NEW ENGLAND POWER POOL

PROPOSED AGENDA

Integrating Markets and Public Policy (IMAPP)
Plenary Meeting #6
Thursday, November 10, 2016
DoubleTree Hotel, Westborough, MA

Morning Session **9:30 a.m. - 12:00 p.m.**

- **Introductory Remarks**
- **Draft Results of 2016 Economic Studies (NEPOOL Scenario Analysis)**
- **Refinement and Discussion on Conceptual Proposals**
    - Carbon Integrated Forward Capacity Market (FCM-C)
    - Forward Clean Energy Market (FCEM)

Lunch Break **12:00 – 12:30 p.m.**

Afternoon Session **12:30 – end of day (estimated to be 4:00 p.m.)**

- **Refinement and Discussion on Conceptual Proposals (cont.)**
    - Carbon Pricing in the Energy Market
    - Update on Clean Power Plant Solicitation Proposal (High Liner Foods)
    - Update on FCM Two-Tiered Pricing Construct (NRG)
- **Overview: Interaction between Current State-Mandated Solicitation Timelines & FCA Schedules**
- **Revised IMAPP Schedule/Concluding Remarks**

NOVEMBER 10, 2016 | WESTBOROUGH, MA

2016 Economic Studies Executive Summary

IMAPP

Michael I. Henderson

DIRECTOR, REGIONAL PLANNING AND COORDINATION

2016 Economic Study (NEPOOL Scenario Analysis)

Executive Summary

Today

- Present summary of Scenario Analysis metrics for the five base scenarios
- 2030 results will be emphasized because the differences among the cases are more evident
  - Total costs
  - Total Load Serving Entity expense costs
  - Wholesale energy market revenues and contributions to fixed cost by resource type
  - Key environmental metrics

Schedule

- Almost all detailed metrics and draft results were discussed with the PAC on August 18, September 21, and October 19
- Additional Scenario Analysis discussions are planned for the balance of PAC meetings during 2016
- Phase II analysis of Forward Capacity Auction prices, and regulation, ramping, and reserves is scheduled for 2017

Process and Scope of Work

- The scope of work and all draft results reflect input from the Planning Advisory Committee
- Phase I consists of production cost simulation results for five scenarios, which were examined for 2025 and 2030 with the transmission system constrained and unconstrained and with resource mixes meeting NICR

5 Scenarios Included in 2016 Economic Study

Approximately 25 metrics presented for each scenario

1. Generation fleet meeting existing Renewable Portfolio Standards (RPS) and retired units replaced with natural gas combined cycle (NGCC) units
2. Generation fleet meeting existing RPS and all future needs, including retirements, met with new renewable/clean energy resources
3. The "RPS-plus scenario" - Generation fleet meeting existing RPS plus additional renewable/clean energy resources, EE, PV, plug-in electric vehicles, and distributed storage
4. Generation fleet meeting existing RPS by resources currently under development and use of Alternative Compliance Payments with NGCC additions, and with no retirements (the "no retirement scenario")
5. Existing fleet meeting existing RPS by resources currently under development and use of Alternative Compliance Payments and retirement replacement with NGCC additions

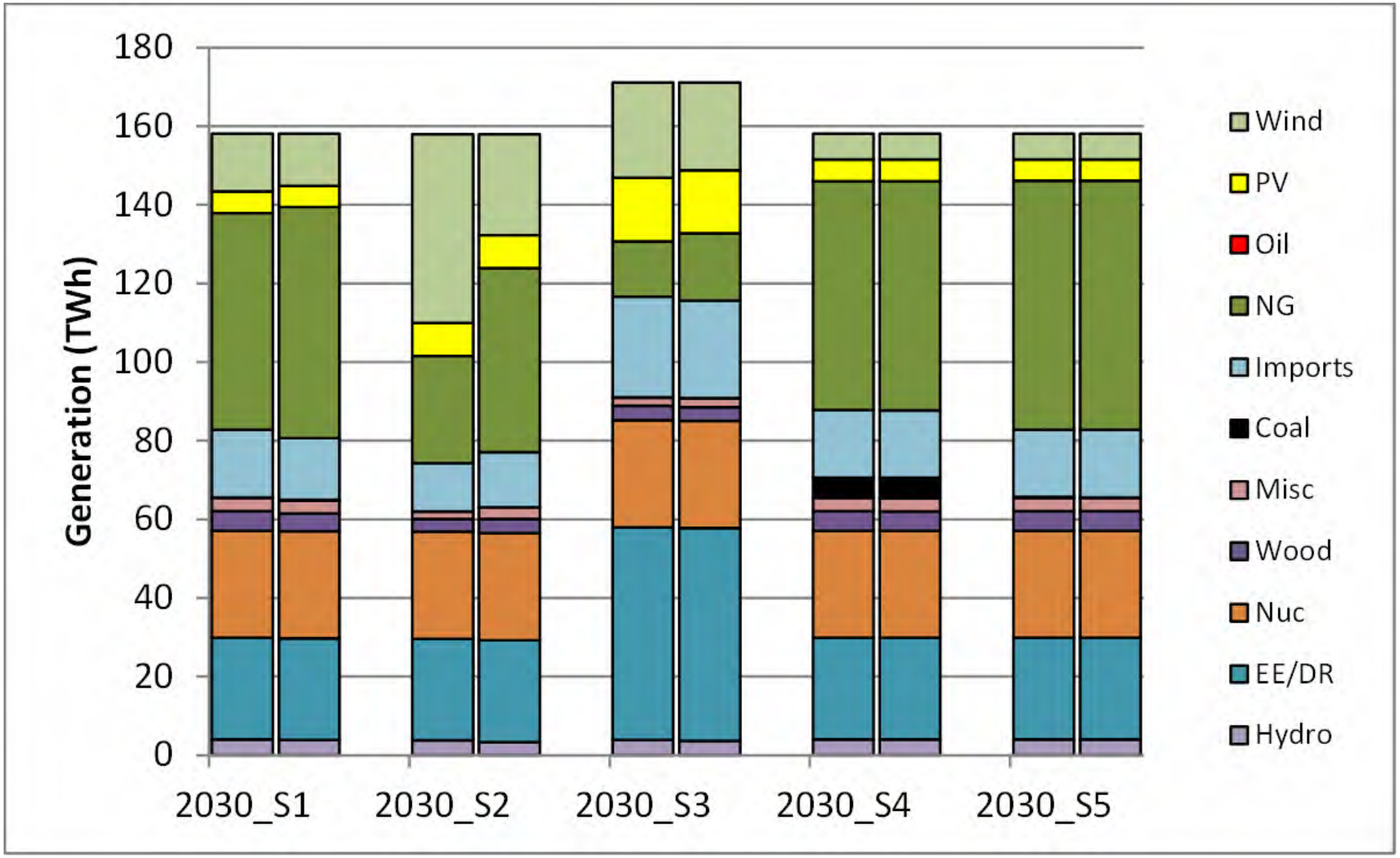
EXECUTIVE SUMMARY

Review of Results Previously Discussed by the Planning Advisory Committee

Energy By Source 2030 (TWh)

Unconstrained (Left) vs. Constrained (Right)

Note differences in wind generation and PV among cases. Oil units run under 0.5%, even in S4. Coal is competitive with NGCC in Scenario 4. NG capacity factors range from a high of 35% in S5 to a low of 10% in S3.

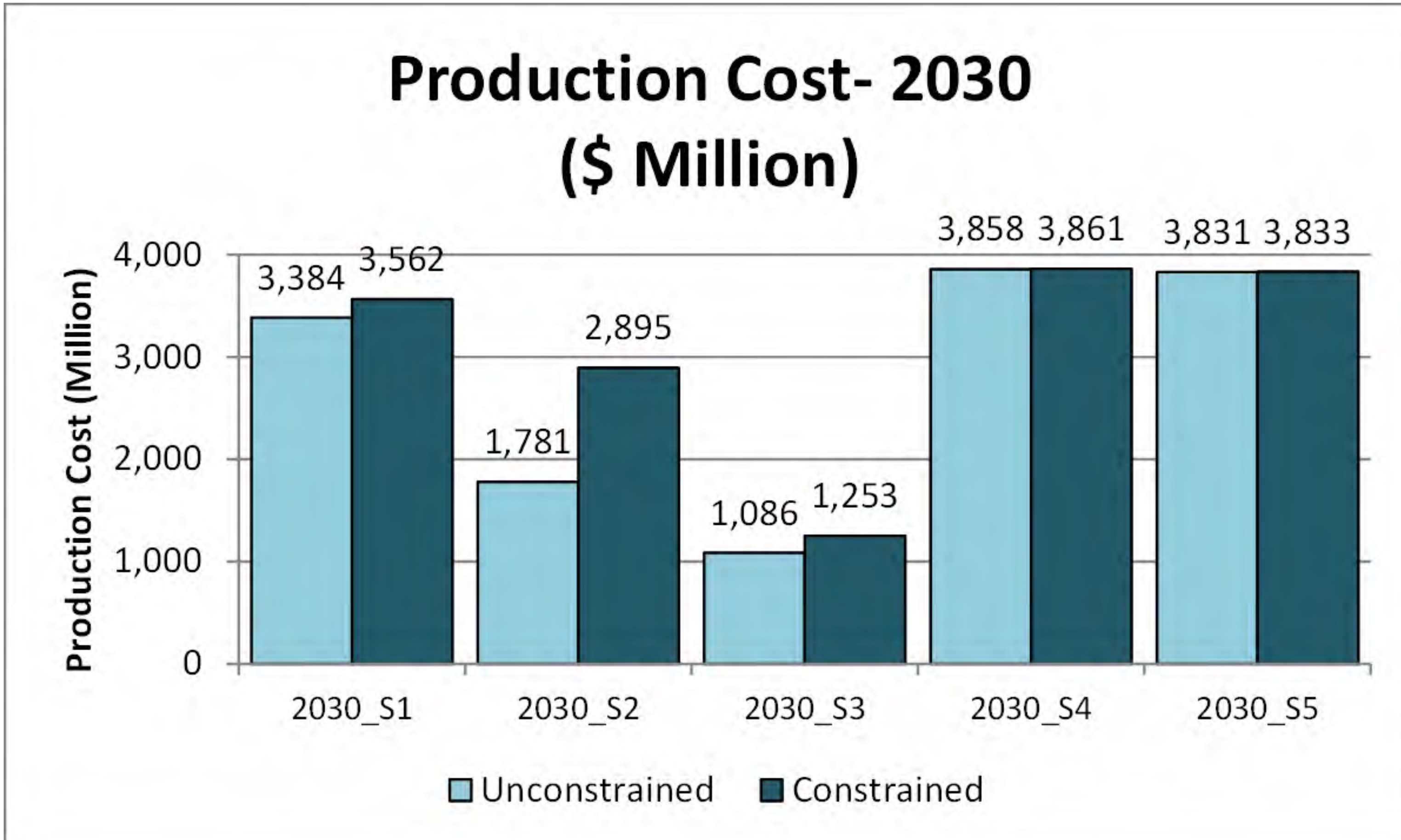


Annual System-Wide Production Costs ($M/Year) – 2030

Transmission Interfaces Unconstrained and Constrained

Large penetrations of $0 cost resources reduce production costs (S1, S2, and S3)

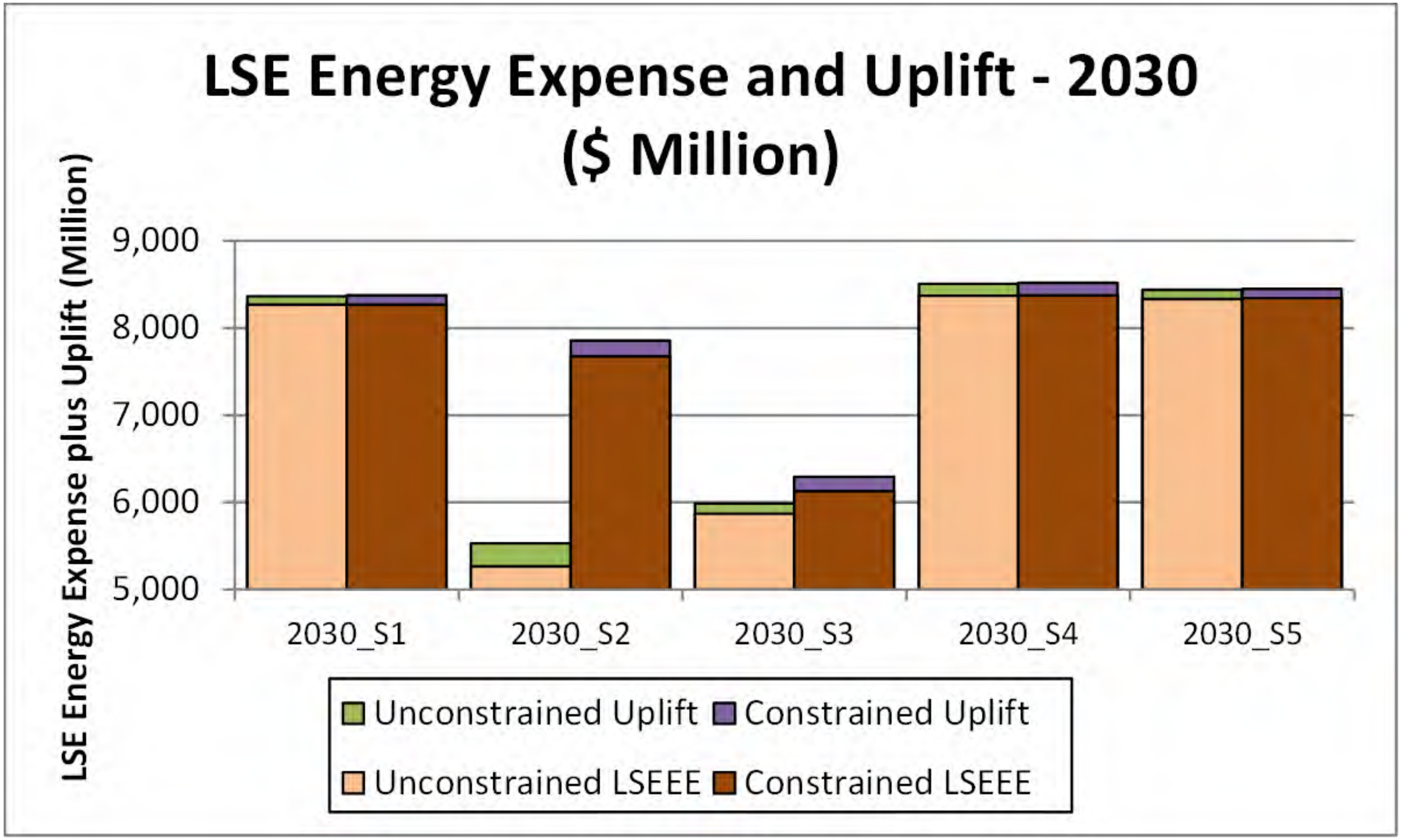
Transmission constraints bottle inexpensive resources in ME (S2 especially)



Load Serving Energy Expenses and Uplift - 2030

Uplift shows payments made to resources when the unit is running and the total unit cost is higher than the cleared LMP as calculated by the GridView Program

Transmission development provides access to less expensive resources in ME that lower Load Serving Energy Expense costs

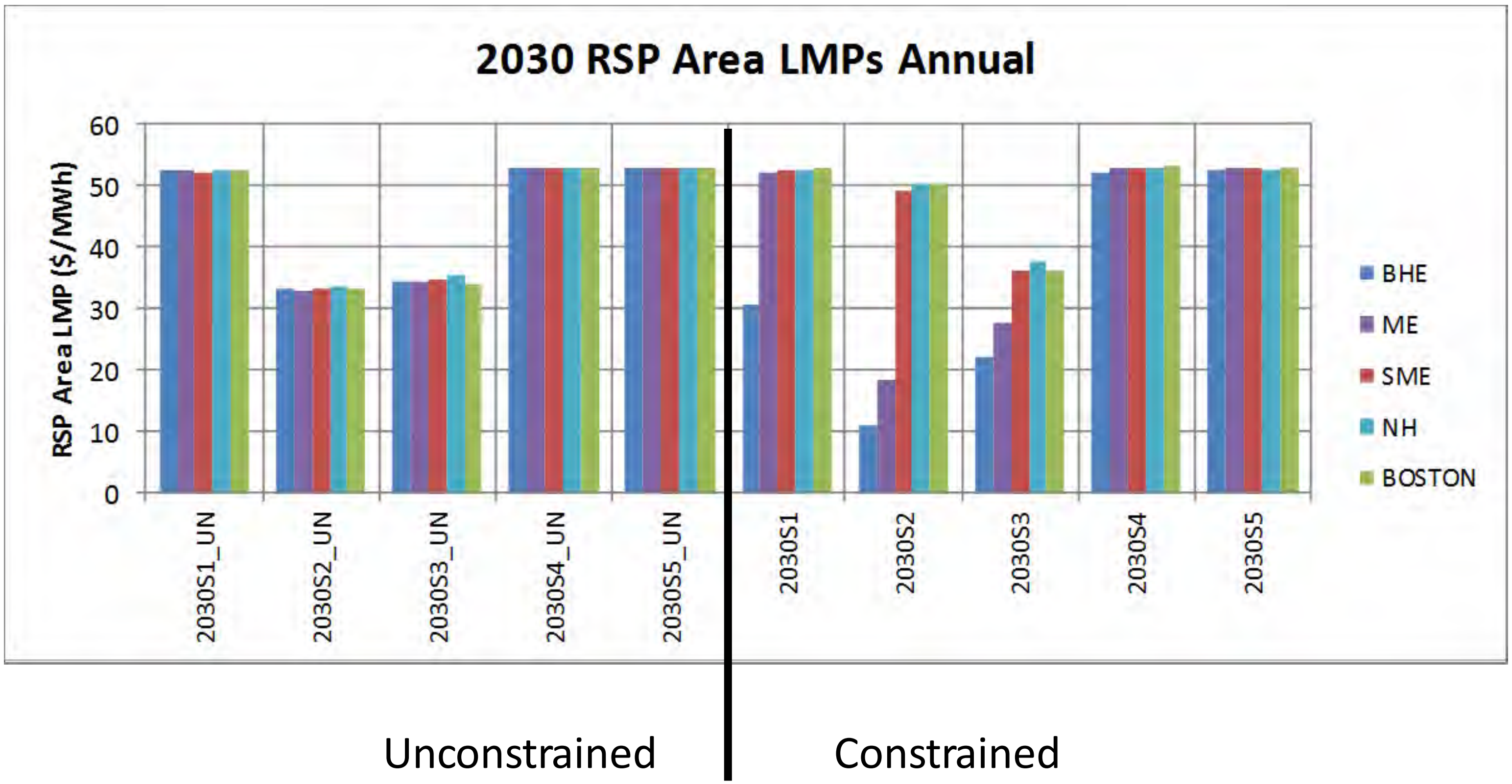


RSP Area LMP - 2030

Transmission Interfaces Unconstrained and Constrained

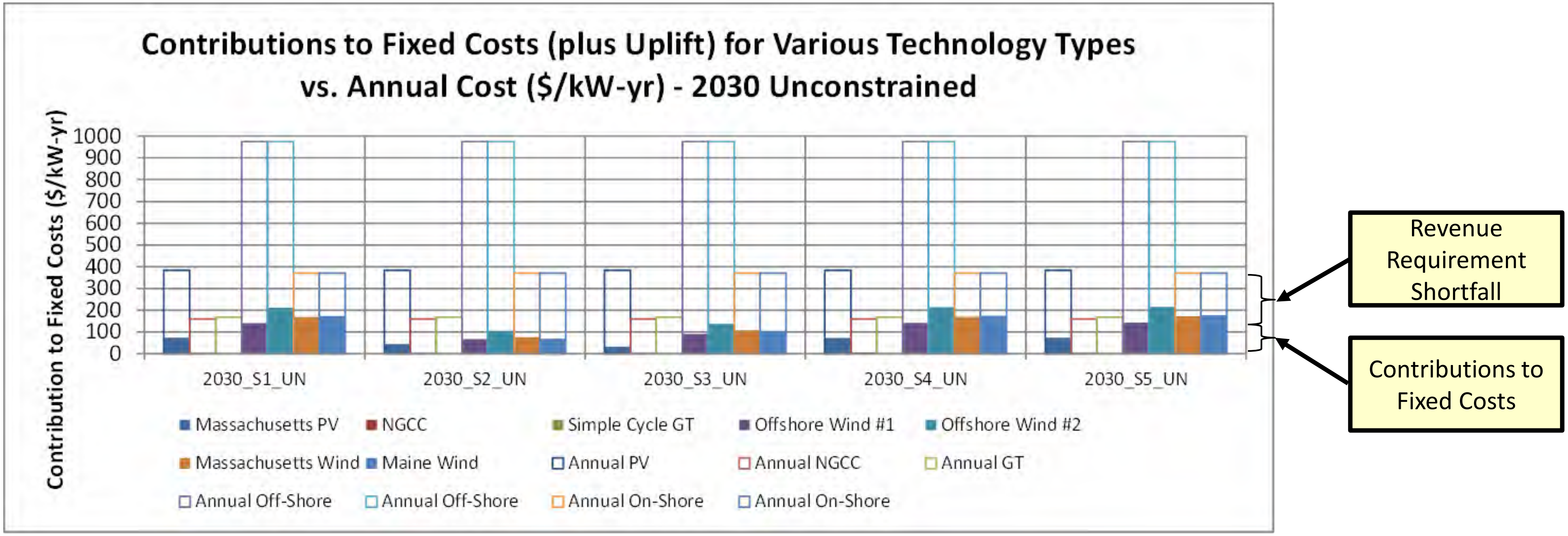
Natural gas is typically on the margin for S1, S4, and S5, but less so in S2 and S3 that have large penetrations of $0 cost resources

Large amounts of wind energy development bottles resources in Northern ME



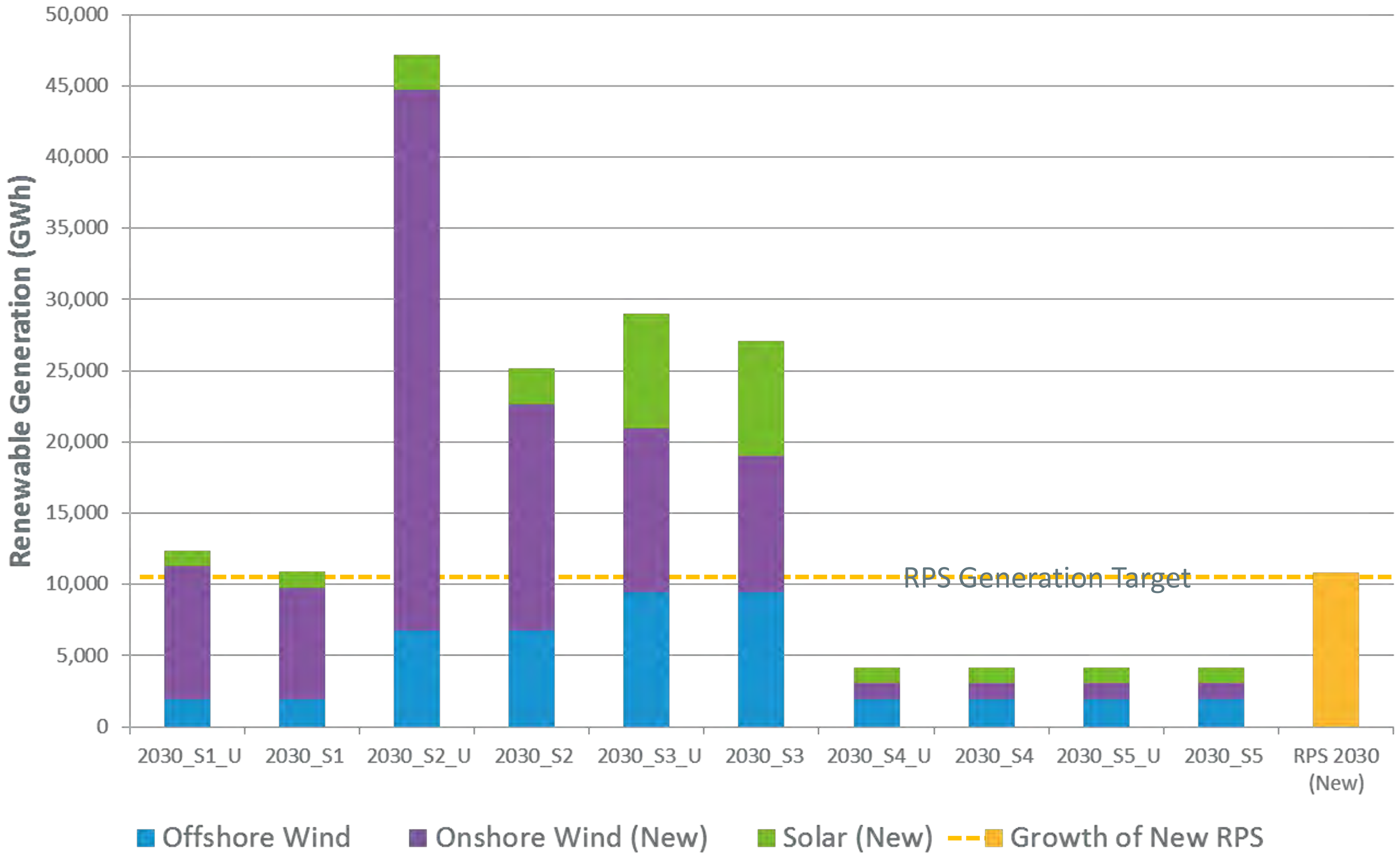
Net Resource Revenues from the Energy Market 2030

Resource revenues from the energy market contribute little to fixed costs across all technologies due to $0 cost resources and NGCC on NGCC competition. Capacity factors of fossil units are low.



2030 New Renewable Generation (GWh)

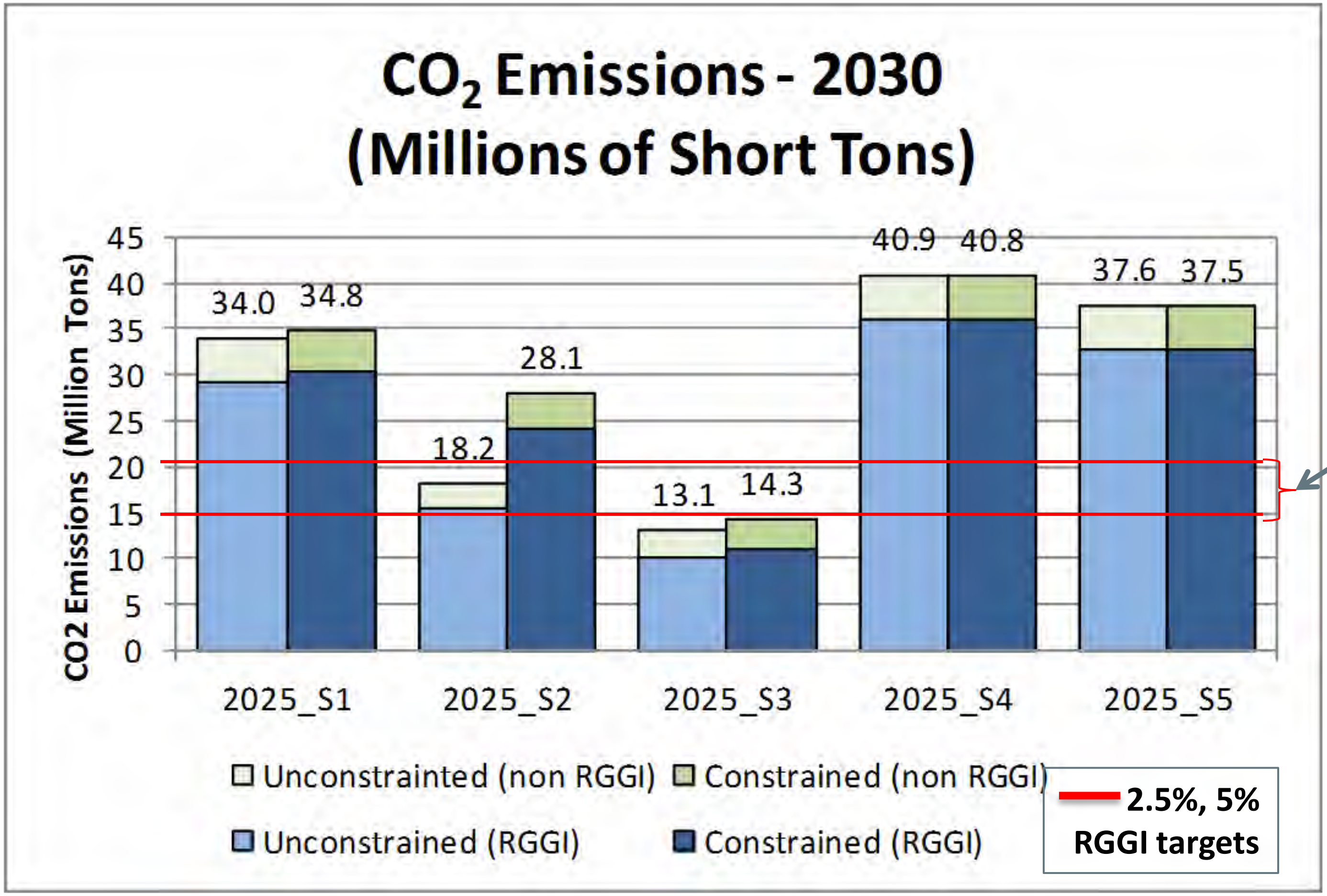
S1, S2, and S3 physically meet RPS, even with transmission constraining wind generation in Maine. S4 and S5 assume use of Alternative Compliance Payments



2030 Annual System-wide CO_2 Emissions
RGGI and Other Generators (Million Short Tons)

Transmission Interfaces Unconstrained and Constrained

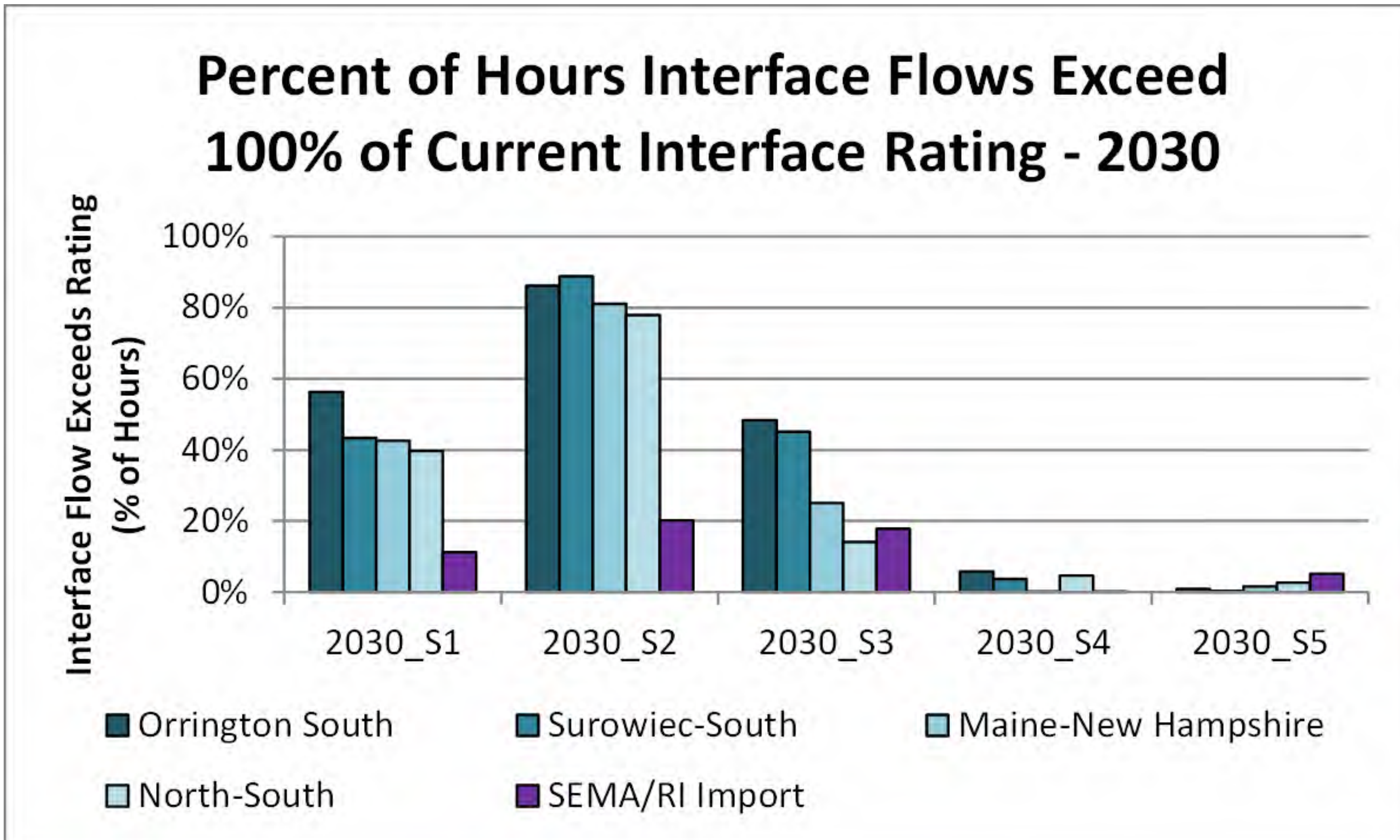
Meeting current RGGI goals with primary auction allowances for the six New England states may prove challenging



Range of RGGI limit for jurisdictional resources

Interface Flow Metric - 2030

Transmission Interfaces Unconstrained
Without transmission system expansion, wind resources developed in ME bottle inexpensive resources



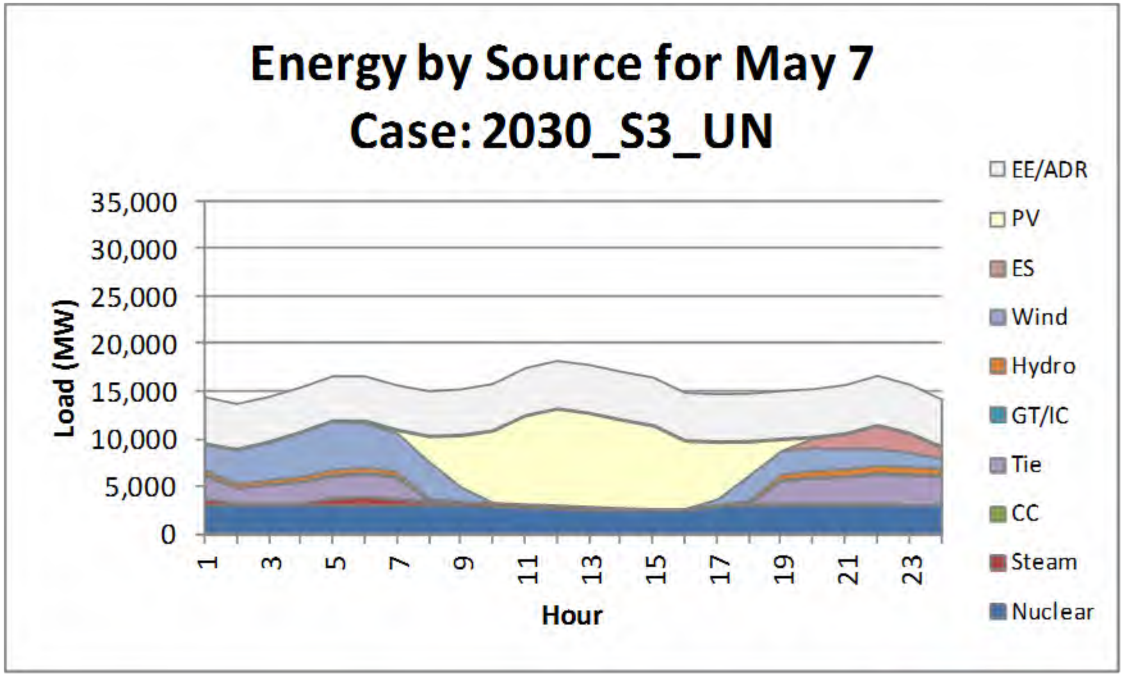
Transmission Cost Summary

	Scenario 1	Scenario 2	Scenario 3
2030 Maine Nameplate Wind Injection (MW)	2,955 MW	12,872 MW	3,652 MW
Needed Congestion Relief Capacity (MW)	1,471 MW	9,043 MW	1,839 MW
Integrator System (Description)	1 AC parallel 345 kV path	---	2 AC parallel 345 kV paths
Integrator System (Cost $ Bn)	1.5	---	3
Congestion Relief System (Description)	Connecting Larrabee 345 kV to the Millbury hub	Connecting POIs directly to the Millbury hub	Connecting Larrabee 345 kV to the Millbury hub
Congestion Relief System (Cost $ Bn)	3.7	20.0	3.7
Total Cost ($ Bn)	5.2	20.0	6.7
Total Cost ($ Bn) + 50% margin	7.8	30.0	10.0

Costs described here are preliminary high-level order of magnitude costs and are based on judgement.
Also, they do not account for individual plants' interconnection costs or potential costs from system operational issues.

Technical Challenges with Renewable Integration

- The large scale addition of asynchronous resources (EE, PV, wind, and HVDC imports) poses physical challenges
  - Special control systems may be required, especially to stabilize the system and provide frequency control
  - Protection system issues resulting from lack of short circuit availability could require major capital investment
  - Many other issues with power quality, voltage regulation, etc.



NEXT STEPS

PAC Comments Requested

- This presentation discusses several high level observations
- Stakeholders are invited to examine detailed results on the PAC website
  - https://www.iso-ne.com/committees/planning/planning-advisory
- Please provide the ISO with additional observations by participating in the PAC
  - Comments may be submitted to PACmatters@iso-ne.com

Schedule

- November 16 PAC
  – Summary of high level Phase I observations and key messages
  – Draft results of natural gas pipeline analysis, which is a Phase II item advanced from 2017 deliverable
- November 29 PAC
  – Discussion of sensitivity analysis results, assuming a limited number of cases (otherwise the schedule will slip)
  – Discussion of Phase II Scope of Work for Regulation, Ramping, and Reserves Analysis (May slip to December PAC)
- December 16 PAC
  – Discussion of Phase II Scope of Work for Forward Capacity Auction Pricing
  – Additional discussion of sensitivity analysis results as may be warranted

Schedule cont.

- 1st Quarter 2017
  - Discuss draft and then finalize the Scenario Analysis Report (for the five base scenarios)
  - Discuss draft and then finalize Sensitivity Case Scenario Analysis Report as may be required
  - Phase II Analysis to be conducted in 2017
  - Examine representative Forward Capacity Auction (FCA) clearing prices for several scenarios
  - Analyze hourly and intra-hourly ramping, regulation, and reserve requirements

Questions

CLF Proposal Potential Adjustments

Robert Stoddard
Senior Consultant
Charles River Associates

Jerry Elmer
Senior Attorney
Conservation Law Foundation

Kathleen Spees
Principal
Brattle Group

November 11, 2016

Key Issues to Address in the CLF Proposal

- In our discussions, it has become clear that two key issues raised by NESCOE need to be somehow addressed in CLF's proposal:

  1. **Existing Clean Resources**: How to provide the most efficient going-forward incentives, while mitigating customer costs associated with payments to existing clean resources?

  2. **Cross Subsidies Among States:** How to address NESCOE objective that no state should be required to pay for the environmental policies of other states?

Issue 1: Existing Clean Resources

Economic Efficiency: All existing and new clean resources should be treated exactly the same to minimize societal cost

- **Economic Efficiency: Level Playing Field**
  - Key advantage of markets is that they enable competition and innovation to drive down costs
  - The widest possible competition (existing vs. new, different technologies, different business models, internal vs. imported) will allow the least-cost options to survive and drive out higher-cost options
  - Lowest societal cost is achieved through a level playing field
- **Inefficiencies from Excluding Existing Clean Resources**
  - Excluding existing clean resources would increase societal costs. Lower-cost existing resources needing modest reinvestments may retire even while high-cost new clean resources are being developed
  - Problem exacerbated if PPA-driven (or FCM-C driven) new clean resources are added and drive down energy/capacity prices. Poorer financial performance for existing resources will make them even more likely to retire
  - Clean energy investments are then self-defeating. Customers spend money on new clean resources only to induce retirements of existing clean resources (potential to spend money without net gains in CO_2 reductions)

Customer Costs: NESCOE's transitional concern regarding customer cost effects

- **Short-Term Concern for Customers:**
  - A subset of existing clean resources have low net going-forward costs and might stay online for several years even if they earn no additional payments
  - These low-cost existing clean resources would earn higher payments from ZECs or CO_2 price over this interim period, without making incremental contributions to the CO_2 objective compared to the status quo
  - This transfer payment does not affect economic efficiency, but does increase customer costs. Customers wish to mitigate payments to existing clean resources that would have stayed online regardless
- **Longer-Term Customer Interest:**
  - Over time, the net going-forward reinvestment/ refurbishment costs of existing clean resources will rise until they are similar to those of new resources
  - Once that happens, existing clean resources will retire unless they are paid the same as new resources
  - Customers will see lowest cost if all existing and new resources are treated the same, so that the lowest cost resources can continue operating or be developed

Issue 1: Existing Clean Resources

Considerations for Existing Clean Resources

- No easy solution for treatment of existing clean resources
- Directionally, customer and societal interests would both be best served if it were possible to develop options that could do two things:
  - Give the right going-forward incentives to existing clean resources (and eventually put them on an entirely level playing field with new clean resources before any reinvestment or retirement decisions need to be made)
  - Mitigate the potential for large transfer payments from customers to existing clean resources over an interim transition period
- But these two objectives are in conflict. We want to be clear that any level of resource discrimination will introduce economic inefficiency and associated concerns:
  - No good way to determine when any particular existing clean resource's net going-forward costs are "high enough"
  - Permanently baking in any resource discrimination against some clean energy resource types will have adverse consequences that may grow over time
  - For example, excluded resources will retire early even if they are very low cost compared to included resources (increasing societal and customer costs in the long run, while undermining the CO_2 reduction objectives driving new clean energy procurements)
  - States might be able to step in and save those existing clean resources on an out-of-market basis, but one-off negotiations risk an uncompetitive price, paying a high price to recontract when lower-cost in-market options might have been available, and there is a risk that states may not have the institutional mechanisms in place to act quickly

Issue 1: Existing Clean Resources

Potential Options for Addressing NECSCOE Concerns

- We view the first-best option from a societal perspective as one that treats all clean energy resources on an entirely level playing field
- Second-best alternatives can be developed that sacrifice some economic efficiency, but prevent most of the potential for substantial transfer payments over a transition period. For example:
  - PPAs between States/Utilities and Existing Clean Resources: Existing clean resources that are under a PPA before FCM-C is implemented are unlikely to pose a concern. PPA agreements are typically structured to return market revenues to the contractual counterparty (just like capacity and energy revenues are returned, ZEC revenue would also be returned)
  - Phase-in of Existing Clean Resources: Another option is to phase existing clean resources into FCM-C as a function of age (their full quantity of ZECs would be accounted for in auction clearing, but the resources would be paid for only a portion of their ZECs, increasing to 100% as the resources age). Some efficiency would be sacrificed, but transfer payments prevented
  - Hedge-Like or PPA-Like Tariff Structure: For existing clean energy resources in a transition period, FCM-C payments would be at a fixed, negotiated rate. Over time those resources would be transitioned into being treated on a level basis with new resources. Again, some efficiency may be sacrificed, but transfer payments would be prevented
- Many variations, each with pros and cons. We hope to initiate discussion about what options may be promising to pursue further

Issue 2: Cross Subsidies Among States

- NESCOE "Objective 1" states that cross subsidies need to be prevented
- Two perspectives on cross subsidy issues:

Perspective of Non-Participating States with Modest Decarbonization Targets

- Do not wish to pay for the decarbonization policies of other states
- CO_2 price alone might result in higher customer costs in non-participating states (but impact would be mitigated by CO_2 charges that are returned to customers, and offsetting changes in capacity market)

Perspective of Participating States with the Most Ambitious Decarbonization Goals

- Concern about subsidizing the energy use of non-participating states
- PPA-driven or ZEC-driven clean energy will reduce energy and potentially capacity prices, benefitting customers across New England (regardless of whether they are allocated any costs of the procurements)
- Lower energy and capacity prices have the effect of increasing the "green attribute" payment for clean resources through PPAs, RECs, or ZECs
- Potential retirement of existing clean resources would magnify the cross subsidy effect, if this leads to even more PPA or ZEC procurements for new clean energy or PPA interventions to save existing clean resources

Issue 2: Cross Subsidies Among States

Potential CLF Proposal Adjustments

- Two-part proposal with both CO_2 pricing and ZEC procurement creates an opportunity to mitigate cross subsidies (can be entirely prevented if there is perfect foresight)
- Proposal mechanics to be worked out if the overall concept is agreeable

Step 1: FCM-C

1. ZECs procured through FCM-C are allocated to loads in the *participating states*
2. Causes energy and capacity price suppression that benefits all customers (creates a cross subsidy from participating to non-participating states)*

Step 2: CO_2 Pricing

1. Moderate CO_2 price is imposed, high enough to restore customer costs for non-participating states back to a status quo level without FCM-C (after accounting for rebates from CO_2 charges)
2. Non-participating states' customer costs not affected on a net basis. Note that substantial estimation errors may require relying on informed judgement within a reasonably supported range
3. Size of the CO_2 price may be lower than the societal cost that CLF has previously proposed

*More accurately, the price suppression induced by clean energy procurements would suppress prices in a way that harms suppliers but benefits customers that purchase energy and capacity at the market price.

Importance of Incorporating a CO_2 Price

- NESCOE has previously expressed a preliminary view that CO_2 pricing options (especially if pursued alone without FCM-C) could be undesirable due to the potential for remunerating existing clean resources at a higher level than in the status quo, and requiring non-participating states to pay for the policy objectives of other states
- These potential adjustments to CLF's proposal are intended to address both concerns
- We want to take this opportunity to reiterate the importance of incorporating a CO_2 price from an economic efficiency perspective

Advantages of CO_2 Pricing

- Directly corrects the market failure by internalizing the externality. Most efficient (lowest societal cost) way to achieve CO_2 reductions
- Immediate CO_2 reduction impact based on fuel switching away from remaining coal plants, utilizing DR for peaking needs, reducing CO_2 emissions associated with start-up/shut-down
- Customer cost impacts are limited due to: reductions to ZEC and capacity prices, rebate from ZEC payments, and inducing greater energy efficiency

- Creates differentiation among clean energy resources, providing the strongest incentives for the resources that avoid the most CO_2 reductions. Importance of this attribute will grow enormously as the system becomes more decarbonized, e.g. if in the future gas is only on the margin ½ of the hours, some clean resources may not displace much fossil generation
- Mitigates potential for adverse interactions between ZEC product and energy market price formation (magnitude of negative pricing and associated problems are mitigated, plus the CO_2 implications of min generation events are incorporated into commitment/dispatch decisions)

Discussion

A Thought Experiment in FCEM

NEPOOL IMAPP Stakeholder Process

Pete Fuller
November 10, 2016

Goals and Rationale for FCEM

- ✓ Facilitate cost-effective entry and financing of new renewable energy projects, and compensation for existing, non-contracted renewable energy resources
- ✓ Provide renewable project developers with a high-quality revenue stream to support financing, and a predictable market structure for revealing value and prices over time
- ✓ A standardized, repeatable market will enable scaling of the entry of renewables by moving beyond one-off solicitations and customized, negotiated agreements
- ✓ Visibility of a forward demand quantity and pricing creates confidence of developers and investors, and will support a pipeline of early development efforts

Open, competitive process fosters confidence *in all parties* of the cost-effectiveness of the selected projects and the opportunity for innovation and competition among projects

Goals for Today

- ✓ Take a deeper dive into the design of FCEM – to identify further questions and suggest further details
- ✓ Illustrate a framework and a process for thinking about FCEM design elements
  - ✓ Present a concrete example as an aid to getting deeper into the design
  - ✓ Design choices and interdependencies
  - ✓ Important details
  - ✓ Interactions with other markets
- ✓ Follow the Sept 14 Framework Document outline[1]; major differences are in **bold**

Today's discussion is only an illustrative starting point and is *not* a proposal

1 http://nepool.com/uploads/IMAPP_20160914_Framework_FCEM.pdf

Goals for Further Development

- ✓ The FCEM should not be limited to a single ‘class’ in the states’ RPS
  - ✓ the focus on a single REC product today is intended to enable the consideration of design choices in a more tangible example, not to preclude a broader market definition
- ✓ The FCEM should be integrated and co-optimized with FCM, as CLF is proposing, if possible
  - ✓ The focus on FCEM today is not intended to preclude co-optimization
- ✓ The Net ICR (resource adequacy) is a function of unit characteristics; how does it change as penetration of variable renewables increases?

Outline – Framework Document

- ✓ General Understandings
- ✓ Product Definition
- ✓ Procurement Requirements
- ✓ FCEM Auction
- ✓ FCEM Obligations and Payments
- ✓ Relationship to FCM
- ✓ Cost Allocation

Intent is to follow the outline and structure of the September 14 Framework Document

General Understandings

- ✓ FCEM to be governed by FERC-approved tariffs
- ✓ FCEM to procure renewable resource commitments to meet state policy goals through a competitive, financeable structure
- ✓ FCEM could work in tandem with other mechanisms, such as a two-tier pricing mechanism in FCM

Product Definition

- ✓ **Class 1 RECs, as defined by the New England states.** New and existing resources **eligible as Class 1 resources in any state would be eligible for FCEM**
- ✓ The obligation on selected resources is to deliver the specified number of **RECs** in the delivery year, which will be measured by ISO-NE as the MWh produced by the resource, with **no temporal differentiation**

- ✓ **Why perform this thought experiment with Class 1 RECs?**
  - ✓ **i) they are already defined in the six states, with clear eligibility and numerical requirements;**
  - ✓ **ii) they are generally interchangeable within (and beyond) the region; and**
  - ✓ **iii) they trade in a spot/prompt market for RPS compliance, providing a price and mechanism for settling imbalances in forward positions**

Procurement Requirements

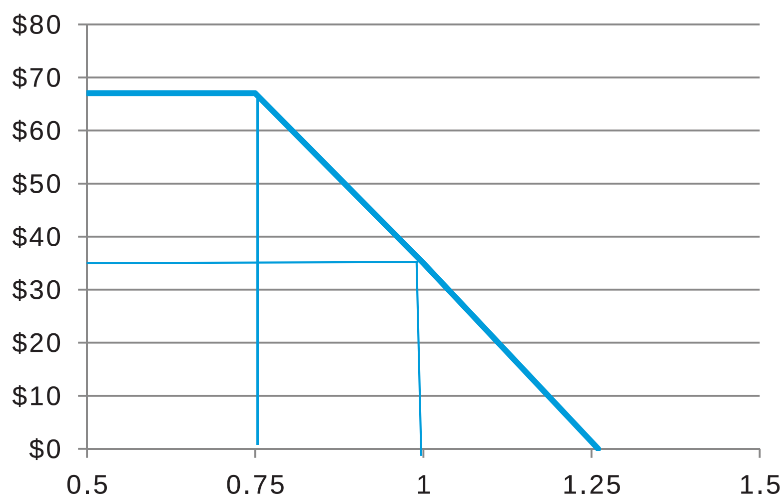
- ✓ Process for setting requirements would be defined in ISO-NE Tariff
  - ✓ Total annual **Class 1 REC requirements** as established by the states
- ✓ No locational or other clearing constraints
- ✓ **This annual net REC requirement could set the 'target' quantity (Q) in a downward-sloping demand curve**
- ✓ **The 'target' price of the demand curve could be based on the estimated equilibrium value of Class 1 RECs (currently ~$35)**
- ✓ **The demand curve would be a straight line between the 'target' value of (Q, [$35]), and a 'maximum cost' point at (0.75Q, [ACP]). To the left of the 'maximum cost' point, the line would be flat at the ACP level. To the right of the 'target' point, the line would continue downward at the same slope until it intersects the quantity axis at a price of $0/MWh.**

All illustrative values are subject to modification and refinement – the purpose here is to begin to make FCEM more tangible

Procurement Requirements (2)

Illustrative FCEM Demand Curve:

- ✓ **1.0 Requirement = Aggregate state Class 1 REC requirements**
- ✓ **Assumes 'equilibrium' price of $35/MWh**
- ✓ **Assumes 'cap' price of $67/MWh**
  - ✓ All parameters subject to further development



Estimated Aggregate New England States' Class 1 REC Requirements

	Class 1 RECs (GWh)	Class 1 RECs as Percent of Load
2018	18,709	14%
2019	20,293	15%
2020	21,159	16%
2021	21,873	16%
2022	22,611	17%
2023	23,365	17%
2024	24,142	18%
2025	24,929	18%

Values are for illustrative purposes only, based on current New England state RPS parameters and prices

FCEM Auction

- ✓ FCEM would procure forward commitments to produce energy that would generate **Class 1 RECs**
- ✓ FCEM auctions would occur ~3.5 years prior to the commitment period, with FCEM results known prior to FCM final offer deadlines*
- ✓ FCEM qualification and FA schedules and processes comparable to FCM, as defined in ISO-NE Tariff
- ✓ ISO-NE qualification would determine maximum qualified MWh for each eligible resource
- ✓ **Physical, resource-specific qualification (like FCM)**
- ✓ Trading of FCEM obligations permitted through bilateral transactions
- ✓ FCEM offers, in $/MWh, **would be based on a similar concept as FCM, ie, total project going-forward costs less anticipated market revenues***

* Subject to adjustment if a joint, co-optimized FCEM/FCM structure can be developed

FCEM Auction (2)

- ✓ FCEM clearing price also in $/MWh
- ✓ To facilitate financing, new FCEM resources could elect a price lock-in period of up to **[15] years**
- ✓ FCM Auction Mechanics:
  - ✓ No strong preference; sealed-bid as default
- ✓ FCEM Mitigation:
  - ✓ **Presume resources participating in FCEM would not have a PPA or other state financial support, so mitigation of resources entering FCEM should be unnecessary**
    - ✓ **If IMM detects new FCEM resources with OOM revenues, apply mitigation based on Appendix A.21**

FCEM Obligations and Payments

- ✓ FCEM payments based on MWh output times FCEM clearing price, **separate from energy and capacity**
- ✓ **Pay twice-weekly based on meter reads; true-up to minted RECs**
- ✓ **Collect FCEM costs from LSEs in the same twice-weekly cycle**
- ✓ **ISO-NE payments to FCEM resources would also include energy LMP (DA or RT, as appropriate)**
- ✓ **FCEM clearing price paid only for 'obligation' MWh; no FCEM payment for over-production**
- ✓ Each resource with an FCEM obligation would be subject to charges for under-delivery of its annual commitment**, in the form of Class 1 RECs purchased bilaterally or the ACP**
  - ✓ **LD collections would be applied to reduce the cost of FCEM allocated to LSEs**

Relationship to FCM*

- ✓ **Resources clearing in FCEM could, but would not be obligated to, participate in the subsequent FCM auction**
  - ✓ Could participate up to the maximum FCM Qualified Capacity, as determined by ISO-NE

FCM Mitigation Adjustments:

- ✓ **A cleared new FCEM resource participating in FCM, that had not previously cleared in FCM, would participate with a $/kW-mo offer price equivalent to its $/MWh FCEM offer price**
- ✓ **FCEM could work in conjunction with a two-tier pricing mechanism in FCM; FCEM resources not clearing in ‘tier 1’ could obtain a CSO and be paid the lower ‘tier 2’ price, and participate under those rules until cleared in tier 1**
- ✓ ISO-NE would continue to be responsible for the qualification and determination of the resource adequacy contribution of FCEM resources participating in the FCM

* Subject to adjustment if a joint, co-optimized FCEM/FCM structure can be developed

Recap

- ✓ The FCEM concept has great promise as a more transparent, competitive means to use centralized market structures to achieve state clean energy policy objectives
- ✓ Our goal today was to present some further detail and considerations based on several design choices
- ✓ Discussion of those choices will undoubtedly continue, but hopefully we've identified further important details and interactions that need to be considered in any FCEM design
- ✓ Whether FCEM is considered 'in-market' or 'out-of-market,' it is critical that FCM continue to achieve its objective of supporting resources needed for adequacy

Today's discussion is presented as an illustrative starting point, not a definitive proposal

Questions?

Update on Carbon Price Proposal

November 10, 2016

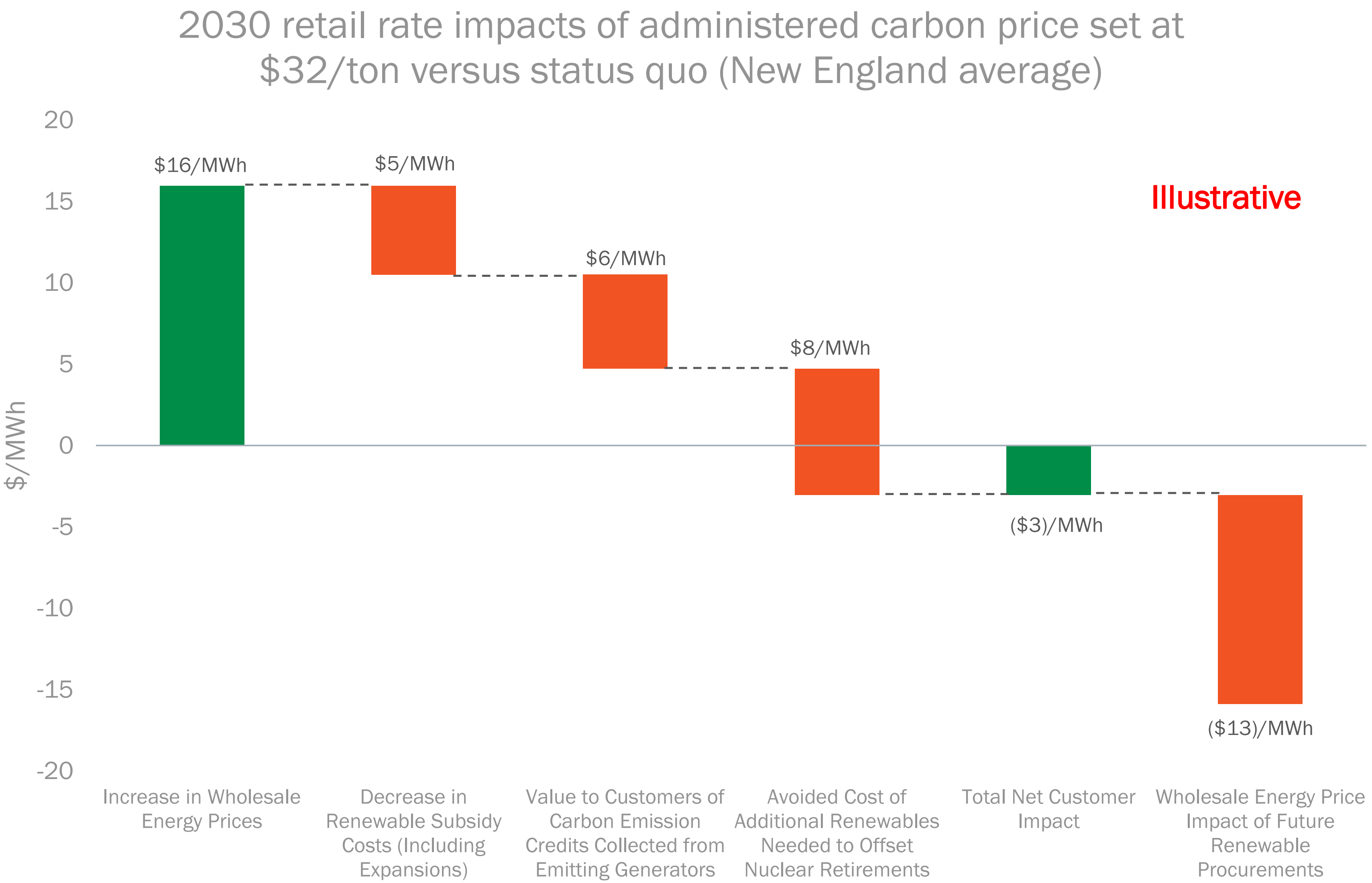
DRAFT

Exelon.

NESCOE identified three major concerns with the carbon price proposal

- **Concern #1: the carbon price raises customer costs and presents cost allocation challenges**
  - In response to these concerns, Exelon has revised its proposal to set the initial carbon price at $32/ton, rather than at the Social Cost of Carbon ($42/ton). This level is based on the Social Cost of Carbon less the $10/ton RGGI soft price cap
  - At this price level, offsetting benefits lead to net customer savings relative to the status quo
  - Customers in states that lack legislative carbon goals are better off with a carbon price when the price impact of renewable procurement by other states is considered
- **Concern #2: the carbon price does not guarantee new entry by clean generation**
  - On its own, a carbon price at this level is not high enough to incent entry by new renewables. For this reason, Exelon proposes that the carbon price be combined with a procurement backstop mechanism to ensure state procurement goals are met.
  - With appropriate contracting, a carbon price will directly lower the cost of such procurements
  - A $32/ton carbon price is likely sufficient to retain nuclear and non-RPS qualifying hydro alleviating any future need to provide state support for these resources
  - By moving some resources in-market and reducing state-support costs for others, a carbon price reduces concerns related to Minimum Offer Price Rule mitigation (or similar)
- **Concern #3: doubts exist as to whether ISO-NE has legal authority to implement a carbon price**
  - FERC has adequate authority to allow market rules to reflect carbon intensity
  - This concern is no more significant for the carbon price proposal than it is for any of the other proposals.

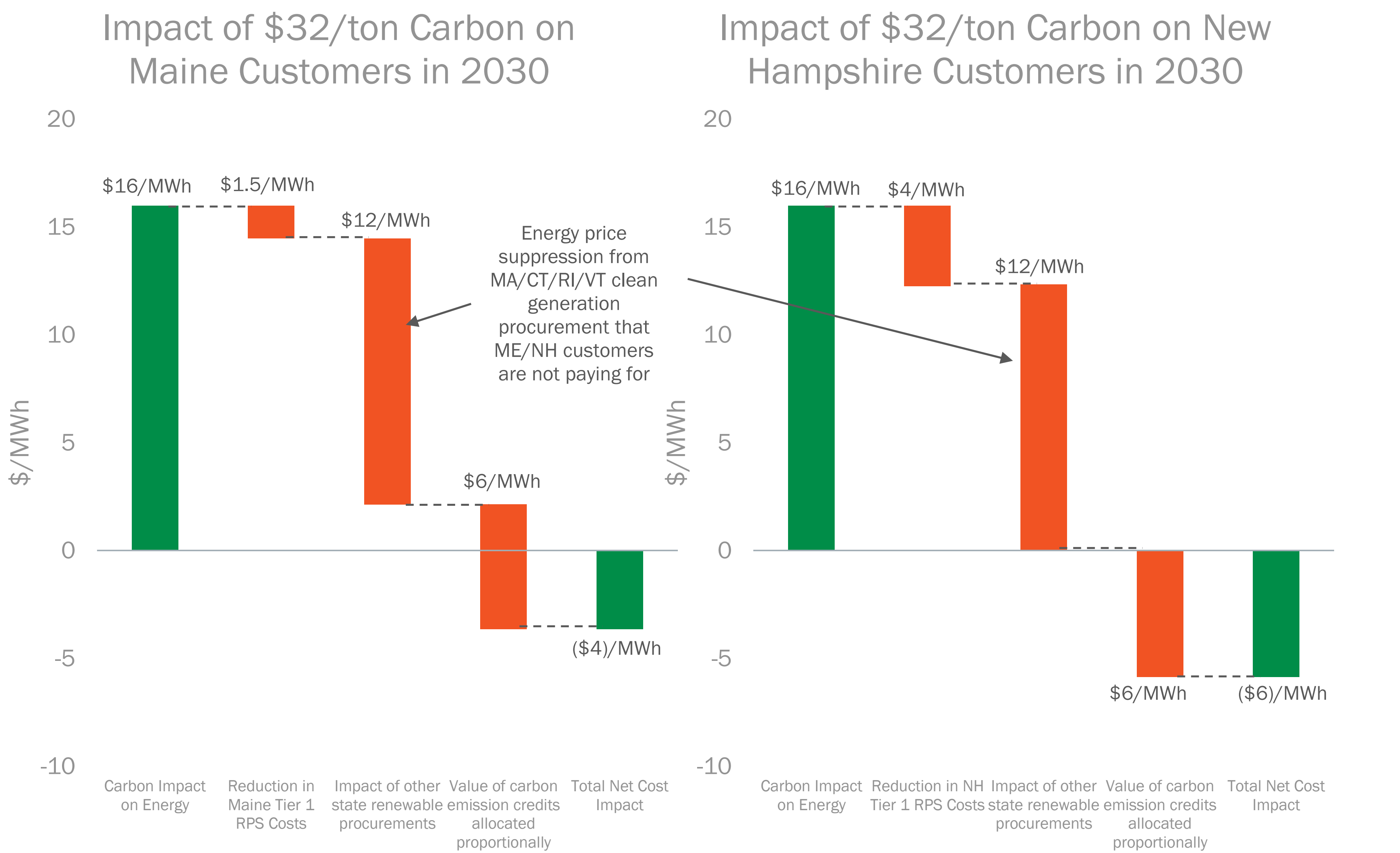
Benefits from carbon emission revenue, renewable subsidy cost decrease, and nuclear retention outweigh the price impact of carbon at $32/ton



Assumptions: 0.47 short ton per MWh marginal emission rate; 0.17 short ton per MWh average emission rate; baseline REC price of $35/REC; Future state renewable price impacts estimated based on ISO-NE 2016 Economic Study draft results (comparison of constained scenarios 3 and 5 assuming 20.7 TWh of new renewables).

Exelon.

Customers in states without carbon goals are also better off with a carbon price, which reduces the need for a differential credit allocation scheme

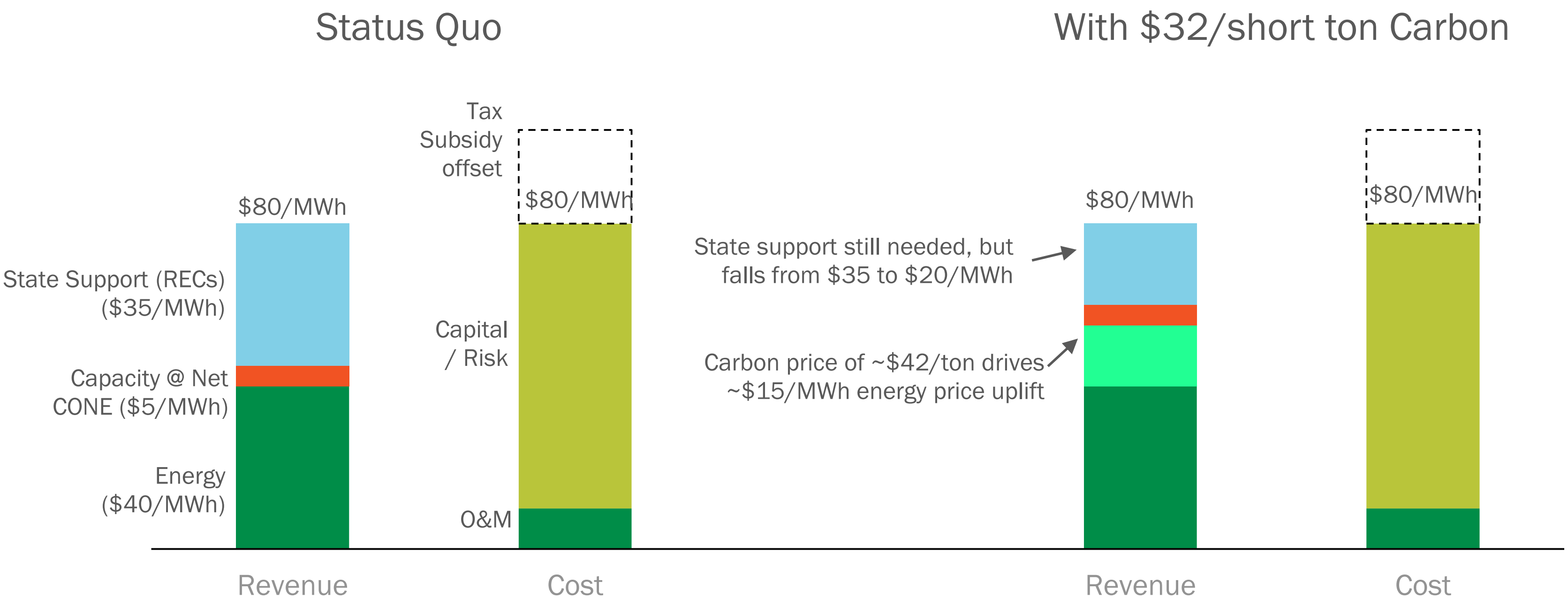


Assumptions: 0.47 short ton per MWh marginal emission rate; 0.17 short ton per MWh average emission rate; baseline REC price of $35/REC; Future state renewable price impacts estimated based on ISO-NE 2016 Economic Study draft results omitting price impact from future ME/NH RPS increases.

Exelon.

$32 carbon will reduce renewable subsidy costs but not drive new entry alone; combination with a backstop achieves this

Illustrative New Renewable Economics



New Entrant renewables are provided state support which allow them to continue to enter even with depressed energy prices

A $32/ton carbon price reduces, but does not eliminate, the amount of state support needed to induce renewable entry

To address concerns regarding to new entry by clean generation, Exelon proposes that the carbon price proposal be combined with a clean generation procurement backstop mechanism. The FCM-C or FCEM proposals are examples of such a mechanism, as is the current range of state RPS & clean generation contracting programs. Any of these mechanisms could be combined with the carbon price proposal to achieve the desired result.

Carbon pricing enhances efficiency of all backstop mechanisms

- Carbon pricing at an adequate level can provide a complete and efficient solution to achieving carbon reductions without the need to rely on backstop mechanisms

- However, carbon pricing and other mechanisms such as RPS, contracts or an FCEM are not mutually exclusive

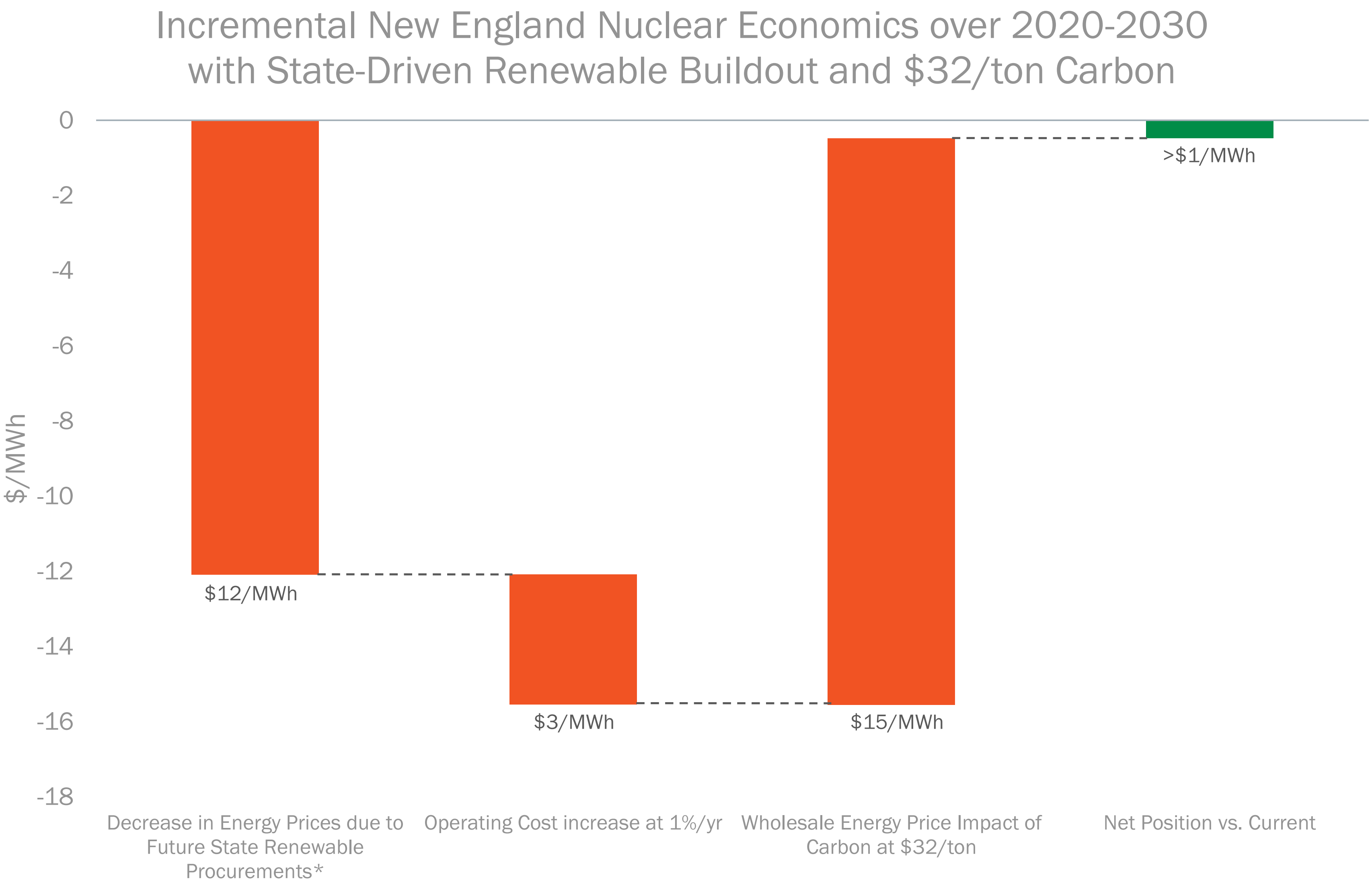
  - To prevent sudden consumer impacts, it may not be feasible to immediately incorporate the level of carbon pricing necessary to cover the cost of investment in new zero-carbon generation. A $32/ton price should be sufficient to keep largest existing zero carbon resources in-market

- From a consumer perspective, carbon pricing is not an additive expense but should allow REC prices, contract rates or FCEM prices to be proportionally lower

  - Future contracts can include a mechanism to offset contract rates with carbon price benefits dollar for dollar

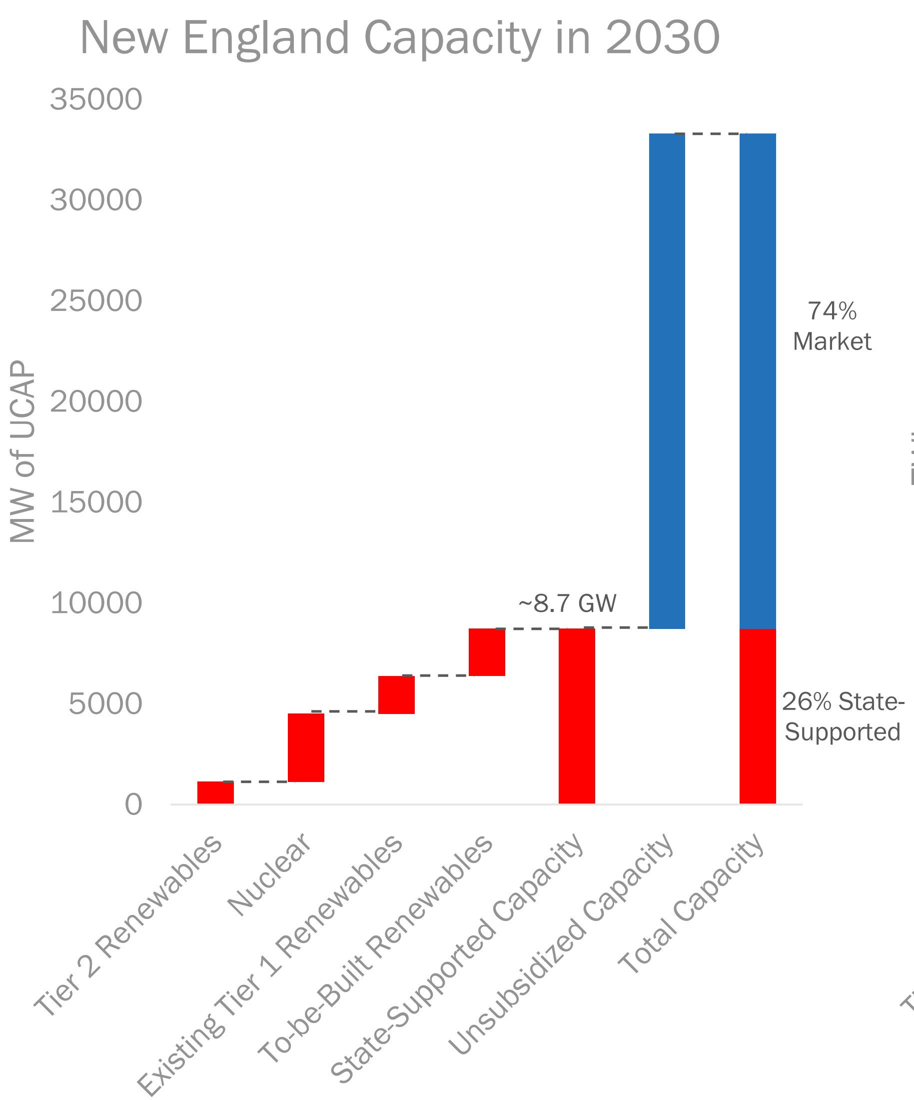
- Because the benefits of carbon pricing can be attained with or without these other mechanisms it should be thought of as a foundation upon which these other mechanisms can be layered to the extent they demonstrate merit.

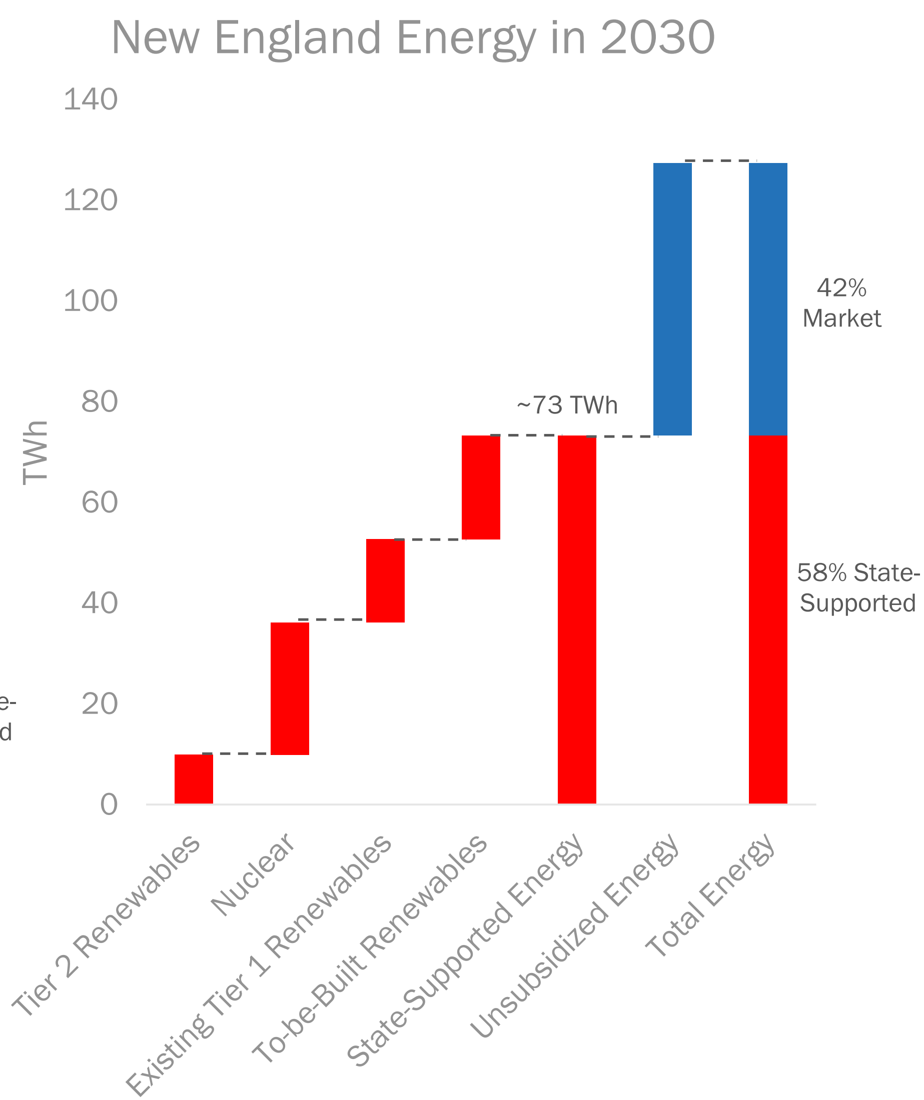
A $32/ton carbon price is sufficient to offset future price suppression and cost inflation for nuclear



* Based on ISO-NE 2016 Economic Study draft results. Estimate is derived by assuming 20.7 TWh of new renewables by 2030 (based on incremental growth in aggregate RPS targets plus MA legislation mandating purchase of 9.45 TWh of incremental clean generation) by a wholesale energy price impact rate of $0.59/MWh per TWh of new renewables based on comparison of constrained scenarios 3 and 5 (scenario 3 has +23 TWh of renewables driving $2.1 B/yr in reduced customer energy costs relative to scenario 5)

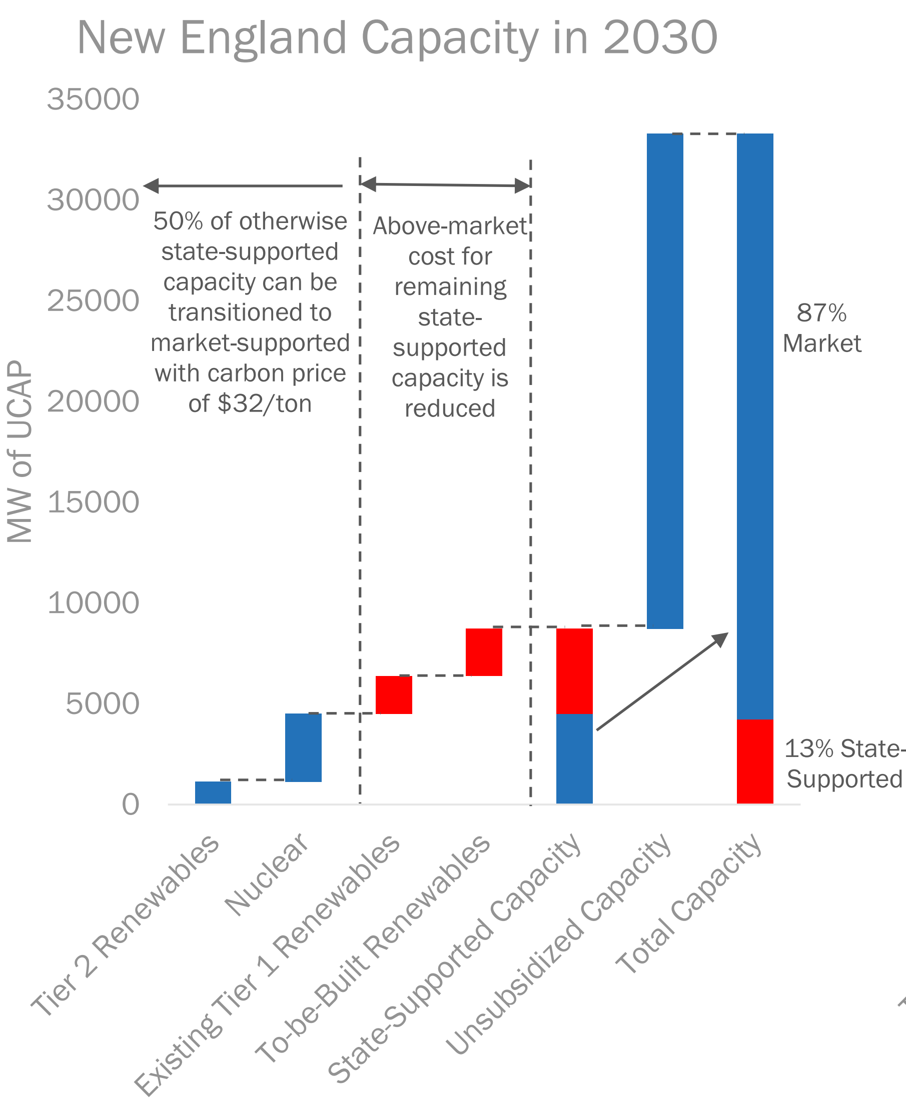
Under the current status quo, approximately 25% of capacity and 60% of energy will require state support by 2030

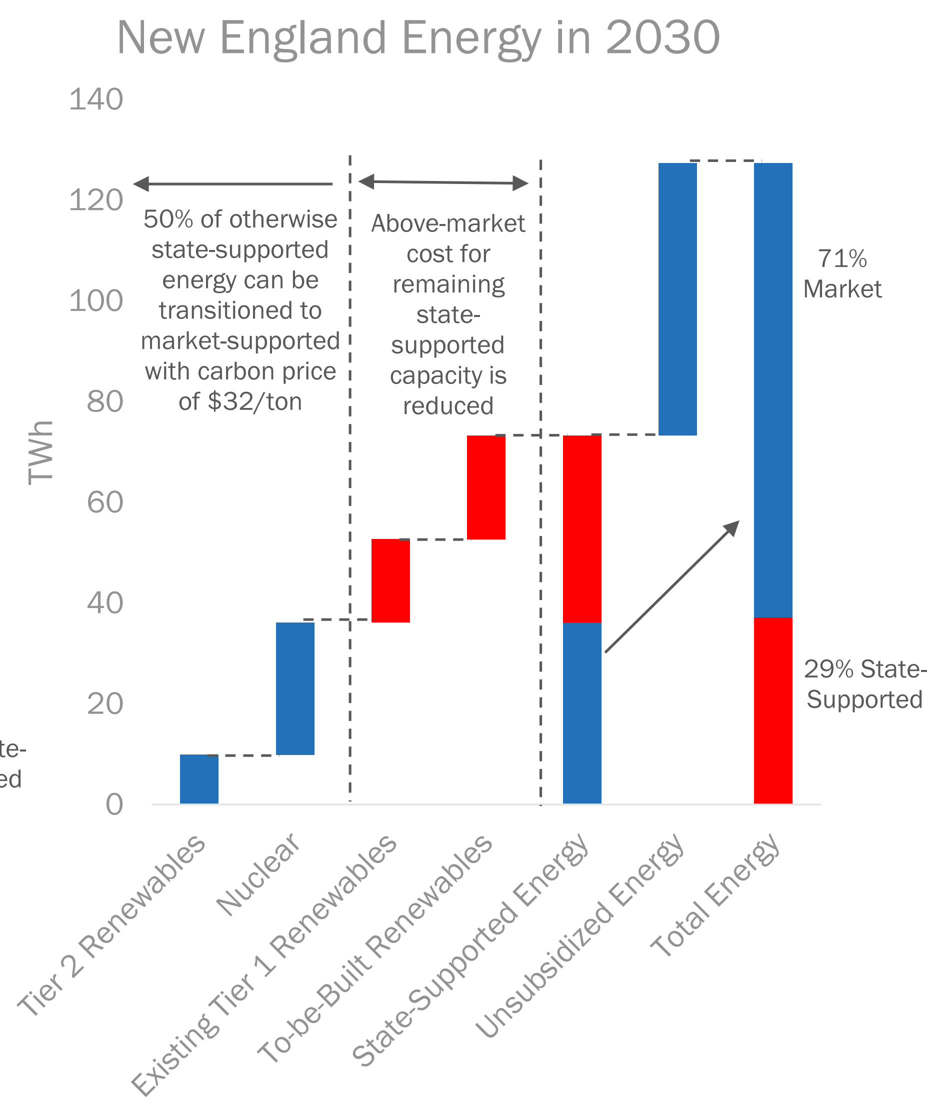




Note: To-be-built renewables includes 9.45 TWh of incremental clean generation specified in MA H. 4568

A $32/ton carbon price would transition about half of state-supported energy and capacity to market





Note: To-be-built renewables includes 9.45 TWh of incremental clean generation specified in MA H. 4568

Exelon.

Legal concerns are not unique to carbon price proposal, and in any event are surmountable

- The term "just and reasonable" is ambiguous and courts have recognized FERC has wide discretion to determine what is just and reasonable

- There is statutory and case law support for the concept that FERC can consider environmental issues in setting rates

- The same fundamental legal issue is raised by both the carbon price proposal and the various versions of the FCM-C/FCEM proposals. Both require FERC to accept as just and reasonable rates that reflect environmental goals.

Recommended Next Steps

- Continue work on refining proposals that have not reached the needed level of development
- Once all proposals have been developed, request that the ISO conduct an economic evaluation of the costs and benefits of each proposal, including carbon pricing
- Goal: identify the proposal that best balances the functioning of wholesale markets and cost to consumers while providing the states with the flexibility to meet their needs.

Brookfield

Carbon Adder and Cost Allocation

Aleks Mitreski

Aleksandar.mitreski@brookfieldrenewable .com

November 10, 2016

One of the largest public pure-play renewable businesses globally

100 years of experience in power generation

Full operating, development and power marketing capabilities

Over 2,000 operating employees

$25B
POWER ASSETS

Over **250** power generating facilities

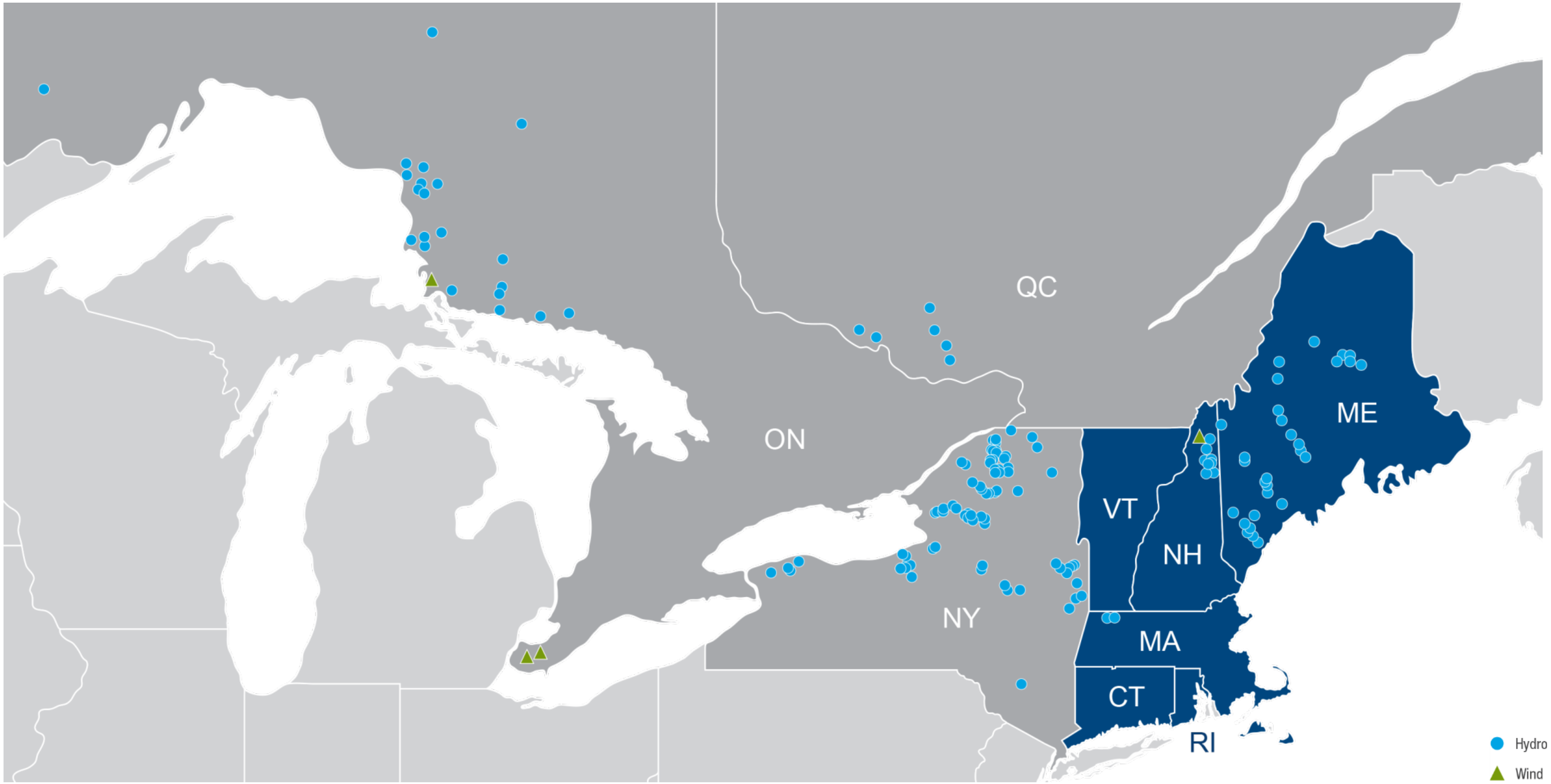
10,000+
MEGAWATTS OF CAPACITY

15 markets in **7** countries

87%
HYDROELECTRIC GENERATION

Situated on **81** river systems

NEW ENGLAND	NEW YORK	QUÉBEC	ONTARIO
49 Hydro Stations 1 Wind Farm 1,374 MW	74 Hydro Stations 711 MW	6 Hydro Stations 291 MW	21 Hydro Stations 3 Wind Farms 1,412 MW



Objective: Reduction of CO_2 emissions and meeting RPS goals

- Solution - Ensuring non-emitting resources receive priority in the energy market dispatch (i.e., maximizing MWh of non-emitting resources)

- The carbon adder solution meets this objective to new or existing resources, in a transparent, technology and vintage neutral, cost-effective, non-discriminatory way

Overview of today’s discussion points

1. Carbon adder can still allow states to pursue PPAs to non-emitting resources

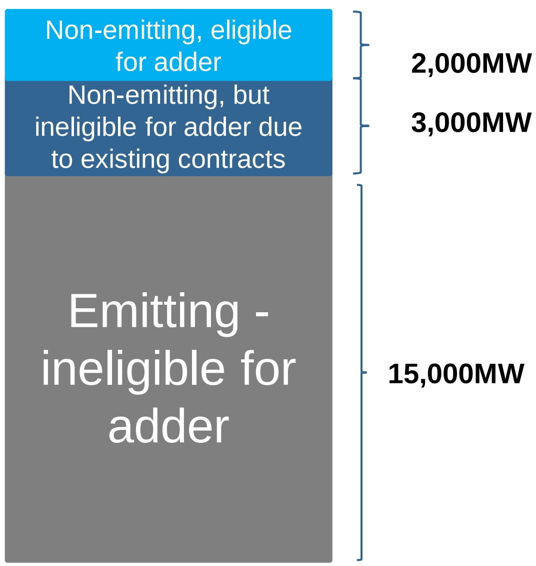
2. If a state has met its renewable mandates solely from contracts/PPAs then cost from the carbon adder is not allocated to that state
   - One state does not pay for the mandates of another state

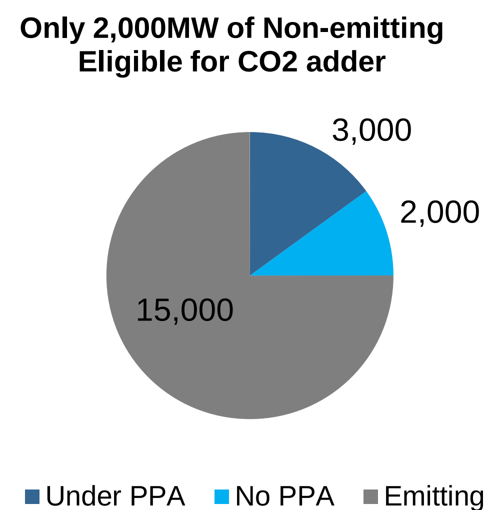
3. Existing resources without PPA receive compensation for their non-emitting attributes

4. GIS-like carbon tracker system will track generation from non-emitting generators to determine:
   a) Carbon adder eligibility
   b) RPS goals for each state
   c) Cost allocation

Eligibility to Receive the Carbon Adder

- Assume 20,000MW generated during an hour
  - 15,000MW are from carbon emitting generation **(Not receiving carbon adder)**
  - 3,000MW from non-emitting resources but claimed by a load in the carbon tracker due to an existing PPA that compensates the attribute **(Not receiving carbon adder)**
  - 2,000MW from unclaimed non-emitting resources **(Receiving carbon adder)**





- **Incremental cost of the carbon adder is only associated with the 2,000MW of unclaimed non-emitting MW**

Non-emitting generator with PPA enters in the carbon tracker its generation output to be claimed by the load that awarded the PPA and is ineligible for carbon adder			
Load that has contracted the generation via PPA can track the delivery	This non-emitting generator now becomes ineligible to keep the carbon adder (Similar how the PPA for energy works today)	On a monthly basis the carbon tracker adds up the hourly generation claimed per load and is compared against the state RPS goals	ISO-NE uses the claimed MWh per state for cost-allocation purposes

Non-emitting generation not claimed in the carbon tracker becomes eligible to receive the carbon adder		
Each state enters is RPS goals, so some may chose not to participate	If a state has a 20% RPS goals and has claimed 20% of it via the tracker then the state does not receive any cost allocation from the CO2 adder	If a state is short from its RPS goal, then can use unclaimed non-emitting generation from the tracker to meet its goal, and receives cost allocation

- Assume the carbon tracker identified that loads in MA, CT, RI were short claiming non-emitting generation to meet its RPS goals during a month
- Only these 3 states receive cost allocation from the carbon adder program
  - States can use these unclaimed non-emitting resources (2,000MW from earlier example) toward meeting their RPS goal (e.g., on a load-share basis)
  - **This can be viewed as market procurement of non-emitting attributes via the carbon adder since new or existing resources can be in this 2,000MW mix**

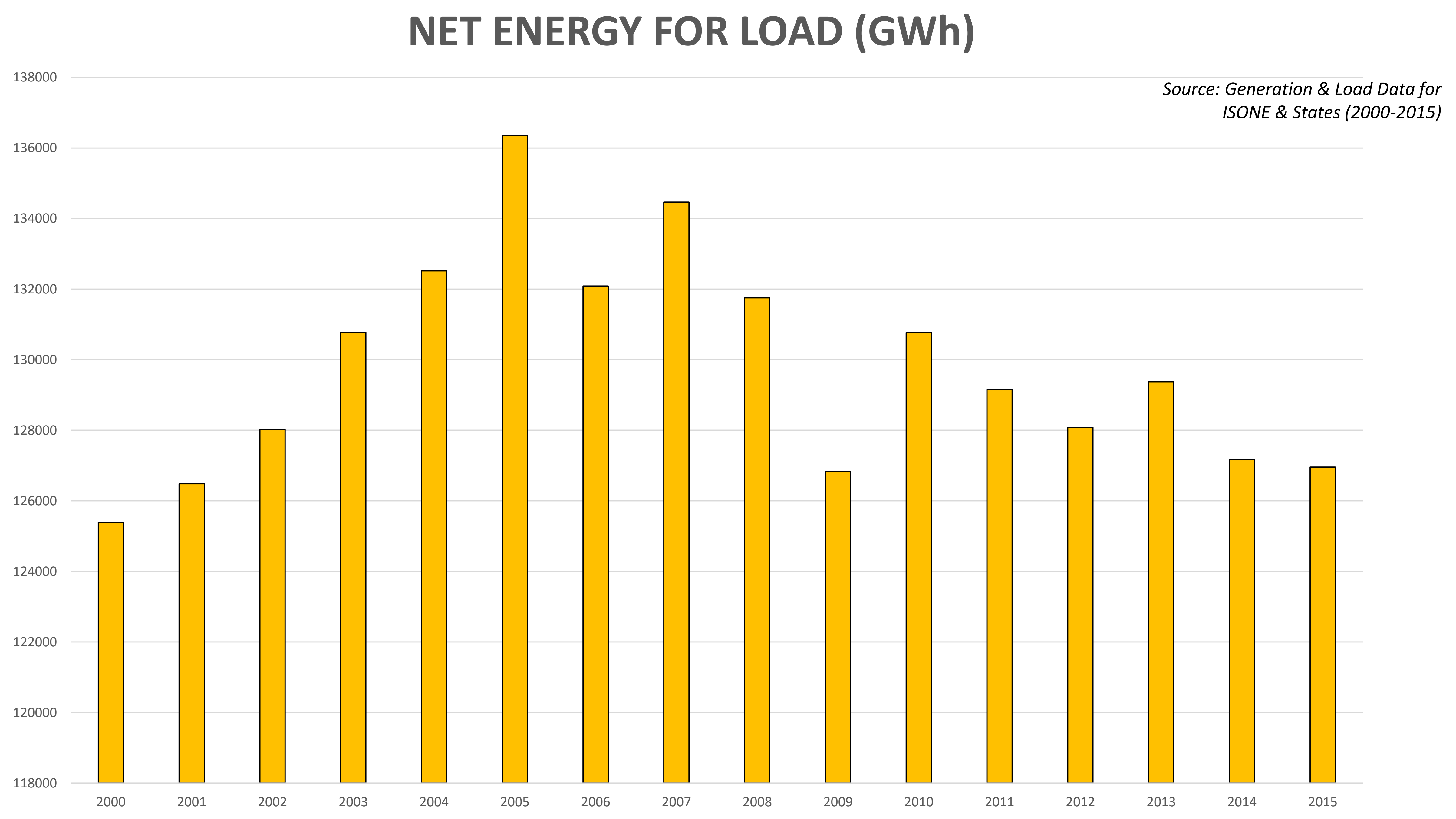
State	Goal	Claimed in carbon tracker MW from non-emitting with existing PPA as % of load	2,000MW of unclaimed non-emitting MW is now available to be assigned to deficient states on a load share basis	RPS Goal after claiming non-emitting MW that received the carbon adder	Receiving Cost Allocation of the Carbon Adder
MA	**20%**	**18%**	**1100MW**	**19%**	**Yes**
CT	**20%**	**17%**	**700MW**	**18%**	**Yes**
RI	**20%**	**16%**	**200MW**	**19%**	**Yes**
VT	20%	21%	0MW	N/A	No
ME	20%	20%	0MW	N/A	No
NH	0%	10%	0MW	N/A	No

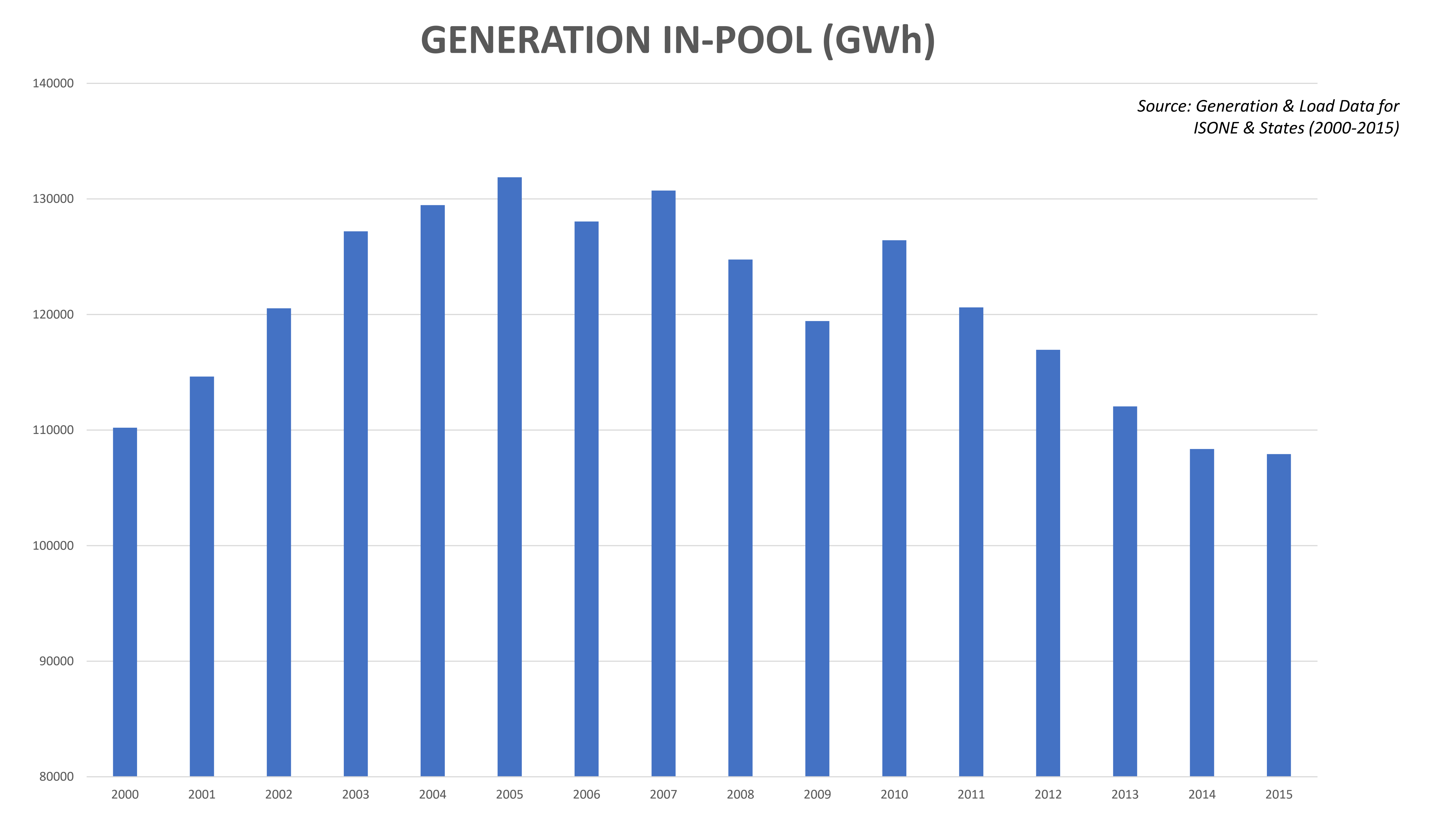
States can continue pursuing contracting via PPAs	New and existing resources with PPAs do not receive the carbon adder, which reduces/eliminates cost allocation of the carbon adder to that state/load
	Existing resources without PPAs receive revenue stream for their non-emitting attributes
	New non-emitting generation can come in the market and receive carbon adder without pursuing PPA
States procure non-emitting carbon resources based on their RPS needs	States that have met their are RPS goals do not get allocated cost from the carbon adder program
	States that are short of meeting their RPS goal can use unclaimed non-emitting MW to meet their goals
	One state does not pay for the mandate of another state
Value of carbon tracker for meeting RPS goals	Having generation be claimed in the tracker ensures that existing non-emitting generation remains on-line and is claimed by a New England state

ISO-NE IMAPP

ASSESSING TRENDS: LOAD, GENERATION, NET IMPORTS

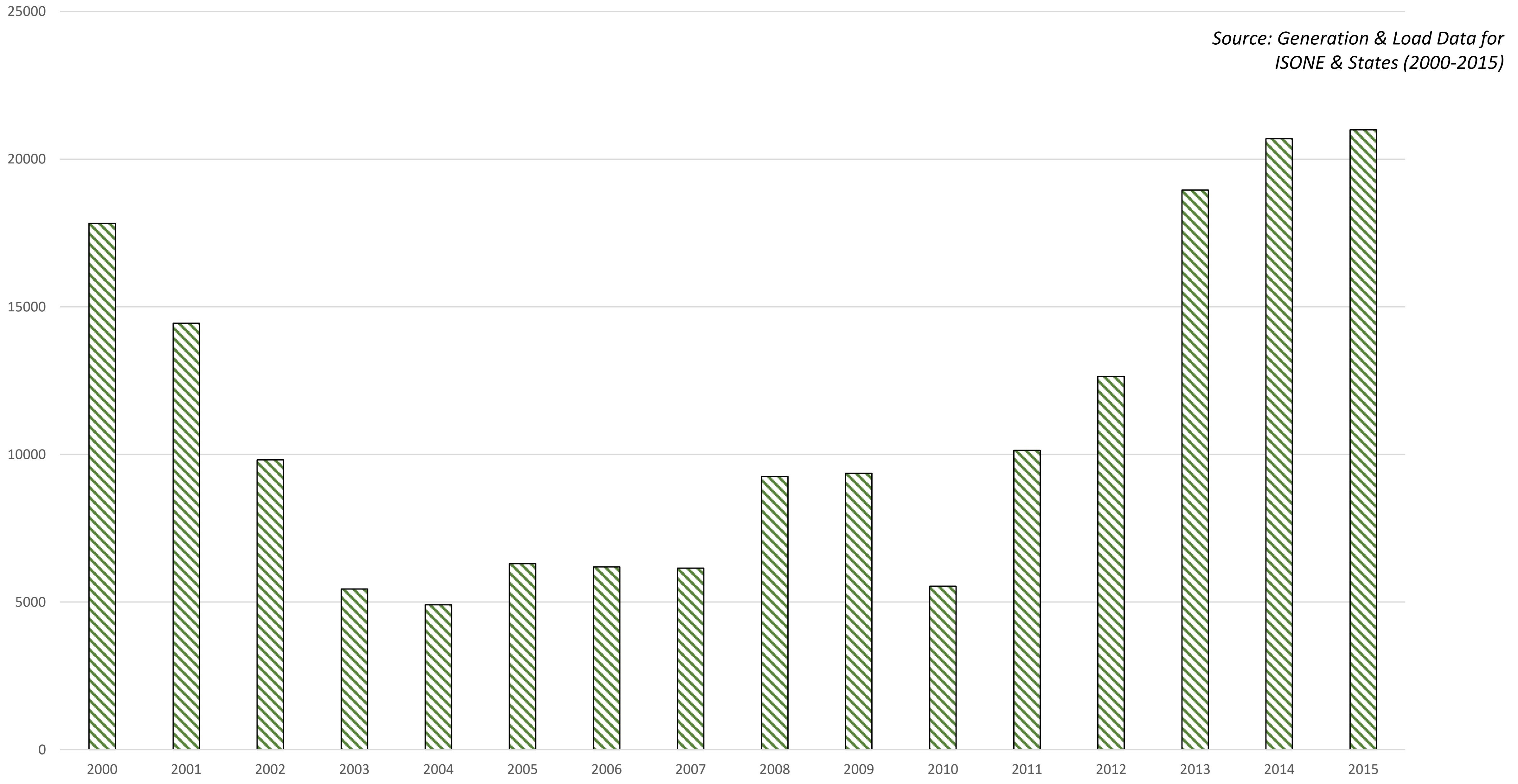
W. Short and L. Linowes
November 10, 2016


NET ENERGY FOR LOAD (GWh)
Source: Generation & Load Data for ISONE & States (2000-2015)
138000
136000
134000
132000
130000
128000
126000
124000
122000
120000
118000
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015

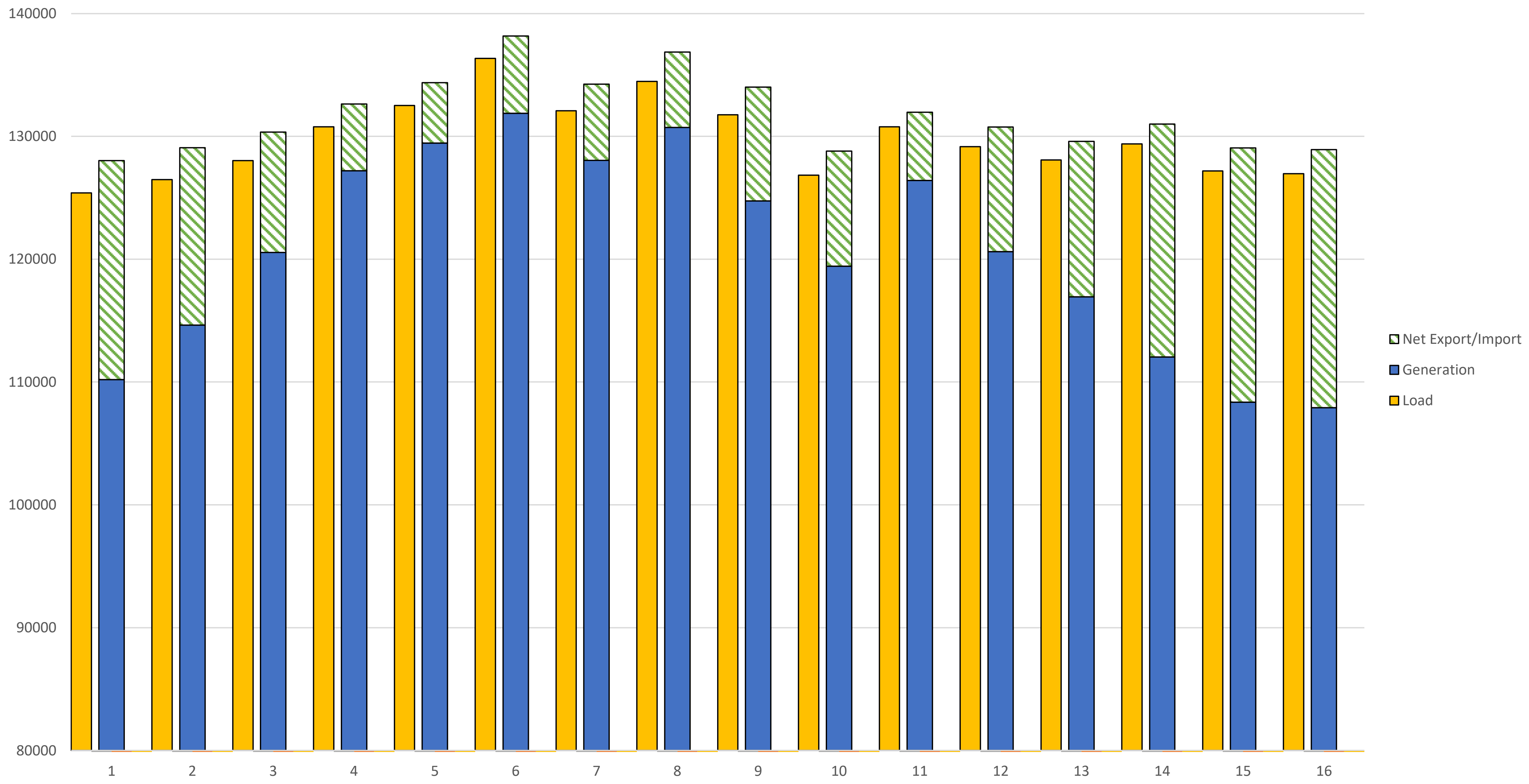


GENERATION IN-POOL (GWh)
Source: Generation & Load Data for ISONE & States (2000-2015)
140000
130000
120000
110000
100000
90000
80000
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015

NET IMPORTS/EXPORTS (GWh)



LOAD - GENERATION - NET IMPORTS/EXPORTS (GWh)



Source: Generation & Load Data for ISONE & States (2000-2015)

Fossil Generation Represents ~50% of Pool

Year	Fuel	# Certificates	Percent	CO2 Tons
2015	Fossil	60,654,985	54.3%	**34,493,201**
2015	CN Renewable	8,880,489	7.9%	13,414,622
2015	ZE Renewable	10,295,724	9.2%	328
2015	Nuclear	31,889,911	28.5%	0
	Total	111,721,109		47,908,151

Emissions Well Below RGGI Base of 52 million tons

Year	Fuel	# Certificates	Percent	CO2 Tons
2014	Fossil	55,650,327	49.8%	**31,360,941**
2014	CN Renewable	9,281,948	8.3%	15,161,514
2014	ZE Renewable	10,322,841	9.2%	0
2014	Nuclear	36,837,636	33.0%	0
	Total	112,092,752		46,522,455

Source: NEPOOL GIS

QUESTIONS?

Further Thoughts on Two-Tier Pricing

NEPOOL IMAPP Stakeholder Process

Pete Fuller
November 10, 2016

Outline

- Clarifications in Response to Feedback
- Key Objectives
- The Two-Tier Picture

Feedback

- Will two-tier pricing apply to resources with existing state support?
  — In general, no. NRG's proposal is to apply this treatment to *new* state-supported resources entering the market, and to existing resources that receive *new* state support.
- Will the NRG two-tier proposal result in FCM purchases 'on the demand curve?'
  — The results will be very close, if not identically, on the demand curve. By pro-rating the quantity of all obligations, the problem of 'over-buying' is resolved.
- Will the NRG two-tier proposal create incentives to depart from bidding risk-adjusted going-forward costs?
  — As Jim Wilson describes[1], there may be a slight incentive to shade bids slightly higher. Our expectation is that the reduction in risk and the increase in opportunity for two-settlement (PfP) payments will have a larger, offsetting effect.

1 http://nepool.com/uploads/IMAPP_20161021_NESCOE_2Tiered_Pricing_Analysis.pdf

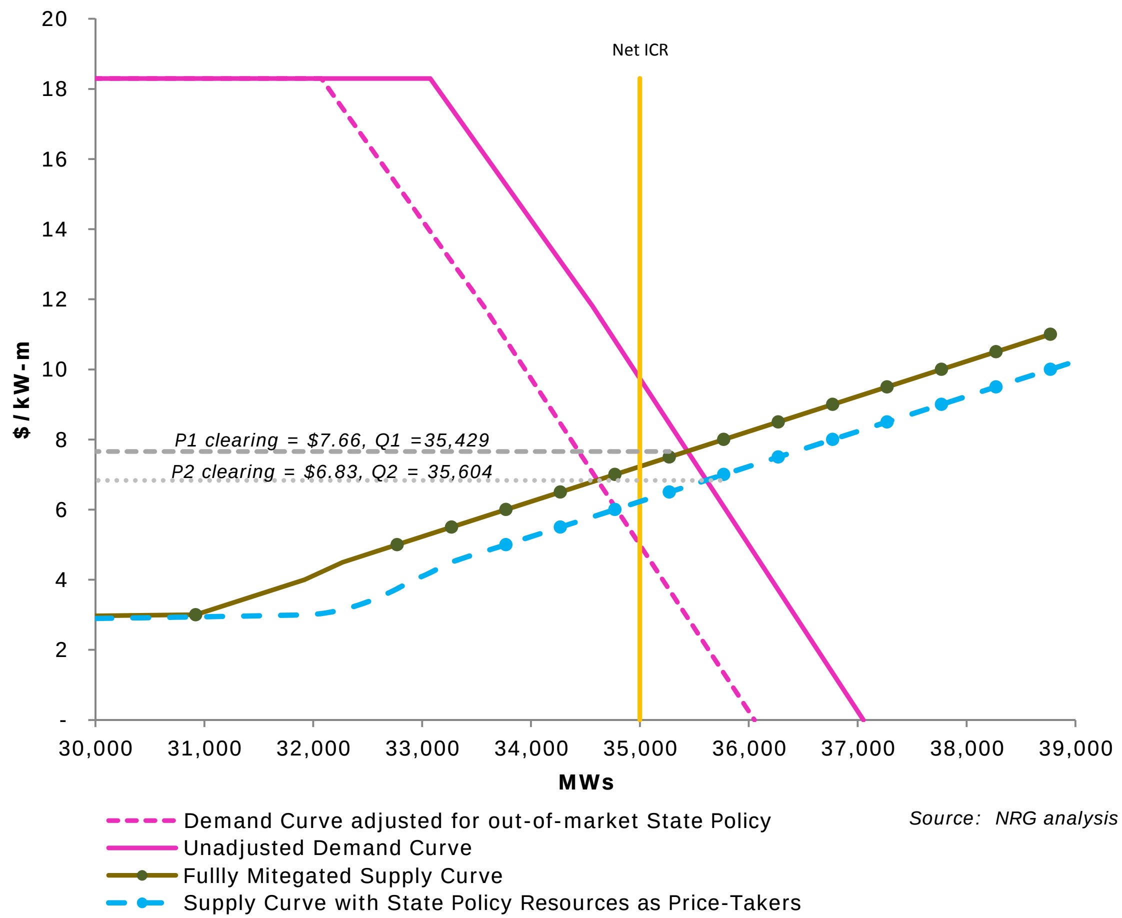
IMAPP Objectives

- ✓ **States' Objective 1**: Accommodate states' near-term procurement mandates in wholesale markets with existing or revised market rules, to maintain reliability at least cost.
  - ✓ States will be proceeding with mandated contracting processes
  - ✓ According to the States, the existing renewable technology resource (RTR) exemption 'reasonably accommodates' state objectives
- ✓ **Wholesale Suppliers' Objective 1**: Support and accommodate states' policy objectives without bearing the full cost of them through wholesale market price suppression
  - ✓ Just as states insist that policy mandates of one state not impose costs on consumers in another state, state policies should not impose undue burdens on investors relying on FERC-jurisdictional markets.
  - ✓ Wholesale markets are the basis for building and maintaining reliability infrastructure, and need to be free of distortion from entry and exit driven by non-market/non-economic factors

The near-term issue – FCM Price Formation

- ✓ With full application of mitigation, i.e., all resources offering at a competitive level (green supply curve), the clearing price in this example is **$7.66 / kW-mo**, and the cleared quantity is 35,429MW.
  - o The total market cost is $7.66/kW-mo x 35,429MW = **$3,257 million**
- ✓ With 1,000MW of State Policy (SP) Qualified Capacity inserted as price-takers (blue supply curve), the clearing price is **$6.83 / kW-mo**, and the cleared quantity is 35,604MW
  - o The total (market) using the blue curve would be $6.83/kW-mo x 35,604MW = **$2,918 million**
  - o *This is the price-suppression effect of out-of-market capacity*
- ✓ Adjusting the market demand (dotted pink demand curve) leads to similar price suppression. Clearing with the green supply stack, the clearing price would be **$6.83 / kW-mo**, and the cleared quantity would be 34,604MW
  - o The total market cost is $6.83/kW-mo x 34,604MW = **$2,838 million**

Illustrative FCM auction pricing

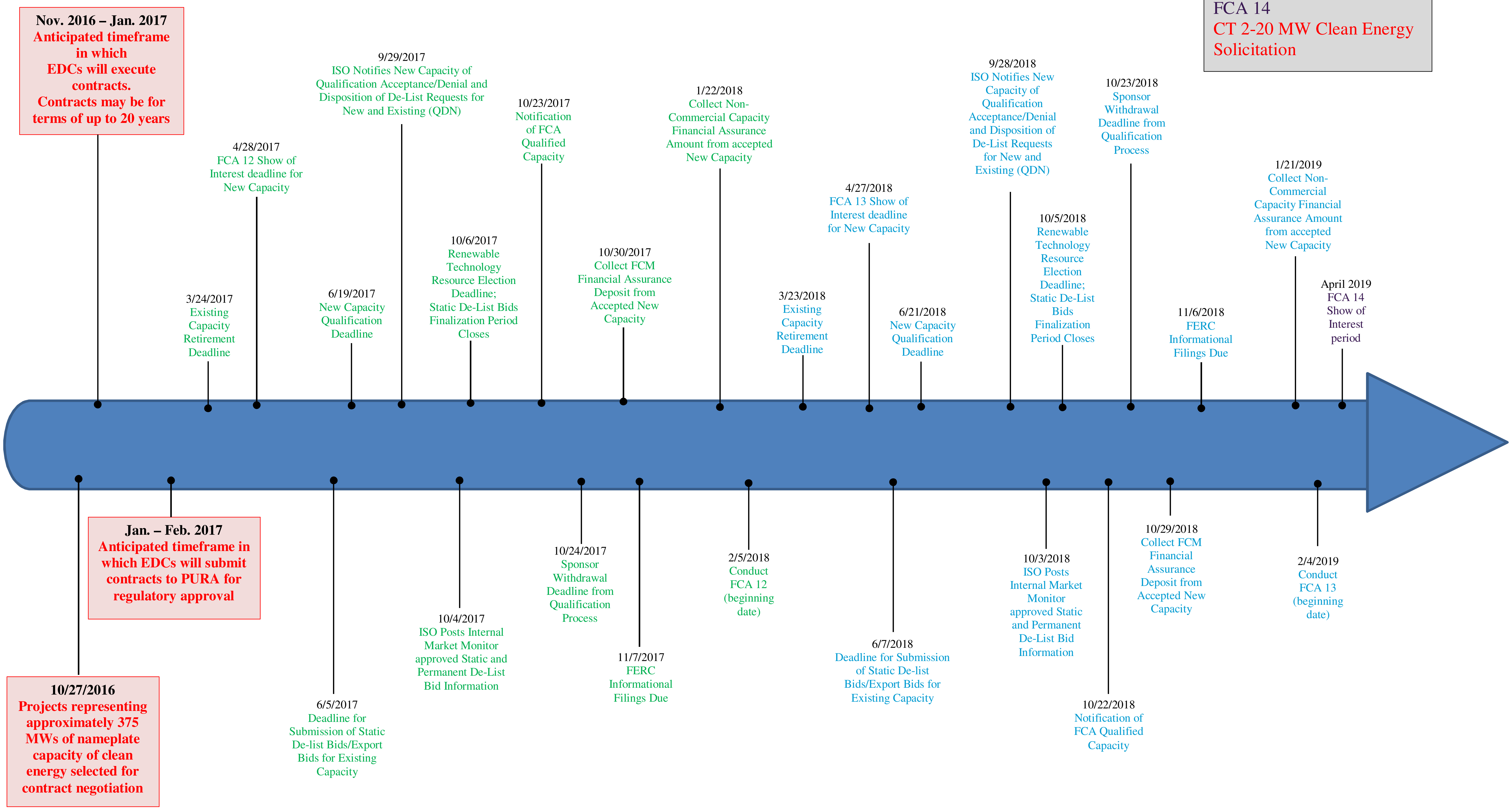


Source: NRG analysis

Questions?

Timeline: FCM and CT 2-20 MW Clean Energy Solicitation

Key:
FCA 12
FCA 13
FCA 14
CT 2-20 MW Clean Energy Solicitation



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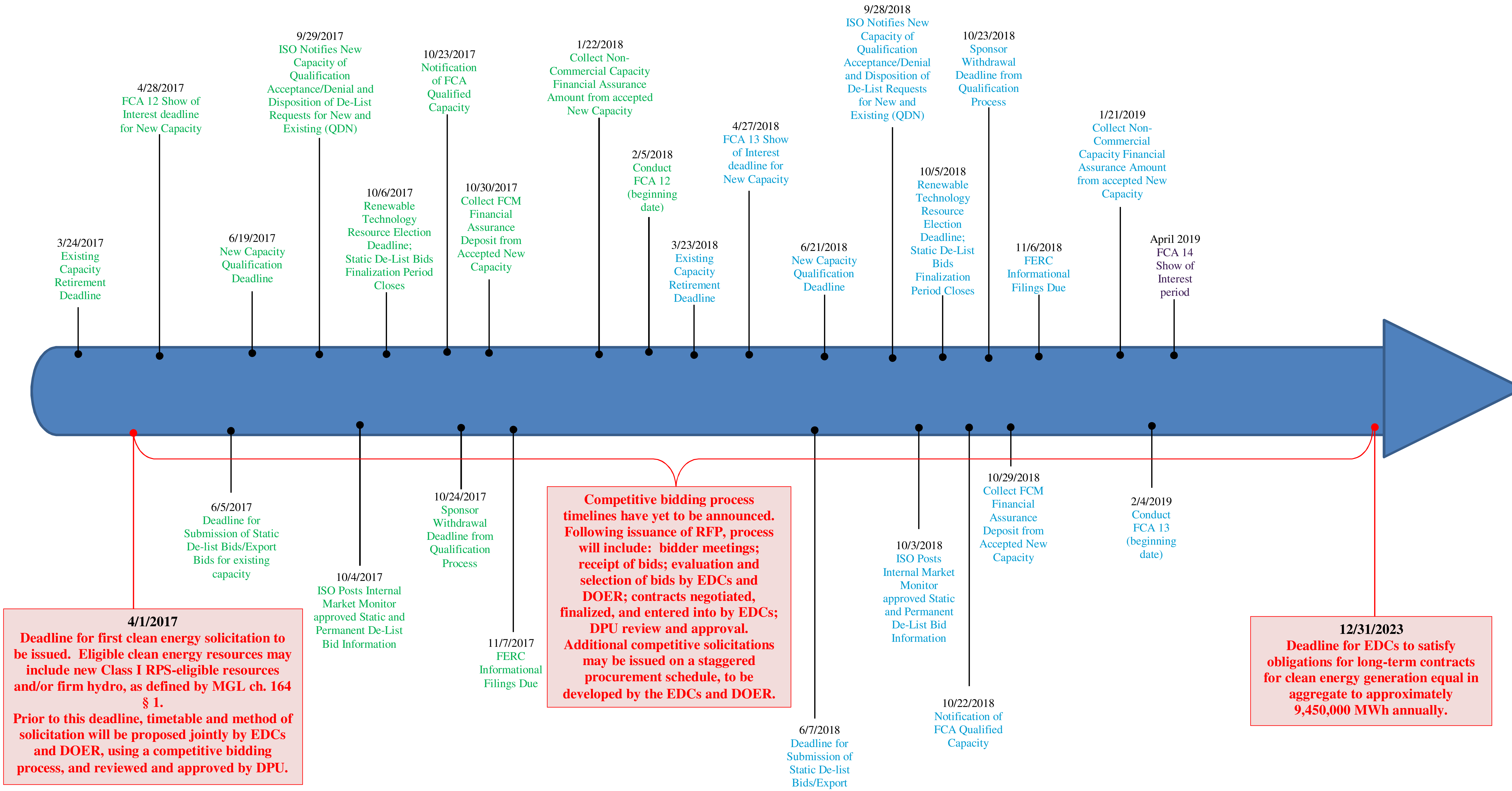
As of 11/7/2016

Timeline: FCM and MA Clean Energy Solicitation

Key:
FCA 12
FCA 13
FCA 14
MA Clean Energy Solicitation



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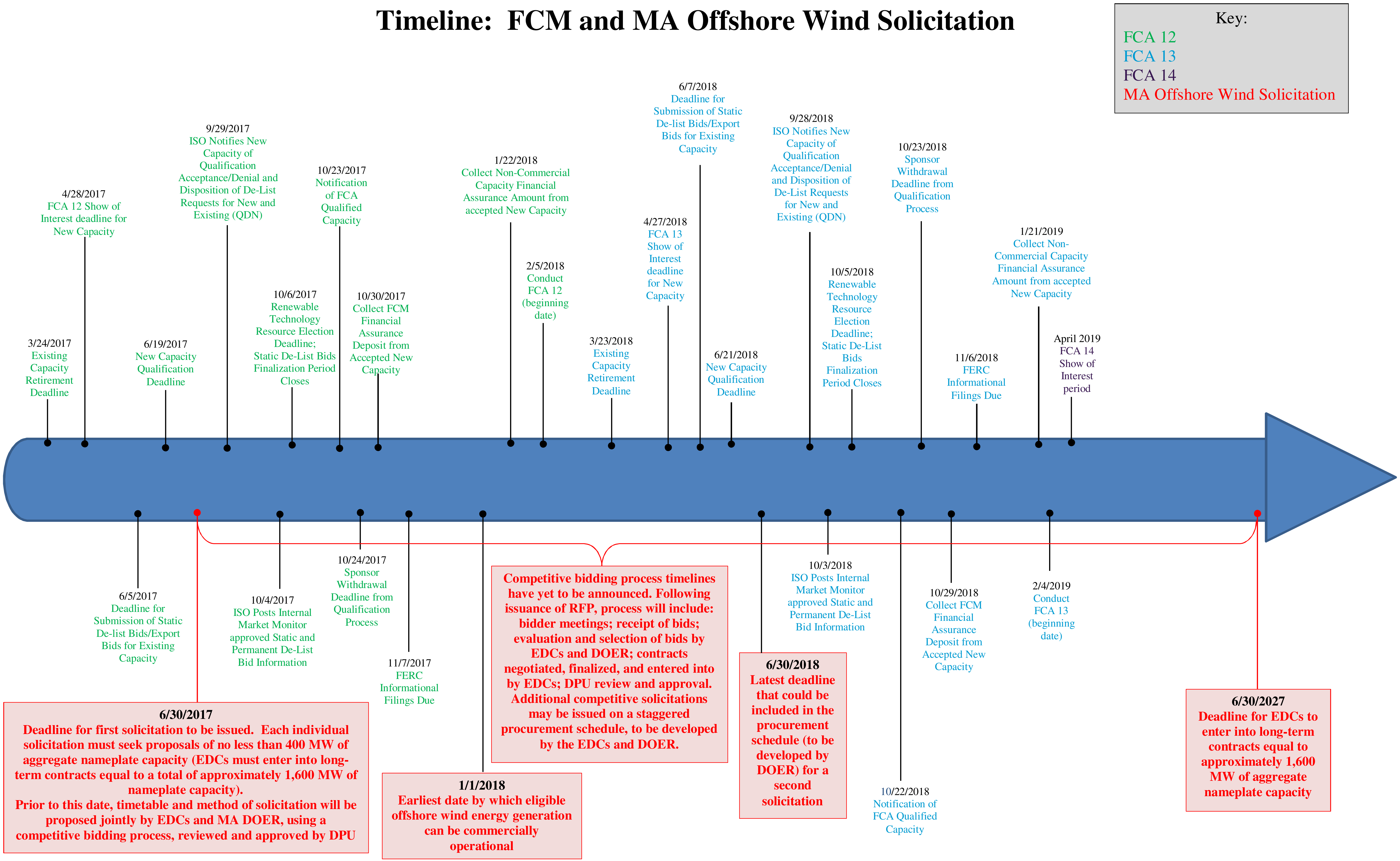
As of 11/7/2016

Timeline: FCM and MA Offshore Wind Solicitation



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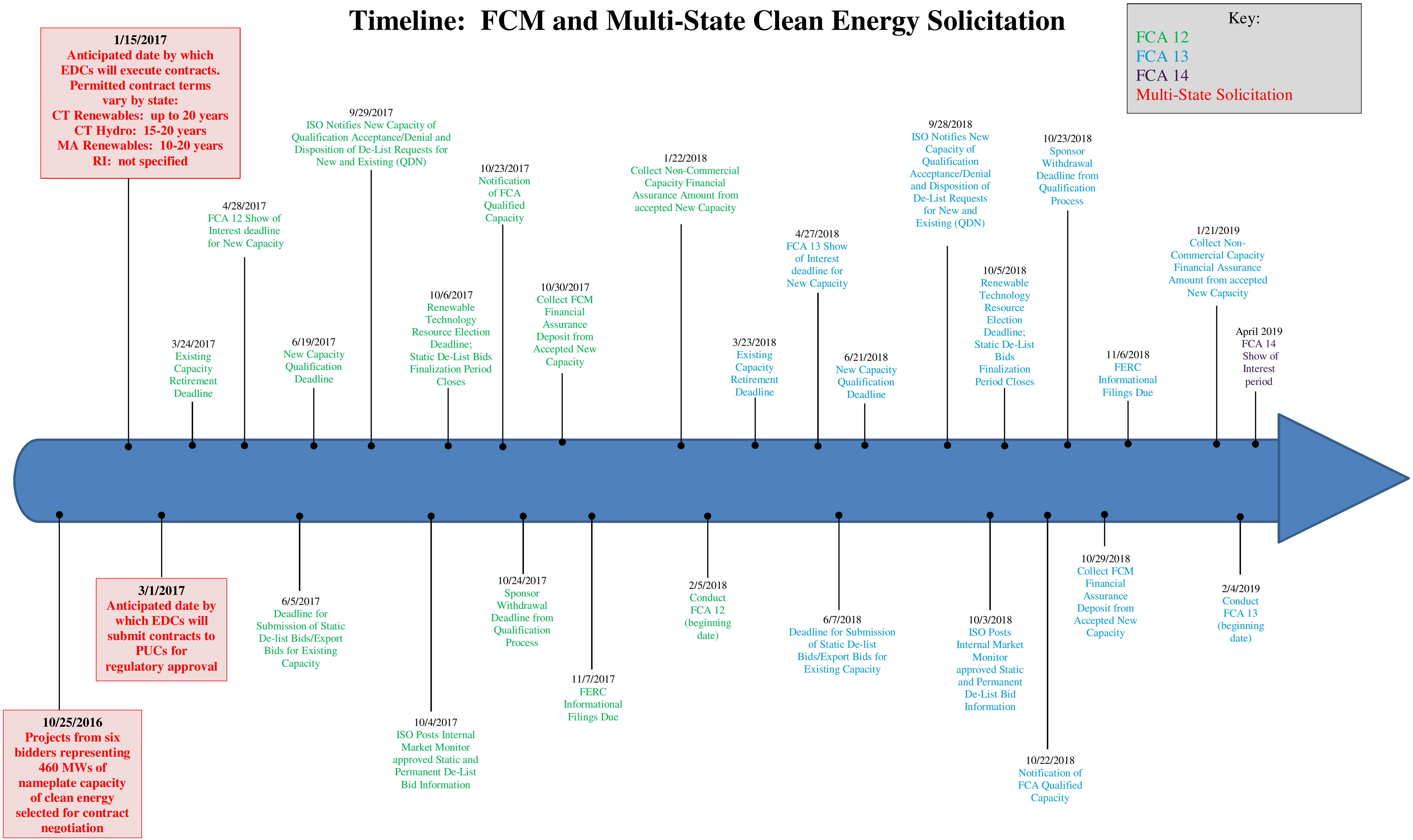
As of 11/7/ 2016

Timeline: FCM and Multi-State Clean Energy Solicitation



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As of 11/7/2016

NEW ENGLAND POWER POOL

M E M O R A N D U M

TO:	NEPOOL Members, New England State Officials, ISO New England and Invited Guests
FROM:	NEPOOL Counsel and Secretary
DATE:	November 9, 2016
RE:	Integrating Markets and Public Policy (IMAPP) – Revised Stakeholder Schedule

This memorandum lays out a suggested revised schedule for the IMAPP process, reflecting what has been learned over five IMAPP meetings. At the beginning of this process, an admittedly aggressive schedule was issued in an effort for NEPOOL to be able at its December 2, 2016 Annual Meeting "to provide guidance to ISO New England (ISO-NE) on adjustments to New England's wholesale power markets to be pursued to accomplish public policy objectives of New England states through the wholesale power market." As reflected in the Chairman's October 2 message circulated prior to the third IMAPP meeting, "I … believe we need to step back, to take a breath, to ease off from the break-neck speed we have been traveling, and to recalibrate our efforts together." The suggested revised schedule is intended to do just that.

As with the initial proposed schedule, this revised schedule has been assembled by NEPOOL leadership with preliminary input from ISO-NE staff and NESCOE staff. Please let us or a NEPOOL Officer know if you have comments on this revised schedule, which will be reviewed at the November 10 IMAPP meeting.

Future IMAPP Meetings and Process?

NEPOOL's revised process for IMAPP is intended to provide an opportunity for the organization to advance what had been originally envisioned for the October – December 2016 timeframe into a Q1/Q2 2017 timeframe (original schedule can be viewed at: http://nepool.com/uploads/IMAPP_Stakeholder_Schedule_Summary_20160719.pdf). All materials for the IMAPP meetings to date are posted at: http://nepool.com/IMAPP.php.

Optimistically, with the benefit of additional input from the IMAPP group, the States, and ISO-NE, and any further refinement of proposals, NEPOOL could be in a position late in the first quarter or in the second quarter of 2017 to take the previously contemplated indicative vote on one or more conceptual proposal(s). As indicated in the initial proposed stakeholder schedule, "[t]he form of vote would be formulated with the intent of providing sufficient guidance to the States and ISO-NE that could be used to set a clear path forward." To clarify, NEPOOL counsel expects that, if NEPOOL were to decide to proceed with an indicative vote, that vote would precede any necessary impact studies, conversion of proposals to more detailed framework designs and documents, and potentially ultimately to Tariff language on the supported conceptual proposal(s) that would subsequently be developed within the standard FERC-approved NEPOOL process. To get to the point of an indicative vote, the following revised process is suggested, with at least two additional IMAPP meetings contemplated in 2017:

November 10, 2016 Meeting – A proposed agenda for this meeting has been circulated previously and posted. That agenda includes a summary for stakeholders on the preliminary results of the scenario analyses that ISO-NE has been performing in response to earlier NEPOOL requests and that are being discussed in detail at ISO-NE's Planning Advisory Committee. The agenda will also entertain further discussions on conceptual proposals, including FCM-C, FCEM, and carbon pricing in the energy market. For perspective on the timing of recent public policy objectives, the stakeholders will receive at the November 10 meeting timelines that overlay certain scheduled State-mandated solicitations with future Forward Capacity Auctions.

January 25, 2017 Meeting – The time period between the November 10 meeting and this proposed late January meeting is intended to accomplish the following:

- permit and encourage proponents to engage productively in "off-line" discussions with State officials, ISO-NE staff, and other interested stakeholders in efforts to further refine, combine or augment their proposals;
- provide ISO-NE, with the benefit of additional time, the opportunity to better reflect upon, and provide further feedback on, IMAPP discussions to date, including any additional input on conceptual proposals and thoughts on potential next steps; and
- provide State officials, with the benefit of additional time, the opportunity to provide further input on any conceptual proposals and/or propose adjustments to conceptual proposals.

The plan at this point for the January 25, 2017 meeting will be for proponents to have the opportunity to present any new, updated or refined proposals and the group to hear further input/feedback from the ISO and NESCOE, and to discuss expectations for future IMAPP process.

Additionally, at the outset of this process, NESCOE indicated that it was conducting a study of potential state-jurisdictional mechanisms. NESCOE's study was timed to conclude in December 2016. This was to enable consideration of state-jurisdictional mechanisms simultaneously with any potential wholesale market mechanism(s) that might have emerged from the IMAPP process. NESCOE has indicated to us that it expects to be able to share the results of its study with the IMAPP group.

February 16, 2017 Meeting – This additional meeting in February 2017 would provide stakeholders the opportunity, after hearing from ISO-NE, NESCOE and others on January 25, to identify any refinements or details on any of the proposals that would be useful for the NEPOOL members, ISO, and the States to explore at any further IMAPP meetings and to confirm any future plans for the indicative NEPOOL vote described above or any future action by NEPOOL through its regular FERC-approved stakeholder processes.

NEPOOL

NEW ENGLAND POWER POOL

Proposed Schedule for IMAPP Process

November 2016

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
30	31	1	2	3	4 NPC	5
6	7	8	9 TTF STF MC	10 IMAPP MRWG	11 Veterans Day	12
13	14 MEMB	15 RC	16 PAC	17 TC	18	19
20	21	22 B&F	23	24 Thanksgiving	25 Thanksgiving	26
27	28	29 STF	30 TTF DRWG	1	2	3

December 2016

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
27	28	29	30	1 CLG	2 NPC	3
4	5 VRWG	6 MC	7 MC	8 MRWG	9	10
11	12 MEMB	13 RC	14 STF TTF PAC	15 TC	16 DGWG	17
18	19	20	21	22	23	24
25	26 Christmas	27	28 DRWG	29	30	31

January 2017

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
1	2 New Years Day	3	4	5	6 NPC	7
8	9	10 MC	11 MC	12 MRWG	13	14
15	16 MLK Day	17 RC	18 MEMB PAC	19	20	21
22	23	24 STF TC	25 IMAPP TTF DRWG	26 B&F	27	28
29	30	31	1	2	3	4

February 2017

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
29	30	31	1	2	3 NPC	4
5	6	7 MC	8 MC	9 MRWG PAC	10 B&F	11
12	13 MEMB	14	15 RC	16 IMAPP	17	18
19	20 Presidents Day	21 TC	22 DRWG	23	24	25
26	27	28 STF DGWG	1	2	3	4

March 2017

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
26	27	28	1 TTF	2	3 NPC	4
5	6 VRWG	7 MC	8 MC	9 MRWG	10	11
12	13 MEMB	14	15	16	17	18
19	20	21 RC	22 PAC	23 PAC	24	25
26	27 B&F	28 STF TC	29 TTF DRWG	30	31	1