2022-2025 Roadmap to the Future Grid

NEPOOL Participants Committee Summer Meeting

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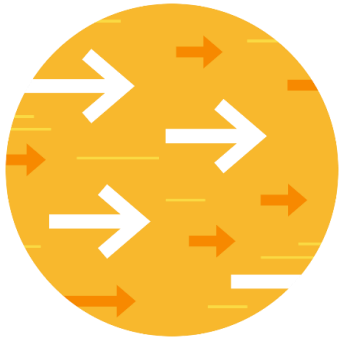
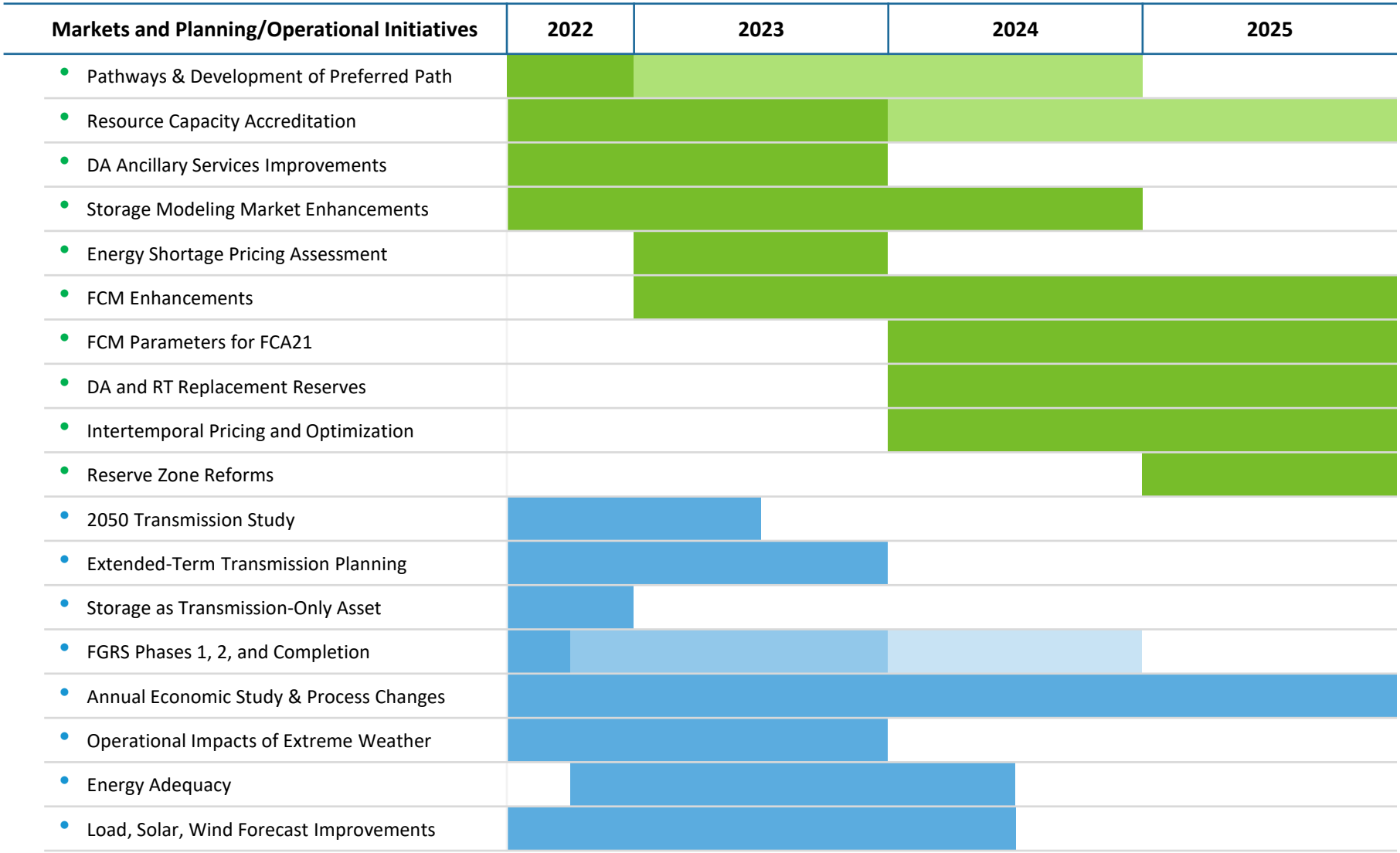
About the 2022-2025 Roadmap

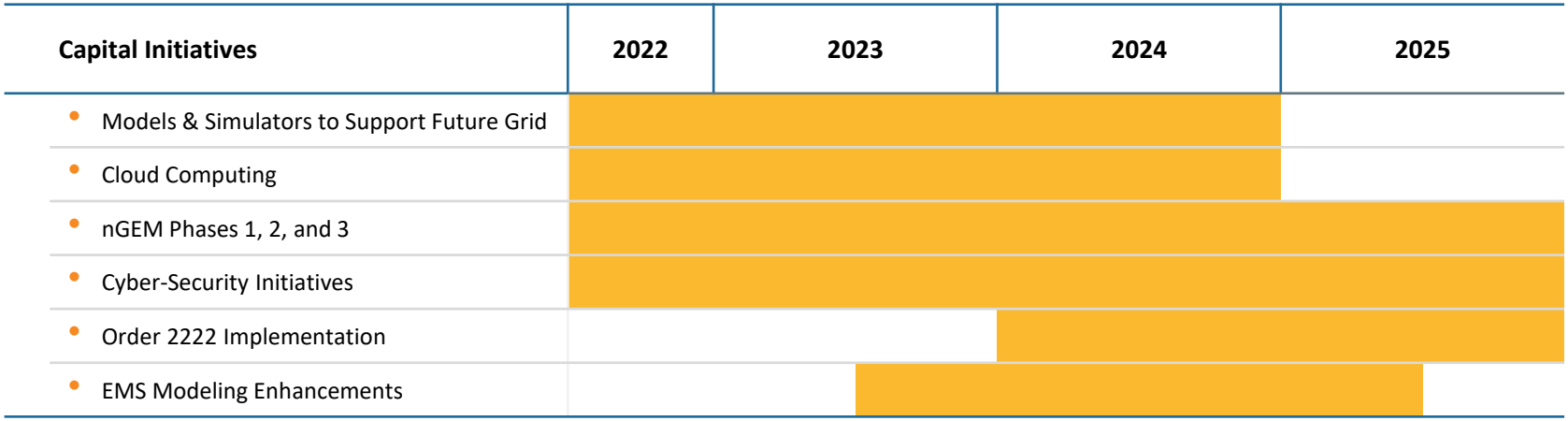


- The following charts show ISO initiatives anticipated to span the next four years that advance the ISO's strategic goals of achieving a reliable, clean-energy transition
  - Includes a number of intensive capital priorities that involve developing technologies foundational to supporting a future system
- The ISO's 2023-2024 budgets are being planned to incorporate the volume of work indicated in this roadmap
- Roadmap does not include:
  - Some smaller projects or projects nearing completion
  - Work representing the ISO's extensive day-to-day operations related to running the grid, markets, IT infrastructure, and its organization
  - Current estimated FERC-mandated or stakeholder-requested work (listed in Appendices)
- Roadmap is snapshot in time; some initiatives in chart may be deferred depending on the scope of Energy Adequacy and Preferred Pathway projects
  - Plans may also adjust over time to reflect emerging requests, regulations, trends, risks
- Timeframes in chart represent ISO work, including assessment, development, and stakeholder processes
  - Lighter shading on chart reflects potential follow-on work (does not indicate implementation work)

2022-2025 Project Roadmap–Current Snapshot



2022-2025 Project Roadmap–Current Snapshot



Summary Descriptions: Market Initiatives

- **Pathways to the Future Grid & Development of Preferred Path –** Solicit feedback on a preferred path(s), confirm the jurisdiction/governance and design, and as necessary develop a detailed design
- **Resource Capacity Accreditation –** New capacity accreditation framework that will more appropriately accredit resource contributions to resource adequacy as the resource mix transforms
- **DA Ancillary Services Improvements –** Appropriately price Day-Ahead Flexible Response Services (10 minute and 30 minute) and Energy Imbalance Reserve products in the market and design market mitigation mechanisms
  - These ancillary service capabilities are needed for a reliable, next-day operating plan with an evolving generation fleet
- **Storage Modeling Market Enhancements –** Consider significant new opportunities to more efficiently integrate fast-responding storage resources into the real-time and day-ahead energy and ancillary service markets (consistent with FERC Order 841 due to be implemented by 2026)
- **Energy Shortage Pricing Assessment–**Evaluate how a load shed event is treated in the energy and ancillary services market pricing software and whether enhancements may be needed to signal appropriate day-ahead and real-time prices in the event of an energy shortage
- **FCM Enhancements –** Portfolio of FCM initiatives, such as Retirement Reforms and other FCM-related initiatives that may stem from assessments

Summary Descriptions: Market Initiatives, cont'd

- **FCM Parameters for FCA 21–** Develop a new set of FCM Parameters, including the choice of "new entry" technology
- **DA and RT Replacement Reserves –** Day-Ahead and Real-Time products to ensure the system has the flexibility and prices to handle uncertain events that may last longer than 30-minute reserve products
  - Example: Sustained and unanticipated multi-hour drop-off in wind production intra-day
- **Intertemporal Pricing and Optimization –** Revise market dispatch and pricing algorithms to better address steep load ramps anticipated with greater solar PV and other renewables (aka, the "duck curve")
  - Benefits reliability by enabling dispatch software to better model variable net load conditions; benefits market efficiency by ensuring the system is more cost-effectively positioned through steep ramps and that costs are transparently signaled though LMPs
- **Reserve Zone Reforms:** Update locational reserve zones to better reflect changes in the New England transmission system in recent years and to accommodate the reliable integration of new clean-energy resources into the system; implement consistent locational reserve zones in the real-time and the new day-ahead co-optimized energy and ancillary service markets to facilitate the day-ahead markets' ability to produce a reliable next-day operating plan

Summary Descriptions: Planning/Operational Initiatives

- **2050 Transmission Study –** Develop a 2050 transmission plan for state-developed scenarios and associated cost estimates
- **Extended-Term Transmission Planning –** Adds Tariff process for approval of public policy-related transmission investments and associated cost allocation
  - Process should permit conversion of the 2050 Transmission study solutions and similar future studies into real projects
- **Storage as Transmission Only Asset –** Develops narrow circumstances in which a storage asset may participate as a transmission-only asset eligible for cost-of-service rates versus participation as market asset
- **Future Grid Reliability Study Phases 1, 2, and Completion –** Studies the future grid from a reliability perspective; extends the study to consider new scenarios and sensitivities, and identifies revenue sufficiency for resources under the various scenarios; and concludes with identifications of gaps and potential approaches to address them
- **Annual Economic Study and Process Changes –** Ongoing effort to study stakeholder-recommended studies from a production-cost modeling perspective that enables insights into system trends as the region transitions to clean energy

Summary Descriptions: Planning/Operational Initiatives, cont'd

- **Operational Impacts of Extreme Weather –** Builds an innovative framework to conduct a probabilistic energy-security study to assess the operational impact of future extreme weather events
- **Energy Adequacy –** Consider a solution to the long-prevalent concerns about energy adequacy during the winter months; the near-term and long-term solution space is dependent on ongoing conversations within the region and with FERC
- **Load, Solar, Wind Forecast Improvements –** Seeks to improve the wind, solar, and load forecasts through a continuous improvement method including more sophisticated forecast models, increasing the number of weather stations

Summary Descriptions: Capital Initiatives

- **Models and Simulators to Support Future Grid –** Develop a suite of models and tools that allows the ISO to simulate market designs and the future grid, including active participation in industry efforts to develop inverter-based models for a more accurate simulation of the power grid
- **Cloud Computing –** Reliably operating a modern system comprised of renewable and storage resources requires the transfer and storing of vast amounts of data. Over the next five years, implement cloud-computing infrastructure to reduce reliance on energy-heavy data centers and enable faster transfer of data than standard computing methods
- **nGEM Phases 1, 2, and 3 –** Replace 20+ year old DA and RT Market software with the next Generation Electricity Management platform (being developed by GE in a consortium with the ISO, MISO, and PJM) that supports 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
- **Cyber-Security Initiatives –** Portfolio of projects to implement planned initiatives in the 3-year cyber-security plan to address increasingly complex and frequent cyber-security threats plus new attack vectors, including the Beyond Trust, Security Event Monitoring Infrastructure, expansion of the Electronic Security Perimeter, new Security Operations Center, Crowdstrike, etc.

Summary Descriptions: Capital Initiatives, cont'd

- **Order 2222 Implementation –**Implement the FERC Order 2222 filing that integrates distributed energy resources into the wholesale markets
- **EMS Modeling Enhancements** – Implement necessary EMS modeling enhancements, including those necessary to incorporate storage models, distributed energy resources, and ambient and potentially dynamic line ratings

APPENDIX A:
ESTIMATED FERC-MANDATED WORK

Potential issues signaled by FERC to incorporate into ISO work plans that may impact Roadmap to the Future Grid

Summary Descriptions: FERC Mandates

- **AD21-10:** Modernizing Wholesale Electricity Market Design—Requires ISO/RTOs to report on energy and ancillary services markets and changes necessary over the five and 10 year horizons to address concerns about compensation for flexible resources. Could lead to 2023 FERC order directing changes to these markets
- **RM21-17:** Notice of Proposed Rulemaking on Building for the Future Through Electric Regional Transmission Planning and Cost Allocation and Generator Interconnection—Proposes reforms to exiting transmission planning and cost allocation processes. A final rule is anticipated either by year end or early 2023
- **RM22-2:** Notice of Inquiry on whether the current compensation framework for reactive power capability requires revision. If rulemaking moves forward, it would affect compensation for reactive power service under Schedule 2 of the OATT
- **RM22-14:** Improvements to Generator Interconnection Procedures and Agreements
- **RM22-10:** Transmission Planning Performance Requirements for Extreme Weather
- **RM22-16:** One-Time Informational Reports on Extreme Weather Vulnerability Assessments Climate Change, Extreme Weather, and Electric System Reliability

Summary Descriptions: FERC Mandates

- **AD22-5:** Notice of Inquiry that seeks to examine whether dynamic line ratings are needed to ensure just and reasonable wholesale rates; if rulemaking moves forward, it would likely affect/expand ongoing Order No. 881 compliance effort
- **EL21-94**: Order Establishing Additional Briefing and Instituting Section 206 Proceeding regarding its concerns that Section I.3.10 of the Tariff and the definition of Affected System may be unjust and unreasonable. This proceeding relates to the disputes between NECEC and NextEra regarding the impacts on the Seabrook breaker
- **TBD**—Expecting NOPR on interconnection queue reforms and cost allocation for interconnection-related network upgrades, with a potential final rule in 2023
- **TBD**—Potential NOPR in 2023 on transmission planning cost management and transparency. (Docket No. AD22-8, FERC technical conference scheduled for October 6, 2022)

APPENDIX B:
POTENTIAL NEPOOL ISSUES FOR 2023

Potential items NEPOOL is considering to request for inclusion in the ISO's 2023 Annual Work Plan

Summary Descriptions: Potential NEPOOL 2023 Requests

Market-Based Winter Reliability Program

- Explore and potentially develop a market-based winter reliability program that reflects its cost via a market mechanism (e.g., LMP) so that it is transparent to the marketplace, load suppliers, and can be hedgeable

FCM Entry-Related Improvements

Work with stakeholders to review and adopt and/or develop proposed reforms to establish a better balance of incentives for new entry in the FCM

- **FCM Financial Assurance Reforms** – Review/assess the current FCM Financial Assurance requirements and implement reforms to address identified deficiencies/gaps (such as the ISO adopting CPV proposal or something similar)
- **3-Year Capacity Time Out** – Work with stakeholders to review/evaluate current rules and consider elimination or modification of the 3-year time out rule while continuing to address the queue blocking issues that the time out rule was intended to mitigate

Summary Descriptions: Potential NEPOOL 2023 Requests

FCM Bidding/Exit-Related Issues & Potential Reforms

- **Dynamic Delist Bid Threshold (DDBT) Review/Assessment** – Consider possible revisions to the current formula to add more bandwidth
- **FCM Retirement Reforms** – In addition to Sigma proposal, conduct further review/assessment of the current rules and market monitoring review process relating to retirement of existing units, including treatment of retirement bids and bid modifications, retirement track obligations, and alternative mothball options
- **Further Evaluation/Consideration of Sealed Bid FCA** – Work with stakeholders to review and consider a sealed bid FCA

Summary Descriptions: Potential NEPOOL 2023 Requests

Capacity Resource Performance Mechanisms

- **Pay-For-Performance (PFP) Issues –** Perform follow-on work to PFP Memo. Consider if the Performance Penalty Rate (PPR) is too high, do the stop loss and PPR rate at current levels work against each other and send inappropriate signals during scarcity conditions that lasts longer than an hour, should we revisit the definition of a Capacity Scarcity Condition, is the current construct frustrating retirement signals, and others
- **Consideration of an Additional Performance Mechanism** – Further consider additional performance distinctions among resources holding a Capacity Supply Obligation (separate and distinct from scarcity event hours under PFP)

FCM Planning Horizons

- Review the current three-year forward planning horizon and depending on outcome of assessment, consider potential alternative time horizons

Summary Descriptions: Potential NEPOOL 2023 Requests

Potential Regulation Market Enhancements

- Review, evaluate, and consider implementing a co-optimization of the regulation market, increasing the current caps of the regulation market, how a unit that provides regulation is treated during PFP events, and how NCPC would not cover shortfall if an asset is regulating in an hour with day-ahead schedule, and energy prices in real-time increase over day-ahead

Settlement Item on Reactive Power

- Consider how capacity cost payments should be a capacity type payment and treated more similarly to capacity revenues than energy revenues

Dynamic Line Ratings (DLR)

- Further consider with stakeholders whether DLR requirements would help with some of the congestion issues in the region

Summary Descriptions: Potential NEPOOL 2023 Requests

Transmission Planning-Related Priority

- **Explore Incremental Improvements/Right-Sizing Transmission Projects–**Develop standards or guidelines for right-sizing future transmission projects
- **Transmission Planning Transparency & Oversight of Costs**—Analyze and report on how to ensure highest impact, lowest cost solutions; evaluation of alternatives; oversight of transmission projects for design, scope and cost; how to ensure broadest benefit from transmission solutions; and how to work with states on potential siting-related issues early in the process of evaluating transmission solutions

Summary Descriptions: Potential NEPOOL 2023 Requests

Information/Transparency-Related Requests

- **Overlapping Impact Study Result Transparency** – Publish publicly (with the appropriate CEII approval) overlapping impact test results, in exactly the same way that Feasibility Study and System Impact Study reports are available in the interconnection space
- **Request for Detailed Information on ISO's Overall Plan to Support Clean Energy Transition** – Produce a detailed roadmap of the initiatives it believes will be necessary to achieve a reliable decarbonized grid
- **Environmental Justice** – Detail plans to address the issue of environmental justice