

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Electrification and the Grid of the Future)
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Prepared Statement of Peter Klauer

My name is Peter Klauer. I serve as Senior Advisor Smart Grid Technology at the California Independent System Operator Corporation (CAISO). My prepared remarks address issues identified in Panel 3 - *Transmission and Distribution System Services Provided by Flexible Demand* - of this technical conference.

The CAISO operates wholesale electricity markets for the benefit of approximately 80 percent of electric demand in California and small portion of electric demand in the state of Nevada. We also serve as the market operator for the western Energy Imbalance Market, which provides real-time market services to participating balancing authorities throughout the Western Interconnection.

The CAISO has developed multiple market participation platforms for flexible demand to provide transmission services in its markets. To date, participation in the CAISO's markets is primarily water pumping loads, grid-scale storage, load curtailment, and behind-the-meter energy storage systems providing demand response. The CAISO believes there is far greater opportunity to unlock the potential of flexible demand to help ensure reliable transmission operations in the grid of the future.

The grid of today and the future includes increased variability and uncertainty. Within the CAISO, we continue to set new limits for minimum net load during the day and three hour ramps in the evening. The ability of flexible demand to shape and shift

the load curve can provide a huge value to mitigate the operational conditions reflected by the duck curve. Transmission operators, distribution operators, and regulators need to find ways to value the load shaping and shifting capabilities of new sources of flexible electric demand.

In addition, new sources of flexible demand can also help balance supply and demand and provide additional reliability services by participating in wholesale markets. Grid services from these devices include both energy and ancillary services. The CAISO's markets allow flexible demand resources to participate through various platforms, including as demand response, as non-generator resources (positive and negative generator), and as distributed energy resource aggregations.

With respect to EVs, the CAISO has participated in Vehicle Grid Integration (VGI) pilots and technical demonstrations since 2011 and successfully demonstrated Vehicle-to-Grid (V2G) participation in the CAISO's wholesale markets where EV aggregations demonstrated the ability to respond to 5-minute energy dispatch as well as 4-second frequency regulation control. The current state of development for V2G technologies is relatively nascent but the technologies exist and continue to evolve rapidly, reducing costs and improving interoperability. Further advancements in EV management systems, EV and charging station communication protocols, and advanced inverter capabilities will continue to help EVs provide additional grid services in the future.

Some flexible demand resources may face constraints or limitations in terms of their wholesale market participation based on the primary purpose of the resource. For example, EVs and grid-interactive buildings can provide grid services but their primary function is to provide transportation or meet building occupancy needs. In addition,

resource owners need to consider how to group these resources to optimize and maximize their value to the grid. There are cases where grouping multiple technologies provides a synergistic benefit and cases where they do not.

To unlock the value of these resources as grid service providers, we need to consider the cost and complexity to provision these services. Because the majority of these resources interconnect on the distribution system, often behind the customer meter, the distribution system operator must conduct reliability studies and assessments, which may result in distribution system upgrades and other costs to ensure the participation of these resources does not harm the reliability of the grid. In addition, there are costs associated with a resource participating in the wholesale market. Given the smaller nature of some newly electrified resources, current methods of providing wholesale market-based services may be too costly and outweigh the benefit of obtaining services from these resources as compared to traditional resources. Grid operators need to continue to explore these barriers with stakeholders and policy makers to find new ways of integrating flexible demand in to the wholesale markets to support reliable transmission operations.

Finally, as new sources of flexible demand develop and participate in wholesale markets, a new system of coordination and information exchange between the distribution system operator, the transmission operator, and third party aggregator needs to emerge. Little or no real-time coordination exists today to ensure that a market dispatch to an aggregation of newly electrified resources on the distribution system is feasible and reliable. Lack of grid operator coordination and visibility is a barrier to unlocking the value of these resources as grid service providers. Transmission

operators and distribution operators must identify new mechanisms to coordinate the operation of the transmission-distribution interface.