NEPOOL
NEW ENGLAND POWER POOL

FINAL AGENDA

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

To participate in the special Participants Committee Teleconference,
please dial 1-866-803-2146; Passcode 7169224.
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The final agenda items for the March 18 working session are as follows:

- Continued discussion of scope of FCEM design framework to be studied
- More detailed analysis and assessment of key design questions regarding the FCEM framework
- Discussion of scope of net carbon pricing design framework to be studied, including key design elements

MARCH 18, 2021 | NEPOOL PARTICIPANTS COMMITTEE WORKING SESSION

Pathways to the Future Grid

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

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Pathways work will evaluate two potential market designs

- ISO is working with stakeholders and the Analysis Group to evaluate two market frameworks that have been discussed as potential pathways to the future grid
  - Forward clean energy market
  - Net carbon price
- The ISO plans to study both frameworks simultaneously and issue a final report in early 2022 that discusses the market impacts of both designs

Today's discussion focuses on key elements of each market design

- ISO offers preliminary straw frameworks associated with each market design for stakeholder consideration and discussion
- A straw approach provides one possible path for how each design could work for the purpose of conducting the quantitative modeling associated with the pathways work
- Welcome stakeholder feedback and concerns
- Comments can be provided either during committee discussions, or in writing to both Chris Geissler (cgeissler@iso-ne.com) and the Chair of the Participants Committee (or designee) for posting

Feedback on pathways designs received to date

- We appreciate the numerous written responses and comments received since the February meeting including
  - Advanced Energy Economy (and co-commenters)
  - Eversource
  - NESCOE
  - NRG
- Stakeholders have expressed views on various Forward Clean Energy Market (FCEM) design elements, including:
  - The set of resources that would receive clean energy certificates
  - Whether these certificates should be "static" or "dynamic"
  - The possibility of an integrated clearing of capacity and clean energy

Today's discussion seeks to be responsive to these stakeholder comments

- In putting forth a straw FCEM framework, we seek to respond to many of the comments stakeholders have raised on design elements, and help answer key questions outlined in the February presentation
- Included graphics on the straw FCEM framework slides to signal when topics in our presentation materials relate to those raised by stakeholders, providing additional opportunity for discussion
  - Colors signal the organization that commented; numbers reflect relevant slide or page number of stakeholder materials (if applicable)

AEE — Advanced Energy Economics	NES — NESCOE
EVS — Eversource	NRG — NRG

Detailed discussion of model mechanics and assumptions will occur at future meetings

- Once we have a clearer understanding of each of the designs to be modeled, we will be well equipped to discuss key modeling decisions, including:
  - Core model mechanics
  - Key input assumptions
  - Desired model outputs and analysis
- We look forward to engaging in further discussions about the modeling approach, inputs, outputs, and analysis in the coming months

ISO has published numerous memoranda for this meeting

- **FCEM scoping memo**: Provides more detail on a straw FCEM framework for stakeholder consideration and discussion
- **Evaluation of integrated clearing memo**: Discusses a theoretical auction framework that could allow for the joint procurement of capacity and clean energy
- **Net carbon price scoping memo**: Provides more detail on a straw net carbon price framework for stakeholder consideration and discussion
- Discuss contents from each of these memoranda in the slides that follow

STRAW FCEM FRAMEWORK: APPROACH AND PRODUCT DEFINITION

ISO raised numerous design questions at last stakeholder meeting

- These questions highlighted areas where the FCEM framework may not be fully developed yet and the ISO sought feedback to better understand certain design elements
- Questions indicated that there may be multiple approaches to various FCEM design details
- Feedback and observations that stakeholders raised at the February meeting helped to inform the straw FCEM framework it has put forth

Basis for ISO's straw FCEM framework

- Where the ISO did specify potential design elements, these were guided by three criteria:
  - Stakeholder feedback and preferences
  - Alignment with sound market design principles
  - Simplicity to model
- Anticipate that modeling will also consider alternate design elements, where specified by others and time permits
- ISO's presentation of a straw FCEM framework for purposes of study should not be construed as an ISO endorsement of any potential design

What resources are awarded clean energy certificates?

NES – 5

NRG - 3

- ISO proposes to evaluate effects of awarding clean energy certificates to resources that produce electricity without emitting carbon
- Includes: Wind, solar, hydro, nuclear
- In order to translate this straw framework into a more complete design, would need to determine more specific rules governing many other types of electricity generation including emerging technologies, etc.

NES – 6

NRG - 4

Do storage resources receive clean energy certificates?

- Storage can contribute to clean energy production by charging during off-peak hours (where the marginal resource may be clean) and discharging during on-peak hours (where the marginal resource is less likely to be clean)
- Stakeholders have expressed interest in ensuring that storage is compensated for its clean energy contributions
- The ISO is assessing whether it is sensible for such compensation to include clean energy certificates in addition to other wholesale market revenues
  - Storage may naturally see increased energy market revenues under an FCEM
  - Storage's participation via certificates does not always increase clean energy production in the region
- Welcome discussion and stakeholder feedback on this topic

Current straw framework presumes static certificates

NES – 6

AEE

NRG - 4

- ISO proposes to evaluate static certificates, which do not vary with the emissions intensity of the marginal resource
- This static approach is simpler to model than a dynamic approach, which applies weights when awarding clean energy certificates
  - Weights are based on the carbon intensity of the marginal resource
- A dynamic approach is more complicated to design and model
  - How are these weights calculated? Are they determined before the applicable interval, or are they calculated in real-time?
- A dynamic approach may raise challenges for clean energy suppliers when offering into the FCEM and energy markets
  - If weights are not known when submitting FCEM and energy offers, participants have to formulate offers based on expected weights

NES – 6

NRG - 6

Straw framework procures a single clean energy product

- ISO proposes to evaluate a single clean energy product
- This approach may be simpler to model and requires the development of fewer demand parameters
- The use of a single product also promotes competition from all resources that can provide clean energy
- Using a single, broadly-defined product may therefore help to procure clean energy in a more cost-effective manner than if there were several different products

STRAW FCEM FRAMEWORK: SETTLEMENTS

NES – 6

NRG – 7, 9

Supplier settlements

- Resources that sell clean energy in the FCEM have two avenues to meet the obligation associated with this position
  - Produce clean energy during the delivery period and receive the corresponding clean energy certificates
  - Buy clean energy certificates from other resources that are willing to sell such credits (where they may expect to produce more clean energy than they sold forward)
- Because production of clean energy yields clean energy certificates that can meet a forward obligation or be sold, expect clean energy suppliers to lower their energy offer price to reflect the value of these certificates
  - Similar to how resources internalize the value of other environmental credits (i.e., RECs) in their energy offer price
- The assumption of a sensible spot market price is important for modeling as it leads to the cost-effective production of clean energy and facilitates realistic energy market offers

NES – 6

NRG – 8

Non-compliance penalty rate

- ISO proposes to include a non-compliance penalty rate to incent resources to provide the clean energy certificates sold forward
  - Any revenues collected due to clean energy certificate shortfalls would be rebated to load
- A higher rate will tend to reduce the likelihood that the region produces less clean energy than was sold forward, but it may also increase the price associated with clean energy certificates
  - Low penalty rate may produce modeling scenarios where demand for clean energy is not fully met through clean energy production
- ISO believes that this rate should be developed in close coordination with stakeholders and welcomes feedback on this design element

NRG – 13

Settlements to load

- ISO proposes to allocate the cost associated with the procurement of clean energy to Real-Time Load Obligation (RTLO) in the states that buy these environmental attributes
- Cost allocation follows a two step process:
- **Step 1**: Each state is allocated costs equal to the product of the forward clean energy price and the quantity of clean energy it procures
- **Step 2**: Allocate each state's costs to its RTLO over the applicable delivery period
- The FCEM scoping memo includes a numerical example walking through these steps in more detail

STRAW FCEM FRAMEWORK: INTERACTION WITH EXISTING STATE PROGRAMS

NES – 7

NRG – 11, 12

Interaction with existing state programs (RECs)

- Identify three potential approaches for stakeholder consideration
- **Approach 1**: Clean energy is a new environmental attribute that is distinct from other attributes (e.g., renewable)
- **Approach 2**: Clean energy certificates include all environmental attributes
- **Approach 3**: Existing state programs are discontinued with introduction of FCEM
- Each approach has different implications for the modeling efforts and how the region meets its environmental objectives in the future

NES – 7

NRG – 11, 12

Approach 1: Clean energy is separate attribute

- Under this approach, FCEM does not directly interact with existing state policies
- A wind resource would receive a clean energy certificate and a REC for each MWh of energy it produces
- Existing state programs such as RECs are assumed to continue, and would be considered in the modeling efforts

Approach 2: Clean energy includes all environmental attributes

NES – 7

NRG – 11, 12

- Clean energy certificates include all environmental attributes
- A wind resource that sells clean energy does not receive RECs or any other certificates (besides clean energy certificates)
- This approach requires further consideration of how clean energy certificates interact with other credits
  – How is demand for existing certificates impacted by the introduction of clean energy certificates?
  – Would suppliers potentially choose to forgo selling clean energy in order to receive RECs?
- Due to these interactions, this approach may be more complex to develop for the pathways modeling efforts

NES – 7

NRG – 11, 12

Approach 3: Existing state programs are discontinued with FCEM

- The FCEM replaces, rather than supplements, the existing programs as the mechanism by which the states pursue their environmental objectives
- A wind resource receives a clean energy certificate for each MWh of energy it produces and no other certificates
- Reduces the number of demand parameters that must be considered and modeled

Welcome stakeholder feedback on the preferred approach

NES – 7

NRG – 11, 12

- The approach taken here should be broadly consistent with that employed for the straw net carbon pricing framework
- In other words, both frameworks should either assume that the existing state programs are continued or discontinued
  - Will better allow for apples-to-apples comparisons between the frameworks
- To date, have heard some stakeholder support for approaches 1 and 2

POTENTIAL ICCM CONSTRUCT FOR PATHWAYS EFFORTS

AEE | NES – 7, 8
EVS | NRG – 15, 16, 17

Integration with FCM?

- ISO has identified an ICCM approach that appears to be conceptually feasible and can be used in the pathways modeling efforts
- Under this approach, resources would submit a single offer for two products – capacity and clean energy
- Auction would then jointly determine the capacity and clean energy awards that maximize social surplus, and specify separate prices for each product

Evaluation of an ICCM

- This presentation outlines a high-level concept for how such a market could function, but there are many outstanding questions that would need to be analyzed before a full market design could be developed
  - E.g., whether sensible pricing rules can be developed to consider non-rationable (lumpy) offers, implications for the FCA calendar, etc.
- The next few slides will consider a potential approach that does not consider these design details, but may serve as the basis of a framework for the Pathways work
  - Further discussion is available in the "Evaluation of an Integrated Forward Clean Energy Market" memo

Forward clean energy demand

- The FCM would be expanded so that, in addition to sloped MRI-based demand curves for capacity, it would include demand bids from states that reflect their willingness to buy clean energy forward
- The ICCM would thus procure two distinct products concurrently: (i) capacity and (ii) forward clean energy
- To meet demand for each product, supplier offers would include both capacity and clean energy components

ICCM offer structure

- Participants would submit a capacity offer, as in the FCM today, that includes both a maximum quantity and a price reflecting the minimum payment rate they would accept in selling capacity
- The ICCM would introduce a new clean-energy parameter to their offer that indicates how many MWh of forward clean energy it would sell per unit of CSO
  - E.g., a clean resource may specify that for each MW of capacity sold, it will also sell 100 MWh of clean energy forward
- A participant's offer price would then represent the minimum payment the participant would accept to take on a CSO *and* sell the associated bundled clean energy forward

Integrated auction clearing

- The ICCM would award capacity and clean energy positions to resources based on their offers and their contributions to meeting capacity and clean energy demand
- Much like with today's FCM, resources that offer these products at lower cost are more likely to be awarded positions than those that offer at higher prices
- However, the auction may award positions to a resource that submits a higher priced offer if this offer also includes clean energy
- Awards would be determined to maximize social surplus, where the social surplus considers the benefits of both products, as determined by the demand curves

POTENTIAL ICCM CONSTRUCT: NUMERICAL EXAMPLE

Numerical example: introduction

- The following numerical example represents a simple case illustrating how prices and awards might be determined when participants submit fully rationable offers
- For more details on how participants determine their offers and how prices are set given rationability, please see the corresponding "Evaluation of an Integrated Forward Clean Energy Market" memo

Numerical example: supply and demand parameters

Table 1. Resource Parameters

Generator	Max Capacity	Clean Energy Parameter	Offer
Non-Clean 1	500 MW	-	$60,000/MW
Non-Clean 2	500 MW	-	$70,000/MW
Clean 1	300 MW	6000 MWh/MW	$150,000/MW
Clean 2	300 MW	7000 MWh/MW	$200,000/MW

- For simplicity, assume vertical demand curves for both capacity and clean energy
- Capacity demand = 850 MW
- Clean energy demand = 2,500,000 MWh

Numerical example: clearing and awards

Table 2. ICCM Clearing and Awards

Generator	Offer	Capacity Award	Clean Energy Award
Non-Clean 1	$60,000/MW	450 MW	0 MWh
Non-Clean 2	$70,000/MW	0 MW	0 MWh
Clean 1	$150,000/MW	300 MW	1,800,000 MWh
Clean 2	$200,000/MW	100 MW	700,000 MWh

- The auction awards capacity positions to Non-Clean 1, and capacity and clean energy positions to Clean 1 and Clean 2

Numerical example: determination of prices

- In this example, prices are set for each product using the marginal resource
- Price for capacity is $60,000/MW, where Non-Clean 1 is the marginal resource with respect to capacity
  - $60,000 is the incremental cost associated with a 1 MW increase in capacity demand
- Price for clean energy is $20/MWh, where Clean 2 is the marginal resource with respect to clean energy
  - $20 is the incremental cost associated with a 1 MWh increase in clean energy demand
  - This cost results from a modest increase in Clean 2's capacity award, and a corresponding decrease in Non-Clean 1's capacity award so that total clean energy sold increases and capacity is unchanged

Numerical example: resource compensation

Table 3. Resource Specific Clearing Prices

			Non-Clean 1	Clean 1	Clean 2
[1]	CSO Clearing Price		$60,000/MW	$60,000/MW	$60,000/MW
[2]	Clean Energy Parameter		0 MWh/MW	6000 MWh/MW	7000 MWh/MW
[3]	Forward Clean Energy Price		$20/MWh	$20/MWh	$20/MWh
[4]	Resource Price Per MW	=[1]+[2]*[3]	$60,000/MW	$180,000/MW	$200,000/MW

- Each resource's total compensation per MW of capacity sold is equal to capacity clearing price ($60,000/MW) plus the product of the clean energy parameter and the forward clean energy price ($20/MWh)

Key observations

- There are two prices for the procured products – one for capacity in $/MW and one for clean energy in $/MWh – to account for the two distinct products procured
- The optimization may award capacity to a higher priced resource instead of a lower priced resource because the higher priced resource also offers clean energy
  - For example, Non-Clean 2 does not receive an award while Clean 1 and Clean 2 both do receive awards
- Resources will receive different payment rates per unit of capacity sold to reflect varying quantities of clean energy sold
  - E.g., Clean 2 receives a higher payment rate than Clean 1 to reflect that it sells more clean energy per unit of capacity

ICCM construct represents a high level framework for modelling

- The numerical example above includes fully rationable offers. Incorporating non-rationable offers may raise challenging issues that have not yet been evaluated
- At present, the ISO has not evaluated the challenges that may arise when translating this conceptual framework into a more fully developed market design
  - The ICCM would likely add significant complexity to the FCM and would require a number of substantial changes to the FCM rules, schedule, and processes
- Stakeholder feedback on this element of the framework design and potential alternatives the ISO should explore are most welcome

STRAW NET CARBON PRICING FRAMEWORK FOR STAKEHOLDER CONSIDERATION

ISO provided overview of net carbon pricing framework at Feb. stakeholder meeting

- There are outstanding design questions about this framework relating to various components, including:
  - Cost allocation
  - Interaction with existing state programs
- Welcome continued stakeholder feedback on the straw net carbon pricing framework

Basis for ISO's straw net carbon pricing framework

- Where the ISO did put forth specific design elements, these were guided by three criteria:
  - Aligns with sound market design principles and allows the region to decarbonize its electricity sector cost-effectively
  - Simplicity to model
  - Where possible, choose design elements that are consistent with those in the FCEM framework to better allow for apples-to-apples comparisons
- Anticipate that modeling will also consider alternate design elements, where specified by others and time permits
- ISO's presentation of a straw net carbon pricing framework for purposes of study should not be construed as an ISO endorsement of any potential design

Product is carbon emissions

- Resources are charged a carbon price for each unit of carbon emitted to produce electricity
- Such a construct is already in place in the region, as each state participates in the Regional Greenhouse Gas Initiative (RGGI)
  - A net carbon price is likely to be significantly higher than that associated with RGGI, and therefore further drive the region's decarbonization
- In practice, design could use a fixed carbon price, which allows the emissions quantity to float, or a cap-and-trade approach, which fixes the quantity of emissions and allows the price associated with carbon to float
  - These approaches may have different practical implications
  - The modeling efforts are likely to be applicable to both approaches, so it does not appear necessary to choose between them in developing the straw framework

Supplier settlements

- Suppliers incur a cost for each unit of carbon emitted in electricity production
- Carbon-emitting suppliers will increase their energy offer price by the product of the carbon price and the intensity of their carbon emissions to cover these costs
- This has two important implications that will be reflected in the modeling:
  - May reshuffle supply stack to make lower emitting resources more likely to produce electricity
  - Increases energy market revenues for lower emitting resources that emit less carbon than the marginal resource, which will help region transition to lower emissions resources

Settlements to load

- ISO proposes that the revenue collected from a net carbon price would be rebated to all RTLO for the region
  - Under this approach, this rebate would not vary between states
- The per MWh rebate will be equal to the product of the applicable carbon price and the average carbon intensity of electricity production for the delivery period

Interactions with existing state environmental programs

- Identify two potential approaches:
- **Approach 1**: Existing state programs continue with the net carbon price
- **Approach 2**: The net carbon price replaces the existing state programs
- For consistency, the approach should be consistent with that assumed in the straw FCEM framework
  - In other words, if the straw FCEM framework assumes that existing state environmental programs are continued, the straw net carbon price framework should as well

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 these efforts, including the two frameworks to be studied
- Look forward to discussing the modeling approach at future stakeholder meetings
- Share final report on modeled market outcomes with stakeholders in February 2022

ISO new england

memo

To: NEPOOL Participants Committee Working Session

From: Market Development

Date: March 11, 2021

Subject: Developing a Straw FCEM Framework

At the PC working session in February on Pathways to a Future Grid, stakeholders discussed a conceptual design specification for a Forward Clean Energy Market (FCEM) to be evaluated as part of the pathways efforts.[1] As part of this discussion, the ISO highlighted several design questions associated with this FCEM framework that would need to be addressed before this concept could be quantitatively studied.[2] In response, stakeholders requested that the ISO provide more guidance regarding potential approaches to address these "gaps" so that stakeholders could finalize the development of a straw FCEM framework that the ISO's consultants can model as part of the pathways analysis.

This memorandum seeks to be responsive to these stakeholder requests by outlining possible approaches to resolve many of the identified design questions. The outcome of this exercise is a framework that reflects but one of many potential design approaches for an FCEM, which is conducive to quantitative analysis. We look forward to hearing stakeholder comments and reactions, and expect that the straw framework will be updated to reflect an FCEM approach that can be studied by the ISO's consultants.

In some instances, the ISO puts forth an approach for the straw framework that we believe serves as a sensible starting point for the design. In other places, the ISO does not choose between design options, but provides observations on the potential approaches it has identified with the goal of facilitating productive discussions about stakeholders' preferred approach.

If the New England stakeholders ultimately were to consider market rule changes to introduce an FCEM, the pathways analysis may provide some guidance about potential design parameters and their expected outcomes. However, a process to further flesh out design details, more comprehensively assess

[1] The materials supporting this discussion include a written document (henceforth, referred to as the "stakeholder FCEM document"), available at https://nepool.com/wp-content/uploads/2021/02/FCEM-design-parameters-20-12-29.pdf, and a corresponding presentation, available at https://nepool.com/wp-content/uploads/2021/02/FCEM-for-NEPOOL-Pathways-210218-Rev1.pdf.

[2] See, for example, slides 15-19 of the ISO's presentation materials, available at https://nepool.com/wp-content/uploads/2021/02/ISO_New_England__Pathways_Kickoff_2-18-2021_final.pdf.

implementation questions, and draft market rules would still be needed and would involve significant additional time and effort. Such work is outside the scope of this phase of the pathways project.

Where the ISO did put forth specific design elements for consideration in the straw framework to help further stakeholders' interests, it used three criteria:

i. Generally choose design elements that are consistent with those put forth by proponents in their FCEM design materials to date;

ii. Choose the design options that more closely align with sound market design principles;

iii. Put forth an FCEM framework that is more conducive to quantitative modeling.

Observe that there may be instances where these criteria are not all in harmony. In such cases, the criteria may not offer clear guidance on how to model a design element thus requiring the ISO and stakeholders to consider the tradeoffs between these criteria when choosing a design approach.

The ISO anticipates that the modeling efforts undertaken as part of the pathways work will consider not only a straw framework, but also alternative design elements. Thus, even if a design feature is not included in the straw framework, this does not preclude its consideration for future evaluation, which may also be discussed with stakeholders and included in the final report associated with this phase of the project as time permits (this final report is expected by February 2022).

Importantly, this memorandum aims to help stakeholders move their FCEM concept forward into a framework that can be modeled as part of the pathways discussion. The content of this memorandum should not be taken as an ISO endorsement of such a concept or an indication that such an approach could be implemented. The results of the quantitative analysis, as well as a more comprehensive assessment of the feasibility of the straw FCEM framework, would be critical inputs to the ISO's ultimate opinion on such an approach.

We look forward to stakeholders' reactions to the ISO's views on potential straw framework elements, as put forth herein, and anticipate that this document will be updated during the pathways process to reflect stakeholder feedback and further ISO analysis.

1. Overview of straw FCEM framework

Table 1 below summarizes the key design elements that could be part of the straw FCEM framework. Column [a] specifies each of the design questions that is contemplated, and column [b] summarizes an approach for the straw FCEM design for stakeholder consideration. Column [c] notes the section in this memorandum that discusses this question in greater detail.

Table 1: Summary of Potential Straw Framework Elements

	[a] **Design Question**	*[b]* **Approach in Straw Framework**	*[c]* **Section**
A. Who Receives Clean Energy Certificates?			
[1]	Technology types that receive clean energy certificates	Wind, Solar, Hydro, Nuclear	2.a
[2]	Does storage receive clean energy certificates?	To be determined with stakeholder input and further ISO evaluation.	2.b
[3]	Are energy certificates static or dynamic?	Static	2.c
[4]	Are there additional clean energy products?	No, there is only single product	2.d
B. Settlement			
[5]	What is the settlement structure for sellers?	Two settlement structure where supplier buys/sells certificates to true up to forward position	3.a
[6]	What is the non-compliance penalty rate?	To be determined with stakeholder input	3.b
[7]	Cost allocation for clean energy certificates bought forward	Allocated to RTLO in states that buy clean energy certificates forward	3.c
C. Interaction with existing programs			
[8]	How do clean energy certificates interact with existing state programs such as RECs	To be determined with stakeholder input. There are three possible paths: (i) clean energy certificates are separate from, and additive to, existing state programs; (ii) clean energy certificates include all environmental attributes; (iii) the FCEM replaces the existing state programs.	4
D. Integration with Forward Capacity Market			
[9]	Is the forward clean energy certificate procurement separate from or integrated with FCM?	Run a single auction that jointly procures capacity and clean energy certificates and specifies a separate price for each	5

As this table illustrates, the straw framework outlined in this memorandum specifies potential technologies for which resources receive clean energy certificates for their production (section 2). It also outlines a settlement structure for suppliers and a cost allocation methodology for consumers (section 3). It presumes that the FCEM and FCM are integrated, such that forward clean energy is procured jointly with forward capacity (section 5). We welcome stakeholder feedback on such design elements, including consideration of alternative approaches.

However, the table also notes that there are some design questions that remain outstanding, where the ISO's evaluation is ongoing or stakeholder feedback is requested. In particular, we continue to evaluate whether storage resources should receive clean energy certificates under a straw FCEM framework, and welcome stakeholder feedback on this topic (section 2.b). We also welcome stakeholder thoughts on a reasonable non-compliance penalty rate for clean energy certificates (section 3.b). Additionally, we invite stakeholder on how clean energy certificates would interact with the existing state environmental programs. The discussion identifies three potential paths: one where clean energy certificates do not directly interact with the existing state programs, a second where clean energy certificates include all environmental attributes, including those associated with existing state programs, and a third where the FCEM replaces these existing programs (section 4).

2. Determination of clean energy certificates

a. What technologies receive clean energy certificates?

A design consideration for a straw FCEM framework is that resources that generate electricity without any direct carbon emissions would receive clean energy certificates for their energy production. This approach is broadly consistent with that outlined in Section III.1 of the stakeholder FCEM document. Under such a definition, resources that are generally categorized as renewable energy resources, including wind and solar, could receive clean energy certificates for their production. Moreover, generation that comes from other technologies that do not emit carbon, including hydropower and nuclear, would also receive clean energy certificates.

This approach would not award clean energy certificates to generation technologies that emit carbon, such as natural gas, oil, and coal.

b. Treatment of storage

As noted above, resources that generate electricity without any direct carbon emissions would receive clean energy certificates for their energy production. However, this approach does not offer clear guidance regarding storage resources, which are different than other types of electricity supply. More specifically, storage resources charge when energy prices are low, and then discharge when energy prices are high. This act can help to increase clean energy production when the storage resource charges during a period where the marginal energy supply is clean, and discharges during a period when the marginal energy supplier is not clean.

Stakeholders have expressed an interest in ensuring that the design compensates storage resources for their contributions to clean energy production, with some supporting the position that energy supply from storage resources are awarded clean energy certificates. The ISO agrees that to be consistent with sound market design, storage resources should be compensated for their contributions to clean energy production. However, we continue to assess whether this objective is satisfied by awarding storage resources clean energy certificates, or if these resources are likely to be fully compensated for these contributions without receiving any clean energy certificates via increased energy market revenues.

We look forward to stakeholder feedback and continued discussion of the treatment of storage under a straw FCEM framework, and hope to share additional observations about how storage can be sensibly compensated for its contributions to clean energy at future stakeholder meetings.

c. Employing "fixed" rather than "dynamic" clean energy certificates simplifies design

At present, the straw FCEM framework described herein would award a certificate for each MWh of energy produced by a resource that can receive clean energy certificates for its energy production. We refer to this as a "fixed" certificate approach, as the quantity of certificates awarded for each MWh of clean energy produced is fixed across all hours of the delivery period. Alternately, stakeholders have raised the possibility of pursuing a dynamic approach, where the compensation for providing clean energy is weighted by the emissions rate associated with the marginal supplier.[3] The fixed approach appears to be

[3] For further discussion of this dynamic approach see slides 24 through 28 of the pathways presentation by Kathleen Spees from August 6, 2020, available at https://nepool.com/uploads/FGP_NPC_20200806_Spees.pdf.

simpler than a dynamic approach for purposes of modeling, and this factor informs the recommendation to use fixed certificates in the straw FCEM framework.

More specifically, there appear to be many outstanding questions with how a dynamic approach would work in practice. Importantly, a dynamic approach requires a methodology to determine the weights that correspond with marginal emissions. These weights can either be determined before the corresponding interval (ex-ante), or they can be calculated based on actual system conditions during the relevant interval (ex-post). Each approach introduces potential challenges for the modeling efforts, and possibly for clean energy suppliers making FCEM and energy offers.

An ex-ante approach raises numerous questions about how these weights would be estimated, including how granular they are with respect to time of day, season, day of week, and how frequently they are re-estimated. Consideration of such an approach could add significant complexity to the model. Moreover, if these weights were not known to sellers before the forward auction is run (3 years before the delivery period), they face a new form of risk associated with selling clean energy forward, as they must not only forecast their energy production during the delivery period, but they must also develop expectations about the applicable weights that would be used when they are generating. If their expectations of these weights are incorrect, they may fail to provide sufficient energy to meet their forward position.

An ex-post approach that determines weights using actual the actual marginal emissions rate introduces potential modeling challenges and raises a similar concern about suppliers' ability to forecast the weights when determining how much clean energy to sell forward. Moreover, it also introduces a new source of uncertainty for suppliers, as they must forecast the weights when bidding into the energy market, as these values will not be determined until the interval has occurred.

d. Consideration of additional clean energy products

A straw FCEM framework that only includes a single clean energy product may simplify the modeling process for several reasons, including that it limits the number of demand parameters that must be developed and modeled. Using a single clean energy product may therefore help facilitate the production of model results in a more timely manner than if the model straw framework allowed for multiple forward clean energy products to be procured.

Additionally, by only specifying a single product, the approach will foster greater competition between clean energy suppliers than if there were multiple products. This will help ensure that the straw framework will procure clean energy in a cost-effective manner.

3. Settlement and cost allocation

a. Settlement for energy suppliers

As the ISO has noted in numerous proceedings and projects, a forward market most sensibly settles against a corresponding spot market. Employing a two-settlement approach will create strong incentives for market participants to satisfy their forward positions in a cost-effective manner while helping to meet the region's clean energy goals. Consistent with this observation, the straw FCEM framework should include a "spot market" for clean energy certificates that allows suppliers to buy and sell clean energy certificates if their production during the delivery period turns out to be higher or lower than what they sold forward.[4]

This approach would create strong incentives for resources to deliver clean energy (and thus, receive clean energy certificates) during the delivery period to meet the clean energy certificates that were sold forward. More specifically, resources that sold clean energy certificates forward would have a strong incentive to produce this clean energy during the delivery period to satisfy their positons. Moreover, resources that did not sell clean energy forward would also have strong incentives to produce clean energy as they could sell the certificates they created to participants that may otherwise not meet their forward positions.

The inclusion of a spot market for clean energy certificates would tend to reduce energy market offers from clean resources relative to current market rules. More specifically, resources that receive clean energy certificates for their spot market production would tend to lower their competitive energy offer price to reflect the fact that if they generate electricity, they receive a certificate that can then either be used to meet their forward position (thus preventing them from having to buy this certificate from another participant) or be sold.[5] In either case, the value of this certificate is equal to the price at which it could be sold. Thus, if the spot price at which certificates were sold is $10 per MWh, we would expect resources that produce clean energy to reduce their energy market offer price by $10 per MWh to reflect this value.

b. Non-compliance penalty rate

Under the proposed settlement structure, the design must specify a non-compliance penalty rate (presumably specified in dollars per MWh) that is applied to any clean energy certificate shortfalls, where the resource sells more certificates forward than it accumulates during the delivery period (either by producing clean energy or buying certificates from other resources).[6] Revenues associated with any non-compliance would be rebated to load.

A higher penalty rate will tend to reduce the likelihood that the region produces less clean energy than was procured forward, but it also is likely to increase clean energy certificate prices because resources must consider higher charges if they fail to procure sufficient certificates to meet their forward position.[7] Given its impact on clean energy certificate prices, and thus its close relationship with the specification for clean-energy demand, the ISO believes that the straw framework non-compliance penalty rate should be

[4] This spot market could resemble those currently in place for existing environmental certificates, where participants buy and sell certificates to satisfy their obligations (and therefore avoid non-compliance penalties). These transactions could be conducted bilaterally between market participants, or the ISO could take a more direct role in this process. However, for purposes of the straw framework, we do not believe it is necessary to determine whether the ISO has a role in administering this market.

[5] This same logic leads resources that receive RECs or production tax credits for their electricity to reduce their competitive energy market offer price to reflect the expected revenues associated with these credits.

[6] The need for this feature is noted in the stakeholder FCEM document in section III.3.

[7] Furthermore, this penalty rate acts as a price ceiling for the certificates, as participants would never pay more than this price to procure a certificate.

developed in close coordination with stakeholders and looks forward to continued discussion on this topic.

c. Cost allocation

In our understanding, the costs associated with the compensating energy suppliers for providing forward clean energy will be covered by new charges to consumers in states that buy this clean energy using a two-step process, where the approach outlined here seeks to build from that outlined in section I.4 of the stakeholder FCEM document. First, each state's total costs associated with this forward procurment are calculated as the product of the clean energy price and the quantity of clean energy awarded to that state, as determined by its accepted demand bid(s). Second, these costs are then allocated within each state on a pro-rata basis to Real-Time Load Obligation (RTLO) over the course of the delivery period.[8] This cost allocation methodology is illustrated via a simple numerical example.

Imagine that there are three states with different levels of load for the delivery period, and differing environmental goals that lead to varying levels of clean energy procurements. This is illustrated in Table 2 below, which considers these three states (column [a]) and for each, shows the total clean energy procurements for the commitment period (column [b]), and their total RTLO for the commitment period (column [c]). In this example, small state 1 serves the entirety of its 1,000 MWh of load via clean energy, large state 2 serves 1,500 MWh of its 3,000 MWh of load via clean energy, and medium state 3 does not serve any of its 2,000 MWh of load via clean energy.

Table 2: Clean Energy Procurements and Load

[a]	*[b]*	*[c]*
State	Clean Energy Procured *[MWh]*	Total RTLO *[MWh]*
State 1	1,000	1,000
State 2	1,500	3,000
State 3	0	2,000
Total	2,500	6,000

With these procurement and RTLO quantities established, we now consider how the costs associated with these forward clean energy procurements are distributed to consumers across the three states. We start with the first step, which determines the total costs borne by each state. These values are shown in column [d] of Table 3 (where columns [a] through [c] follow from those in Table 3). Because state 1 procures 1,000 MWh of the clean energy certificates, its consumers bear total costs of $10,000 (1,000 MWh × $10/MWh). Similar logic indicates that consumers in state 2 incur total costs of $15,000 for clean

[8] Whether these charges are administered by the ISO or another entity, the precise manner and frequency by which these charges are assessed, and the process to "true up" any deviations that occur if expected load differs from realized load would need to be determined for a fully developed proposal, but may not be critical for the purpose of modeling the straw framework.

energy certificates. Because state 3 does not procure any clean energy forward, it does not bear any incremental costs.

Table 3: Clean Energy Costs and Charge Rates				
[a]	*[b]*	*[c]*	*[d]*	*[e]*
State	Clean Energy Procured *[MWh]*	Total RTLO *[MWh]*	Total Costs *[$]*	Charge Rate *[$/MWh]*
State 1	1,000	1,000	$10,000	$10
State 2	1,500	3,000	$15,000	$5
State 3	0	2,000	$0	$0
Total	2,500	6,000	$25,000	

For the second step, we calculate the charge rates to RTLO that states 1 and 2 apply to cover their respective forward clean energy costs. These values are given in column [e] of Table 3. When the $10,000 of costs in state 1 are distributed to its RTLO from the delivery period, this results in an additional cost of $10 for each MWh of energy consumed on top of the wholesale electricity price, thereby reflecting that a forward certificate is procured at a cost of $10 for every MWh of energy consumed. For consumers in state 2, the additional cost is instead $5 per MWh. This lower cost reflects the fact that only half of state 2's energy consumption is clean. Thus, the incremental charge associated with forward clean energy in state 2 is equal to half of the cost of a clean energy certificate.

4. Interaction with existing state programs (RECs, etc.)

Stakeholders have discussed several potential approaches on how the clean energy certificates could interact with existing state programs.[9] We discuss the three approaches that appear most sensible to consider for purposes of the pathways modeling efforts, where the first two broadly align with the two options discussed in section V of the stakeholder FCEM document.

Approach 1: Clean energy certificates reflect a clean attribute that does not overlap with other environmental attributes. Under this approach, a wind resource that qualifies under existing state renewable energy programs would receive both a clean energy certificate and a renewable energy certificate for each MWh of production.

Approach 2: Clean energy certificates encompass all environmental attributes. Under this approach, a wind resource that qualifies under existing state renewable energy programs and sells clean energy certificates would not receive renewable energy certificates for its production.

Approach 3: The existing programs are discontinued, and the region uses clean energy certificates to meet its environmental objectives. Under this approach, the wind resource is only awarded a clean energy certificate, as this is the only environmental attribute for which the region provides compensation.

[9] As the straw FCEM framework is developed, we may also consider how it accounts for existing long-term PPA contracts that have already been executed to meet state environmental objectives.

The first and third approaches are simpler in that they do not require consideration of direct interactions between the existing state programs and a new clean energy product. The second approach may raise questions about these interactions that would need to be considered further. These questions relate to how demand for the existing products is affected by the introduction clean energy certificates and whether a resource would ever forgo electing to receive a clean energy certificate to instead receive other environmental attributes.

We welcome stakeholder input on the preferred approach to this design element for the FCEM. Moreover, we believe it is prudent to pursue consistency between this framework and the net carbon pricing framework with respect to the assumption about whether the existing state programs persist. This would require that the modeling of both frameworks either assumes that i) the existing state programs remain or ii) they are eliminated. Such an approach will better allow for an apples-to-apples comparison of these frameworks and is more likely to facilitate productive evaluation of their relative outcomes merits.

5. Integration of the FCEM with the Forward Capacity Market

Stakeholders have expressed interest in exploring the feasibility of determining forward clean energy positions as part of a single joint optimization with the existing Forward Capacity Market (FCM) that simultaneously determines clearing awards and prices for both capacity and forward clean energy. Such a design is referred to as an Integrated Clean Capacity Market (ICCM) and may reduce the uncertainty that occurs under a sequential approach where participants do not know the awards or prices for the second product when determining offers for the first product.

As the ISO explains in its memo titled “Evaluation of an Integrated Forward Clean Energy Market,” our analysis to date suggests that the joint clearing of capacity and clean energy in a single auction is theoretically feasible and thus we plan to model a straw framework where these products are procured jointly. This aligns with option 2 under section IV of the stakeholder FCEM document.

Under the approach outlined in the ISO’s integrated FCEM memo, resources would submit a single price, much like under the current FCM. In addition to submitting a capacity quantity, they would also submit a clean energy parameter that reflects the MWh quantity of forward clean energy they would sell for each unit of capacity sold. The auction would determine capacity and clean energy awards to maximize social surplus and specify separate prices for each product.

While we believe that the ICCM is theoretically feasible and the concept put forth can be modeled as part of the pathways efforts, significant additional work would be necessary to evaluate the challenges that may come with translating this novel concept into a fully developed and economically sound auction framework.

memo

To: NEPOOL Participants Committee Working Session

From: Market Development

Date: March 11, 2021

Subject: Evaluation of an Integrated Forward Clean Energy Market

Introduction

As part of the Future Pathways project, stakeholders have requested feedback on the feasibility of a forward clean energy market (FCEM) that is integrated with the forward capacity market, also known as an integrated clean capacity market (ICCM). This memo describes, at a high level, the ISO's current assessment of a potential conceptual approach for an ICCM construct for purposes of the pathways analysis. The ISO welcomes feedback on the approach and looks forward to continued discussion of a forward clean energy framework that will be modeled in these pathways efforts.

Conceptually, an ICCM would jointly procure both conventional capacity and clean energy on a forward basis to satisfy both sets of demand bids at least cost. Under such an approach, "clean" resources would be able to sell forward both capacity and clean energy, where the states would submit demand bids for clean energy.[1] More specifically, as part of their capacity offers, "clean" resource owners would include an offer parameter indicating how many MWh of forward clean energy they wish to sell for each unit of capacity awarded. As a result, capacity and clean energy awards would be bound together in a single procurement. The next section provides a more in-depth review of the formulation, including a numerical example.

While there are still many outstanding questions, this memo provides a high-level discussion of a possible conceptual approach for an integrated design. As such, stakeholders should not consider the details included in this memo as ISO recommendations or implicit confirmation that the ISO could implement such an approach. Rather, as is typical with the development of novel auction constructs, significant additional work would be necessary to evaluate critical design details, potential pricing rules (given there are multiple products and non-rationable offers), and potential implementation challenges.

[1] The ISO presumes that the forward positions would settle against a "spot" position that is determined by the resource's actual clean energy production during the delivery period. Further discussion of how this may work is included in the FCEM scoping memo.

Design Details

In an ICCM that procures clean energy forward, the FCM would be expanded to include clean energy bids determined by the states. In the following subsections, the memo details the ISO's current thinking on i) how participants might formulate and submit offers under this ICCM construct, ii) how the integrated auction clearing process would assign awards, and iii) how prices would be determined (when the marginal offer for each product is rationable). The memo concludes with a numerical example to illustrate these points.

Offer Structure

With the FCM as currently structured, resources submit offers that reflect the minimum amount of payment needed for the resource to take on a Capacity Supply Obligation (CSO). Such an offer includes, at a minimum, any "missing money" that the resource would need to recover its capital costs as well as any forgone revenues associated with selling capacity forward under pay-for-performance. With this $/unit of capacity offer, resources also have a qualified capacity value that represents the maximum capacity award that they can receive. The capacity offers can be rationable, where the CSO awarded can be less than the resource's qualified capacity, or non-rationable, where the resource's CSO award is all-or-nothing.

The ISO anticipates that a conceptual ICCM framework could build off this structure: participants would still submit a $/unit of capacity offer, their capacity awards would still be capped by their qualified capacity, and the resources would still be able to submit rationable or non-rationable offers. New to the FCM through an ICCM construct, however, is that resources would also submit a clean energy parameter that reflects the MWh quantity of clean energy they would sell on a forward basis per unit of capacity awarded. This clean energy parameter would bind the resource's CSO award with their clean energy award, so that, for each MW of CSO awarded, they are also awarded a forward clean energy position equal to their offered clean energy parameter.

Note that allowing non-rationable offers, as under the current FCM construct, may raise additional questions and challenges with current rules, including numerous questions about the pricing rules and the possibility of make-whole payments in the primary forward capacity auction.

Integrated Auction Clearing

The ICCM would clear resources based on their offers and their contribution to both the capacity and the clean energy bids. The capacity demand bids would be set in a manner consistent with the current FCM rules, but the clean energy demand bids would be set by the states. The auction would then clear bundles of capacity and clean energy to maximize social surplus, where the social surplus considers the benefits of both products. Holding a resource's offer constant, resources that are willing to take on larger forward clean energy positions would have a higher chance of receiving forward positions in the auction because their award would contribute more to meeting the region's clean energy demand.

Numerical Example

Three tables below outline a numerical example. Table 1 below contains key parameters for the example.[2]

[2] Note that, to simplify the incorporation of clean energy awards in these examples, offers and CSO awards are measured in MW-Year rather than the typical kW-Month.

Table 1. Resource Parameters			
Generator	Max Capacity	Clean Energy Parameter	Offer
Non-Clean 1	500 MW-Year	-	$60,000/MW-Year
Non-Clean 2	500 MW-Year	-	$70,000/MW-Year
Clean 1	300 MW-Year	6000 MWh/MW-Year	$150,000/MW-Year
Clean 2	300 MW-Year	7000 MWh/MW-Year	$200,000/MW-Year

In the example, there are two resources that can sell clean energy forward (Clean 1 and Clean 2) and two resources that cannot (Non-Clean 1 and Non-Clean 2). Each resource submits offers that are fully rationable, meaning the auction can award it forward positions that are less than its maximum capacity capability.[3]

Non-Clean 1 and Non-Clean 2 are each qualified to sell 500 MW-Year of capacity and Clean 1 and Clean 2 are each qualified to sell 300 MW-Year of capacity. Non-Clean 1 and Non-Clean 2 submit offers to sell capacity of $60,000/MW-Year and $70,000/MW-Year, respectively. These offers reflect the minimum payment per MW-Year that Non-Clean 1 and Non-Clean 2 must receive to sell capacity. Clean 1 and Clean 2 offer to sell both capacity and clean energy forward. For every MW-Year of capacity that Clean 1 sells, it would also sell a quantity of clean energy forward. More specifically, for each MW-Year of capacity that Clean 1 sells, it would sell 6,000 MWhs of clean energy. Clean 1's offer of $150,000/MW-Year indicates that to sell both one MW-Year of capacity and 6,000 MWhs of clean energy, Clean 1 would need to be paid at least $150,000. Similarly, for every MW-Year of capacity that Clean 2 sells, it would sell 7,000 MWh of clean energy forward. Clean 2's offer of $200,000/MW-Year indicates that Clean 2 would need to be paid at least that price per MW-year of capacity to sell its capacity and clean energy.[4] Note that the offers from Clean 1 and Clean 2 of $150,000 and $200,000 per MW-Year, respectively, represent an offer to sell a bundled product of capacity and clean energy on a forward basis. As such, their offers include both costs associated with capacity and costs associated with taking on a forward clean energy position. See Appendix A for a more detailed examination of how participants might submit offers in an ICCM.

For simplicity, this example assumes vertical demand curves for capacity and clean energy set at 850 MW and 2,500,000 MWh, respectively.[5] Given the offers and clean energy parameters in Table 1 above, Table 2 below contains the awards and clearing prices for this simple ICCM.

[3] This assumption allows prices for each product to be set based on the marginal supply offer. If these offers were instead assumed to be non-rationable, it is less clear how prices for each product would be established.
[4] The difference between the two resources' clean energy parameters could reflect differences in expected production or risk preferences.
[5] This ICCM concept can be applied similarly to instances where sloped demand curves are employed.

Table 2. ICCM Clearing and Awards			
Generator	Offer	Capacity Award	Clean Energy Award
Non-Clean 1	$60,000/MW-Year	450 MW	0 MWh
Non-Clean 2	$70,000/MW-Year	0 MW	0 MWh
Clean 1	$150,000/MW-Year	300 MW	1,800,000 MWh
Clean 2	$200,000/MW-Year	100 MW	700,000 MWh

Non-Clean 1 is the marginal resource for capacity and sets the capacity price at $60,000/MW-Year. This is the price Non-Clean 1 is paid per MW-Year. To see how this price is determined, consider an incremental increase in the installed capacity requirement of one MW-Year without a corresponding increase in the clean energy bids. To meet this additional MW-Year of capacity demanded, Non-Clean 1 would receive an additional one MW-Year of capacity award, at a cost to the system of $60,000/MW-Year. Note that, absent the clean energy requirement, Non-Clean 2 would be marginal for capacity and would set the capacity price at $70,000/MW-Year.

Clean 2 is the marginal resource for the forward clean energy positions and so sets the forward clean energy price at $20/MWh. To see how this price is determined, consider an incremental increase in the forward clean energy demand bids of one MWh. To meet this additional one MWh bid, Clean 2 must be awarded an additional $\frac{1}{7000}$ MW-Year of CSO,[6] costing the system $\frac{1}{7000} * \$200{,}000 = \$28.57$. Because Clean 2 clears for an additional $\frac{1}{7000}$ MW-Years of CSO, however, Non-Clean 1's CSO award can be decreased by $\frac{1}{7000}$ MW-Years, saving the system $\frac{1}{7000} * \$60{,}000 = \$8.57$. The total change in system costs is thus $28.57 - $8.57 = $20, and so the forward clean energy price is $20/MWh.

The total price paid to each resource per unit of capacity awarded is the capacity clearing price ($60,000/MW-Year) plus their clean energy parameter times the forward clean energy price ($20/MWh). That is, resources can be paid different prices per unit of capacity sold if their clean energy parameters differ. Table 3 below details price formation for the three resources that receive capacity awards.

Table 3. Resource Specific Clearing Prices					
			Non-Clean 1	Clean 1	Clean 2
[1]	CSO Clearing Price		$60,000/MW-Year	$60,000/MW-Year	$60,000/MW-Year
[2]	Clean Energy Parameter		0 MWh/MW-Year	6000 MWh/MW-Year	7000 MWh/MW-Year
[3]	Forward Clean Energy Price		$20/MWh	$20/MWh	$20/MWh
[4]	Resource Price Per MW-Year	=[1]+[2]*[3]	$60,000/MW-Year	$180,000/MW-Year	$200,000/MW-Year

Note that Clean 2 is paid more per MW-Year than Clean 1 because Clean 2 sells an additional 1,000 MWh of clean energy forward each awarded MW-Year of capacity.

[6] From Table 1, Clean 2 provides 7000 MWh of clean energy/MW-Year of capacity, so one additional MWh of clean energy from Clean 2 requires 1/7000 MW-Year of additional capacity from Clean 2.

Key Observations

- This formulation effectively yields two prices for the procured products – one for capacity in $/MW-Year and one for forward clean energy in $/MWh. This is necessary to account for the fact that the optimization procures two distinct products, and there are different costs associated with each.

- Some stakeholder presentations have discussed an ICCM with fully non-rationable offers for both capacity and clean energy. The concept proposed in this memo allows for participants to offer the products in a more flexible manner, as their offers can be either non-rationable or rationable. This is consistent with the current capacity market rules. However, allowing participants to submit non-rationable offers for both capacity and clean energy may raise additional challenges that need to be investigated further.

- At present, the ISO has not evaluated the work or implementation challenges that may arise when considering whether this conceptual framework could be sensibly translated into a more fully developed market design. We expect it would likely add significant complexity to the FCM process, and there would require a number of substantial changes to the FCM rules, schedule, and processes to implement such an approach. Further consideration of these challenges is outside the scope of these pathway efforts.

Conclusion

Based on preliminary analysis, the ISO believes that the joint procurement of capacity and clean energy in an integrated forward market is conceptually feasible as illustrated above and thus can be considered in the pathways analysis. However, additional work would be necessary to fully evaluate if this conceptual approach can be sensibly translated into a more concrete market design, and such work is outside the scope of these efforts. The ISO welcomes observations and feedback from stakeholders on this approach.

Appendix A

Table A1 below displays the offer components for “Clean 2”, a resource that features prominently in the numerical example above.

Table A1. Clean 2's Optimal Offer, $/MW of CSO

	Offer Components		Capacity Only	Capacity + Clean Energy
[1]	Expected PFP Settlement		$60,000/MW-Year	$60,000/MW-Year
[2]	Clean Energy Parameter		N/A	7000 MWh/MW-Year
[3]	Expected Spot Clean Energy Price		N/A	$20/MWh
[4]	Clean 2's Offer	=[1] + [2]*[3]	$60,000/MW-Year	$200,000/MW-Year

In the FCM as it currently exists (capacity only), Clean 2’s offer for capacity is simply the expected PFP settlement. (For simplicity, we are assuming that the resource has no missing money.) With an ICCM, however, the resource would also submit a clean energy parameter, given in Row [2]. Because Clean 2 could opt not to sell their clean energy forward and instead sell it in the delivery year, they must be paid at least the expected clean energy price in the delivery year per MWh of clean energy they sell forward. As such, their ICCM offer is the sum of the expected PFP settlement (Row [1]) plus their offered clean energy parameter (Row [2]) times the expected clean energy price in the delivery year (Row [3]). Note that Clean 2’s offer is substantially larger in an ICCM than in a “capacity only” market. This reflects the additional costs of the forward clean energy position Clean 2 would take if they receive an award.

ISO new england

memo

To: NEPOOL Participants Committee Working Session

From: Market Development

Date: March 11, 2021

Subject: Developing a Straw Net Carbon Pricing Framework

At the PC working session in February on Pathways to a Future Grid, the ISO outlined key components associated with a net carbon pricing framework.[1] This document seeks to build upon those materials and provide stakeholders with more design detail about a potential straw net carbon pricing framework to be evaluated as part of the ISO's pathways analysis.

The ISO puts forth an approach for the straw framework that we believe serves as a sensible starting point for the design. This approach uses three criteria for specific design elements it is considering in the straw framework:

i. Choose design options that more closely align with sound market design principles and allow the region to decarbonize in a cost-effective manner;

ii. Put forth a net carbon framework that is conducive to quantitative modeling;

iii. Where possible, choose design options that are consistent with those in the FCEM framework, thus more easily allowing for apples-to-apples comparisons.

Observe that there may be instances where these criteria are not all in harmony. In such cases, the criteria may not offer clear guidance on how to model a design element thus requiring the ISO and stakeholders to consider the tradeoffs between these criteria when choosing a design approach.

If the New England region ultimately were to consider market rule changes to introduce a net carbon pricing mechanism, the pathways analysis may provide some guidance about potential design parameters and their expected outcomes. However, as with FCEM, a process to further flesh out design details, more comprehensively assess implementation questions, and draft market rules would still be needed and would involve additional time and effort. Such work is outside the scope of this phase of the pathways project.

[1] See, for example, slides 20-22 of the ISO's presentation materials, available at https://nepool.com/wp-content/uploads/2021/02/ISO_New_England__Pathways_Kickoff_2-18-2021_final.pdf.

We look forward to stakeholder comments and reactions to the ISO's views regarding these straw net carbon pricing framework elements, and anticipate that this document will be updated during the pathways process to reflect stakeholder feedback and further ISO analysis.

1. Overview of straw net carbon pricing framework

Table 1 below summarizes the key design elements that we envision for the straw net carbon pricing framework. Column [a] highlights the design question and column [b] then offers the ISO's current thinking. Finally, column [c] specifies the section in this document where the topic is discussed further.

Table 1: Summary of Potential Straw Framework Elements

	[a] Design Question	*[b]* Approach in Straw Framework	*[c]* Section
A. Product definition			
[1]	What is the product in this framework?	Suppliers pay for each unit of carbon they emit to generate electricity	2
B. Settlement			
[2]	What is the settlement structure for sellers?	Pay carbon price for each unit of carbon emissions from electricity generation	3
[3]	How are revenues from carbon price distributed?	Allocated to RTLO across all states	3
C. Interaction with existing programs			
[4]	How does a carbon price interact with existing state programs such as RECs	To be determined with stakeholder input. There are two possible paths: (i) a carbon price does not interact with these programs, which are assumed to continue; (ii) the carbon price framework replaces the existing state programs.	4

Compared to the straw FCEM design, this summary includes fewer open design elements because net carbon pricing is a less novel concept that has been employed in numerous settings. For example, a net carbon price is more well-defined and widely understood, and it does not require the development of a forward procurement of the relevant product or the determination of a non-compliance penalty rate.

However, there remain outstanding design elements to consider. Most notably, as with the FCEM framework, we must determine whether the existing state programs would continue with the introduction of a net carbon price framework, or if this new market would replace the existing state programs. This design question is outlined in row [4] of Table 1.

2. Product definition

Under a net carbon price,[2] the product is defined as carbon emissions arising from electricity production. While the current discussions around FCEM have not yet landed on a crisp product definition around clean energy certificates that could be procured, this product definition is simple and transparent. Carbon emissions can be measured, and carbon markets have been used in New England and elsewhere. For example, the Regional Greenhouse Gas Initiative (RGGI) represents a carbon emissions market that

[2] The term "net" reflects the fact that revenues collected from generators are rebated to load. This is discussed further in section 3.

includes the six New England states as well as New York and several states in the Mid-Atlantic. To limit the scope of work for these modeling efforts and to allow for more sensible comparisons between market design frameworks, we propose to limit the carbon market to the electricity sector.[3]

One design question with any carbon pricing market is which value to fix. That is, should the carbon price be fixed, which ensures a constant price per unit of carbon emissions and allows the total quantity of emissions to float? Or should carbon emissions be fixed (i.e., “capped” as in a cap-and-trade system), which instead sets a maximum carbon emissions quantity and allows the price associated with carbon emissions to float? While these two approaches may have different practical implications, for purposes of modeling a conceptual framework for the pathways efforts, we do not believe it is critical to specify one approach over the other, as quantitative analysis of net carbon pricing can provide information on both approaches.

There are a number of product definition details and questions that would require further consideration if the region were to develop net carbon pricing market design and may there necessitate additional discussion during the pathways discussions. These include questions relating to the treatment of carbon emissons from resources outside of New England that import energy into the region, carbon emissions from resources in New Elgnad that export energy out of the region, and carbon emissions from resources that are behind-the-meter. We look forward to working with stakeholders to develop sensible approaches to these questions for purposes of the pathways modeling efforts.

3. Settlement and cost allocation

a. Settlement for energy suppliers

With a net carbon price, energy suppliers are charged a cost based on carbon emissions from producing electricity. Thus, a participant’s total cost associated with the carbon price is equal to the product of the carbon price and the total carbon emissions and we expect suppliers to reflect this new cost in their energy offer price.[4]

This will have two primary effects that will be considered in the modeling efforts. First, it will tend to reorder the energy market supply stack so that non-emitting and lower emitting resources are more likely to sell energy. Second, it will increase the net revenues for non-emitting and lower emitting resources, as these resources incur lower costs associated with carbon emissions than the marginal resource that sells energy. This will reduce the missing money for such resources, and may therefore make them more likely to enter or remain in the New England market relative to current market rules. Both of these effects will reduce the region’s carbon emissions by displacing electric generation from higher emitting resources with that from lower emitting resources.

b. Revenue allocation

[3] In theory, this carbon market could be expanded to other sectors of the economy, but such a framework is outside the scope of the pathways work.
[4] This would be similar to how, under current market rules, carbon-emitting generators would include any carbon costs associated with RGGI in their energy market offer price.

Unlike an FCEM framework where the payments made to clean resources result in charges to load, a net carbon pricing framework collects revenues from carbon emitting generators which are then rebated to load.

While there are several ways to distribute any revenues collected from carbon-emitting suppliers, we propose for stakeholder consideration allocating these revenues on a pro-rata basis to all Real-Time Load Obligation (RTLO) in New England.[5] Under such an approach, the rebate to each MWh of RTLO during the delivery period would be constant across states, and would be equal to the product of net carbon price and the average carbon emissions per MWh of energy produced for the relevant delivery period. This approach is illustrated using a simple example.

Imagine that the carbon price is $50 per ton of carbon emissions and that there are three resources that provide energy during the delivery period. Resource A is renewable and generates 175 MWh of energy. Because it does not emit carbon, it does not incur a carbon charge. Resource B is an efficient combined cycle resource that produces 250 MWh of energy and emits 0.5 tons of carbon per MWh. Finally, resource C is a less efficient peaking resource that produces 75 MWh of energy, with 1 ton of carbon emissions for each MWh produced.

Table 2: What Technologies Are Awarded Clean Energy Certificates?

	Rate of Carbon Emissions *Tons/MWh*	Energy Generated *[MWh]*	Total Carbon Emissions *Tons*	Carbon Charges *$*
Resource A	0	175 MWh	0	$0
Resource B	0.5	250 MWh	125	$6,250
Resource C	1	75 MWh	75	$3,750
Total		500 MWh	200	$10,000

In this example, the three resources emit a total of 200 tons of carbon during the delivery period for which they are charged $10,000 (200 tons × $50/ton). This revenue would then be distributed back to the 500 MWh of load from this delivery period on a pro-rata basis. Thus, the rebate to load during this period would be equal to $20 per MWh ($10,000 / 500 MWh).

4. Interaction with existing state programs (RECs, etc.)

Much like with the FCEM, there are two broad approaches for the interaction between a net carbon pricing framework and the existing state environmental programs.[6]

[5] Whether these charges are administered by the ISO or another entity, the precise manner and frequency by which the rebates are distributed, and the process to "true up" any deviations that occur if expected load differs from realized load would need to be determined for a fully developed proposal, but may not be critical for the purpose of modeling the straw framework.

[6] As the straw net carbon price framework is developed, we may also consider how it accounts for existing long-term PPA contracts that have already been executed to meet state environmental objectives. Furthermore, the straw framework could consider how the net carbon price interacts with RGGI, though it is not clear if this determination is important for the purpose of the modeling work.

Approach 1: The carbon price does not interact with the existing state programs. Under this approach, the existing state renewable energy programs would persist and resources that can provide renewable energy would continue to be compensated for these environmental attributes. Thus renewable resources may receive increased energy market revenues via the net carbon price, and they would also continue to receive additional revenues for their environmental attributes associated with these state polices.

Approach 2: The net carbon price replaces the state programs. Under Approach 2, the net carbon pricing framework would replace the existing state environmental programs. As such, resources would no longer be directly compensation for providing renewable energy via renewable energy certificates. Rather, non-emitting resources (and lower emitting resources) would be compensated via larger energy market revenues than they receive under current market rules, where no such carbon price is in place.

We seek stakeholder input on the preferred approach to this design element for net carbon pricing. Moreover, we believe it is prudent to pursue consistency between this framework and the FCEM framework. This would require that the modeling of both frameworks either assumes that i) the existing state programs remain or ii) they are eliminated. Such an approach will better allow for an apples-to-apples comparison of these frameworks and is more likely to facilitate productive evaluation of their relative outcomes and merits.

NESCOE
New England States Committee on Electricity

To: ISO-NE and NEPOOL Stakeholders
From: NESCOE
Date: March 5, 2021
Subject: Pathways Analysis Initial Thoughts

NESCOE appreciates stakeholders' time and effort to develop the Forward Clean Energy Market ("FCEM") design specification white paper in late December 2020 ("Whitepaper").[1] It has been helpful to inform our own thinking around an FCEM. We also appreciate ISO-NE's evaluation of the FCEM and Net Carbon Pricing frameworks ("Pathways Analysis"), and ISO-NE's plan to analyze those in the same timeframe.[2]

In this memo, we provide initial thoughts on the Pathway Analysis goals, offer some initial questions on the Pathway Analysis, and give preliminary answers to ISO-NE's February 18, 2021 questions. The suggestions related to the analysis reflect NESCOE's interest in understanding how the market outcomes for both potential market designs compare to current market rules and to achieving state policies using long-term Power Purchase Agreements ("PPAs"). As you know, we are still evaluating an FCEM model and NESCOE's responses to questions or analysis suggestions should be viewed in that context. They do not indicate and should not be interpreted to signal design preferences, or the point of view or position of NESCOE or any NESCOE Manager.

As a threshold matter, we appreciate that the Whitepaper sets out principles against which to assess an FCEM design and generally view those principles as helpful guideposts. We will continue to turn back to those, as well as the NESCOE Vision Statement wholesale market principles as this process moves forward.[3]

Pathways Analysis Goals

The main goal of the Pathways Analysis should be to represent real world dynamics of the interactions between wholesale electricity markets and state energy and environmental requirements.

At minimum, one goal of the Pathways modeling should be, of course, to represent the actual operation of the wholesale markets. In New England's electricity markets, the Forward Capacity Auction ("FCA") outcomes determine the resource mix in the energy market approximately three

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

2 *See* February 18, 2021 NEPOOL Participants Committee Working Session, *Pathways To The Future Grid*, at slide 4.

3 Whitepaper, at page 1.

years later, for a 12-month period (the Capacity Commitment Period, or "CCP").[4] Over time, the relationship between the energy market and FCA influences the resource mix. One year's FCA outcomes become the corresponding CCP's resource portfolio.[5] Moreover, changes to system topology and load forecast updates are implemented on an annual cycle tied to the FCA calendar. How the Pathways modeling will include these relationships over the study horizon may have a significant impact on the model results and any associated lessons for states and stakeholders.

Often, exercises in electricity market modeling include a limited simulation of future time periods. For example, many studies, for practical reasons, only simulate one year or a selection of years within a study horizon (e.g., 2030 in a study horizon of 2021 to 2050). This requires assumptions about the resource mix in a future year. The connection between the assumed future scenario and the actual electricity markets and the current resource mix is based on a plausible narrative. This approach is not necessarily instructive to evaluating wholesale market design concepts where the point is to facilitate a transition, or change in the resource mix, over a long period of time. For this reason, we should not assume a future resource mix but rather ensure the analysis shows whether and to what extent each mechanism is capable of driving change in the future resource mix. For example, one question the analysis has to answer is whether the net carbon pricing mechanism will ensure financing of new clean energy resources?

Compliance with energy and environmental requirements of state laws should also be a foundational objective of the Pathways Analysis. This includes state programs that affect the net load forecast, require the procurement of attributes from eligible resources, authorize agreements to purchase power and/or attributes from certain resources, and may result in updates to system topology over time. It also includes regional and state carbon emission limits on the power sector and the broader economy. One strategy for economy-wide carbon emissions reduction includes electrifying significant portions of the transportation and buildings sectors and anticipates a commensurate increase in the demand for power served by a low-emitting resource mix. Integrating the impacts of these requirements and programs into the Pathways analysis will lead to a better representation of real-world electricity market dynamics and their evolution over time. More importantly, the Pathways analysis must examine the interactions between energy and environmental requirements and programs, the wholesale electricity markets, and any contemplated market designs to achieve compliance with such requirements. In other words, if the mechanism produces such high electric energy rates that it would slow the pace of electrification of the transportation sector, then that demand should be calibrated accordingly. And, vice-versa, if the electric energy pricing is low and therefore incentivizes electrification of the building sector, then that demand increase should be recognized and incorporated in the analysis.

Accordingly, the Pathways analysis should include (i) a detailed analysis of how each market mechanism effects changes to the resource mix year after year over time and (ii) a focus on the

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4 The FCA outcomes include resource new resource location, capacity, and technology type; retiring resource location and timing; and capacity contributions from neighboring control areas.

5 For example, FCA 16 held in 2022 determines the energy market resource portfolio in CCP 2025-2026, FCA 17 held in 2023 determines the portfolio in 2026-2027, and so on.

interactions between markets, legal requirements and associated programs, and contemplated market design concepts.

Initial Questions

NESCOE offers the following general questions related to the overall analysis:

1. How will the analysis determine if the either of the mechanisms will facilitate the financing of new renewable resources and associated infrastructure upgrades?
2. How will it measure how much carbon emission reduction and the consumer cost per ton avoided that are likely under each approach?
3. Is the analysis limited to the power sector? Are the impacts of electricity prices on electric vehicle adoption considered in the scope of the analysis?
4. Is the analysis limited to New England? How will the analysis consider the regional trade impacts of net carbon pricing and any associated border adjustments? Will the analysis measure leakage?
5. What is included in Consumer Costs and how will they be measured? Will Consumer Costs include costs recovered through distribution rates?
6. What and how ancillary services will be modeled? Will this include additional reserve products?
7. Will the analysis assume perfect foresight, or will random volatility be introduced into the analysis of energy market outcomes?
8. Will power sector carbon emissions be explicitly limited with a model constraint, or will they just be monitored and reported?
9. Should a hybrid model be included that uses net carbon pricing set at a level to ensure revenue adequacy for existing[6] clean energy resources with an FCEM mechanism designed to ensure financing and market participation of new clean energy resources.
10. Per prior communications from NESCOE and other stakeholders, could ISO-NE please respond to requests that it evaluate the technical ability of implementing the Integrated Clean Capacity Market("ICCM").[7]

Preliminary Feedback on ISO-NE's February 18, 2021 Questions

In its February 18, 2021 slide deck, ISO-NE posed some questions to inform the analysis. We provide some initial feedback on those questions in red below. Again, we offer the feedback to inform the analysis and this initial feedback does not indicate or reflect support for any particular design or design specification.

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[6] Existing being defined as any resource with low- or zero-carbon emissions in commercial operation as of 12/31/2020.

[7] See, for example, http://nescoe.com/wp-content/uploads/2020/11/ISOBoD_MarketAnalysis_2Nov2020.pdf

Questions, Slide 6: "Welcome stakeholder feedback on model assumptions shared across policies"

What study year (or years) should be evaluated?

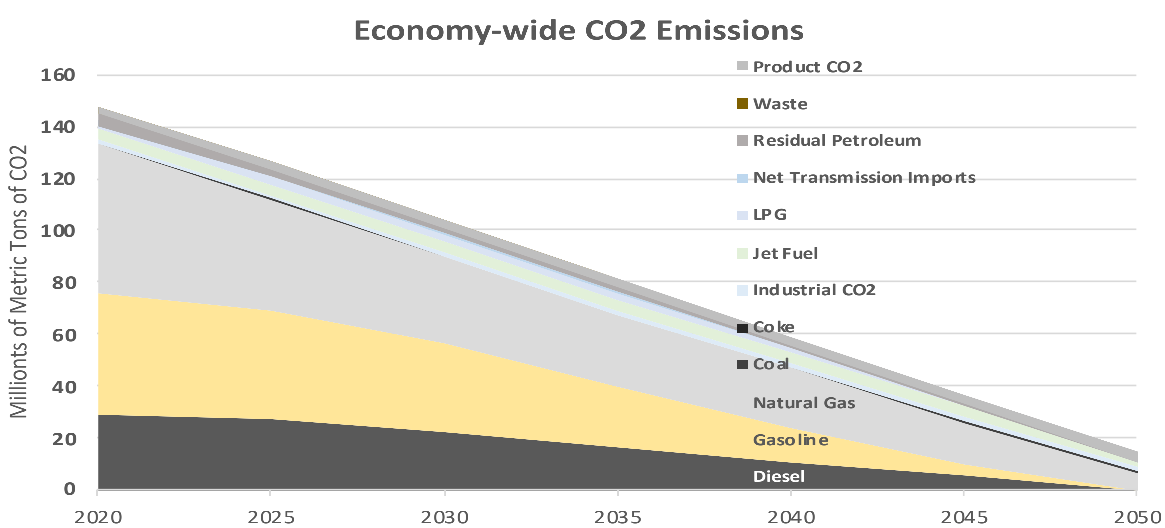
The study should be a period of years from 2026 – 2040. As noted above, the Pathways Analysis should take into account how the mechanisms may affect future electricity demand and impacts on associated regulatory requirements.

–Frameworks are being evaluated as pathways to the future grid, but they should also sustain this future resource mix

Yes, they should also be evaluated as (i) being able to sustain this resource mix and (ii) capable of financing new resources that are consistent with energy and environmental legal requirements.

•What are the regional and state carbon emissions targets for the study year(s)?

The Future Grid Reliability Study assumptions are a reasonable basis for the Pathways analysis.

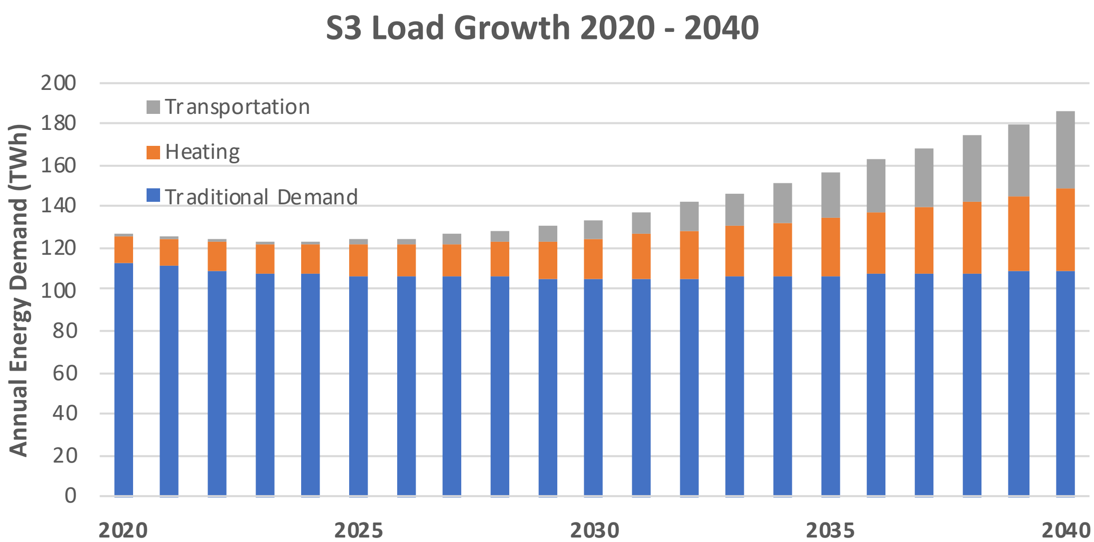


–How does this interact with each of the policies modeled?

We need clarification about what this question seeks.

•What are the assumed load levels and shapes?

The Future Grid Reliability Study assumptions are a reasonable basis for the Pathways Analysis.



•What are the assumptions regarding the MOPR?

The studies should assume that the FCEM revenues count as "in-market." If it would not create material incremental work, understanding the opposite could be useful as well.

Forward clean energy market: product definition – Slide 15

• What resources can sell "clean energy?"

Clean energy attribute credits (CEACs) shall be denominated and purchased in megawatt hours of electricity that have been produced by an eligible clean energy resource that is defined as: (1) Any electrical energy production from a resource delivering electrical energy into the New England power system from a unit that has very low carbon emissions (net lifecycle GHG emissions, over a 20-year life cycle, that yields at least a 75% reduction of greenhouse gas emissions per unit of useful energy relative to the lifecycle greenhouse gas emissions from the aggregate use of the operation of a new combined cycle natural gas electric generating facility using the most efficient commercially available technology as of January 1, 2021)[8] or (2) energy that is discharged from a storage facility[9] or (3) eligible for certain Class I or similar renewable and clean energy standards in any New England state.[10]

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[8] This portion of the eligibility definition, intended to be non-discriminatory in nature, is based on the Massachusetts Clean Energy Standard, with a somewhat more stringent threshold of emissions that is 75% lower than a new combined cycle gas turbine, rather than 50% lower. This provision should be interpreted to mean resources that have very low emissions. Life cycle greenhouse gas emissions, rather than just smokestack emissions, are appropriate for this comparision.

[9] To the extent practicable, storage resources should be considered elgible for FCEM.

[10] Rounding out the broad eligibility definition are resources that are currently eligible for the new, growth tier / class of state renewable portfolio and clean energy standards.

– Does it include imports?
No

– Does this definition apply to resources that do not produce electrical energy, but can store it (e.g., pumped pumped-storage hydro, batteries batteries)?
Yes

– Would credits be "dynamic" (e.g., varying with marginal GHG emission rate)? If yes, how would this work?
At least not initially, but if not too much work it could be phased in later.

• Is there a cap on the quantity of "clean energy" a resource can sell forward?
No

– If yes, how would this cap be determined?
N/A

– Is there a qualification process?
Yes, similar to the FCM.

• Is there a single "clean energy" product, or are there potentially multiple products (and if so, what are they they)?
Single product (see above).

Forward clean energy market: settlement – Slide 16

•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?
While this will be an important design criterion, it seems immaterial for this analysis. Generally, we believe there should be a penalty for non-delivery and no other benefit for over delivery of clean energy. We are also interested in hearing other stakeholder preferences on this question.

–Are there opportunities to buy/sell credits during the commitment period so that a resource can align its forward and spot positions?
We understand the proponents envision "reconfiguration auctions" as part of the overall design. We would benefit from hearing a discussion to understand other all stakeholder preferences and reasoning, as well as the materiality of this issue on the results of the analysis.

–Can a resource without an FCEM obligation buy/sell credits?
We do not envision this occurring; however, we would like to better understand other stakeholder preferences and the materiality of this issue on the results of the analysis.

•Are there any exemptions that would allow resources to avoid covering their forward position during the commitment period?
No, we believe this should be similar to the current FCM rules.

•Can credits be banked across commitment periods?
Currently many state programs with compliance requirements use some form of banking and borrowing to smooth out lumpiness and increase liquidity. Understanding the value of this type of feature in the analysis could be beneficial.

Forward clean energy market: interaction with existing state REC/RPS programs - Slide 18

• 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?
The analysis should assume a resource receives 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
We agree. We continue to analyze and attempt to better understand the implications of these design elements.

Forward clean energy market: pricing and cost allocation – Slide 19
•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?
Supply offers should be considered non-rationable. Demand bids are rationable.
We would like to better understand other stakeholder preferences on price determination caused by non-rationable offers and the materiality of this issue on the results of the analysis.

Forward clean energy market: integrated clearing with FCM – Slide 19
• 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 non-rationable? If yes, how would prices be determined? Are side payments required?

Similar to above, we would like to better understand other stakeholder preferences, especially views from stakeholders supporting the ICCM design.

• Outstanding question: Is such a joint optimization feasible?

– Requires further assessment of product space and the auction's bid and offer parameters

This is an important question that ISO-NE and other market design experts should address concurrently with this analysis.

To: Chris Geissler, ISO New England, and Dave Cavanaugh, Chair, NEPOOL Participants Committee

From: Advanced Energy Economy, Borrego Solar, Enel X North America, E4TheFuture

Subject: Feedback on Pathways to the Future Grid Analysis

Date: March 3, 2020

Advanced Energy Economy, Borrego Solar, Enel X North America, and E4TheFuture appreciate the opportunity to provide feedback into Phase II of the Pathways to the Future Grid effort as ISO-NE and NEPOOL define a scope for analysis. Our organizations are very support of the Pathways to the Future Grid effort initiated in response to the New England States' memo to ISO-NE in July 2019[1] and subsequent position established as part of the New England States' Energy Vision initiative launched in October 2020[2]. Our feedback is intended to ensure that the analysis provides stakeholders with information needed to assess the pros and cons of the various pathways under consideration, as well as some of the design decisions within the pathways. Specifically, to ensure a thorough exploration of all pathways that have garnered significant interest among stakeholders and the New England states, we ask that the analysis include a full exploration of the Integrated Clean Capacity Market (ICCM).

As explained in prior comments, we view ICCM as a potentially promising solution to meet the clean energy and resource reliability objectives of the New England states while evolving the regional resource adequacy construct to reflect the shifting reliability needs of a cleaner grid.[3] In particular, we believe that analyzing ICCM is important to help states and stakeholders understand:

- **The benefits of co-optimization of forward purchases of clean energy and capacity.** By co-optimizing clean energy and capacity, the ICCM reduces uncertainty and risk to suppliers of clearing in only one auction. This will reduce the risk premium these suppliers factor into their bids, and should result in lower costs and more efficient auction outcomes. These anticipated consumer cost-saving impacts should be considered and quantified.
- **The impact of the proposed forward capacity market reforms included in the ICCM proposal.** The ICCM proposal put forward by Dr. Kathleen Spees on Oct. 1, 2020 outlined a series of recommended reforms to the resource adequacy side of the co-optimized market (see slide 5 from Dr. Spees's presentation, reproduced

[1] http://nescoe.com/resource-center/2020-workplan-jul2019/
[2] http://nescoe.com/resource-center/vision-stmt-oct2020/
[3] https://nepool.com/wp-content/uploads/2021/01/FGP_FRC_-Advanced-energy-stakeholders.pdf

below for reference). In our view, these reforms are central to ensuring that the ICCM results in a resource mix that is not only sufficiently clean to meet the demand of the New England states and other voluntary buyers, but sufficiently reliable to meet the resource adequacy needs of the region as the resource mix shifts. These elements include consideration of a flexible capacity product, separate summer and winter capacity products, and reliance on resource-neutral Effective Load Carrying Capability (ELCC) based accounting, which we interpret to mean that ELCC would apply to all resource types. It is our understanding that these changes were intended to be a non-exclusive list, and we therefore encourage consideration of other resource adequacy reforms that may be beneficial. We believe consideration of these elements will also better align the Pathways analysis with ISO-NE's stated intent to reform the Minimum Offer Price Rule (MOPR) by addressing any concerns that resource adequacy needs may be undermined in the absence of MOPR.

In addition to these items that are specific to ICCM, we urge ISO-NE to study the effects of including dynamic Clean Energy Credits (CEACs) under either the FCEM or the ICCM. A dynamic credit is intended to improve the efficiency of the FCEM/ICCM as a tool to decarbonize the grid, similar to the way that carbon pricing would introduce a preference for cleaner resources in energy market dispatch. The dynamic CEAC would be available to all clean resources and is anticipated to particularly affect participation by clean, flexible balancing resources such as energy storage, electric vehicles, and distributed energy resources. A robust understanding of the financial and operational impacts on these clean, flexible balancing resources under any of the potential pathways is critical for market reform considerations moving forward. These resources are anticipated to play an essential role in the region's reliability needs as the grid decarbonizes and it is unclear if carbon pricing alone would be sufficient to incent their participation at the necessary scale.

Evaluating all of these impacts together would help stakeholders and states as they consider the design of the FCEM/ICCM, and as they weigh these options against a net carbon pricing proposal. Taken holistically, we believe ICCM, if well designed and inclusive of the proposed forward capacity market reforms, offers a viable approach to achieve the New England States' Energy Vision by providing a regional procurement mechanism for the development of new and retention of existing clean energy resources necessary to achieve the various decarbonization mandates while maintaining resource adequacy at the lowest cost. We are looking to the Pathways Analysis to help us and other stakeholders better understand the implications of the various options on the table, and believe a full exploration of ICCM is necessary to achieve that goal.

We appreciate ISO-NE's and NEPOOL's consideration of our input, and look forward to participating in Phase II of the Pathways process.

Contact:

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Dr. Kathleen Spees, October 1, 2020 NEPOOL Presentation, Slide 5:

NEPOOL PARTICIPANTS COMMITTEE
OCT 1, 2020 MEETING, AGENDA ITEM #13

Key design elements

Design Element	Resource Adequacy Objectives	Clean Electricity Objectives
Responsible Entity for Defining the Need	• **ISO New England**	• **State policymakers** • **Voluntary buyers** (retailers, companies)
Product Definition	• Unforced capacity (UCAP MW) • Keep locational specificity (as today) • *Consider also specifying*: separate summer and winter products & "flexible" capacity needs	• Clean energy attribute credit (CEAC) • States would make an effort to align definitions into a uniform product to the extent possible (though multiple products would be accommodated as needed) • *Consider*: "dynamic" CEAC product
Supply Eligibility	• All clean and fossil resources are eligible • ELCC-based accounting for resource-neutral capacity values (by location, season, and flexibility)	• All clean resources are eligible for a "base" product • All revenues are considered "in market" • States can specify technology (but aim to limit the number and size to maximize competition)
Quantity to Procure	• Quantity needed to support 1-in-10 • Based on advanced reliability modeling that considers resource characteristics & flexibility needs in the clean grid	• States and customers decide the quantity needed • Pre-existing contracts are fully accounted for in this market as self-supply
Willingness to Pay	• Sloping demand curves for each capacity product • Hierarchy of needs reflected in price formation (e.g. import-constrained and "flexible" capacity prices are equal or greater than system/traditional capacity prices)	• States submit sloping demand curves for state-mandated CEAC demand • Voluntary buyers can submit price-quantity pairs to exceed state mandates

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Source: Dr. Kathleen Spees, "The Integrated Clean Capacity Market A Design Option for New England's Grid Transition" (presented to NEPOOL Oct. 1, 2020), available at https://nepool.com/uploads/FGP_NPC_20201001_Spees_Integrated_Clean_Capacity_Market.pdf, at 5.