

UNITED STATES DISTRICT COURT  
DISTRICT OF MAINE

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FRIENDS OF MERRYMEETING BAY and	)		
ENVIRONMENT MAINE,	)		
	)		
Plaintiffs,	)		
	)	C.A. No. 1:11-cv-00038-GZS	
v.	)		
	)		
NEXTERA ENERGY RESOURCES, LLC;	)		
NEXTERA ENERGY MAINE OPERATING	)		
SERVICES, LLC; FPL ENERGY MAINE	)		
HYDRO, LLC; and THE MERIMIL LIMITED	)		
PARTNERSHIP,	)		
	)		
Defendants.	)		
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**DECLARATION OF PLAINTIFFS’ EXPERT MAXIMILIAN CHANG  
IN SUPPORT OF PLAINTIFFS’ MOTION FOR PRELIMINARY INJUNCTION**

Pursuant to 28 U.S.C. § 1746, I, Maximilian Chang, state as follows:

**I. Qualifications and Summary of Conclusions**

1. I am an Associate at Synapse Energy Economics, Inc., an energy-economics consulting group. My expertise is in the areas of energy markets, renewable energy sources, and the New England electric power grid. I make this declaration in support of Plaintiffs’ motion for a preliminary injunction in the above-captioned matter. My testimony is intended to assist the Court in determining, in the context of awarding injunctive relief, the ability of the New England electric grid to absorb the impact of a spring seasonal turbine shutdown at the Defendants’ four hydroelectric facilities, should the Court determine that such a shutdown is

necessary to protect migrating fish during the spring salmon migration period between April and June.

2. I have a B.S. in Biology from Cornell University and an M.S in Environmental Science and Engineering from Harvard University. I have twelve years of experience working in the field of environmental consulting, economics, and engineering. I also have six years of experience in the field of financial analysis. In my current position at Synapse Energy Economics, my research focuses on issues relating to wholesale electricity markets and technologies, electric policy modeling, energy efficiency, capacity markets, distribution system reliability, environmental compliance, and the economics of energy supply resources. I also conduct analyses of the benefits and costs of electric and natural gas energy efficiency measures and programs. I have provided testimony and/or analyses about avoided energy costs to the State of Massachusetts Department of Public Utilities, Maine Public Utilities Commission, and the Vermont Public Service Board. In 2009 and 2011, I co-authored reports on avoided energy supply costs in New England, quantifying the value of energy efficiency programs through simulations of the entire New England power grid; both reports are used by New England electric utility regulators and New England energy efficiency program administrators (including those from utilities such as Northeast Utilities, National Grid, and NSTAR) to value energy efficiency relative to other resources (including hydropower). Additionally, in 2011 I co-authored a report for the Union of Concerned Scientists analyzing the projected comparative contributions of proposed nuclear power generation and alternative energy sources, including renewable sources, as means

of meeting the resource needs of two major utilities in Florida and Georgia.

Preparation of these reports required the same kind of analysis of energy demand and capacity markets that I have performed for the Plaintiffs in this case. My CV is attached to this declaration as Exhibit A.

3. My opinions, expressed herein, are based on my education and professional experience and are informed by (a) a review of documents and statistics prepared by the Department of Energy's Energy Information Agency ("EIA") and the New England Independent System Operator ("ISO-NE"), (b) relevant industry analyses, and (c) information provided by the Defendants in this case through answers to interrogatories. The opinions expressed here do not differ in any meaningful way from those provided in the initial report I prepared for this case, which was produced to Defendants in January of 2012 and is attached to this declaration as Exhibit B. The report includes tables and graphs that provide a visual illustration of many of the points discussed below. An updated bibliography to my initial report, which lists the sources for the 2011 data analyzed below, is attached as Exhibit C.
4. In summary, it is my opinion that neither the New England electric power grid nor the local electric system within Maine would be adversely affected by a spring seasonal shutdown of the electrical generation from the four hydroelectric projects involved in this litigation (specifically, the Lockwood, Shawmut, Weston and Brunswick dams). The four hydroelectric projects do contribute power to the electric grid; however, a seasonal shutdown of these small units would not result in any noticeable impact to customers or to the New England electric power system

operator. Both the state of Maine and the New England region have adequate supply capacity to offset a seasonal loss of electricity production from these dams. In the spring, both demand and prices are generally lower than the rest of the year.

II. **Overview and General Explanation of New England Power Grid**

5. The New England electrical power system spans the six states of New England, and serves 14 million people. The New England Independent System Operator (ISO-NE) is the non-profit entity that manages and coordinates the generation and transmission of power across New England to meet demand. ISO-NE's operational responsibilities include ensuring minute-to-minute reliable operation of the New England power grid, ensuring the dispatch of lowest-priced resources, and coordinating operations with neighboring power systems. ISO-NE's market responsibilities include the administration and monitoring of wholesale electricity markets, which include both energy generation and production capacity. ISO-NE's planning responsibilities include administering requests to interconnect generation and transmission resources, and conducting transmission needs assessments to meet current and future power needs in New England.
6. All electric generating units measure their electrical output in two different but related ways. Amounts of electric energy used or produced (e.g., in a year) are measured in megawatt-hours (MWh). When discussing an amount of electric energy produced (e.g., the number of MWh produced in a given year), the terms "generation," "generated," or "electric output" will be used. The amount of electric power produced or consumed at a given moment will be referred to as "load" or "demand," respectively, while the amount that *can* be produced at a given moment

will be referred to as “capacity.” Capacity is measured in kilowatts (kW) or megawatts (MW). The amount of energy that is produced by a generator in a given period is often compared to the amount it could have produced if running at full capacity for the same period at 100 percent. That ratio, expressed as a percent or as a number between zero and one, is called the plant’s capacity factor (CF).

7. The most recent available ISO NE data, which covers 2011, indicates that New England’s 2011 total generating *capacity* (the amount that *can be* produced at a given moment), consists of approximately 43 percent from natural gas combustion units (13,760 megawatts), 22 percent from oil combustion (7,040MW), 15 percent from nuclear units (4,800MW), and lesser amounts from other sources – including just 4 percent from hydro resources (1,280MW). See Exhibit B at page 4 (graph labeled “Exhibit 1”) for an illustration of New England’s 2010 generation capacity.
8. ISO-NE sets energy prices in New England primarily through two markets that match forecasted and actual demand with generator supplier bids. The Day-Ahead Market sets hourly and financially binding energy prices for the following day based on forecasted demand and bids provided by suppliers based on their marginal cost to produce electricity. The Real-Time Market balances the Day-Ahead Market with real-time events (foreseen and unforeseen). The price paid to all generators is determined by the marginal cost of the last generator to meet demand.
9. In New England, natural gas-fired units are generally the marginal unit, and thus they set the energy price. Therefore, the price of natural gas in New England is generally a good proxy for the price of electricity.

**III. Impact of Spring Seasonal Shutdown on the Public’s Energy Consumption in Maine and New England**

10. ISO-NE notes that Maine accounts for approximately 9 percent of the population and 9 percent of the electricity consumption of New England. (ISO-NE 2011(b)). In terms of capacity for the 2011 – 2012 commitment period (June 1, 2011 to May 31, 2012), Maine had 3,244 MW of in-state generation and 287 MW of in-state non-generation resources, for a total capacity of 3,531 MW (“non-generation resources” are customer-side resources that include both energy efficiency savings and activities that change customer usage of electricity). According to ISO-NE, Maine’s 2011 actual peak demand was 1,964 MW, for an excess capacity of 1,567 MW. Thus, Maine currently exports electricity to other New England states, since Maine’s capacity exceeds its demand.
11. The four hydropower projects involved in this case are “run-of-the-river” dams, meaning that these dams have either limited or no storage at all. ISO-NE classifies these hydropower units as an “intermittent” resource, meaning they are to some extent dependent on uncontrollable conditions, such as river flow in the case of run-of-the-river dams. Periods of reduced power generation are thus expected. While the grid operates on a regional basis, there are situations where local generation is required to meet specific reliability needs of the transmission system. In northern Maine, ISO-NE has identified the need of transmission upgrade projects to maintain the availability of certain local generation resources and to maintain voltages across transmission lines. However, ISO-NE has *not* specifically

identified any of the four dams in question here as being needed to maintain availability and voltages in its 2012 Regional System Plan.

12. ISO-NE works to ensure that capacity is available to meet New England's peak demand, which occurs during the summer months (not during spring). ISO-NE rates the summer and winter capacities of intermittent resources based on historical output. For the summer rating of an existing run-of-the-river hydro resource, ISO-NE uses a formula based on the resource's median output from 1 p.m. to 6 p.m., from June through September, for the last five years. The winter rating is the median output from 5 p.m. to 7 p.m., from October through May, for the last five years. Thus, ISO-NE's summer and winter ratings for a hydro resource may differ, depending on historical river flow conditions. This means that the hydro resource's value in the capacity market may also differ from season to season.
13. In 2011, electric generation from these four hydropower projects represented approximately 3.5 percent of Maine's total energy demand in 2011 based on ISO-NE and EIA data. For the three months of April through June 2011, the dams represented 0.2 to 0.3 percent of New England monthly energy demand. The ISO-NE summer capacity of these hydro plants represented 1 percent of Maine's 2011/12 capacity supply obligation, which totaled 3,244 MW. On a New England-wide basis, the four dams represent 0.22 percent annual energy demand and 0.10 percent of 2011 generation capacity. This information is displayed graphically in Figures 1 and 2, below:

Figure 1: New England 2011 Average and Peak Load by Month, compared to the aggregate capacity of the four NextEra Dams (MW)

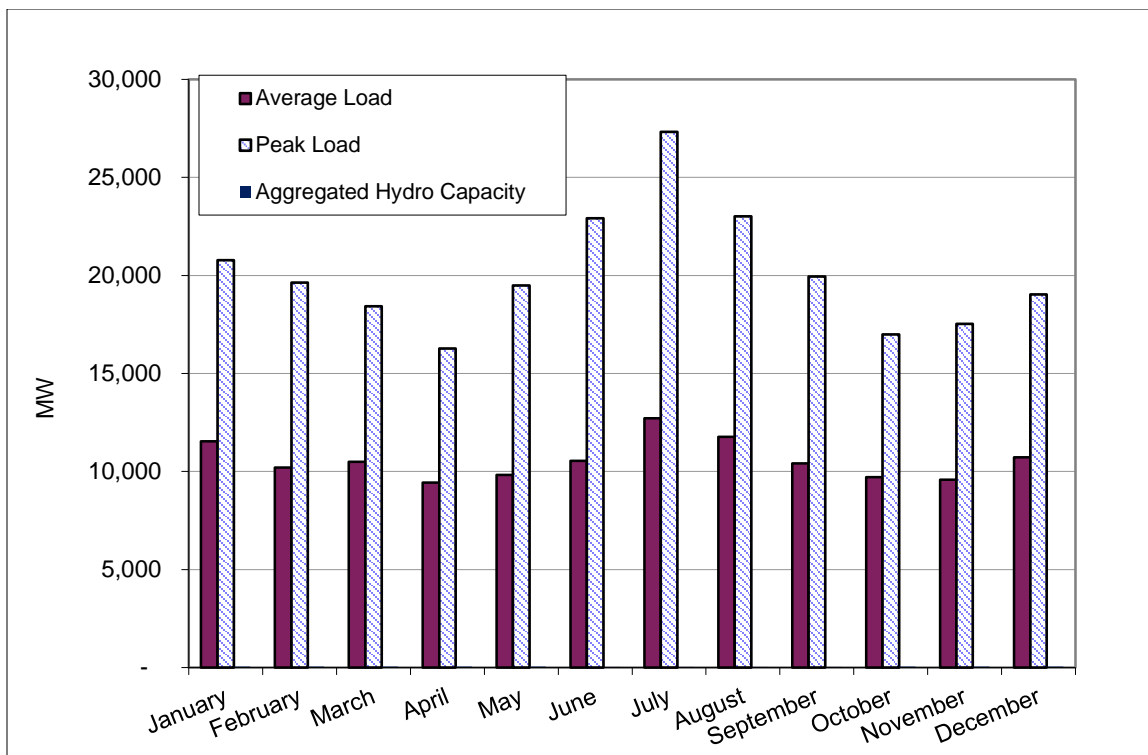
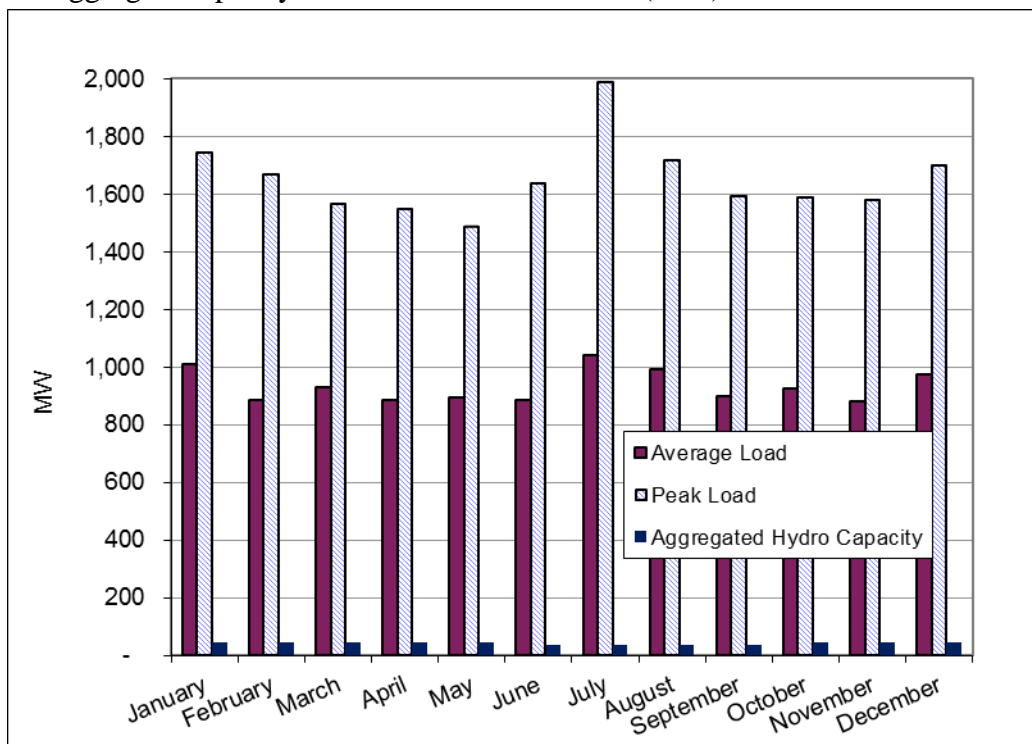


Figure 2: Maine 2011 Average and Peak Load by Month, compared to the aggregate capacity of the four NextEra Dams (MW)





In Figure 1, the Aggregated Hydro data may not be visible because the amounts are so small. For 2010 data, see Exhibit B at pages 11-12 (graphs labeled “Exhibits 6 and 7”).

14. Because the generation and capacity of these projects constitute such a small fraction of Maine’s and New England’s energy demand and capacity, and because both Maine and New England each have substantial amounts of excess capacity (far exceeding the contributions of these projects), it is my opinion that a seasonal shutdown of these small units would not result in any noticeable impact to customers or to the New England system operator.

I declare under penalty of perjury that the foregoing is true and correct.

Dated: March 14, 2013

/s/ Maximilian Chang  
Maximilian Chang

**CERTIFICATE OF SERVICE**

I hereby certify that on 14<sup>th</sup> of March 2013, I electronically filed the above *Declaration of Plaintiffs’ Expert Maximilian Chang in Support of Plaintiffs Motion for Preliminary Injunction* on behalf of the above-named Plaintiffs, with the Clerk of Court, using the CM/ECF system, which will send notification of such filings to all other counsel of record.

/s/ Rachel Gore Freed  
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