Synapse
Energy Economics, Inc.

ISO New England Scenario Analysis Companion Report
Constructing a Future that Meets Regional Goals

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1. Executive Summary

Over the last ten months, ISO New England has conducted a Scenario Analysis project that evaluated how seven different future scenarios would affect wholesale electric power system production in the year 2020.[1] The seven scenarios represented seven different assumptions about how the region might add 5,400 MW of resources to meet an overall New England peak load of 35,000 MW.

This paper builds upon the ISO's project, using its assumptions and the data from its dispatch model to suggest a Modified scenario that meets the region's goals that the ISO identified in its report: a reliable bulk power system that delivers electricity at a reasonable price while making environmental progress. We conclude that using a combination of scenario resources (energy efficiency, demand response, and renewables) points to a better future than any of the scenarios developed by the ISO.

We also suggest some additional changes to the Modified scenario to create a Preferred scenario that will achieve the region's goals even more effectively while reducing emissions beyond current targets. The Preferred scenario will require some additional data from ISO New England that can be developed with its dispatch model.

The ISO Report identified four key themes from its overall results that provide some suggestions on how to move towards the region's goals:

- Natural gas resources will continue to be the marginal unit in the energy market in approximately 90% of all hours regardless of the particular scenario.
- Many of the scenarios will have difficulty supporting full cost recovery for the "scenario resource" over the long term.
- Current, modest goals for CO_2 reduction (RGGI) will be difficult to meet under all scenarios.
- Most scenarios require significant infrastructure support.

None of these results are surprising given the assumptions ISO New England used in its scenario analysis project. The current New England resource mix that is used to meet a peak load of approximately 27,000 MW consists of over 10,000 MW of natural gas resources with many of these units relatively new and efficient. The mix of resources in the current interconnection queue is the basis for the "queue mix" that is used as a proxy for the first 2,600 MW that are added to all of the scenarios. The current queue is heavily dominated by natural gas (for both small peakers and larger intermediate or baseload units). Only the resource specific 5,400 MW in each scenario has an effect on the total 35,000 MW of resources. But no matter the scenario, natural gas will set the price in most hours.

[1] The year 2020 is an estimate of when New England will have a peak load of 35,000 MW. It could occur a few years earlier or later than 2020. The critical assumption for the ISO's analysis is the MW level (35,000), not the year. All the Scenario Analysis documents are located on ISO New England's website at http://wwww.iso-ne.com/committees/comm_wkgrps/othr/sas/mtrls/index.html. All references to the ISO Report refer to the final version dated August 2, 2007.

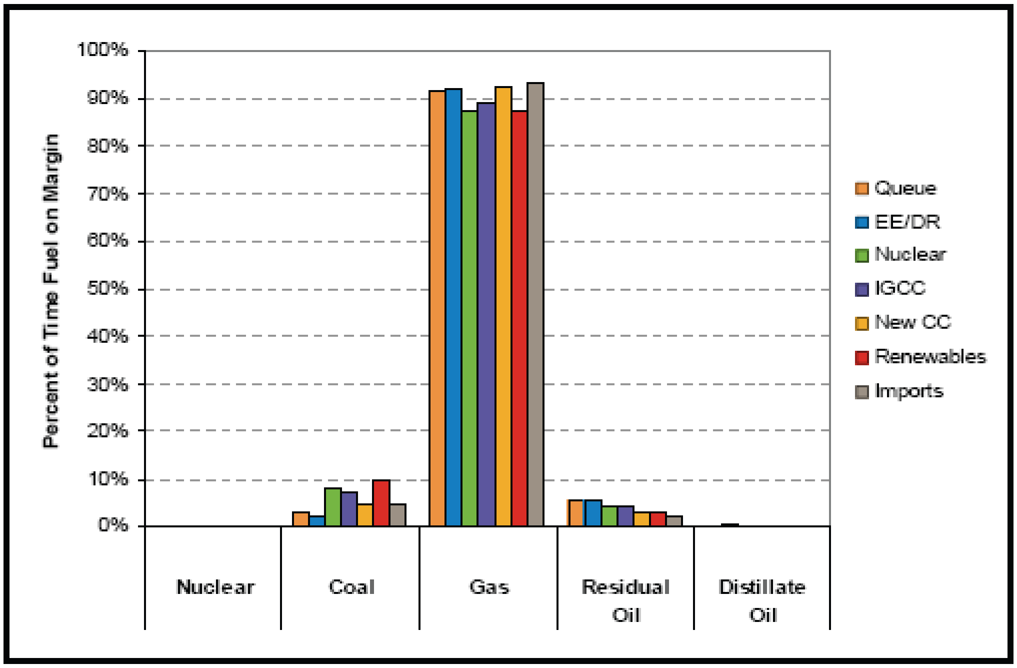

Figure 5-2: Percent of time fuel is on the margin.

One core conclusion we reach from these results is that consumers (and policy makers) cannot affect the price that the market will set for electricity. Most of the time the price will be set by a natural gas unit bidding its marginal cost, which will reflect the market price of natural gas. The best that consumers can do is to reduce the cost of the electricity that they use (i.e., lower electric bills) by becoming more efficient and consuming less.

A second core conclusion we draw is that none of the scenarios outlined by the ISO will allow New England to reduce carbon dioxide emissions to levels that will stabilize our region's contribution to global warming. The "business as usual approach" of continually building new fossil-fuel fired generation plants to meet ever growing demand no longer works. The one scenario that appears attractive (5,400 MW of new nuclear plants) is much riskier and more costly than portrayed in the ISO's analysis and may be the most politically infeasible choice among all the scenarios.[2] There are also significant costs associated with building transmission lines and other infrastructure facilities if we try to import large quantities of new resources. The ISO Report demonstrates the futility of trying to build our way out of our current, large carbon footprint. We must fundamentally change the way we approach meeting the electric power needs of the region if we intend to reduce emissions to meet climate change goals.

These are the bases for the scenario options discussed in this paper. Focusing on the effects of selecting particular scenario resources, we have constructed a Modified scenario, limited by the data provided by the ISO, that is dominated by energy efficiency, demand response, and the retirement of New England's oldest fossil units. Renewables can also play a significant role in reducing emissions, but the ISO data did not provide a means of incorporating more renewables into our Modified scenario. This Modified scenario demonstrates a way to achieve lower

[2] See further discussion at page 12 of this report.

electricity costs (as contrasted with clearing prices) for consumers, lower infrastructure costs (mostly T&D), and almost meet the RGGI carbon reduction targets for New England.

We also suggest further changes to our Modified scenario that we believe will allow for CO_2 reductions beyond the RGGI targets while still keeping consumer costs low and maintaining a reliable system. These additional changes (including the addition of more renewable resources) will need to be modeled in a new series of dispatch runs using the ISO New England Scenario Analysis dispatch model to fully understand the impacts of our Preferred Scenario.

In Figures 4 and 5, below, we show a comparison of three of the ISO scenarios and our Modified scenario on the basis of annual energy market cost to LSEs and CO_2 emissions We have also included in each figure, as a place holder, a bar for our Preferred scenario and what we estimate it may show.

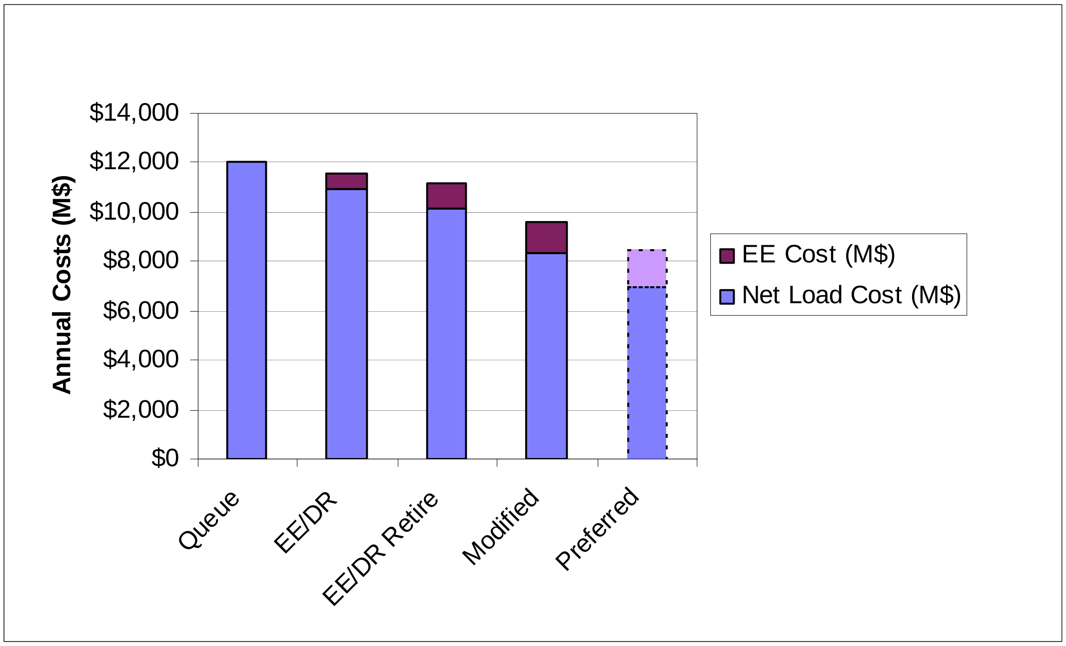

Figure 4: Annual Energy Market Cost for Various Scenarios

The future that our Preferred scenario supports is one with significant reductions in carbon emissions, improved efficiency in the production and use of electricity, and lower cost than any of the futures described in the ISO's report.[3] We think that we can achieve this future through an emphasis on energy efficiency (EE) and demand response (DR) resources that will maintain and possibly be lower than 2006 peak demand levels. We also focus on the retirement of fossil-fuel generation (in excess of the retirements modeled by the ISO) and replacement of those fossil resources with clean renewable resources.

[3] This statement excludes the ISO's low fuel price sensitivities. Due to modeling limitations, we are unable to dispatch our Modified scenario to include the low fuel price sensitivity; we must rely on the ISO to run this additional scenario and sensitivity. Nonetheless, it is highly likely that the low fuel price sensitivity will further reduce the cost of our Modified and Preferred scenarios, just as it lowers the overall cost of all other scenarios that the ISO modeled.

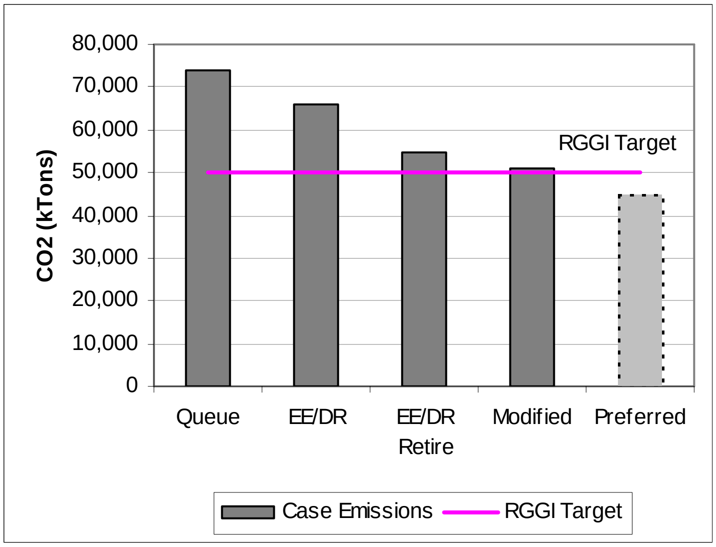

Figure 5: Annual CO_2 Emissions for Various Scenarios

During the Stakeholder process, questions arose as to whether any of the scenarios could actually be achieved. While we share that concern in regard to some of the scenarios (in particular 5,400 MW of Nuclear, Renewable, or Imports) we are confident that the Modified and Preferred scenarios developed in this report are achievable today. Based on numerous analyses of the historic under-acquisition of cost-effective demand resources, the 5,400 MW of EE and 4,500 MW of DR resources that we include in our Modified scenario can be acquired cost-effectively with existing technology and applications.

In order to refine our cost and emissions estimates, we recommend that ISO New England modify some of the inputs to its dispatch model to allow full dispatch runs with some new sensitivities:

(1) A Double EE, DR, and retirement scenario that uses the assumptions we selected for the Modified scenario

(2) A further modification of the inputs to eliminate all fossil generation that exceeds a specified emissions threshold (replaced with 50% gas generation, 25% energy efficiency, and 25% renewables)

(3) A further modification to include 2,700 MW of additional renewables

These last two dispatch runs can be used to create a Preferred scenario that maintains a reliable system, keeps consumer costs low, and exceeds the RGGI target reductions.

2. ISO Models and Data Development

2.1 The ISO Seven Scenarios and Relevant Sensitivities

The ISO Report describes in detail the seven future scenarios that were modeled. The starting point for all scenarios uses the current resource mix for the first 27,000 MW and a projection of currently proposed new resources in the ISO's interconnection queue (the queue mix) for the next 2,600 MW.[4] Of the 35,000 total MW used in each scenario, only the last increment of 5,400 MW changes from one scenario to the next.[5] The resource variations for the last 5,400 MW are:

- Queue: an expansion of the mix in the interconnection queue;
- EE and DR: 2,700 MW of energy efficiency and 2,700 MW of demand response;
- Nuclear: new nuclear reactors near existing sites;
- Coal: new integrated gasification combined cycle (IGCC) coal plants;
- Gas: natural gas combined cycle (NGCC) power plants;
- Renewables: new renewable resources that meet state RPS standards; and
- Imports: imports from low-emissions resources in Canada and New York.

The seven scenarios were used to develop seven different future "outcomes" for the New England electric system by running the seven different sets of resources through a production dispatch model.[6] The model provides hourly output data for an entire year that enables estimates of production costs, wholesale consumer costs, and emissions levels for an entire year. These annual estimates provide a basis for comparing the implications of the seven future scenarios.

In addition to the seven scenarios, the ISO used its dispatch model to vary the output results based on certain sensitivities. Six of the sensitivity cases were applied to all the scenarios; four had only limited application. In all, over 50 different annual dispatch scenarios were run through the ISO's model.[7]

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[4] The "queue mix" is based on the interconnection queue as of September 30, 2006. The ISO maintains a public listing of all new interconnection requests on its website. That list can be found at http://www.iso-ne.com/genrtion_resrcs/nwgen_inter/status/index.html

[5] New England currently has over 31,000 MW of resources to meet a summer day peak load of 27,000 MW. In the ISO Report, the scenarios are all based on this starting point of 27,000 MW of resources that are actually dispatched to meet the single day peak load. In order to maintain a reliable system, resources in excess of the actual peak load are necessary. For comparison purposes, the 35,000 MW peak load assumed for approximately 2020 will be met with 35,000 MW of actually dispatched resources from a total resource mix of over 39,000 MW. It is important to acknowledge the two ways of describing the scenario resources needed to meet peak load requirements: the total quantity of resources available (a large number) versus the total quantity of resources that are used (dispatched) by the ISO model (a smaller number).

[6] ISO New England used the Interregional Electric Market Model (IREMM) to simulate the economic dispatch of the wholesale electric system. IREMM is the same model that the ISO uses do develop its Regional System Plan (RSP).

[7] See ISO Report Table 3-1 for a list and description of the scenarios and sensitivities.

Each scenario dispatch run was adjusted for (1) high and low natural gas prices; (2) high and low carbon allowance prices; (3) a replacement of 3,500 MW of the scenario “fuel” with 1,750 MW of EE and 1,750 MW of DR; and (4) an assumed retirement of 3,500 MW of the oldest fossil resources that are replaced with 3,500 MW of the scenario “fuel”.

The four special case sensitivities included: (1) the coal scenario adjusted for IGCC units with carbon sequestration; (2) the EE and DR scenario adjusted for all EE (5,400 MW) and no new DR; (3) the EE and DR scenario adjusted for all DR (5,400 MW) and no EE; and (4) a reduction in the total energy available from the Import scenario (30 TWh reduced to 23 TWh).

For all of the scenarios and the sensitivities, the same basic structure was used. The figure below shows the various elements for a scenario and a scenario with a sensitivity (in this case the Retirement sensitivity, which retires 3,500 MW of the oldest fossil units and replaces it with 3,500 MW of the scenario resource).

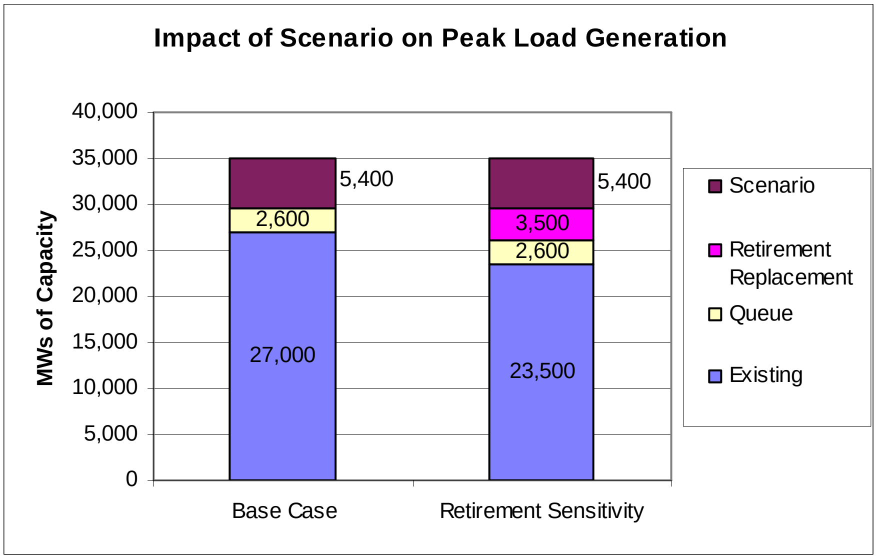

Figure 1: Impact of Scenario fuel on overall generation mix. Even in the retirement sensitivity, the scenario fuel only comprises 8,900 MW of the 35,000 MW needed to meet peak load.

Each scenario resource comprise only 15% of the total resource mix; when the Retirement sensitivity is applied, this percentage increases to about 25% of the total resource mix. In all of the ISO’s scenarios, the current resource mix (over 40% natural gas) dominates. That is why the ISO scenarios produce such small variations in the results.

2.2 Summary and Conclusions from ISO Data

The ISO data suggest several important conclusions:

- Gas is the marginal resource in most of the hours for all scenarios
- CO_2 reductions to meet RGGI targets are difficult to obtain for all scenarios
- Cost recovery for many resource scenarios is uncertain
- Most scenarios require significant infrastructure support

The ISO Report documents that the 27,000 MW of existing resources and the 2,600 MW of queue resources that are dispatched to meet the peak load are dominated by natural gas resources (38.1 percent and 77 percent, respectively). Of the total 29,600 MW dispatched by the model for all seven scenarios, approximately 12,300 MW (41 percent) are natural gas resources. It is not a surprise that gas is the marginal unit in most of the hours of all the scenarios (approximately 90 percent of the time for all scenarios). Regardless of other resource choices, natural gas prices will be the major determinant of electricity prices (and consumer costs) under all of the ISO Report scenarios.[8] ISO Figure 5-2 shows the percentage of time that gas is on the margin for the basic seven scenarios.

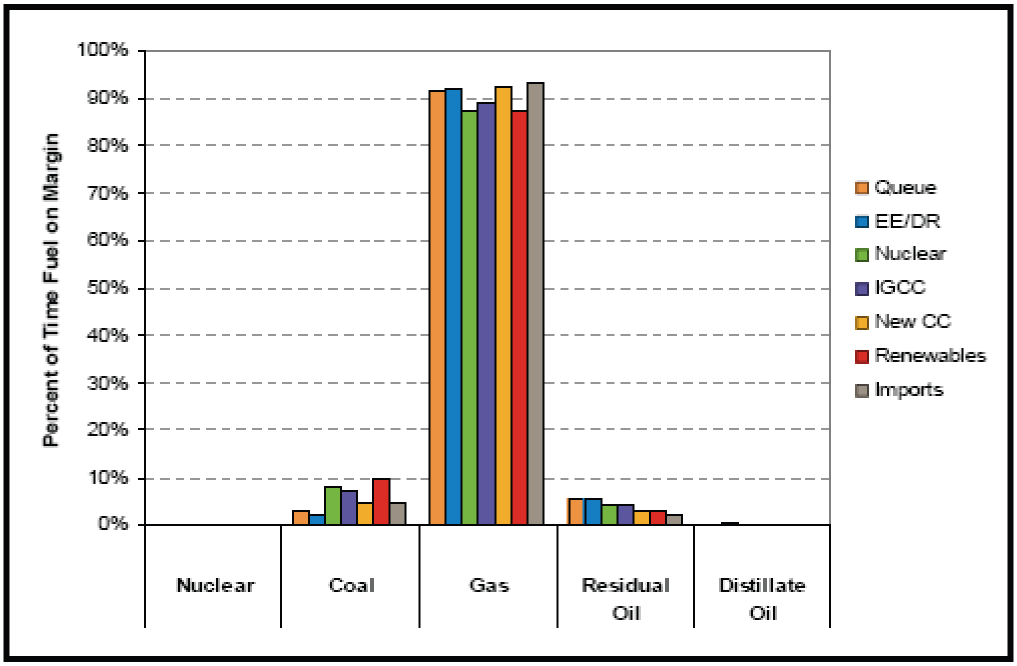

Figure 5-2: Percent of time fuel is on the margin.

8 See, Figure 5-2 (gas on the margin); Figure 5-1 (clearing prices); and Figure 5-2 (LSE dollars) of the ISO Report.

ISO Figure 5-1 below shows how the average clearing price for the basic seven scenarios are all clustered together for each of the common sensitivities; that is, each group of the bar graphs show very little variation.

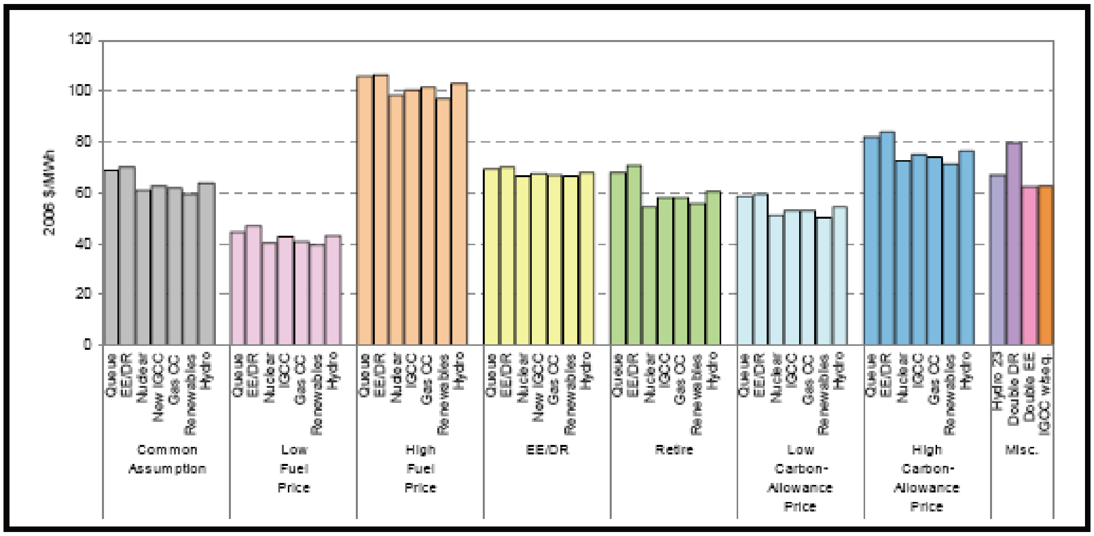

Figure 5-1: Average clearing price for wholesale electric energy, grouped by sensitivity case, $/MWh.

Note: The figure does not include other market payments, such as capacity payments, or transmission costs, which will likely vary by scenario.

ISO Figure 5-3 shows the estimate of LSE costs for each of the scenarios and sensitivities. As with clearing prices, the LSE costs have remarkably similar values for all the scenarios under each sensitivity.

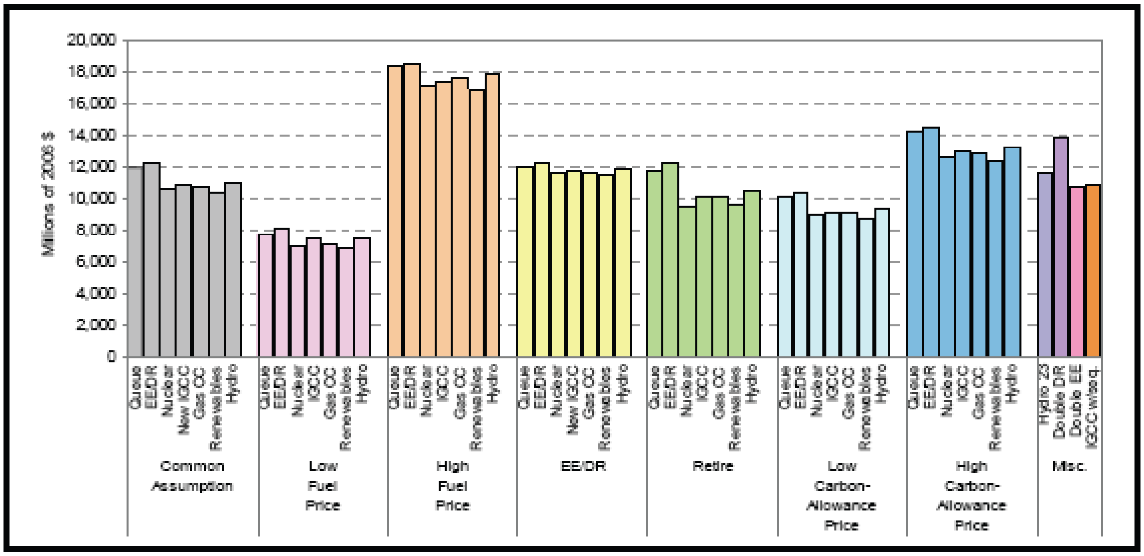

Figure 5-3: Load-serving entity annual expense for wholesale electric energy, grouped by sensitivity case, millions of 2006 dollars

Note: The figure does not include other market payments, such as capacity payments, or transmission costs, which will likely vary by scenario.

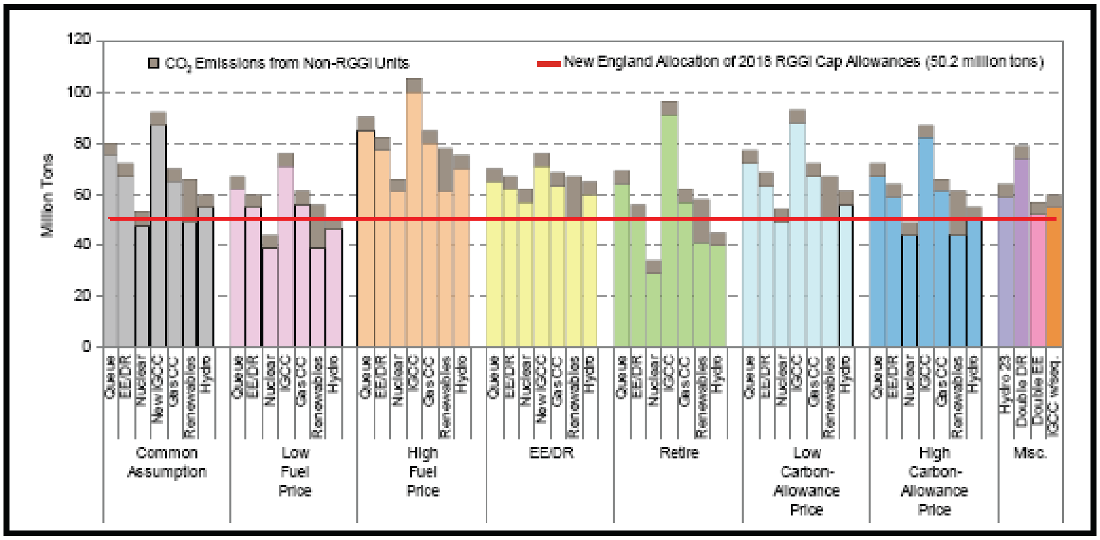

Figure 5-10: Total annual CO_2 emissions, grouped by sensitivity case and showing the New England allocation of the 2018 RGGI cap allowances.

Note: Table includes emissions for units that are not obligated to comply with RGGI requirements.

Similarly, the likelihood of meeting the modest RGGI goals for CO_2 emissions reductions does not change significantly among the seven scenarios themselves or when the sensitivities are applied, except for the Nuclear scenario.[9] ISO Figure 5-10 shows the annual CO_2 emissions for all cases, grouped by sensitivity.

Natural gas resources will provide large amounts of the region's total electricity consumption under all scenarios. Although natural gas resources emit less SO_2 and NO_X per MWh than coal and oil resources, their contribution to regional CO_2 emissions is still significant.

Predictably, low gas prices will tend to increase the total contribution of natural gas resources to electric system costs and CO_2 emissions (they will run more often in the ISO dispatch model). However, as modeled by the ISO, even high natural gas prices do not reduce system costs or emissions. In the high fuel price sensitivity natural gas units run fewer hours in the ISO dispatch model and are generally replaced with an increased dispatch of coal and oil resources that maintain the same level of CO_2 emission while increasing SO_2 and NO_X emissions.

2.3 Cost Recovery

The ISO Report identifies a serious concern with the ability of the various scenario fuel resources to recover their costs through the existing New England market mechanisms. The ISO Report evaluated the revenues that the scenario resource would receive through the energy and capacity markets.[10] That analysis showed that the base case, IGCC, Gas, and Renewables

[9] See ISO Figure 5-10. The Nuclear case provides the greatest contribution to reduced CO_2 when the Retirement sensitivity is applied (oldest fossil units retired and replaced with more nuclear units).

[10] The energy and capacity markets are the two major sources of revenue for the scenario resources. However, some traditional generation resources are eligible for other revenue streams from the locational forward reserve market (LFRM) the regulation market, for VAR support , and for "blackstart" capability. Other revenue streams may be available in the form of tax incentives, renewable portfolio standard compliance, NO_X and SO_2 reductions, and greenhouse gas compliance.

scenarios fell short of the total compensation needed.[11] The Nuclear scenario came close to recovering all its costs. The EE and DR scenario recovered revenues significantly above its cost.

The significance of the cost recovery analysis is that developers of traditional generation will see risky investment opportunities. In contrast, the development of EE and DR resources is more likely to succeed financially.

2.4 Infrastructure Costs

The ISO Report also attempts to quantify the infrastructure costs associated with many of the scenarios. For example, in the Import scenario there would need to be a significant investment in new transmission lines to deliver the resources from Canada and New York to the New England load centers. Similarly, the Gas scenario would require new gas pipelines and LNG terminals to provide the increased quantities of natural gas implied by that scenario. The IGCC Coal and Nuclear scenarios, even if the new plants are located near existing high transmission facilities, would require extensive and costly upgrades of the bulk power system. Under all scenarios, except the EE and DR scenario, there would be significant expansion of the distribution system to accommodate the higher load level of 35,000 MW that is assumed.

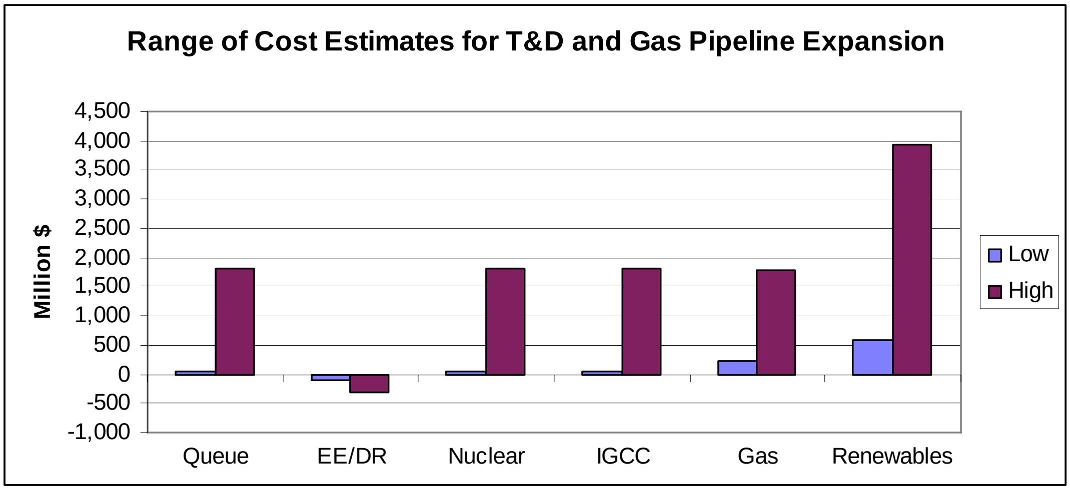

Figure 2: High and Low Infrastructure Cost Estimates for various scenarios using common assumptions. All scenarios except EE/DR could require billions of dollars in new infrastructure. Imports are not shown because cost estimates are very high, ranging from a low of $1.04 billion to a high of more than $20 billion for AC lines. The EE/DR case has no transmission nor gas pipeline costs, and actually saves money on distribution costs.

2.5 Nuclear Scenario

The Nuclear scenario appears to provide improvements in two areas: production costs and CO_2 emissions reductions. However, as the ISO acknowledged during the stakeholder review process, the ISO did not attempt to include fuel-cycle costs and impacts for the Nuclear scenario (or any other scenario). This omission is certainly a significant one for the Nuclear scenario and

[11] ISO Report Fig. 5-4 and Table 5-2, at pp. 53-55. The Import scenario assumes a resource cost of zero and only models the cost of transmission upgrades within New England; these two assumptions make it difficult to determine the actual annual revenue requirements for the Import scenario.

could have significant impact on other “traditional fuel” dominated scenarios (Queue, Gas, and Coal). In the Nuclear case, the glaring cost omission is not having a specific value (estimate) for the cost of long-term high level waste management. A value for the mining and manufacturing costs of nuclear fuel might also be necessary to provide a more complete comparison of the cost differences among the scenario fuels.

The ISO Report notes that it attempts to capture these unknown costs through the use of a carrying charge addition to all the scenarios. The ISO assumes that all unknown costs for each scenario (including transmission upgrades, permitting processes, land acquisition, cost of money, and others) can be captured in a 15 percent carrying charge. To provide a range, the ISO also used a 25 percent carrying charge.[12] We think that for the Nuclear scenario in particular, the use of a generic carrying charge (whether 15% or 25%) is particularly suspect given the history of nuclear facility construction. The massive cost overruns of the current generation of nuclear plants may not be applicable to the new generation of nuclear plant designs, but no one knows for sure. It is certainly one of the biggest risk factors associated with this technology.[13]

The overall conclusion that we reach is that the Nuclear Scenario needs to be revised to include some analysis of its fuel-cycle cost (particularly the cost of high-level waste monitoring and maintenance) and some discussion of the risks associated with the lengthy permitting process and the history of significant construction cost overruns that accompany the siting of nuclear plants. We leave for others to discuss the feasibility (from a cultural and political standpoint) of installing 5,400 MW of new nuclear resources for the Nuclear scenario, or the even more aggressive goal of almost 9,000 MW of new nuclear resources in the Nuclear & Retirement sensitivity case.

2.6 Reliability

In this report we do not address the ISO’s analysis of the reliability impact of any future scenarios. Because the ISO operates a reliable system today, we think that it is reasonable to assume that any future scenario in which peak loads remain at current levels will also be reliable. The Modified and Preferred scenarios anticipate such a reliable future.

In addition, most of the ISO’s concerns about operable capacity (its reliability metric) are related to fuel availability, import limits, pipeline capacity, and other factors that are not relevant to EE and DR resources upon which our Modified and Preferred scenarios rely. We address the issue of whether the quantities of EE and DR in our scenarios can be achieved in a later section of this report.

2.7 Drawbacks of ISO Analysis

In its effort to demonstrate impartiality in regard to resources types, the ISO limited its ability to make policy judgments. As stated throughout the process (with emphasis): “[The ISO] did not

[12] ISO Report at 5.1.4., p.54. The ISO also notes that incentives and credits that may exist for certain resources and provide an offset to their total costs are not included in its analysis, either.

[13] ISO Table 5-2, p.55, shows that even under the ISO’s optimistic assumptions for the Nuclear scenario that there is considerable uncertainty (risk) about the ability of nuclear resources to recover the full costs of the Nuclear scenario from the wholesale markets.

try to predict what the future would look like or prescribe one particular scenario over another."[14] This is an understandable and appropriate posture for ISO New England. The ISO leaves it to individual stakeholders to imagine specific future scenarios, and we have taken this challenge. The only future scenario that meets both economic and climate change goals and has a reasonable chance of being implemented is one that meets future resource needs with significantly increased levels of Energy Efficiency, Demand Response, and Renewables. This is the Preferred scenario that we describe in Section 3.0, below.

In its modeling of EE and DR, the ISO did not account for the "negawatt" impact of these resources. Rather, the ISO modeled them as "full cost" resources and assumed that all their energy "production" (actually, the energy consumption avoided) would be charged to the LSE at the market clearing price (LMP). In reality, the avoided energy consumption attributable to EE and DR is an energy cost that LSEs actually avoid. In our analysis, we show this "avoided energy cost" as a savings to the LSE.

In its input assumptions for its dispatch model, the ISO assumed that Demand Response would perform as a peak shaving resource. That is, DR was modeled to reduce system peaks during a defined set of peak hours. While this is an appropriate way to model the performance of many DR resources, there are other DR resources that can provide reductions in many hours, not just the peak hours. Direct load control, load management, and some distributed generation can provide significant reductions to system energy needs across a broad range of hours. In its report the ISO admits that "demand response measures might be able to provide greater energy savings than assumed in these analyses."[15]. The impact of not modeling the significant energy reduction potential of DR resources (beyond just the peak hour reductions) is that the LMP prices, and ultimately the cost to LSEs, are overstated in the EE/DR scenario. The inability of the ISO dispatch model to reflect these additional DR savings becomes even more important when we develop our Preferred scenario, below. This is one of the modifications to the ISO dispatch model that we recommend that the ISO include as part of the additional dispatch runs that we suggest later in this report.

2.8 Summary of ISO Analysis

The bleak future described by the ISO Report can be summarized as follows:

- under almost all scenarios, the price of electricity will be determined by highly volatile natural gas prices;
- it will be extremely difficult to achieve significant reductions in CO_2 emissions (and perhaps SO_2 and NO_X, too);
- there will be a large increase in transmission and distribution infrastructure costs; and
- most of the resource choices will need some supplemental revenue mechanisms to recover their overall costs.

The one scenario in the ISO Report that hints at a brighter future is the EE/ DR scenario.[16] Section 3 of this companion report focuses on that scenario.

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[14] ISO Report at p.2.

[15] ISO Report at footnote 10 on p. 3

[16] ISO Report at pp. 7, 69-70.

3. Companion Analysis

3.1 The Synapse Approach

In our review of the dispatch runs of ISO-NE's seven scenarios and sensitivities, we focused on resources that could provide cost savings and reduced emissions while ensuring that overall system reliability is maintained. We thought of lower costs and reduced emissions as two minimum criteria that a "preferred" mix of current and future resources would want to address. Unlike the ISO, Synapse is not constrained by a need to appear to be a "neutral" evaluator of resource options for the future. We are free to favor resources that can reduce future demand and provide hedges against the price volatility associated with carbon resources. We can choose, also, to favor resources that can reduce CO_2 emissions, primarily, and further limit other emissions (NO_X, SO_2, Mercury, and particulates).

We reviewed the ISO data and then selected several elements of the ISO analysis to construct a desirable future: one that maintains or improves the reliability of the bulk power system and reduces carbon emissions at the lowest cost to consumers (ratepayers). Instead of assuming a single resource as "the scenario" and analyzing the various outcomes from each of those single resource selections, we used the ISO data to identify combinations of resources to create a reliable, reasonable cost, and low emissions future. That is, we identify the future that we would like to achieve and use the ISO-NE data to identify the combination of new resources that can move us in that direction.

Our analysis was constrained by the data that the ISO made available and by the ISO's inability to conduct additional dispatch runs after the first draft report. Nonetheless, with the richness of the data provided by the ISO through its spreadsheet tool, we were able to modify the ISO's results based on a few simplifying assumptions. From these results, we produced our Modified scenario. With some additional adjustments to the input assumptions, we can develop our Preferred scenario. The impact from these additional adjustments will require additional dispatch runs by the ISO.

We envision a future comprised of the following elements of the resource mix to come closest to our preferred future:

- Maximum energy efficiency
- Significant contribution from demand response
- Retirements of the oldest fossil units
- Replacement of additional fossil resources
- Renewables

For the first three elements we have provided an extrapolation of the ISO's model runs. The last two elements will require input modifications to the ISO's dispatch model and subsequent runs of that model by ISO New England.

3.2 Modified Scenario

We began with the modeling results of the EE/DR case with the Retirement sensitivity. This means that 5,400 MW of new resources (2,700 EE and 2,700 DR) are augmented by the replacement of 3,500 MW of retired resources (oil, coal, and gas) with an additional 1,750 MW of EE and 1,750 MW of DR. At this step, we have 4,450 MW each of EE and DR.

Then we used the modeling results of the Double EE scenario to increase the amount of energy efficiency to 5,400 MW (the amount used in that scenario). This leaves our Modified scenario with a total of 5,400 MW of energy efficiency, almost 4,500 MW of demand response, and the remaining 25,100 MW from a mix of existing and queue resources.

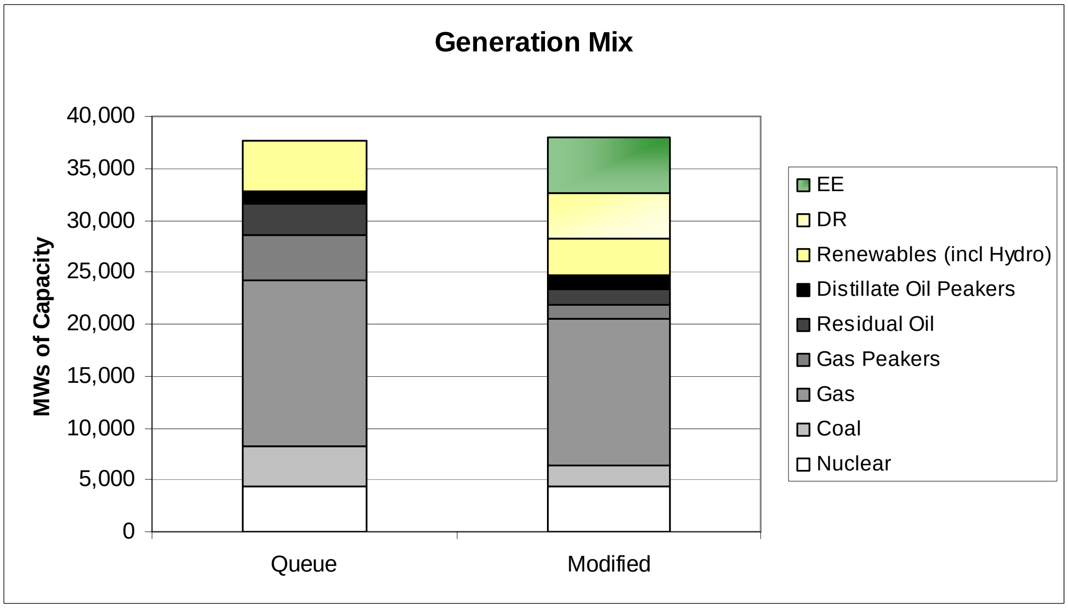

Figure 3. A comparison of the resource mix for the Queue scenario with our Modified scenario. Note that the Queue resource mix does not include any EE and DR resources. The amount portrayed here is the amount of capacity needed to reliably serve a peak load of 35,000 MW.

In order to determine the economic impact of our Modified scenario it was necessary to estimate an average wholesale energy market cost. The closest scenario from the ISO dispatch runs to our level of demand resources was the Double EE case which – like our scenario – assumed 5,400 MW of energy efficiency installed. We can see from Figure 5-1 of the ISO Report (on Page 10, above) that the average clearing price in the energy market for the double efficiency case is $60/MWh. We have assumed that our Modified scenario would produce a similar result, and we use $60/MWh for our economic analyses. Although they are dispatched in only a small number of hours, it is likely that the extra demand response in the Modified scenario would reduce this average cost.

3.3 EE and DR Resource Savings

In our comments on the ISO's Draft Report, we requested that the ISO present comparative cost charts for the seven scenarios (and sensitivities as appropriate) to illustrate one of the unique features of the EE/DR scenario.[17] In the ISO's dispatch model, the cost of these resources is

[17] Comments to ISO NE sent May 9, 2007 from EE-DR Coalition.

represented as a purchase at the energy market clearing price. In reality, all energy efficiency resources and many demand response resources perform as a reduction to load. They produce energy and capacity savings in the form of avoided purchases for the LSEs that are serving customer loads. These savings (a negative cost or a reduction in cost) are part of the total "costs" of providing these demand resources and are reflected in the bar graphs in the Figure 5-3 of the ISO Report (on Page 10, above). Since a portion of the costs in the ISO bar graph is actually a savings, we have modified the ISO's results to reflect these savings.

We used an average value of 3.5 cents/kWh for the resource cost of energy efficiency and demand response resources. The shaded top portion of the bars in our graph represents this cost to implement energy efficiency and demand response programs. The bottom portion of the bars represents the actual load in the energy market times the clearing price. The LSE cost, then, is the actual load times the energy clearing price plus the cost to acquire the EE or DR resource (at 3.5 cents/kWh). The difference between the energy market clearing price (an average of about 6.0 to 6.5 cents/kWh) and the cost to acquire these resources is the savings associated with these resources. While the ISO agreed that demand resources (EE and DR) had this feature, the ISO was reluctant to try and estimate the value of this cost reduction as part of its analysis and Report.

The graph below shows the results of our stepwise approach to building a Modified scenario from the ISO data. We have also included a placeholder for our Preferred scenario which we can develop after seeing data from additional ISO runs of its dispatch model based on some changes to the input assumptions and the scenarios that are modeled.

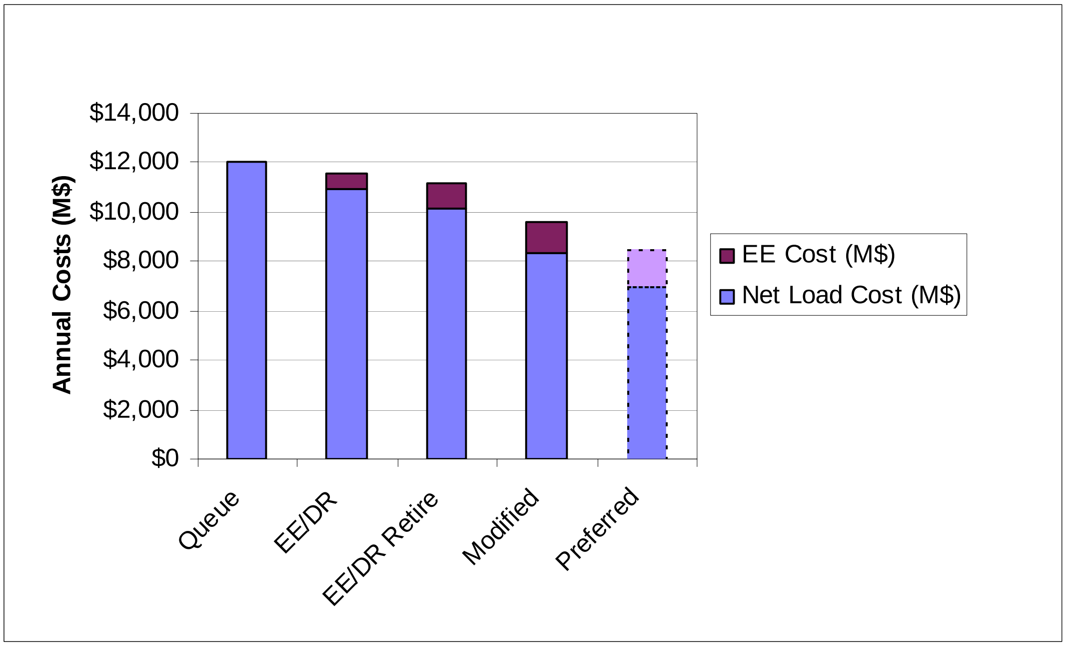

Figure 4: Annual Energy Market Cost for Various Scenarios

The CO_2 reductions associated with the Modified scenario, with a placeholder for our Preferred scenario, are represented below. Note that the Modified scenario does not quite achieve the RGGI target reductions, while the Preferred scenario does.

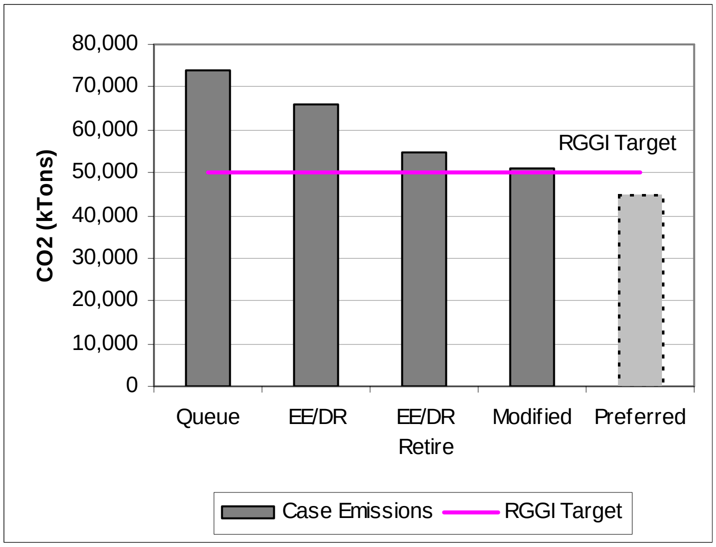

Figure 5: Annual CO_2 Emissions for Various Scenarios

We are confident that the significant quantities of EE and DR that are assumed in the ISO scenarios, and to an even larger extent in our Modified scenario, are realistic and achievable levels of these resources. The goal in our Modified scenario is almost 10,000 MW of EE and DR in New England by 2020.[18] States in New England are increasingly relying upon energy efficiency to meet their growing electricity needs. Massachusetts is committing to meet its forecasted load growth through energy efficiency. In other states (Connecticut, Rhode Island, Vermont, and likely Massachusetts), policies are being implemented or considered to procure all cost-effective energy efficiency.

Other states in the Northeast are also turning to energy efficiency as a resource to meet their electricity needs. For example, New York's recently announced goal of a 15% reduction in energy use by 2015 assumes an aggressive program that will produce a lower consumption of energy in 2015 (in absolute terms) than New York consumes today (2007). Other states have set similar ambitious goals based on studies to date that show that these goals are achievable. These findings are consistent with other state energy efficiency potential studies across the country that indicate significant energy savings opportunities ranging from 9 – 24 percent of total forecasted sales.[19]

[18] Optimal Energy, Inc. *The Economically Achievable Energy Efficiency Potential in New England.* Prepared for Northeast Energy Efficiency Partnerships, Inc. May 2005. This study shows that over 8,000 MW of cost effective achievable energy efficiency potential is available in the region before 2020.

[19] GDS Associates, *Vermont Electric Energy Efficiency Potential Study*, Final Report January 2007, Prepared for the Vermont Department of Public Service.

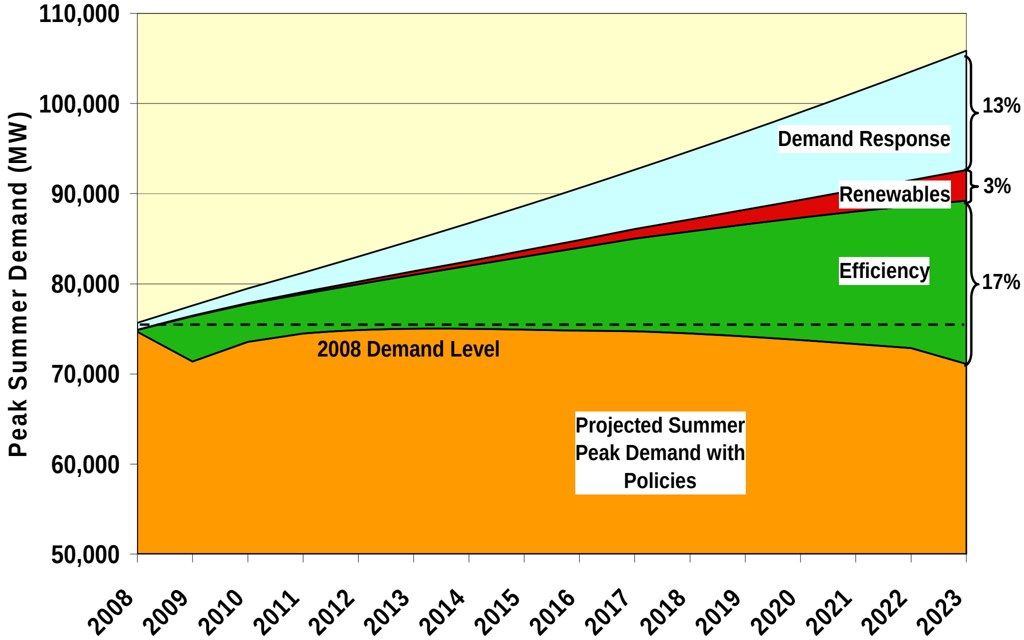

Figure 6: A particularly helpful example of how EE, DR and renewables can help to meet capacity needs is a recent analysis of Texas' growing demand.

One important basis for states to adopt energy efficiency as a core element of their future electricity needs is the cost of EE relative to supply resources. A comparison of these costs is shown below.

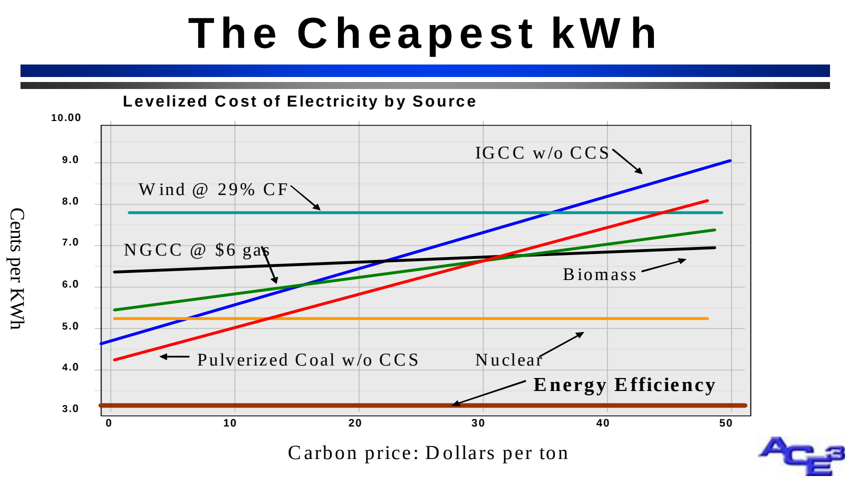

Figure 7: A comparison of resource costs that assumes a carbon tax.

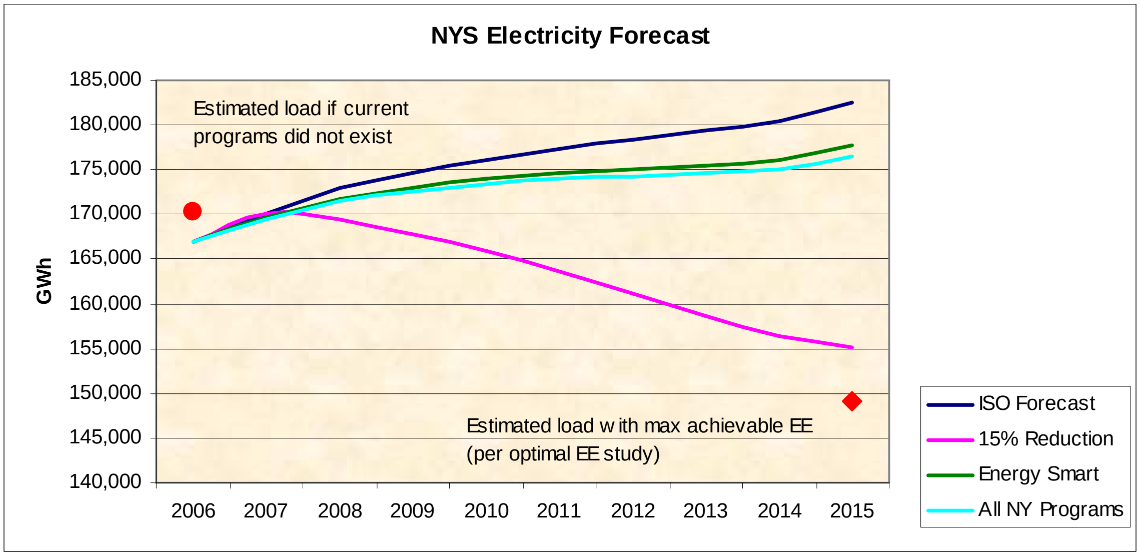

Figure 8: A graph showing the energy impacts of New York's "15 By 15" approach (15% energy reduction by 2015).

3.4 Preferred Scenario

The Modified scenario represents a resource mix that we could develop from the data in the ISO Report. Our Modified scenario demonstrates how much EE and DR we can add based on the ISO dispatch runs to date. We believe that both the ISO's results, as described in the ISO Report, and our attempt to create a Modified scenario show the benefits of incorporating even greater quantities of EE and DR. Our Preferred scenario anticipates further reductions in peak demand and annual energy consumption beyond those obtained through our Modified scenario. We anticipate CO_2 emissions reductions from the Preferred scenario will be beyond those targeted by the RGGI process to the extent that low-efficiency fossil sources are replaced with high efficiency resources and more renewables.

In order to develop our Preferred scenario, we will need some additional data from the ISO. We believe that this data can be provided by the ISO through some additional scenarios being run through the dispatch model used in its Report.

The first additional scenario would be the Modified scenario described above: the ISO's EE/DR scenario with the Retirement sensitivity and additional EE added to equal the Double EE quantity in the ISO's Report. The DR assumption should be changed to reflect energy savings in non-peak hours for some quantity of DR resources.

The second scenario would be the Modified scenario with more fossil fuel retirements (including all low-efficiency gas and oil peaking units) and replacing those resources with EE, DR (low emission), and renewables.

The third scenarios would be the Modified scenario as adjusted by the second scenario and then an additional 2,700 MW of renewables added as zero-bid resources.

These three additional dispatch runs would provide valuable data about the economic and environmental metrics (ability to exceed RGGI targets with more renewables) in comparison to the existing scenarios that the ISO presented in its Report. We have not developed all the assumptions that would go into the second and third scenarios briefly outlined above. The ISO could develop them in coordination with a stakeholder process, or, alternatively, the ISO could propose some assumptions and then solicit comments form interested stakeholders.

3.5 Other Factors

The ISO Report identifies several additional metrics by which to compare the seven scenarios in addition to the sensitivity analyses. These can be grouped as "infrastructure support" necessary for various scenarios. The most obvious are the needs for transmission and distribution upgrades to support both the delivery of the energy from a particular resource scenario and to accommodate the new, higher 35,000 MW peak load.

The ISO Report assumes that the distribution system build out to accommodate the new 35,000 MW peak demand is a common cost to all the scenarios. The cost estimates for the transmission system build out in the Report vary depending upon the specific resource scenario.[20]

One of the additional advantages of our Preferred scenario is that virtually all of the transmission system build outs can be avoided and the distribution system build outs are substantially less. Because of our emphasis on EE and DR resources, the actual peak loads for the bulk power system may be slightly lower than today's loads.

The cost differential for infrastructure support for our preferred future is a significant benefit. Avoiding new transmission projects, pipeline construction and LNG terminals, and nuclear waste are positive contributions and elements for the provision of a least cost electric system.

3.6 Other Revenue Sources for the Preferred Scenario

There are additional sources of revenue for the resources that are featured in the Preferred scenario (EE, DR, and renewable resources). Existing Renewable Portfolio Standards that have been adopted by most New England states provide a premium payment to resources that qualify. Wind, photovoltaic, fuel cells, biomass, and other DR and Renewable scenario resources can qualify for these additional revenue streams. In addition, some states are providing tax credits or other incentives to some or all of these resources. In the event that states establish minimum portfolio standards for EE resources or implement policies for distribution companies to procure all cost-effective energy efficiency, these resources will find additional revenue streams available.

[20] See ISO Report p.54. The Report assumes that a common transmission build out case for the Nuclear, Coal, and Gas scenarios could be as high as $399m annually. The Gas case would require up to an additional $330m annually for pipeline expansion. The build out for the Import case could be as high as $1.9 billion annually and does not include any costs outside of New England.

4. Conclusions

4.1 Summary of Synapse Results

In regard to the four major conclusions that we derived from the ISO Report, our analysis shows that alternative scenarios can be developed (our Modified scenario or a Preferred scenario) that mitigate most of the deficiencies of the ISO's scenarios while maintaining system reliability. We can achieve this more desirable future by expanding upon existing mechanisms to develop and implement much larger quantities of energy efficiency, demand response, and renewable resources.

- Gas will still be the marginal resource and set the clearing price in most hours, but the cost to consumers can by less by reducing the overall quantity of electricity purchased.
- CO_2 reductions can be achieved that exceed the current RGGI targets.
- Cost recovery (financial viability) for EE, DR, and Renewable resources is achievable with available revenue streams.
- Most infrastructure expansion (costs) can be avoided with a largely EE, DR, and Renewable resource scenario.

Most importantly, this desirable future is achievable and cost effective using current technology; future technological advancements will make this future even easier to attain.

4.2 Policy Issues

The ISO Report invites the use of the dispatch runs to inform and stimulate a healthy debate in the region as to what possible futures are desirable. We applaud the ISO for its efforts to date and suggest that the regional discussion and analysis of future scenarios has just begun. The ISO can continue to perform its role as the independent regional grid administrator and assist the region's policymakers through additional "scenario analysis" modeling. ISO New England is uniquely situated to conduct the region-wide analysis and dispatch runs that are necessary to understand the impacts of resource choices on an inter-connected New England bulk power system.

The results of the ISO's analysis will provide much useful information to regional stakeholders who will all be working to shape and form our future electricity system.