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New England Future Grid Pathways Study

Summary of process and results

Chris Geissler

Manager, Economic Analysis

How we got here: Future Grid background

- In 2019, the New England states and stakeholders requested that the ISO help evaluate how market approaches could facilitate a more decarbonized electricity sector[1]
- The ISO worked with the Analysis Group, an economic consulting firm with expertise in electricity markets, to conduct and share analysis that is responsive to this request
- This analysis is summarized in a report prepared for the states and stakeholders that was published in April

[1] New England States' Vision Statement (Oct. 2020) https://nescoe.com/resource-center/vision-stmt-oct2020/

Study evaluates four pathways to decarbonization

- **Status Quo** (SQ): New England states continue to sign long-term power purchase agreements with renewable energy developers
- **Forward Clean Energy Market** (FCEM): Centralized clean energy market with forward procurement that awards certificates for clean energy production
- **Net Carbon Pricing** (NCP): Generators pay for each unit of carbon emitted
- **Hybrid Approach**: Includes both an FCEM for new resources and an NCP for all resources

Status Quo: Continuation of current state policies

- New England states continue to sign long-term power purchase agreements with renewable developers
- Selection of these resources may depend on various factors including costs, technology type, location, etc.
- Model assumes states will pursue a technology mix that aligns with their publicly stated ‘roadmaps’ to decarbonization

FCEM: Introducing clean energy certificates

- Clean energy certificates (CEC) are awarded to resources for each MWh of ‘clean’ energy produced
- States buy CECs in a forward auction to meet environmental objectives and clean energy owners sell CECs to earn revenues for their (expected) clean energy production
  - Spot market allows for resources to cover their forward positions
- Clean energy resources would lower offer price to obtain CECs
- Novel concept, though many design details have not been fully evaluated (interaction with existing REC programs, etc.)

Net Carbon Pricing: Directly pricing carbon emissions

- Carbon emitting resources increase offer price to account for cost of carbon emissions
- Leads to higher energy market prices, where some of these costs are returned to load, and the remainder goes to clean and low-emitting resources
- Not a novel design – carbon pricing has been studied and implemented in many regions
  - The Regional Greenhouse Gas Initiative (RGGI) is a form of carbon pricing and includes the six New England states and several PJM states

Hybrid Approach: FCEM for some, NCP for all

- There are many ways to combine elements of an FCEM and carbon price, though this version was requested by the New England states during the study process
- Includes a carbon price applied to all resources, and an FCEM that only awards CECs to new resources
- Target an average energy price of $41/MWh to try and retain existing clean resources
- Like FCEM, a novel concept

Study assesses differences between pathways

- Quantitative analysis:
  - How costly is decarbonization under each pathway?
  - How does the set of resources that provide energy to meet demand differ between pathways?
  - Each pathway's prices for energy, environmental attributes, capacity
- Qualitative analysis:
  - Design and implementation challenges for each pathway
  - Level of regional coordination needed under each pathway

Modeling framework for quantitative analysis

- For each pathway:
  - Reduce 2040 carbon emissions by 80 percent from 1990 level
  - Simulate capacity and energy market outcomes from 2020 to 2040
  - Solve for optimal resource mix each year, and dispatch each hour
  - Calculate energy, environmental, and capacity prices based on incremental costs of providing each attribute
- Where possible, assumptions are consistent with current market rules

Key quantitative takeaways: costs

- NCP is the most cost-effective approach to decarbonizing
  - Hybrid costs $100 million more per year in 2040 (0.6 percent higher)
  - FCEM costs $200 million more per year in 2040 (1.3 percent higher)
  - SQ costs $1.2 billion more per year in 2040 (9 percent higher)
- NCP provides incentives for all forms of decarbonization, including development of new clean resources and switching from higher to lower emitting resources

Key quantitative takeaways: resource mix

- New resources are needed across all pathways to meet growing electricity demand caused by the electrification of the heating and transportation sectors
- Some fossil resources remain, but large majority of new resources under each pathway are non-emitting
- SQ procures the most offshore wind resources, as this aligns with current state plans and roadmaps
- Other pathways procure more onshore wind and solar energy

Key quantitative takeaways: prices

- Environmental prices impact consumer costs in multiple ways
  - Carbon price increases wholesale energy prices, but also results in a direct rebate to consumers
  - Clean energy certificates reduce wholesale electricity prices, but also result in a direct additional charge to consumers
- As the fraction of renewables increases, SQ and FCEM produce negative energy market prices with increased regularity
  - Renewables offer energy at negative prices to reflect contract terms or value of clean energy certificates
  - Negative energy prices in roughly one-third of hours in 2040

Key qualitative takeaways: design and implementation

- SQ represents a continuation of current policy, but may present long-term challenges as region further decarbonizes
- NCP is simpler to design and implement than FCEM or Hybrid
  - Carbon pricing is well understood and region already has a form of it via Regional Greenhouse Gas Initiative (RGGI)
- FCEM is a novel design that would require more work to define the product(s) procured, auction/mechanism to procure these products, interaction with existing state programs, etc.
- Hybrid may add yet further complexity by including elements of both NCP and FCEM

Key qualitative takeaways: regional coordination among states

- SQ requires lowest degree of regional coordination, whereas NCP likely requires the greatest
- SQ reflects the current regional approach
- For FCEM, region must agree to common definition of clean energy, but states can buy different clean energy quantities
- Under NCP, region must decide on a single regional carbon price or emissions target

Key study limitations and caveats

- Study each Pathways at a conceptual level
  - Many important design elements remain outstanding
- Any study looking ahead 20 years is heavily dependent on the modeling assumptions
  - Study's focus is on differences across pathways, rather than economic outputs for any given Pathway (e.g., total costs)
- Study focuses on market outcomes and does not consider other key factors such as reliability outcomes, legal questions about jurisdiction

Pathways materials

- Pathways report: https://www.iso-ne.com/static-assets/documents/2022/04/schatzki-et-al-pathways-final.pdf
- Summary of the report: https://isonewswire.com/2022/04/20/iso-ne-finalizes-study-analyzing-potential-market-designs-for-the-future-grid/
- Library of materials: https://www.iso-ne.com/committees/key-projects/new-englands-future-grid-initiative-key-project/

Questions