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Pathways Study

Evaluation of Pathways to a Future Grid

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March 1, 2022

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Overview

Purpose of today's presentation is to provide an overview of the ***Draft* Pathways Study**

- Introduction
  - Assignment, scope, approach (Section II)
  - Summary of key findings (Section I)
- Alternative policy approaches evaluated (Section III)
- Approach to quantitative analysis: Central Case assumptions (Section IV)
- Quantitative analysis: decarbonization (Section V)
- Assessment of policy approaches to achieving decarbonization
  - Design considerations affecting achievement of emission targets (Section VI.A)
  - Cost-Effectiveness and market outcomes (Section VI.B-C)
  - Social costs, prices, payments and other environmental, economic and market consequences (Section VI.D-F)
- Scenarios (Section VII)
- Next steps

Updates and Incremental Materials

- Results for Central Case and previously presented Scenarios have been modified, reflecting minor technical changes
  - These changes did not modify any previously reached conclusions
- New scenarios presented today (and included in Draft Pathways Report):
  - Transmission
  - Alternative Hybrid Approach (with alternative LMP target)
- Analytic and qualitative assessments included in the Draft Pathways Report:
  - Key issues for decarbonization in New England
  - Tradeoffs among policy approaches, reflecting results of quantitative analysis
  - Design and implementation issues for particular policy approaches (e.g., Dynamic CEC Appendix)

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Introduction (Sections I-II)

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Overview – Assignment and Scope

- Assignment and Scope
  - Pathways Study is evaluating alternative policy approaches to decarbonizing the New England Grid
  - Focus of evaluation is on alternative economic and market outcomes
  - Pathways Study does not evaluate reliability outcomes, which are, in part, being evaluated in the Future Grid Reliability Study ("FGRS").

Overview – Policy Approaches

- Analysis considers the continuation of current policies pursued by New England states to achieve decarbonization:
  - ***Status Quo (SQ)***
- And three alternative, centralized approaches:
  - ***Forward Clean Energy Market (FCEM)***
  - ***Net Carbon Pricing (NCP)***
  - ***Hybrid Approach***
- While these are not the full universe of potential alternatives, the New England States, NEPOOL stakeholders, and the ISO expressed interest in analyzing these approaches:
  - Other "hybrid" approaches that combine elements of procurements, carbon pricing, and new environmental certificates (e.g., CECs)
  - Phasing-in or transitioning of instruments over time (e.g., gradual increasing of carbon pricing over time, with diminishment of procurements (e.g., shorter contract terms))
  - Other policy approaches (e.g., others identified in 2020 Potential Pathways process)
  - The present study does not evaluate these types of alternatives

Overview – Quantitative Analysis

- Quantitative analysis is designed to illustrate and measure differences in key economic and market outcomes between policy approaches under reasonable assumptions about future demand, technologies, costs and market structure
  - Key differences reflect analytic/economic differences in how each approach incents investments, affects market and operational incentives, etc. – quantitative analysis illustrates and measures these differences
  - Quantitative analysis is ***not a forecast*** – assumptions reflect current technologies, expected costs and market rules, but with technological change, uncertainty in market conditions and changes in ISO-NE market rules, actual outcomes will likely differ
  - Assumptions related to technology options ***do not reflect an assessment of future viability or merit***, and assumptions related to market rules ***do not reflect an endorsement or proposal*** for preferred future rules
  - Reasonable assumptions were selected to evaluate differences in policy approaches, with scenario analysis used to test the robustness of conclusions to changes in assumptions

Summary of DRAFT Key Conclusions

- Approaches differ in various policy design considerations, such as the extent to which they accommodate different levels of regional coordination and consensus, implementation challenges, and uncertainty about emission or economic outcomes
- Approaches differ in the way in which they incent emission reductions, with implications for the cost-effectiveness of emission reductions, price discrimination and creation of transparent price signals
- Approaches differ in the extent and nature of other market consequences, such as negative LMPs and the factors affecting economic curtailments across variable renewables
- Social cost is lowest with Net Carbon Pricing, higher for the FCEM and Hybrid Approach, and notably higher for the Status Quo
  - Differences in outcomes reflect cost-effectiveness, assumptions regarding resources mix, and other factors
- Customer Payments vary across policy approaches, lowest for the Hybrid Approach, next highest for Net Carbon Pricing, and higher for Status Quo and FCEM
  - Differences reflect the combined effect of multiple factors, including cost-effectiveness, price discrimination, assumptions regarding resources mix, and assumed payments for existing clean energy resources (among other factors)
- The scenario analysis changes magnitude of results, but not the general findings

Summary of Key *Preliminary* Modeling Results

Policy Factor	Status Quo	FCEM	Net Carbon Pricing	Hybrid Approach
Reliance on Regional Coordination and Consensus	Low	Moderate	Moderate/High	Moderate/High
Cost Allocation Flexibility	Low	High	Moderate	Moderate
Cost-effective CO_2 Emission Reduction	Low	Moderate/High	High	Moderate/High
Incentives for Reductions in Carbon-Intensity	No	No	Yes (efficient)	Yes (below efficient)
Incentives and Cost-Effective Investment in All Clean Energy Resources	No	Yes	Yes	Yes
Efficient Incentives for Storage Resource Use and Investment	Not Efficient (storage "churning," incentive reflects PPA price)	Not Efficient (storage "churning," incentive reflects CEC prices)	Efficient	Not Efficient (storage "churning," incentive reflects CEC prices)
Transparent Price Signals	No	Yes	Yes	Yes
Creates Potential Distortions in Market Offers (e.g., curtailment based on PPA price not costs)	Yes	No	No	No
Negative LMPs ("churning," inefficient battery use/investment, inefficient commitment and uplift)	Yes	Yes	No	Yes (less frequently than Status Quo and FCEM)
Price Discrimination (capital allocation between new / existing assets, need for additional out-of-market contracts)	Yes	No	No	Yes (risk of resource exit may remain)

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Policy Approaches (Section III)

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Four Policy Approaches Evaluated

- Four approaches evaluated
  - Status Quo
  - Net Carbon Pricing
  - Forward Clean Energy Market
  - Hybrid Approach

- Report provides a review of each policy approach, including a description of how the approach achieves emission reductions and key design components
- Report does not provide a detailed assessment of each policy approach, particularly with regard to key design decisions
- If the region decides to pursue one of these alternatives to the Status Quo, substantial additional time and effort would be required to develop design details

Status Quo

- Reflects outcomes of unilateral policies by each of the six New England States
- Assumes continuation of current direction of state policy of procuring clean energy supplies through bilateral multi-year contracts
  - New resources incented by energy resource procurements resembling recent competitive procurements, such as those for offshore wind in southern New England
  - Provides a benchmark for comparison given recent trends and direction, given feedback from New England States and NEPOOL stakeholders
- Procurement process generally involves multiple steps, including:
  - Planning stages (e.g., specifications including technology eligibility, quantities, contract terms, need parameters, etc.)
  - Procurement implementation (RFP development, determination of selection criteria and processes, review and selection of offers to be awarded contracts, contract negotiation and execution, etc.)
  - Contract execution (over life of contract)
- Policy with respect to existing (and off-contract) clean energy resources in the future is not clear

Forward Clean Energy Market

- Compensates non-emitting resources via a centralized, forward market for clean energy certificates ("CECs") with corresponding costs allocated to electricity consumers
- Creates a market (like a Renewable Portfolio Standard) for CECs
  - CEC demand created by state-imposed utility CEC requirements
  - CEC supply created by awarding CECs to clean energy resources for energy generation
- Forward centralized auction
- Many important and potentially challenging outstanding design questions – for example:
  - CEC product definition and resource eligibility
  - CEC demand formation and supply participation
  - Market settlement
  - Interactions with existing state policies
  - Whether to integrate forward market with FCM
  - Dynamic CECs

Forward Clean Energy Market

- **Dynamic CECs**
  - **Appendix C** provides an evaluation of issues associated with a dynamic CEC
  - Dynamic CEC awards would vary over time to better match CEC awards with marginal emission reductions
  - Key observations regarding potential benefits
    - Dynamic CECs do not make FCEM incentives comparable to Net Carbon Pricing
    - Dynamic CEC would not necessarily improve incentives to avoid delivery of energy during periods when variable renewable output is curtailed relative to static CECs
    - Benefits (relative to static CECs) limited to improving incentives to develop variable renewables that supply in periods with higher relative fossil-fired marginal emission rates
    - Reduces the frequency and magnitude of negative LMPs, but diminishes incentive for storage resources by compressing LMP spreads
  - Practical implementation considerations
    - Dynamic CECs based on actual marginal emission rates appear to be impractical and/or infeasible
    - Efficacy of dynamic CECs based on proxy marginal emission rates (using historical data) depends on reliability/uncertainty of these metrics given scope of potential improvements in incentives

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Net Carbon Pricing

- Impose a price on CO_2 emissions from wholesale electricity generators
  - Cost a generator incurs is proportional to its CO_2 emissions
- Two general types of carbon pricing
  - Cap-and-trade (with tradeable emission allowances)
  - Fixed (predetermined) carbon price
- Revenues from carbon pricing collected by centralized authority (e.g., ISO-NE)
- Collected revenues can be used for one of many purposes
  - Credited to customers (based on various formulas/criteria)
  - Used for other purposes (e.g., RGGI allocates allowance auction revenues to states, that then use them for various purposes, such as funding energy efficiency programs)

Hybrid Approach

- Stakeholder requested that this approach be included in the study (from New England States Committee on Electricity, "NESCOE")
- Combines two elements:
  - Carbon price set to allow the largest clean energy plant in the region (i.e., Millstone Power Plant) have sufficient revenues to remain financially viable
  - An FCEM with CEC awards limited to "new" resources
- Requires an administrative process to determine (1) target revenues (e.g., LMPs), (2) carbon prices that would achieve target revenues, and (3) CEC targets for new clean energy resources
  - Process would be computationally complex given interactions between carbon prices, CEC target and evolving market conditions

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Approach to Quantitative Analysis: Central Case Assumptions (Section IV)

Central Case Assumptions: Period, Targets

- **Central Case** assumptions are held constant across each policy approach studied
  - Further detail on Central Case assumptions has been provided in prior presentations to the Participants Committee
- Overview of Central Case assumptions
  - Time period: **2020 to 2040**
  - Geographic scope: **ISO New England system only**, with assumed imports
  - 2040 decarbonization target: **80% of 1990 carbon emissions for the New England electricity sector**
  - No MOPR
- **Reference Case** is analyzed in which the region achieves less ambitious decarbonization reflecting only certain planned procurements
  - This case does *not* achieve the 2040 decarbonization target
  - All other assumptions (including loads) the same as the Central Case
  - Not intended as an alternative Pathway, but as a benchmark against which to measure the incremental change in economic outcomes from greater decarbonization

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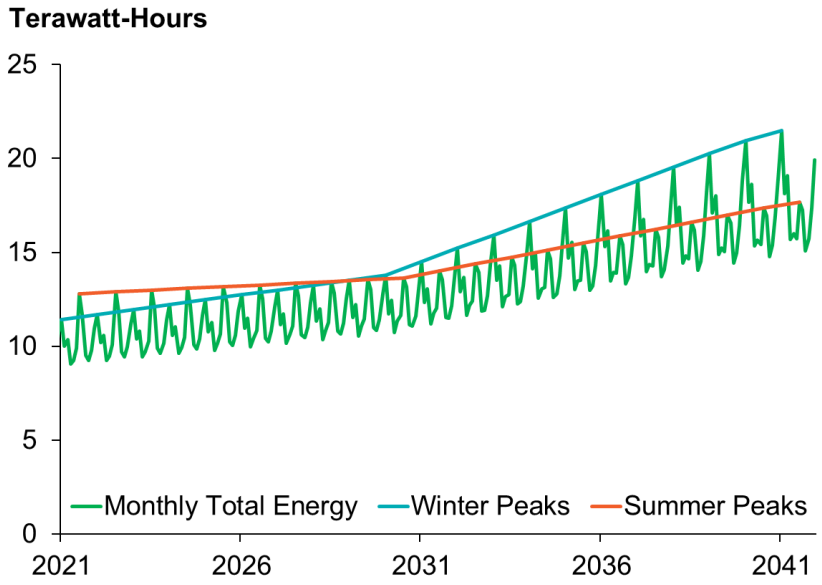
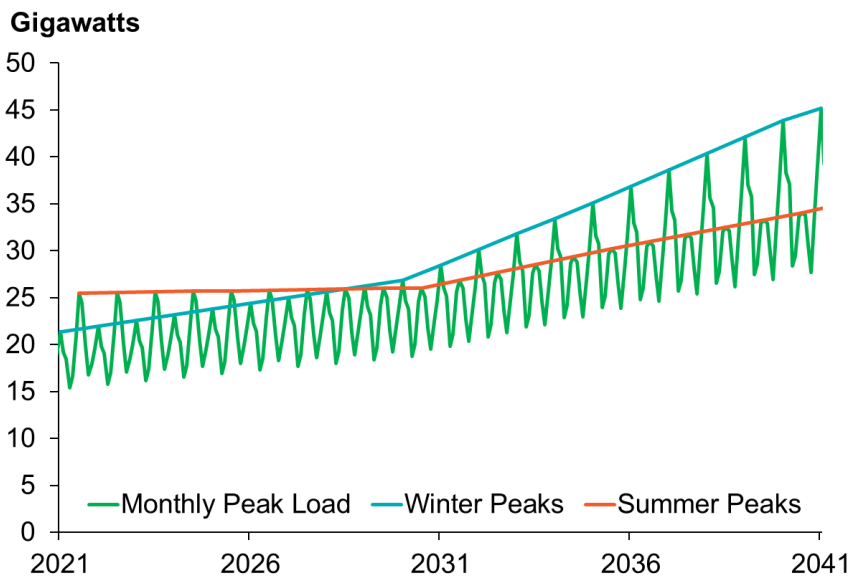
Central Case Assumptions: Loads

- **High load** assumed, reflecting electrification of transportation and heating (consistent with FGRS Scenario 3)

ISO New England Monthly Total Energy



ISO New England Monthly Peak Load



Central Case Assumptions: Supply-Side

- Resource mix includes existing and new resources
- ***Baseline state policies***:
  - All studies assume baseline state clean energy policies, including: offshore wind procurements, New England Clean Energy Connect, and mix of other resources
  - Resource mix is generally the same across policy approaches in first half of study period because of these common policies
- ***Incremental resource entry: technological options***
  - All cases assume the same set of potential new generation technologies (and associated costs)
  - Set of potential technologies considers only existing, commercially available technologies – costs over time reflect technological improvements (which lowers cost over time) and siting/delivery factors (which increase with cumulative capacity builds)
  - Do not consider advanced technologies, not yet commercially available (e.g., flow batteries or combustion turbines fired with “green” hydrogen)
- ***Fossil Resources.*** Some fossil resources remain under all policy approaches as we assume the region has some carbon emissions (declining to 80% below 1990 emission levels)