Transactive Energy and the Impacts of FERC Order 2222: Preparing Duquesne Light Company for a Distributed Energy Future

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The innovation of energy technology and the digitization of information gives customers more autonomy than ever. Customers are interacting with the grid in new ways and have control over their energy choices, like how and when they use energy. We are seeing this today at Duquesne Light Company (DLC) with the adoption of rooftop solar panels, battery storage systems, electric vehicles (EV(s)) and electric vehicle supply equipment (EVSE). To support innovation and maximize the benefits customer receive from distributed energy resources (DERs), Federal Energy Regulatory Commission (FERC) issued regulatory Order 2222 in September 2020.

FERC Order 2222 removes barriers for distributed energy resources (DERs) to participate in wholesale electricity markets. The Order requires regional transmission organizations (RTOs) and independent system operators (ISOs) to revise their market rules to allow aggregated DERs (e.g., rooftop solar panels and energy storage systems) to participate in wholesale markets as a single resource for grid services (e.g., frequency regulation, capacity and energy) and be compensated accordingly. The Order directs RTOs and ISOs to develop new market rules that accommodate DERs' unique operational characteristics and the needs of both the grid and the DER owners/operators. Furthermore, electric utilities, like DLC, must consider several factors to implement FERC Order 2222 successfully. Some key considerations are provided in Table 1.

Table 1: Key Considerations to Implement FERC Order 2222

Criteria	Description
Planning	Developing a comprehensive plan to include timeline, budget, staffing needs, and stakeholder coordination.
Capabilities & Limitations	Identify potential DERs for participation in the wholesale markets, while considering their capabilities and limitations.
Communications	Establish communication channels to keep DER owners/operators informed of changes in the wholesale market, the requirements for participation, and the compensation mechanism.
Data Quality	Ensure the quality and accuracy of the data that will be used for market participation and compensation calculations.
Market Rules	Collaborate with the RTO/ISO to develop new market rules to accommodate the DERs' unique operational characteristics, while considering the needs of the grid and key stakeholders.
Requirements	Establish and validate the technical requirements (e.g., metering, telemetry, and other standards) for participation.
Compliance	Ensure compliance with the new rules and regulations (e.g., reporting, record-keeping, etc.).
Monitor & Evaluate	Establish a monitoring and evaluation program to assess the effectiveness of the new rules and identify areas for improvement.

One of the toughest implementation challenges is the integration of these criteria into a platform that can optimize the resources. The GridWise Architecture Council and Pacific Northwest National Laboratory have been promoting the implementation of transactive energy (TE) concepts in wholesale markets to support adoption of the Order. Their work has been focused on developing and deploying advanced information and communication technologies to enable seamless DER integration to the grid. The transactive energy concept is a system of economic and control mechanisms that will enable the

buying and selling of energy in a distributed energy system. The goal is to provide a more efficient, reliable and sustainable energy system by actively empowering consumers to participate in energy markets.

Duquesne Light Company and IEMS Solution Ltd. (IEMS) have actively started to assess and develop an Advanced Market Management System (AMMS) to support FERC Order 2222 requirements; minimize cost; and maximize reliability planning and operations of the transmission & distribution (T&D) system as part of the integrated project planning process. The AMMS tool will allow for optimal planning. Eventually, it will be used to understand the operations and management of the many-to-many grid edge DER technologies' interactions, i.e., EVs and EV charging infrastructure and demand response from Smart Electric Energy Districts (SEEDs).[1]

The IEMS AMMS platform includes:

- Predictive analytics modules for T&D systems' load forecast; DER generation forecast; and EV-fleets' demand forecast in short-term, mid-term and long-term for operations and planning purposes.
- DERMS (distributed energy resource management system) for T&D systems' optimal operation and planning, including DER, demand response (DR), virtual power plants (VPP) and V2G (vehicle to grid) as new sources of energy with aggregators.
- Transactive Energy (TE) platform with software agents as negotiators for the power utility and VPP, DER, DR and EVSE aggregators to submit bids, offers and counteroffers to trade energy and ancillary services (A/S). In addition, the TE platform has smart contracts that embed the TE market rules and only allow the TE participants to trade energy. Smart contracts also monitor the meters, including AMI, IoT and smart meters, to ensure that all VPP, DER, DR and EVSE aggregators respect the TE market rules and electronically signed contracts at all times. The smart contracts also manage the financial transactions, including debits/credits for fulfilled TE contracts in periodic financial settlements.

IEMS's work with DLC will also help DLC design efficient and mutually beneficial TE market rules; provide cyber-secure and robust communications between the DLC ADMS/DERMS and customer technologies; ensure compliance of the aggregators with new TE market rules; and monitor and evaluate TE market rules, clearing mechanism and financial settlements between DLC and the aggregators. These market rules will make sure that the TE markets for energy and A/S are efficient, cyber-secure and benefit all participants.

As customer needs evolve, so do the programs and services electric utilities will offer. The Transactive Energy platform has many other beneficial features that will provide DLC with the capabilities to enable demand response programs, EV charging infrastructure and distributed generation. In all these cases, the Transactive Energy platform provides a mechanism for customers to actively participate in energy markets, responding to price signals and grid conditions and providing valuable services to the grid. This can help promote a more efficient, reliable and sustainable energy system while providing customers with new opportunities to manage their energy usage and costs.

[1] SEEDs are an interactive network of grid connected DERs, electrified buildings, building management systems, and other electrified infrastructure.

When fully implemented, FERC Order 2222 will allow customers to become active participants in energy markets. By partnering with outside firms, DLC can boost our technical capabilities and prepare ourselves for a future where we can better serve our customers and their needs.