AGENDA
NEPOOL Participants Committee
Working Session: Pathways to the Future Grid
February 18, 2021, 9:30 a.m.

To participate in the special Participants Committee Teleconference, please dial 1-866-803-2146; Passcode 7169224. To join WebEx, click this link and enter the event password **nepool**.

This working session will commence efforts to help scope and define the ISO's proposed deeper analysis of certain potential pathways/market frameworks.

- Overview of ISO's approach to studies related to New England's clean energy transition
  Presented by: Vamsi Chadalavada, ISO

- Kickoff of scoping process to inform ISO's evaluation of alternative market frameworks
  (ISO, Chris Geissler)

  - FCEM Design Parameters - Summary of potential FCEM framework parameters
    Presented by: Peter Fuller, Autumn Lane Energy Consulting LLC on behalf of NRG

  - Identification and discussion of necessary elements for modeling FCEM and net carbon pricing
    (ISO, Chris Geissler)

ISO New England's Approach to Future Grid Studies

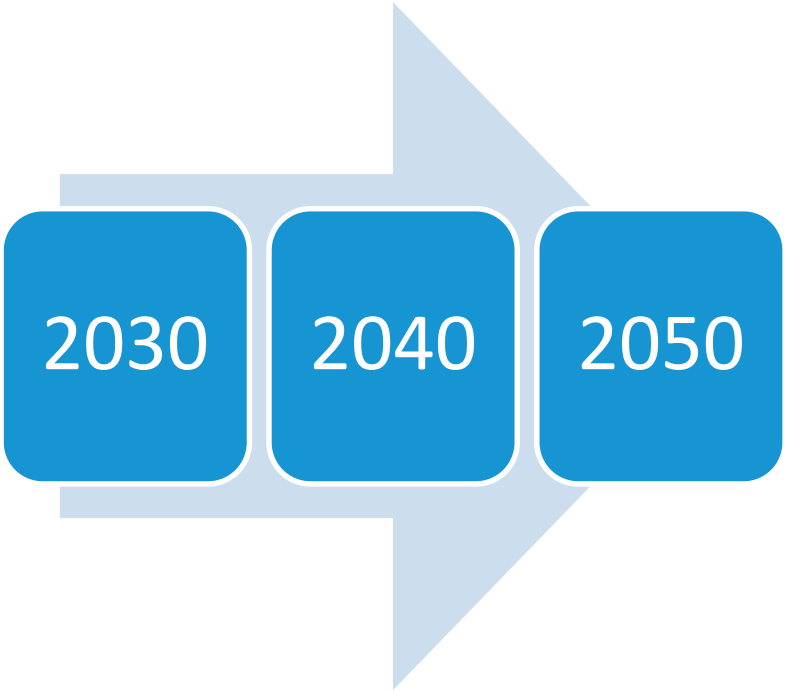
Supporting New England's transition to a clean energy future

Vamsi Chadalavada

EXECUTIVE VICE PRESIDENT AND COO

Study Time Horizons and Timeframe

- Time horizons for future-grid-related studies already underway at the Planning Advisory Committee (PAC), plus new studies for the States and NEPOOL stakeholders, span from the end-of-decade to mid-century
- Conducting these studies would occupy much of the next year



2021 Future Grid Studies

The studies in bold are discussed in this presentation

Study (*Sponsor*)	Start	Est. Finish	Forum	Horizon Year	Study By
Transmission Planning for the Clean Energy Transition *(ISO-NE)*	Sept. 2020	2021	PAC	2030	ISO
2020 Economic Study (*National Grid)*	4/1/20	Est. 6/1/21	PAC	2035	ISO
Future Grid Reliability Study (FGRS) Phase I *(NEPOOL)*	**4/1/21**	**Q1 2022**	**MC/RC (PAC)**	**2040**	**ISO**
2050 Transmission Study *(NE States)*	**Q1 2021**	**TBD**	**NESCOE/PAC**	**2050**	**ISO**
Pathways: Analysis of FCEM/ICCM *(States/Stakeholders)*	**Feb. 2021**	**Q1 2022**	**PC**	**TBD**	**ISO**
Pathways: Analysis of Net Carbon Pricing *(ISO-NE)*	**Feb. 2021**	**Q1 2022**	**PC**	**TBD**	**ISO**
FGRS Phase II *(NEPOOL)*	**Fall 2021**	**TBD**	**MC/RC**	**2040**	**TBD**

Future Grid Reliability Study (FGRS) Phase I

Use stakeholder-defined scenarios to examine how New England's power system could operate in 2040 in light of current state energy and environmental policies

- Primary objective of Phase 1
  - Build assumptions under the defined scenarios and identify operational and reliability challenges that could occur in 2040, using the following:
    - Production Cost Simulation
    - Ancillary Services Simulation
    - Resource Adequacy Screen
    - Probabilistic Resource Availability Analysis
- The ISO has agreed to conduct Phase I of the study
  - Anticipate completion by **Q1 2022** if incorporated as 2021 Economic Study

2050 Transmission Study

New England States' vision statement seeks a transmission study that can help states determine how to expand the system to incorporate wind, hydro, and distributed energy resources

- Primary objectives
  - Develop high-level transmission scenarios to evaluate large-scale renewable energy integration and cost estimates
  - Look well beyond the ISO's typical 10-year horizon for transmission needs
  - Is not a plan to build specific projects unless States choose to move forward
- States have requested the ISO to conduct the study, which we will do
  - Building on discussions at the New England Energy Vision February 2 transmission planning technical forum, States are engaging with the ISO to further develop their study request
  - The ISO anticipates discussing the **scope, assumptions,** and **inputs** at the PAC before finalizing

Pathways Evaluations: Forward Clean Energy and Carbon Pricing Studies

Stakeholder effort to review market frameworks that may help evolve the power grid to a future state reflecting states' policies

- Frank Felder's January 2021 report assessed pathways (1) in helping to advance state clean energy policy objectives and (2) on market efficiency
  - Frameworks assessed included: Forward Clean Energy Market (FCEM), Integrated Clean Carbon Market, Carbon Pricing, Energy-Only Market, and Alternative Reliability Assurance Frameworks
- The ISO has committed to evaluate **FCEM** and **net carbon pricing** proposals
  - **Kickoff today** to discuss scope, deliverables, and timeline
  - The ISO expects to complete these studies in **Q1 2022**

FGRS Phase II

Contemplates whether revenues from the existing markets could be sufficient to attract and retain the new and existing resources necessary to continue operating the system reliably under stakeholder-defined scenarios

- Two components still require additional scoping
  - Transmission System Security: Thermal, Voltage, and Stability Analysis
  - Revenue Sufficiency Analysis
- The ISO suggests stakeholders pause on these components to allow the ISO and the region to focus on the four other requested 2021 studies the ISO will be conducting
  - FGRS Phase I
  - Pathways Evaluation: forward clean energy market
  - Pathways Evaluation: net carbon pricing
  - Transmission 2050 Study

ISO View–FGRS Phase II Reliability Study should follow 2050 Transmission Study because of linkages

- The 2050 Transmission Study scope will help inform the System Security study in FGRS Phase II
- The ISO believes that key modeling assumptions will substantially improve the quality of a future System Security review, including:
  - Detailed transmission network (bus-branch model) should be represented in a grid security assessment (likely consideration for the 2050 study)
  - Neighboring systems will have significant impacts on the security of New England and need to be represented in certain detail, especially for transient stability and inter-area oscillations (likely consideration for the 2050 study)
    - Such assumptions will improve as interconnection-wide models are created through industry working groups

ISO View–Key modeling improvements are needed before undertaking FGRS Phase II Reliability Study

- Inverter technology is rapidly evolving from ‘Grid Following’ to ‘Grid Forming’
  - The need for newer advanced-inverter technologies has been recognized by the industry and models are under development
  - It is important to include such models in studies much beyond the ten-year horizon as for example, Grid Forming Inverters provide direct voltage and frequency control and also help with inertial-response
- The ability to simulate the fast switching and non-linear dynamics of inverters is critical to understanding the stability and security of the system
  - This will require newer techniques that are currently being tested
- The ISO has been working with NERC, EPRI, and industry vendors to develop and test the necessary models and tools and has several internal efforts underway in 2021 and 2022
- The ISO believes that it is prudent to let some of these efforts mature before engaging in a longer-term system security study as contemplated in FGRS Phase II

ISO View–Outcomes from Pathways studies can help inform FGRS Phase II Revenue Sufficiency analysis

- The 2021 Pathway studies will require building at least two models, one for Net Carbon Pricing and the other for FCEM, which will inform the region's next steps
- The Pathways process should determine how the Minimum Offer Price Rule (MOPR) will be treated in the modeling assumptions to assess how it affects the outcomes of the proposed frameworks
  - The FERC has recently made clear that addressing the MOPR is one of its top priorities
  - If this process doesn't resolve the central question "What is a solution that addresses MOPR?," additional analysis may be necessary to answer the question by Q1 2022
- Linking this back to the FGRS Phase II study request, the ISO believes that understanding these outcomes will better inform studies related to revenue sufficiency
  - Holding the existing markets static may not represent a realistic scenario because the existing markets will evolve before the time horizon that the study seeks to examine

ISO Resources and Budget

- The ISO has dedicated resources and budget to work with stakeholders in finalizing scope and assumptions, developing models, running simulations, presenting, and discussing results of the four 2021 study commitments
- A fifth study on Resource Capacity Contributions to Resource Adequacy, while not directly related to the future grid studies, will be informative because it seeks to identify a methodology that appropriately accredits capacity value to resources as the resource mix evolves over time
  - The study will look at using Effective Load Carrying Capability (ELCC) techniques to determine capacity ratings
  - The scope of this study will be discussed with stakeholders in Q2 2021
- The ISO is able to perform the committed 2021 studies, meet its planning and operational commitments, and respond to current FERC orders such as 2222
  - These efforts have placed a significant strain on the ISO operating budget
  - If new priorities emerge, the ISO will seek to rebalance its work and discuss with stakeholders

Summary and Next Steps

- The future grid studies will reveal useful information about
  - The future of resource adequacy
  - High-level transmission scenarios and costs estimates
  - Analyses related to various assumptions associated with possible resource mixes
- There are some dependencies and efficiencies that can be better captured through appropriate sequencing
- Additional efforts are underway to develop models and tools that are adaptive to new technologies and changes as they materialize, which will better position the region to replicate studies under evolving conditions
  - The ISO is hoping to address this objective by 2023 by improving network models, assessing resource capacity contributions, and developing an integrated market simulator, as well as other efforts
- The ISO will always be looking ahead for needed adjustments to market structures; planning and operational models, tools, and procedures; and software and IT infrastructure
- Further information on our other projects will be in the Annual Work Plan update

Pathways to the Future Grid

Evaluating clean energy and carbon pricing frameworks as alternative market designs to advance the region's clean energy transition

Chris Geissler

CGEISSLER@ISO-NE.COM

Background: How we got here

- Starting in 2019, stakeholders expressed an interest in discussing future market frameworks to support the transition to a future grid that better aligns with state environmental objectives
  - This effort evolved into New England's Future Grid Initiative
- Focused discussions on the Pathways to the Future Grid track of New England's Future Grid Initiative began at the Participants Committee's (PC) June 24, 2020 Summer meeting
- Over the summer and fall, a series of speaker panels were held at the PC so stakeholders could identify and discuss alternative pathways/market frameworks to potentially transition New England to its future grid
- As part of this discussion, the ISO has agreed to analyze the impacts of two of these frameworks: a forward clean energy market and a carbon pricing market

PRELIMINARY PROJECT OVERVIEW, SCOPE, AND SCHEDULE

ISO to evaluate two frameworks

- Retained a team from the Analysis Group to model the impact of two market frameworks that have been discussed as potential pathways to a future grid:
  - **Forward clean energy market**: Procure "clean energy" via a centralized auction several years forward
    - One outstanding question is whether the procurement occurs separately from or integrated with the Forward Capacity Market (FCM), where this impacts various design considerations raised later in the presentation
  - **Net carbon pricing**: Suppliers are charged for their carbon emissions and, therefore, incorporate this cost into their energy market offers
  - This Analysis Group team has prior experience with ISO-NE and NEPOOL engagements
- The ISO plans to study both frameworks simultaneously and issue a final report that addresses the impacts of both designs

Scope of analysis

- Evaluate how market outcomes for both potential market designs compare to current market rules and state policies, where the environmental objectives are met using long-term Power Purchase Agreements (PPAs) with specific resources, among other programs
- Key metrics will include:
  - Total carbon emissions
  - Total production costs
  - Total consumer costs
- Study may also consider how each market design affects the resource mix and/or revenues for various resource types
- The analysis will not focus on reliability outcomes
  - Such analysis will be a part of the Future Grid Reliability Study (FGRS)
  - However, this Pathways study may align certain input assumptions with those used in the FGRS

Welcome stakeholder feedback on model assumptions shared across policies

- What study year (or years) should be evaluated?
  - Frameworks are being evaluated as pathways to the future grid, but they should also sustain this future resource mix
- What are the regional and state carbon emissions targets for the study year(s)?
  - How does this interact with each of the policies modeled?
- What are the assumed load levels and shapes?
- What are the assumptions regarding the MOPR?

Anticipated stakeholder schedule

- **Q1 2021**: Discussion of study scope to discern the key elements of the market designs to be studied
- **May 2021**: Finalize study scope of market designs to be evaluated
- **Q2-Q3 2021**: Build model; discuss and define model inputs and assumptions; get feedback on specific scenarios to evaluate
- **Q4 2021**: Finalize and run model, present preliminary model results
- **February 2022**: Final report presented to stakeholders

Welcome stakeholder feedback on model scope and schedule

- The ISO and its consultant will make every effort to be responsive to stakeholder feedback on model scope and schedule
  - Regular touch points will occur along the way to ensure mutual understanding of the proposed designs and model options, decisions and tradeoffs
- Feedback can be shared during stakeholder discussions, or written comments for posting should be provided by email to Chris Geissler (cgeissler@iso-ne.com) and the Chair of the Participants Committee (or designee)
- We will be best equipped to fully consider feedback that is provided early in the stakeholder process

FRAMEWORK OVERVIEWS AND OUTSTANDING DESIGN QUESTIONS

The frameworks have outstanding questions and “gaps” that must be addressed

- We have identified design question relating to the frameworks based on our review of available materials
- We outline some of these major design questions in the following slides that are most critical for building models of the frameworks
- The ISO does not expect that these questions will be fully resolved during today’s discussion
- However, they will need to be answered to build the models necessary to run simulations of market outcomes under each framework

Addressing outstanding questions and “gaps”

- We seek continued stakeholder input on these and other questions today and throughout the March-April timeframe
  - Welcome this input in many forms including during meetings, via written responses, and through bilateral discussions
- Plan to provide more detailed summary of the frameworks that incorporates stakeholder feedback
  - Initial summary in March, will update as frameworks are refined
- ISO and its consultant will make every effort to reflect stakeholder feedback in the models, but there may be instances where we have to make modeling decisions about design elements for any number of reasons, including:
  - Lack of stakeholder consensus
  - Feasibility concerns
  - Time constraints

Addressing these questions will allow for more informative quantitative modeling

- ISO and its consultant must clearly understand key design elements in order to quantitatively model expected resource bidding behavior, market clearing, etc., in a manner that will inform stakeholders about market outcomes
- In the following slides, we briefly discuss the frameworks to be modeled and outstanding questions pertaining to each
  - Forward clean energy market framework, including consideration of integrated clearing with the FCM
  - Net carbon price framework
- Before diving further into these frameworks, we turn to stakeholders to summarize their work on the FCEM concept to date

A Forward Clean Energy Market for New England

A REPORT ON STAKEHOLDER EFFORTS TO CONTRIBUTE TO REGIONAL MARKET REFORMS

JANUARY 18, 2021

PETE FULLER, ON BEHALF OF NRG ENERGY

Today's Topics

- Ambitions of our stakeholder process
- FCEM Design Objectives
- Key design elements
- Critical open questions

Stakeholder Discussions

- Convened by NRG Energy
- We have engaged a diverse set of interests across the market and industry space
- Individual meetings with interested stakeholders over the summer; monthly group meetings since September; Chatham House Rule
- Volunteer working group has been meeting more frequently to discuss and draft documents
- The thoughts in this presentation and the accompanying document are the product of these group efforts
- Our ambition is to contribute to the broader stakeholder consideration of reforms that will align wholesale markets with States' decarbonization goals – recognizing that achieving reform will take very broad regional engagement

FCEM Objectives

A successful Forward Clean Energy Market will:

- Incentivize investment and production of clean energy and contribute to achievement of state-mandated clean energy and carbon reduction goals through market-based revenues, shifting risk from ratepayers to investors
- Provide a path for clean energy resources to count as capacity resources without undermining the price signal necessary for resource adequacy
- Ensure that FCEM revenues are 'in-market' from FERC's perspective, while vesting the states with substantial control over FCEM
- Avoid allocating FCEM costs to non-participating states
- Avoid inefficient price suppression in real-time energy markets

Our Taxonomy

- Demand Participation
- Supply Eligibility
- Market Integration
- Regulatory Integration
- Settlement Characteristics

  - We found it very helpful to focus our discussions on one topic at a time

Demand Participation

- Establish durability of demand participation
- Establish FCEM as the primary vehicle for procuring clean energy
- Demand bidders could be states or designees; costs would be allocated to LSEs in participating states according to Real Time Load Obligation
  - Voluntary bidders (eg, corporates, municipals) may also participate
- Demand bids can have both quantity and price specifications
- Potential to include 'targeted' resource characteristics in the FCEM auction that may clear at a higher price than the 'base' product

Supply Eligibility

- Eligibility should be as broad as possible, eg, "any resource that produces electricity without direct carbon emissions"
- Comparability – no distinction between 'new' and 'existing', no distinction among technologies, locations, etc
- Voluntary participation by sellers, subject to appropriate market power protections
- Offer a price lock for new FCEM resources, eg, 7-12 years
- Resources under existing contracts could participate via the contract off-takers (utilities) as the 'sellers' in FCEM; revenues would offset contract payments
- 'Dynamic' credits to create value for energy storage; further enhancements?

Market Integration – Two Approaches

- 1) Separate but coordinated (FCEM+FCM)
  - FCEM qualification mirrors FCM qualification process, in terms of timing and content of non-binding Show Of Interest, critical path schedules, offer price reviews, financial assurance
  - FCEM auction runs shortly before FCA
  - Resources with cleared FCEM obligations adjust FCA offer prices to reflect FCEM revenues
  - Clearing in FCEM does not guarantee clearing in FCM; treating FCEM revenues as 'in market' diminishes the impact of MOPR
- 2) Integrated/Co-optimized (ICCM)
  - As presented by Kathleen Spees of Brattle at October 1 NEPOOL meeting
  - Single offer 'price' for both capacity and clean energy attribute, but distinct clearing prices for each product
  - Market 'clears' resources for both products; no risk of obtaining one obligation without the other if both are offered
  - MOPR would be limited to assessing the market value of any revenues from outside ICCM

Regulatory Integration – (At Least) Two Approaches

- 1) A Carbon-free Attribute
  - FCEM transacts the part of existing RECs that meet the broad clean energy definition; this would create a Clean Energy Attribute Credit
  - Compliance with RPS would require a CEAC plus the 'residual' part of the REC representing other attributes, such as technology, vintage, location, etc
  - CEACs would count toward FCEM obligations and also partial RPS compliance, but otherwise could not be double counted
- 2) All Environmental Attributes
  - Sellers in FCEM relinquish all environmental attributes and RPS eligibility of their units
  - Buyers in FCEM receive proportional shares of all GIS certificates, which would then be bought/sold as needed to meet applicable state RPS obligations
- These assume the use of GIS; it may be possible to track and settle outside of GIS

Settlements

- Track energy production through NEPOOL GIS, including time and system carbon intensity for 'dynamic' approach
- FCEM charges and payments settled through normal ISO processes as clean energy is produced and verified
- FCEM delivery obligation for sellers is an annual obligation
  - Under-delivery subject to penalty; over-delivery potentially eligible for 'spot' compensation
  - Final settlement for compliance purposes would occur after the close of the delivery year, similar to the settlement of RPS compliance

Critical Open Questions

- Clarity on a path to state adoption and authorization to use FCEM/ICCM
  - How do states determine their demand quantities and prices? Is the quantity anticipated to increase each year?
- Clarity on the respective roles of FERC and States in designing and governing FCEM/ICCM
- Settling on a sufficiently broad definition for supply eligibility
- If ICCM is not selected, clarity on treatment of FCEM revenues in FCM MOPR
- Integration of existing clean energy contracts into FCEM/ICCM
- Integration of FCEM/ICCM with existing RPS (and similar) programs
- Impact of eliminating the price lock from FCM

Questions and Feedback

AUTUMN LANE
ENERGY CONSULTING LLC

Pete Fuller

pete@autumnlaneenergy.com

508/944-5075

David O'Connor

+1.617.348.4418

DOConnor@mlstrategies.com | MLStrategies.com

ML STRATEGIES

Forward clean energy market: overview

- Run auction for “clean energy” roughly three years before delivery period to determine forward positions and price
  - This may be standalone (FCEM) or integrated to occur jointly with the determination of capacity awards (ICCM)
- States (and other entities) submit priced demand bids for “clean energy,” as measured in MWh of energy production
- Suppliers submit priced offers to provide “clean energy”
  - These offers may also include costs to sell capacity under ICCM
- Suppliers with forward positions produce “clean energy” during the delivery period
  - Suppliers that fail to meet their forward position may incur a cost associated with this shortfall
- Costs associated with the sale of “clean energy” are allocated to real-time load obligation (RTLO)

Forward clean energy market is a novel concept and requires key questions to be answered

- This concept requires the development of several complex market design elements, including:
  - The product definition
  - Development of spot settlement methodology
  - Determination of forward positions and prices
- This complexity increases if the procurement is integrated with the FCM
- It is, therefore, natural that at this stage there are a number of outstanding design questions; some of which are discussed further in the following slides

Forward clean energy market: product definition

- What resources can sell “clean energy?”
  - Does it include imports?
  - Does this definition apply to resources that do not produce electrical energy, but can store it (e.g., pumped-storage hydro, batteries)?
  - Would credits be “dynamic” (e.g., varying with marginal GHG emission rate)? If yes, how would this work?
- Is there a cap on the quantity of “clean energy” a resource can sell forward?
  - If yes, how would this cap be determined?
  - Is there a qualification process?
- Is there a single “clean energy” product, or are there potentially multiple products (and if so, what are they)?

Forward clean energy market: settlement

- What are the settlement implications of producing more or less “clean energy” during the commitment period than was sold forward?
  - Is there a “penalty” for the non-delivery of “clean energy”? If so, how is it determined?
  - Are there opportunities to buy/sell credits during the commitment period so that a resource can align its forward and spot positions?
  - Can a resource without an FCEM obligation buy/sell credits?
- Are there any exemptions that would allow resources to avoid covering their forward position during the commitment period?
- Can credits be banked across commitment periods?

Forward clean energy market: interaction with existing state REC/RPS programs

- Can a resource provide “clean energy” under the FCEM and also qualify for credits/certificates under current state programs?
  - If yes, does it receive credits for both programs?
  - If not, does the resource choose which credit it is awarded, or does one program supersede the other?
- The answer to the above question may have important implications for other design elements, including:
  - If/how suppliers price “clean energy” offers
  - Whether the FCEM replaces (or reduces) certain state policy requirements

Forward clean energy market: pricing and cost allocation

- The design appears to allocate “clean energy” costs to RTLO in the states that buy this product
- If it allows non-rationable “clean energy” MWh offers (or demand bids), there may not be a single price for “clean energy” that is acceptable to all buyers and sellers
  - In such cases, the design would require side payments
  - This is similar to how minimum offers in the energy market can create uplift
- In such cases, how would the “clean energy” price be determined? How would the costs associated with any side payments be allocated?

Forward clean energy market: integrated clearing with FCM

- Stakeholders have discussed an approach that would jointly optimize forward capacity and "clean energy" positions
  - https://nepool.com/uploads/FGP_NPC_20201001_Spees_Integrated_Clean_Capacity_Market.pdf
- Would resources offer capacity and "clean energy" jointly?
  - How would such offers be formulated?
  - Do participants submit separate offers for each product, or a joint offer for both? If separate offers, could an offer clear for one product but not the other, or would the products be bundled?
- Are offers non-rationable? If yes, how would prices be determined? Are side payments required?
- *Outstanding question*: Is such a joint optimization feasible?
  - Requires further assessment of product space and the auction's bid and offer parameters

Net carbon pricing: overview

- Charge a price per ton of carbon emissions to energy suppliers that emit carbon when generating electricity
- Energy suppliers modify (increase) their energy offer price to account for any costs associated with carbon emissions
- This carbon price may thereby change the energy supply stack, making lower emitting resources more likely to be dispatched (because their offer price is relatively lower), and higher emitting resources less likely (because their offer price is relatively higher)
- Revenues associated with the carbon price are distributed to load

Net carbon pricing is a more well understood design concept

- Emission pricing is not a novel design, and thus there is already a general framework upon which to draw
  - For example, New England electricity suppliers already experience a carbon price via the Regional Greenhouse Gas Initiative (RGGI)
  - This concept was discussed at length at the FERC Technical Conference, held on September 30, 2020
- Net carbon pricing does not raise similar questions about the product definition (the product is simply carbon emissions) and does not require a forward procurement of this product

Yet a number of outstanding questions about net carbon pricing remain

- How is the applicable carbon price determined?
- How are revenues from this carbon price distributed? To RTLO or in some other manner?
- How does the design address geographic leakage?
- Does the design interact with RGGI, other state programs?
- Plan to work with stakeholders to flesh out this framework and address these questions, as well as others that are likely to emerge as work progresses
  - Expect to provide more details on a potential net carbon pricing framework at March meeting

ISO looks forward to working with stakeholders to evaluate Pathways to the Future Grid

- With help of stakeholders and the Analysis Group, ISO will evaluate market outcomes under forward clean energy market and net carbon pricing frameworks
- Welcome stakeholder feedback on the model assumptions and outstanding questions related to these frameworks to facilitate modeling efforts
- Share final report on modeled market outcomes associated with these frameworks in February 2022

A Forward Clean Energy Market for New England – Design Specifications
December 2020

This document represents the product of on-going discussions among interested stakeholders on the necessary and desirable characteristics of a Forward Clean Energy Market (FCEM) that might someday be implemented in New England. These discussions were convened and facilitated by NRG and its consultants. They have relied on market design concepts initially formulated by some of the participating stakeholders who presented them in 2016 NEPOOL stakeholder process known as the Integrated Markets and Public Policy (IMAPP)[1] and who subsequently worked with The Brattle Group and others on their further development.[2] While the authors have attempted to faithfully capture all viewpoints expressed in these discussions, no stakeholder has necessarily expressed support for or endorsement of this formulation of FCEM, or of the FCEM concept, and some stakeholders may have strong preferences among the options presented here. The organizations participating in these discussions are listed in Appendix 1.

In addition, this document remains a working draft and is subject to further revision as these discussions continue in the coming months. Our goal is not to present a fully defined market design for implementation; rather it is to provide a framework of the major parameters and design considerations that will need to be resolved to successfully implement a FCEM, as a starting point for broader discussions among regional stakeholders.

To achieve their clean energy goals, states are currently relying primarily on individual solicitations offering long-term contracts for certain new resources outside of the wholesale markets and/or the purchase of clean energy attributes from existing resources through short-term markets often reflective of administratively set alternative compliance payments. The goal of a Forward Clean Energy Market is to allow all new and existing clean energy resources to compete in a centralized forward auction, resulting in a more efficient and cost-effective achievement of the region's clean energy goals.

As discussed among this group of stakeholders, a successful FCEM design will:

- Incentivize investment and production of clean energy and contribute to achievement of state-mandated clean energy and carbon reduction goals through market-based revenues, shifting risk from ratepayers to investors;
- Provide a path for clean energy resources to count as capacity resources without undermining the price signal necessary for resource adequacy;
- Ensure that FCEM revenues are "in-market" from FERC's perspective, while vesting the states with substantial control over FCEM;
- Avoid allocating FCEM costs to non-participating states; and
- Avoid inefficient price suppression in real-time energy markets.

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[1] *See, for example, http://www.nepool.com/uploads/IMAPP_Presentation_National_Grid.pdf; and* http://www.nepool.com/uploads/IMAPP_Presentaion_NextEra.pdf

[2] *See, for example, https://www.brattle.com/news-and-knowledge/publications/how-states-cities-and-customers-can-harness-competitive-markets-to-meet-ambitious-carbon-goals-through-a-forward-market-for-clean-energy-attributes-expanded-report;* and *http://nepool.com/uploads/FGP_NPC_20201001_Spees_Integrated_Clean_Capacity_Market.pdf*

I. Demand Participation

1. For an FCEM to be successful, there will need to be a robust and durable demand for clean energy attribute credits (CEACs), denominated and purchased in megawatt hours of electricity that have been produced by eligible clean energy resources.
2. The primary source of that demand will be state governments seeking to achieve their clean energy goals, whether established by state laws, regulations, or other state authority, and each state will need to ensure it has adequately authorized a state agency with the ability to submit demand bids consistent with such clean energy goals.
3. States will communicate their demand bids to the auction administrator for the FCEM auction. The demand bid will be determined by each state pursuant to its goals for carbon emission reductions and/or clean energy supply and its forecasted energy requirements. The auction should include the full volume of state compliance requirements to ensure efficient price formation.
4. The costs of CEACs procured in the auction pursuant to a state's bids will be allocated to the ISO-NE wholesale market participants with Real Time Load Obligations (RTLO) in that participating state in the period that the clean energy is produced, adjusted for any CEACs self-supplied by Load Serving Entities (LSEs).
5. Secondary sources of voluntary demand, in the form of bids to purchase CEACs by, for example, corporations, municipalities and aggregations, can also participate and can contribute to the robustness and durability of total demand. The costs associated with any CEACs procured as a result of such secondary sources of voluntary demand will be allocated to the ISO-NE participant(s) submitting the associated demand bid(s).
6. To provide sellers with confidence that there will be robust demand on an on-going basis, States should make foundational commitments to continue to submit robust demand bids, annually, for a minimum period, e.g. ten years. Ideally, states will publish forecasts of their expected purchase requirements for multiple years even farther into the future.
7. To foster the development and market entry of new carbon-free resources, the FCEM rules will include the option for 'new' generators to elect a price lock for a minimum number of years (e.g. up to 7-12 years) from the date at which they begin to deliver power and create CEACs. The costs associated with those multi-year commitments would be allocated to LSEs in those years through the normal settlement process.
8. State governments and secondary sources will convey price sensitive demand bids to purchase CEACs to the market administrator by a specified date in advance of each annual auction. Subject to accompanying price limits, bids will specify an amount of CEACs sought to be delivered by eligible supply resources during a delivery year (June 1 – May 31) that begins approximately three years following the year in which the auction takes place.
9. The fundamental intent and design of the FCEM is to allow all carbon-free energy resources, whether new or existing, and regardless of their technological characteristics, the opportunity to compete on an equal basis to supply the carbon-free emission attributes participating states may seek to procure to satisfy their clean energy goals. However, if states desire to specify demand bids for CEACs from resources that have specific characteristics (e.g., not only carbon-free, but also renewable), the FCEM could be configured to enable such bids. Under this design

alternative, States would be able to specify demand bids that "target" resources with specific technologies or characteristics beyond the 'base' CEAC eligibility criteria, subject to providing sufficient notice to the market.

II. Supply Eligibility

1. The definition of resources eligible to produce CEACs should be as broad as possible to enable the maximum degree of competition, which can be expected to produce CEACs and achieve the States' clean energy goals at the lowest cost. FCEM eligibility should be open to all resources that produce energy with no direct carbon emissions. If there is a certain resource type that is eligible for a particular RPS or similar state program that does not meet the 'no direct carbon emissions' definition, it may continue to participate in those programs as a state may allow, but it would not be eligible for participation in the FCEM.
2. A fundamental principle of an FCEM is the comparability among sources of carbon-free emission attributes. To the extent they can each produce energy with no associated direct carbon emissions, there should be no eligibility distinction between new and existing resources, or among different technologies.
3. Recognizing that in many respects CEACs and state authorized renewable energy program RPS[3/] credits both represent clean energy aspirations and that consumers should not pay twice for the same attribute from the same MWh, appropriate rules will be required to ensure that CEAC and RPS product definitions are aligned and that each environmental attribute is only counted once for compliance.
4. Participation by eligible CEAC supply resources in FCEM auctions should be voluntary (subject to market monitor review to deter the exercise of market power). Among other reasons for choosing not to sell in a FCEM auction, a supply resource may find it financially preferable to sell its environmental attributes through other channels.
5. A new resource should have the option to elect a price lock for some number of years (e.g. up to 7 to 12) to enhance the certainty of FCEM revenues and facilitate financing. The structure of this mechanism, and a potential built-in sunset of it over some number of years, need to be considered in light of the FERC order eliminating the price lock from FCM.
6. The output from eligible non-emitting resources being compensated under contracts approved by State regulatory authorities, under which the buyer has rights to the non-carbon and potentially other environmental attributes of the resource, should be eligible to participate and be compensated as CEAC supply, provided the affected State submits CEAC bids for quantities that are no less than the expected energy production associated with such contracts offered into the auction. CEAC market revenues should be allocated to the buyers under such contracts to offset contract payments.
7. A 'dynamic' approach, that would create differential value of CEACs based on the marginal carbon intensity of the electric supply at the time the CEAC was created, would

3/ In this document we use the term 'RPS' to refer generically to state attribute compliance programs, including Clean Energy Standards, Alternative Energy Standards, Renewable Portfolio Standards, Renewable Energy Standard, and similar programs.

align CEAC value with the relative amount of carbon emissions offset by clean energy production, and could provide, for example, a greater value stream to resources incorporating energy storage in its operations.

III. Settlement Characteristics

1. The production of clean energy attribute credits (CEACs) from eligible supply resources with FCEM obligations would be tracked and verified through the NEPOOL GIS. As is the case now, this information would include date and time of production, emissions, as well as eligibility for other programs such as state RPSs.
    a. As an alternative, it may be possible to track and settle the delivery of carbon-free energy entirely through the ISO-NE settlement system, avoiding the complexity of reconciling a new CEAC product with existing REC and similar products. The balance of these documents, though, assume the use of the GIS system.
2. To enable a 'dynamic' approach to reducing grid carbon intensity, CEACs could be earned by suppliers in proportion to the grid's carbon intensity at the date and time of production, and perhaps also as a function of location.
3. The CEAC supply obligation would be for an annual quantity. Under-delivery of a supplier's CEAC obligation quantity should be subject to a penalty or charge to incentivize the supplier to cover any shortfall. Production of CEACs would be compensated through existing ISO settlement processes as non-emitting energy is produced. The total CEAC obligation of a supplier would be trued up annually. To provide intermediate confirmations that a resource is on track to meet its annual obligation, it may be desirable to settle quantities and deviations more frequently than annually.
4. The ultimate settlement of the market would take place with the close of the CEAC compliance period, likely to be approximately six months following the end of the CEAC delivery year. This timing would allow for confirmation of actual obligation quantities and late-stage trading among participants to balance long or short CEAC positions.
5. Presuming the use of GIS, delivery of CEACs will be accomplished by the seller of said CEACs transferring confirmed GIS certificates to the accounts of the LSEs being allocated FCEM costs, as well as any voluntary buyers. The GIS administrator will identify each CEAC by the physical source of the energy that caused its creation and by the date and time when that energy was produced, to correlate with system emissions intensity data.

IV. Market Integration

Option One: Forward Clean Energy Market with the Forward Capacity Market:

1. Consistent with the objective of the FCEM to support investment in new non-emitting resources as well as to compensate existing resources for their non-emitting attributes, FCEM could parallel the existing Forward Capacity Market (FCM) in a number of respects:

a. Qualification procedures for FCEM participation would mirror existing procedures for FCM, such as timing and content of 'show of interest' and qualification submittals, monitoring of critical path schedules, offer price reviews and financial assurance requirements.
b. The annual FCEM auction for energy deliveries three-plus years in the future would occur shortly before the associated Forward Capacity Auction which takes place in February.
c. Offer prices in FCM are assumed to reflect revenues secured through the FCEM auction (and vice versa).
d. New non-emitting resources should have the option to elect a multi-year price lock (potentially in the range of 7 to 12 years) when first clearing in the market, to enhance revenue certainty and facilitate financing.

Implementation of FCEM would not eliminate the Minimum Offer Price Rule (MOPR) in FCM. However, FCEM revenues associated with 'base' CEACs, i.e., the technology-neutral requirement for non-emitting attributes, would be considered 'in-market' for purposes of calculating offer floor prices for new resources in FCM. Incremental revenues above the 'base' CEAC value (such as associated with a 'targeted' demand bid for a specific technology or other characteristic) that are '(a) not tradable throughout the New England Control Area or that are restricted to resources within a particular state or other geographic sub-region; or (b) not available to all resources of the same physical type within the New England Control Area, regardless of the resource owner,'[4] would not be considered as 'in-market' revenues.

2. Likewise, for purposes of the MOPR and participation in FCM, a clean energy attribute product (CEAC) procured outside of FCEM would have those attributes valued at the 'base' CEAC price

Option Two: Integrated Clean Capacity Market:

1. FCEM and FCM would be combined into a single auction structure that would seek to satisfy both a MW-based resource adequacy constraint and a MWh-based clean energy constraint. ISO would establish the resource adequacy requirements and states (and voluntary buyers of CEACs) would create the requirements for clean energy with their price-sensitive demand bids.
2. Supply offers into the ICCM would comprise a resource's MW of Qualified Capacity, its MWh of CEAC-eligible energy production, and a price based on its net annual revenue requirement after accounting for energy and ancillary service revenues from the ISO markets. Suppliers should have flexibility to offer quantities less than their theoretical maxima of both capacity and clean energy, as a means of managing delivery risk, weather uncertainty, etc., including offering only capacity or only CEACs, even if eligible to provide both products.
3. The minimum offer price rule (MOPR) would continue to be enforceable, but only to the extent either clean energy or 'balancing' resources received revenues from sources outside of the ICCM, ie, FCEM revenues would be explicitly 'in market' for FCM purposes, and vice versa.

[4] ISO-NE Market Rule 1, Appendix A.21.2(b)(i)

4. Many FCM-based mechanisms for qualifying and implementing offers and the auction would be adapted, including the show-of-interest and qualification package processes, financial assurance, critical path schedules, the option of a multi-year price lock for new resources, etc.
5. The co-optimizing auction would clear whole resource offers, i.e. a resource that offered both capacity and CEACs could not receive an obligation for one without also receiving an obligation for the other. The auction would produce separate clearing prices for each product, and delivery performance of each product would be measured independently.

V. Regulatory Integration

A Forward Clean Energy Market (FCEM) would be a new wholesale market mechanism available for participating states to utilize for the procurement of the clean energy attributes they deem required to achieve their clean energy goals. The ISO-NE would administer the market on behalf of participating states. A revised ISO-NE tariff would specify, among the many rules which would apply to the FCEM, that:

> (1) each state will determine whether it will participate, and, if so, the structure and specifics of its demand bids;
>
> (2) charges for payments to clean energy resources for CEACs clearing the auction pursuant to a state's demand bids will be allocated to LSEs based on their Real-Time Load Obligations in that state at the time the CEACs are generated and will be adjusted for any CEACs self-supplied by LSEs; and
>
> (3) FCEM charges will not be allocated to LSEs in non-participating states.

For purposes of this document, we assume the ultimate compliance obligation for any state clean energy regulatory programs (e.g., CES, RPS, RES) would continue to reside with the Load Serving Entities in that state. We further assume the use of the GIS system to track the creation, trading and retirement of the certified clean energy-attribute or attributes transmitted through the FCEM, as is done today for all existing clean energy-associated attributes.

There are at least two ways that the mechanics of an FCEM could be designed to enable integration with state programs. In one, a Clean Energy Attribute Credit (CEAC) would represent only the carbon-free attribute of a MWh. In the other, a CEAC would represent all of the clean energy attributes of a MWh. What follows are descriptions of these two ways.

Option One: A "Carbon-Free Attribute"

In this approach, a CEAC would represent only the carbon-free attribute of a MWh. Other attributes of a MWh that are tracked for RPS compliance (such as the type of producing technology and the location of its production) would be considered separate and distinct. A CEAC would be used, in the first instance, to achieve compliance with the requirements of the

FCEM. In addition, the same CEAC would be eligible to apply towards partial compliance with one or more of a State's clean energy programs.

All of the various attributes of the clean energy production associated with a CEAC would be identified by the NEPOOL Generation Information System (GIS) so the associated GIS certificates could be traded and used to demonstrate compliance with FCEM and, to the extent states allow, with state programs.

The numbered paragraphs that follow provide more detail on what the mechanics of this approach to regulatory integration could be.

1. Load Serving Entities would comply with their FCEM obligations by using a CEAC. States would allow LSEs to also use that same CEAC for partial compliance with their clean energy programs; that is, with the portion of state clean energy programs designed to achieve "carbon-free" energy production.
2. Effectively, each MWh of production that would qualify for compliance with the FCEM would be designated by the GIS system as creating two or more certificates; (1) one representing the carbon-free attribute of the underlying energy production, designated for discussion here as a CEAC, and (2) the other representing other attributes of that energy production (such as technology type, vintage or location), designated generically for discussion here as Residual Credit(s).
3. Residual Credits will reflect the attributes that define eligibility to comply with state programs based on attributes other than carbon-free energy production. For example, that residual value might be related to its production by a particular technology (such as hydro or solar) or by a particular vintage of resource (such as commercial after 2009), or in a particular location (such as within the state in question). These differing attributes and designations will allow these Residual Credits to be bought and sold separately from CEACs and from one another.
4. Suppliers of CEACs that clear in the FCEM auction would be understood to have sold only the carbon-free attribute of their production. They would retain ownership of any residual value that would accrue to their power production for its GIS attributes apart from its carbon-free character. Residual Credits could be sold to compliance entities that will need them (in combination with CEACs) to comply with state RPS programs.
5. Suppliers that do not sell their carbon-free credits (CEACs) in the FCEM auction (either because they did not offer them or they did not clear in that auction) would retain the full value of both the CEACs and the Residual Credits and all of their attributes. They would be free to sell those combined credits to compliance entities who would use them to comply with state energy regulatory programs, as is done today.
6. Compliance with state portfolio and energy standard programs would require both the appropriate number of CEACs, reflecting the carbon-free aspect, and the appropriate number of Residual Credits that address the other non-carbon-free requirements of the state regulations. Residual Credits would demonstrate compliance with all other criteria required by the particular state program, besides being carbon-free.
7. A CEAC could only be used once for FCEM compliance, but could also be used for partial compliance with a state RPS program; i.e., the 'carbon-free' aspect of the program. Likewise, a Residual Credit could only be used once for compliance with a

state regulatory program unless a state has specifically approved of its simultaneous use for more than one state program (such as the MA regulation that allows RECs to count toward compliance with the Clean Energy Standard).

8. Any CEACs or Residual Credits retired for compliance with a program in one state could not be used for compliance with a program in another state.

Option Two: "All Clean Energy Attributes"

In this approach, a Clean Energy Attribute Credit (CEAC) from a resource would represent all of the clean energy-associated attributes of a MWh produced by that resource (including absence of carbon, type of producing technology, resource vintage, location, etc.). When a CEAC from a resource is sold in the FCEM auction, it would come with all of the associated GIS certified attributes for which the resource qualifies/is eligible.

For example, a resource which qualifies as a CT Class 1, MA RPS Class 1, MA CES, MA CPS, RI New Renewable, and VT Tier 1 resource, if its offer price is cleared in this market, would be committed to providing to the buyers (LSEs) all corresponding entitlements to the GIS certified attributes for the associated MWhs, once produced. A clean energy resource which might not qualify as any type of the examples provided above would be committed to provide, at a minimum, certification of and entitlement to its Carbon Emission-Free Energy attribute.

Following the real-time production of energy, the various attributes of clean energy production associated with each CEAC would be identified by the NEPOOL GIS and noted on its GIS certificate. The GIS certificate for a CEAC, provided to an LSE based on the ultimate FCEM settlement of charges and CEACs based on applicable Real-Time Load Obligations, could be traded or used by the LSE to demonstrate its compliance with state programs.

The paragraphs that follow provide more detail on what the mechanics of this approach to regulatory integration could be.

1. The sale of a CEAC in the FCEM auction would include the sale of all the clean energy and environmental attributes of a MWh that are produced by a qualifying generating unit. Buying a CEAC would secure ownership of all clean energy associated attributes of each MWh generated by the supplying clean energy resource.
2. Based on the outcome of the FCEM auction, generation offers that cleared in the auction would be allocated to load serving entities (LSEs) in the form of CEACs. Likewise, the costs of purchasing these CEACs would be allocated to LSEs in proportion to their share of Real Time Load Obligations (RTLO). The allocation of CEACs would likewise include a proportional share of all GIS certificates associated with the clean energy that created the CEACs.
3. Voluntary buyers (i.e., any entities submitting demand bids other than the participating states) would be allocated the amount of CEACs they purchased in the auction. That allocation of CEACs would likewise include a proportional share of all GIS certificates associated with the clean energy that created the CEACs themselves.
4. Each *pro rata* share of CEACs awarded to a buyer would reflect ownership of a proportionate share of the various types of state program qualifications on the GIS

certificates attributed to the suppliers of CEACs sold in the auction. As a result of the auction, a LSE might receive a group of CEACs that included more or less of the qualifying characteristics needed to comply with state programs. An LSE would be free to trade CEACs to balance its position.

5. Once a MWh is produced and its attributes confirmed, it will be assigned a GIS certificate. That certificate will specify the attributes for that MWh, including whether it qualifies with various state programs. The ownership of a GIS certificate would be used to demonstrate compliance with state programs.
6. LSEs could buy and sell the GIS certificates that were secured through ownership of CEACs, as needed, to balance positions and meet state compliance obligations.
7. Voluntary buyers who received CEACs from the FCEM auction would also be free to trade CEACs. However, the sale of a CEAC would necessarily include the sale of all its clean energy attributes and the seller could no longer claim to own that MWh or its "clean energy" attributes.
8. A CEAC (and its corresponding GIS certificate) used for compliance with a regulatory program in one state could not be used for compliance in another state.
9. A state might need to clarify, by regulation, which attributes a CEAC would need to represent to accomplish compliance with its clean energy program requirements.

APPENDIX I

Forward Clean Energy Market Design Discussions

Participating Stakeholder Organizations

- Advanced Energy Economy
- Associated Industries of Massachusetts
- Brookfield Renewable Energy
- Connecticut Business and Industry Association
- Conservation Law Foundation
- Direct Energy
- Energy New England
- Eversource
- National Grid
- New England States Committee on Electricity (NESCOE)
- New England Power Generators Association
- NextEra Energy
- Northeast Clean Energy Council
- NRG Energy
- Power Options
- Renewable Energy and Efficiency Business Association (REEBA)
- RENEW Northeast
- Union of Concerned Scientists