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The Road to Better System Planning: ISO-New England's Revised Energy Efficiency Forecast

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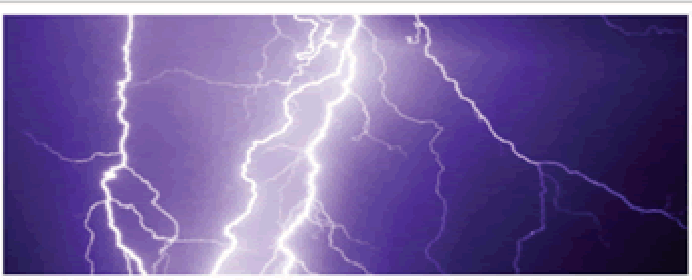

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1. Introduction

In 2012, ISO-New England will apply a revised energy efficiency forecast in its annual 10-year Regional System Plan (RSP, or Plan). The forecast will allow the ISO to explicitly account—for the first time—for expected energy efficiency resources for the full ten years of the RSP. Prior to the development of this revised forecast methodology, the ISO's 10-year Plan used only the three years of energy efficiency resources that had cleared in the annual Forward Capacity Market (FCM) auctions. For years 4 through 10 of the planning horizon, ISO assumed no new energy efficiency resources—a practice that disregarded not only historical trends for energy efficiency implementation, but also anticipated energy-efficiency spending for the latter seven years of the ISO's planning horizon.[1] While this approach ensured that the ISO would never overestimate the amount of energy efficiency resources available in its 10-year Plans, it has become clear in recent years—as evidenced by the results of the ISO's FCM auctions—that the ISO's treatment of energy efficiency was overly conservative.

The revised energy efficiency forecast helps to rectify this shortcoming, and allows each annual Plan to more accurately fulfill its purpose: "to determine the resources and transmission facilities needed to maintain reliable and economic operation of New England's bulk electric power system over a ten-year horizon."[2]

2. Background: ISO-NE's Forward Capacity Market

ISO-New England does not need to *forecast* the quantity of energy efficiency resources that will be available and secured to meet reliability requirements for years 1 through 3 of its 10-year Plan, because those resources have been committed in the Forward Capacity Market (FCM) auctions. For each of those years, the ISO uses the FCM auction to procure the amount of capacity deemed necessary to operate a reliable electric system.

In 2006, as part of a FERC-approved settlement, energy efficiency became a recognized, eligible resource to bid into ISO-New England's new FCM.[3] Like supply-side resources and demand response, energy efficiency resources can offer to sell capacity to the region in each auction. If they clear, they are given a capacity supply obligation, and the right to receive capacity payments during that future power year.

The quantity of megawatts that an energy efficiency resource bids into the FCM auction represents the amount of energy reduction that must be available from that resource on a peak load day in the summer for the obligation year. Table 1, below, shows the total quantity of

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1 According to ISO-NE, some amount of future energy efficiency resources were embedded in the econometric data of past Regional System Plans; however, it is clear from Figures 1, 2, and 3 (in this paper) that these embedded assumptions fell far short of the actual quantity of energy efficiency resources being cleared in FCM auctions and projected by the ISO's revised energy efficiency forecast.

2 Source: ISO-New England website, accessed April 10, 2012.

3 Synapse represented several clients as a member of the working group charged with developing the rules for the FCM.

megawatts from new energy efficiency resources that cleared FCM auctions 2 through 6 (i.e., FCA-2 – FCA-6).[4]

As shown in the table, the average amount of new energy efficiency resources cleared in FCA-2 through FCA-6 is 232.6 megawatts.

Table 1. Amount of New EE Cleared in FCM Auctions[5]

FCA	Amount of New EE Cleared (MW)
FCA-2	226
FCA-3	211
FCA-4	258
FCA-5	221
FCA-6	246
Average	232.6

Regarding the quantities Table 1, it is important to note the following:

1) These quantities represent *new* energy efficiency resources, only, for each year. For example, the 211 MW of resources cleared in FCA-3 are completely separate from the 226 MW of resources cleared in FCA-2. A cumulative total of 1162 MW of *new* energy efficiency resources have cleared the FCM auction in years 2 through 6. When the quantity from FCA-1 is added in, total energy efficiency capacity resources approach 1800 MW.

2) These quantities represent first-year energy reduction, only. For example, the new energy efficiency resources that were cleared in FCA-5 must provide 221 megawatts in the initial obligation year (2014). For years *after* 2014, the FCA-5 efficiency resources will continue to provide reductions, but will be treated as “existing resources” in the FCM auction. A rigorous Measurement and Verification (M&V) process will be applied to determine the amount of energy reduction that is being achieved in those years, throughout the “life” of the applicable energy efficiency measures.

3) These quantities represent an *obligated* amount of energy reduction three years into the future. If the future quantity is over-estimated by a supplier, the shortfall can be subject to penalties and the loss of financial assurance. Therefore, suppliers tend to bid conservatively (e.g., a quantity of energy reduction that they are certain they will be able to provide). If the quantity is under-estimated, the excess can be included in the next auction.

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[4] The first FCM auction (FCA-1) is not included in this figure, because it includes three additional years of Transition Period energy efficiency resources. The total quantity in FCA-1 was ~600 MW, and is not useful for comparison to subsequent years.

[5] Data for FCAs 2 – 5 are from a presentation by Eric Winkler to the NEPOOL Reliability Committee on December 13, 2011. Data for FCA-1 was specifically excluded from the table and the average. For FCA-6, we have used the total amount of new On Peak and new Seasonal Peak resources that cleared in the auction, as reported by the auction software. We expect a small amount of this total to be distributed generation rather than energy efficiency.

4) These amounts do not include demand response, which is described as an "active" demand resource to distinguish it from a "passive" resource such as energy efficiency.[6]

3. The Revised Energy Efficiency Forecast

Because energy efficiency resources have participated in the Forward Capacity Market (FCM) since 2006, ISO-New England is able to use the FCM's three-year-forward auction results as inputs to the 10-year forecast in its annual RSP. In this way, the ISO explicitly accounts for new energy efficiency resources that will become available in the first three years of its Plan. For years 4 through 10, the practice prior to 2012 was to assume that *zero* new energy efficiency resources would become available. This was a clear shortcoming; the state programs anticipate many future years of energy efficiency implementation using existing funding mechanisms. The primary funding source is some form of a system benefits charge (SBC); however, there are three additional sources of funding: state appropriations above and beyond the SBC funds, the Regional Greenhouse Gas Initiative (RGGI), and FCM auction revenues. The lack of any projection of new energy efficiency resources for years 4 through 10 of the annual RSP has been a contentious item in the ISO's Planning Advisory Committee (PAC) discussions for the last three years, and the subject of specific participant comments on the 2010 and 2011 RSPs.[7]

For the 2012 RSP, ISO-New England will apply the recently developed energy efficiency forecast for the first time, in order to explicitly account for expected new energy efficiency resources in the latter seven years of its planning horizon. This forecast is distinct from the ISO's capacity, energy, loads, and transmission (CELT) forecasts, and is not used for Installed Capacity Requirement (ICR) determinations. It is used exclusively for the RSP needs assessment and related transmission planning studies.

A. Forecast Assumptions

In essence, the ISO's revised energy efficiency forecast is based on the expected state budgets to be spent on energy efficiency during years 4 through 10 of the ten-year forecast timeframe, and on the amount of energy savings realized in the past per dollar spent on energy efficiency. However, the forecast is more conservative than this summary implies, because the model used by ISO-New England:

- Reduces the expected budgets for energy efficiency in Massachusetts and Rhode Island by 10% (to account for "budget uncertainty"). This is conservative, since these budgets could increase in future years.
- Anticipates that energy efficiency will be more expensive in the future. Specifically, it applies a production cost increase of 5% per year for more costly energy efficiency measures, starting in 2011 for Massachusetts, Connecticut, New Hampshire, and Maine, and starting in 2015 for Rhode Island and Vermont. In Maine, the production cost increase scales up to 7.5% by 2021. In early drafts, the ISO modeled an annual 2.5% increase in

[6] We expect a small amount of the total for FCA-6 to be distributed generation rather than energy efficiency.
[7] *See,* 2011 RSP, pp38-39; PAC meeting of August 11, 2011, NESCOE comments; PAC meeting of August 12, 2010, NESCOE comments and Synapse comments; and PAC meeting August 19, 2009, Summary of RSP09 Comments Received. These are all available on the ISO website under PAC materials for the relevant year.

production cost, in addition to the 5% increase. The ISO chose to use the 5% increase, despite comments from stakeholders that competing factors (such as program delivery efficiency, technology advances and economies of scale) might lead to **lower** annual production costs.

- Adds an inflation adjustment, equivalent to 2.5% annually, to the production costs. This inflation adjustment, combined with the 5% annual production cost increase mentioned above, acts to reduce the quantity of energy-efficiency megawatts estimated for years 4 through 10.

The equation used by the ISO to calculate megawatts of new energy efficiency that will be available in years 4 through 10 of the RSP timeframe is:

MW = $ * %Spent * MWh/$ * Realization Rate * MW/MWh

The components of this equation are defined as follows[8]:

- **$:** An estimate of the dollars to be spent on energy efficiency (including adjustments for budget uncertainty)
- **%Spent:** Percentage of dollars that can be spent on energy efficiency programs in that time period (developed from historical data)
- **MWh/$:** MWh savings per dollar spent (developed from historical data)
- **Realization Rate:** Comparison of observed/measured savings to estimated savings (developed from historical data)
- **MW/MWh:** Peak to energy ratio. This is developed from historical data.

The 2012 Plan's energy efficiency forecast is further modified by a number of state-specific adjustments. For the 2012 forecast, adjustments included the following:

- **CT:** Excluded municipal energy sales from SBC; adjusted RGGI dollars down to $3.5M; SBC remains at $0.003/kWh
- **NH**: Excluded RGGI; SBC remains at $0.0018/kWh
- **ME**: Adjusted RGGI dollars down to $5M; MPRP $3.8M; only 75% of sales subject to SBC; SBC remains at $0.0015/kWh
- **MA:** Based on 2010 – 2012 budget, increased "policy dollars" to $365M; SBC remains at $0.0025/kWh
- **RI:** Based on approved 2012 – 2014 budget; SBC increased to $0.0099/kWh; adjusted RGGI dollars down to $2.7M; set 2014 production cost to $467/MWh and peak to energy ratio to 0.173 (held constant)
- **VT:** Based on approved 2012 – 2014 budget, set total revenue to $45.9M via policy dollars; set 2014 production cost to $412/MWh and peak to energy ratio to 0.185 (held constant)

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[8] Details regarding the ISO's methodology and specific assumptions are available at http://www.iso-ne.com/committees/comm_wkgrps/othr/enrgy_effncy_frcst/frcst/2012/iso_ne_ee_forecast_2015_2021.pdf

B. Forecast Results for 2012

The ISO provided a draft 2012 energy efficiency forecast in mid-March, and then revised the forecast in early April to include the 2.5% annual inflation adjustment mentioned above. The inflation adjustment reduced the average megawatts of new energy efficiency resources for years 4 through 10 of the RSP from 239 MW to 206 MW.[9] Interestingly, the historical average amount of new energy efficiency resources cleared in FCA-2 through FCA-6 (232.6 MW) is close to the results of the draft, mid-March forecast (239 MW).

The revised, April forecast results (which include the 2.5% annual inflation adjustment to the production costs) are provided in Table 2, below. These are the values that will be used for this year's RSP (2012). The average value of 206 MW for years 4 through 10 of the forecast is lower than the average historical value (232.6 MW), which may be an indication that the energy efficiency forecast model is too conservative. The steadily decreasing energy and peak load quantities of energy efficiency resources also appear incongruous with state intentions to acquire increasing amounts of energy efficiency resources going forward; however, the 2015 estimate of 249 MW is remarkably close to the preliminary results from FCA-6 of 246 MW of new energy efficiency resources.[10]

Table 2. ISO-New England Energy Efficiency Forecast Model Outputs for 2012 RPS

GWh Savings							
Year	**Sum of States**	**ME**	**NH**	**VT**	**CT**	**RI**	**MA**
2015	1619	99	65	110	244	163	948
2016	1518	82	62	102	230	153	889
2017	1423	77	59	95	216	143	833
2018	1333	71	56	88	204	134	780
2019	1247	65	53	82	191	125	731
2020	1167	60	50	77	180	117	684
2021	1092	55	48	71	169	109	640
Total	9399	499	393	625	1434	944	5505
Average	1343	71	56	89	205	135	786
MW Savings							
Year	**Sum of States**	**ME**	**NH**	**VT**	**CT**	**RI**	**MA**
2015	249	10	11	20	33	28	147
2016	233	9	10	19	31	26	138
2017	218	8	10	18	29	25	129
2018	205	8	9	16	27	23	121
2019	192	7	9	15	26	22	113
2020	179	7	8	14	24	20	106
2021	168	7	8	13	23	19	99
Total	1444	55	65	115	193	163	853
Average	206	8	9	16	28	23	122

[9] See March 16 PAC presentation slide #18 and compare to April 12 PAC presentation slide #32.
[10] FCA-6 took place in early April of 2012.

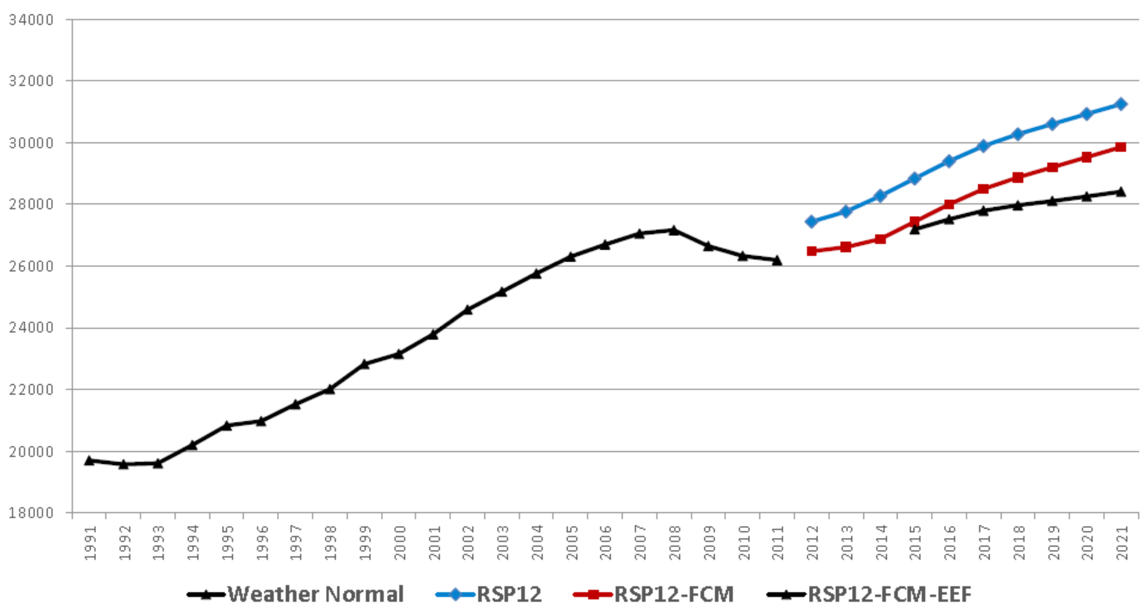
C. Impact on Annual Energy and Peak Load Forecasts

As part of the energy efficiency forecast analysis, the ISO provided energy (GWH) and peak load (MW) impacts from energy efficiency resources for each of the six New England states and for New England as a whole. We review just the New England impacts in the three figures below.

Figure 1, below, shows ISO-New England's weather normalized summer peak history, and its summer peak forecast for 2012 – 2021 from the 2012 RSP.[11] Three lines are provided for the 10-year RSP timeframe:

1. A blue line that shows the ISO's forecast without the explicit inclusion of any new energy efficiency resources in the RSP timeframe;
2. A red line that shows the results of the ISO's approach, prior to the development of the new energy efficiency forecast, wherein FCM auction results for new energy efficiency were used as inputs in years 1 through 3, and zero new energy efficiency resources are assumed for years 4 through 10; and
3. A black line that shows the impact of the newly developed energy efficiency forecast on the ISO's projection for years 4 through 10 of the RSP timeframe.

Figure 1. ISO-NE RSP12 50/50 Summer Peaks (MW). Weather Normal History 1991 – 2011 and Forecast 2012 – 2021.

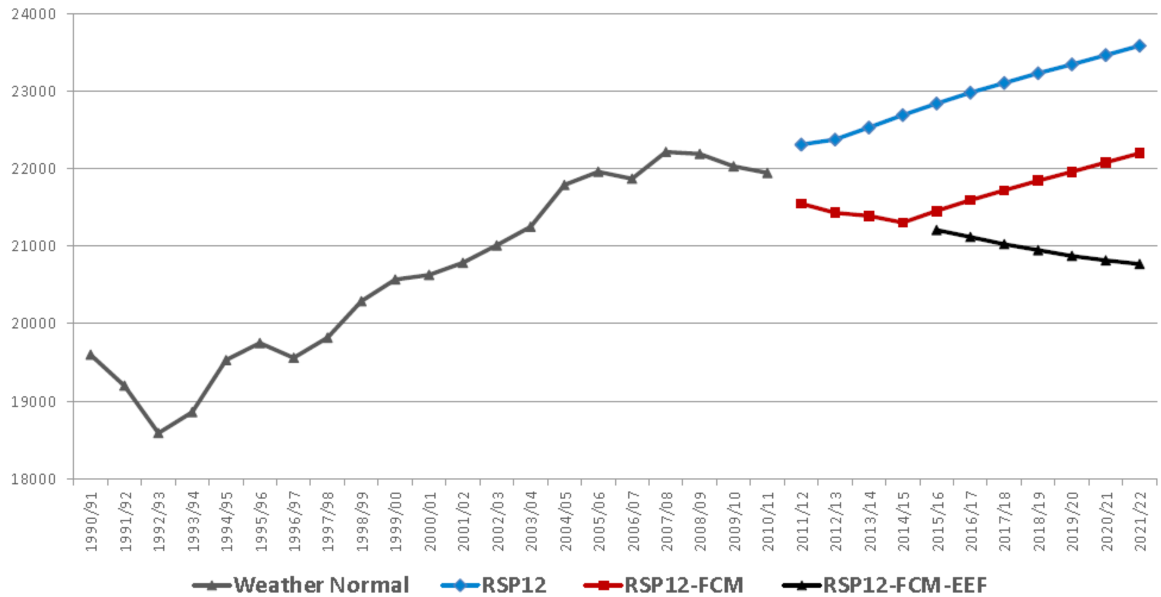


As you can see, applying the energy efficiency forecast makes a significant difference, especially in the outer years of the 10-year RSP projection. The winter peak results (shown in Figure 2,

[11] All of the load graphs are from the April 12 presentation.

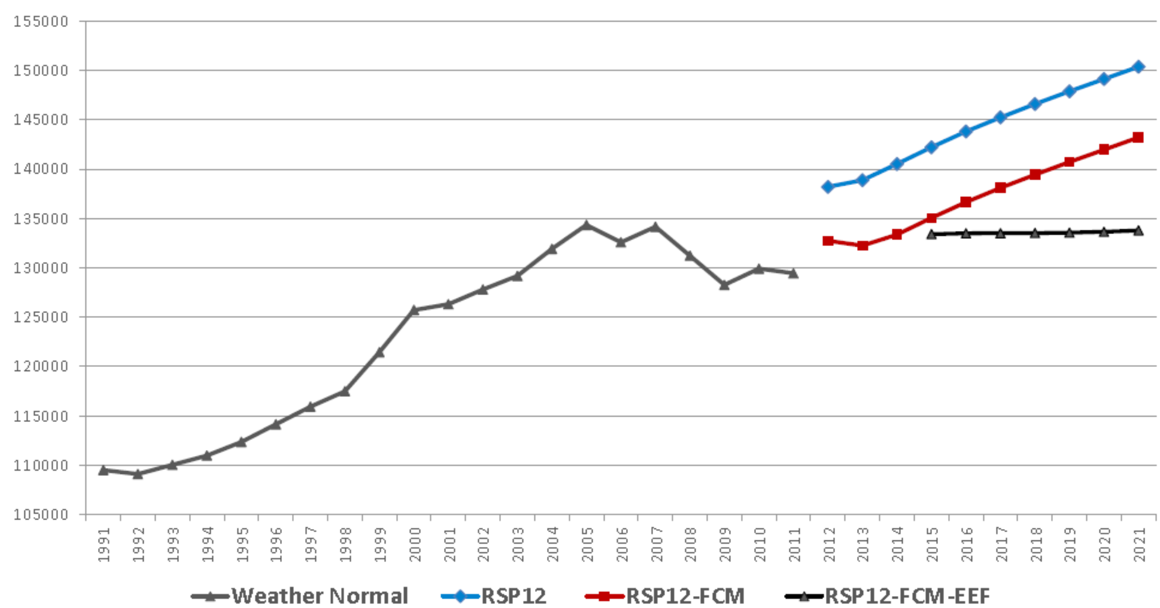
below) are even more dramatic; with the inclusion of the ISO's new energy efficiency forecast, winter peak load is expected to decline significantly in the 10-year RSP timeframe.

Figure 2. ISO-NE RSP12 50/50 Winter Peaks (MW). Weather Normal History 1991 – 2011 and Forecast 2012 – 2021.



Shown in Figure 3, below, the new energy efficiency forecast also has significant impact on the ISO's energy forecast for the 2012 RSP, effectively flattening the expected growth.

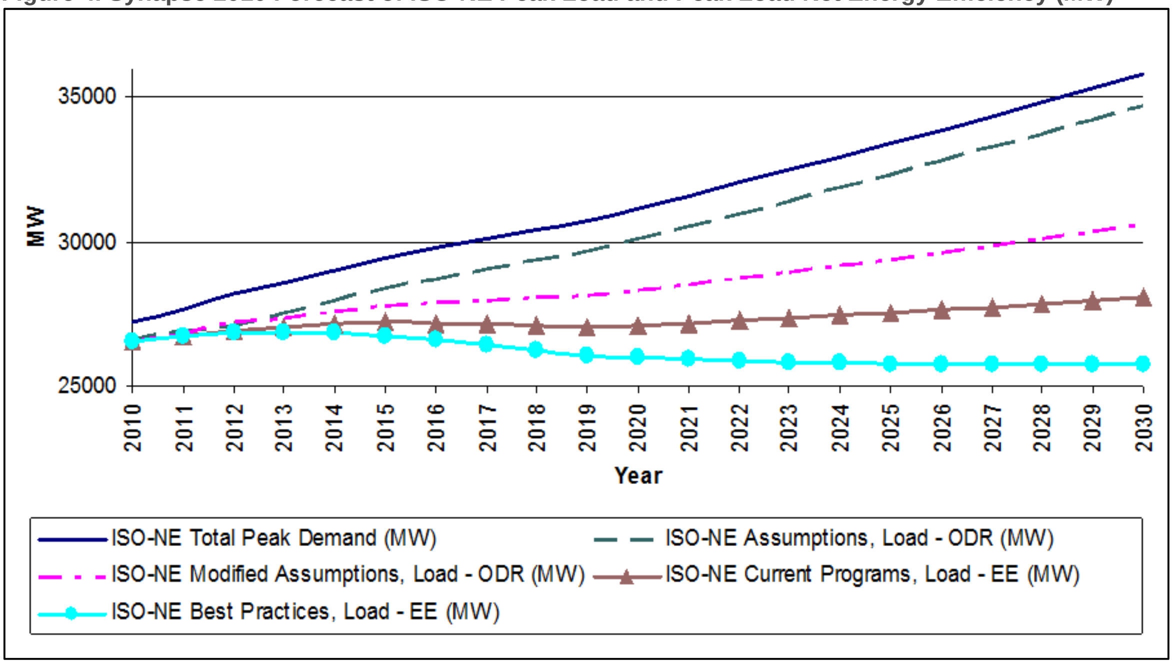
Figure 3. ISO-NE RSP12 Annual Energy (GWh). Weather Normal History 1991 – 2011 and Forecast 2012 – 2021.



These figures demonstrate the importance of including a forecast of expected new energy efficiency resources in the latter seven years of ISO-New England's RSP 10-year analysis. Even with the ISO's many conservative assumptions and adjustments, the new energy efficiency forecast makes a sizeable difference in the ISO's projections—and, ultimately, the system planning decisions it makes based on those projections, and their costs to ratepayers.

It is useful to note that the three figures above show a remarkable consistency with two other efforts to forecast energy efficiency impacts. The first is an analysis of summer peak load impacts that Synapse produced for a report for EarthJustice in late 2010.[12] The second is an analysis of annual energy consumption done by Northeast Energy Efficiency Partnerships in 2005.

Figure 4. Synapse 2010 Forecast of ISO-NE Peak Load and Peak Load Net Energy Efficiency (MW)



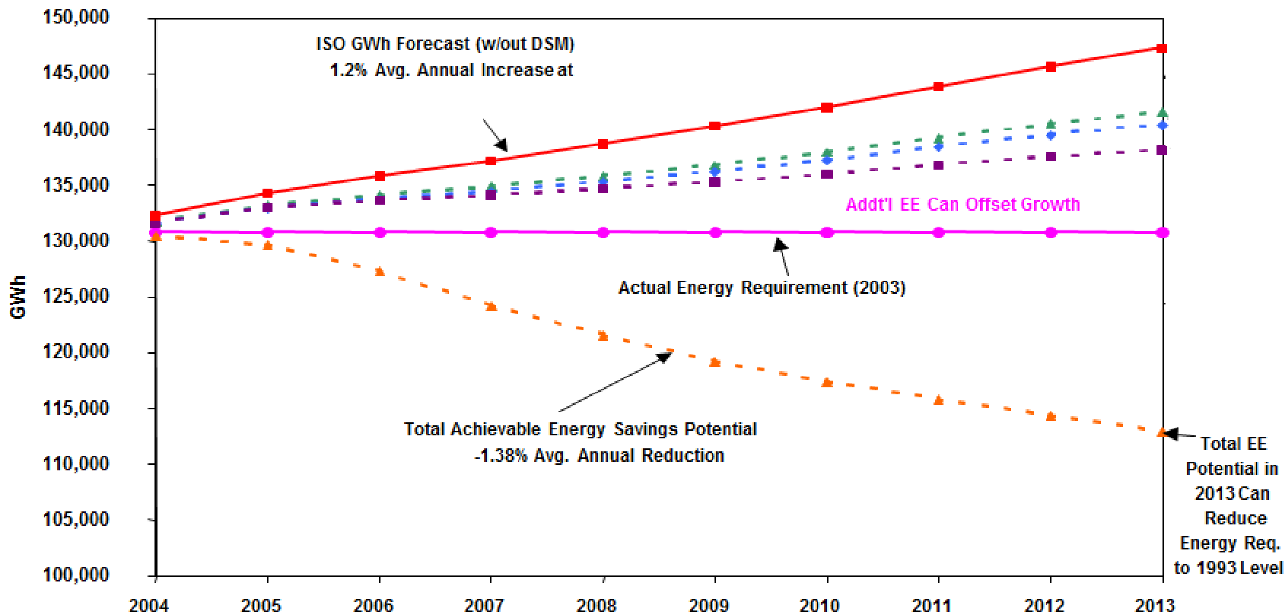
The fourth line from the top is an estimate based on the current level of energy efficiency implementation from state programs, and tracks quite well with the ISO's slowly increasing summer peak loads from Figure 1, above. The fifth line from the top shows the impacts from even more aggressive implementation of state energy efficiency programs, beyond the current efforts of the New England states.

The NEEP analysis (in Figure 5, below) shows a level of annual energy consumption at just over 130,000 GWH per year (the pink line). This is very similar to the ISO forecast for annual energy in

[12] Peterson, P., V. Sabodash, R. Wilson, and D. Hurley. December 2010. "Public Policy Impacts on Transmission Planning." Prepared for EarthJustice. Available at: www.synapse-energy.com/Downloads/SynapseReport.2010-12.EJ.Public-Policy-Impacts-on-Transmission.10-064.pdf

Figure 3, above. If NEEP had been able to anticipate the economic recession of 2008 – 2009, these estimates might have mirrored the ISO's even more closely.[13]

Figure 5. 2005 Northeast Energy Efficiency Partnerships Estimate of EE Potential. "Existing and New EE Strategies Can Offset ISO Forecasted Energy Requirements (GWH) and Beyond"



4. Summary

The energy efficiency forecast assumptions that the ISO chose regarding budget uncertainty, escalating production costs, and annual inflation adjustments all contribute to a more conservative forecast. However, other elements of the ten-year energy efficiency forecast—such as FCM auction results, FCM revenues, and actual production cost data—will help the forecast self-correct each year as the ISO gains more experience with actual energy efficiency implementation and reflects that information in subsequent forecasts. Overall, we conclude that the ISO's revised energy efficiency forecast will provide useful estimates of the energy and peak load impacts of state energy efficiency programs.

In fact, the draft 2012 energy efficiency forecast has already provided useful information to the ISO planning process. In a recent re-assessment of the NH/VT Needs Assessment and Solutions Study, the ISO incorporated the new energy efficiency forecast results. As presented at a PAC meeting in March 2012, the reductions related to the energy efficiency forecast contributed to the deferral (for two to three years) of ten transmission projects that total $265 million. The other factors listed by the ISO were: overall changes to the load forecast, some new resources from FCA-4 and FCA-5, and some small-scale system upgrades that have occurred since the initial

[13] Economic recessions act as short -term (and sometimes longer-term) reductions to overall energy consumption and peak loads.

NH/VT Needs Assessment and Solution Studies analyses. The ISO did not indicate how much each of the four cited factors contributed to the deferral of the ten transmission projects.

Incorporation of the new energy efficiency forecast will enable ISO-NE to more accurately fulfill the overall purpose of its annual Regional System Plan reports: “to determine the resources and transmission facilities needed to maintain reliable and economic operation of New England’s bulk electric power system over a ten-year horizon.” Going forward, it will be important for ISO-NE to continue fine-tuning and adjusting its treatment of energy efficiency in planning forecasts as more data becomes available.