ENERGY

Grade: C+

Overview

The overall health of the energy generation and transmission system in Maine is good, but reliability and security concerns are posed by the state's dependence on natural gas fueled generation, as well as weak links and interface limits in the transmission system. Diversification of energy supply and approximately $2 billion of transmission system investment are needed to address these issues.

Introduction and Background

Maine, like many other states, developed its electric energy system over a long time period as technology and demand permitted. Originally, electricity was generated locally (often dependent on hydro power) to meet specific demands such as in a mill or for community street lighting. As demands grew, distribution circuits were developed to get the energy from the source to the point of need. These early electrical systems were islands, operating independently from other electrical systems, with generation matching the local demand.

As demand continued to grow, it became apparent that connecting some of these island systems together would improve economy of scale and offer improved service to the end user, in addition to a better price. This was the beginning of electric energy transmission. It was also the beginning of Maine's electric companies – Central Maine Power (CMP), Bangor Hydro Electric (BHE), and Maine Public Service Company (MPS), which grew out of the small island suppliers with the addition of transmission networks. As demands and economics continued to change, these new "islands" discovered the need to interconnect. BHE connected to CMP, which connected to New Hampshire's utilities as well as the rest of New England, and MPS connected to New Brunswick. These connections allowed economical energy exchange, which met demands and improved reliability. This expansion and the addition of 345kV class transmission lines developed into the electrical system we know today.

In the 1990s there was a major shift in Maine's electric utilities. The traditional utilities were required to divest from generation resources and generation became a competitive market. With this change of structure came a change of need for transmission. Today, generation is no longer locally controlled and dispatched. Transmission and distribution utilities do not rely on the local generation as in the past, but are obligated to ensure that adequate energy is available from the open, regional market.

The regional energy system is operated and managed by independent system operators (ISO) that are private, non-profit entities responsible for the procurement of energy generation via a wholesale electricity market and auctions, as well as the efficient and reliable transmission and distribution of that electricity. ISO New England Inc. (ISO-NE) is the operator of the region's bulk power system and wholesale electricity markets except in northern Maine, which is connected to the New Brunswick system. In 2006, the Federal Energy Regulatory Commission (FERC) created a newly designed Forward Capacity Market (FCM) in New England that established competitive auctions for capacity resources held three years ahead of their projected need. The first FCM auction was held in February 2008. This capacity market setup aims to provide incentives to encourage adequate future capacity, efficient generation, increase reliability, and control the cost of electricity to end users. However, there is some concern in the industry that these goals may not be fully realized. It often takes significantly longer than three years to site and construct new transmission or large generation projects, which could present major investor risk for bringing these projects to market.

Condition and Adequacy

Generation - Table 1 represents Maine's current generation capacity, actual generation, and mix of generation sources. Maine went from a net exporter of electricity in the early to mid-1990s to a net importer with the closing of the Maine Yankee nuclear power plant in 1997, back to a current net exporter with the increase in natural-gas-fired plants since 2000.

Table 1: Energy Generation for Maine

Source	2007 Generation Capacity[i] (Claimed Summer Capacity)		2004 Actual Generation[viii]
	Megawatts (MW)	% of Total Capacity	% of Total
Natural Gas	1,533	46.6% *	60%
Hydroelectric	587	17.8%	20%
Biofuel/Refuse	306	9.3% *	13%
Petroleum (oil)	867	26.3%	5%
Coal	-	-	2%
Nuclear	-	-	-
Total	**3,294**	**100%**	**100%**

*Generation resources with dual fuel fired capabilities, 13.5% of total generation capacity, 8.6% from gas with oil backup and 4.9% from bio and refuse with gas or oil backup.

Wind energy generation was not included in the above capacity data by regulators and system operators because wind is not an on-demand energy source. Wind generation often does not coincide with peak electricity demands due to time of day and seasonal constraints. However, wind power is a viable source of small scale generation, helps to offset our carbon footprint, and reduces dependence on fossil fuels. Maine has one active wind facility with 28 turbines (42 Megawatt (MW)) in Mars Hill, and two under construction at Stetson Mountain (38 turbines, 57 MW) and Kibby Mountain (44 turbines, 132 MW). Several other potential sites for wind turbines have been identified.

Development of alternative and renewable energy generation sources such as wind, biofuel, and tidal are on the rise and Maine is considered a leader in this arena. LD 1920 has been enacted and requires that Maine increase its share of renewable capacity resources at one percent per year beginning in 2008—to reach 10 percent by 2017.[v] This is an increase beyond the 30 percent renewable portfolio standard set in 1997. This bill requires competitive electricity providers to meet this portfolio standard through "green" credits or compliance payments. The Governor's Office of Energy Independence and Security, along with a Wind Power Development Task Force, has set a goal of 2,000 MW of wind power generation statewide by 2015. There also has been recent state legislative action to better facilitate co-generation and distributed generation by small producers.[vii] In addition, a wood to energy initiative has been established.

Due to energy generation and transmission being a *regional* infrastructure, with electricity being dispatched throughout New England largely by ISO-NE (except northern Maine), the following discussion on current and forecasted capacities versus system demands is on a regional level. The Northeast Power Coordinating Council (NPCC) establishes standards for generation and transmission system reliability. The resource adequacy reliability criterion is a loss of supply expectation of 0.1days per year or one day per ten years for both the reference (baseline peak) and high (extreme peak) demand load forecasts.[iii]

The New England region experienced record electricity use on August 2, 2006, when consumer demand peaked at 28,130 MW due to above average temperatures and humidity. [iii] This event triggered ISO-NE to implement several standard operating procedures, which included delivery of electricity sales from outside their operating region, with little to no impact on consumers.

In April 2008, ISO-NE forecasted a potential for record-breaking electricity use in the summer of 2008, but indicated that power supplies would be sufficient to meet consumer demand.[iv] ISO-NE forecasted that under normal weather conditions of 90 degrees Fahrenheit, the peak electricity demand could reach 28,000 MW. Under extreme weather conditions, such as an extended heat wave with 95 degree temperatures and high humidity, a new record

could be set at approximately 29,900 MW. Generating capacity was forecasted to be 31,100 MW.[iii] This represents a four to 11 percent margin over the forecasted demand load depending on what weather model is utilized. This margin needs to be significant to cover unplanned contingencies such as the loss of a major generator or transmission line. In this instance, the forecasted peak demands did not occur.

ISO-NE forecasts that in 2010, 32,305 MW of power resources will be needed under the baseline peak load forecast to meet NPCC's resource adequacy reliability criterion—a 15 percent increase from 2008.[iii] The first FCM auction was held in February 2008 for the commitment period of June 2010 to May 2011. A total of 38,405 MW of resources were qualified to participate in the auction—a 23 percent increase from 2008 capacity—which is well above the 32,305 MW forecasted demand. Not all 38,405 MW of the qualified resources will be procured by ISO-NE, only those that are cleared will be committed and available in 2010. However, this forecasting implies that potential generation supply is increasing at a rate at least equal to system demands—23 percent versus 15 percent. It is also worth noting that in 2002, ISO-NE forecasted 2007 baseline peak demand to be 27,360 MW and extreme peak demand to be 30,082 MW. The actual 2007 peak load topped out at 26,145 MW, demonstrating the accuracy of the forecasting.[iv] This indicates that there is sufficient power generation capacity in the ISO-NE system to meet demand over the next several years.

In terms of the reliability of energy generation resources in Maine, the biggest concern is dependence on natural gas as a generation fuel, particularly since the closing of the Maine Yankee nuclear power plant. Prior to 1997, nuclear power represented approximately one-third of Maine's power generation. Currently, natural-gas-fired plants account for at least half of Maine's power generation. Since 1999, a large percentage of the natural gas powering these plants has been imported from Canada through two pipelines.

Maine, and New England in general, will continue to face potential reliability risks associated with the availability of natural gas during winter peak load periods due to coincident demand for natural gas from the core natural gas heating industry. Unlike the natural gas electricity generation industry, the core natural gas heating industry is served by "firm" delivery contracts.[iii,vi,vii] Currently, there is a downward trend in Maine on natural-gas-fueled generation, while renewable generation is increasing. Actual natural gas generation was as high as 73 percent in 2002,[v] and fell to 60 percent in 2004. Comparing 2007 capacity in Table 1 to 2004 actual generation data suggests that natural gas is favorably dispatched over oil in the open market, likely due to the volatility of oil pricing.

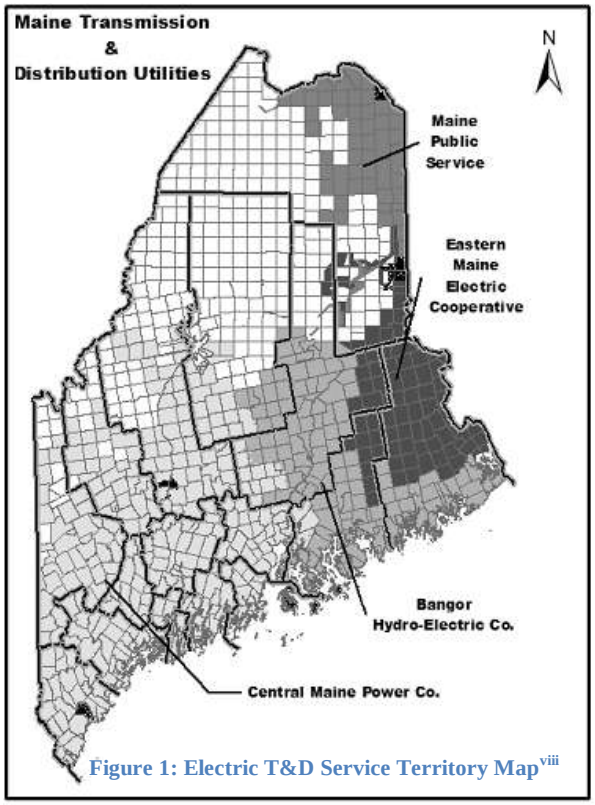

Figure 1: Electric T&D Service Territory Map[viii]

Transmission and Distribution - Maine is served by three investor-owned utilities (IOUs): Maine Public Service Company,[ix] Bangor Hydro Electric Company,[x] and Central Maine Power Company,[xi] in addition to a number of consumer-owned utilities (cooperatives). The state's largest cooperative is the Eastern Maine Electric Cooperative. Figure 1 shows the service territory of the major electric transmission and distribution utilities in the state.

The Maine Public Service transmission system is not connected with the energy market in southern Maine or the rest of the United States. Instead, its transmission system is connected with New Brunswick, Canada. The northern Maine electric system is managed by the Northern Maine Independent System Administrator.

The southern Maine transmission system is administered by ISO-NE and currently interfaces with New Hampshire through four—two 345 kV and two 115 kV—lines. An additional 115kv line will be operational soon. This system also interfaces with New Brunswick, through two 345 kV lines.

While Maine has multiple 345 kV transmission paths—from southern Maine to Wiscasset and a recently completed second path from the Bangor area to New Brunswick—there is a gap, with only a single path between Wiscasset and the Bangor area. This is a critical weak link, creating the potential that a single 345 kV line outage or double circuit tower failure would result in separation of major portions of Maine and eastern Canada from the rest of New England.[xiii]

Transmission congestion has not been an issue in Maine, but transmission constraints have limited exports to the rest of New England, creating higher transmission costs to the south.[xiv] This also has an impact on the economic viability of constructing additional generation in Maine, with a potential impact on regional price, reliability, fuel mix and future jobs. Maine recently commissioned the Northeast Reliability Interconnect Project (NRI).[x] In December 2007, Bangor Hydro Electric commissioned the second 345 kV transmission tie between Maine and New Brunswick to improve interface limits between these areas. This project also included New England's first 345 kV series capacitor installation to further enhance performance.

Investment Needs

Overall, the health of the energy generation and transmission system in Maine is good, but reliability and security concerns are posed by the state's dependence on natural-gas-fueled generation, as well as weak links and interface limits in the transmission system. A large part of the transmission and distribution system is 30 to 40 years old. If Maine is to maintain efficient, cost-effective energy generation sources and a robust transmission and distribution grid that meet regional reliability standards and environmental emission regulations, significant investments are needed.

Fortunately, the majority of these needs have been studied and identified by the utility owners. Project plans have been filed with ISO-NE and the Maine Public Utilities Commission for two milestone projects: the Maine Power Reliability Program (MPRP)[xv] and the Maine Power Connection Program (MPC).[xvi] The MPRP is a $1.4 billion project on Central Maine Power's bulk transmission system, which includes reinforcements to meet the projected needs through the year 2017. This includes a second 345 kV path from the Bangor area to southern Maine, installing additional parallel transmission paths and transformers. The MPC project would invest $625 million to interconnect the northern Maine Public Service transmission system with southern Maine, and subsequently connect Aroostook County wind energy facilities to the electric grid.

Further regulatory review of these projected needs is necessary in order to finalize project scopes and investment levels. The capital for these projects will be provided by private investments that will be offset by regulated transmission rates. This focus on improved reliability needs to continue and cooperation of the many public and private entities will be needed to get these projects through regulatory approval and construction.

Conclusions and Recommendations

The energy generation, transmission and distribution systems in Maine are in need of significant investment in order to ensure reliable, efficient and cost-effective delivery of electricity. Maine ASCE gives energy in Maine a grade of **C+**.

Maine ASCE makes the following recommendations:

- Continue to diversify power generation sources, including dual-fired-generation sources and new generation types, to address natural gas dependency;
- Expand renewable energy generation projects and research to meet federal Regional Greenhouse Gas Initiative compliance by 2012[iii] and the state's LD1920 Renewable Portfolio Standard (10% increase beyond original 30%) compliance by 2017;[v]
- Address regional transmission interface limits and reliability concerns by designing and constructing the projects in the $1.4 billion Maine Power Reliability Program and the $625 million Maine Power Connection Program; and
- Continue inspection, maintenance, and upgrade of the electric system in order to ensure reliability.

Sources:

[i] ISO New England Inc., *2008-2017 Capacity, Energy, Loads, and Transmission Report*, April 2008.
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[iii] ISO New England Inc., *NPCC 2007 New England Interim Review of Resource Adequacy*, December 2007;
[iv] Northeast Power Coordinating Council, *Multi-Area Probabilistic Reliability Assessment For Summer 2008*, 04/30/08
[v] Governor's Office of Energy Independence & Security, Energy Landscape For Maine and the Region, August 3, 2007
[vi] Power Planning Committee of the New England Governor's Conference Inc., *Meeting New England's Future Natural Gas Demands*, March 1, 2005.
[vii] Energy Advisors, LLC, *Maine Energy Policy Overview and Opportunities for Improvement*, December 3, 2003.
[viii] Maine Public Utilities Commission, *2006 Annual Report on Electric Restructuring*, December 31, 2006;
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