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ISO New England's 2023 Annual Work Plan (AWP)

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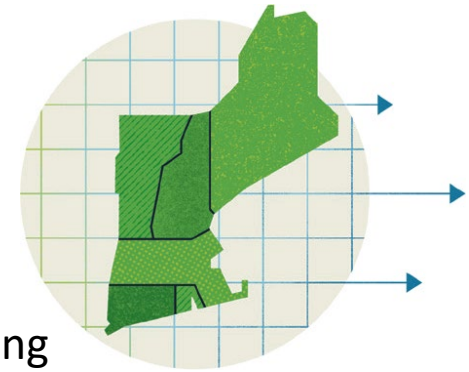
EXECUTIVE VICE PRESIDENT AND CHIEF OPERATING OFFICER

2023 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-energy resources
  - **Resource Capacity Accreditation** to update the approach for reflecting individual resource contributions to resource adequacy in the capacity market as the resource mix evolves
  - **Day-Ahead Ancillary Services** to create pricing incentives for specific energy and reserve capabilities needed for reliability as regional supply and demand transform
  - **Extended-Term Transmission Planning Phase 2** to develop Tariff changes allowing a process for states to move policy-related transmission investments forward and allocate the costs
  - **2050 Transmission Study** to inform region of possible transmission infrastructure and associated cost estimates needed to reliably serve peak loads in 2035, 2040, and 2050 using scenarios that reflect state decarbonization policies
  - **Operational Impacts of Extreme Weather Events** to model and assess energy-security risks from future low-probability, high-impact weather events under a changing power system
  - **Energy Adequacy Considerations and Actions** to more precisely define the region's energy adequacy challenges and begin to consider options and directions
  - **nGem Market Clearing Engine** to continue development and implementation of a new platform that is foundational to supporting an exponentially complex, future system
- **Notable initiatives** target innovation, advance efficiency, and help manage risks across markets, planning, operations, and software structures

Effects of Shifting Priorities

The ISO strives to support regional reliability and decarbonization goals in a coordinated manner

- Plans may need to adjust over time to reflect emerging requests, regulations, trends, and risks
  - Increased or expanded stakeholder requests, regional policy interests, and new issues can affect project schedules of planned efforts
  - Upfront agreement on priority work, including NEPOOL and state priorities, are intended to keep listed projects and schedules on track
  - A number of Federal Energy Regulatory Commission (FERC) actions (orders, notices of proposed rulemaking) are expected by or in 2023 and may shift priorities (e.g., NOPR RM21-17; Docket No. AD22-8)
  - Major changes that arise will be reflected in the Spring 2023 AWP Update
- Note that the AWP identifies key initiatives and not the full ISO workload; the ISO's annual budget incorporates the full volume of ISO work, including initiatives in the AWP as well as:
  - Work on smaller projects or projects nearing completion
  - Work to implement projects already through design, stakeholder, and regulatory phases
  - Work representing the ISO's extensive day-to-day operations related to running the grid, markets, IT infrastructure, and its organization

ANCHOR PROJECTS

Enhancements for the Current and Future Grid

Markets Anchor Projects

Improving pricing and resource valuation to promote reliability and manage resource uncertainty as grid evolves

- **Resource Capacity Accreditation (RCA) in the Forward Capacity Market (FCM)**
  - This effort already underway seeks to implement new methodologies to quantify/accredit resources' capacity contributions to regional resource adequacy, which will be critical to reliability and market efficiency as the resource mix transforms
  - In 2023, the ISO and stakeholders will discuss the detailed framework design; the ISO plans to file with FERC by Q4 2023 and implement changes for Forward Capacity Auction 19 (FCA 19)
- **Day-Ahead Ancillary Services Initiative**
  - This initiative seeks to develop market constructs for procuring and transparently pricing ancillary service capabilities needed for a reliable, next-day operating plan with an evolving resource mix
    - **Energy Imbalance Reserve** would cover the "gap" when the day-ahead market's physical energy supply awards are below the ISO's forecast real-time load
    - **Day-Ahead Flexible Response Services** would procure day-ahead 10- and 30-minute response services to enable the system to recover from sudden source-loss contingencies and respond quickly to fluctuations in net load during the operating day
  - Market mitigation and other conforming rule changes will be addressed, including elimination of the Forward Reserve Market
  - In Q4 2022 and throughout 2023, the ISO and stakeholders will discuss the detailed designs; the ISO plans to file with FERC by the end of 2023

Planning Anchor Projects

Providing longer-term transmission planning that assesses a reliable, clean-energy future grid in response to the New England States' Energy Vision

- **Extended-Term/Longer-Term Transmission Planning Phase 2**
  - In 2022, FERC approved a first phase of changes to Attachment K of the OATT, creating a process that allows the New England States to request the ISO to perform planning analyses that may extend beyond the 10-year planning horizon that would provide visibility into the transmission investment needed to further state energy policy objectives
  - The second phase of changes would provide the process for the states to move public policy-related transmission investments forward along with the associated cost-allocation method; the process should permit conversion of longer-term transmission studies into developable projects
    - Phase 2 along with process changes that may arise from FERC's potential RM21-17 Order likely will create channels for input about sizing the transmission system for future needs, addressing NESCOE and NEPOOL's request for a "right-sizing" initiative in 2023
  - Stakeholder discussions on Phase 2 to begin in late 2022/early 2023, with a potential FERC filing in Q3 2023; ongoing processes at FERC may further inform this effort
- **2050 Transmission Study**
  - As per the Phase 1 changes above, the ISO has been conducting a transmission study that informs the region of possible transmission infrastructure and associated cost estimates needed to reliably serve peak loads in 2035, 2040, and 2050 using scenarios/assumptions that reflect state decarbonization policies
  - The ISO presented study results in spring and summer of 2022 and began developing possible transmission solutions; further development of solutions and associated cost estimates will extend into 2023

Operations Anchor Project

Energy adequacy study of reliability risks from severe events as grid supply and demand transform

- **Energy-Security Study: Operational Impacts of Extreme Weather Events**
  - The ISO is working with the Electric Power Research Institute (EPRI) to build an innovative framework for conducting a probabilistic energy-security study that assesses the operational impact of future extreme weather events
    - Step 1 Weather Modeling: Identify weather events of interest using statistical analysis and develop hourly profiles of weather variables for the periods of study in the future
    - Step 2 Risk Model Development and Scenario Generation: Identify events of interest and develop the inputs to the 21-day energy assessment in Step 3
    - Step 3 Energy-Security Assessments: Using the enhanced 21-day Energy Assessment tool, assess operational impacts by studying scenarios generated in Step 2
  - Steps 1 and 2 are expected to be completed in 2022; step 3 analysis and discussions to continue through Q1 2023

Energy Adequacy Anchor Project

Addressing winter reliability challenges

- NEPOOL, the New England States, FERC, and the ISO agree that energy adequacy discussions and actions are a top priority
- Upcoming work is outlined on the next slide
- To guide discussions, the following time horizons are considered:
  - **Immediate-term**: Winter 2022/23
  - **Short-term**: Winters 2023/2024 and 2024/2025
  - **Medium-term**: The subsequent seven winters–2025/2026 through 2032/2033
  - **Longer-term**: Beyond 2033 (roughly a decade from now)
- Defining timelines in terms of calendar years may offer clarity to the marketplace

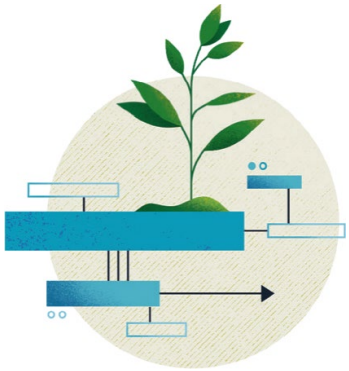
Energy Adequacy Anchor Project, cont'd

Addressing winter reliability challenges

- **Q4 2022**
  - Immediate-term: Confirm protocols to work with the DOE on emissions restrictions; maintain lines of communication for Jones Act waivers
  - Short-term: Update the Inventoried Energy Program for Winters 2023/2024, 2024/2025 (as indicated on slide 13)
  - Short/medium-term: Continue regional dialogue with respect to the Everett LNG Facility
  - Medium/longer-term: Present and gather feedback on the EPRI energy security study's risk model and scenario generation (Step 2 as indicated on slide 7)
- **Q1 2023**
  - Short-term: Review past winter and confirm readiness plans for winter 2023/2024
  - Medium/longer-term: Present preliminary results of the EPRI study energy-security assessments (Step 3 as indicated on slide 7)
    - Run additional Step 3 scenarios based on stakeholder feedback
  - Medium/longer-term: Finalize problem statement
- **Q2 2023**
  - Medium/longer-term: Discuss scope and viability of energy adequacy solutions and define the list of options to pursue, which could include:
    - A modernized strategic energy reserve, market enhancements, infrastructure options such as transmission
  - Reflect energy adequacy plans in the 2023 AWP Update published in the spring

Technology Anchor Project

Overhauling the market software system to manage an exponentially complex future grid



- **nGEM Market Clearing Engine**
  - This major initiative replaces the ISO's 20+ year old Market Management System (MMS) with the next Generation Electricity Management (nGEM) platform that is foundational to supporting a system with a growing number and type of grid assets, new and more complex market features, ever multiplying security threats, and advancing IT technologies
    - GE Solutions is developing nGEM in collaboration with ISO-NE, MISO, and PJM
    - This effort spans 2020-2027/2028
  - The ISO has been working on the complex processes for customizing and implementing the day-ahead version of the new market clearing engine (MCE) software and infrastructure, which is expected to be in service in Q2 2023
  - Once the day-ahead MCE goes in service, the ISO expects to go onto the next phase, which includes real-time MCE

NOTABLE INITIATIVES

Other Major Initiatives Identified for 2023

New England's Future Grid Initiative

Continuing two-part initiative to help prepare for and support the transition to a future grid that meets state energy policies

- **Future Grid Reliability Study (FGRS) Phase 2**
  - In Phase 2, modeling tools and assumptions from the Pathways and FGRS Phase 1 studies will be used to solve for the set of clean-energy resources that are revenue sufficient and meet the 1-in-10 resource adequacy standard, including for a "preferred pathway" if established
  - Reliability attributes/capabilities of this revenue-sufficient resource mix and any potential reliability "gaps" that remain will be identified
- **Preferred Pathway to the Future Grid Assessment**
  - The ISO, states, and stakeholders have been working to define a preferred market pathway for facilitating the evolution of New England's power grid that reflects state energy policies (forward clean energy market, net carbon pricing, or hybrid)
  - In 2023, this will require a threshold determination of jurisdiction and governance frameworks for the path, which will largely involve policymakers and regulators, as well as identifying details needed to develop the market design

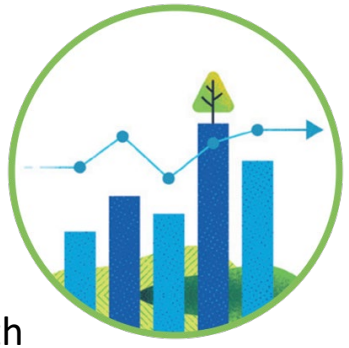
Notable Markets Initiatives, cont'd

Efficient pricing and updating the IEP

- **Updates to Interim Energy Program (IEP) for Winters 2023/2024, 2024/2025**
  - The IEP was approved by FERC in June 2020; eligibility terms need to be updated to comply with a recent court order, and the rate needs to be updated to reflect the current fuel-price environment
  - Stakeholder discussions to begin in 2022; the ISO plans to file changes with FERC in early 2023 so that updates can be implemented in time for winter 2023/2024
- **Energy Shortage Pricing Assessment**
  - In 2023, the ISO plans to evaluate treatment of load-shed events in the energy and ancillary services market pricing software and discuss with stakeholders enhancements that may be needed to signal appropriate prices during an event
  - Discussions targeted to begin by Q4 2023
- **Alternative FCM Commitment Horizons (Prompt/Seasonal)**
  - In 2023, the ISO plans to begin its evaluation of changes to the FCM commitment horizon under a construct that would replace the FCA with a prompt capacity auction and would structure the capacity product as a seasonal product
  - Stakeholder discussions would take place in 2024

Notable Markets Initiatives

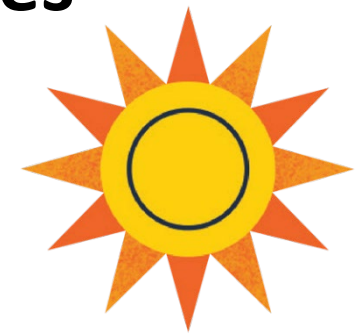
Adjusting the FCM to better balance incentives for resources



- **FCM Retirement Reforms: Bid Flexibility**
  - Beginning in Q4 2022 and extending into 2023, the ISO will discuss with stakeholders the ISO's assessment of the proposal, and possible market rule changes regarding bid flexibly associated with Retirement and Permanent De-list Bids, with a potential FERC filing by end of 2023 targeting FCA 19 implementation
  - Project stems from NEPOOL Proposal/2022 AWP Update
- **FCM Retirement Reforms: Return to Service**
  - Beginning in Q4 2022 and extending into 2023, the ISO will discuss with stakeholders the ISO's assessment of the proposal, as last presented to the Markets Committee in January and February 2022, with a potential FERC filing of any market rule changes by end of 2023 targeting FCA 19
  - Project stems from NEPOOL Proposal/2022 AWP Update
- **FCM Financial Assurance Policy/Entry-Related Improvement**
  - In 2023, the ISO plans to assess whether and why new capacity resources are clearing in the FCA when they may not be commercial by the associated Capacity Commitment Period and discuss possible reforms with stakeholders, with a potential FERC filing by end of 2023 targeting FCA 18 implementation
  - Project stems from NEPOOL Proposal/2023 Priorities

Notable Planning & Operations Initiatives

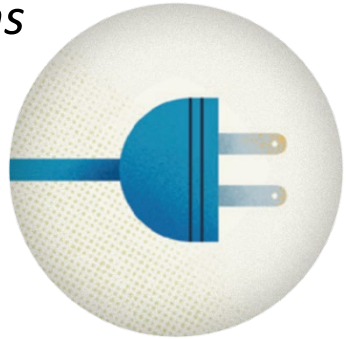
Continuously improving operations and processes



- **FCM Three-Year Capacity Time Out**
  - As new generation shifts largely from gas-fired generation to renewable energy, resource development approaches and timelines have changed significantly since the three-year time-out rules were first designed
    - The rules aligned with pre-existing queue-discipline time-out rules and designed to protect against "queue-blocking" in the FCM by resources not ready for development
  - As a priority item for NEPOOL, the ISO will discuss with stakeholders in 2023 possible elimination of the time-out rules, with a potential FERC filing by end of year
- **Expanded Weather Analytics for 21-Day to Intra-Day Load Forecasting**
  - This initiative will expand the number of weather forecasts from 8 to 23 cities and add two additional weather attributes to improve the forecast accuracy of the zonal and regional operational load forecast models
  - The project will also implement a behind-the-meter photovoltaic (BTM PV) forecasting blending process, which will eliminate reliance on a single vendor forecast for BTM PV forecasting data to increase accuracy
  - The ISO plans to present to stakeholders in Q2-3 and implement in Q3 2023
    - This initiative is one of the "Load, Solar, Wind Forecast Improvements" listed in the ISO's 2022-2025 Roadmap to the Future Grid

Notable Technology & Security Initiatives

Implementing sophisticated technologies and security applications to support the clean-energy transition and mitigate risks

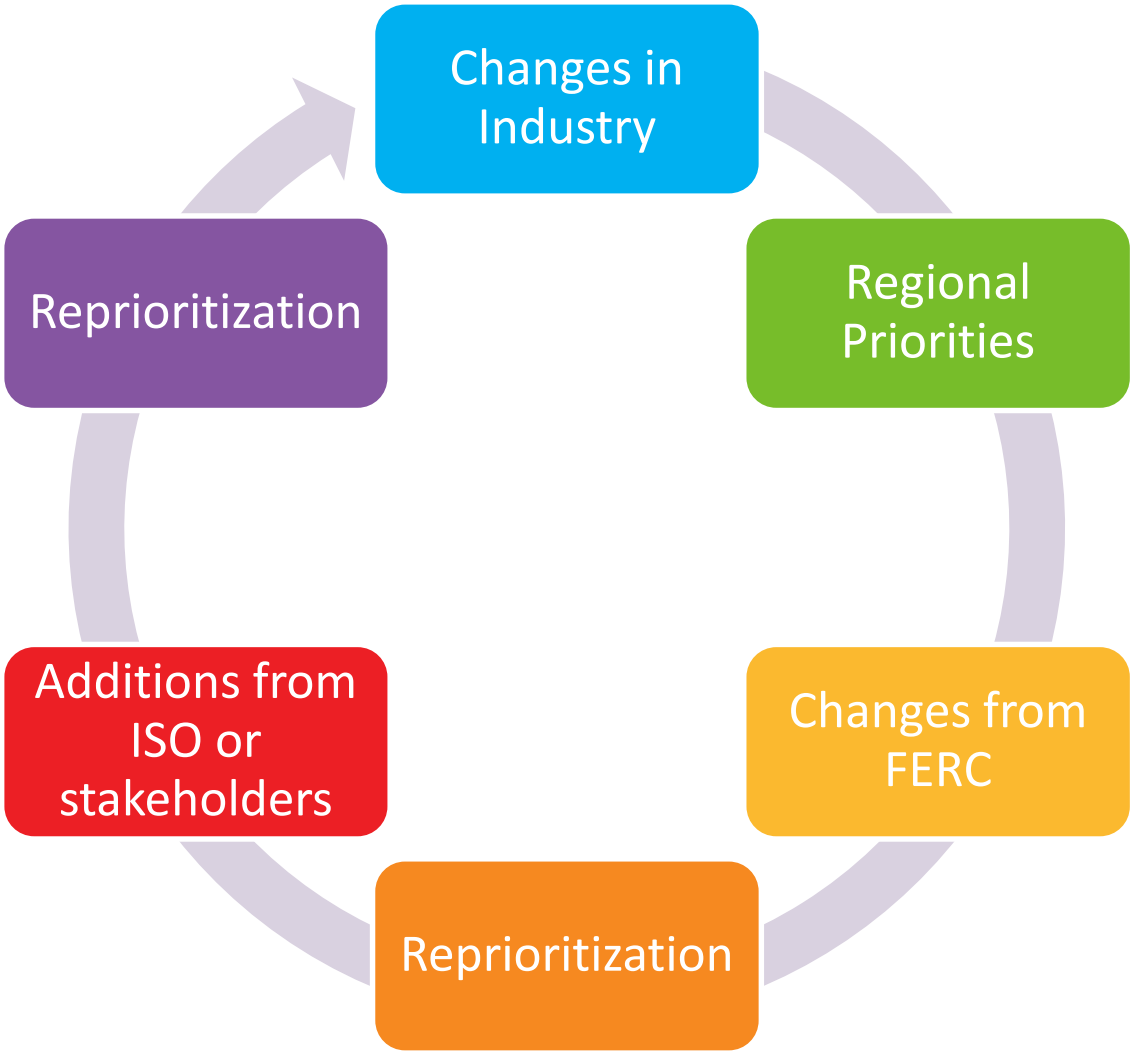


- **Models and Simulators to Support Future Grid:** The ISO is continuing development of models and tools for both reliability and planning study purposes that allows the ISO to more accurately and efficiently simulate potential market design changes and a future grid with rapidly evolving and increasing levels of DERs and inverter-based resources
  - **Inverter-Based Resource Integration and Modeling**: In 2023, the ISO will work to integrate new hybrid-simulation processes and multi-core parallel capability into large-scale system studies and standardize the Electromagnetic Transient simulation workflow
  - **Integrated Market Simulator:** Work continues on the day-ahead simulator; in 2023, the ISO will improve the performance of sub-hourly simulation and start developing network analysis capability
- **Cloud Computing:** Reliably operating a modern system comprised of renewable and storage resources requires the processing, transfer, and storing of vast amounts of data; in multiple phases, the ISO will be implementing cloud-computing infrastructure and virtualization technology to reduce reliance on energy-heavy data centers and enable more dynamic expansion of computing capability, while maintaining reliability
- **Cyber Security:** The ISO is implementing a portfolio of projects to address increasingly complex and frequent cyber-security threats plus new attack vectors, including Identity and Access Management improvements, Security Event Monitoring Infrastructure, updates to the CIP Electronic Security Perimeter, a new Security Operations Center, and other improved detection and response capabilities

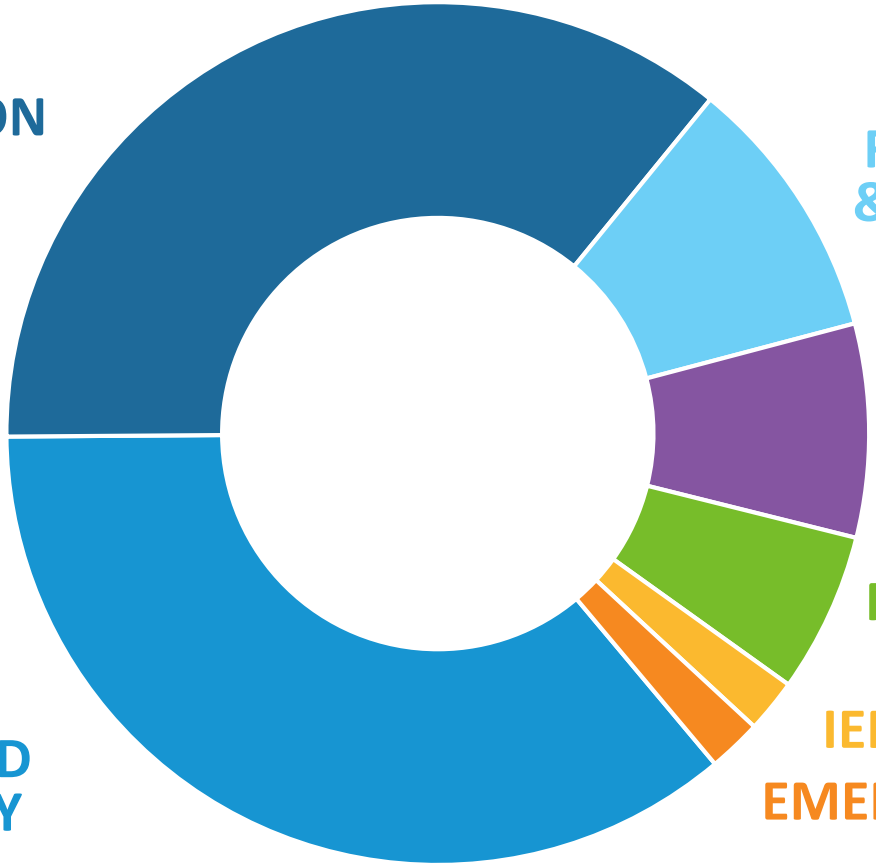
WORK PLAN PRIORITIZATION

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



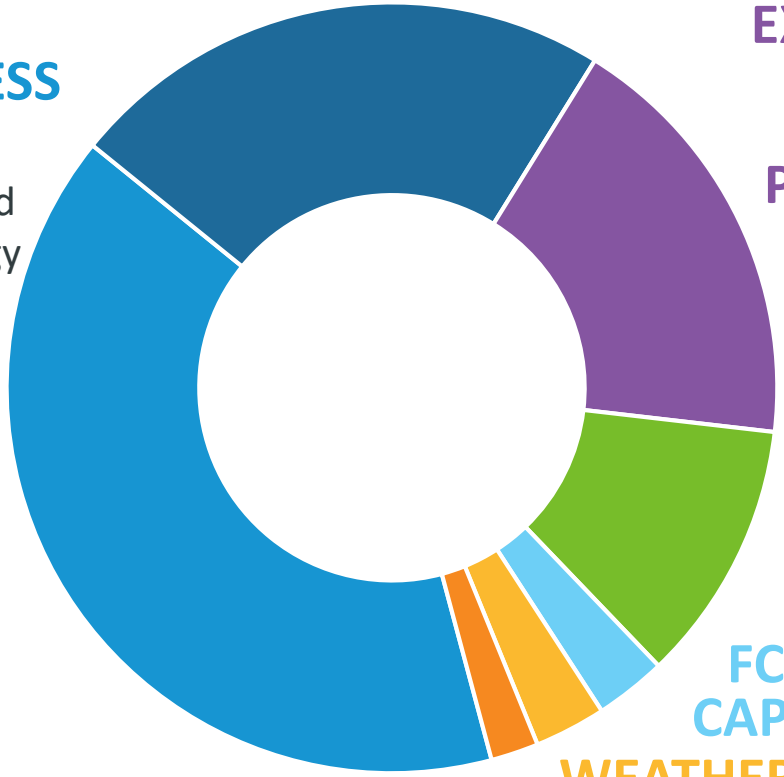
Markets-Related Priorities Include:



Planning/Operations Priorities Include:

CONTINUING BUSINESS

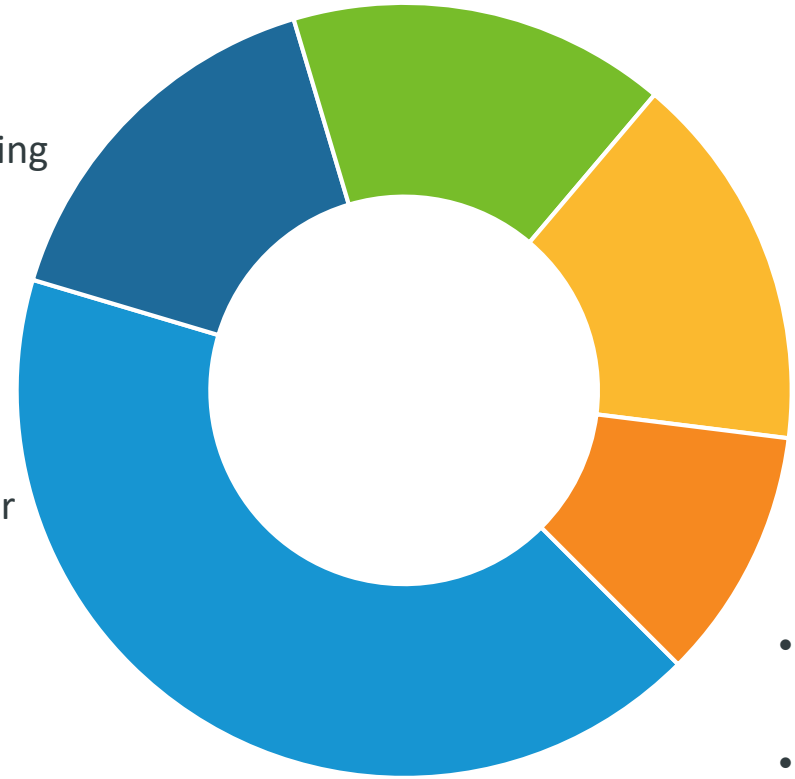
- Support qualification and interconnection of increased volume of distributed energy resources
- Administer FCA #17 and FCM-related modeling
- Economic Planning for the Clean Energy Transition Pilot Study
- NERC/FERC Compliance
- Implement lessons learned from the Controlled Outage Tabletop Exercise with TOs



Capital Project Priorities Include:

APPLICATION AND DATABASE ENHANCEMENTS

- Support for systems managing increased quantity and complexity of grid assets
- FCTS Infrastructure Conversion Part III
- MIS Sub Accounts
- Integrated Market Simulator
- Windows Server 2019R2 Deployment
- IT Asset Workflow
- PMU Data Repository
- Order 2222 Software Development



CLOUD COMPUTING

CYBER SECURITY

IT INFRASTRUCTURE ENHANCEMENTS

- Control Room Voice Recorder Modernization
- Hardware replacements
- Amazon Web Services Pilot
- Website Migration to Cloud

nGEM MARKET CLEARING ENGINE

2023 AWP	Q1	Q2	Q3	Q4
Markets Related	**Resource Capacity Accreditation**			
	Day-Ahead Ancillary Services			
	Preferred Pathway to the Future Grid Assessment			
	FCM Assessments and Enhancements			
	Energy Shortage Pricing Assessment			
	IEP Updates			
Planning & Operations	**Extended/Longer-Term Transmission Planning Phase 2**			
	2050 Transmission Study			
	Future Grid Reliability Study Phase 2			
	FCM Three-Year Capacity Time Out			
	Extreme Weather/EPRI			
	Energy Adequacy			
	Expanded Weather Analytics			
	Continuing Business			
Capital Priorities	**nGEM Market Clearing Engine**			
	Models & Simulators to Support Future Grid			
	Cloud Computing			
	Cyber Security			