Stakeholder Comments Template

FRACMOO 2 Stakeholder Working Group

This template has been created for submission of stakeholder comments on the FRACMOO 2 Working Group Call that was held on August 2, 2017. The working group presentations and other information related to this initiative may be found at: http://www.caiso.com/informed/Pages/StakeholderProcesses/FlexibleResourceAdequacyCriteria-MustOfferObligations.aspx

Submitted by	Company	Date Submitted
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Upon completion of this template, please submit it to initiativecomments@caiso.com. Submissions are requested by close of business on **August 18, 2017.**

Please provide your organization's comments on the following items:

1. **Operational issues discussed during the working group related to flexible capacity needs.**

   LS Power supports CAISO's analysis and agrees that operational issues will only get worse as more inflexible capacity gets integrated into the grid and not enough fast ramping flexible capacity is available to manage ramping challenges. As noted in CAISO's presentation, operational issues and NERC CPS compliance violation risks exist during the day time when all solar generation is close to full dispatch and also during the evening after solar ramps off. Flexible Capacity product development should take both of these issues in account and analyze if there is a need for developing Flex Down capacity products in addition to Flex Up capacity products.

   We fully support CAISO in working towards creating market products that can help Operators manage these challenges. Unless market products are procured to address these operational issues, there will be no choice left but to handle these issues in Real Time, which may lead to exceptional dispatches (Out of Market), procuring more Ancillary Services (added ratepayer cost), and significantly more renewable curtailment (hurting progress towards GHG goals).

2. **Proposed flexible capacity procurement framework presented by The Brattle Group.**

   LS Power generally supports the proposed framework, however due to it being a high level proposal at this time, we would like to request that CAISO share more information on the scope of this analysis and invite stakeholder feedback before finalizing it's recommendation.

3. **Proposed flexibility metrics and any additional metrics that you believe the CAISO should consider.**

LS Power agrees with CAISO's proposal to look into the need for shorter duration flexible capacity products such one hour, 15-min, 5-min in addition to the three hour product. We further suggest that CAISO consider: 1) Fast start time requirements (seconds or minutes, not hours); 2) Low or zero minimum loads; and 3) Fast ramp rates (Up and Down).

As CAISO further thinks about developing these products, it should consider an additional metric which should account for the issues caused by over-supply and should attempt to define how much curtailment of renewables should be allowed during over-supply. In Front of the Meter Solar resources are often curtailed middle of the day when CAISO experiences over-supply conditions. This is done partly to create room for the conventional flexible capacity fleet to stay online during oversupply hours so it is available to ramp up after Solar ramps off in the evening. This leads to renewable curtailments, takes California away from its GHG goals and is potentially leading to uneconomic outcomes which hurts CAISO ratepayers. If Flex Capacity products are developed (both Flex Up and Down) then these issues can be optimally resolved.

4. **Plan to move the flexible capacity initiative forward.**

LS Power encourages that CAISO should move expeditiously to complete the FRACMOO 2 initiative, and implement shorter duration flexible capacity products which recognize the value of fast start and ramp time in both the Up and Down direction. It is only prudent planning to develop more flexible capacity products before the operational issues already manifesting themselves in the CAISO market become unmanageable or needlessly expensive to manage.

5. **Any other comments.**

In the following Section, we attempt to demonstrate how the operational challenges could potentially get much worse as California approaches 50% RPS and as a result development of new Flexible Capacity products should be done in a timely fashion so these issues can be optimally, reliably and economically resolved.

It is widely understood that meeting California's goals for 50% renewable energy will lead to a huge increase in solar power connected to the CAISO grid. This is a great thing for the state. It also presents great challenges for getting the right mix of flexible grid assets online that the grid operators will need. Owners of photovoltaic generation serving CAISO have seen frequent curtailment already in 2017, indicating that CAISO already has more solar power than the grid can handle some days, made worse by the non-dispatchability, slow ramp rates, and long start times of much of the existing generation fleet. Curtailment may be an operational necessity at times, but it means that clean solar power is being spilled so that fossil fueled peaking generation can run instead, undermining California's GHG and Renewable Portfolio Standard goals.

To meet both the CAISO's operational standards and the state's GHG goals, curtailment must be minimized, and that means incentivizing and adding thousands of megawatts of truly flexible capacity with the following characteristics:

- Fast start times (seconds or minutes, not hours)
- Low or zero minimum load
- Fast ramp rates in both the up and down directions

The figures below are intended to help visually illustrate the need for Flexible Capacity that addresses ramping and over generation.

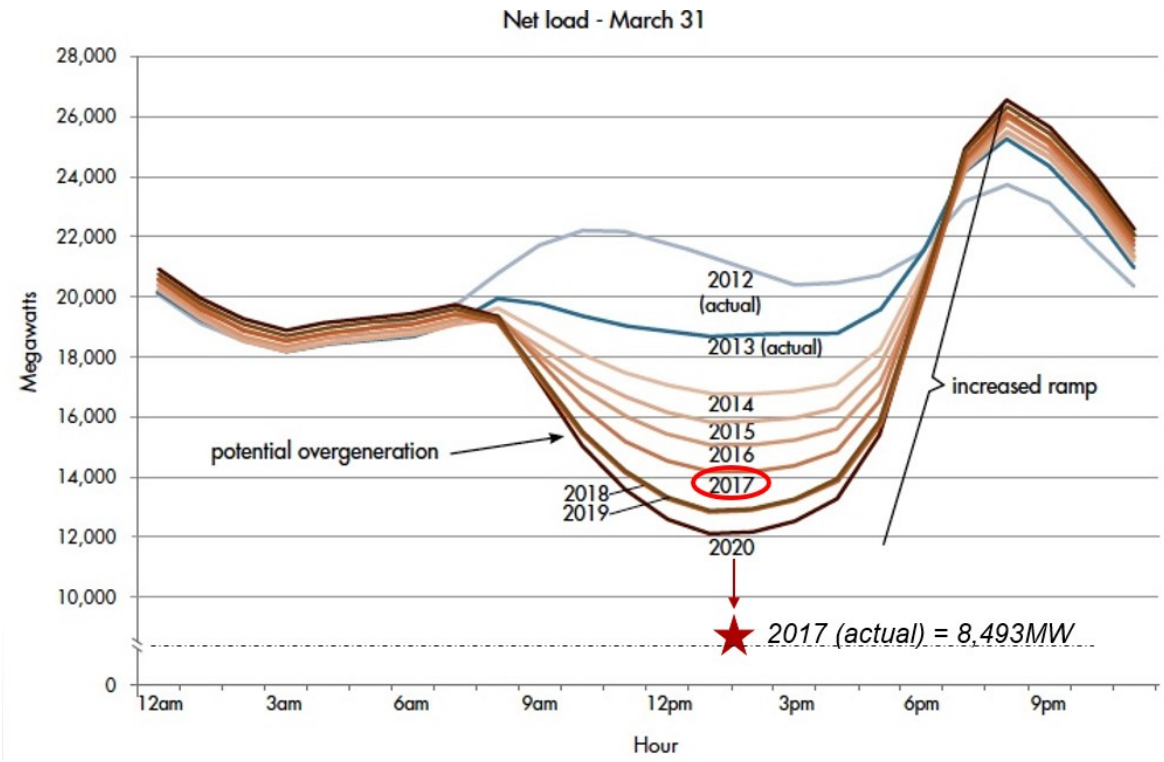

Figure 1: CAISO's original "Duck Chart", with the added star showing actual low Net Load on May 14, 2017

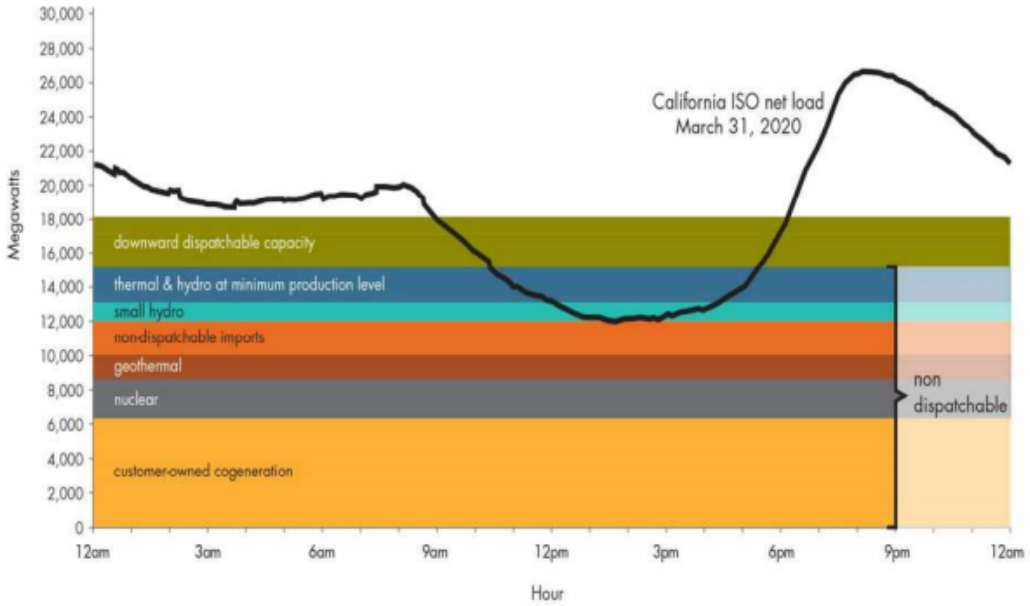

Figure 2: The Duck Chart and non-dispatchable generation. Source: Prepared Statement of Brad Bouillon on behalf of the California Independent System Operator Corporation.
https://www.ferc.gov/CalendarFiles/20140610083142-Bouillon,%20CAISO.pdf

Almost everyone in the California energy industry is familiar with the "duck chart" projections, but it is important to stress just how far ahead of schedule we are. 2017's minimum net load was on May 14, 2017, and was more than 5500 MW lower than anticipated when the original forecast was made. Figure 1 adds the actual net load number to the original figure from CAISO. Figure 2 is from a 2014 FERC filing, when CAISO presented their analysis around the original duck chart, which included documenting that their non-dispatchable generation was approximately 15,000 MW. This means that net loads below 15,000 MW will require curtailment or extraordinary and undesirable out of market actions to maintain reliability, unless the state's generation mix becomes far more flexible, and negative generation from solar becomes a reality at a very large scale.

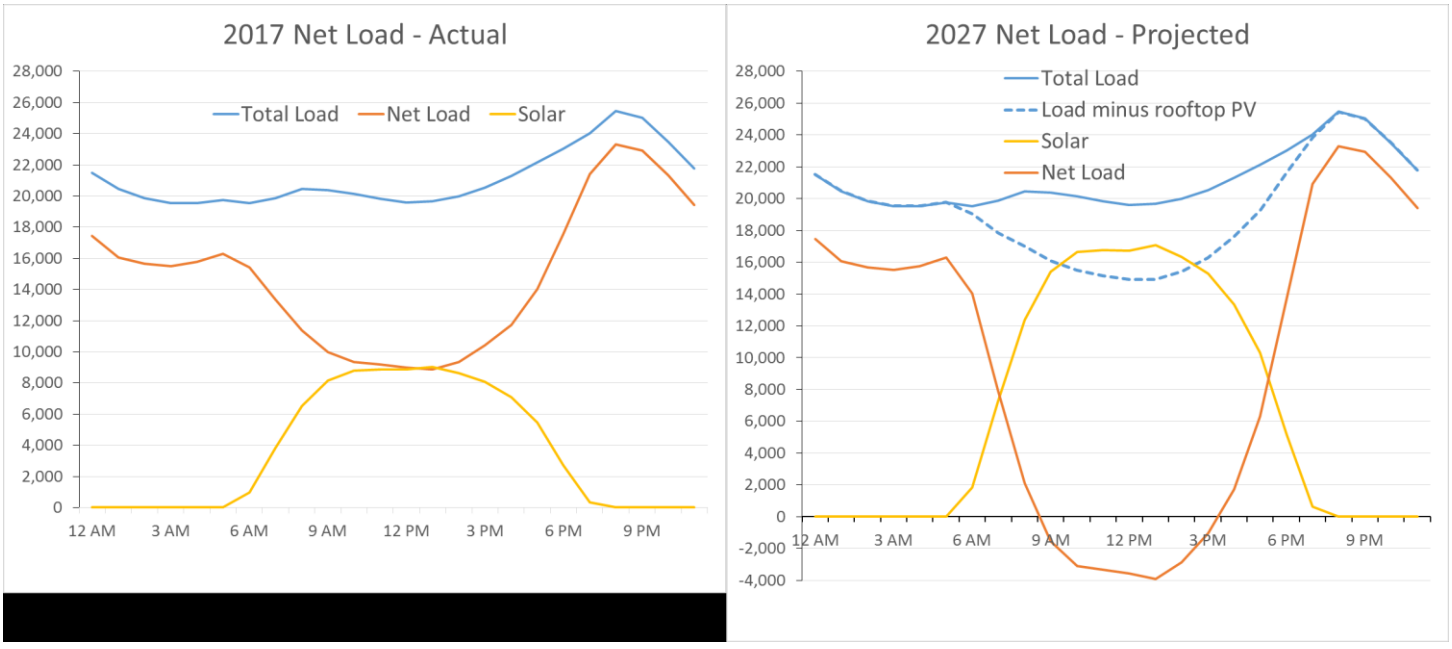

Figure 3 (Left): Actual Net Load and Solar PV from May 14, 2017. Data Source: CAISO OASIS

Figure 4 (Right): Projected Net Load in 2027 based on Actual Net Load in 2017 and the California Energy Commission's mid-case projection for solar photovoltaic adoption. Data Source: CAISO OASIS and California Energy Commission

Figure 3 shows the Actual Solar generation, Load, and Net Load (Total Load minus wind and solar) from CAISO's publicly available data for May 14, 2017. This is a "real duck curve" and not a forecast. The data for this day is remarkable, even more so because it was generated *after* the curtailment of an average 1000 MW during overgen hours, or over 6,000 MWh total of wind and solar energy[1], and it could have had an even more severe profile without this curtailment.

Using this data and the baseline forecast for solar PV penetration from the CEC, LS Power created the projection shown in Figure 4. The spreadsheet with this data is available on request, and all data is from official public sources (CEC and CAISO).

The Projected net load for 2027 as shown in Figure 4 takes the Actual data from May 2017 and scales the solar PV up to a total of 17,962 MW of photovoltaic capacity, with an increase up to 9,500MW of distributed photovoltaics reducing peak load (wind and all other sources were not altered). We include this chart to illustrate a few key points:

1. Net load ramp rates projected for the upcoming solar eclipse will become an everyday phenomenon on the grid in just a few years.
2. Using traditional generation with multi-hour start times and substantial minimum load levels to deal with these growing ramp rates will worsen the over generation and curtailment problem.
3. Curtailment is already a reality for operating the grid today, and there is a lot more solar coming. Without incentivizing flexible capacity, California will need to curtail *the majority* of its solar output on a typical day within 10 years. This would severely undermine progress toward state RPS goals, and can be avoided with the right mix of assets with the right flexible capacity attributes.

We thank CAISO for the opportunity to submit these comments, and strongly urge all stakeholders to support market mechanisms to incentivize truly flexible capacity that will enable California to meet its GHG goals in the most cost effective and reliable manner possible.

[1] Source: http://www.caiso.com/Documents/Wind_SolarReal-TimeDispatchCurtailmentReportMay14_2017.pdf