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Supporting Transactive Energy Research and Development

Additional submitted attachment is included below.

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Project Title: Development of the California Energy Commission Electric Program Investment Charge 2018–2020 Triennial Investment Plan

Subject: Supporting Transactive Energy Research and Development

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The following topic areas are recommended for consideration in the California Energy Commission Electric Program Investment Charge (EPIC) 2018-2020 Triennial Investment Plan.

1 Hierarchical markets/transactive energy modeling and simulation

Problem Statement

There is growing interest in retail/real-time markets and transactive energy systems driven by research results and demonstration projects at the national level over the last decade. Retail and transactive systems enable greater participation by consumer end-use resources and distributed generation in distribution system planning and operations, as well as facilitating small resource aggregation for participation in wholesale markets and transmission planning and operations. Research in transactive energy approaches to resource integration in both planning and operations is hampered by a lack of modeling and simulation tools that can represent transactive control systems jointly with power system simulations and market modeling systems. Existing tools such as GridLAB-D developed by the US Department of Energy provide a platform for the development of such tools. However, in their present state they do not provide all the requisite capabilities needed to support the research on hierarchical markets and transactive energy systems in California.

Recommendation

The EPIC program should consider an effort to identify California's needs with respect to modeling and simulating transactive energy systems, and invest in tools that support agent-based modeling, design and simulation tools that integrate markets, telecommunications, and power systems from transmission down to distribution systems and end-use resources as an integrated tool suite. The Commission is encouraged to support the development and dissemination of an open-source modeling and simulation platform to (1) enable researchers and utilities to design, evaluate and compare various proposed solutions based on transactive energy solutions, (2) provide a common set of reference models and data for researchers and utilities to use in the conduct and publication of research, and (3) provide a basis for ensuring the reproducibility of research and demonstration project results.

2 Transaction-based energy systems control security/authentication

Problem Statement

Transactive energy approaches to distribution resource integration and aggregation have been successfully demonstrated by the US Department of Energy and the European Commission over the last 10 years. As a result of these

successes there is growing interest in supporting the design of larger scale and more comprehensive transactive systems. The US Department of Energy and the National Institute of Standards and Technology are currently conducting research in standardizing reference models for transactive energy systems. However, no solutions have been proposed to address the problem of security, validation and authentication in distributed transaction-based system planning and operations.

Recommendation

The EPIC program should consider supporting research in various transaction security, validation and authentication technologies, including centralized, decentralized and fully distributed approaches. These approaches should be based on existing transaction technologies, and focus among other things on the tradeoffs and issues associated with using existing versus introducing new coins, as well as using existing versus introducing new methods of proof.

3 Retail markets/retail competition

Problem Statement

Transactive energy concepts rely on the ability of utilities and aggregators to engage distribution-level consumers and producers using real-time prices. Tariff design, retail competition, and retail market-design problems must be addressed to encourage the broader adoption and implementation of transactive energy solutions.

Recommendation

The EPIC program should consider supporting research to enable the development and approval of new real-time tariffs that enable electricity retailing by load and distributed generation aggregators, and encouraging the use of local retail real-time markets and ancillary service aggregation of distribute generation and demand response resources.

4 Distribution Systems Operator business models

Problem Statement

Transactive energy concepts are expected to challenge the existing utility business model. Consumers are expected to become more engaged in price discovery mechanisms at the retail level, acting as both suppliers of energy and demand response resources. Utility will increasingly find themselves in competition with their own customers and less and less acting as the principle supplier of energy and power to consumers, or ramping response to the system. The transition of the utility business model from a top-down supply chain with revenue flowing up to cover costs, to a bidirectional trading environment challenges utilities to rethink their primary *raison d'être*, what their principal revenues and costs are, and how they transition from a market player/participant to a market maker at the retail level.

Recommendation

The EPIC program should consider supporting research to enable an understanding of the social, regulatory, economic and technical underpinnings of the transition from the conventional utility business model to a transactive utility business model. This research requires a multi-disciplinary approach to understanding the drivers of the evolution in the utility business, the barriers to adoption of transactive energy systems, the opportunities that transactive energy systems present, and the key enablers of such a transformation.