U.S. DEPARTMENT OF ENERGY | Office of ELECTRICITY

# Integrated System Planning and Coordination within the DOE Office of Electricity

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**DOE Office of Electricity**
**Briefing to the Industrial Technology Innovation Advisory Committee**

# Office of Electricity

**The mission of DOE's Office of Electricity is to ensure that the United States has a secure, resilient, and reliable power grid**

## GRID SYSTEM AND COMPONENTS

- Transformer Resilience and Advanced Components
- Microgrids
- Grid Enhancing Technologies

## GRID CONTROLS AND COMMUNICATIONS

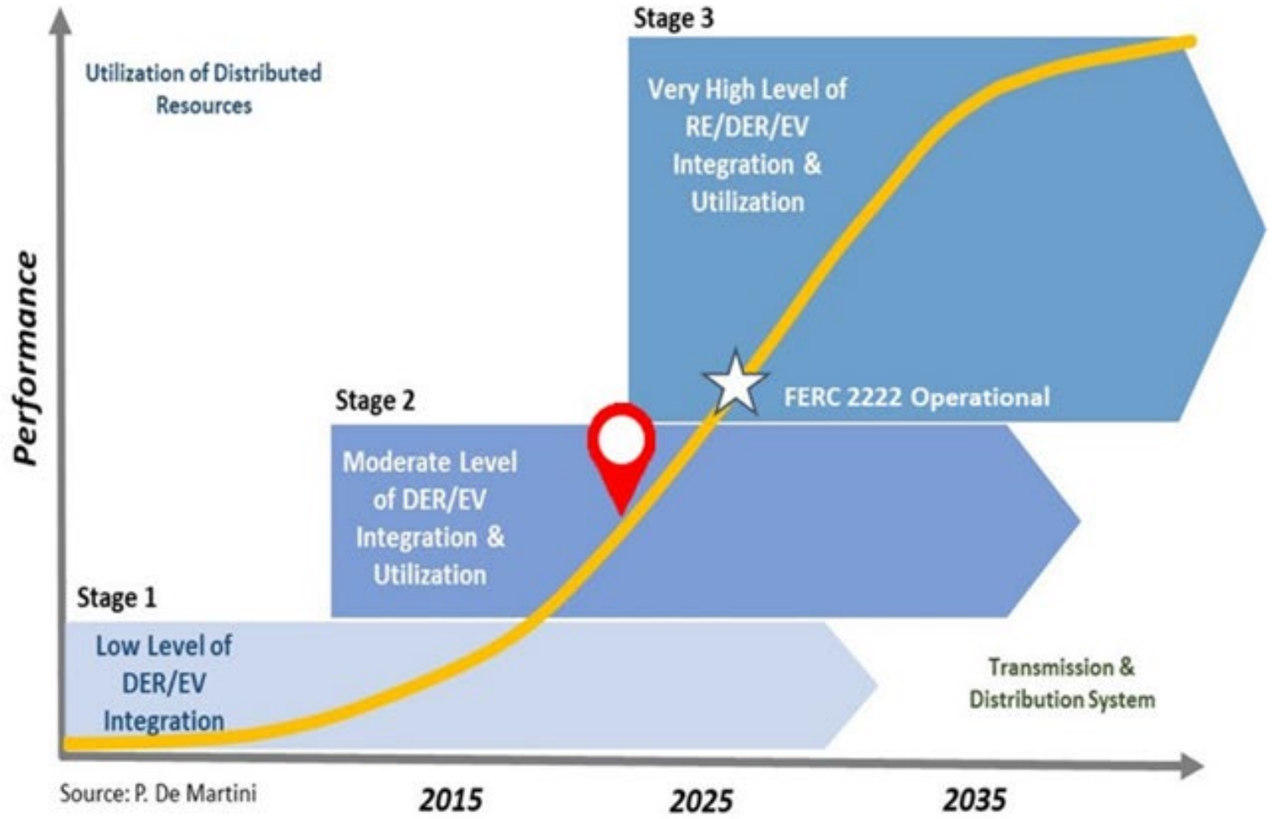
- Advanced Grid Modeling
- Distribution Grid Transformation
- Transmission Reliability
- North American Energy Resilience Model


## ENERGY STORAGE

- Energy Storage R&D
- Energy Storage Grand Challenge
- Long Duration Energy Storage
- Grid Storage Launchpad

# Addressing Grid-Edge Evolution

**Increasing levels of DER adoption means additional complexity in grid planning and operations, as well as in the design and operation of markets. In addition, fundamental investments in grid infrastructure are needed to address load growth in combination with grid modernization.**




**Stage 3: High DER/EV adoption; optimization and orchestration of DERs for the provision of grid services; alternative grid and ownership structures, including community microgrids; interjurisdictional coordination of markets, planning, and operations**

**Stage 2: Moderate DER adoption; emphasis on use of DERs as load-modifying and energy resources; IDP and grid modernization required to enable real-time visibility and operational use of DERs**

**Stage 1: Low DER adoption; emphasis on reliability, resilience, and operational efficiency; no material change to infrastructure, planning, and operations**

# Integrated Systems Planning and Coordination

**Advancing processes to enable the formulation of holistic, grid investment strategies that serve communities, states, and their affected publics which also address increasingly complex system requirements for integrating new resources and business structures**

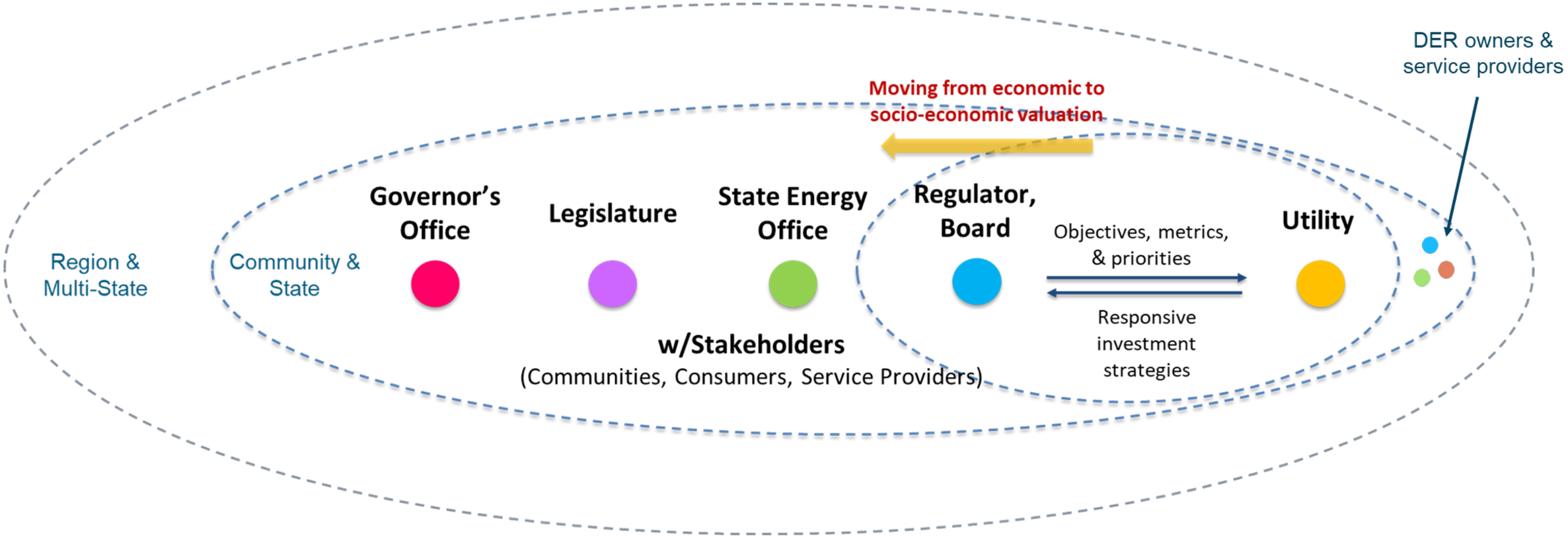
| System Planning | | System Design | |
|---|---|---|---|
| Advance coordinated planning practices and supporting analytical methods to support multi-state, regional grid investment decision-making. | Comprehensive System Planning (IDSP + IRP + T) | Operational Coordination Across the T-D-BTM Domains | Guidelines and best practices to help standardize operations at the grid edge, including coordination frameworks, for enabling the provision, management, oversight of services from DERs |
| | IDSP & IRP Coupling | Industry Working Group | |
| Framework to help decisionmakers develop holistic grid investment strategies that address community, state, and federal policies and increasing complexity at the grid edge | Integrated Distribution System Planning (IDSP) | Distribution System Architecture and Engineering | Application of grid architecture and system engineering principles to develop and assess design options for meeting the structural and functional requirements envisioned for future distribution systems |

Informs

**Partners**:
Internal – EERE for DER integration and GDO for resilience planning
External – NARUC, NASEO, NGA, NCSL, NRECA, APPA, RMI, ESIG, EPRI, & AEIC

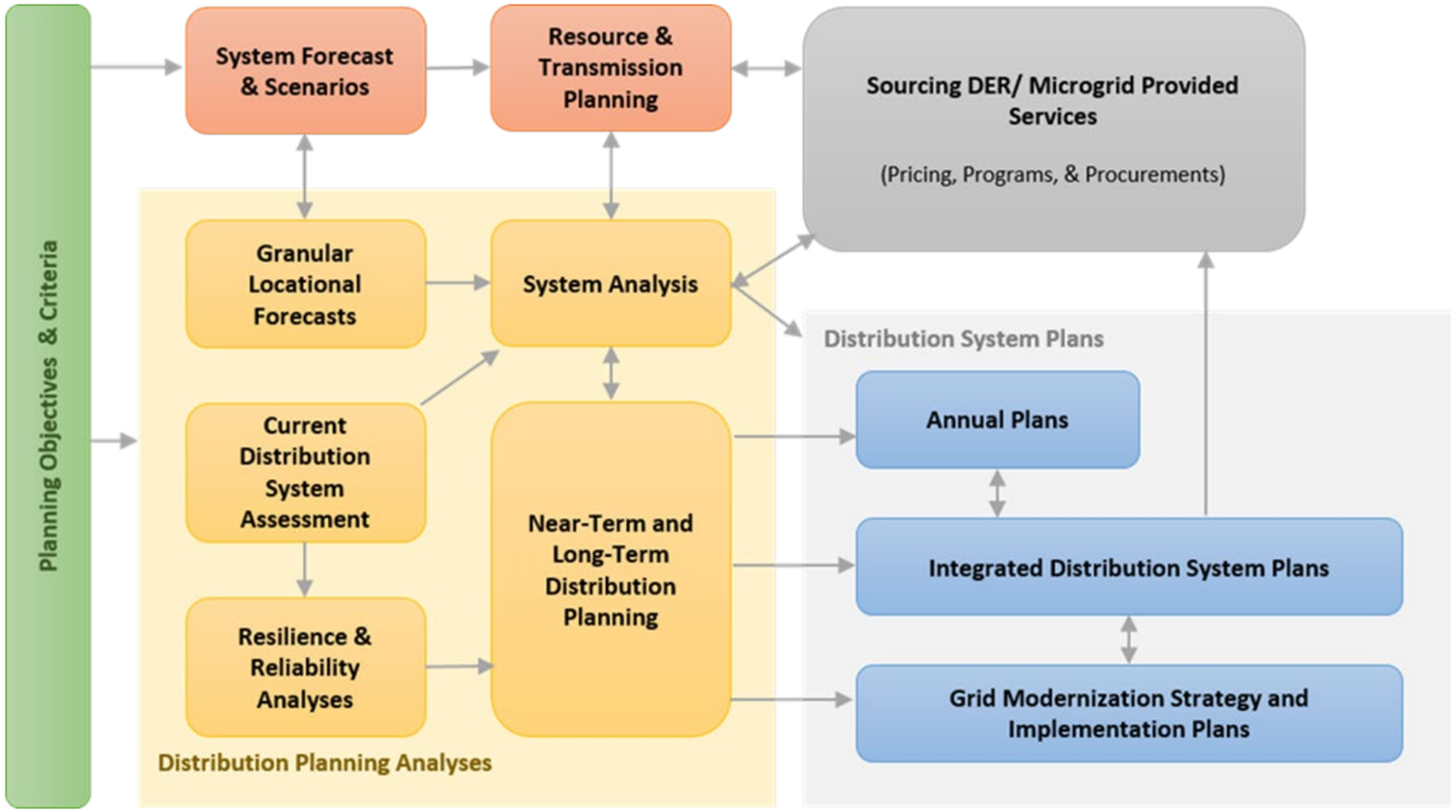
# Multi-jurisdictional Coordination

**Unprecedented levels of coordination are required for advancing decision practices and processes to enable the formulation of holistic, cost-effective, and forward-looking grid investment strategies**



# Integrated Distribution System Planning

## IDSP processes provide a platform for translating community/state objectives and priorities into holistic grid investment strategies with participation of key stakeholders



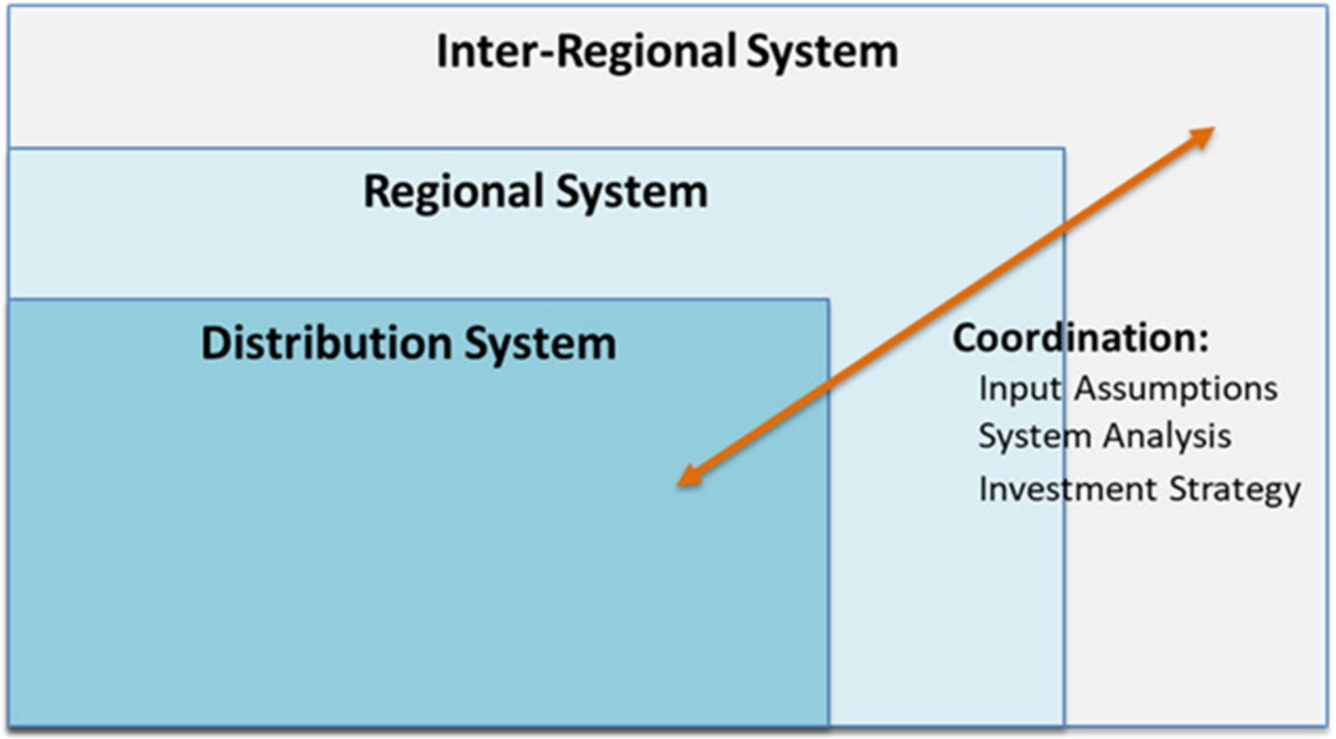

From Modern Distribution Grid Guidebook, DSPx Volume 4, June 2020, PNNL: Grid Architecture - Modern Distribution Grid Project

# Comprehensive System Planning

## Comprehensive energy planning will require coordination of planning and operations across multiple jurisdictions

**We are moving towards a regional, multi-state planning paradigm:**

- DERs are becoming part of the resource mix
- Reliance on DERs may become more pronounced to satisfy load growth requirements (electrification) given transmission system constraints
- Strategic deployment of energy storage should be considered to address flexibility requirements.
- Resilience planning will require a combination of community, state, and regional investments, with comprehensive assessments of resource adequacy.
- Understanding interdependencies between the electricity and natural gas infrastructures



# Distribution Grid Codes

**The presence of distributed energy resources owned by multiple entities requires standard processes for coordinating grid operations**

**Grid codes** refer to the collection of institutional and business processes, and technical standards to safely and effectively integrate and utilize distributed energy resources and aggregations within the electric distribution system

Distribution Grid Code Framework, U.S. DOE, Nov 2023;
Distribution Grid Code Framework (energy.gov)

## Grid Codes

| Code Families | Code Elements |
|---|---|
| Grid Engineering | Hosting Capacity Analysis<br>Short- and Long-Term DER Forecasting<br>Locational Value Analysis<br>Electrification |
| DER and Microgrid Integration | Inverter Based Resources<br>Microgrids<br>Monitoring and Control of DERs<br>DER Interconnection Procedures<br>Community Based Renewable Energy<br>Microgrid Interconnection Procedures |
| Virtual Power Plants and Microgrid Services | Retail Energy and Distribution Grid Services<br>Distribution Resilience Service<br>DER Aggregation<br>DER Aggregator Wholesale Market Services |
| DER and Microgrid Operations | Monitoring and Control of DERs<br>Distributed Resource Management – Utility<br>Distributed Resource Management – Aggregator<br>Operating Agreements<br>Common Information Sharing Model<br>Utility Operational Technology<br>Registration of DERs and DER Aggregators for Market Services<br>Market Participation Rules Validation for DER Aggregations<br>Net Load Baselining and Performance Analytics |
| Information Sharing and Security | Customer Data Access and Privacy<br>Distribution System Data<br>Information Sharing – Aggregators<br>Cybersecurity |
| Governance and Oversight | Distribution Open Access<br>DER Aggregator Oversight<br>DER/ Microgrid Value Determination and Cost Allocation<br>Governance and Oversight of Wholesale Market Participating DER |

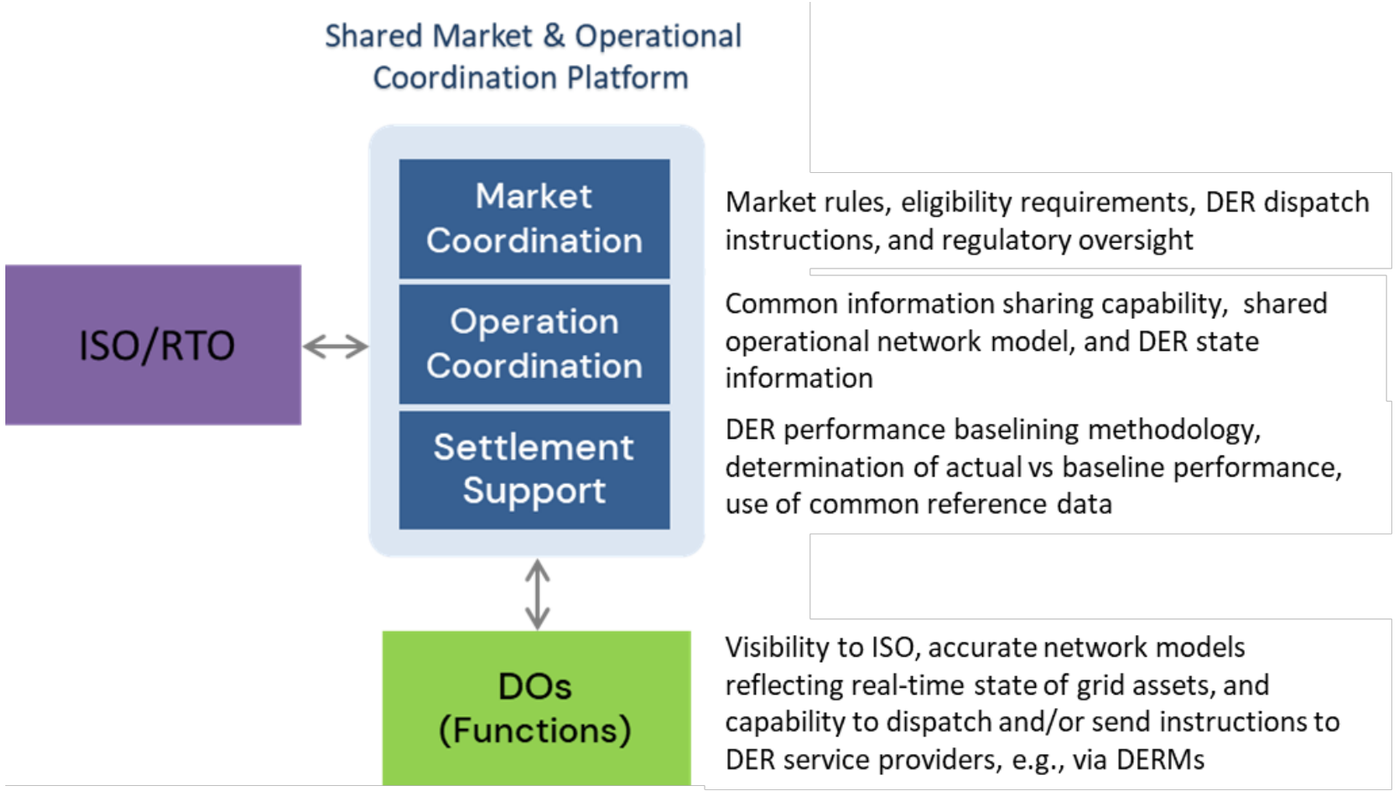
# Architectural Platform for Operational Coordination

## FERC Order 2222 is driving requirements to utilize DERs across the power system requires coordinated planning and operations across jurisdictions

### Enabling the application of grid services from DERs will require:

- Deploying capabilities to provide real-time visibility and dispatching of grid assets while maintaining grid reliability under all conditions in support of coordinated operations amongst all participants
- Developing distribution system designs and modeling capabilities that lead to technology deployment strategies enabling the use of myriad DERs, including microgrids, VPPs, and electric vehicle infrastructure
- Determining interoperability requirements so that disparate assets and systems can seamlessly share data and interoperate, and
- Formulating planning guidelines so that regulators and utilities can formulate holistic grid investment strategies that incorporate DERs.

### Platform architecture required to support operations across the transmission, distribution, and BTM domains



# Thank you