UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Reactive Supply Compensation in Markets Operated by Regional Transmission Organizations and Independent System Operators Workshop	)))))	Docket No. AD16-17-000

Prepared Statement of Keith Johnson
on behalf of the California Independent System Operator Corporation

My name is Keith Johnson. I serve as Manager, Infrastructure Policy at the California Independent System Operator Corporation (CAISO). Previously, I served as Manager, Infrastructure Policy and Contracts at the CAISO. I hold degrees in economics and finance from the University of Oregon. Prior to joining the CAISO, I worked for 18-years at an international management and engineering consulting firm, where I worked on rate design, project financing, project management, operations engineering, and transmission planning.

The CAISO appreciates the opportunity to participate in the Commission's workshop on reactive supply compensation in markets operated by Regional Transmission Organizations and Independent System Operators. In 2015, the CAISO undertook a stakeholder initiative to examine uniform reactive power capability and voltage regulation requirements for asynchronous resources[1] as well as compensation for reactive power capability and provision by all resources. Although the CAISO issued

[1] Asynchronous resource is a generator that does not use mechanical rotors that synchronize with system frequency. The Commission refers to these resources as non-synchronous resources. *See Reactive Power Requirements for Non-Synchronous Generation* 155 FERC ¶ 61,277, Order 827(2016).

a Draft Final Proposal in its initiative[2], the CAISO suspended its initiative while the Commission considered a related policy in Docket RM16-1. The Commission issued an order in that proceeding on June 16, 2016.

In its Draft Final Proposal, the CAISO proposed to adopt uniform requirements for all non-synchronous resources to provide reactive power capability and automatic voltage control. Requiring non-synchronous resources to have the capability to provide reactive support and automatically control voltage schedules is a more reliable, efficient, and equitable approach than examining this issue through interconnection system impact studies on a case-by-case basis, which has been the CAISO's existing process. A uniform requirement is superior than the existing case-by-case study approach because the forecast conditions upon which a case-by-case study are done change over time, and, although a study may show that reactive power support is not required from a resource at the time of the study, the CAISO has found that the need for reactive power support from that resource can change in the future due to unexpected changes in the electric system.

In addition to reactive power and voltage regulation requirements for non-synchronous resources, the CAISO explored financial compensation structures for both the capability to provide reactive power and the provision of reactive power. The CAISO currently compensates resources for the provision of reactive power outside of a standard range when the CAISO directs a resource to reduce its real power output to provide reactive power. The CAISO concluded, however, that providing reactive power

[2] A copy of the CAISO's Draft Final Proposal is available on the following website: http://www.caiso.com/Documents/DraftFinalProposal-ReactivePowerRequirements-FinancialCompensation.pdf

capability is a good utility practice, essential for resources to generate and deliver real power to the grid. Reactive power capability should be a uniform interconnection requirement for all generating resources and the costs for that capability should be included in the bilateral purchase power agreements that cover the capital and fixed costs of the generator. In the CAISO balancing authority area, both synchronous and non-synchronous resources have the opportunity to recover capital costs associated with providing reactive power capability when they construct or retrofit their facilities. In addition, because most manufacturers now routinely include reactive power capability in the inverters used by non-synchronous resources as standard equipment; the CAISO's proposed policy creates minimal incremental capital costs for non-synchronous resources. For these reasons, the CAISO does not support a CAISO administered capability payment for reactive power. While other RTOs/ISOs may support such an administrative payment, the Commission should recognize that regional differences are appropriate with respect to reactive power supply compensation.

The CAISO provides the following initial responses to the specific questions posed in the Commission's May 19th, 2016 Supplemental Notice of Workshop.

4. Compensation Methods for Reactive Supply in Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs)

4.1 How does each RTO and ISO currently compensate for Reactive Supply capability and Reactive Supply service?

The CAISO does not compensate resources for the capability of reactive power supply through an administrative payment mechanism. The CAISO compensates

resources for their opportunity cost of reducing the real power output in order to allow the provision of reactive power supply outside of the normal lead/lag power factor range (0.95 leading, 0.95 lagging). This provision payment compensates resources that are asked to reduce real power output in order to move beyond the normal 0.95 lead/lag power factor range. For synchronous resources designed to provide reactive power within this range, the provision of reactive power within the normal 0.95 lead/lag range does not require resources to reduce their real power output, which therefore creates no lost opportunity cost associated with provision of reactive power within that normal lead/lag power factor range.

4.2 Is compensation for Reactive Supply capability and Reactive Supply service in RTOs and ISOs commensurate with the associated costs?

The CAISO's provision payment for reactive power supply compensates resources for their opportunity costs associated with that reactive power supply. This compensation is commensurate with the associated costs of providing reactive supply because it pays for the lost opportunity cost of providing energy. Resources have the opportunity to recover the capital costs associated with the construction of the resource or retrofitting of the resource through bilateral contracts. This opportunity to recover capital costs occurs outside of the CAISO's market and allows for the recovery of fixed costs associated with the capability of reactive power supply.

4.3 How do the RTOs and ISOs monitor the availability and amount of Reactive Supply capability, and is availability and amount of Reactive Supply capability and Reactive Supply service linked to compensation?

The CAISO's long-term, near-term and seasonal study processes all assess the need for reactive power to ensure the reliability and adequacy of the transmission system. In addition, the generation interconnection study process assesses the need for reactive power created by the interconnection of new resources, or needed to support the reliable interconnection of new resources, on a case-by-case basis. The CAISO monitors the overall need for and amount of reactive power supply on its system through the CAISO's transmission planning process. In this process, the CAISO identifies system upgrades to maintain the reactive power supply in areas that it identifies do not have sufficient voltage support from generation resources. Based on planning, operational, and real-time assessments, the need and availability of reactive power and voltage support is known to CAISO operators in the operation horizon and resources are dispatched as required to maintain reliable operation of the system. Although the system is planned so that there is adequate reactive support without the need for generators to supply more than the required amount of reactive power within the specified power factor range, under extreme system conditions, there may be a need for additional reactive power from generators. The compensation for generators to provide more than the required amount of reactive power is discussed above (see response to 4.1).

4.4 How could RTOs and ISOs compensate for Reactive Supply based on the actual provision of Reactive Supply service?

The CAISO currently compensates resources based on the actual provision of reactive power supply as described above (see response to 4.1). The CAISO compensates resources based upon the opportunity costs associated with a reduction in real power output to provide reactive power supply outside of a normal lead/lag power factor range.

4.5 Are there compensation mechanisms other than those currently in place that would be more commensurate with costs?

The CAISO's recent Reactive Power Requirements and Financial Compensation stakeholder initiative explored the need for additional or new compensation mechanisms for reactive power supply and concluded that the current compensation structures are appropriate.

4.6 Should real power capacity compensation mechanisms (i.e., centralized capacity markets and other capacity constructs in RTOs/ISOs) account for reactive power capital cost compensation, and, if so, how?

The CAISO's resource adequacy construct is based upon a bilateral contracting paradigm that provides adequate real power capacity supply. This bilateral contracting construct provides resource developers with the opportunity to structure contractual arrangements in order to provide compensation for the resource's fixed costs associated with generator including the capability to supply reactive power supply. The

CAISO acknowledges that resource adequacy contracts for existing resources may not provide for fixed cost payments associated with reactive power capabilities, but resource developers can capitalize these fixed costs through long-term power purchase agreements or agreements to retrofit their facilities.

4.7 Should Reactive Supply compensation be adjusted to account for changes in Reactive Supply capability (e.g., capability that has degraded or increased), and, if so, how? Should a degradation threshold be considered?

The CAISO's proposal to adopt uniform reactive power requirements for non-synchronous resources and its rules for the provision of reactive power within a specified range does not contemplate the degradation of reactive power supply capability. The CAISO's reactive power compensation mechanism does not easily lend itself to making adjustments to the level of compensation based upon changes to the reactive power supply capability.