ESIG
ENERGY SYSTEMS INTEGRATION GROUP

ESIG REPORT

DER Integration into Wholesale Markets and Operations

FACT SHEET

What are the challenges the report is responding to?

Distributed energy resources (DERs)—including generation, energy storage, demand flexibility, and electric vehicles and other responsive devices connected to distribution systems—can provide a range of benefits for electricity systems and customers. But realizing these benefits will require enhancements to distribution system operations as well as closer coordination between distribution and transmission systems. Without coordination, electricity systems risk being exposed to inefficient capital spending and operational challenges, leading to unnecessarily high costs and potentially lower reliability.

The report *DER Integration into Wholesale Markets and Operations* by the Energy Systems Integration Group examines the changes in regulation, market rules, planning, and operating practices needed to better integrate DERs into U.S. wholesale markets and operations. Its focus is on nearer-term implementation of the Federal Energy Regulatory Commission's (FERC's) Order 2222, the order's implications for electricity distribution systems, and the broader gaps related to DER integration in wholesale markets and distribution systems.

How was the report developed?

The report was developed by a consortium of expert consultants and overseen by ESIG's Distributed Energy Resources Task Force. The report incorporates discussions from a 10-month-long consultative process with the task force that included experts from grid operators, utilities, technology providers, and regulatory commissions.

This fact sheet is adapted from ESIG's report DER Integration into Wholesale Markets and Operations.

How do DERs currently participate in wholesale markets and operations?

DERs can participate in wholesale markets through different models, which we refer to as structural participation models. Structural participation models are organized around the functions of the distribution utility (or distribution operator), load-serving entity (which may or may not be the same as the distribution utility), DER aggregator, and independent system operator (ISO) (see Figure 1).

- In the **DER aggregator model,** long used by demand response providers but broadened under Order 2222, DERs can participate in the supply side of ISO markets through a DER aggregator.
- In the **load-serving entity (LSE) model**, DERs passively or actively participate in ISO markets through load-serving entities' demand bids or changes in metered demand.
- Both of the above models have drawbacks that could be addressed through a third model, the **total distribution system operator (DSO) model**, in which a functionally independent distribution system operator ensures that DER supply offers and demand bids would not violate distribution system limits before the offers are submitted to the ISO markets, and ensures that DER responses to ISO dispatch instructions respect any changes in distribution system conditions.

How extensive are the changes needed to implement FERC Order 2222?

In the near term, the answer to this question depends mainly on the existing capabilities and operating practices of each distribution utility. The ISOs have made progress in developing compliance plans for Order 2222; therefore, many of the remaining challenges for Order 2222 implementation are at the state regulatory and distribution utility level. Distribution utilities and their regulators should start by identifying minimal "least-regrets" changes in distribution system planning and operations; coordination among the distribution system, DER aggregator, and ISO; and utility investments in monitoring and controls necessary to support these changes.

We found that the changes needed in the near term are less about technological investments and more about utility procedures and coordination, and identified four main gaps involving:

FIGURE 1

Three Structural Participation Models for DER Participation in Wholesale Markets

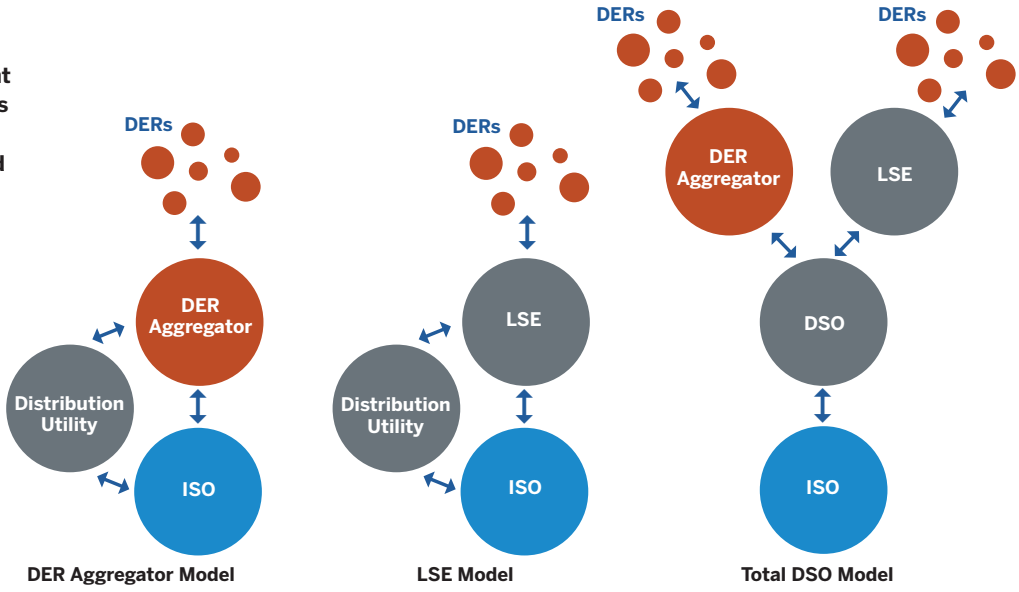
Structural participation models describe different approaches for how DERs participate in wholesale markets; they vary based on the nature of the interactions among the ISO, distribution utility, and DER aggregator.

DER = distributed energy resource;

DSO = distribution system operator;

ISO = independent system operator;

LSE =load-serving entity. In the LSE model, the LSE and the utility may be the same entity.



Source: Energy Systems Integration Group.

- Distribution interconnection procedures for individual DERs
- Distribution utility review of a proposed DER aggregation; Order 2222 allows utilities a maximum of 60 days for this review
- Communication of distribution system outages and abnormal configurations
- Distribution utility overrides of ISO dispatches

Few distribution utilities have developed interconnection procedures that are consistent with Order 2222 or have established rigorous processes for reviewing DER aggregations, communicating distribution system conditions, and overriding ISO schedules and dispatches. State regulatory commissions will need to ensure that utilities develop procedures and processes that are efficient, fair, transparent, and non-discriminatory.

What can state regulators do to address these gaps and facilitate implementation of FERC Order 2222?

The report's key recommendations for regulators on actions they can take to facilitate FERC 2222 implementation include:

- **Interconnection:** Ensure that utility interconnection rules are transparent and fair, that interconnection agreements describe procedures for utility override of ISO scheduling and dispatch of DER aggregations, and that interconnection processes result in predictable interconnection costs and timely interconnection.
- **DER aggregation review:** Ensure that utility aggregation review is timely, fair, and flexible. The review of a proposed DER aggregation should leverage information from the individual DER interconnections to avoid the need for new interconnection studies.
- **Distribution outage communication:** Ensure that distribution system outage and reconfiguration communication is timely and sufficiently informative to allow DER aggregators to manage non-performance risks in the wholesale market, if utilities must curtail their day-ahead schedules or real-time dispatch to manage distribution constraints.

- **Distribution utility overrides:** Ensure that distribution utility override procedures are transparent and non-discriminatory, as required by Order 2222. Regulators should prioritize the adoption and statewide implementation of the Institute of Electrical and Electronics Engineers (IEEE) 1547-2018 standard within existing interconnection rules, as voltage support provided through compliance with interconnection standards may reduce the need for overrides and distribution upgrades.

How can utilities work with regulators, DER aggregators, and ISOs to begin to address these four gap areas?

The report offers the following recommendations for utilities' actions:

- **Interconnection:** Specify operating limits (e.g., maximum power injection) and requirements (e.g., inverter settings) in the interconnection agreement of an injecting DER and include this information in the utility's DER database, along with DER location and other relevant information. This will streamline the DER aggregation review and facilitate timely communication of changing grid conditions to the affected DER aggregators.
- **DER aggregation review:** Develop and publish data requirements and transparent review procedures to comply with Order 2222's 60-day requirement. Leverage data from the ISO DER aggregation registration and previously completed utility DER interconnection

processes to support DER aggregation reviews. In most cases, DER aggregation review should not require additional engineering studies.

- **Distribution outage communication:** Make use of and build upon existing protocols and processes for demand response aggregations as the basis for communications and data-sharing among utilities, DER aggregators, and ISOs, rather than create new processes and additional complexity.
- **Distribution utility overrides:** Initially focus on developing workable, transparent approaches to link distribution circuit outages and reconfigurations to affected DER aggregations, as this will enable the DER aggregator to inform the ISO in a timely fashion about reduced capacity and to modify its ISO market offers appropriately. Utility and aggregator responsibilities regarding overrides should be clearly articulated in interconnection and aggregator agreements and can evolve over time. Utilities should also prioritize the adoption and implementation of IEEE 1547-2018.

Are there additional gaps that have to be addressed in the long term as DER levels rise?

Yes, over the long term, we think that regardless of how DERs participate in wholesale markets—that is, regardless of the structural participation model used—there are fundamental changes needed in eight areas:

- Transmission and distribution planning coordination
- Distribution interconnection and aggregation review
- Communications and data-sharing
- Distribution operations
- Federal-state market regulation
- ISO market design
- Open access distribution tariffs
- Utility regulation and business models

What does the report recommend for addressing these long-term challenges?

A national, industry-wide dialogue needs to begin around forward-looking issues in anticipation of growing DER adoption, where solutions can be accelerated through joint, creative problem solving. This dialogue will need to include the topics of flexible interconnection (key stakeholders: utilities, commissions), transmission and distribution planning coordination (key stakeholders: utilities, ISOs), distribution operator independence and open access distribution tariffs (key stakeholders: commissions, utilities), future distribution operations (key stakeholders: utilities, commissions), issues around state-federal jurisdiction (key stakeholders: commissions, FERC), ISO market designs (key stakeholders: ISOs, FERC, market participants), and utility tariff designs (key stakeholders: commissions, utilities, network users, electricity customers).

PHOTOS

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This fact sheet was adapted from *DER Integration into Wholesale Markets and Operations*, a report by the Energy Systems Integration Group's Distributed Energy Resources Task Force. The fact sheet and the full report are available at https://www.esig.energy/reports-briefs.

To learn more about the recommendations described here, please send an email to info@esig.energy.

The Energy Systems Integration Group is a nonprofit organization that marshals the expertise of the electricity industry's technical community to support grid transformation and energy systems integration and operation. Additional information is available at https://www.esig.energy.