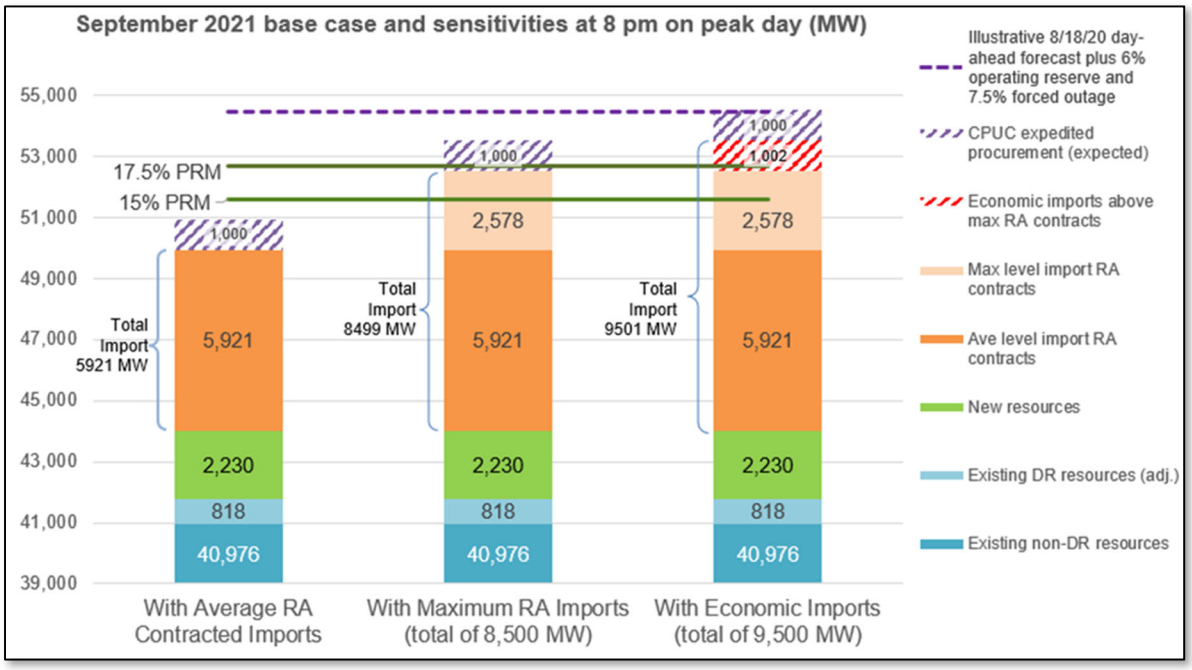
- The middle bar shows that if system imports reach 8,499 MW, approximately 2,600 MW greater than the typical RA procurement levels, 1-in-5 loads and the 17.5 percent planning reserve margin can be met.

- The bar on the right demonstrates that loads equivalent to the day-ahead forecast for August 18, 2020, the day of the ISO 2020 summer peak, would only be met if imports reach to a level of approximately 3,600 MW greater than the typical RA procurement levels and forced outages do not exceed the normal 7.5 percent rate.

[5] The 2015 – 2020 average of the total import capacity procured by all load serving entities to meet their RA obligation is 5,921 MW.

Figure 2

ISO stack analysis for September 2021
(PRM levels based on CEC 1-in-2 load forecast plus planning reserve margin)



Status of the Aliso Canyon Gas Storage Operating Restrictions

On April 1, 2021, SoCalGas published its Summer 2021 Technical Assessment, which concluded that conditions remained about the same as last year and that SoCalGas will be able to meet the forecasted summer peak day demand, even without supply from Aliso Canyon. In addition, SoCalGas has more flexibility to use Aliso Canyon to balance the system and ease energy price spikes pursuant to revisions made by the CPUC on July 23, 2019 under the Aliso Canyon Withdrawal Protocol to remove its classification as “an asset of last resort.”

Preparation for Summer Operation

Preparing and publishing the summer assessment report and socializing its results with industry participants and stakeholders is one of many activities the ISO undertakes each year to prepare for summer system operations. Given the widespread heatwave events of 2020 that led to firm load shedding in the ISO balancing authority area, the ISO, State entities, and others have taken a host of measures to improve system preparedness and performance in 2021. These include pursuing and approving procurement of additional resources, ensuring existing resources are retained in service, and improving operational readiness and measures to access resources or load reductions that can be implemented when faced with the risk of shortfalls. Those reforms, modifications and other actions were

discussed publicly most recently at a California Energy Commission workshop on summer 2021 reliability[6] held on May 4, 2021.

Other routine preparatory activities include coordinating meetings on summer preparedness with the WECC, California Department of Forestry and Fire Protection, natural gas providers, transmission operators and neighboring balancing areas. For 2021, the ISO engaged these entities in a tabletop exercise where participants walked through scenarios that started seven days out from a peak load day and proceed through to the potential need for shedding load in real time. The exercise practiced using the ISO's Alerts, Warnings and Emergencies procedures, communications protocols, recent policy changes, and contingency reserve management procedures. The ISO's ongoing coordination activities with these entities will help to ensure everyone is prepared for the upcoming summer operational season.

[6] CEC Integrated Energy Policy Report Joint Agency Workshop on Summer 2021 Reliability - Reliability Outlook, May 4, 2021, available at: https://www.energy.ca.gov/event/meeting/2021-05/session-1-iepr-joint-agency-workshop-summer-2021-reliability-reliability