



ISO New England's 2022 Annual Work Plan

Incorporates feedback from stakeholders

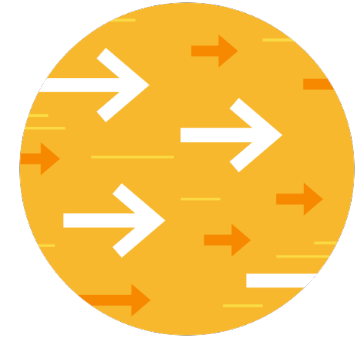
Vamsi Chadalavada

EXECUTIVE VICE PRESIDENT AND CHIEF OPERATING OFFICER



2022 Objectives and Highlights

Advancing a reliable clean-energy transition through innovation and collaboration



- **Anchor projects** require dedicated focus and a regional commitment to securing power system reliability while facilitating the integration of clean-energy and distributed resources
 - **Market Improvements for the Current and Future Grid**
 - **Resource Capacity Accreditation** to accurately reflect resource contributions to resource adequacy in the capacity market as the resource mix transforms
 - **Day-Ahead Ancillary Service Improvements** to create pricing incentives for specific energy and reserve capabilities needed for reliability as the resource mix and regional energy demand evolve
 - **Transmission Planning for the Future Grid**
 - **Extended-Term Transmission Planning** to support recurring assessments of a future system beyond the current ten-year transmission planning horizon by modifying the ISO Tariff
 - **2050 Transmission Study** to assess the amount, type, and high-level cost estimates of transmission infrastructure necessary to maintain reliability with prospective renewable and distributed energy expansions to meet states' energy policies
 - **Operational Impacts of Extreme Weather Events** to model and assess low-probability, high-impact weather risks under New England's changing power system
- **Notable initiatives underway** target innovation, advance efficiency, and help manage risks across markets, planning, operations, and software structures
- **Other potential projects** may emerge but not achievable for development in 2022

Project Timing and Effects of Shifting Priorities

The ISO strives to support the reliability and decarbonization goals of the region in a coordinated manner

● Project timing

- Because the planning/study phases of a number of projects are scheduled to be completed in early 2022, follow-on work, such as additional studies or design work, would need to be discussed at that time; this work is broadly identified here but may be clarified in the Spring 2022 Annual Work Plan Update



● Shifting priorities

- FERC actions (orders, notices of proposed rulemaking) and policy directives can shift regional priorities
- Increased or expanded stakeholder requests, regional policy interests, and new issues will affect project schedules of planned efforts
- Upfront agreement on priorities helps keep the region's anchor projects on track



ANCHOR PROJECTS

Market Improvements for the Current and Future Grid



Maintaining Resource Adequacy: Resource Capacity Accreditation (RCA) in the Forward Capacity Market (FCM)

Reforming the way resources are qualified in the FCM to support a reliable, clean-energy transition

- This major effort seeks to identify and implement methodologies that will more appropriately accredit resource contributions to resource adequacy as the resource mix transforms
 - It is critical to reliability and market efficiency that the methodologies are updated to reflect resources' capabilities and how those capabilities contribute to resource adequacy
- The ISO has begun assessing and discussing methodologies with stakeholders, including how Effective Load Carrying Capability (ELCC) techniques could be used in quantifying resource capacity contributions to regional resource adequacy
- After its assessment and in consultation with stakeholders during the project phase, the ISO will finalize its filing and implementation timeline
 - Currently contemplating a FERC filing by the end of 2022, targeting Forward Capacity Auction (FCA) 18, and a second filing by the end of 2023, targeting FCA 19



Day-Ahead Ancillary Services Improvements

Procuring and transparently pricing the ancillary service capabilities needed for a reliable next-day operating plan with an evolving generation fleet

- As the power system transforms, new and updated ancillary products and services are needed to procure and price:
 - 1) the “gap” between day-ahead physical energy supply awards and the ISO’s forecast real-time load, and
 - 2) day-ahead generation contingency response capabilities
- In 2022, the ISO will revisit efforts to co-optimize reserves in the day-ahead energy markets
 - This includes developing both the product design (focused on Energy Imbalance Reserve and Generation Contingency Reserve) and the mitigation design, as well as conforming market changes, including elimination of the Forward Reserve Market
- The ISO anticipates it will take until mid-late 2023 to complete (e.g., design, impact assessment, stakeholder process, and regulatory process)



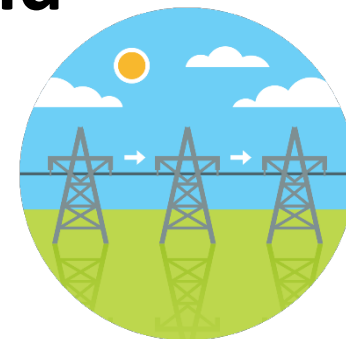
ANCHOR PROJECTS

Operations and Planning Improvements for the Future Grid



Transmission Planning for the Future Grid

Providing transmission planning beyond a 10-year horizon that assesses a reliable, clean-energy future grid (initiated in response to the New England States' Energy Vision)



- **Extended-Term Transmission Planning:** The ISO is proposing changes to Attachment K of the Open Access Transmission Tariff to create a process that will allow the New England States to request, on a recurring basis, the ISO to perform extended-term planning analyses on the system beyond the current 10-year planning horizon
 - Beginning in 2022, the ISO also expects to discuss with stakeholders a second phase of Tariff changes to allow a process for states to consider potential options in addressing longer-term issues and cost allocation
 - Ongoing processes at FERC may further inform this effort
- **2050 Transmission Study:** The ISO is conducting a high-level transmission study for the years 2035, 2040, and 2050, that informs the region of the amount, type, and high-level cost estimates of transmission infrastructure that would be needed to cost-effectively incorporate clean-energy and distributed-energy resources and to meet state energy policy requirements and goals, including economy-wide decarbonization
 - The study looks well beyond the ISO's 10-year horizon for transmission planning to meet reliability needs so states can prepare for their future outlook
 - It is not a plan to build specific projects
 - The ISO anticipates sharing the scope, assumptions, and inputs requested by the states at the Planning Advisory Committee (PAC) in fall 2021

Modeling and Assessing Operational Impacts of Extreme Weather Events

Considering how to study New England's reliability risks from severe weather events



- The 2021 events in Texas have caused the ISO to further evaluate whether our region is adequately assessing and preparing for low-probability, high-impact reliability risks (tail risks)
- The ISO is initiating the project with discussion at the October 7, 2021, Participants Committee meeting; in Q1 2022 extending into 2023, the ISO and stakeholders will discuss approaches to modeling tail risks related to extreme weather events
- This process will:
 - Initially focus on understanding the modeling approaches to quantify such risks
 - Subsequently focus on understanding if and how the region should protect against the risks
- The ISO will work with Electric Power Research Institute on this project

NOTABLE INITIATIVES UNDERWAY

Major Initiatives Already Identified for 2022

New England's Future Grid Initiative

Assessing the future of the regional power system in light of state energy and environmental laws



- **Future Grid Reliability Study (FGRS) Phase 1:** For its 2021 Economic Study, the ISO is conducting a series of engineering and economic analyses that use stakeholder-defined scenarios to identify grid reliability challenges that could occur in the year 2040 in light of state energy policies; the ISO will issue a report in March 2022
- **Pathways to the Future Grid:** The ISO is evaluating potential market frameworks for facilitating the evolution of New England's power grid that reflects state energy policies; the ISO will issue a report on the following three studies in April 2022
 - **Study 1:** Evaluate a forward clean-energy market
 - **Study 2:** Evaluate net carbon pricing
 - **Study 3:** Evaluate a hybrid option that incorporates elements of the above two frameworks, as well as unique design components

New England's Future Grid Initiative, cont'd

Next steps on both initiatives will be discussed after study results are published



- **FGRS Phase 2:** Identify products or services that may need to be obtained via the ISO-administered markets to address gaps to reliably operating the future power system identified in Phase 1 (may address balancing services/resource issues)
 - Use of a consultant to assess system security and revenue sufficiency in a gap analysis; results of and issues resolved through Phase 1 and other future-grid-related studies will be critical inputs to and create efficiencies in how the Phase 2 analyses may be shaped
- **Pathways to the Future Grid:** Consideration of a preferred pathway and next steps

Capacity Markets without a Minimum Offer Price Rule (MOPR)

Developing a proposal to remove this component for FCA 17 while seeking to preserve the FCM's ability to attract new entry

- The MOPR requires minimum offer prices for new resources in the Forward Capacity Market
- Significant concerns have been raised at both the regional and federal level that the MOPR precludes resources sponsored by the states from clearing in the FCM
 - The FERC has identified this matter as its priority
- The ISO intends to develop a proposal with input from stakeholders to address the dual objectives of allowing sponsored resources to clear and maintaining competitive capacity pricing that can attract merchant entry when needed to maintain resource adequacy
- Following a robust stakeholder process in 2021 and early 2022, the ISO will file a proposal for FCA 17 in February 2022



FERC Order No. 2222 Compliance

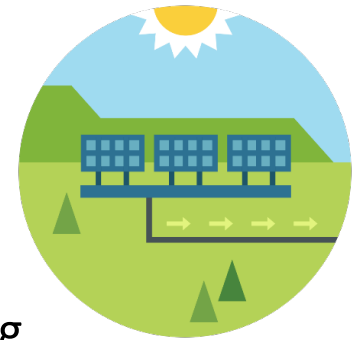
Allowing participation of DER aggregations in wholesale markets

- FERC issued Order No. 2222 on September 17, 2020, which requires ISOs/RTOs to allow distributed energy resources (DERs) to provide all wholesale services that they are technically capable of providing through an aggregation of resources
- The ISO is dedicating resources to create a responsive market design, develop the compliance proposal through an extensive and comprehensive stakeholder process, and implement changes in ISO systems
- The compliance filing of proposed tariff revisions is due February 2, 2022; regulatory processes to follow for an unknown duration
 - Work during the remainder of 2022 (conforming changes/implementation) will depend on the progression of the regulatory process



Solar DNE Design

Enabling solar resources to be dispatched in the Real-Time Energy Market under the Do-Not-Exceed (DNE) model



- The quantity of front-of-meter solar generator assets in the New England region is expected to continue growing
- In 2022, the ISO will begin developing the rules, processes, forecasts, and tools necessary to enable these resources to take electronic dispatch instructions using the DNE model (as presently used with wind resources)
- Integrating these resources into the DNE dispatch process will help maximize the use of low-cost renewable energy, improve congestion management in constrained areas, and set appropriate price signals in the energy market
- The ISO expects to file changes with FERC in 2022 and implement the Solar DNE dispatch in Q2 2023

Additional Transmission Planning Enhancements for the Evolving Grid

Updated assumptions used in transmission planning studies will reflect future-grid trends and Tariff changes will allow storage to be considered as a transmission asset

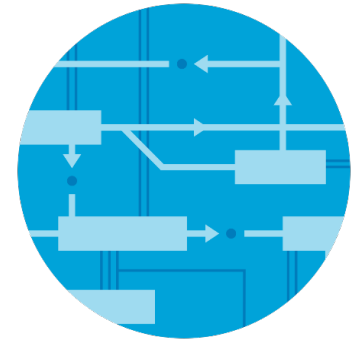


- **Transmission Planning for the Clean-Energy Transition (CET):** The ISO, through the PAC process, has pilot tested a variety of transmission planning assumptions for 2030 (typical 10-year planning horizon); based on those results, the ISO will finalize and document new study conditions for load, solar generation, and wind generation to use going forward in its planning studies (e.g., Needs Assessments)
 - The ISO will continue further analyses into 2022 on renewable energy modeling and inter-area coordination of renewable energy integration— including detailed DER modeling, DER protection settings, and criteria for the acceptable level of DER tripping following transmission system events
- **Storage as a Transmission Solution:** Beginning in Q1 2022, the ISO will initiate discussions of proposed Tariff changes to consider storage as a transmission asset that meets transmission needs



Models and Tools to Support Future Grid Studies

Models, simulators, and other tools that are adaptive to evolving technologies and system conditions are needed to support future-grid studies



- **Inverter-Based Resource Integration and Modeling Assessment:** The ISO has begun a multi-year project (2021-2023) to assess and adopt advanced, innovative analysis techniques that capture the unique performance characteristics of inverter-based resources (e.g., solar and wind), critical to its studies beyond the 10-year horizon
 - By the end of 2021, the ISO will develop recommendations for the deployment of Electromagnetic Transient power system software and analytical methods that will enable efficient and reliable integration and modeling of rapidly-evolving inverter-based resources
 - In 2022, the ISO will begin to implement the recommendations to integrate hybrid-simulation processes and multi-core parallel capability into large-scale system studies, standardize the Electromagnetic Transient simulation workflow, and develop and deliver training to engineers
- **Integrated Market Simulator Development:** This is a multi-year project (2021-2023) to develop a new platform that will produce accurate, timely, long-term wholesale electricity market-simulation results through which the ISO can better and more cost-effectively quantify the potential outcomes of future market design changes, or potential changes in system supply and demand conditions, and aid in the ISO’s research and development projects and cost impact studies
 - The ISO will complete the day-ahead portion of the market simulator in 2021 and will develop sub-hourly simulation and network analysis capability throughout 2022 and into 2023

nGEM Day-Ahead Market Clearing Engine Implementation

This is one project within the broader nGEM Program

- GE Solutions is modernizing its market application suite in a program called Next Generation Markets (nGEM), co-funded by GE, ISO-NE, MISO, PJM
 - The ISO's Market Management System (MMS) is based on the GE suite
 - This effort spans 2020-2027 and is broken into four phases
 - The ISO plans to update stakeholders on its nGEM program coincident with its Annual Work Plan presentation
- As part of this nGEM Phase 1 program, GE is developing a new market clearing engine (MCE) and implementation of the day-ahead version of this MCE will be a major focus in 2021 and 2022
 - In this timeframe, the ISO will be working on the complex processes for customizing and implementing the nGEM DA MCE software and infrastructure into the ISO's unique MMS
 - The DA MCE replaces the legacy MCE, and benefits include improved performance, flexibility, functionality, and scalability
 - The DA MCE is expected to be in-service Q1 2023



Enhance Cyber Security Tools

Upgrading monitoring, detection, and recovery tools to adapt to increasingly sophisticated threats and new attack vectors given ISO's heavy reliance on information technology



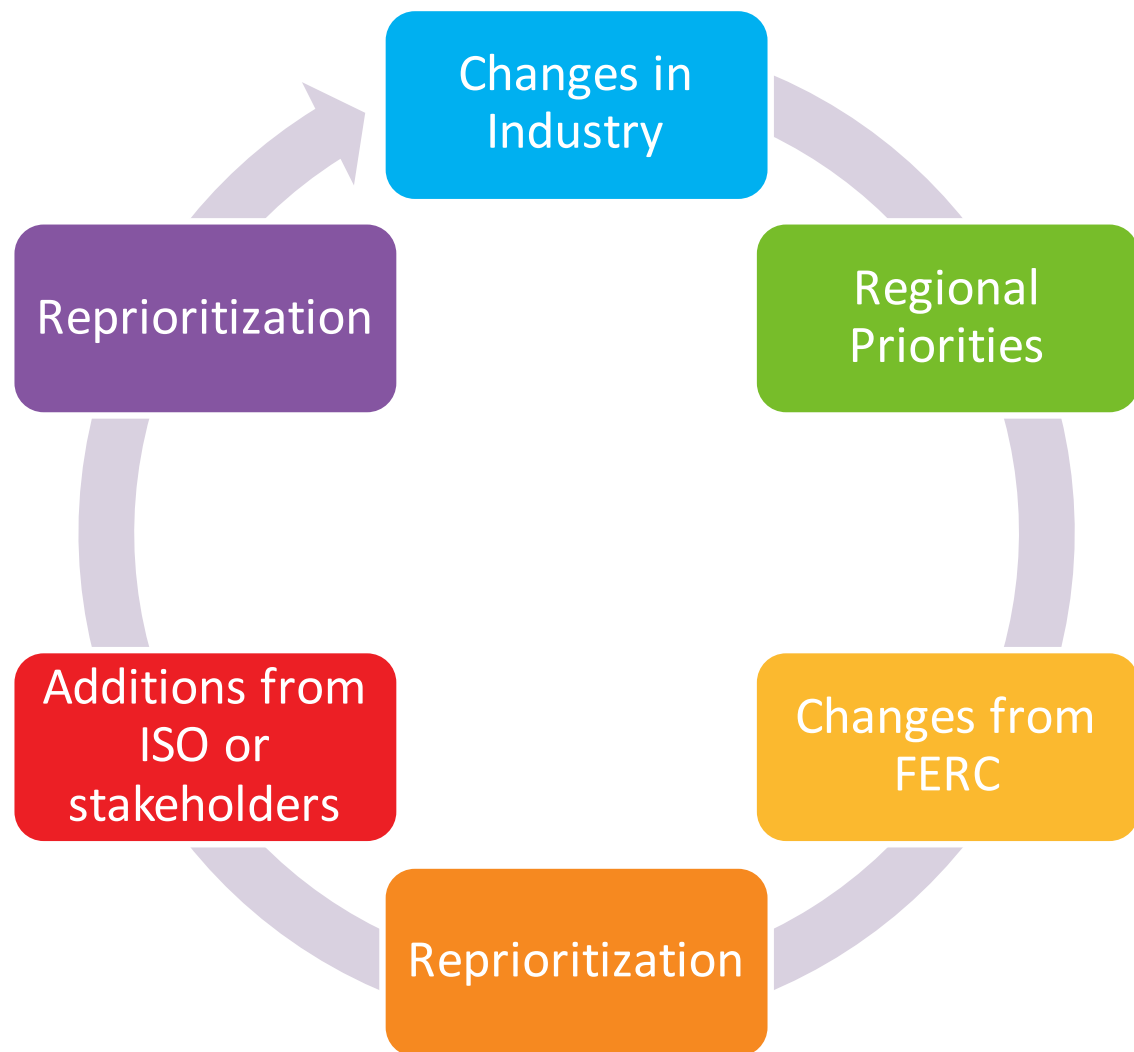
- **Identity & Access Management (IAM)** replaces the ISO's access rights application that records approval of users to thousands of ISO assets (e.g., applications, badged physical access, etc.)
 - IAM is the foundation of the ISO's cyber-security program: improves the functionality and security associated with logical and physical access management, and maintains compliance of these functions with NERC Critical Infrastructure Protection standards
 - Final phase to be completed by end of 2022
- **Security Information and Event Management (SIEM)** collects and correlates logs for monitoring and alerting on security events from hundreds of servers, network devices, and the applications running on them
 - ISO will implement new hardware by end of 2021 and software and related process changes by July 2022
- The **Cyber Security Improvements** project will refresh the hardware and software for the systems that support the collection of network traffic data that feeds the Network Intrusion Detection system and the Security Information and Event Management analysis system
 - The targeted completion date for this project is December 2022

WORK PLAN PRIORITIZATION

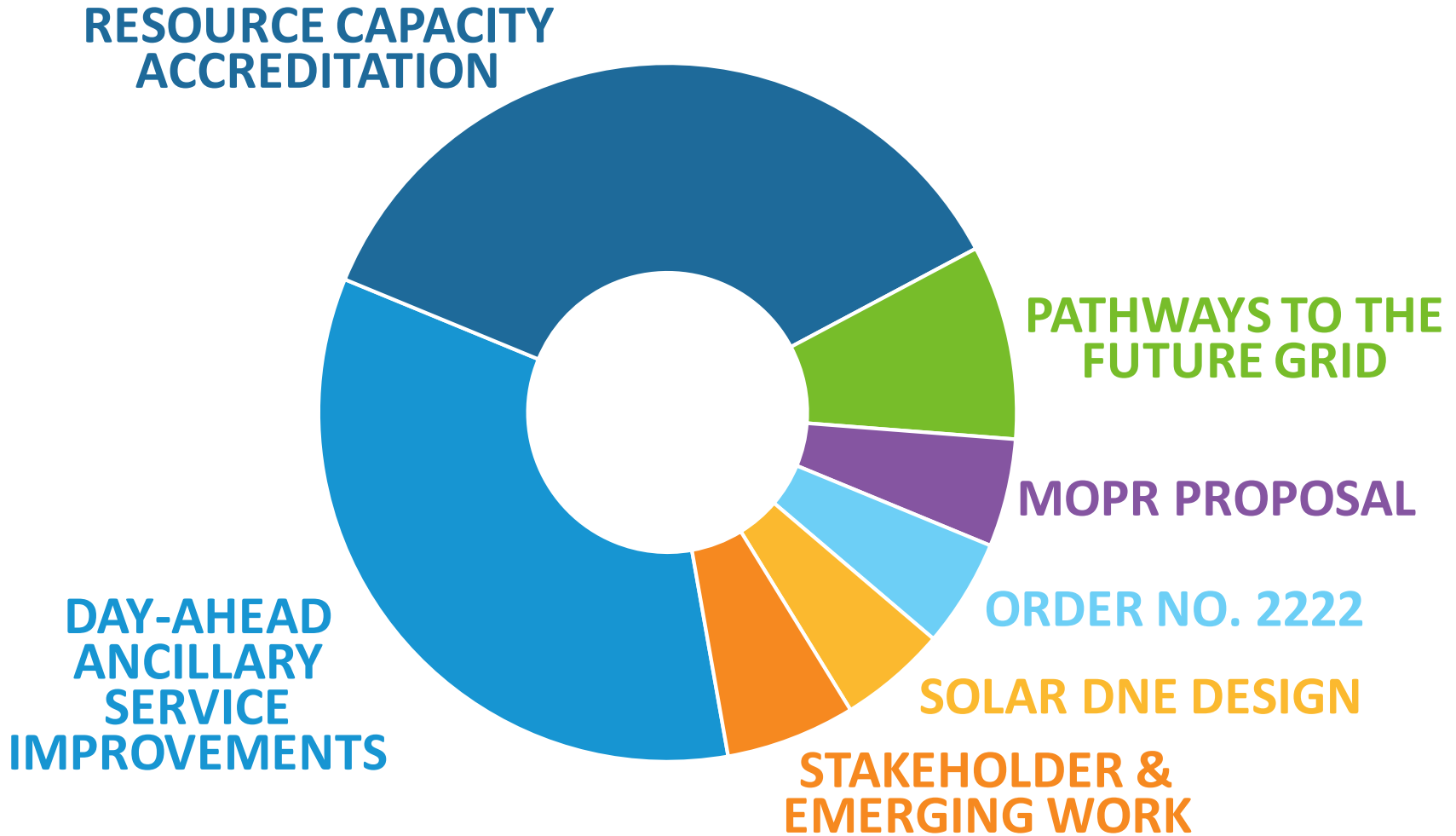


Prioritization Process

- The ISO adjusts its priorities as needed to best maintain reliable operations, robustly plan for a changing grid, and ensure competitive wholesale markets
- Planned projects are impacted as scopes shift or new projects emerge



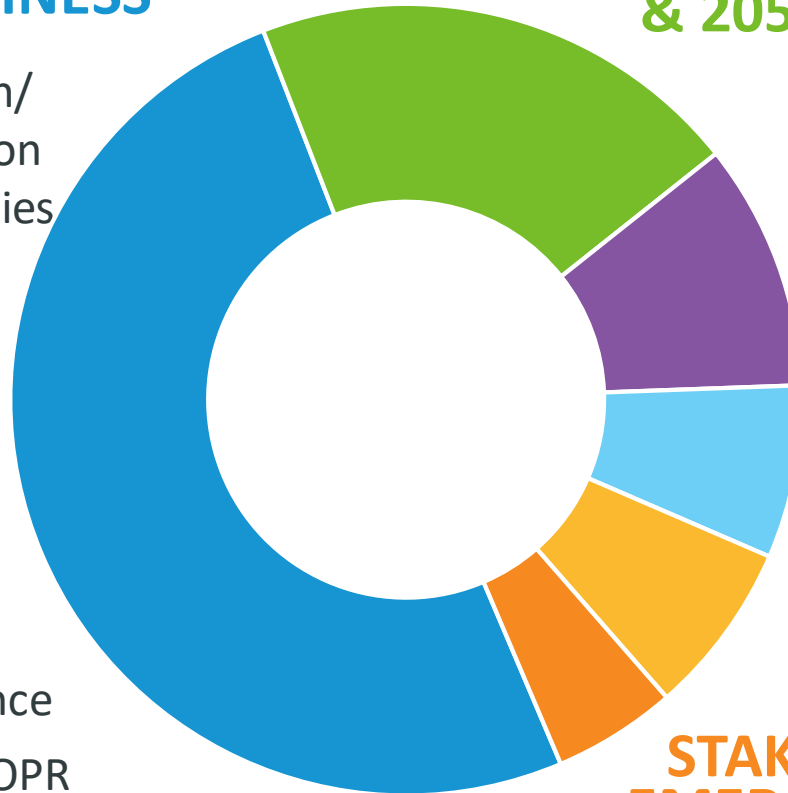
Markets-Related Priorities Include:



Planning/Operations Priorities Include:

CONTINUING BUSINESS

- Increased Generation/Distributed Generation Interconnection studies due to increasing number of interconnection requests
- Administer FCA #16 and FCM-related modeling
- NERC/FERC Compliance
 - FERC ANOPR/NOPR
- 2022 Economic Study



**EXTENDED-TERM
TRANSMISSION PLANNING
& 2050 TRANSMISSION
STUDY**

**EXTREME WEATHER
MODELING**

**FGRS PHASE 1 (2021
Economic Study)**

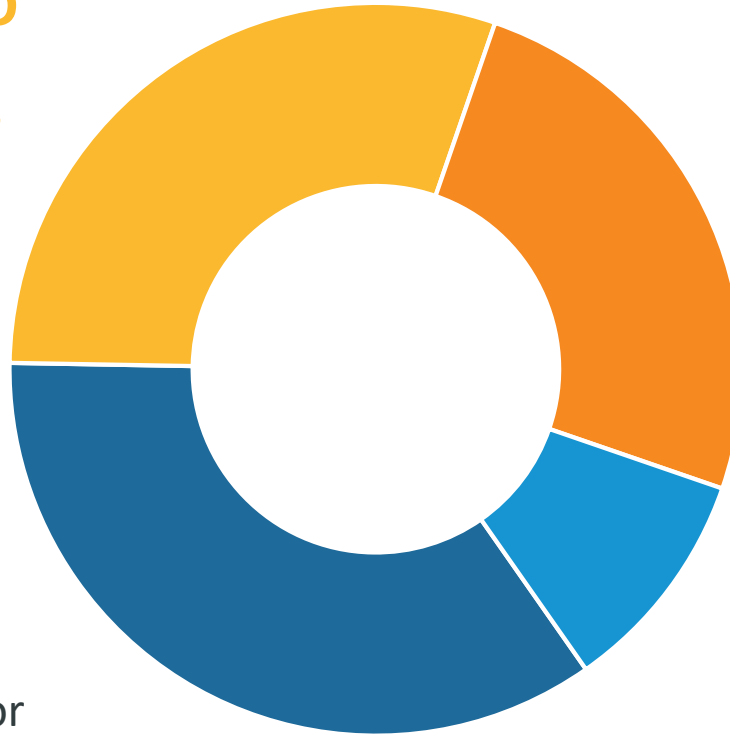
**CET & STORAGE AS
TRANSMISSION
SOLUTION**

**STAKEHOLDER &
EMERGING WORK**

Capital Project Priorities Include:

APPLICATION AND DATABASE ENHANCEMENTS

- FCTS
- IMM Data Analysis
- Integrated Market Simulator
- TranSMART
- FCM Accelerated Billing
- Issue Resolution
- Linear State Estimator
- Enterprise Application Integration
- TTC Calculator



nGEM DAY-AHEAD MARKET CLEARING ENGINE IMPLEMENTATION

CYBERSECURITY

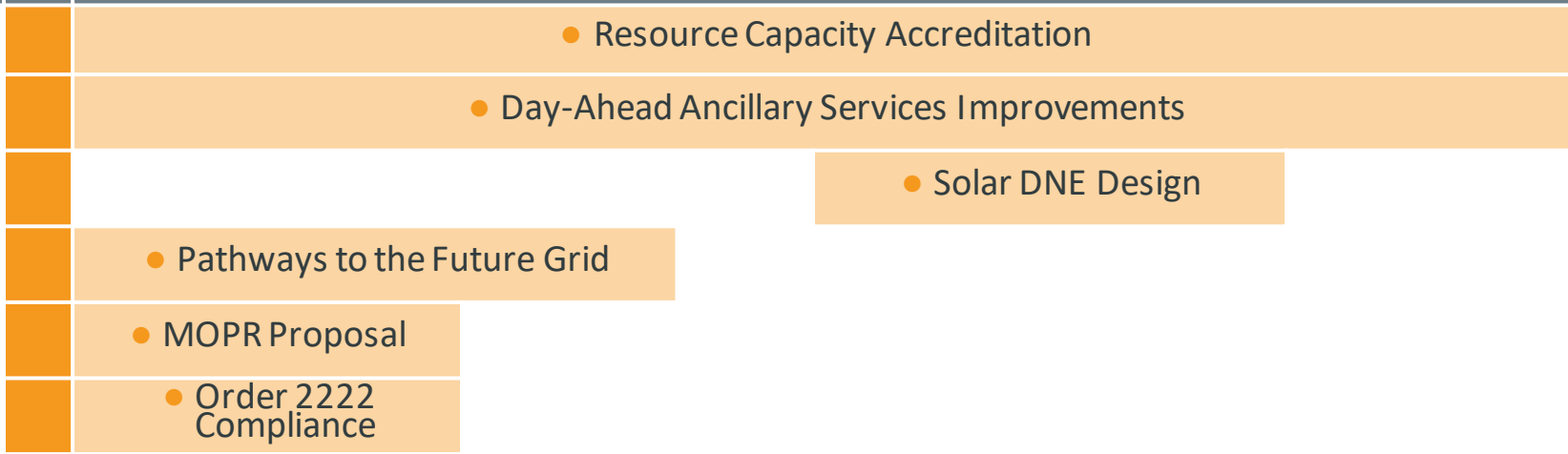
- IAM
- SIEM
- Critical Infrastructure Protection Electronic Security Perimeter

IT INFRASTRUCTURE ENHANCEMENTS

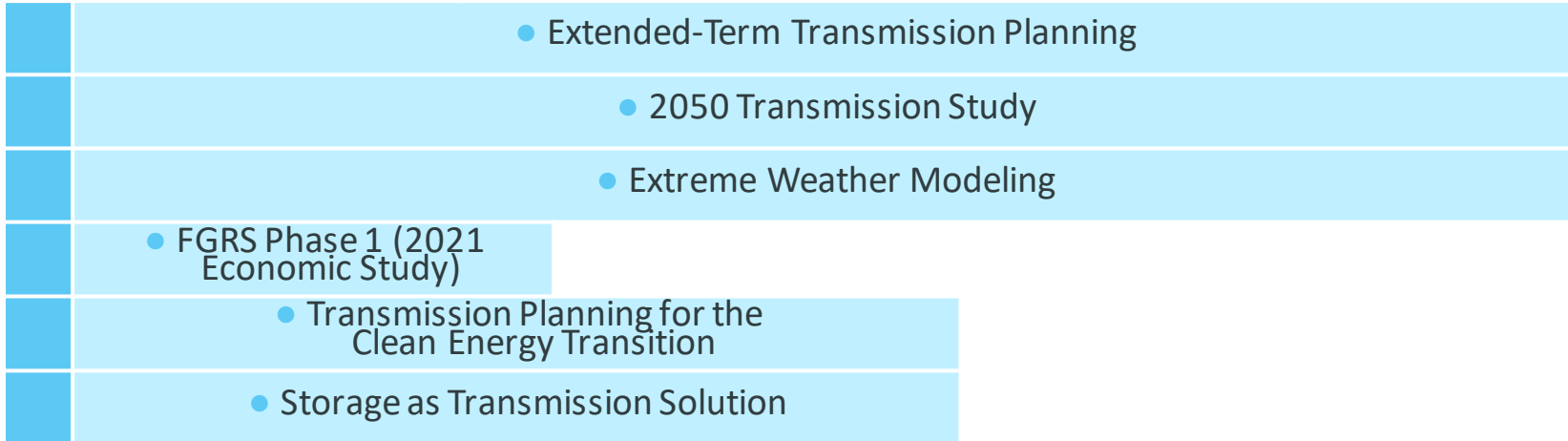
- LMP Monitor
- Amazon Web Services Cloud Foundation
- Website Migration to Cloud



Markets Related



Operations/Planning



Capital Project Priorities

