

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Reliability Technical Conference)
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Docket No. AD17-8

**Prepared Statement of Dede Subakti
on behalf of the California Independent System Operator Corporation**

My name is Dede Subakti. I am currently responsible for Operations Engineering at the California ISO (CAISO). These functions include completing resource adequacy assessments, seasonal operating studies, outage coordination studies, day-ahead reliability analysis, real time operations engineering analysis, as well as developing operating procedures and tools along with other engineering needs to support system operations. Prior to joining the CAISO, I worked with OATI, Inc. managing project development for various transmission system applications for transmission service providers in both the Western and Eastern Interconnections. Prior to my work with OATI, I served as Manager of Regional Operations Engineering at the Midwest ISO (now Midcontinent ISO) where I managed real-time operations engineers providing control room operations support. I have also worked with representatives of both the North American Electric Reliability Corporation and the Western Electricity Coordinating Council to develop reliability standards and support operation of the Western Interconnection. I am a licensed Professional Engineer with the State of Minnesota and a certified NERC System Operator. I received a Master of Business Administration from the Carlson School of Management at the University of Minnesota and Master of Electrical Engineering from Iowa State University with an emphasis in power systems. I also earned a Bachelor of Science in Electrical Engineering from Iowa State University.

My remarks today address two topics: (1) the need recognize gas system constraints in operating the bulk power system; and (2) emerging issues relating to inverter-based resources. Each of these topics underscore the importance of a portfolio of resources that can provide essential reliability services to support operation of the bulk power system as well as the need to ensure transmission providers have a wide range of operational tools to manage their systems.

I. Injection and withdrawal constraints at the Aliso Canyon gas storage facility have required increased levels of coordination between affected entities as well as new operating tools for managing the reliability of the bulk power system.

In October 2015, a natural gas leak was detected at the Aliso Canyon gas storage facility in southern California. Although the gas company has now sealed the leak, it cannot resume injecting into Aliso Canyon, and can only withdraw on a limited basis until it obtains necessary regulatory approvals. The limited operability of Aliso Canyon is a concern not only for residential gas customers but also for gas-fired electric generating resources in southern California that normally rely on gas stored in Aliso Canyon. To the extent these gas-fired resources are unable to obtain sufficient gas supplies through gas utility's pipeline service to meet electric demand, such deficiencies could, under certain circumstances, result in gas curtailments to electric generation and the need to curtail electric service to southern California customers.

In the wake of the Aliso Canyon gas leak, California state agencies organized an Inter-Agency Task Force to assess the risks posed by the limited operability of Aliso Canyon and the actions required to mitigate those risks. The CAISO continues to participate in that effort. Recently, the Inter-Agency Task Force issued an assessment for the upcoming summer identifying risk and mitigation measures. As part of that

assessment, the CAISO and the Los Angeles Department of Water and Power performed a technical analysis that finds expected demand this summer can be met if the gas utility's pipeline supply in southern California is at 100 percent and adequate storage inventory remains available, excluding inventory at Aliso Canyon. If pipeline supply is reduced, system reliability is dependent on the availability of natural gas at the other gas storage facilities in southern California.

Accordingly, it is critical to mitigate the risk of low inventory stored at other natural gas storage facilities in southern California. In addition, affected entities need to continue to employ other mitigation measures to ensure electric reliability for the coming summer. These measures include continued use of gas balancing rules to encourage customers to buy natural gas to meet their demand on a daily basis rather than relying on gas storage or monthly pipeline balancing rules, robust operational coordination among affected entities, customer conservation, identifying steps to increase gas supply, and the possible use of existing natural gas at Aliso Canyon. The mitigation measures identified by the Inter Agency Task Force should help meet energy needs. However, prolonged periods of hot weather and other unpredictable events could pose problems to reliable electricity supplies.

In its agenda for this conference, the Commission asks a series of questions related to the Aliso Canyon gas storage facility: What has industry learned from this event and what mechanisms have been put into place to mitigate the impact of the reliance on a single gas storage facility? How have these lessons been applied to similar gas storage facilities and the increased dependence of the bulk-power system on natural gas across the country? How can the Commission better address the risks of

fuel disruptions to the reliable operation of the bulk-power system and its ability to recover?

An important lesson learned from Aliso Canyon is the importance of robust coordination among regulatory authorities as well as entities supporting reliable bulk power system operations. State energy agencies in California have worked in close coordination to explore safety and electric reliability issues associated with Aliso Canyon. The CAISO and SoCalGas have developed operating procedures to coordinate limitations or outages that arise on the SoCalGas' system that could impact reliable electric operations. The CAISO has also worked with LADWP, Peak Reliability, and market participants to ensure that measures are in place to help mitigate potential electric service disruptions because of gas storage constraints in southern California.

The constraints at Aliso Canyon have also underscored the need for a balanced portfolio of resources and infrastructure to help ensure that balancing authorities do not over rely on one fuel source to meet electric system needs and can adjust to changing operating conditions. New resources such as solar and electric storage have contributed to electric reliability in southern California. Access to north-south transfers within the CAISO balancing authority area as well Energy Imbalance Market transfers from other balancing authority areas has helped the CAISO operate its system in southern California. In addition, natural gas-fired generators have reliably scheduled gas in response to daily balancing rules implemented by SoCalGas.

In 2016, the Commission authorized the CAISO to implement various mitigation measures to manage the lack of injection and withdrawal of natural gas at Aliso Canyon. Among other measures, the Commission authorized the CAISO to use a

market constraint to limit the maximum amount of natural gas that natural gas-fired resources may burn in applicable gas regions anticipated by the CAISO during specific hours. This natural gas constraint permits CAISO operators to enforce in the day-ahead and real-time markets a constraint to limit the dispatch of generators in the affected area to a maximum gas usage. The constraint also limits the CAISO market dispatch of the affected generators in the real-time market to a maximum gas usage, if there is a limitation that relates to differences between gas scheduled with the gas company and gas consumed during the operating day due to gas system imbalance limitations. The CAISO used this constraint this past winter in response gas curtailment watches issued by SoCalGas arising from cold temperatures and forecasted high gas demand. The CAISO's authority to use this constraint as well as implement certain other interim mitigation measures expires on November 30, 2017.

The CAISO is currently exploring through a stakeholder process whether to extend the maximum gas burn constraint, on a permanent basis, along with accompanying provisions to prevent undesirable potential market outcomes when operators enforce the constraint. The CASIO is also exploring whether to extend the maximum gas burn constraint to other areas of its balancing authority area as well as the Western Energy Imbalance Market. Tools such as the maximum gas burn constraint serve as important mechanism to avoid excessive stress on the gas system that may exacerbate the risk of gas curtailments and result in impacts to electric system reliability. The maximum gas burn constraint helps keep the gas system within operational limits by ensuring market dispatches of electric resources respect these limits. The CAISO believes this tool can help electric system operators manage gas

system limitations. This constraint can also help address constraints that may arise at gas storage facilities if inventories drop to levels that cannot support operation of electric generators or if gas pipeline pressure is projected to drop. Although the CAISO does not at this time support developing reliability standards to address instances in which the bulk power system relies on a large gas storage facility, the Commission should support and approve efforts of transmission providers and market operators have a broad range of planning and operational tools to respond to changing system conditions. The Commission should also continue to foster communications between electric and natural gas transmission operators in order to ensure coordination of planned outages and protocols to address system constraints that may arise in the day ahead horizon as well as real-time.

II. As the level of inverter based resources increase, these resources must provide essential reliability services, including voltage support, frequency response, ride-through capabilities, and ramping.

Between the months of August and November 2016, the CAISO experienced transmission system faults that resulted in the unanticipated loss of inverter based resources. An additional transmission line fault occurred in February 2017 that also resulted in the unanticipated loss of inverter based generation. When an inverter trips, it electrically isolates itself from the grid (typically by opening a circuit breaker) and ceases to operate. With respect to the observed transmission line faults, these cleared in four cycles or less. Inverter based resources should not have tripped for any of these events.

A joint NERC and WECC task force has studied one such event that resulted in the loss of approximately 1,200 MW of solar photovoltaic (solar) resources. The task

force determined that inverter based resources are susceptible to tripping during transients generated by faults on the power system.

As the Commission is aware, the CAISO has experienced the most rapid growth of inverter based resources in the United States – most prominently solar photovoltaic resources. During light load days, as much as 50 percent of the CAISO load may be served by solar photovoltaic resources. Any widespread tripping of inverter based generation presents a significant challenge to reliable operation of the bulk power system in the CAISO's balancing authority area. Additionally, with the proliferation of solar in other balancing authority areas, this issue may be critical to reliable operation of the Western Interconnection.

The CAISO is working with inverter manufacturers, resource owners, and transmission providers as well as with the NERC and WECC joint task force to identify why inverter based generation tripped during faults with very quick recovery times and what mitigation is appropriate. This effort may involve several steps, including recalibrating inverters. This effort may also require clarification of existing NERC standards and development of new standards.

In its agenda for this conference, the Commission asks are there other emerging issues that could have severe impacts on the bulk-power system. As inverter based resources become more prevalent these resources must have the capability to provide essential reliability services to the electricity grid. In this respect, the Commission should support efforts to ensure these resources are configured to ride through transmission faults as well as voltage and frequency disturbances similar to conventional synchronous resources. In addition, the Commission should ensure these

resources have reactive power capability, frequency response capabilities and also can operate with controlled ramp rates. The Commission has already taken affirmative steps such as establishing reactive power requirements for newly interconnecting non-synchronous resources and issuing a proposed rule to require inverted based generation connected to the bulk power system to have frequency response capabilities. The Commission should also support efforts to clarify or develop new rules to mitigate steep ramps on the bulk power system when inverter based resources come online or reduce their output.

The CAISO continues to explore how it can efficiently use a large volume of inverter based resources to balance loads on its system. These efforts include development of new market rules such as the CAISO's flexible ramping product to help optimize resources on a system with new operating challenges. However, successful integration of inverter based resources at the high levels that California and other Western states are pursuing will require a resource mix that has the capabilities that conventional synchronous resources have typically provided to the bulk power system. In addition, the CAISO is pursuing ways to balance resources and loads over a larger geographic footprint with diverse resources and load profiles. In this respect, the Western Energy Imbalance Market and possibility of a regional system operator in the West are important initiatives.