Bringing Possibilities Into Focus

2011-2012 REGIONAL ELECTRICITY OUTLOOK

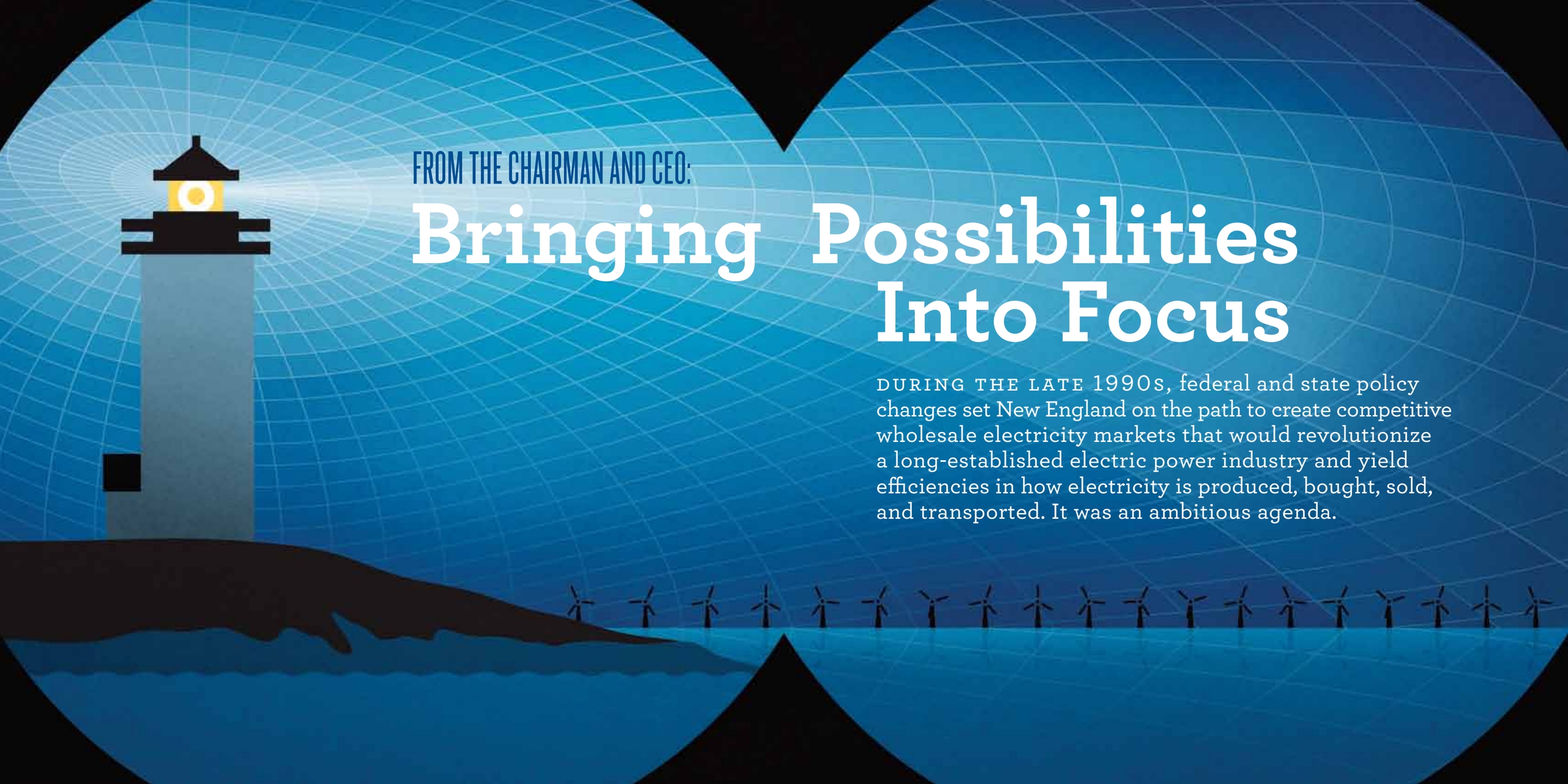
About ISO New England

ISO New England is the independent, not-for-profit corporation responsible for overseeing the day-to-day reliable operation of New England's power generation and transmission system, designing, administering, and monitoring the region's competitive wholesale electricity markets, and managing comprehensive regional power system planning. The company's workforce of power system engineers, economists, computer scientists, and other professionals fulfill these three critical responsibilities that together ensure New England has reliable, competitively priced electricity today and into the future.

ISO New England's board of directors and employees have no financial interest in any company doing business in the region's wholesale electricity marketplace. The ISO serves the six-state region of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont and is regulated by the Federal Energy Regulatory Commission (FERC).

2011-2012

Regional Electricity Outlook



FROM THE CHAIRMAN AND CEO:

Bringing Possibilities Into Focus

DURING THE LATE 1990S, federal and state policy changes set New England on the path to create competitive wholesale electricity markets that would revolutionize a long-established electric power industry and yield efficiencies in how electricity is produced, bought, sold, and transported. It was an ambitious agenda.

ISO New England was established to help carry out this promise. We assumed three primary responsibilities—operating the power system, administering the wholesale electricity markets, and conducting power system planning—that together ensure a reliable supply of competitively priced wholesale electricity for New England residents and businesses.

In a relatively short time, New England has seen a dramatic, positive impact on its power system and the pricing of wholesale electricity. Billions of dollars in private investment in cleaner and more efficient power plants and demand resources have boosted the region's supply by more than a third, new transmission lines have improved the flow of power throughout the region, and considerable efficiencies and savings have been realized.

Today, federal and state policy are setting the industry on another bold course—one that emphasizes the importance of renewable resources and advanced technologies to reshape how electricity is produced and delivered, while providing numerous incentives to modify the way electricity is used.

Over the next several years, prevailing economic factors, such as high oil prices and the need for compliance with pending environmental regulations, are likely to result in *substantial and relatively rapid changes* to the types of power plants and other resources New England will need to use to meet electricity demand. As a result, our industry has a tremendous and exciting opportunity to realize important environmental and technological advances, although the magnitude and complexity of this transformation creates significant challenges for the region.

Recognizing that grid-altering changes are just on the horizon, ISO New England has kicked off a strategic initiative that draws together stakeholders representing a variety of constituencies, resources, and interests in New England to determine a comprehensive course of action for shaping how the region's electricity landscape evolves.

Our first goal has been to examine the situation and bring the region's challenges into focus. This year's *Regional Electricity Outlook (REO)* briefly summarizes this assessment. The REO describes the resource concerns we are already facing, the expected transition of the resource mix in the next several years, and the relationship between those changes and critical issues such as fuel diversity and operational flexibility of the power system.

Once stakeholders come to understand and reach a broad-level agreement on the causes, concerns, and impacts of the challenges, we will begin to consider suitable responses. New England has a long history of proactively identifying risks and spearheading coordinated approaches to solving difficult tasks. However, because the issues are fast approaching and intricately connected, the region must take a holistic approach to developing solutions. We must consider the effect on and possible alterations to current grid operations, market design, and planning processes as a whole to preserve system reliability and efficiency. The results will drive ISO New England's business plan for the next several years and will affect future investments in New England's power system.

In the end, New Englanders must be able to count on a dependable supply of reasonably priced electricity. This is essential to the life and productivity of the region's 14 million residents and to its $720 billion economy. The grid must be prepared for and operated to withstand a wide range of operating and economic circumstances.

We at ISO New England are committed to working with state regulators and policymakers, market participants, and other electricity stakeholders to advance the state of the art in wholesale market design, regional system planning, and system operations to effectively tackle these challenges. While viewpoints may differ, we all have a vested interest in securing New England's electricity future. Some tough choices lie ahead, and trade-offs may be required. Together, we have the experience, skills, and fortitude to keep the grid and markets advancing in step with the needs and goals of our region.

Sincerely,

David Vitale

Gordon van Welie

David Vitale
Chairman of the Board

Gordon van Welie
President & CEO

Challenges on the Horizon

NEW ENGLAND HAS SECURED AMPLE GENERATION, demand resources, and imports to meet electricity demand over the coming years. However, certain changes in the region's resource mix could affect the ability of the grid to operate reliably.

These shifts have been identified and documented in many recent analyses, including the *New England Wind Integration Study*, *2010 Regional System Plan*, and *2009 Economic Study* published by ISO New England; the *Potential Resource Adequacy Impacts of U.S. Environmental Regulations* report published by the North American Electric Reliability Corporation; and the *New England Governors' Renewable Energy Blueprint*.

In addition, the ISO has been experiencing circumstances first hand while operating the grid that are validating concerns brought to light in these reports and underscoring their imminence.

From these analyses and experiences, the ISO has identified five core challenges on the horizon:

0-3 Years

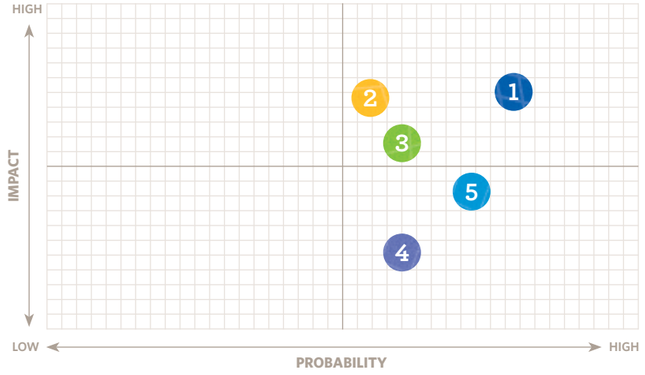
1. Resource performance and flexibility
2. Increased reliance on natural-gas-fired capacity

3-6 Years

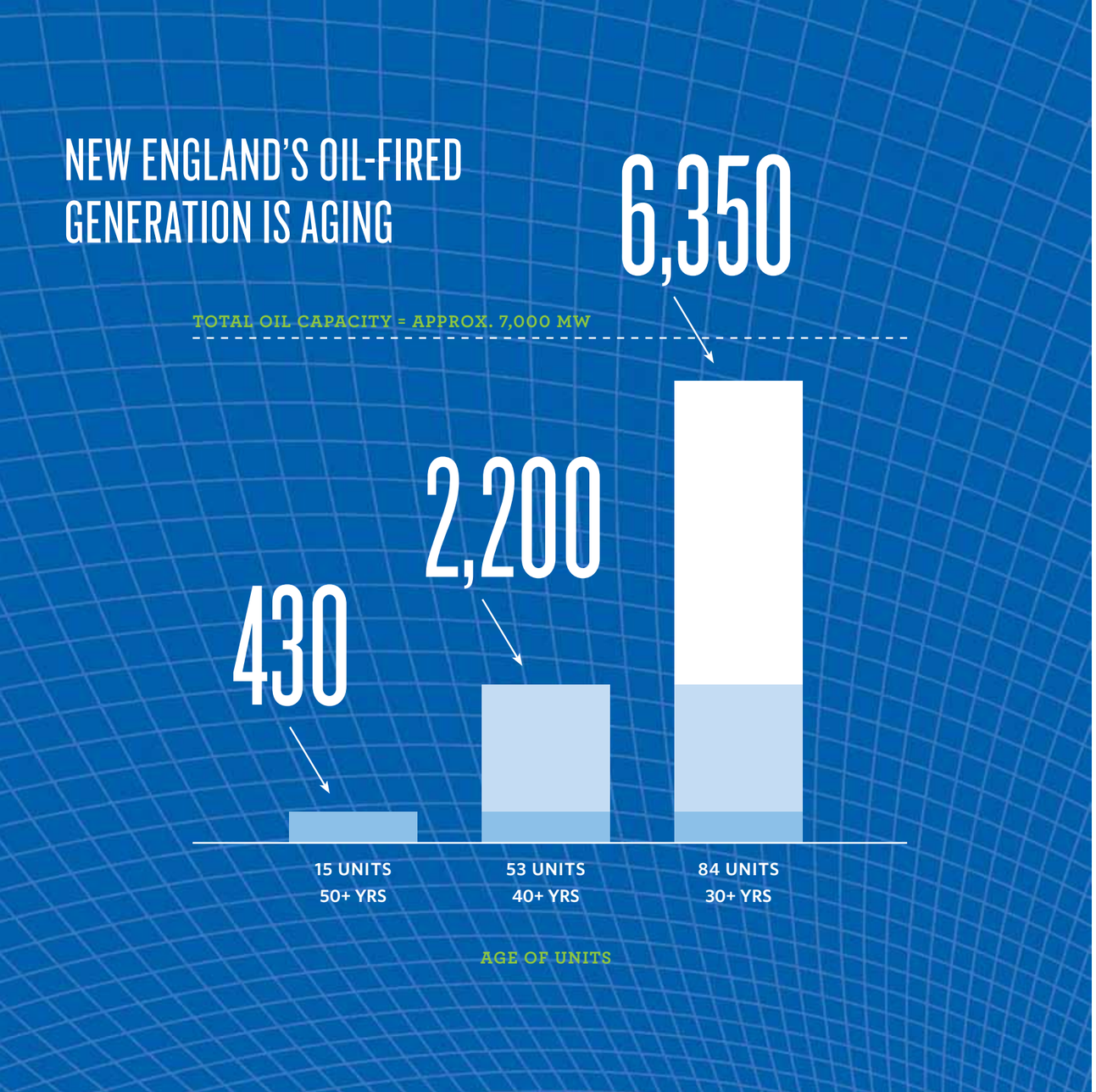
3. Retirement of generators

6-7 Years

4. Integration of variable resources
5. Alignment of system planning and wholesale electricity markets



The challenges are numbered for reference, but in fact, they do not easily fall into any order of priority. Because they are highly intertwined, decisions made on one challenge will impact every other. To anticipate and adopt any necessary changes, it is important to first understand these issues as a whole. In doing so, the industry will be better able to address them proactively and vigorously to ensure New England's power system stays on a reliable and efficient course.



Resource Performance and Flexibility

1

To operate the power system reliably, ISO New England needs a significant amount of resources held in reserve to cover a contingency, such as the sudden loss of a generator or transmission line. Reserve resources must have the capability and flexibility to come on line when called and must be able to perform as needed.

During 2010 and 2011, ISO grid operators experienced several instances when the performance and flexibility of power plants and demand resources were insufficient to correct these situations in a timely manner (see sidebar on page 14). These events demonstrate the need to enhance market rules and operating procedures to improve resource performance and dispatch, better meet current operational needs, and bolster the long-term efficiency and reliability of the system.

Causes and Concerns

PERFORMANCE AND FLEXIBILITY OF AGING SUPPLY RESOURCES

New England continues to rely heavily on older generators, particularly oil-fired units, to run for short periods during stressed system conditions. However, about 90% of the approximately 7,000 megawatts (MW) of oil-fired units in New England were built to run for longer time periods as baseload or intermediate generation and are more than 30 years old. Because this generation wasn't built with flexibility

in mind, some of the units are slow to start up when contingencies on the system occur and, on occasion, are not performing as needed in the wholesale market environment. By 2020, these units will range in age from 40 to 70 years old.

Because the decision to call on these slower-start units must be made in advance of the Day-Ahead Energy Market, they are often committed "out of market," at an additional cost. Reliability costs increased 71% in New England, from $55.7 million in 2009 to $95.5 million in 2010.

PERFORMANCE AND FLEXIBILITY OF ACTIVE DEMAND RESOURCES

New England has been very successful in adding a significant number of demand resources to its resource mix. The ability for system operators to call on such a large amount of demand reduction can accomplish several objectives. It can defer the need to build expensive power system infrastructure, reduce the region's reliance on imported fuel supplies for certain power plants, and reduce emissions by not using certain plants during peak demand days. In addition, demand resources eventually may be able to facilitate the overall integration of wind resources with their ability to quickly reduce demand on the system when the wind stops blowing.

To reap the benefits of such a large amount of demand resources, the ISO is working on numerous initiatives to ensure these resources are integrated effectively into system operations, market operations, and system planning. This includes making improvements to the software and communications infrastructure used between demand resources and the ISO during real-time system operations; revising market rules and operating procedures to more effectively employ these resources as reserves during shortage events and emergencies; and designating dispatch zones so operators can call on demand resources precisely where, when, and in the amount they are needed.

Because these resources are not yet integrated into economic dispatch and can be called on only during limited circumstances, they cannot fully contribute to system flexibility. Moreover, these resources are relatively new, with a short performance history, and some, when activated in the past year, have demonstrated inconsistent availability and performance.

The uncertainties around the performance of demand resources are intensified by the fact that the current requirements for their participation in the wholesale electricity markets differ from those for generators, and the measurement and verification processes for demand-resource performance are complicated.

Impact

When the ISO does not have precise information about a resource's capabilities or response time, or when a resource does not perform in accordance with its specifications, grid operators are forced to depart from efficient and reliable dispatch of the system (see sidebar). This increases both the cost of operations and the chances of unintended power system outages and puts the ISO in jeopardy of violating federal reliability standards.

Timing

Performance and flexibility of resources is the most pressing challenge the region faces. The impact is particularly pronounced during times of stressed system conditions. Left unaddressed, the effects will exacerbate the remaining four challenges.

1 Resource Performance and Flexibility

Analysis Underway

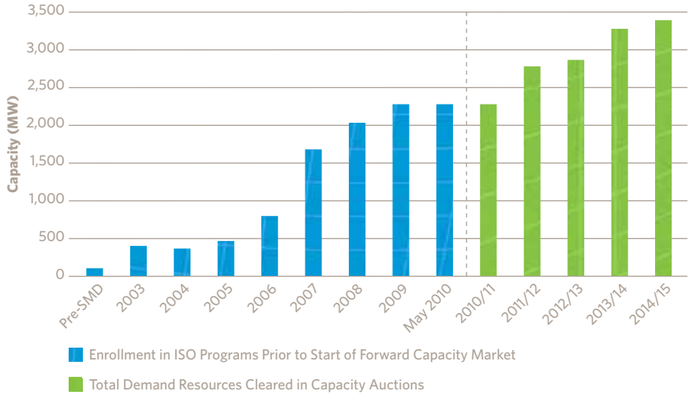
In response to recent events, ISO New England met with more than 100 plant managers and operators in December 2010 and launched a comprehensive web-based training program in summer 2011 to review the importance of following dispatch instructions. The ISO also is examining its contingency tools, generator auditing processes, and market rules and operating procedures to adjust the range during which resources must operate when responding to a dispatch signal.

To increase the flexibility of system operations, the ISO is reviewing the requirements for operating reserves to possibly adjust the amount and types of resources procured in the locational Forward Reserve Market.

Moreover, in early 2011, FERC issued Order 745, which establishes how demand resources should be compensated in energy markets. The ruling set in motion a major business and information technology project at ISO New England to develop and implement the market rules needed to enable the full integration of demand resources into the energy markets.

Demand Resources Are Replacing Generation as Capacity

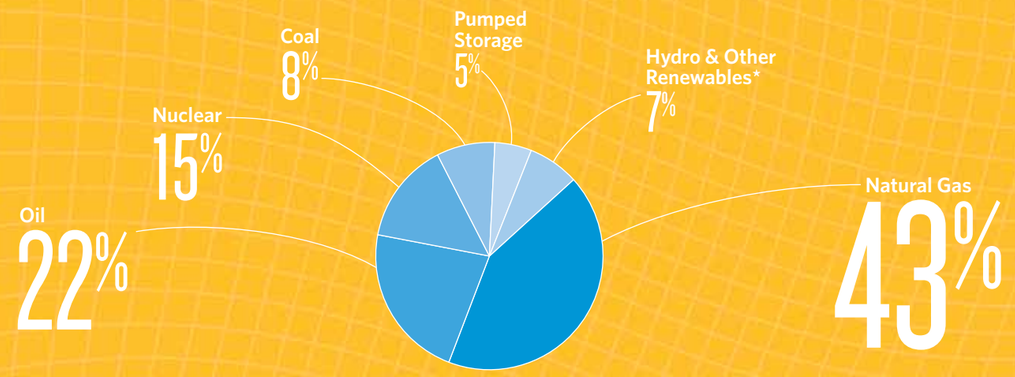
Approximately 8% (2,500 MW) of the region's capacity comes from demand resources today, growing to 10% (3,400 MW) in 2014/15



A combination of high loads and forced outages during two days in 2010 caused unusual operating conditions. On June 24, total system capacity dropped below the level needed to meet demand plus operating reserve, and several actions of the ISO's Operating Procedure No. 4 (OP 4), *Action during a Capacity Deficiency*, were called. This was the first time demand resources procured through the Forward Capacity Market (FCM) were dispatched. While in aggregate, the response was good, most resources either overperformed or underperformed. In a separate incident, on September 2, a large generating unit tripped, forcing the operators to dispatch all reserves available within 10 minutes to restore the area control error (ACE) to precontingency levels. The ISO dispatched more than enough megawatts needed to cover the contingency; however, generator response to the dispatch instructions was inadequate to restore the ACE in a timely manner. The current market rules did not allow the operators to access demand resources under these conditions, limiting the resources available to the operators.

GENERATION FLEET CAPACITY IN NEW ENGLAND BY PRIMARY FUEL TYPE

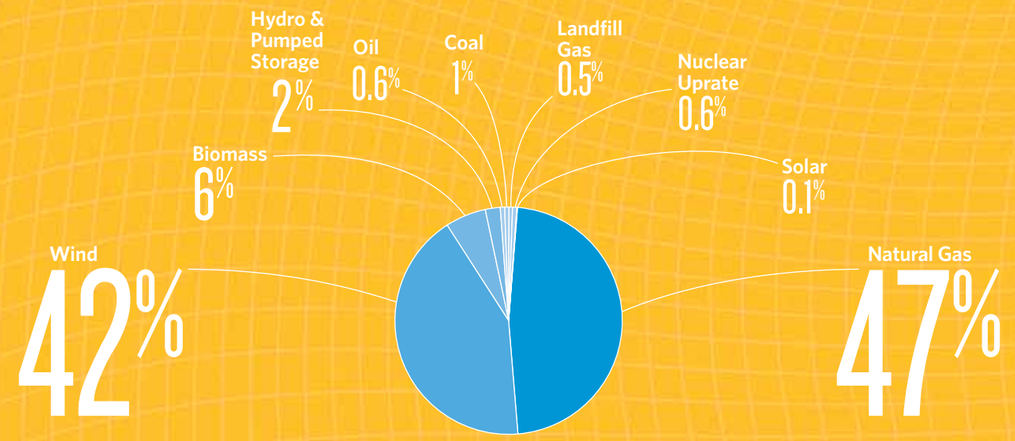
SUMMER 2011
TOTAL APPROX. 32,000 MW



* "Other renewables" includes landfill gas, other biomass gas, refuse, wood and wood waste, wind, and misc. fuels.

PROPOSED GENERATION CAPACITY IN NEW ENGLAND BY PRIMARY FUEL TYPE

SUMMER 2011
TOTAL APPROX. 7,000 MW



Increased Reliance on Natural-Gas-Fired Capacity

2

New England is heavily dependent on natural gas as a fuel for generating electric energy. This dependency is expected to intensify over time. Most of the 10,800 MW of new generating units that have come on line in New England since 1999 are natural-gas-fired resources; natural gas plants make up almost half of the new generation being proposed in the region.

While these generators operate efficiently, emit relatively few pollutants, and help meet environmental goals, increased reliance on natural-gas-fired plants reduces the variety of resources on the grid. This complicates reliability of operations, particularly under cold winter conditions and other times of system stress when gas may not be readily available.

The region has taken many steps to mitigate issues associated with its dependence on natural gas generators since 2004, when a severe cold snap hit the region causing reliability concerns related to gas availability. New and revised operating procedures and improved communications between electric power and gas system operators have lessened operational risks and improved reliability. Recent improvements to the regional and interregional natural gas infrastructure have helped expand and diversify natural gas sources. Nevertheless, challenges remain with the availability of this resource.

Causes and Concerns

COMPETING WITH HEATING MARKET

Dependence on natural gas is a particularly acute problem during cold winter months when a substantial amount of the fuel is needed simultaneously for heating and electricity generation. Natural-gas-fired power plants in the region generally do not have firm contracts for the supply of natural gas and instead rely on an interruptible supply. Residential, governmental, and certain commercial interests have a contractual priority over electric power generation.

In addition, the power plants do not have the economic incentive or obligation to refrain from selling their natural gas supply into the heating market, especially when the price of gas is higher than the price of electricity.

LACK OF DUAL-FUEL CAPABILITY

New England does not require generators to have an alternate fuel as backup, and this lack of dual-fuel capability at most gas-fired plants exacerbates the problem. In the early to middle part of the last decade, generators began adding dual-fuel capability to gain the ability to switch between oil and natural gas depending on the economics of the two fuels. As the prices of the two fuels have separated and the price of oil has climbed well beyond the price of natural gas, generators have been less inclined to invest in or maintain the ability to quickly and flexibly switch from natural gas to oil.

SUSCEPTIBILITY TO GAS INFRASTRUCTURE CONTINGENCIES

The ISO plans the power system to withstand a variety of contingencies. However, ISO system planners cannot plan for a problem on the natural gas infrastructure, such as the loss of a major interstate pipeline. Difficulty on a natural gas pipeline could have an impact on multiple generators and could severely limit available gas-fired capacity at any point in the year, including at the time of summer peak.

RELATIONSHIP TO ENERGY PRICE SETTING

Because natural gas power plants produce more than 40% of our region's electricity, the prices of natural gas and electricity are closely tied, subjecting the region to potential price increases when gas prices are high. In 2009, natural gas prices were down significantly—and the region saw a 50% decline in energy market prices from 2008 to 2009. In other periods, such as during the summer of 2005 when hurricanes devastated natural gas delivery systems in the Gulf of Mexico, increases in natural gas prices drove up electric energy market prices.

Impact

When ISO New England grid operators are uncertain about the availability of natural gas plants, they have to call on other resources, often older oil-fired resources, to ensure the reliability of the system. These older resources often are not able to fulfill a reliability need during certain operational situations, and calling on them creates out-of-market costs (see challenge 1).

In the past year, the region faced several instances that raise serious concerns about the performance of resources and illustrate the importance of fuel diversity. During a cold-weather period in January 2011, major generators in the region experienced performance issues, a natural gas pipeline faced potential curtailments, and natural gas prices quadrupled. The ISO was forced to commit approximately 4,500 MW of oil-fired plants out of market to ensure adequate operating reserves, adding costs. The prospect of unreliable grid operations that could cut heating and lighting during a cold New England winter could be more detrimental to New Englanders than during a summer period.

2 Increased Reliance on Natural-Gas-Fired Capacity

Timing

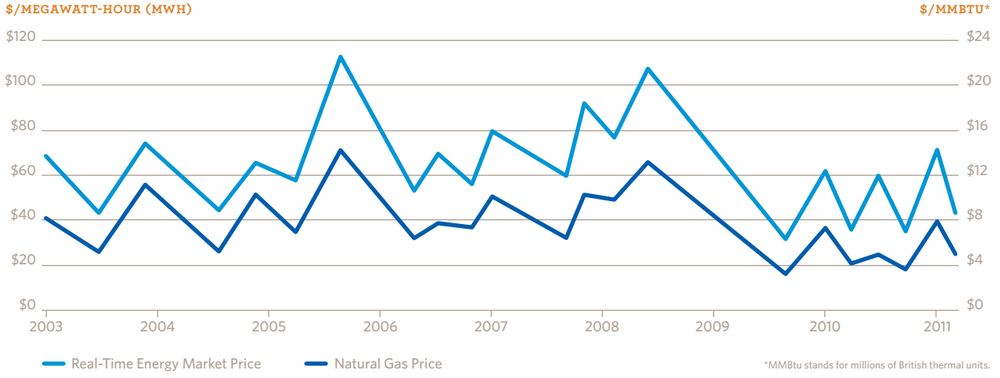
New England has become even more reliant on natural gas over the past few years because the price for the fuel has been lower than the price of oil, and therefore, natural-gas-fired power plants have been selected to run more often than oil-fired generators (see challenge 3).

The region's reliance on natural-gas-fired resources is expected to increase even further over the next decade if additional natural-gas-fired plants are developed to respond to retirements in the oil, coal, and nuclear fleet. This is likely to occur for several reasons. New oil, coal, and nuclear plants are not expected to be built in New England because of environmental issues and regulations. Wind generation will continue to increase as an energy resource but may provide only limited contributions to reliable daily operations, particularly if it is located within constrained areas (see challenge 4), and it will likely require significant transmission investments. As a relatively new resource category, the extent of the ability of demand resources to contribute to reliable operations under a full range of stressed system conditions is uncertain (see challenge 1). For example, active demand resources—a large portion of which is air conditioning load relief—is absent in the winter months when the natural gas concerns are more severe. On the other hand, new gas-fired plants could be built in locations requiring little additional transmission system infrastructure.

Analysis Underway

A study of the region's natural gas system is underway to assess the effects of generator retirements on fuel-diversity concerns; determine the quantities of gas-fired megawatts available after all firm, priority gas deliveries are accounted for; review natural gas infrastructure contingencies affecting reliable electric power operation; and determine the need for additional natural gas system supply to reliably serve the New England generating resources.

Wholesale Electricity Prices Track Natural Gas Prices



DRAMATIC SHIFT IN NEW ENGLAND'S GENERATION MIX

New, highly efficient natural-gas-fired generators displace use of fuel oil.

Generation Retirements

3

Economic factors combined with environmental concerns and pending environmental regulations will likely result in the retirement of some of the region's power plants, including resources important for systemwide or local reliability.

Causes and Concerns

LOSS OF REVENUE

At 20% of New England's generating capacity, oil-fired power plants have been important contributors to the region's ability to meet reliability requirements. However, as the cost of oil has gone up and the cost of natural gas has declined, natural-gas-fired power plants have been selected more often in the energy markets to run, displacing the oil-fired units. Over the last few years, oil-fired generators have produced less than 1% of the electric energy generated annually in the region. In 2010, oil-fired plants accounted for less than 1% of energy production, down from 22% in 2000. In addition, recent upgrades to the transmission system have reduced the need in certain locations to commit some oil-fired units to maintain reliability.

POLICY PRESSURES

Between now and 2015, the U.S. Environmental Protection Agency (EPA) is expected to implement a variety of stricter rules regulating sulfur dioxide, nitrogen oxide, hazardous air pollutants like mercury, coal-combustion byproducts, other pollutants, and power plant water intake structures. These regulations are forcing owners of older generators, including coal- and oil-fired plants, to confront a difficult decision: invest in large capital projects such as emission-control and water recycling technologies to keep a power plant compliant, or close the plant down.

In fact, national studies have estimated that more stringent environmental regulations could cause as much as 4,000 MW of oil- and coal-fired generation to retire in New England as soon as 2015.

Dominion Energy Marketing Inc. plans to retire two coal-fired units at its Salem Harbor power plant in December 2011 and retire the remaining two units—one coal, one oil—in June 2014, even though ISO New England determined that the two remaining units would be needed in 2014–2015 to ensure the reliability of the power system in northeastern Massachusetts and Greater Boston. Dominion has chosen not to pursue an out-of-market arrangement and retire the units nonetheless.

Impact

When a resource chooses to disconnect from the grid, it must provide advance notice to ISO New England, which is required to study whether the loss of that resource would adversely affect power system reliability. Given the major investments in transmission, generation, and demand resources in New England over the past decade, the ISO's studies may show that certain generators that wish to retire are not needed to maintain reliability.

However, the exit of some generation in key locations on the transmission system, close to demand centers, could trigger reliability problems. If the necessary system modifications are not in service by the time a plant is scheduled to retire, the ISO has options to address contingencies that could occur, such as developing special operating plans or issuing requests for proposals to have emergency generators brought in. Under some circumstances, the ISO may have to initiate emergency operating procedures, including asking consumers to conserve. As a last resort, the ISO and local transmission owners could employ controlled power outages as a temporary measure to protect the integrity of the power system.

The region also has the option to keep generators economically viable and on line in the short term by paying them extra revenues to keep from retiring. Resources that agree to postpone their retirement because they are needed for reliability have the option to file with FERC a request to receive cost-of-service compensation. This compensation could include payments for capital upgrades needed to stay in service. While ISO New England may determine a resource is needed for reliability, the ISO cannot prevent a resource from retiring (see sidebar).

Additionally, the retirement of a significant quantity of coal, oil, and nuclear capacity could further increase the region's dependence on natural-gas-fired power plants, intensifying reliability concerns (see challenge 2). More demand resources could be obtained to help meet peak demand; however, as a relatively new resource category, the extent of the ability of these resources to contribute to reliable operations under a full range of stressed system conditions is uncertain (see challenge 1).

3 Generation Retirements

Timing

If the cost of oil remains high, the economic pressures on oil-fired plants will persist. Should the region continue to have surplus capacity, forthcoming changes to the Forward Capacity Market mandated by FERC could further decrease revenue for these plants.

While the exact form and timing of the regulations are not certain, compliance with stricter environmental requirements is expected to begin within the next two years. As a result, some resources already are requesting to retire; more retirement requests are anticipated in the next three to six years.

The region could see reductions in its nuclear fleet as early as 2012.

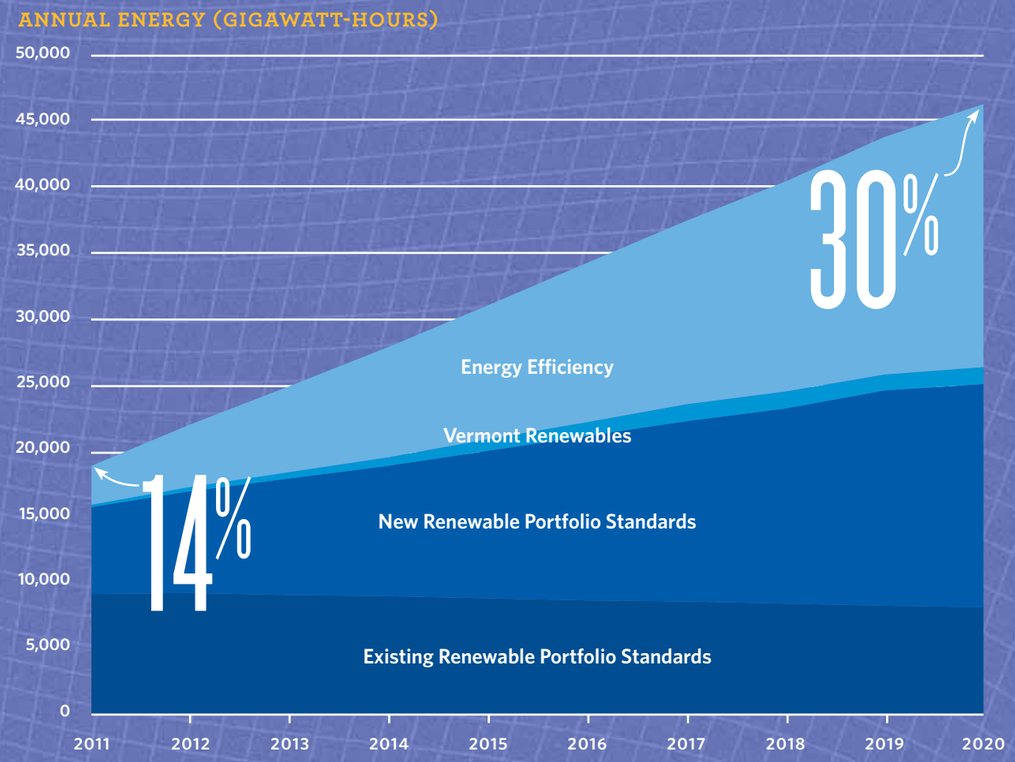
Analysis Underway

The ISO is conducting a study of power plants expected to face large capital costs as a result of impending environmental requirements and is analyzing the potential impact of generator retirements on system operations. Enhancements to the wholesale market design and system planning procedures will likely be considered so that the region can develop new tools to more efficiently address the replacement of retiring resources. The retirement of generators at important locations on the system raises many of the issues presented in challenge 5.

Rule	Proposed	Projected Final	Projected Compliance Date
Clean Air Transport Rule	August 2010	June 2011	Begins 2012
Utility Air Toxics Rule	March 2011	November 2011	2016
Clean Water Act 316(b) Cooling Water	March 2011	July 2012	2013-2020

PROJECTION OF RENEWABLE-RESOURCE AND ENERGY-EFFICIENCY TARGETS IN NEW ENGLAND TO 2020

Renewables provided approximately 12% of New England's electric energy in 2010.



Integration of Variable Resources

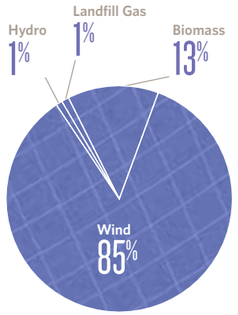
4

Each New England state has set ambitious goals, including Renewable Portfolio Standards, for the development of renewable resources. Taken together, these goals call for 30% of New England's projected total electric energy demand in 2020 to be met by renewable energy resources and energy efficiency.

The individual states also have pursued ways to reduce carbon dioxide emissions, and all six are members of the Regional Greenhouse Gas Initiative. Last year, the region's governors asked the New England States Committee on Electricity to explore the concept of coordinated procurement for cost-effective renewable resources. And FERC is poised to implement a requirement for system planners to factor public policy goals into transmission planning studies.

The combination of these policies has sparked a dramatic increase in proposals to develop renewable energy—particularly wind energy, which has the potential to be the fastest growing resource in the region. ISO studies show that New England has an abundance of high-quality wind resources. They also show that wind power could meet as much as 24% of the region's electricity demand by 2020 if upgrades are made to the transmission infrastructure needed to deliver the energy to demand centers.

Proposed Renewable Energy Projects in New England by Type
Summer 2011, Total Approx. 3,300 MW



Causes and Concerns

Studies conducted by ISO New England and regional stakeholders have shown that, when available to provide energy, wind generation would reduce the use of natural-gas-fired generation as an energy resource and almost fully displace oil-fired generation. Therefore, with zero emissions and no fuel costs, the addition of significant amounts of wind energy will help achieve environmental goals, mitigate wholesale electricity price volatility caused by wide-ranging fuel prices, and help alleviate fuel diversity concerns under normal system operating conditions.

However, renewable resources such as wind are not always capable of producing much electricity at times when the need for diverse resources is most important. Wind speeds can be at their lowest levels in the summer, when New England's demand is peaking, and in the winter during extreme cold conditions when demand is high.

Adding large amounts of this variable resource also would increase the complexity of control room operations, such as restricting dispatch flexibility. If this wind potential is realized, system operators must be prepared to manage dispatch with resources in the mix that can have rapid and sizeable swings in output. To balance these potential swings by variable resources, the system must hold more capacity in reserve that can come on line quickly. But as challenge 1 describes, resource flexibility continues to be a concern. If this requirement is filled by natural-gas-fired generation, fuel-diversity concerns will be exacerbated (see challenge 2).

Impact

Considerable investment will be needed to interconnect and integrate significant wind resources into the grid. Specifically, the transmission system will need to be expanded to bring electricity from the often remotely located wind resources to central locations where demand on the grid is higher. An analysis conducted at the request of the six New England Governors found that the cost to interconnect from 2,000 MW to 12,000 MW of wind power would be between $1.6 billion to $25 billion in transmission upgrades.

To balance the variability of wind, the region will need to increase the number of flexible resources on the system that can provide reserves, regulation service, and ramping capability in the most effective locations (see challenge 1).

4 Integration of Variable Resources

Currently, procedures are in place to maintain reliability if the system were to add a greater level of variable resources. However, considerable investment in smart grid technologies will be needed to provide system operators with the tools to operate the system nimbly enough to adjust to the unpredictability of wind.

Timing

While new renewable resources are being added to the system, the current amount and pace of the additions remains modest relative to the overall resource base. Substantial increases in variable renewable resources are not expected for several years. The extent to which wind energy will be developed will depend on the region's willingness to fund transmission investment.

The pace of growth also may be mitigated by sustained, low natural gas prices; a delay at the federal level in developing clean energy and carbon legislation; and resistance in some parts of the region on meeting Renewable Portfolio Standards.

Analysis Underway

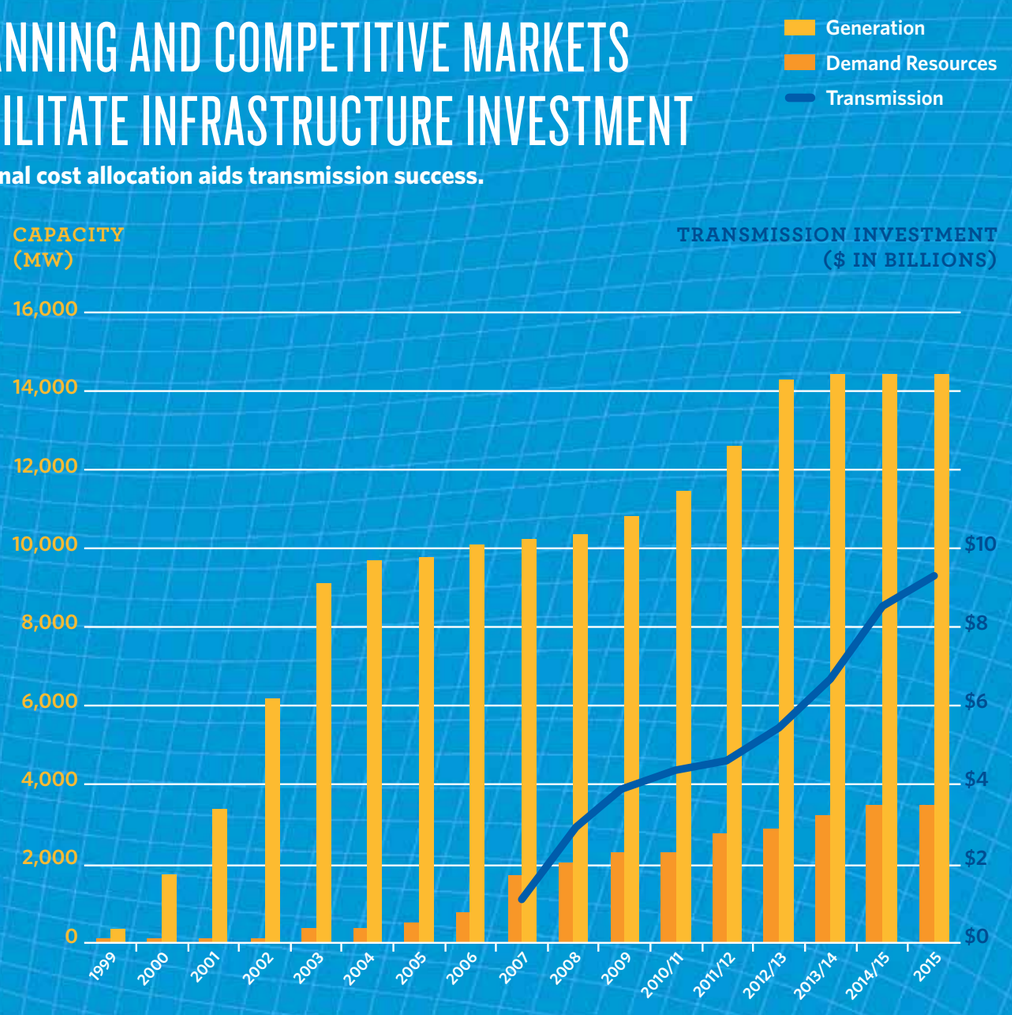
The ISO has embarked on a series of wind-integration activities to address these challenges; it is developing centralized wind forecasting tools and processes for 2012 and continues to analyze wind-resource development.

As with challenge 1, the ISO is reviewing the requirements for operational reserves and evaluating possible enhancements to the locational Forward Reserve Market to better meet operational needs and improve the long-term efficiency and reliability of the system.

On a national level, ISO New England is active in a number of forums and working groups on transmission planning for the North American interconnections to meet economic and environmental policy objectives. The ISO is working to ensure that broader planning initiatives take into account the status, needs, and future development of New England's system. A process that harmonizes regional plans with federal energy policy goals will best serve the interests of the states, regions, and the federal government.

PLANNING AND COMPETITIVE MARKETS FACILITATE INFRASTRUCTURE INVESTMENT

Regional cost allocation aids transmission success.



Aligning System Planning and Wholesale Electricity Markets

5

As discussed in previous challenges, New England is facing a period of potentially rapid turnover in its generation fleet. With its current system planning, operations, and market tools, ISO New England can manage the grid through this change. However, existing tools are reactive in nature and depend on out-of-market contracts and backstop cost-of-service transmission projects, so they may not be the most efficient way to address emerging reliability issues.

At the same time, some of the states and stakeholders in New England are looking for mechanisms that will allow supply and demand resources to address power system reliability needs as an alternative to transmission and have requested that the ISO perform analyses on the potential of these market resources to provide reliability solutions. The design and implementation of these mechanisms will determine the shape of the industry for years to come.

Causes and Concerns

As part of its regional system planning process, ISO New England conducts ongoing engineering assessments that analyze and estimate New England's power system requirements 10 years into the future. Through these analyses, the ISO provides considerable information on the amounts, types, locations, and performance requirements of resources that could meet system needs.

This information, combined with pricing signals from the markets, enables participants in the marketplace to make sound business decisions about investing in the power system. Informed decision-making is critical to participants who, in this market-based setting, carry the financial risk of these large-scale investments.

New England relies first and foremost on projects proposed from the marketplace to solve power system reliability needs. To the extent that market responses are not forthcoming or adequate to meet these needs, the ISO is required through its tariff to identify the appropriate transmission infrastructure solutions.

In the past decade, the existing combination of planning processes and wholesale markets has brought forward more than 10,000 MW of new, efficient generation; over 2,500 MW of demand resources; and over $4 billion in new transmission infrastructure.

Nevertheless, the current interaction between the system planning process and the wholesale markets may not include sufficient signals and incentives for market resources to respond to the forthcoming evolution of the power system. What's more, the pace of changes to the generation fleet may not allow for the marketplace to respond and develop efficient solutions before transmission projects are put forward.

Impact

Because market resources can include disparate types of generation (including distributed generation), end-use efficiency, and storage technology options, assessing their suitability during the planning process will be challenging. For the region to follow this path, consensus on planning criteria will be needed to complete a robust and accurate analysis of these resources.

A primary issue that must be resolved is how costs for a market resource should be recovered. One side of the debate says that, if these resources can solve a reliability problem or defer a need for a transmission investment, they should receive cost-of-service recovery just like transmission. Others advocate that these resources should recover costs through the markets and that the market design should be changed to reflect the types of solutions that can meet the reliability needs identified in the regional system planning process.

These issues have far-reaching implications for both wholesale market design and system planning procedures. Whether the mechanisms chosen are accomplished through the markets or by the ISO taking on a more proactive resource-planning role is another fundamental decision for the region. Choices made could affect the mission of ISO New England and the overall competitiveness, efficiency, and effectiveness of the wholesale markets.

Timing

It is desirable to have at least a partial solution to this issue in time to address the emergence of challenge 3. However, the complexity of the issue is such that the ISO and regional stakeholders will need several years to review and arrive at a solution that more fully aligns the regional system planning process with wholesale market

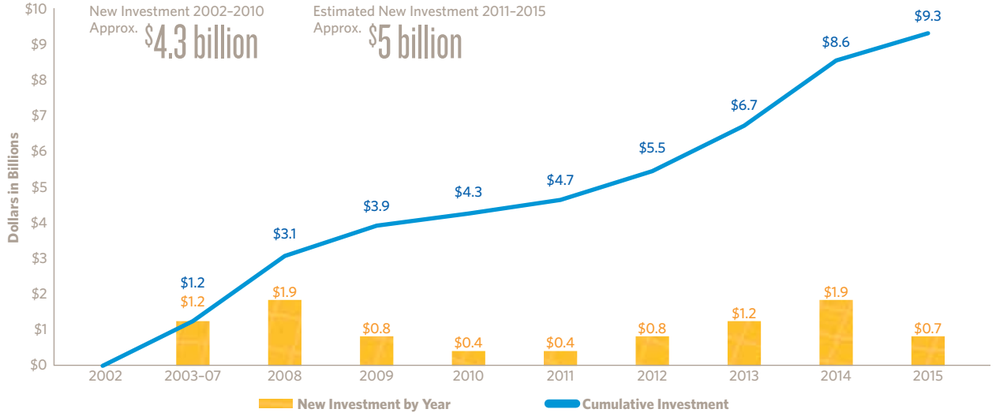
5 Aligning System Planning and Wholesale Electricity Markets

design. Because some of the region's challenges are impending, interim solutions may have to be considered in the mid-term.

Analysis Underway

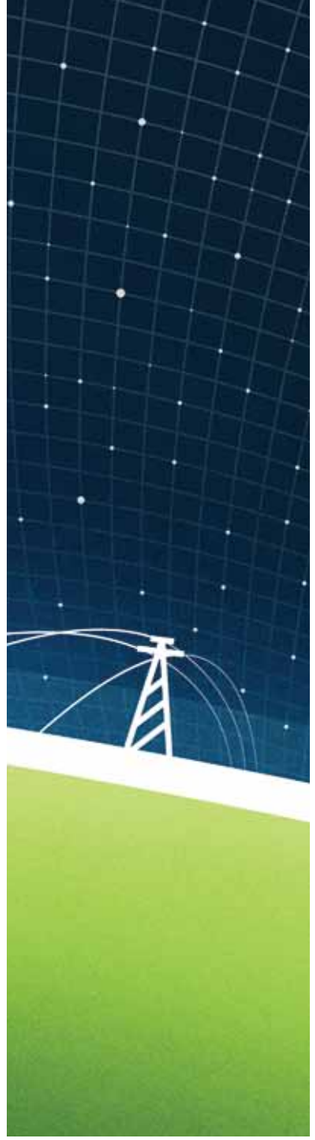
ISO New England has already piloted an analysis on the potential for market resources to solve reliability needs in the *Vermont/New Hampshire Solution Study*, conducted in 2011. The ISO assessed demand resources and generation alternatives and their effectiveness in meeting some of the reliability needs identified for this area. Stakeholders are evaluating the benefits of the pilot analysis and will provide input and feedback before the ISO performs additional studies. Requests for additional analyses from the states and other stakeholders will likely increase over time.

Transmission Investment in New England



Advancing Grid Planning and Market Design

NEW ENGLAND HAS MADE a momentous effort to implement and foster a thriving wholesale electricity marketplace, advanced grid operations, and successful regional planning processes.



The region's wholesale electric power industry has now reached its next stage of maturity in which existing rules, processes, and systems need to be refined to preserve and improve the efficiency and reliability of system operations.

Given the magnitude of current system operational challenges and the pace and complexity of upcoming changes, the region must quickly decide whether existing tools should be improved and better integrated or whether new approaches are warranted.

With many complex, interrelated variables and differing viewpoints to consider, ISO New England launched a multi-year strategic initiative to take a proactive approach to tackling these challenges.

Strategic Planning Initiative

Each year, ISO New England management and its board of directors develop the company's business plan through an open process. The process incorporates input from the states and market participants so that the ISO can accurately align its workplan with regional priorities and so that all industry stakeholders have a clear understanding of the company's goals and objectives. In late 2010, ISO New England expanded the scope of this process to develop a multi-year strategic planning initiative based entirely on the imminent issues on the horizon.

The initiative involves undertaking a comprehensive risk assessment, and presenting the results to regulators and policymakers from the six states, market participants, and other stakeholders for discussion. Once a broad-level agreement on the nature of the challenges is reached, the states and stakeholders will meet throughout 2011 and 2012 to develop solutions.

These discussions provide the opportunity for the various market participant sectors and state representatives to interact with each other and share their viewpoints outside of the formal committee structure where market rules, operating procedures, and regional plans are reviewed and voted on. Documentation from this initiative is available on the ISO website. The results of the initiative will drive ISO New England's business plan for each of its areas of responsibility: designing and administering the wholesale electricity markets, operating the grid, and planning the power system. Ultimately, solutions identified will follow both the formal committee and federal approval processes.

Simultaneously, the ISO continues to move forward on many initiatives to prepare for, plan for, and begin the integration of new resources and technologies and to continuously improve the efficiency of the markets and operations. As always, the ISO strives to complete these projects in priority order and meet its extensive day-to-day responsibilities while ensuring that business operations are well-managed, fiscally responsible, and responsive to New England's electricity stakeholders.

Working Together

Just as the electric power grid is an interconnected network, so too are the people who operate it, own its parts, set policies around it, and benefit from it. To provide the best possible results for the region, ISO New England counts on the active involvement of and collaboration with stakeholders in all areas of its work—whether coordinating an outage, developing new market rules, or conducting an in-depth planning analysis. Stakeholders represent a wide variety of constituencies, technologies, and interests. They include the New England Power Pool, the voluntary association of the participants in New England's wholesale electricity marketplace; state regulators who form the New England Conference of Public Utilities Commissioners; state and federal legislators, attorneys general, consumer advocates, and environmental regulators; and the six governors, primarily through the New England Governors' Conference and New England States Committee on Electricity.

Progress to Date

Over the past decade, the combined functions of competitive electricity markets, a dynamic and transparent regional planning process, and centralized system operations have guided the development of a bulk power system that is more reliable and efficient. The region has also made important progress toward meeting environmental goals.

Supply

Approximately 10,800 MW of new, efficient, low-carbon-emitting generation facilities have been connected to the power system since 1999; another 3,600 MW are committed for 2010 to 2014. The addition of resources ensures that the grid operates reliably and that adequate supply is available to meet demand. Because private firms and not public utilities make this investment, consumers are shielded from the investment risks they had been exposed to under the prior, vertically integrated system.

Demand Resources

In New England, demand resources, such as energy efficiency, load management, and distributed generation, are a well-established tool used to manage the power system. Through the Forward Capacity Market—which allows demand resources to compete with traditional generation resources to provide capacity—and ISO-run programs, the amount of demand resources in the region has grown over 10-fold since 2003 and is now up to more than 2,500 MW, or roughly 8% of capacity. This translates into about 5,000 individual demand assets integrated into the power system.

Transmission

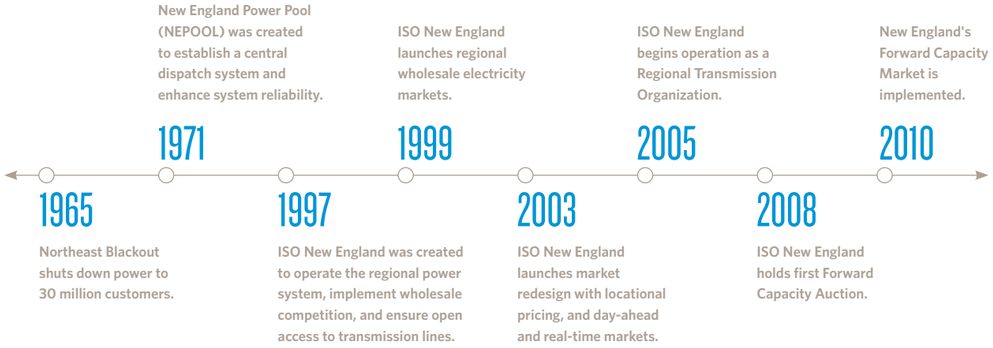
Between 2002 and 2010, more than 300 transmission upgrades totaling $4 billion have been put in service in all six New England states. Enabling electricity to move more efficiently within and between regions provides greater access to low-cost suppliers, improves market competition, reduces transmission congestion costs and line losses (both components of market prices), and reduces the need for costly reliability provisions with specific power plants.

Approximately $5 billion in transmission investment is planned over the next 10 years to meet reliability requirements, improve the economic performance of the system, and position the region to integrate renewable resources and alternative technologies.

Environment

New England policymakers have long proven to be leaders in the advancement of environmental initiatives. Over the past decade, state policies and market forces have steadily moved the region's grid toward a system that has less environmental impact. The introduction of cleaner, more efficient power plants and added emission controls to some fossil-fuel-fired plants has decreased average emission rates between 1999 and 2009 for sulfur dioxide (SO_2) by 71%, nitrous oxides (NO_X) by 66%, and carbon dioxide (CO_2) by 18%. Total emissions for SO_2 and NO_X have also have also decreased from 2001 levels by 62% and 54%, respectively. In addition, the region has seen the amount of wind energy grow from 20 MW in 2008 to more than 300 MW. More than 30 on- and off-shore wind projects totaling about 2,900 MW have proposed to connect to the region's electric grid over the next five years.

ISO New England Timeline



New Technology

Markets are stimulating technological innovations that are modernizing the bulk power system. These smart grid projects will create a more efficient, responsive, and reliable system that can incorporate greater amounts of price-sensitive demand, new technologies such as electric vehicles, and an expanding array of alternative energy sources. The ISO is working on several projects to enhance and integrate new power system, communication, and information technology, and is actively participating in smart grid research, education, and standards development.

Price

Overall, the markets are working as designed, producing competitive prices that accurately reflect suppliers' costs of delivering power to the grid to meets consumers' real-time demand. Because approximately 40% of the region's power plants use natural gas to generate electricity, the day-to-day fluctuations in the price of this fuel directly affect the volatility in wholesale electricity prices. The close link between fuel costs and wholesale electricity prices illustrates that wholesale markets are efficient and competitive because changes in the cost of key production inputs are rapidly reflected in wholesale electricity prices. Wholesale prices have remained stable over the past decade, when adjusted for fuel impacts. Energy prices fell in 2009 as a result of plummeting fuel costs and decreased demand. Prices increased in 2010 as both fuel costs and demand for electricity rose that year.

The operating cost to provide our essential services is approximately $130 million per year. That's about 79 cents per month for the average residential customer in New England.

Participation

ISO New England has worked collaboratively with market participants, state regulators, and other government officials and groups to develop an open, transparent regional planning process and construct a comprehensive suite of markets that ensures a level playing field for a large and diverse mix of participants. The marketplace has grown steadily, with the number of participants increasing from 200 buyers and sellers in 2000 to nearly 500 in 2010.

Learn more from the following reports available on ISO New England's website or by contacting info@iso-ne.com. The *Regional System Plan* describes the status of the power system, regional challenges and opportunities, and initiatives underway to address the power grid's needs over the coming 10 years. The *Wholesale Markets Project Plan* describes the market enhancement projects currently in development. The *Annual Markets Report* analyzes the performance of the markets. The *2010 Financial Report* provides a complete analysis of ISO costs.

Key Facts

Approximately
350
generators

6.5 million
households and businesses

population
14 million

More than
8,000
miles of transmission lines

13
interconnections to power systems in New York and Canada

Approximately
32,000
MW of generating capacity

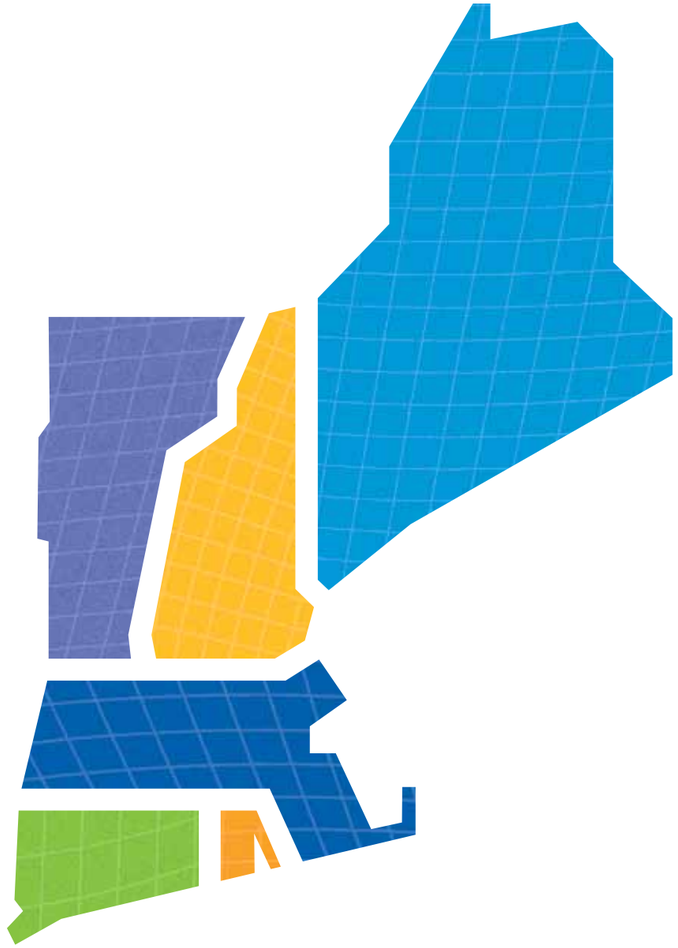
Approximately
2,500
MW of demand resources

$4 billion
in transmission investment since 2002 (including six major 345 kV projects); another $5 billion planned

$9.1 billion
traded in wholesale electricity markets in 2010 ($7.3 billion traded in energy markets; $1.8 billion traded in capacity and ancillary services markets)

Approximately
500
buyers and sellers in the markets

All-time peak demand of
28,130
MW set on August 2, 2006



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ISO new england