Planning for Demand Resources in New England

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- Properly Presented Information
  - Accurately represents the positions of ISO New England
- Inaccurate Information or Opinions that May Not Fully Agree with ISO New England
  - My private views and are not meant to represent any organization with which I am affiliated

Key Facts About New England's Electric Power System and Wholesale Electricity Markets

- 6.5 million households and businesses; population 14 million
- Over 350 generators
- 31,700 MW of total generation
- Over 8,000 miles of transmission lines
- 13 interconnections to electricity systems in New York and Canada
- Approximately 1,850 MW of demand resources for 2013
- All-time peak demand of 28,130 MW, set on August 2, 2006
- Approximately 500 participants in the marketplace (those who generate, buy, sell, transport, and use wholesale electricity and implement demand resources)
- $6.10 billion total market value—
  $4.77 billion energy market,
  $1.19 billion capacity market,
  and approximately $0.13 billion for ancillary services
- Approximately $5.5 billion in transmission investment since 2002; approximately $5.7 billion planned over the next 5 years

Eligible Resources in the Forward Capacity Market

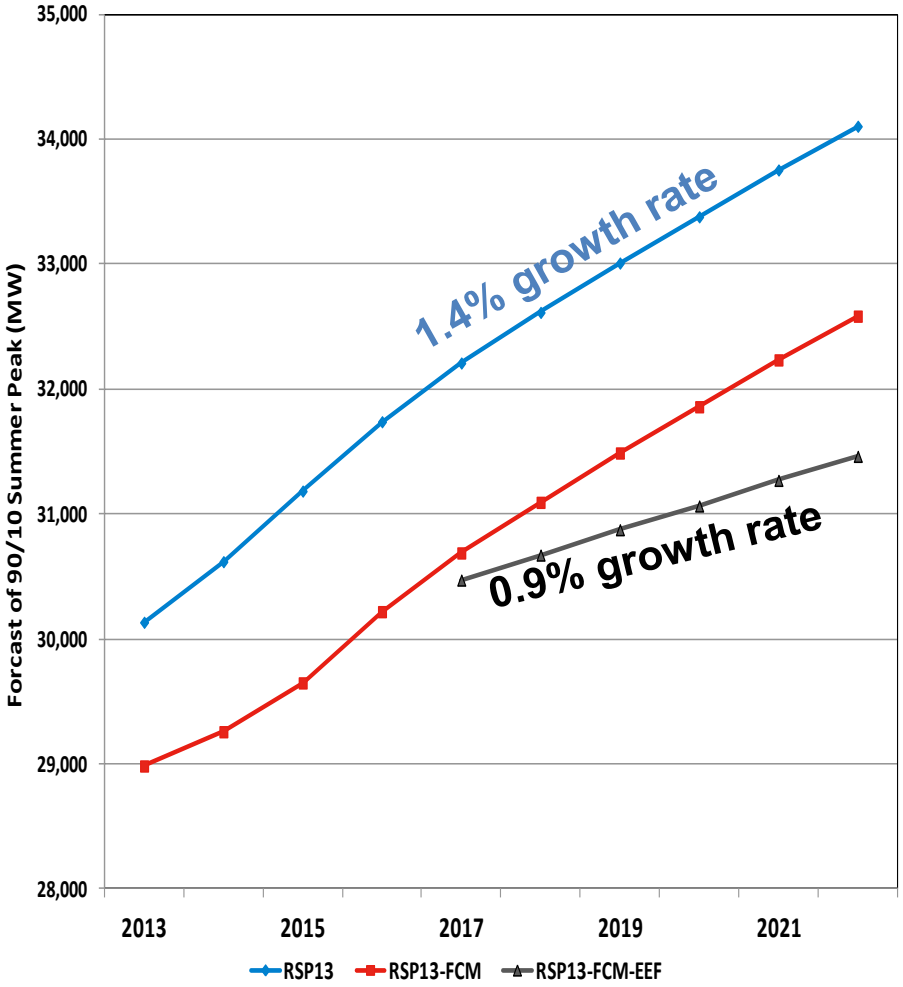
- Supply Resources
  - Traditional Generation (Oil, Coal, Natural Gas, etc.)
  - Intermittent Generation (Wind, Solar, etc.)
  - Renewable Generation
- Demand Resources
  - Energy Efficiency
  - Load Management
  - Distributed Generation

Energy-Efficiency Forecast Model
Key Parameters for EE Forecast Model

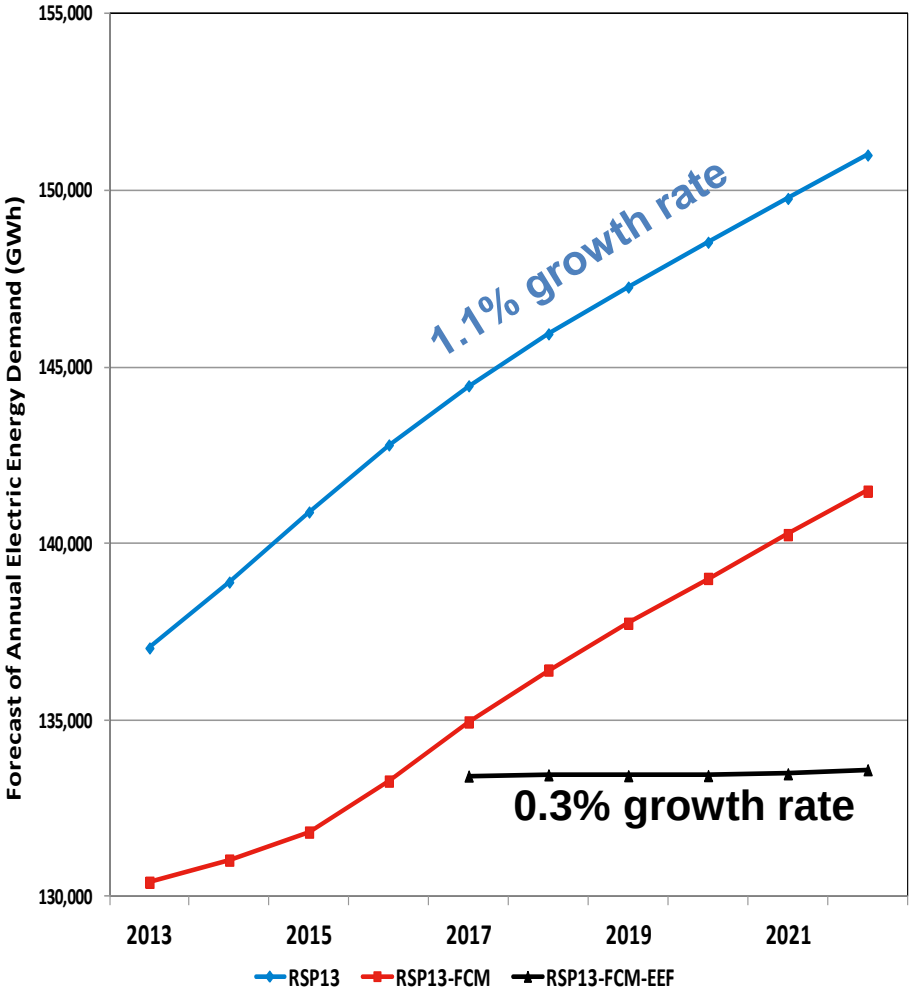
- MW = Budget $ * %Spent * MWh/$ * RR * MW/MWh
- Budget $: an estimate of the dollars to be spent on EE (Including Budget Uncertainty)
- %Spent: percentage of dollars that can be spent on EE programs in that time period – developed from historical data
- MWh/$: MWh savings per dollar spent – developed from historical data (includes cost increases and decreases)
- RR: Realization Rate comparison of observed/measured savings to estimated savings – developed from historical data
- MW/MWh: peak to energy ratio (inverse of load factor) - developed from historical data (developed from load forecast for Proof of Concept)

2013 New England Demand and EE Forecast Results

New England: Summer 90/10 Peak (MW)



New England: Annual Energy Use (GWh)



Effect of DR Participation in FCM: Four Key Observations

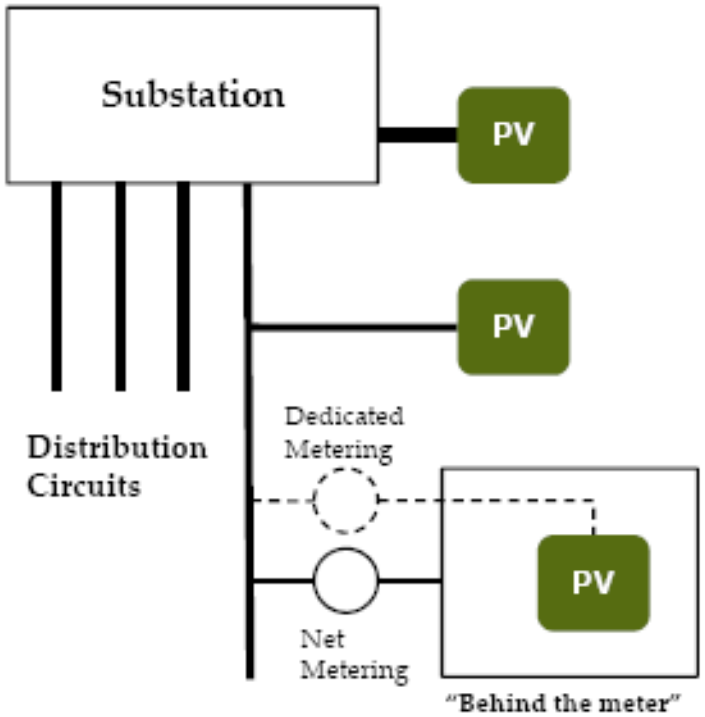
1. As the MWs of Active DR grow, their dispatch frequency increases
2. Active DR will be needed during shoulder months
3. As a general rule, there are few hours when 100% of the Active DR is needed
4. Under the 90/10 Load Forecast, more Active DR will be called upon for more hours

Large Amounts of Active DR

- Challenges
  - Increased frequency and amounts of active demand resource operation
    - Potential fatigue factor is a concern
    - Use during the non-traditional shoulder load periods
    - Coordination of DR usage with traditional supply resource maintenance and unanticipated forced outages
  - Control of DR
  - Monitoring performance of DR
- Solutions
  - Provide information so that bidders can better anticipate required performance
  - Incorporate DR dispatch in Security Constrained Dispatch

Connecting Distributed Generation to the Distribution System (Photovoltaic Example*)

- Distributed PV can be connected to:
  1. Substation
     - PV must be in proximity to substation, and is connected to low side bus
  2. Primary distribution system:
     - Connected to the distribution system without integration with a customer's electrical system
  3. Behind the Meter
     - PV is integrated with a customer's interconnection as a net metered facility or one that utilizes dedicated metering



*Source: Navigant Energy, Integrating PV on Distribution, Carnegie Mellon Conference on the Electricity Industry, March 9, 2011, available at: http://www.ece.cmu.edu/~electricityconference/2011/pdfs/Navigant%20-%20Integrating%20PV%20on%20Distribution%20-%20CMU%20Electricity%20Industry%20-%2003-09-2011.pdf

Summary

- A multi-state energy long-term energy efficiency forecast has been developed
- Price responsive demand must offer daily just like a generator
- Integrate Demand Response Resources into security constrained dispatch
- Large quantities of active Demand Resources could create potential operating issues for providers and ISO
- Forecasting distributed generation resources is challenging, but is under development