NESCOE
New England States Committee on Electricity

**To:** **ISO-NE/ NEPOOL**
**From:** **NESCOE Staff (contact: Jeff Bentz)**
**Date:** **June 22, 2021**
**Subject:** **Pathways Hybrid Model Scope Document**

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The June 11, 2021 NEPOOL Participants Committee meeting included discussion of the Pathways Hybrid model scope. This memo follows on that discussion and is intended to help further refine the approach and assumptions associated with the Hybrid model. Specifically, this memo is responsive to ISO-NE's suggestion that others' work on a Hybrid model scope would assist ISO-NE in producing all modeling results close in time, rather than having a multi-month lag for results of different approaches. This memo proposes developing the Hybrid model using the forward clean energy market (FCEM)/integrated clean capacity market (ICCM)-only model with the addition of the net carbon price settlement logic and calculated inputs for both the carbon price level and the incremental annual FCEM/ICCM requirement.

Please consider this as a first draft effort. We remain open to suggestions and improvements. Additionally, consistent with what NESCOE has stated throughout this study process, the information provided here does not indicate and should not be interpreted to signal a preference for a hybrid approach, a change in prior statements about net carbon pricing, partiality toward any particular model or approach, or the position of NESCOE or any NESCOE Manager. The sole purpose is to obtain information that will assist states' continuing consideration of a range of options.

**Hybrid Model Overview**

The Hybrid model uses a combination of net carbon pricing (NCP) and the FCEM/ICCM to provide the compensation required to achieve the goal of 80% carbon reduction. Development of the Hybrid model should generally follow the same modeling approach as used in these two other approaches. There are a couple of differences, however, that must be considered.

The Hybrid model constrains the eligible resources that can clear in the FCEM/ICCM, limiting participation to new clean energy resources that do not have a capacity supply obligation (CSO) as-of a certain date.[1] Imports are only eligible if they are associated with the new transmission line from an external area, and imports on existing lines for this exercise are considered existing.

[1] Resources that have cleared only a small portion of their eligible capacity (<30% of its available FCM qualified capacity) prior to the established cut-off date will be treated as having no CSO for purposes of this modeling and be fully eligible for the FCEM/ICCM. This includes resources that have contracts in place.

Further, the Hybrid model carbon price is not intended on its own to provide revenue adequacy to meet the regional target, but rather to ensure that the average annual energy price (including the carbon adder) is at a level to ensure revenue adequacy for the largest existing clean energy resource. As we noted in our April 29, 2021 scenario request, we believe this to be the Millstone facility. This approach is based upon the assumption that "[f]or the purposes of the pathways study, [Analysis Group] propose[s] to assume that both Seabrook (1,309 MW) and Millstone (2,163 MW) remain in operation for all three central cases."[2]

Under the NCP-only approach, the model solves for the carbon price and under the FCEM/ICCM-only approach, the model is solving for the clean energy certificate (CEC) price. The Hybrid model in concept would need to solve for both the CEC price and the targeted carbon price discussed above, which may prove to be difficult. While we are open to feedback from ISO-NE and the Analysis Group on how this could be achieved within the modeling tools being used, we are recommending what we believe is a potentially simpler approach.

The Hybrid model would be based upon the FCEM/ICCM-only model and would include an incremental carbon price as an input into the model similar to how the Regional Greenhouse Gas Initiative (RGGI) is being treated in the FCEM/ICCM model. This allows the Hybrid model to only solve for the CEC price. The model would also require the net carbon settlement logic to be included to rebate to load any funds collected through the carbon tax.

We are requesting three scenarios be run for the Hybrid model. The central case for the Hybrid model would set the carbon price level as discussed below. The other two scenarios suggested for the Hybrid model are 1) to decrease the carbon price by 25% and 2) increase the carbon price by 25%, but not higher than the carbon price in the NCP model central case. We believe this would provide useful information on the relationship between FCEM and carbon prices and demonstrate the impacts to locational marginal prices, total consumer costs, total carbon, and other outputs.

**Changes in Assumptions**

Generally, the expectation is that the same assumptions would be used in the Hybrid model as used in the NCP and FCEM/ICCM model runs; however, there are two potential areas where the Hybrid model assumptions are different; Carbon Price Level and FCEM/ICCM Requirement.

***Carbon Price Level***

While our preferred approach would be to allow the model to solve for both the carbon and CEC price, it is possible that this may be complicated or not easily feasible.

As an alternative to solving for the carbon price, the carbon price could be established as an input to the model. To avoid debate on what level of support may be required, we are proposing to use

[2] Analysis Group, Pathways Study: Evaluation of Pathways to a Future Grid, June 11, 2021, p.14.

the existing contract in place with the Millstone facility.[3] Based upon the contract terms, we estimated that the average LMP that would need to be achieved with the carbon price adder over the study period is $41/MWh. This was calculated based upon the average of the annual (simple average) day-ahead Hub LMP for 2016-2020 ($32.36/MWh)[4] and the Milestone contract rate ($49.99/MWh) with each carrying a 50% weight reflecting the contract terms.

To determine the carbon price inputs, we are proposing to run the model with different carbon price inputs and determine if the results are in line with an average annual LMP of $41/MWh. The carbon price inputs would be adjusted as necessary to ensure that this is achieved on average over time (some years it may be below while others above).

The carbon price inputs should be stable, with the price potentially increasing at discreet points (e.g., every 5-10 years) in the simulation to achieve the $41/MWh on average value over the study period. The carbon price will not be tuned up and down from year to year to precisely achieve this outcome as this is not a reasonable reflection what would occur outside of the simulation. In the "real world" the carbon price would be set based upon an expectation which could result in prices being higher or lower in any given year based upon the resource mix and system conditions and would only be changed periodically if the value was observed to be persistently too low or too high relative to its objective.

***FCEM/ICCM Requirement***

Since the Hybrid model limits eligibility to just new clean energy resources (as noted above), the FCEM/ICCM is only acquiring the incremental quantity of clean energy and not the full amount required to meet the target carbon reduction in a period. This is different than the FCEM/ICCM-only model which would procure the total amount of carbon reduction expected for a period.

We are proposing to set an incremental, rather than total, requirement for the FCEM/ICCM based upon the total targeted carbon reduction for the year minus the expected amount of clean energy that is provided from resources not eligible for the FCEM/ICCM. Ideally, the model could just solve for this value and use it in the FCEM/ICCM clearing, but similar to the carbon price level, it may be necessary to estimate what a reasonable incremental requirement would be from year to year to achieve the carbon reduction target in 2040. The incremental requirement will be apportioned to each state based upon its identified share of the total requirement used in the FCEM/ICCM-only simulation.[5]

This requirement would be expected to increase each year during the simulation period based upon a combination of existing clean resource retirements and the increase in the total carbon reduction target.

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[3] Zero Carbon Emissions Generation Unit Power Purchase Agreement between the Connecticut Light and Power Company d/b/a Eversource Energy [Buyer] and Dominion Energy Nuclear Connecticut, Inc. [Seller] as of March 15, 2019.

[4] ISO-NE Internal Market Monitor, 2020 Annual Markets Report, Table 1-1: High-level Market Statistics, June 6, 2021.

[5] Another alternative is to map which existing clean energy resources are meeting what portion of the states' total requirement for clean energy and then adjust the demand for each state by this value; however, mapping all existing clean energy resources to each state's clean requirements may be challenging.