

**BEFORE THE
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION**

Reliability Technical Conference

Docket No. AD15-7-000

**Prepared Statement of Mark Rothleder on behalf of the California
Independent System Operator Corporation**

On behalf of the California Independent System Operator Corporation (CAISO), I offer these comments for consideration by the Commission as part of its June 4, 2015 reliability technical conference. I serve as Vice President, Market Quality and Renewable Integration at the California Independent System Operator Corporation. In this role, I lead the CAISO's renewable integration work. Prior to this role, I served as Executive Director of Market Analysis and Development and oversaw the design and implementation of market rules and software modifications related to the launch and implementation of the CAISO's nodal markets.

My comments address how we will need to modify our study approaches as we transition to low-carbon electric grid to ensure we maintain reliability during this transformation. My comments also encourage the Commission and the Electric Reliability Organization (ERO) to ensure mechanisms exist to obtain the reliability services to operate the electric grid with significant variable energy resources.

I. Transitioning to a low-carbon grid requires grid operators to modify planning study approaches

Over the last decade, the CAISO balancing authority has successfully integrated a tremendous increase in variable energy resources. Among other state environmental policies, California has a 33 percent renewable portfolio standard by 2020 and a target to reduce greenhouse gas emissions to 1990 levels by 2020. California is examining increasing its renewable portfolio standard to 50 percent by 2030. California is also considering increasing its Greenhouse Gas emission reduction goals to achieve 40 percent of 1990 levels by 2030 and 80 percent of 1990 levels by 2050. The CAISO expects that its fleet of renewable resources will continue to grow. Renewable development is also happening in other parts of the West and the CAISO expects that increasing renewables will be a critical strategy for states developing compliance approaches with any final rule adopted by the United States Environmental Protection plan to reduce emissions from existing power plants. Besides renewable development throughout the West, the CAISO also expects increased use of natural gas as coal plants either retire or are repowered. In addition, we expect the growth of behind-the-meter solar resource to continue.

The CAISO and other balancing authority areas in the West must adjust and refine planning study approaches to address the ongoing transformation of the electric grid. These studies will be iterative as increased regional collaboration across the West will help ensure we can operate a low carbon grid. As a foundational matter, we will need to refresh models regularly to reflect system changes. These changes will include new transmission elements, new

resources, and the resultant changing characteristics to operate the grid reliably. Planning studies have become increasingly stochastic (as opposed to deterministic) because grid operators must study variability of resource output we cannot precisely predict. Instead, we are examining patterns we can statically analyze.

Planning studies will need to quantify and assess resource characteristics, including ramping capability, minimum operating levels, and the capability to start and stop a resource more than once a day. To operate a low-carbon grid powered with variable resources, the CAISO and other balancing authorities must assess the need for these flexible characteristics and the capability of the resource fleet to provide them. We will also need to understand any constraints or changes in demand on natural gas pipelines and storage facilities to make sure that adequate fuel will be available to balance the system.

The CAISO also must model variability from resources like wind and solar during seasonal timeframes and in the day-ahead and real time to account for differing levels of uncertainty relative to resource commitment decisions. This effort raises the question of how to model conventional and hydro-electric resources based on the operating patterns of variable energy resources. Understanding unit commitment decisions in a stochastic modeling will become increasingly important to ensure we have resource characteristics to meet ramping needs and arrest frequency excursions. In addition, the CAISO must expand its study efforts to model distributed energy resources and their impact on grid operations.

The CAISO has embarked on a high level scope of work to study the impacts of distributed energy resources on the CAISO's controlled grid. This study includes potential changes to the utilization of the transmission system with increasing levels of DER, which may cause operational challenges or opportunities resulting from the distributed level of visibility and control of such resources, and potentially stranding elements of the transmission system.

With current penetration levels of wind and solar photovoltaic resources, the CAISO has already identified increasing need for flexibility in the existing resource fleet to meet net load ramps. Our studies reflect (1) the potential for over-generation conditions and negative prices in the middle of the day prior to longer and steeper evening ramps; (2) multiple intra-day upward and downward ramps; (3) increased intra-hour load-following capacity requirements; and (4) increased regulation capacity requirements.

We have also discovered that planning studies for transmission maintenance must consider new congestion patterns that will result from power flows created by a new low-carbon fleet. While transmission providers typically have planned maintenance of transmission elements during shoulder months, this action has sometimes exacerbated over-generation conditions and negative prices within localized areas. We need to anticipate this congestion and proactively plan to address it.

The CAISO has also performed a study based on the trajectory of renewable development under a 40 percent renewable portfolio standard in

2024.¹ This study assumes no renewable curtailment and finds there are upward and downward reserve shortfalls along with unsolved over-generation for all months except August. Reserve shortfalls occur because the shutdown of generation leads to insufficient online flexible resources to provide necessary reserves.

These studies are informing the following strategies to ensure we maintain reliable operations as we transition a low-carbon grid.

- The CAISO is examining how to more accurately forecast variable energy resource production in the day ahead timeframe, including encouraging scheduling coordinators to schedule the output of their variable energy resources in the day-ahead timeframe. More accurate production forecasts will help the CAISO position remaining resources in the fleet to serve net load.
- The CAISO is also working with stakeholders to develop a flexible ramping product to obtain both upward and downward ramping capabilities. The CAISO is also examining mechanisms to incentivize resources to operate at lower minimum load and adjust market rules to encourage exports.

¹ See CAISO's Deterministic Studies, filed in CPUC Rulemaking 13-12-010 on May 8, 2015. http://www.aiso.com/Documents/May8_2015_DeterministicStudies_nocurtailment_ExistingTrajectory_40percentRPS_R13-12-010.pdf

- The CAISO is seeking to minimize the use of self-schedules and incentivize more economic bidding. With the Commission's approval, we have already lowered its bid floor to encourage more economic bidding by all resources, including renewable resources, to reduce their output during over-generation conditions.
- The CAISO will continue to look for means to foster the participation of energy storage and demand response resource in its markets including incentivizing shifting loads to periods when there is excess supply from periods of peak net demand.
- The CAISO is exploring how in the longer term a low carbon pathway increases in demand from electrification of transportation or water conveyance and desalination complement increased output from variable energy resources.
- The Energy Imbalance Market implemented by the CAISO and PacifiCorp last year already demonstrates that optimizing across a broader footprint in real-time can help address over-generation conditions. But increased regional collaboration, including optimizing resource portfolios in the day-ahead timeframe, is a more efficient means to integrate increasing volumes of variable energy resources both in the CAISO and across other balancing authorities because it does not involve significant capital investments and will cause more efficient electric system operations while reducing carbon emissions.

II. The Commission and the Electric Reliability Organization should ensure all resources can provide essential grid services

Integrating increasing amounts of variable energy resources has provided several grid benefits. Solar resources have proved valuable in reducing the CAISO's net load during system peaks and flattening the afternoon ramp during summer days. This effect has mitigated the loss of hydroelectric resources because of California's drought. During shoulder months, however, solar output can exacerbate over-generation conditions. In either case, solar photovoltaic and other variable energy resources are displacing conventional generators that have traditionally offered essential grid services.

As we move to a low-carbon grid, the CAISO and other balancing authorities will need mechanisms to obtain the essential grid services to operate the electric grid from resources other than the conventional fleet. All resources – including variable energy resources – will need to provide and absorb reactive power and help regulate voltage of the transmission system. All resources must contribute to mitigating the ramps created by variability. Variable energy resources must install active power controls and respond to dispatch instructions. In addition, all resources must provide frequency and inertial response.

The ERO is examining these issues through the Essential Reliability Services Task Force to ensure capabilities needed for reliability remain available as the resource mix changes. This is a valuable forum, but the CAISO believes that the pace of the grid transformation occurring merits action in the near-term. Through interconnection requirements or reliability standard requirements, the

Commission and the ERO should ensure that all resources interconnected to the bulk power system can offer essential grid services.