New England Long Term Transmission Plan and Possible Market Coordination with New Brunswick

Purpose

This document provides information on two strategic planning initiatives currently being considered by ISO New England as it seeks to update its five-year business plan. This information is intended to serve as a basis for discussion with the New England Conference of Public Utilities Commissioners (NECPUC), the New England Governors' Power Planning Committee (NEG/PPC) and the New England Power Pool (NEPOOL) during the April to June 2008 timeframe, before the submission of the 2009 budget.

Summary

Organized by the following topics, this document outlines a strategy for the long-term development of transmission for the region and the possibility of developing stronger coordination with the New Brunswick System Operator (NBSO) which is the independent Reliability Coordinator for the Maritimes Area.

- Background
- Satisfying RPS and RGGI goals
- Renewable Resource Development in Canada
- ISO New England's System Planning and Stakeholder Processes
- Meeting Regional Needs through a Long-term Transmission Plan
- Exploring Stronger Coordination with New Brunswick

Background

New England has a long history of regional planning and coordination. The region boasts a tightly integrated bulk power system that is designed to provide reliable wholesale electricity service to customers from Connecticut to Maine under a variety of conditions. The region shares in the cost of upgrading the bulk transmission system for reliability reasons, and its market design promotes the efficient development of demand and supply resources in locations where they are needed most.

The six New England States have been leaders and innovators on energy policy individually and collectively through NECPUC. In addition, the Federal Energy Regulatory Commission (FERC) recently approved the States' proposal to form the New England States Committee on Electricity (NESCOE), which will enable enhanced coordination for developing the region's energy policy. New England also has a tradition of close collaboration with its neighboring power systems to the north in Canada.

Over the past few years, the New England Governors and Eastern Canadian Premiers (NEG/ECP) have engaged in discussions regarding energy issues, including opportunities for greater electricity trade. The New England Governors want to develop cost effective solutions, ensure reliability, and meet emerging environmental goals. A number of the New England States are interested in pursuing a strategy of enabling the siting of certain renewable resources within the region. The Eastern Canadian Premiers are interested in developing their provinces as energy resource 'hubs' through the development of

renewable and non-carbon-emitting resources, such as wind, hydro, and nuclear for export to markets in New England, New York, and Ontario.

The New England region's challenge now is to develop new sources of electric energy to meet growing consumer demand for power, keep costs under control and satisfy State and regional environmental goals. In this context, ISO New England's challenge will be to help inform the region's industry and policymakers on the different means by which the region can meet these challenges. ISO's established system planning and stakeholder processes, as well as the region's wholesale electricity marketplace, are effective mechanisms through which the region can pursue solutions.

Satisfying RPS and RGGI goals

The ISO New England Scenario Analysis report, issued in August 2007 at the conclusion of a robust stakeholder initiative, found that the region would continue to depend on natural gas for its electricity supply and that the price of natural gas and oil would drive the price of electricity for the next decade and longer.

The RSP07 Report illustrated that meeting requirements for renewable energy would be challenging, as defined in the various State Renewable Portfolio Standards (RPSs). The region also would have to change its fuel mix, purchase allowances above the region's allocation of allowances, and use offsets to meet the Regional Greenhouse Gas Initiative (RGGI) carbon output reductions. From 2009 to 2014, the electric generators greater than 25 megawatts (MW) in capacity in New England will need to cap their CO_2 emissions to a total of 55.8 million tons and then reduce their emissions by 10% to 50.2 million tons by 2018.

Currently, about 2,600 MW of renewable projects located in New England are in the ISO's Generation Interconnection Queue. If all these projects were to be developed, about half of the region's RPS requirements, or 7% of the 14% goal set for 2016, would be met. Nonetheless, it is unlikely that all these projects will be developed, so additional resources will be needed to meet the 14% RPS goal**.**

Given the significant role that natural gas plays in supplying New England's electricity needs, reducing its role will be difficult, especially in a short-time horizon. As the time horizon lengthens, however, the number of natural gas alternatives grows along with the ability to diversify the resource mix.

State and federal policymakers have taken several actions to encourage the development of alternatives such as renewable resources. At the federal level, tax credits for renewable resources have helped jump-start the industry, particularly wind power development. In New England, RPS and the RGGI initiative have spurred further interest in developing renewable resources, especially in the northern part of the Region. Maine has set a policy goal of bringing 2,000MW of wind into the State and New Hampshire is striving to develop 500MW of renewable resources in the northern part of the State. Massachusetts is aggressively seeking to promote efficiency and is developing plans for locally sited renewable resources. The other states are likewise working hard to promote efficient use of energy and to ensure that renewable goals are achieved.

Although renewable electricity resources located within New England will contribute to RGGI and RPS requirements, the region may need to look beyond its borders to Canada to satisfy these requirements fully.

Renewable Resource Development in Canada

The development of renewable energy resources has become international in scope. The Northeast International Committee on Energy (NICE), a committee of the NEG/ECP, is exploring mechanisms to increase the trade of electricity between the two regions.

NEG/ECP is working to identify potential renewable energy supplies, exploring purchasing options and funding mechanisms, and determining what high-level transmission investments might be needed to facilitate increased trade in renewable resources.

In the Canadian provinces of New Brunswick and Quebec an estimated 6,500 MW of hydro and wind resources are under development. An additional 6,000 MW of hydro and wind resources are being considered for Nova Scotia, Prince Edward Island, and Labrador. In addition, a second (and possibly a third), 1,100 MW nuclear reactor at Point Lepreau in New Brunswick is being planned. All these resources could contribute to a reduction of the region's carbon emissions.

This development marks the natural evolution of a larger and potentially seamless marketplace between New England and New Brunswick for renewable and other non-emitting resources. This evolution is particularly interesting because, as the ISO-RTO Council (IRC) study on renewable resources[1] pointed out, the development of wind generation is better suited to a larger footprint because a larger market, with its five-to-fifteen minute dispatch, reduces the cost of integrating wind into the power system by taking advantage of wind diversity and the ramping capability of conventional generation.

Transmission proposals to bring electric energy from northern New England and Canada to the region's load centers are currently under active development. At the Planning Advisory Committee (PAC) meeting in December 2007, seven independent transmission developers presented their vision of how to move electricity from remote locations to areas in New England that have concentrated consumer demand. Each project appears to provide similar benefits, ostensibly wants to deliver renewable energy to load centers, and seeks cost-of-service recovery from regional transmission customers.

At present, regional needs do not support the development of all seven projects, and a robust stakeholder process to compare the merits of each is therefore necessary. Since most of these proposals are not designed to address specific system reliability needs, but rather provide economic and environmental benefits, they would have to meet the test as a *Market Efficiency Transmission Upgrade* (METU) to be paid for regionally; otherwise, other participant funding mechanisms would have to be agreed to by the beneficiaries of the projects.

A framework to evaluate such proposals will be necessary because the regional transmission Tariff ultimately will determine what projects will be selected and funded. Evaluation criteria should include determining the amount**,** type**,** and cost of the energy to be delivered over the transmission lines, as well as the estimated cost to build the line. In March the ISO embarked on a stakeholder process, with co-chairs from the New England Power Pool (NEPOOL) and NECPUC, to devise an evaluation framework for such economic upgrades.

ISO New England's System Planning and Stakeholder Processes

In 2000, NEPOOL and FERC granted ISO New England responsibility for system planning for the six-state region. Since then, the ISO has developed an annual Regional System Plan (RSP) that serves as the comprehensive needs assessment of New England's bulk power system. New England stakeholders provide input to the regional system planning assessment throughout the year through the PAC. The PAC is made up of representatives from the New England States, environmental organizations, transmission owners, generators, suppliers, public power companies, and other interested parties.

The RSP includes a ten-year forecast of electricity use for New England, the States, and multiple sub-areas. The RSP analyzes the adequacy of the region's bulk power system to serve future demand for electricity reliably. The RSP also describes the fuel mix for generation and reviews the region's ability to meet State and federal environmental regulations, including the Renewable Portfolio Standards and

[1] *Increasing Renewable Resources: How ISOs and RTOs are Helping Meet This Public Policy Objective.*

carbon emission reductions targeted in RGGI. Ultimately, the RSP defines a transmission expansion plan to meet system needs.

Results of the RSP needs assessments are presented to the PAC to encourage the marketplace to develop solutions to system needs. While ISO New England's planning authority is limited to the development of regulated transmission solutions, the ISO accounts for responses from the marketplace (i.e., the development of demand resources, generation, and merchant transmission) in performing the RSP needs assessments. If the ISO determines that a market response addresses a system need, it may defer or eliminate the need for a regulated transmission solution.

ISO New England closely coordinates its planning activities among six New England States, as well as with the federal government and with neighboring systems in the U.S. and Canada. The ISO participates in interregional planning initiatives with the North American Electric Reliability Corporation (NERC), the Northeast Power Coordinating Council (NPCC), the U. S. Department of Energy, the IRC, and the Inter-Area Planning Stakeholder Advisory Committee.

Enhancements to the transmission planning process

In February 2007, FERC issued Order 890 to consider modifications to the Open Access Transmission Tariff (OATT), which led to a review of the transmission planning process in New England. The ISO worked with NEPOOL and NECPUC to identify enhancements to the RSP process and incorporated these changes into the ISO OATT at the end of 2007.

Key modifications include further defining the process for incorporating market responses into the needs assessments and establishing an evaluation framework to determine—through economic studies—whether transmission solutions or other projects could result in economic benefits to the region.

The development of these economic studies will move forward in two parallel processes. First, the ISO has convened a working group of stakeholders to determine *how* to conduct—that is, the methodology or framework for—the economic studies envisioned in FERC Order 890. Because this framework must be developed with consensus among regional policymakers and market participants, the working group will be led by a steering team with representatives from ISO New England, NECPUC, and NEPOOL. This process also will help further develop the factors that should be considered in determining *Market Efficiency Transmission Upgrades* that are eligible for regional cost sharing.[2] This type of upgrade has been part of the ISO's Tariff for some time but to date has not been utilized by the region. The more common type of transmission upgrade that is eligible for regional cost sharing in New England is the *Reliability Transmission Upgrade.* These projects address identified reliability needs.

In the second process, the ISO and PAC will prioritize the transmission studies the ISO must conduct. The PAC has the ability to request the ISO to conduct up to three studies each year. These studies are funded through the regional Tariff. Stakeholders requesting additional studies would be responsible for paying for the costs of those studies.

To date, the ISO and representatives of the New England States have discussed at least three different cases to be studied for the development of new renewable resources on the system. The ISO also needs to consider the seven new transmission projects to move electricity from Canada to customers in New England that were proposed in late 2007, plus any other projects that may be proposed in the future. It is evident that not all the proposed projects will need to be built. Thus, the evaluation framework must determine *what* transmission investment makes sense for the region.

[2] *http://www.iso-ne.com/regulatory/tariff/sect_2/oatt/index.html*

Meeting Regional Needs through a Long-term Transmission Plan

To meet future electricity needs, New England needs a long-term, three-tiered approach to developing transmission. First, a robust underlying AC transmission system is the foundation to operate and efficiently move energy within New England. Consequently, New England must continue to make progress to site and construct the transmission projects already approved through the RSP planning process. These projects are needed to maintain reliability of the bulk transmission system.

Second, New England must evaluate integrating renewable resources within New England.

Third, the region must evaluate creating stronger ties with neighboring regions. These ties can potentially help the region meet environmental goals, strengthen reliability and flexibility of our mutual systems, and create further market efficiencies.

Tier One: Reliability Projects

The 2003 Midwest Blackout that affected the Northeast United States and Ontario heightened the focus on bulk system reliability in the United States and Canada. In the U.S., Congress passed the 2005 Energy Policy Act, which created the Electric Reliability Organization (ERO). Under the ERO, reliability standards are mandatory and subject to monetary enforcement provisions and FERC was named as the entity with overall responsibility for implementation. Subsequently, NERC was selected as the ERO for the U.S. and Canada by FERC and the Canadian government. NERC writes the standards and enforces compliance, while NERC sub-councils, such as the NPCC, audit and impose penalties for noncompliance. Such penalties can run as high as $1 million per day.

Because relatively little investment in the region's transmission system occurred during the 1980s and 1990s, significantly increased investment in transmission infrastructure became necessary to meet the growth in system demand, the retirement of a substantial quantity of baseload generation, and the new demands placed on the grid by wholesale markets. Since 2000, ISO New England's regional system planning process has identified the need for approximately $8 billion in transmission investment, prompting significant transmission development in each of the New England States. More than $1 billion in transmission investment has occurred over the past eight years, and projects estimated at approximately $7 billion in investment are in various stages of development, planning, or construction.[3]

Four major 345-kilovolt (kV) transmission projects have been successfully constructed and put into service in four States, and another two major 345kV transmission projects are under construction in two States. Additionally, numerous smaller projects are being planned (see Figure 1, attached).

This is the first significant transmission development in the region in decades, and the active participation of the States in the planning process has been instrumental in achieving this success.

In addition to keeping the lights on, these projects reduce congestion and line losses; enable new generation to become interconnected; and reduce out of merit operation, or Net Commitment-Period Compensation (NCPC), also known as "uplift".

---

[3] *RSP07 estimates projects totaling approximately $4.4 billion. Since approval of RSP07, additional information about transmission projects and transmission needs has increased this estimate to approximately $7 billion. Note that all estimates are preliminary and are subject to change. Also, some elements of the transmission needs may be satisfied through market responses, thus lowering the estimates.*

Tier Two: Transmission for the integration of renewable resources within New England

To integrate large-scale renewable resources located in New England, additional transmission will be needed since most of these proposals are for wind and biomass generation that will be located in relatively remote areas of New England such as northern and western Maine, northern Vermont, northern New Hampshire, and the shoreline of New England.

Figure 2 identifies the areas in New England where interest exists in developing renewable wind generation. Approximately 2,000 to 3,000 MW of wind generation could be developed in these areas.

Currently, it is difficult to anticipate the full range of transmission system improvements required to interconnect renewable resources across the region. Given the geographic locations of the proposed resources, the total cost for this type of transmission expansion could exceed $2 billion over the next ten years. However, this cost will be capitalized and spread out over the life of these facilities. Alternative cost structures may also be developed to have the wind developers pay for this transmission as their generation comes on line. These transmission lines could be considered a METU if they provide sufficient production cost savings.

Maine Power Connection (MPC) is the first project in this category to be studied. MPC will branch off from the Maine Power Reliability Program in the central part of Maine and interconnect Maine Public Service in far northern Maine, including the wind projects in Aroostook County. It also has the potential to be extended some thirty miles across the border to St Andre, New Brunswick, to create a third interconnection with the province. The second project to be studied is likely to be the New Hampshire Northern Loop. The third project could be evaluating the interconnection of offshore wind.

Tier Three: Integration of external renewables and other generating resources

Significant amounts of renewable and other non-CO_2 emitting generation are currently being developed in up-state New York, Quebec, and the Maritimes (see Figure 3).

Current estimates state that approximately 4,000 MW of external wind generation could be imported into New England as shown on the map. To protect reliability, increase diversity of supply, and diversify wind resources, New England would need to import this generation over a number of new interconnections.

Operational issues will need to be addressed if large amounts of wind generation are developed. Recent reliability problems in Germany and the Electric Reliability Council of Texas (ERCOT) demonstrated that grid reliability must be carefully managed to avoid problems when wind generation suddenly increases or decreases output in a short period. Diversifying resource concentrations could help minimize this problem. Additional pumped-storage hydro, other forms of fast-response electric energy storage, peaking generators, and overall load following or ramping capability will be required for reliable system operation.

The total cost of the transmission investment needed to connect this amount of wind is very difficult to estimate at this stage because it is purely conceptual. It is expected that these projects would be developed only under one or more of the following circumstances:

- If the cost of the energy supplied from Canadian resources is sufficiently competitive to cover the cost of the transmission investment;
- As a result of bilateral agreements between parties in Canada and New England;
- If New England policymakers alter present RPS standards to include Canadian renewable energy; if so, these lines might be paid for regionally.

Exploring Stronger Coordination with New Brunswick

New Brunswick recently has opened wholesale markets; however, they are at an early stage of evolution. As a policy matter, New Brunswick officials are promoting an economic development strategy for the province to become a regional energy hub for New England and eastern Canada. This strategy is based on building generation in New Brunswick through private investment, with current plans including an additional nuclear generator at Point Lepreau and significant amounts of wind generation.

The success of this energy hub strategy depends on the following:

- Stronger transmission ties to New England to enable the export of large amounts of energy
- Better dispatch integration with the New England market to integrate large amounts of wind resources into the bulk power system reliably
- Developing a solution to the management of operating reserves between the two bulk power systems
- Robust market services within New Brunswick
- Ability to attract additional storage and ramping capability into the broader market, e.g., pumped-hydro, compressed-air energy storage, demand response, etc.

In December 2007, the New Brunswick System Operator (NBSO) requested that ISO New England and NBSO jointly study how to better integrate the New England and New Brunswick wholesale electricity markets. A study scope is currently under development.

For the New England region, the potential benefits include access to possibly significant amounts of potentially lower-cost energy, and non-carbon-emitting and renewable resources to help the region meet both RPS and RGGI requirements. The expected benefits of this strategy to New Brunswick are clearly based on its economic goals. Increased integration of the two regions could also improve regional system planning and reliability for both power systems. In addition, resource developers in New Brunswick may be prepared to enter into long-term contracts to capture market share in New England.

The alternatives to better integrate the bulk power system and markets between New Brunswick and New England can be grouped into three broad categories ranging from lightly coordinated to full integration of the markets.

Alternative #1: Increase the frequency and the flexibility of scheduling transactions.

In this approach, the frequency of current hourly transactions would be reduced to a half hour or fifteen minutes. This relies on submitted transactions by market participants so its ability to optimize power flows and economics between the two markets would be limited, but it would be relatively easy to implement. In fact, a pilot program with half hour scheduling is in the planning stages and may be conducted as early as the fall of 2008.[4] In addition, ISO and NBSO are jointly pursuing wind forecasting options with a regional perspective.

Scheduling transactions with increased frequency and flexibility would provide some access to renewable or non-carbon-emitting resources but would only provide limited improvements to regional bulk power system reliability or market efficiency.

[4] *New Brunswick, ISO New England and New York currently participate in the Area Control Error Diversity Interchange program which reduces the need for regulation services.*

Alternative #2: Actively coordinate dispatch

By actively coordinating dispatch, each system operator would adjust its dispatch based on the prices or reliability needs of the other region. For example, prices in each region could be compared every fifteen minutes. On the basis of that comparison, flows between the regions would be adjusted to bring the prices closer together. The extent to which the regions shared operating reserves and regulation could be negotiated. Other approaches also could likely achieve similar benefits.

Coordinating dispatch between the two markets would provide greater access to renewable or non-carbon-emitting resources and could improve regional reliability or market efficiency compared with increasing the frequency of scheduled transactions.

Alternative #3: Conduct a single dispatch within a unified market across New England and New Brunswick/Maritimes

By implementing a single dispatch for this broader region, New England, New Brunswick, and possibly the Maritimes would become a single marketplace. Most likely, ISO New England would conduct the dispatch for the entire market and NBSO would serve as the local control center for the Maritimes. This would require changes to the NBSO market and NBSO being willing to fund those changes. The maximum benefits could be reached if Nova Scotia and Prince Edward Island are also included in the market. While such an arrangement would face international regulatory challenges, it should provide the greatest benefits to the region.

A single dispatch across a large area would provide maximum access to renewable or non-carbon-emitting resources, would improve regional reliability and system planning, and would likely result in maximum market efficiencies for the broader region.

Primary Issues

Before the ISO can pursue this strategy, certain issues must be considered. First, significant improvements to the Maine transmission system and an increase in the interconnections between New England and New Brunswick would be needed to make the last two alternatives worthwhile. Proposed transmission is not likely to be completed until the 2012 to 2014 timeframe. Second, NEPOOL and NECPUC support would be needed to move ahead with alternatives two and three. Third, New Brunswick stakeholders would need to support this strategy.

Project Plan and Resources

ISO New England must dedicate a number of resources to pursue this strategic initiative. This opportunity will have to be developed by a team of senior ISO New England employees and, with the current list of priorities and activities, capacity to engage fully on this strategic initiative is limited in 2008. Recognizing this, and to better understand the resource needs in 2009 and 2010, the initial step would be to work with NBSO to define the scope of a feasibility analysis. This scope will include the identification of specific approaches for each integration alternative. If possible, these approaches will be structured in a way to accommodate the evolution of the integration of the two markets, from loose coordination to dispatch of a single market.

The feasibility analysis is expected to be defined by July 2008, in time to have a high-level estimate of resource/budget needs for 2009.

Once the high-level scope of the study is established and approved, the third and fourth quarter of 2008 will be dedicated to working with NBSO to establish a more detailed project plan to complete the studies/feasibility analysis.

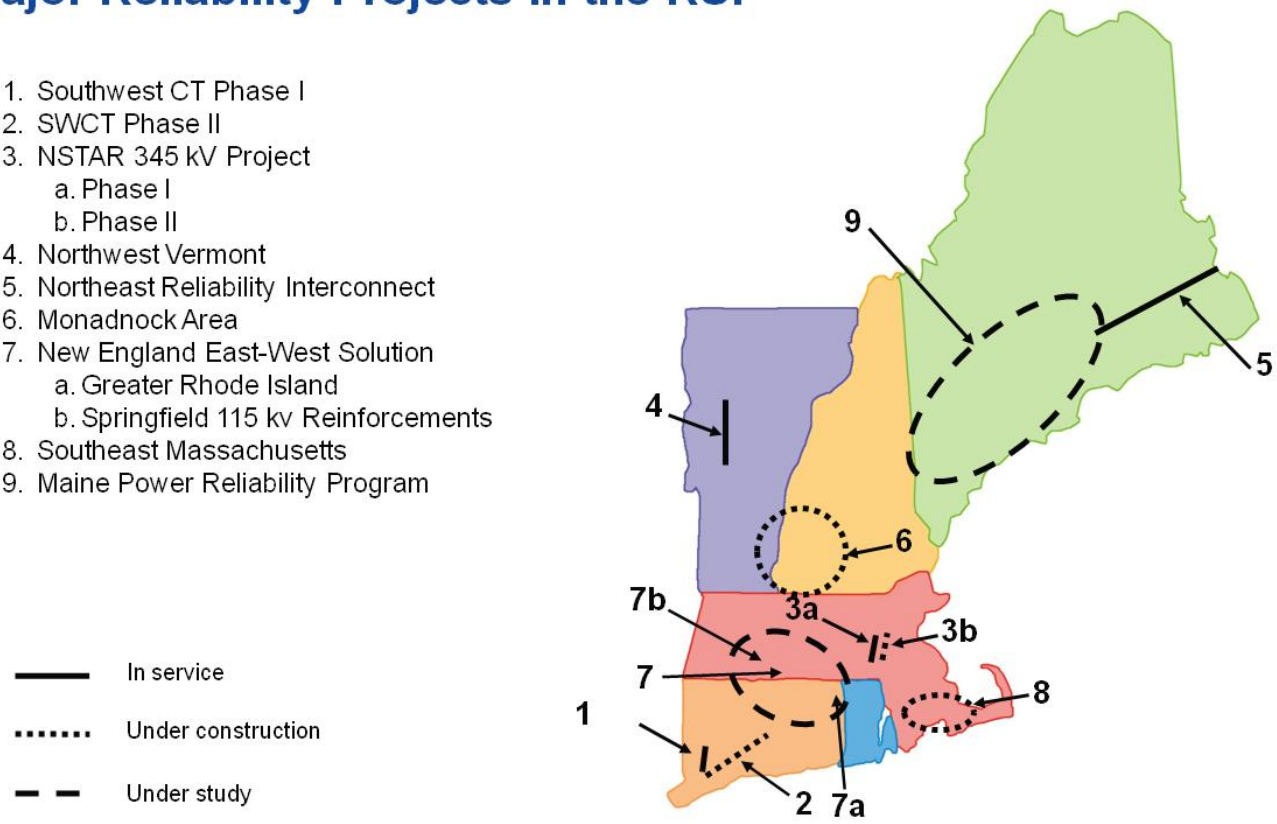
The feasibility analysis is expected to start in 2009 and the initial estimate is that this step will take up to 18 months. A significant amount of this effort will be modeling the dispatch and economic impacts of the various approaches. Identifying the various regulatory and institutional issues and developing a plan to resolve them also will be required.

Upon review of the results of the feasibility study, future steps can be developed. Certainly, the primary issues identified earlier will have significant influence on the future of this initiative. ISO New England looks forward to further discussion on these topics with its stakeholders.

Major Reliability Projects in the RSP

Figure 1

1. Southwest CT Phase I
2. SWCT Phase II
3. NSTAR 345 kV Project
   a. Phase I
   b. Phase II
4. Northwest Vermont
5. Northeast Reliability Interconnect
6. Monadnock Area
7. New England East-West Solution
   a. Greater Rhode Island
   b. Springfield 115 kv Reinforcements
8. Southeast Massachusetts
9. Maine Power Reliability Program



Potential Renewables in New England

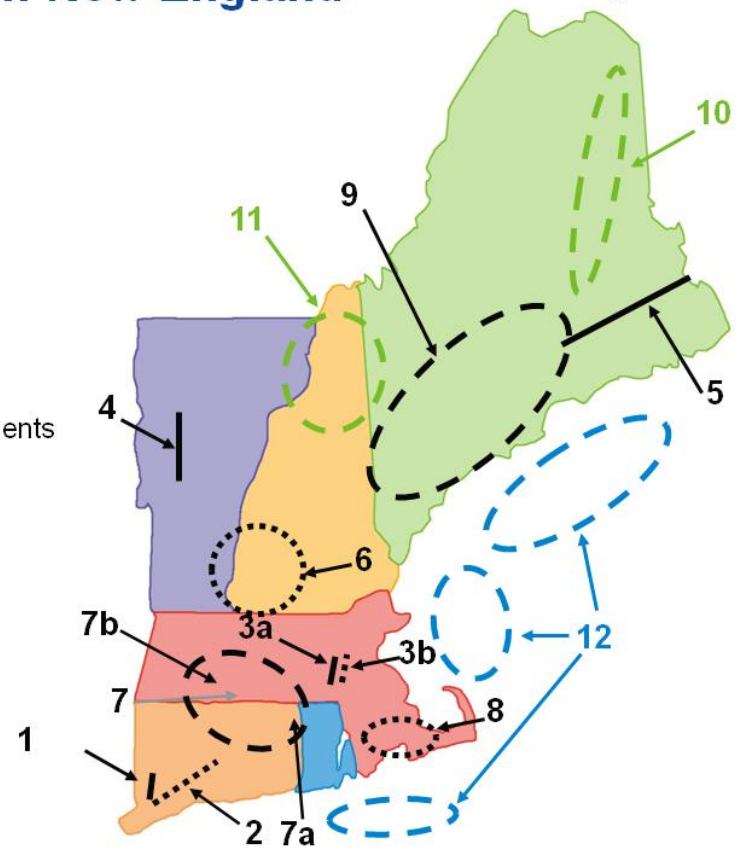
Figure 2

1. Southwest CT Phase I
2. SWCT Phase II
3. NSTAR 345 kV Project
   a. Phase I
   b. Phase II
4. Northwest Vermont
5. Northeast Reliability Interconnect
6. Monadnock Area
7. New England East-West Solution
   a. Greater Rhode Island
   b. Springfield 115 kv Reinforcements
8. Southeast Massachusetts
9. Maine Power Reliability Program
10. Maine Power Connection
11. Northern New Hampshire
12. Off-shore wind

In service

Under construction

Under study



Looking Outside of New England

Figure 3

1. Southwest CT Phase I
2. SWCT Phase II
3. NSTAR 345 kV Project
   a. Phase I
   b. Phase II
4. Northwest Vermont
5. Northeast Reliability Interconnect
6. Monadnock Area
7. New England East-West Solution
   a. Greater Rhode Island
   b. Springfield 115 kv Reinforcements
8. Southeast Massachusetts
9. Maine Power Reliability Program
10. Maine Power Connection
11. Northern New Hampshire
12. Off-shore wind

In service

Under construction

Under study