# AGENDA

**Meeting No. 19**  
NPCC Governmental/Regulatory Affairs Advisory Group

*The Colonnade Hotel*  
120 Huntington Avenue  
*Boston, MA 02116*

**December 5, 2017**  
2:00 pm – 5:00 pm

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Est. Time</th>
</tr>
</thead>
</table>
| 1.   | Convene Meeting  
     | Introductions  
     | 2:00 - 2:15 |
|      |             | Anti-Trust Compliance Guidelines  
|      |             | Roster Update |
| 2.   | Chair Remarks  
     | Carolyn O’Connor  
     | 2:15 - 2:30 |
|      |             | Chair |
| 3.   | New England Regional System Plan  
     | Mike Henderson – Director  
     | 2:30 – 3:00 |
|      |             | Regional Planning & Coordination  
|      |             | ISO New England |
| 4.   | New England Markets and Public Policy Update  
     | Eric Johnson  
     | 3:00 – 3:30 |
|      |             | Director, External Affairs  
|      |             | ISO New England |
| 5.   | Hydro-Quebec Clean Energy Partnership  
     | Carolyn O’Connor  
     | 3:30 – 4:00 |
|      |             | Director, External Affairs  
|      |             | H.Q. Energy Services, US |
| 6.   | IEEE 1547 Distributed Energy Resources Standards  
     | Michael Lombardi  
     | 4:00 – 4:30 |
|      |             | Manager, System Studies  
|      |             | NPCC |
| 7.   | Next Meeting(s)  
     | All  
     | 4:30 – 5:00 |
Antitrust Compliance Guidelines

It is NPCC’s policy and practice to obey the antitrust laws and to avoid all conduct that unreasonably restrains competition. The antitrust laws make it important that meeting participants avoid discussion of topics that could result in charges of anti-competitive behavior, including: restraint of trade and conspiracies to monopolize, unfair or deceptive business acts or practices, price discrimination, division of markets, allocation of production, imposition of boycotts, exclusive dealing arrangements, and any other activity that unreasonably restrains competition.

It is the responsibility of every NPCC participant and employee who may in any way affect NPCC’s compliance with the antitrust laws to carry out this commitment.

Participants in NPCC activities (including those participating in its committees, task forces and subgroups) should refrain from discussing the following throughout any meeting or during any breaks (including NPCC meetings, conference calls and informal discussions):

- Industry-related topics considered sensitive or market intelligence in nature that are outside of their committee’s scope or assignment, or the published agenda for the meeting;
- Their company’s prices for products or services, or prices charged by their competitors;
- Costs, discounts, terms of sale, profit margins or anything else that might affect prices;
- The resale prices their customers should charge for products they sell them;
- Allocating markets, customers, territories or products with their competitors;
- Limiting production;
- Whether or not to deal with any company; and
- Any competitively sensitive information concerning their company or a competitor.

Any decisions or actions by NPCC as a result of such meetings will only be taken in the interest of promoting and maintaining the reliability and adequacy of the bulk power system.

Any NPCC meeting participant or employee who is uncertain about the legal ramifications of a particular course of conduct or who has doubts or concerns about whether NPCC’s antitrust compliance policy is implicated in any situation should call NPCC’s Secretary, Ruta Skucas at 202-530-6428.
2017 Regional System Plan (RSP17)

RSP17 Process and Summary

Michael I. Henderson

Director Regional Planning and Coordination
RSP17 Satisfies Tariff Requirements

• The ISO carries out regional planning with the Planning Advisory Committee (PAC) as part of an open, transparent stakeholder process
• RSP17 reflects the results and findings of the ongoing ISO regional planning process
• RSP17 satisfies all tariff obligations and reports on all activities that satisfy all required planning procedures and criteria
Summary of Key Messages: Successes

• Markets and Planning
  – 20 years of competitive markets and transmission planning and development have significantly enhanced reliability and improved overall market efficiency

• Resource Adequacy
  – New England has the resource base and transmission system needed to meet consumer demand for power

• Transformation of the Grid
  – System is evolving to a cleaner, hybrid grid

• Stakeholder Input
  – The ISO seeks feedback from our stakeholders through an open planning process with the PAC
ISO New England Is Focused on Developing Solutions to Today’s Grid Challenges

• Fuel Security
  – Ensuring adequate fuel for the region’s generators, especially during winter

• Power Plant Retirements
  – Finding new ways to meet peak demand as aging plants close

• Renewable Resource Integration
  – Maintaining reliability as increasing levels of distributed generation and intermittent resources come online
ISO New England is Focused on Developing Solutions to the Region’s Top Reliability Risks

• Resolving fuel security concerns
  – New England is challenged to meet electricity demands with existing fuel infrastructure, particularly during the winter
  – In the absence of new gas infrastructure or adequate use of dual-fuel capability, changes to the market rules may need to be considered to ensure reliability through existing infrastructure and resources

• Ensuring resource adequacy through the competitive markets
  – As resources retire, additional resources will be needed to replace them, and these must be able to perform to ensure flexible, reliable, and economic operation of the system
  – Appropriate price formation is critical to resource retention, investment, and performance incentives
  – As states contract for new sponsored resources, changes will be required to the wholesale market rules to ensure efficient price formation

• Integrating renewable resources
  – Renewable resources provide clean energy but their output is variable
  – The ISO presented results for different megawatt scenarios for the Maine Resource Integration Study (MRIS) and cost estimates for the Cluster Enabling Transmission Upgrades
  – Transmission expansion is needed to connect renewables to demand centers
  – To assure reliability, the region needs fast-responding, flexible capacity resources that are not constrained in their operation
The Region is Addressing the Fuel-Security Issue

Short-term mitigation measures are in place, and long-term solutions are under consideration

**Short Term**
- Modifications to the day-ahead and real-time markets
- Procurement of additional reserves
- Improved coordination and communication among the ISO, generating units, and natural gas pipelines
- Energy market offer-flexibility enhancements
- Winter reliability program incents resources to secure fuel (oil and liquefied natural gas) or demand resources ahead of the 2017/2018 winter season

**Additional and Long Term**
- Existing and new dual-fuel generator capability with adequate fuel storage
- Transmission additions to neighboring systems that provide access to diversified resources
- Increased use of wind and solar resources
- Greater efficiency gains in natural gas and electricity use
- Revisions to the wholesale market rules
Energy Efficiency and Behind-the-Meter Solar Reduce Peak Demand and Annual Energy Use

Note: Summer peak demand is based on the “90/10” forecast, which accounts for the possibility of extreme summer weather (temperatures of about 94°F).

Resource Adequacy Criteria Met by Competitive Markets

• Retirements drive the need for new resources, and the Forward Capacity Market attracts new resources
  – Forward Capacity Auction #10 (FCA #10) and FCA #11 procured sufficient system resources to meet resource adequacy criteria, regionally and in import-constrained zones

• The most reliable and economic place for resource development remains in southern New England near load centers
  – New economic resources reduce congestion and the need for transmission development
  – Repowered generation at brownfield sites are favorably located and able to lock into FCA clearing prices for up to seven years
  – Fast-start resources near load centers in Greater Southwest Connecticut, Greater Connecticut, and Boston provide flexibility as procured through the Forward Reserve Market
Integrating Renewable Resources

• Economic studies have identified key issues with different resource futures for the region
  – Large-scale development of wind resources in Maine requires considerable transmission expansion to serve demand in southern New England
  – Southeastern Massachusetts offshore wind resources will require less transmission but are expensive to build

• The ISO is facilitating the addition of wind resources in northern New England through cluster studies and strategic transmission analysis, although overall transmission costs may remain a barrier to wind development in Maine
  – Major transmission infrastructure will also be required to access additional Canadian hydro

• Market enhancements will help New England as it transitions from a capacity-limited to an energy-limited system
  – Appropriate price formation is critical to resource retention, investment, and performance incentives
Large-Scale Development of Distributed Energy Resources Presents Challenges

• Storage, microgrids, and distributed generation may provide local reliability and flexibility
• Issues of observability, controllability, and infrastructure improvements must be addressed for the hybrid grid
• Proliferation of inverter-based resources (solar, wind, batteries) will require attention to interconnection standards and analysis of declining system inertia
  – Current voltage and frequency ride-through characteristics can be problematic for the system
  – Physical problems exacerbated by energy efficiency (EE) by increasing exposure to light load conditions
• Revisions to the IEEE 1547 standard for interconnecting distributed energy resources have been proposed
  – Implementation of the revised standard will improve system reliability and allow for increased development of distributed energy resources
  – The states and distribution companies are strongly urged to implement the revised IEEE 1547 standard, once adopted
Environmental Issues

• Regional and state environmental regulations likely have a greater potential impact on generating units in the region than national environmental requirements

• Existing and potential new environmental regulations will continue to affect the region’s generators
  – Over the past decade, average and marginal emissions rates have declined, in part due to the region’s increased use of natural gas
  – Compliance could lead to higher operating costs, reduced capacity, or reduced energy production
  – Additional capital improvements and resource retirements
  – Increased use of natural-gas-fired generation is likely
  – Relicensing of nuclear and hydro facilities could reduce output and flexibility
Key Transmission Planning Study Areas in New England

- NH/VT: New Hampshire and Vermont
- P&G: Pittsfield and Greenfield
- Western & Central MA: Western and Central Massachusetts (Includes P&G)
- GHCC: Greater Hartford
- SWCT: Southwest Connecticut
- ECT: Eastern Connecticut
- SEMA/RI: Southeastern Massachusetts and Rhode Island
- Greater Boston
Recent and Upcoming Changes in Long-Term Transmission Planning Assumptions and Criteria

• Criteria and assumptions used in long-term reliability assessments changed significantly
  – Planning Procedure No. 3, Reliability Standard for the New England Area Pool Transmission Facilities, now reflects the evolution of the NERC transmission planning standards
  – Probabilistic planning was incorporated for selecting generator dispatch
  – Material changes were made to the ISO’s planning process to account for FERC Order 1000
  – Transmission Planning Criteria and Assumptions were updated

• Incorporation of the above changes will likely result in fewer identified or delayed transmission system needs
Meeting Future Transmission System Needs

• Approximately $4B of new transmission upgrades is reported in RSP17
  – Many of these are in siting or under construction
• The need for reliability-based transmission upgrades is changing
  – Steady-state studies of peak demand indicate an expected decline in the need for additional reliability-based transmission
  – Generator retirements and studies reviewing system performance, which account for the integration of nonsynchronous resources and improved load modeling, may drive the need for additional reliability-based transmission upgrades
  – Aging infrastructure will likely require replacement
• Needs assessments showed market-efficiency transmission upgrades are not required
• A process has been implemented for “Planning for Public Policy” under Order 1000
Planning Activities Are Closely Coordinated with Neighboring Systems

• ISO-NE, NYISO, and PJM successfully implemented the Northeastern ISO/RTO Planning Protocol
• ISO-NE participates in the NPCC, NERC, and Eastern Interconnection Planning Collaborative (EIPC)
• New elective transmission upgrades that will form new ties between New England and Canada or New York are in various stages of study and development
• ISO-NE coordinates activities with the US Department of Energy, the EIPC, and ISO/RTO Council
Summary: Meeting Regional Challenges

• The planning process continues to evolve

• The need of future regional electrical power system infrastructure is driven by:
  – Mandatory national and regional reliability criteria
  – Low growth of net demand that accounts for EE and PV
  – Aging infrastructure
  – Resource retirements
  – Public policies
  – The large-scale addition of inverter-based resources

• Southern New England is a good place for developing new resources because of the proximity to load, transmission, and retiring resources

• The region has made progress addressing reliability concerns, but fuel security remains an issue
Summary: Meeting Regional Challenges, cont.

• Successfully integrating variable resources poses challenges the region is addressing

• As states contract for new resources, the wholesale market rules will need to be revised to ensure efficient price formation

• Transmission projects provide reliability, market efficiency, and environmental benefits, and additional projects are progressing throughout the region

• Interregional planning is increasingly important, and new ties are in various stages of study and development

• Stakeholders provide vital input to the ISO’s planning process
Special Thanks To:
The Planning Advisory Committee and all stakeholders involved in the development of the 2017 Regional System Plan
Questions
New England Markets and Public Policy Update

NPCC Governmental/Regulatory Affairs Meeting

Eric Johnson
DIRECTOR, EXTERNAL AFFAIRS
ISO’S COMPETITIVE AUCTIONS WITH SPONSORED POLICY RESOURCES PROPOSAL
Discussions Continue on How to Accommodate Public Policies in the Wholesale Electricity Markets

• Last year, NEPOOL launched a formal stakeholder process to discuss potential market rule changes to integrate the region’s wholesale electricity markets with the public policy goals of the New England states (called IMAPP)
  – Currently, the states’ renewable energy and environmental goals are beyond the objectives of the region’s wholesale electricity markets, which are designed to maintain reliability through the selection of the most economically efficient set of resources

• ISO New England has developed a proposal that could be implemented in the near term, involving enhancements to the Forward Capacity Market
  – Competitive Auctions with Sponsored Policy Resources
ISO New England’s Proposed Path Forward

• The ISO’s capacity market design approach:
  – **Accommodates** sponsored policy resources into the Forward Capacity Market over time, and
  – **Preserves** competitively based capacity pricing for other resources

• It builds upon—but does not replace—the capacity market framework in New England

• **Key idea:** Coordinate the entry of new state-sponsored (i.e., clean energy) resources with the exit of existing capacity resources through a new **substitution auction**
  – Utilizes the standard, two-settlement market design familiar in other wholesale markets (e.g., ISO’s day-ahead and real-time energy markets)
Why Is a Near-Term Solution Important?

• New England relies on the wholesale electricity markets to attract private investment, but investor confidence in the market structure may be weakened if action is not taken.

• State procurement efforts for clean energy may attract resources that seek to participate in the ISO’s February 2019 Forward Capacity Auction (FCA #13) with plans for commercial operation in the 2022 timeframe.

• Following an extensive stakeholder process, the ISO plans to file tariff changes in January 2018, in time for FCA #13.

• FERC approval will be needed in early 2018 to accommodate these resources.
FORWARD CAPACITY AUCTION #12

June 1, 2021 – May 31, 2022 Capacity Commitment Period
Forward Capacity Auction #12 is Scheduled to Take Place in February 2018

- **FCA #12** will procure the resources needed to meet the demand for electricity, plus reserve requirements, during the June 1, 2021 to May 31, 2022 capacity commitment period

- In **November**, the ISO submitted a pre-FCA informational filing with FERC for review, which included all FCA-related calculations and determinations
Three Capacity Zones Will Be Modeled in FCA #12

• The ISO studied constraints and transfer capabilities on the transmission system to determine which capacity zones would be modeled in FCA #12

• The ISO will model **three** capacity zones in FCA #12 (same zones as FCA #11)
  - Northern New England Capacity Zone
    • Export-Constrained
  - Southeast New England Capacity Zone
    • Import-Constrained
  - Rest-of-Pool Capacity Zone

• The installed capacity target for FCA #12 is **33,725 MW**

• Overall, **35,007 MW** of existing and **5,605 MW** of new resources have qualified to participate in FCA #12
For More Information...

• Subscribe to the ISO Newswire
  – ISO Newswire is your source for regular news about ISO New England and the wholesale electricity industry within the six-state region

• Log on to ISO Express
  – ISO Express provides real-time data on New England’s wholesale electricity markets and power system operations

• Follow the ISO on Twitter
  – @isonewengland

• Download the ISO to Go App
  – ISO to Go is a free mobile application that puts real-time wholesale electricity pricing and power grid information in the palm of your hand
Massachusetts Background/Context

• **August 2016**: Passage of *An Act Relative to Energy Diversity*

• **March 2017**: Request for Proposals launched by electric distribution companies in accordance with the Act, 9.45 TWh of firm clean energy
  - Hydropower alone
  - New Class 1 RPS resources firmed up with hydropower
  - New Class 1 RPS

• **July 2017**: Hydro Quebec participates in the RFP with an inclusive approach
  - Two supply packages -- a total of six bids into the RFP

• **Ongoing**: Respond to Questions, Stakeholder Outreach, Monitor Progress of Transmission Projects
SIX OPTIONS FOR MASSACHUSETTS

3 potential transmission lines

For each line:

> A 100% hydropower option

> A hydro-wind option
NEW ENGLAND CLEAN POWER LINK

8.3 TWh

20-year agreement

Proponent: TDI New England

Beginning in 2022

1,000 MW transmission line in Vermont
NORTHERN PASS TRANSMISSION

Minimum of 8.5 TWh, up to 9.4 TWh

20-year agreement

Proponent: Northern Pass Transmission, a subsidiary of Eversource Energy

Beginning in 2020

1,090 MW transmission line in New Hampshire
Minimum of 8.5 TWh, up to 9.4 TWh

20-year agreement

Proponent: Central Maine Power, subsidiary of AVANGRID, majoritarily owned by Iberdrola

Beginning in 2022

1,200 MW transmission line in Maine
Hydro-Québec Hydropower

Large quantities, available today

Geographic resource diversity

Robust transmission delivery system

Low carbon emissions profile

Baseload delivery commitment

Flexibility / firms wind resources
Hydro-Québec Wind Project Option

Developed by Gaz Métro and Boralex
- 300MW of Class 1 wind/RECs (SBx)
- Balanced by HQ system power
- Located close to transmission network
- Experienced project developers
Evaluation Challenges/Issues

> Establishing a full and comparable value analysis for all bids
  > Level of firmness of energy deliveries
  > Level of carbon avoidance
  > Energy and capacity market benefits
  > Post-PPA transmission benefits
Evaluation Challenges/Issues (cont.)

> Assessing transmission and supply risks

> Transmission:

  > Cost, In service date, etc.

> Supply:

  > Built vs. To be built

  > Supply situation of region to be interconnected with

    > Overall quantity compared to PPA-committed quantity

    > Carbon displacement policies
IEEE 1547

IEEE Standard for Interconnecting Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces (full revision of IEEE Standard 1547)

NPCC Governmental/Regulatory Affairs Advisory Group

December 5, 2017
Index

• Timeline
• Current Standard and Landscape
• What is IEEE 1547?
• Revision, Scope and Purpose
• From Accommodating to Integrating
• Major impacts of IEEE 1547 on the DER interconnection screens
Timeline - Completed Milestones

• Initial Ballot completed 6/18/17
  – Quorum met and >75% approval
• Recirculation Ballot 1 completed 10/2/17
  – Maintained quorum; 85% approval
• Recirculation Ballot 2 completed 11/15/17
  – Maintained quorum; 92% approval
• Recirculation Ballot 3 completed 12/4/17
  – Maintained quorum; 93% approval
## Timeline - Scheduled Milestones

<table>
<thead>
<tr>
<th>Timeframe</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comment review</td>
<td><strong>Milestone:</strong> Maintain SA Ballot Pool quorum and final approval &gt;75%</td>
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<tr>
<td>Late Nov – Early Dec</td>
<td>Submit P1547 revision to IEEE RevCom for Review.</td>
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<td>This track for Q2/Q3 Publication.</td>
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<td>Also investigating potential for RevCom’s Early Consideration Cycle.</td>
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<td>→ RevCom review meeting → IEEE –SA Standards Board confirmation → SASB approval for publication → SA Staff with WG Chair finalize publication schedule, administrative items and deadlines → publication</td>
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<tr>
<td>Q2/Q3 2018</td>
<td>Final document preparation</td>
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<td><strong>MILESTONE:</strong> Revised IEEE Std 1547-2018 Published</td>
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Source: [http://grouper.ieee.org/groups/scc21/1547_revision/docs/1547-Revision-Milestone-Schedule.pdf](http://grouper.ieee.org/groups/scc21/1547_revision/docs/1547-Revision-Milestone-Schedule.pdf)
Current Standard and Landscape

IEEE:
- IEEE 1547-2003 Standard for Interconnecting Distributed Resources with Electric Power Systems
  - Approved by the IEEE Standards Board in June 2003
  - Approved as an American National Standard in October 2003
  - Available from the IEEE Std 1547-2003 Web page
- IEEE 1547a (Amendment 1) was published in 2014

USA Federal Energy Policy Act of 2005:
- Calls for state commissions to consider certain standards for electric utilities. Under Section 1254 of the act: "Interconnection services shall be offered based upon the standards developed by the Institute of Electrical and Electronics Engineers: IEEE Standard 1547 for Interconnecting Distributed Resources With Electric Power Systems, as they may be amended from time to time."
What is IEEE 1547?

The 1547 series are developed under IEEE Standards Coordinating Committee 21 (SCC21) on Fuel Cells, Photovoltaics, Dispersed Generation, and Energy Storage. http://grouper.ieee.org/groups/scc21/index.html

* Colored background designates IEEE published standards; Clear background is draft standard work in progress.
P1547 Revision, Scope and Purpose

**P1547 Revision:** Draft Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces.

**Scope:** This standard establishes criteria and requirements for interconnection of distributed energy resources (DER) with electric power systems (EPS), and associated interfaces.

*Note: Interfaces defined in IEEE 2030: “a logical interconnection from one entity to another that supports one or more data flows implemented with one or more data links.”*

**Purpose:** This document provides a uniform standard for the interconnection and interoperability of distributed energy resources (DER) with electric power systems (EPS). It provides requirements relevant to the interconnection and interoperability performance, operation, and testing, and, safety, maintenance and security considerations.
Change in Scope and Applicability

**IEEE Std 1547-2003**
- Focused on distribution system aspects.
- Specifications for the “interconnection system” sufficiently achieve the standard’s objective.
- Meant as DER interconnection standard but mainly used for equipment listing.
- Limited to electrical requirements.

**IEEE Std 1547-revised**
- Focused on distribution and bulk system aspects.
- Specifications encompass the whole DER.
- Can be used for equipment listing as well as plant-level verification.
- Includes both electrical as well as interoperability/communications requirements.
From Accommodating to Integrating

Standardizing “smart” DER performance capabilities to enable power system transition

Accommodating

<table>
<thead>
<tr>
<th>Grid</th>
<th>Integrating DER</th>
</tr>
</thead>
<tbody>
<tr>
<td>No changes</td>
<td>Grid</td>
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<tr>
<td>Limited to no control</td>
<td>Specific changes to serve load and DER</td>
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DER

- Limited to no control
- Increased control (watts and vars)
- Additional voltage/var control
- Grid-side changes to voltage control
- Protection changes
- Least-cost solutions for incorporating DER into distribution operations
- Energy storage
- Customer load control
- Increased hosting capacity, improved distribution performance

Objectives

- Accommodate DER without changing distribution
- Least-cost solutions for incorporating DER into distribution operations

Outcomes

- Baseline hosting capacity, no changes to distribution performance
- Increased hosting capacity, improved distribution performance

Source: Demonstration of Improved DER Screening Through Hosting Capacity Method, EPRI December 2016
Major Impacts of the IEEE 1547 on DER Interconnection Screens

- System protection (Supplemental review and full impact studies)
- Anti-islanding protection screens may need to be revised
- System DER hosting capacity
- Modeling the Advanced DER. Lack of modeling tools that are widely used by the utilities for protection and load flow studies
Questions?