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Planning for Resource Adequacy with a Forward Capacity Market

ESIG's Future Directions for Market Design and System Planning

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Forward Capacity Market (FCM) Overview

- **Resource Adequacy**: Procures resources to meet New England’s forecasted capacity needs 3 years in the future
- Selects a portfolio of **supply** and **demand** resources through a competitive Forward Capacity Auction (FCA) process
- Allows **new capacity projects** to compete in the market and set the price for all capacity in the region
- Provides a long-term commitment to new supply and demand resources to encourage **investment**
- The FCM is an opportunity to cover the **missing money problem** facing resources needed, but not actually used often

Pay for Performance In the Capacity Market

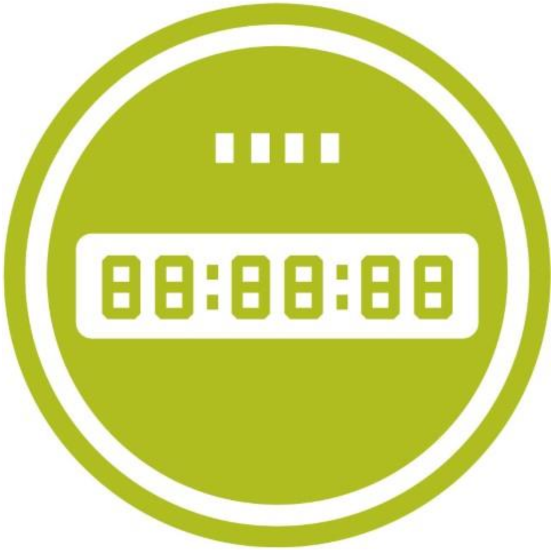
Charges collected from *under*-performing resources are credited to *over*-performing resources

- Under-performing resources get charged

- Over-performing resources get paid

– The rate ($2,000/MWh) is the same for all resource types
– It is ***not*** necessary to have a CSO to receive a credit; *any* resources providing energy or reserves will receive a performance credit

The Forward Capacity Market Is Attracting New Resources Amid Retirements

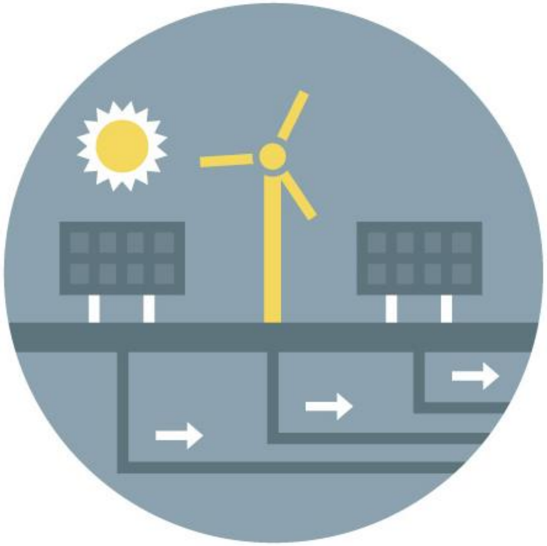


Demand Resources

energy-efficiency and active demand response resources

Natural Gas Resources

efficient and fast-starting gas resources, many with dual-fuel capability

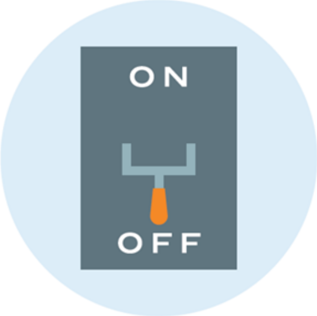


Renewable Resources

onshore and offshore wind, solar photovoltaics, and fuel cells

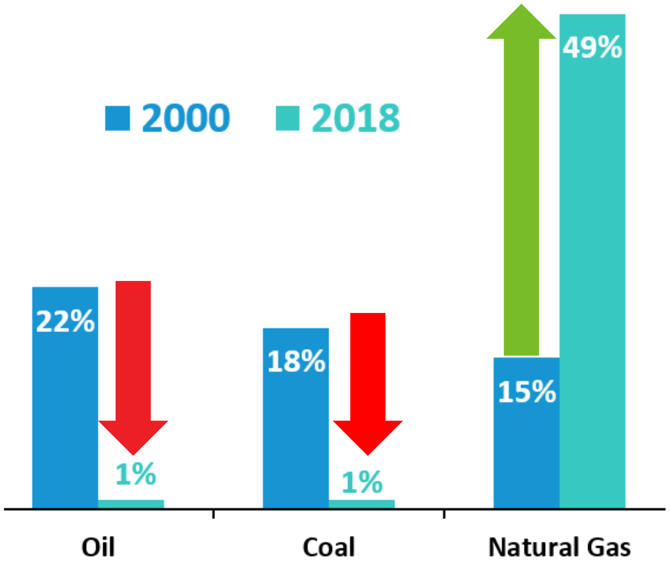
FCA #13 Attracted and Retained a Variety of Resources to Ensure Resource Adequacy in 2022-2023

- The auction concluded with commitments from **34,839 MW** of capacity to be available in 2022-2023
  - 29,611 MW of **generation**, including 783 MW of new generation in the primary auction and 54 MW of new generation in the substitution auction
  - 4,040 MW of **energy-efficiency and demand-reduction measures**, including 654 MW of new resources
  - 1,188 MW of total **imports** from New York, Québec and New Brunswick
- Roughly 2,009 MW of resources submitted **retirement de-list bids,** while an additional 40 MW of resources submitted permanent de-list bids
  - ISO New England retained two units, **Mystic 8 and 9**, for 2022-2023 for fuel security reasons



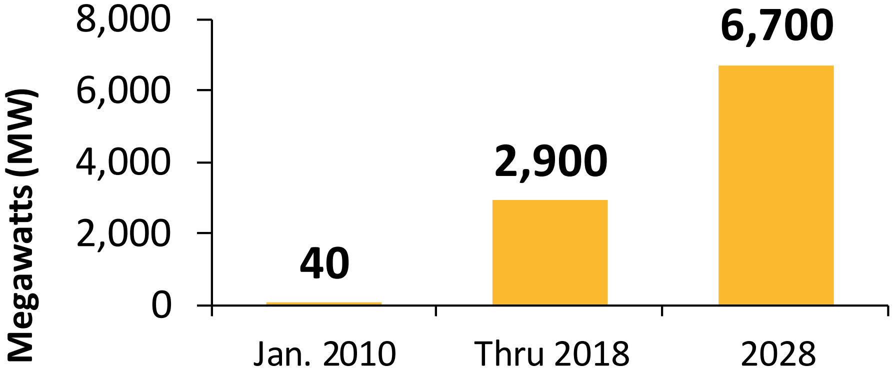
New England’s Energy Mix Is Changing Dramatically

Gas has displaced oil and coal for electric generation …



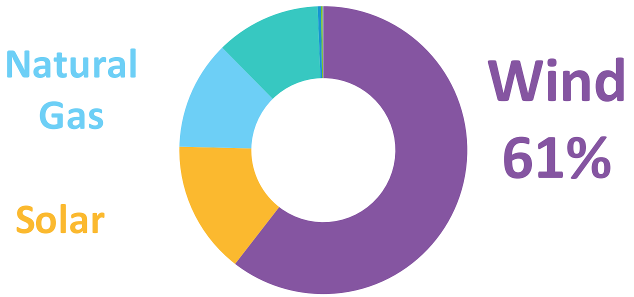
Source: *ISO-NE Net Energy and Peak Load by Source*
Electric generation within New England; excludes imports and behind-the-meter (BTM) resources, such as BTM solar.

… as solar grows steadily …



Source: *Final 2019 PV Forecast (March 2019); MW values are AC nameplate*

… and wind dominates the queue …



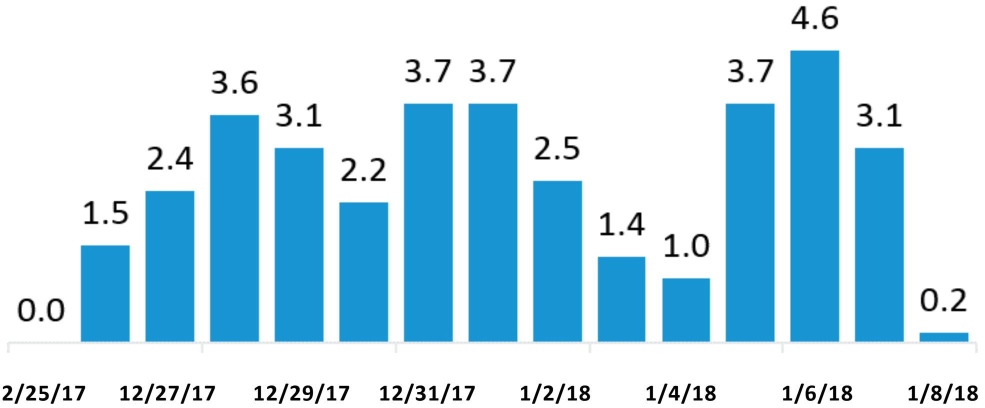
Source: ISO-NE Generator Interconnection Queue (June 2019)

Cold Weather Exposes New Reliability Risks

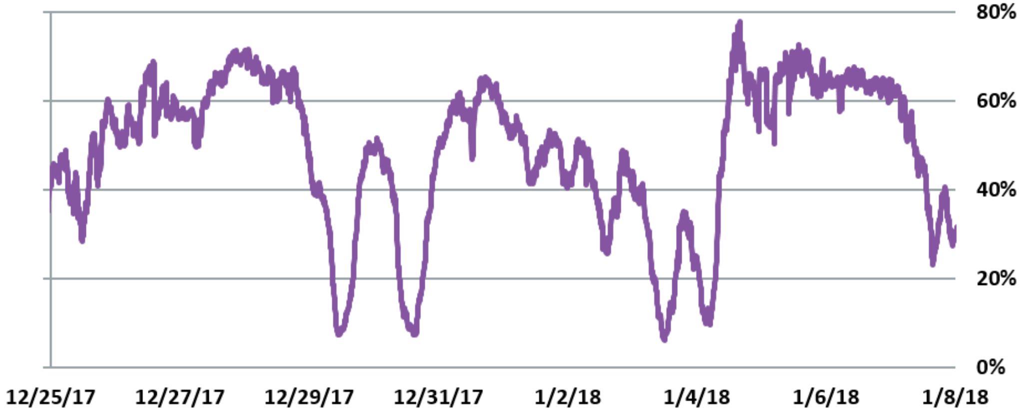
- Natural gas generation is **severely limited** due to infrastructure constraints
- During **extended cold** weather, renewable energy output can be highly variable
- Both technologies rely on **just-in-time delivery** of their energy sources

Sources: ISO-NE Cold Weather Operations (2/2018, p. 50); ISO-NE Seven Day Capacity Forecast, Anticipated Cold Weather Outages (12/25/17-1/8/18)

Estimated Unavailable Natural Gas Generation Capacity (GW) Dec. 25, 2017 – Jan 8, 2018



***Output from Wind Fleet Generation – Dec. 25, 2017 – Jan 8, 2018** (Share of Nameplate)*



Energy Security Improvements are Coming

- ISO proposes new "on call" energy option products within a co-optimized, day-ahead market
- Addresses two inter-related shortcomings of the region's existing energy market design:
  - **a) Insufficient market incentives** for additional energy supply arrangements (e.g., procure LNG inventory, transportation of fuel oil, LNG storage, price-sensitive demand, grid-scale batteries)
  - b) There are many GW of resources that do not receive day-ahead energy awards, *yet* the ISO **relies upon those resources** to meet the system's next-day operating plan requirements

These resources are not presently compensated for the ***"option value"*** *they provide to a reliable power system each day*

See: https://www.iso-ne.com/static-assets/documents/2019/04/a00_iso_discussion_paper_energy_security_improvements.pdf

Generators Can Lose Money for Making Advanced Fuel Arrangements Under Current Market Design

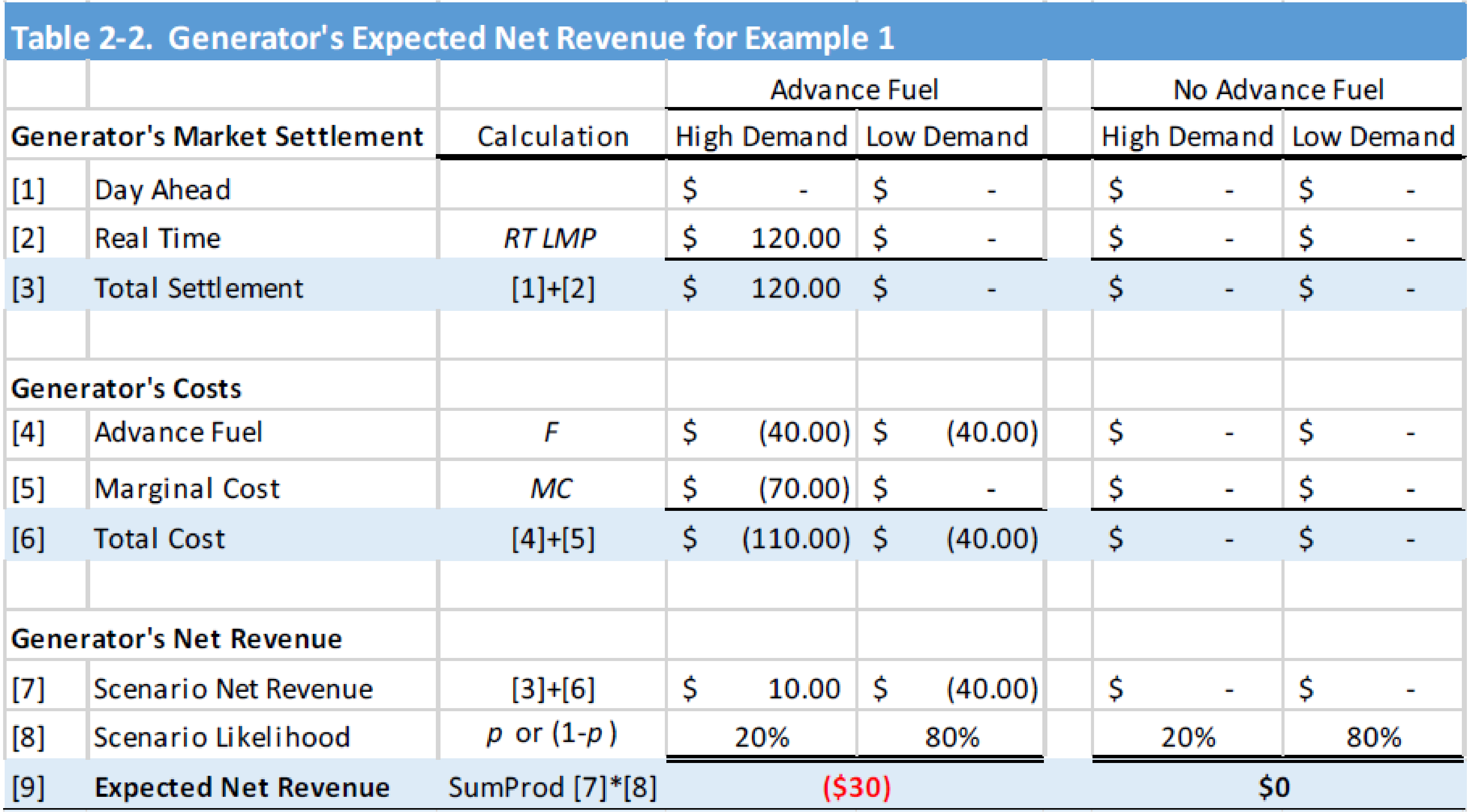


Table 2-2. Generator's Expected Net Revenue for Example 1

			Advance Fuel		No Advance Fuel	
Generator's Market Settlement		Calculation	High Demand	Low Demand	High Demand	Low Demand
[1]	Day Ahead		$ -	$ -	$ -	$ -
[2]	Real Time	*RT LMP*	$ 120.00	$ -	$ -	$ -
[3]	Total Settlement	[1]+[2]	$ 120.00	$ -	$ -	$ -
Generator's Costs						
[4]	Advance Fuel	*F*	$ (40.00)	$ (40.00)	$ -	$ -
[5]	Marginal Cost	*MC*	$ (70.00)	$ -	$ -	$ -
[6]	Total Cost	[4]+[5]	$ (110.00)	$ (40.00)	$ -	$ -
Generator's Net Revenue						
[7]	Scenario Net Revenue	[3]+[6]	$ 10.00	$ (40.00)	$ -	$ -
[8]	Scenario Likelihood	*p* or (1-*p*)	20%	80%	20%	80%
[9]	**Expected Net Revenue**	SumProd [7]*[8]	($30)		$0	

Three New Co-Optimized Day-Ahead Energy Option Products Being Considered

1. **Generation contingency reserves,** the (existing) fast-response reserve products that address sudden supply loss situations

2. **Replacement-energy reserves,** to ensure "on call" energy within 1.5-to-4 hours to restore contingency reserves and for uncertainty in the load forecast and resources' performance (e.g., a day-ahead cleared resource that is unexpectedly unable to operate)

3. **Load-balance (or 'energy imbalance') reserves,** to supply the difference if forecast next-day energy demand exceeds the physical supply cleared in the Day-Ahead Market

*These products provide a greater "**margin for uncertainty**"*
in our increasingly energy-limited grid

Paying for a “Call Option” on Energy Provides Incentives to Make Advanced Fuel Arrangements

Table 3-1. Generator Expected Net Revenue for Example 1, With Option Award

			Advance Fuel		No Advance Fuel	
Generator's Market Settlement			High Demand	Low Demand	High Demand	Low Demand
[1]	Day-Ahead Award	*OCP*	$ 50.00	$ 50.00	$ 50.00	$ 50.00
[2]	Day-Ahead Close-Out	-max{0, *RT LMP* - *K* }	$ -	$ -	$ (280.00)	$ -
[3]	Real-Time	*RT LMP*	$ 120.00	$ -	$ -	$ -
[4]	Total Settlement	[1]+[2]+[3]	$ 170.00	$ 50.00	$ (230.00)	$ 50.00
Generator's Costs						
[5]	Advance Fuel	*F*	$ (40.00)	$ (40.00)	$ -	$ -
[6]	Marginal Cost	*MC*	$ (70.00)	$ -	$ -	$ -
[7]	Total Cost	[5]+[6]	$ (110.00)	$ (40.00)	$ -	$ -
Generator's Net Revenue						
[8]	Scenario Net Revenue	[4]+[7]	$ 60.00	$ 10.00	$ (230.00)	$ 50.00
[9]	Demand Probability	*p* or (1-*p*)	20%	80%	20%	80%
[10]	**Expected Net Revenue**	SumProd [8]*[9]	**$20**		**($6)**	

Questions

APPENDIX

Distributed Energy Resources in New England:
An Evolving Marketplace

Distributed Energy Resources (DERs) Comprise About 19% of the Capacity in New England

TABLE 1: New England Distributed Energy Resources as of 09/01/2019

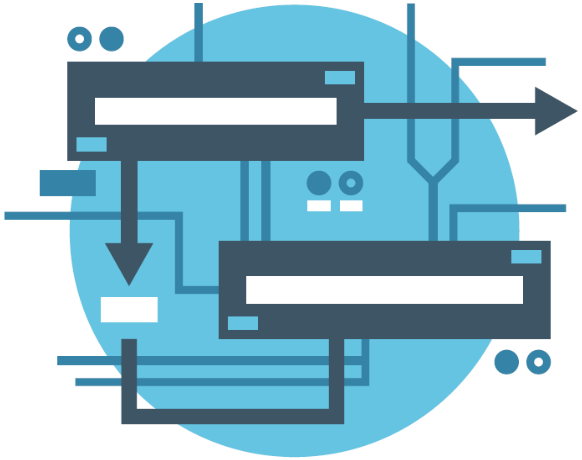
Distributed Energy Resource (DER) Category	Settlement Only Resource (SOR) Nameplate Capacity (MW)	Demand Resource (DR) Maximum Capacity (MW)	Total DER Capacity (MW)
Energy Efficiency	-	2,822	2,822
Demand Response (excluding behind-the-meter DG capacity)*	-	214	214
Natural Gas Generation	22	246	269
Generation Using Other Fossil Fuels	63	354	416
Generation Using Purchased Steam	-	23	23
Non-Solar Renewable Generation (e.g., hydro, biomass, wind)	437	21	458
Solar PV Generation participating in the wholesale market	1,127	129	1,256
Electricity Storage	-	4	4
Solar PV Generation ***not*** participating in the wholesale market**	-	-	1,975
Total DER Capacity	1,649	3,813	7,437
Total DER Capacity/Total System Operable Capacity***	4.2%	9.8%	19.0%

* To avoid double-counting, demand response capacity includes the sum of the maximum interruptible capacities of registered demand response assets less any behind-the-meter generation or storage capacity located at these assets.

** Based on Final 2019 PV Forecast: https://www.iso-ne.com/static-assets/documents/2019/04/final-2019-pv-forecast.pdf

*** System Operable Capacity (Seasonal Claimed Capability) plus SOR and DR Capacity as of 08/28/2019 (MW): 39,055

DER Proliferation Challenges Current Approaches



- Presently, most generation and some demand response are dispatched by the ISO to meet **price-inelastic demand**
- With more behind-the-meter technologies and time-varying retail rates, net demand could become **more price-responsive** and **less predictable**
- In a high-DER future, power flows become **more variable**, **potentially bi-directional**, and **less predictable**
- Real-time operations, wholesale market design, and regional planning become **more complex**

Distributed Energy Resource Management Is Needed in a High-DER Future

- ISOs/RTOs operate and administer markets for **all resources** connected to the **bulk power system (BPS)**
  - DERs participating in wholesale markets are **economically dispatched** along with BPS resources, **but without regard to distribution constraints**
  - **Distribution system capacity** is *probably* sufficient in many areas to accommodate additional DERs at this time
- Maintaining efficiency and reliability require that the operation of DERs be managed effectively
  - In a high-DER future, however, constraints on distribution systems could affect the simultaneous operation of DERs in **specific locations**
  - Knowledge of (visibility) and control over DER operation in real time **improves system reliability**
  - Distribution systems are **more extensive and complex** – modeling will be a challenge

Who Should Be Charged with Managing DERs?

- If DERs proliferate, a **distribution system operator (DSO)** will be needed at some point
  - Note: **DSO is a function, not an entity**
- A DSO would determine the **feasibility** of operating DERs in its footprint and coordinate **economic** dispatch of DER and BPS resources with the ISO
- Uncertainty surrounding **federal/state jurisdiction** may delay the establishment of DSOs
  - Should the DSO be overseen by the states or FERC?
    - Traditionally, the BPS is regulated by the **FERC**, and distribution systems are regulated by the **states**
  - How does a multi-state ISO/RTO manage a system consisting of states and distribution utilities with differing views and preferences?

Conclusion

- ISO New England **has long recognized** the role of distributed energy resources in the wholesale electricity markets
- The ISO has been **adapting, and will continue to adapt,** its market design to accommodate the transition to a growing level of DERs
- It will be essential **to clearly identify early in this transition** which entity will be responsible for functioning as the distribution system operator in a high-DER future