

**NORTHERN MAINE INDEPENDENT SYSTEM
ADMINISTRATOR, INC.**

SEVEN-YEAR OUTLOOK:

**AN ASSESSMENT OF THE ADEQUACY OF
GENERATION AND TRANSMISSION FACILITIES
ON THE NORTHERN MAINE
TRANSMISSION SYSTEM**

April 2016

INTRODUCTION

The Northern Maine Independent System Administrator (“NMISA”) was created in 1999 in response to the mandate of the legislature of the State of Maine that effective retail electric competition be available to all of Maine’s electricity consumers by March 1, 2000.¹ The NMISA’s size, scope, purpose and electricity market were designed to facilitate the development and implementation of retail electric competition and foster regional reliability efforts in the electrically isolated area of the state in portions of Aroostook, Washington and Penobscot Counties. Northern Maine is characterized by low population density and a very low electric demand in comparison with other electricity markets.

The dominant characteristics of the Northern Maine Market are its electrical isolation, large geographic size, small electric demand, and modest population. The electric system in Northern Maine is not directly interconnected electrically with the rest of New England, including any Maine or other domestic United States electric system. NMISA participants, therefore, are not participants in the New England Power Pool and are not subject to the control of ISO New England (“ISO-NE”). The region’s only access to the electric system that serves the remainder of Maine and the rest of New England is through the transmission facilities of New Brunswick Power Corporation (“NB Power”).² In October 2013, the New Brunswick System Operator (“NBSO”) functions were merged into and amalgamated with functions of NB Power. The New Brunswick Transmission and System Operator (“NBT&SO”) is the Balancing Authority and Reliability Coordinator (“RC”) for the Balancing Authority Area that includes the Northern Maine and Maritimes regions.

The maximum peak demand for the NMISA region in 2015 was 135 MW for the combined regions, with a projected annual peak load growth of less than 0.5%. The 2015 energy consumed was 782,465 MWh – a .15% decrease from 2014. There are approximately 90,000 residents and approximately 42,000 electricity consumers in Northern Maine.

The NMISA is a Federal Energy Regulatory Commission (“FERC”)-approved independent system administrator and regional transmission group that encompasses the transmission systems of all FERC-jurisdictional and non-jurisdictional utilities in Northern Maine. The NMISA operates as an independent, objective and non-discriminatory administrator of transmission access, transmission information access, and related functions, and monitors and operates the electricity markets in Northern Maine for energy, ancillary services, and other services. The NMISA is governed by a seven member stakeholder Board of Directors comprising representatives of Emera Maine, Maine Public District (“MPD”) and Eastern Maine Electric Cooperative (“EMEC”), municipal utilities (Houlton Water Company (“HWC”) and Van Buren Light & Power District (“VBL&P”)), large customers, generators, Competitive

¹ P.L. 1997ch.316, 35-A M.R.S.A. §§ 3201, *et seq.*

² The NB Power transmission system connects to two 345 kV transmission lines, one of which is owned and operated by Maine Electric Power Company (“MEPCO”). MEPCO is jointly owned by Central Maine Power Company (“CMP”), and Emera Maine.

Electricity Providers (“CEPs”),³ and the Maine Public Advocate as representative of all other retail electric consumers.

A tariff and the Northern Maine Market Rules (“NMMRs”) govern the NMISA. NMMR 9, System Planning, sets forth provisions relating to the responsibilities of the NMISA, Transmission Owners (“TOs”), Demand-Side Management (“DSM”) program operators/providers, and Generators in relation to the adequacy and reliability of the Northern Maine Transmission System (“NMTS”). NMMR 9.2 -- Long-Term System Planning-- states that the NMISA will prepare a Base Case for the planned development of the NMTS for the following seven years, beginning April 1 of each year. The Base Case comprises four sections: Load Forecast, Generation Resources, Resource Adequacy, and Transmission Planning.

LOAD FORECAST

The load forecast for the region includes the combined loads of MPD, EMEC, HWC, and VBL&P. The average annual load growth for energy (MWh) from 2001 to 2015 was -0.04%. The peak demand (MW) annual load growth for same period was 0.44%. Both exclude the Perth Andover load in New Brunswick that is fed from the NMTS. Perth Andover was part of the NMISA system until January 1, 2005 when the NBSO assumed responsibility for that load.

The forecast used in the Base Case includes an annual load growth of 0.5%, resulting in 2016 projected energy load of 786,337 MWh. The remainder of the period was simply escalated by 0.5% per year. The peak load for each year was calculated using the same growth factor for energy.

Table 1 reflects the seven-year load forecast.

Table 1
NMISA 7-Year Load
Forecast

Year	MWh	Peak
2016	786,377	135.7
2017	790,309	136.4
2018	794,260	137.1
2019	798,232	137.8
2020	802,223	138.5

³ A CEP is any marketer, broker, aggregator or other entity that is legally entitled in the State of Maine to sell, and that is selling or that will sell, electric energy, capacity or Ancillary Services to the public at retail in the Northern Maine Market. A CEP includes only competitive electricity providers as they are defined under 35-A M.R.S.A. § 3201.5.

Table 1
NMISA 7-Year Load
Forecast

Year	MWh	Peak
2021	806,234	139.2
2022	810,265	139.9

GENERATION RESOURCES

A. CURRENT RESOURCES

Table 2 (below) lists the generation resources located on the NMTS. Northern Maine is unique in that it receives most of its generation from renewable resources. In the MPD region the majority of the generation consists of two biomass plants, one wind plant and several hydropower facilities.

In the EMEC region there is 20 MW of Black Liquor/Biomass/NG capacity available from Woodland Pulp, a local paper mill.

Table 2
NMISA Generation Resources

Plant	Capacity (MW)	Type	Notes
Tinker Station			
Hydro #1	4.00	Hydro	
Hydro #2	1.80	Hydro	
Hydro #3	1.80	Hydro	
Hydro #4	4.00	Hydro	
Hydro #5	23.00	Hydro	
Diesel	1.00	Diesel	
Flo's Inn			
Diesel #1	1.40	Diesel	Retired
Diesel #2	1.40	Diesel	Retired
Diesel #3	1.40	Diesel	Retired
Caribou Station			
Steam #1	9.00	Oil	Retired
Steam #2	14.00	Oil	Retired
Diesel #2	2.50	Diesel	
Diesel #3	2.50	Diesel	
Diesel #4	1.00	Diesel	
Diesel #5	1.00	Diesel	
Hydro #1	0.45	Hydro	
Hydro #2	0.45	Hydro	
Loring			

Table 2
NMISA Generation Resources

Plant	Capacity (MW)	Type	Notes
Diesel #1	1.00	Diesel	Retired
Diesel #2	1.00	Diesel	Retired
Diesel #3	1.00	Diesel	Retired
Diesel #5	2.10	Diesel	Retired
Squa Pan Hydro	1.40	Hydro	
Other Resources			
ReEnergy – Fort Fairfield	33.00	Biomass	
ReEnergy - Ashland	37.00	Biomass	
Evergreen Wind	42.00	Wind	
Woodland Pulp	20.00	BLQ, Biomass, NG	
Total Capacity	176.9		

B. RETIREMENTS

The NMISA has received multiple generation retirement requests in the recent past. Algonquin Generation requested to retire Caribou Steam Units 1 & 2, Loring Diesel Units 1-3, the Caribou Diesel units, and 2 units at Flo’s Inn. The NMISA granted these requests. However, the Caribou units were reactivated to fulfill capacity based ancillary services obligations. In January of 2011, Boralex Ashland requested to lay the facility up in a preserved state, which request was granted by NMISA, and the unit subsequently was sold to ReEnergy. The Ashland facility was reactivated and returned to commercial operation in November 2014. In May of 2012 NMISA was notified that Flo’s Inn diesels are permanently retired. The Boralex Sherman facility remains deactivated. The capacity changes are reflected in Table 2.

C. PROPOSED RESOURCE ADDITIONS

There are various projects under study. For more information see the following link: <http://www.emeramaine.com/oasis/>

RESOURCE ADEQUACY

The purpose of the Base Case is to provide information to Market Participants and potential Market Participants of any forecasted long-term deficiency. The calculation by which the NMISA ensures resource adequacy is based upon the Northeast Power Coordinating Council’s (“NPCC’s”) Document C-13, “18-month Load and Capacity Assessment.” The C-13 process determines Gross Margin and Net Margins weekly for the 18-month period. The analysis is conducted twice a year, in the spring and fall, for the coming capability periods. Essentially, the analysis compares the load forecast to net resources plus operating reserve. Net resources are the installed capacity adjusted for firm sales, demand response, forced and unplanned outages, and unit deratings. Weekly, the information from the C-13 for the coming week is updated with current information and provided to the NBT&SO, which is the RC for the Balancing Authority, in preparation for the NPCC-wide conference call. The C-13 is published

in the Documents section of the NMISA web site. The load forecast in this document may differ from the C-13 due to timing differences and the different planning horizons.

The NMISA is part of NPCC's Maritimes Balancing Authority Area, with NBT&SO acting as the Balancing Authority as well as the RC. NMISA's Operating Reserve requirement is its proportionate share of the Maritimes Area Operating Reserve requirement. The NBT&SO calculates the Operating Reserve requirement for the region by maintaining adequate Operating Reserve capacity to cover 100% of the single largest contingency plus 50% of the second largest contingency. The NMISA's responsibility is based upon its monthly coincident peak share of the total Maritimes Area load. The average annual Operating Reserve responsibility is approximately 27 MW.

For the Base Case, a 20% planning reserve criterion was used. The difference between planning reserve and Operating Reserve is that the planning reserve process projects reserve requirements over a long-term horizon while Operating Reserve plans for actual requirements in the near term to operate the system. The NBT&SO also determines the planning reserve. The amount is based upon NPCC generation reliability criterion that a loss of load expectation shall be, on average, no more than 0.1 days per year. NMISA also participates in the NBT&SO *Maritimes Area Comprehensive Review of Resource Adequacy*. As with prior studies a 20% planning reserve margin was used.

The Load and Resources Review attempts to determine if adequate resources will be available over the long run to meet the projected annual peak plus the 20% planning reserve. The resources are the sum of the installed capacity plus firm purchases less firm sales. A positive number indicates resources are adequate and a negative indicates a deficiency. Also, transfer capacity is included to show the system's capability to import resources to relieve any deficits.

The Fort Fairfield facility is committed to operation until 2020, and the Ashland facility is committed to operation until 2019. For planning purposes both units are assumed to be available for the seven year period. Table 3 reflects the NMISA's Load and Resources Review from 2016 to 2022.

**Table 3
Load and Resources Review**

Year	2016	2017	2018	2019	2020	2021	2022
Peak	135.7	136.4	137.1	137.8	138.5	139.2	139.9
+Reserve 20%	162.9	163.7	164.5	165.3	166.2	167.0	167.8
Capacity							
Re Energy Ashland	37	37	37	37	37	37	37
Re Energy Fort Fairfield	33	33	33	33	33	33	33
Tinker Hydro	35	35	35	35	35	35	35
Caribou Steam	0	0	0	0	0	0	0
Diesel	8	8	8	8	8	8	8
Woodland Pulp	20	20	20	20	20	20	20
Mars Hill Wind	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Firm Purchases	74.0	74.0	74.0	74.0	74.0	74.0	74.0
Firm Sales	-7.0	-77.0	-77.0	-77.0	-40.0	-7.0	-7.0
Total	216.6	146.6	146.6	146.6	183.6	216.6	216.6
Deficiency (+/-)	53.7	-17.1	-17.9	-18.7	17.4	49.6	48.8
Firm Transfer Capacity	108	108	108	108	108	108	108

Historically, the peak has occurred in December. Firm Transfer Capacity includes the MPD and EMEC interfaces.

DEMAND SIDE MANAGEMENT

There are no major DSM projects on the NMTS. Most DSM projects are at the local level through the Efficiency Maine program that each utility supports. For more information, the website can be found at the following link: <http://www.energymaine.com/>.

TRANSMISSION PLANNING

Transmission System

The NMTS consists of two independent transmission systems, MPD in Aroostook County and EMEC in portions of Washington County and Penobscot County. The two systems are interconnected only through the NB Power transmission system.

The MPD system is interconnected with New Brunswick via three transmission lines, a 100 MVA import rated interconnection from Flo's Inn to Beechwood, a 64 MVA import rated interconnection at Tinker Station, and a 56 MVA import rated interconnection from Iroquois to Madawaska. The rated Total Transfer Capability ("TTC") between the NB Power system and the MPD system is 112 MW for imports to Northern Maine and 93 MW for exports to New Brunswick. The TTC calculation for the MPD-New Brunswick interface assumes a single

contingency loss of the Flo’s Inn to Beechwood transmission line. See Exhibit 1 for more details regarding MPD’s transmission system.

The EMEC transmission system consists of an approximately 40 mile radial 69 kV transmission line that originates at the Oak Bay, NB substation and terminates at Topsfield, ME substation. There are five load substations that are connected by this line, including Woodland Pulp, which is also a generator. The majority of the line is 266.8 ACSR Partridge conductor, and there is a five-mile section of 1/0 AAAC between Woodland and Princeton. The EMEC system has a TTC of 20 MW for both imports from and exports to New Brunswick.

Transmission Upgrades

A series of capitalized maintenance projects is planned by MPD. A summary of these projects can be found in MPD’s annual MPUC Chapter 330 filing. The most recent version can be found at: <http://www.emeramaine.com/oasis/>. The effect of such capitalized maintenance projects is expected to be reduction in transmission Operations and Maintenance (“O&M”) expenses, reduced probability of outages along these segments, and the extension of the useful lives of these facilities. These projects are not expected to increase the TTC of the system.

In May 2012, MPD commissioned a capacitor bank at the Mullen substation. This addition, along with a partial rebuild of line 6901 and the implementation of Under Voltage Load Shedding, increased the TTC of the MPD/NB Power interface to 129 MW winter and 109 summer. However, in the spring of 2014 Algonquin Tinker Gen Co (ATG) requested that the Tinker Transformer be de-rated until maintenance could be performed. The maintenance was performed in the fall of 2014. Since then the de-rating changed but not restored to prior levels. Table 4 reflects the new ratings for Firm Service for imports and exports:

Table 4

NBPC - MPD	Summer	Winter
TTC	91	91
TRM	17	17
FIRM COMPONENT	74	74
MPD - NBPC	Summer	Winter
TTC	91	91
TRM	48	48
FIRM COMPONENT	43	43

Currently, ATG is in the process of upgrading the Tinker Transformer to 100 MVA and rebuilding lines 6901 and 6904. Emera Maine is rebuilding Line 6901 on the US side. With these upgrades, the NBT&O estimates an increase of 24 MW in the TTC in the NBPC to MPD direction. The MPD to NBC direction is under study. The upgrades are scheduled to be completed by November 1, 2016.

Potential Transmission Deficiencies

As with generation resources, the purpose of the Base Case is to provide information to Market Participants, including the TOs, and potential Market Participants of any forecasted transmission deficiencies to allow such Market Participants to bring forward proposals to address potential deficiencies. Pursuant to NMMR 9.3.2, NMISA is required to analyze whether any potential investments in the transmission system are necessary to maintain reliability in accordance with NMISA Reliability Standards (see NMMR 8), which include NPCC Reliability Standards, improve the performance of the Northern Maine Market, or reduce the cost of congestion constraints. Pursuant to NMMR 9.3.5, where the Base Case identifies that action is or will be required to alleviate an existing or emerging transmission constraint, the NMISA is directed to take the actions described in NMMR 9.4.1 when, in the NMISA's independent judgment, no adequate proposal exists to address the problem. Pursuant to NMMR 9.3.7, a transmission constraint is considered "emerging" if the NMISA identifies it to be likely to occur within one to five years, and it is considered "potential" if the NMISA identifies it to be likely to occur within six to seven years.

When the Tinker transformer upgrade and rebuild of Line 6901 are completed in the fall of 2016, the NMTS will meet the N-1 criteria. With these reinforcements on the interface, the emerging and potential constraints identified in prior Seven Year Outlooks will be considered resolved.

The NMISA is not aware of any planned deactivation, disconnection or retirement of any existing transmission facilities.

Conclusion

The NMISA finds that the emerging transmission constraint after 2019 declared in the 2015 Seven Year Outlook will no longer exist when the Tinker transformer upgrade and rebuild of Line 6901 are completed in the fall of 2016.

SUMMARY OF RESULTS

Load Forecast

The load forecast for Northern Maine projects an average growth rate of 0.5% per year over the seven-year planning period covered in the Base Case for both energy and demand.

The anticipated peak hourly demand for Northern Maine is expected to increase from 135.7 MW in 2016 to 139.90 MW in 2022, the final year covered in the Base Case.

Generation Resources

NMISA projects that based upon committed generation resources, the northern system will rely on the MPD/NB interface through the planning period to account for any deficiencies.

Transmission Planning

With the new transmission upgrades, NMISA finds that the identified transmission constraint will not continue to occur during the period 2016 to 2021.

The system currently complies with NPCC Reliability Criteria due to sufficient in region generation. The RMR contract with the Fort Fairfield facility terminated September 30, 2014, and both units will be available to operate for the next two years. However, from a long-term reliability planning perspective, it is uncertain how long the biomass plants will continue to operate.

Routine annual capital projects that are currently projected for the planning period consist of a series of capitalized maintenance projects by MPD that will increase transmission capacity compared to current levels, and should generally increase system reliability and decrease transmission O&M expenses.

EXHIBIT 1

Summary of MPD Transmission Lines

MPD has 381.63 circuit miles and pole miles of transmission lines. It serves an area of approximately 3,600 square miles and 36,500 retail customers through transmission and distribution level systems. A breakdown of transmission mileage is as follows:

<u>Voltage</u>	<u>Circuit Miles</u>	<u>Pole Miles</u>
34,500	12.31	12.29
44,000	46.57	46.57
69,000	310.87	310.87
138,000	11.89	11.89

The main trunk portion of Line 3470 has been classified as transmission by FERC. Most of this line mileage is for subtransmission lines, i.e. it serves the 28 MPD distribution substations. Two lines, 6904 and 3855, are true transmission lines that do not serve any distribution stations.