NEW HAMPSHIRE
RENEWABLE PORTFOLIO STANDARD

RETROSPECTIVE
2007 - 2015

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About This Report

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Introduction

A Renewable Portfolio Standard is a policy that requires "the inclusion of minimum amounts of renewable generation in the electricity mix of retail electricity providers, and these amounts increase gradually over time".[1] In 2007, the New Hampshire Legislature created the state's first Electric Renewable Portfolio Standard, setting such goals with the expressed intent of providing fuel diversity to New Hampshire and the New England region as a whole, as well as lowering regional dependence on fossil fuels and to stabilize and lower energy costs.[1] The Renewable Portfolio Standard directs electricity providers to procure renewable energy through 'renewable energy certificates' and alternative compliance payments. Nearly ten years later, advancements in the renewable energy sector have been accomplished in part because of the Renewable Portfolio Standard requirements and the resulting developments in the regional renewable energy sector.

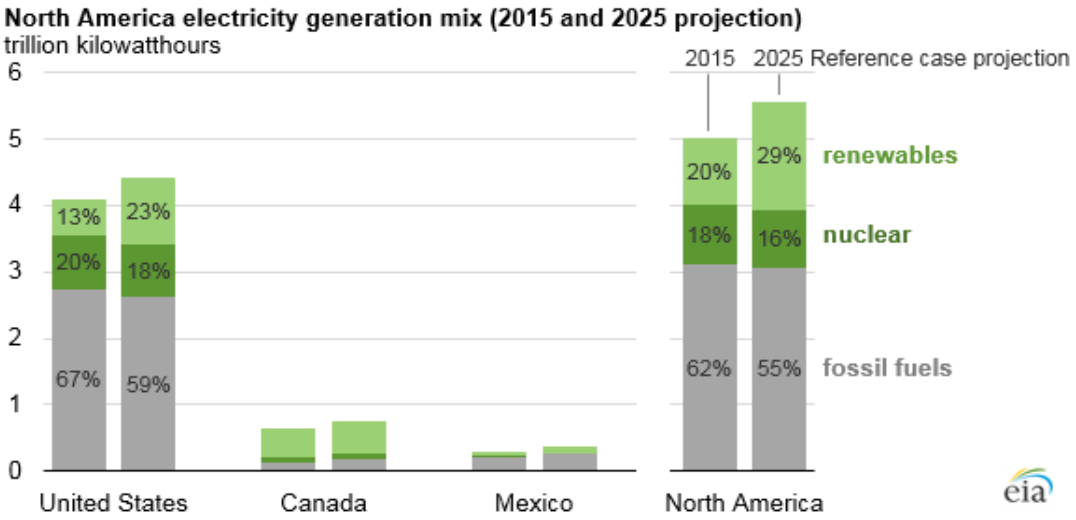
Renewable energy comes from an energy source that is rapidly replaced or renewed through a natural process, including but not limited to: sunlight, wind, hydropower, biomass, and geothermal. When harnessed, these energy sources provide a clean, sustainable, affordable, and relatively unlimited power supply. In 2007 approximately 10% of New Hampshire's electricity generation came from renewable sources. Whereas, in 2015, roughly 17% of New Hampshire's electricity generation is from renewable sources, including large-scale projects that are not certified to participate in the renewable energy certificate market under New Hampshire's Renewable Portfolio Standard criteria.[2] Renewable energy enables New Hampshire municipalities, businesses, and residents to realize economic and energy security benefits. The industries associated with designing, building and installing these systems increase economic activity in the state.

This report contains the available updated information on New Hampshire and surrounding states' Renewable Portfolio obligations, exploring topics such as renewable energy certificates and alternative compliance payments, legislative changes, and future technology and policy considerations. The information in this document can be used to inform policy recommendations and serve as a reference and base for further research. Furthermore, a statutorily-required Renewable Portfolio Standard review will take place in 2018, and this retrospective assessment can provide background information for that review.

[1] NH Statute RSA 362-F – Electric Renewable Portfolio Standard
[2] U.S. Energy Information Administration, *Electricity Data Browser*.

Electricity Generation Nationally and in New Hampshire

The market for renewable energy has increased significantly in the past few decades, throughout the country and in New Hampshire. The United States Energy Information Administration (EIA) predicts this trend will continue. "Based on results from EIA's *Annual Energy Outlook 2016* (AEO2016) Reference case and *International Energy Outlook 2016*, EIA projects that the North American share of energy generation from renewable and nuclear energy sources will grow from 38% in 2015 to 45% in 2025. This projection assumes the Clean Power Plan (CPP) is upheld and takes effect in the United States."[3] The generation mix of this progress can be seen in the chart below, as the United States upholds the majority of the current renewable and nuclear energy production, currently and projected.



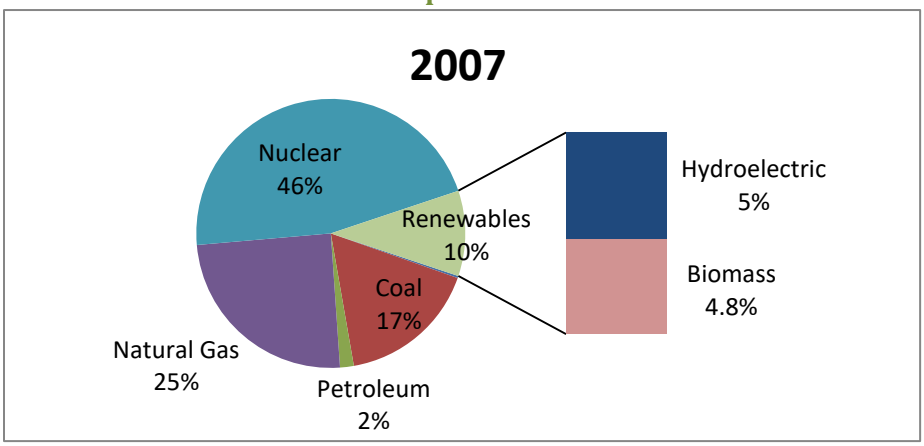
In New Hampshire, the number of renewable energy facilities has increased with the installation of utility scale facilities, and commercial and small scale distributed generation. Renewable generation increases significantly when utility-scale facilities go online. Examples of utility scale generation include Groton Wind (48 MW), Lempster Wind (24 MW), Jericho Mountain Wind (5 turbines, 14 MW) and the Burgess BioPower plant (76.5 MW). Examples of commercial scale distributed generation include; solar at the Peterborough Wastewater Treatment facility; Plymouth Wastewater Treatment facility; Durham Town Solar; and small scale hydro facilities such as Steels Pond Hydro in Antrim and Spaulding Avenue Industrial in Rochester. Small commercial scale and residential distributed generation continue to interconnect to the grid and add to New Hampshire's renewable generation portfolio. At the end of 2015, approximately 27 MW (over 3,400 customers) of net metered, distributed solar was interconnected to New Hampshire distribution utilities.

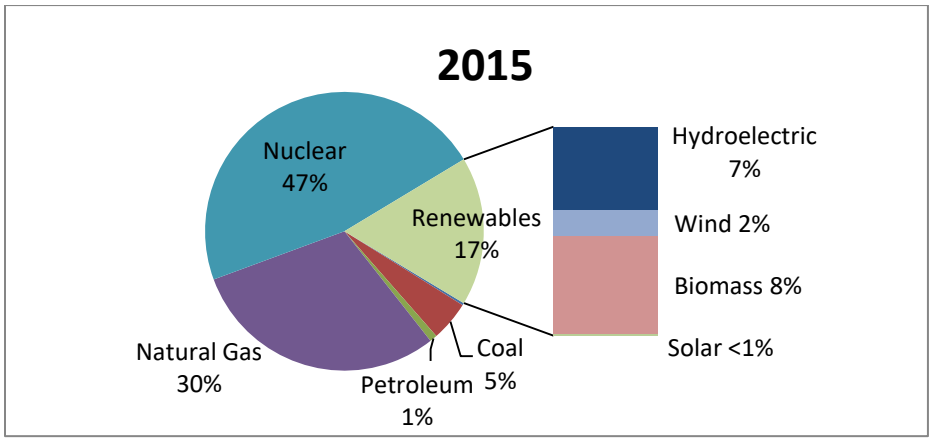
[3] U.S. Energy Information Administration, *Today in Energy,* "Renewables Share of North America Electricity Mix Expected to Rise".

The developments of the renewable energy sector in New Hampshire are evident in the energy 'snapshots' below: from the first year that the Renewable Portfolio Standard was enacted in 2007, and then again with more recent data from 2015. In the eight years since its enactment, renewable generation in New Hampshire has increased from 10% of total generation to 17%. The presence of existing and new technologies has expanded: for example, in 2007, wind was not a statistically significant part of the state's generation mix, and in 2015 it accounts for approximately 2% of generation. Generation from coal was reduced dramatically, going from 17% of New Hampshire's electric generation in 2007 to 5% in 2015.

Generation facilities located in New Hampshire generate more electricity than is consumed in-state, and the charts below indicate total energy *generated* and are not reflective of the energy consumed or sold in New Hampshire.

Generation from Facilities Located in New Hampshire[4]



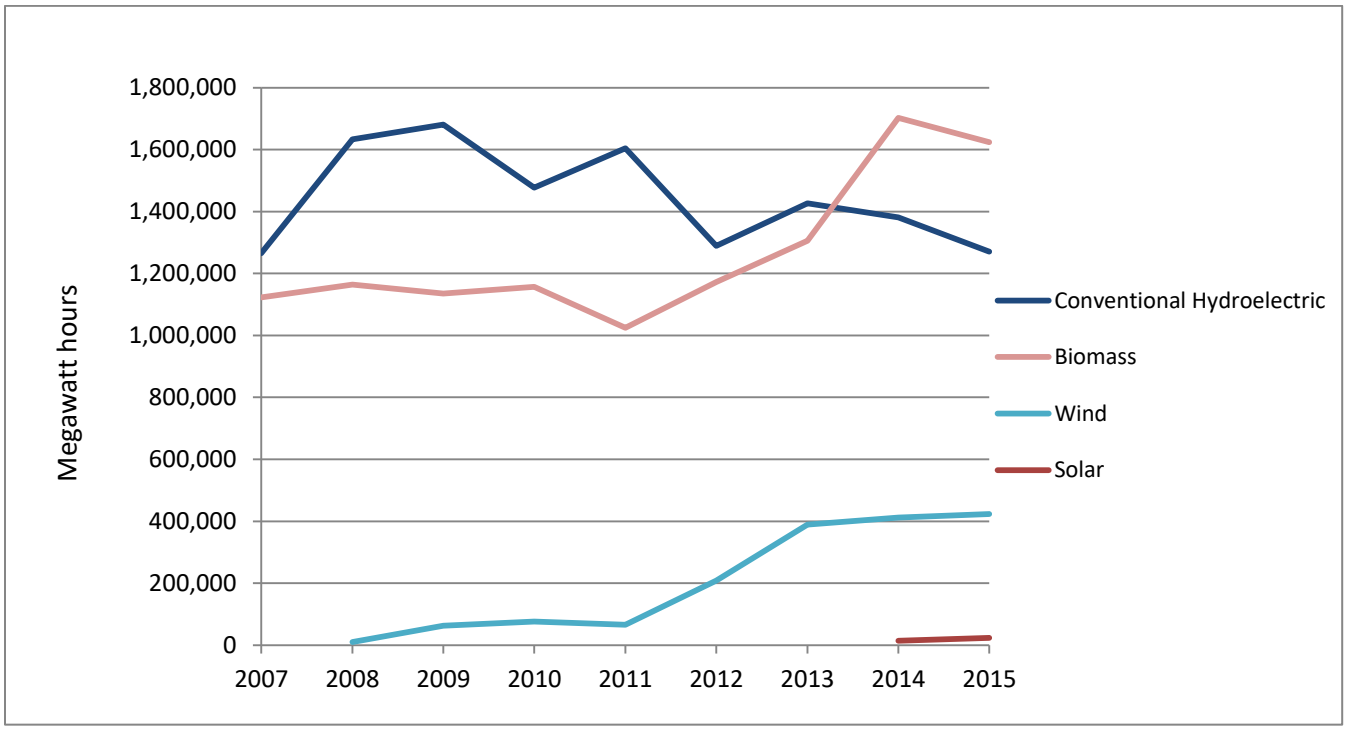


[4] U.S. Energy Information Administration, *Electricity Data Browser.*

Since 2007, renewable energy generation in New Hampshire has seen dips and rises in response to a variety of factors such as individual facilities going on or off line, technological advancements, and seasonal variances. Visible upward trends can be seen in wind and biomass, with biomass experiencing an increase after 2013 when Burgess BioPower went online.

In the years represented below, there have been between 30 -35 active conventional hydroelectric facilities, 1 wind facility in 2008 increasing to 3 facilities in 2012, and 12 biomass facilities increasing to 13 facilities in 2013. There is no utility scale solar installed in NH; the solar below represents the numerous interconnected residential and commercial solar installations throughout the state.

Renewable Electric Generation by Facilities Located in New Hampshire, 2007-2015 (MWh)[5]

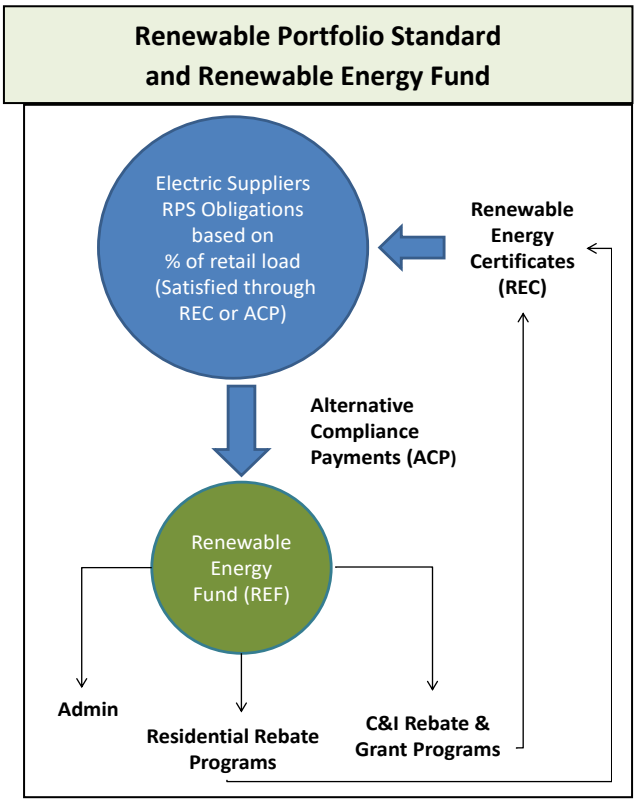


[5] The chart reflects the megawatt-hour generation of facilities in New Hampshire, but does not distinguish between those that are RPS certified and those that are not. Legislative stipulations and PUC rules preclude certain facilities from participating in the RPS, and those ineligibilities are not reflected in the chart data.
(Source: U.S. Energy Information Administration, *Electricity Data Browser.*)

Renewable Portfolio Standard in New Hampshire

In 2007, an economic analysis developed by the University of New Hampshire was submitted to the New Hampshire Department of Environmental Services and the Public Utilities Commission. The analysis highlighted the dynamic effects that a Renewable Portfolio Standard (RPS) represented for New Hampshire, citing the advantages that surrounding states had seen after the establishment of such a policy. At the time, New Hampshire was one of the only states in New England that had not passed RPS legislation, and participation in the regional market was listed as a benefit if the policy was developed.

On July 10, 2007, the New Hampshire Legislature enacted the state's first RPS policy. A common policy tool used by dozens of states throughout the country, New Hampshire's RPS is similar to other states in its mechanisms, yet unique in many of its details. The purpose of the RPS is to provide fuel diversity not only to New Hampshire, but to the New England region as a whole, to lower regional dependence on fossil fuels, and to stabilize and lower energy costs. It was also created with the intention of encouraging investment in local renewable energy in order to benefit the state's economy, and to stimulate investment in low emission renewable energy generation. Low emissions generation can help mitigate the risks of climate change and improve the overall air quality and public health in New Hampshire and New England.[6]



Codified as RSA 362-F, the RPS requires that all electric service providers serving New Hampshire customers satisfy a percentage of their electric retail sales load with renewable energy certificates (RECs), where each REC is created from one megawatt-hour (MWh) of electric generation, or an equivalent amount of thermal energy (3,412,000 Btu) generation, that has been fueled by qualified renewable sources. RECs may be purchased through the established regional trading platform at the New England Power Pool Generation Information System (NEPOOL GIS) or created through self-generation. Compliance began in 2008 with an obligation for each electric service provider to obtain 4% of its annual electric load from qualified renewable sources. The obligation increases gradually until it reaches 24.8% by 2025.

Other key features of New Hampshire's RPS include its

[6] As is stated in RSA 362-F:1.

four class structure and its alternative compliance payment option. Electric service providers must meet the RPS obligations in four separate classes. Class I includes new renewable energy systems and new capacity added to existing biomass, methane gas, or hydroelectric renewable energy generation, including a carve-out for thermal generation from renewable sources. Beginning in 2018, biodiesel production by any certified facility in New Hampshire may be used to meet no more than 1/8 of an electric provider's non-thermal Class I requirements in any given year.[7] Class II includes new solar energy generation. Class III includes existing biomass and methane gas energy generation, and Class IV includes existing small hydroelectric generation. If an electric service provider cannot meet its RPS obligation in a given class with RECs, it delivers alternative compliance payments (ACPs) into the state's Renewable Energy Fund (REF).

The Renewable Energy Fund is a dedicated, non-lapsing fund, administered by the Public Utilities Commission. The purpose of the fund is to support electrical and thermal renewable energy initiatives. ACPs are the sole source of funding for the REF and fluctuate from year to year, depending on the price and availability of RECs in the regional market (comprising CT, RI, MA, ME, VT and NH). RECs generated in one state may be sold in another provided they have acquired the proper certification for the respective state of sale.

In order to evaluate New Hampshire's RPS and ensure that the fundamental purposes are being met, and that the specific policy and regulatory mechanisms are fashioned in the most efficient way to meet such purposes, the RPS law requires the Public Utilities Commission (PUC or Commission), the state agency responsible for implementing and administering the RPS, to conduct periodic reviews; the most recent of these took place in 2011, and two more are scheduled for 2018 and 2025.[8]

[7] New Hampshire Senate Bill 386
[8] RSA 362-F:5

Renewable Portfolio Standard Obligations

The table below conveys the percentage of annual load that electricity providers are required to purchase in RECs or ACPs from each RPS class. The red numbers indicate changes that have occurred in the percentage requirements outlined in the initial Statute 362-F. Changes occurred due to the legislative amendments and PUC orders, which are described in detail after the table.

New Hampshire RPS Obligations[9]

Calendar Year	Total Requirement	Class I	Thermal Class I	Class II	Class III	Class IV
2008	4.00%	0.00%	0.00%	0.00%	3.50%	0.50%
2009	6.00%	0.50%	0.00%	0.00%	4.50%	1.00%
2010	7.54%	1.00%	0.00%	0.04%	5.50%	1.00%
2011	9.58%	2.00%	0.00%	0.08%	6.50%	1.00%
2012	5.55%	3.00%	0.00%	0.15%	1.40%	1.00%
2013	5.80%	3.80%	0.00%	0.20%	0.50%	1.30%
2014	7.20%	5.00%	0.40%	0.30%	0.50%	1.40%
2015	8.30%	6.00%	0.60%	0.30%	0.50%	1.50%
2016	9.20%	6.90%	1.30%	0.30%	0.50%	1.50%
2017	17.60%	7.80%	1.40%	0.30%	8.00%	1.50%
2018	18.50%	8.70%	1.50%	0.30%	8.00%	1.50%
2019	19.40%	9.60%	1.60%	0.30%	8.00%	1.50%
2020	20.30%	10.50%	1.70%	0.30%	8.00%	1.50%
2021	21.20%	11.40%	1.80%	0.30%	8.00%	1.50%
2022	22.10%	12.30%	1.90%	0.30%	8.00%	1.50%
2023	23.00%	13.20%	2.00%	0.30%	8.00%	1.50%
2024	23.90%	14.10%	2.00%	0.30%	8.00%	1.50%
2025 and thereafter	24.80%	15.00%	2.00%	0.30%	8.00%	1.50%

Senate Bill 218 (SB 218), which was enacted in 2012, required electricity providers to purchase useful thermal RECs representative of 0.2 % of their delivered electricity or make a payment of $25 per megawatt hour in ACPs to the REF. (RSA 362-F; 3 and RSA 362-F:10, II (a)) SB 218 also required the Commission to implement rules to "adopt procedures for the metering, verification, and reporting of useful thermal output."[10]

In July 2013, Senate Bill 148 (SB 148) became effective and Class I Thermal obligations were modified (from 0.2% in 2013, 0.4% in 2014, and increased by 0.2% annually) to 0.0% in 2013, 0.4% in 2014, 0.6% in 2015,1.3% in

[9] Chart retrieved from Sustainable Energy Division webpage, Electric Renewable Portfolio Standard (RPS).
[10] RSA 362-F:13, VI-a.

2016, and increased annually by 0.1% per year from 2017 through 2023, after which it shall remain unchanged.

House Bill 542 (HB 542) of the 2013 session adjusted Class III obligations to be 1.4% in 2012, 1.5% in 2013 and 3% in 2014, after which it will increase to 8% per year from 2015-2025 and thereafter.

In addition to statutory changes, the Commission, with good cause, has the authority to modify Class III and Class IV, and accelerate or delay Class I and Class II requirements. Per RSA 362-F:4, V, the Commission may accelerate or delay by up to one year, the incremental increase in Class I (New Renewable) or Class II (Solar) RPS requirement. Additionally, when it is determined that there is good cause to modify the requirements to reflect the Class III or Class IV REC availability in New Hampshire, and pursuant to RSA 362-F:4, VI, after notice and hearing, the Commission can modify Class III or Class IV requirements "such that the requirements are equal to an amount between 85% and 95% of the reasonably expected potential annual output of available eligible sources after taking into account demand from similar programs in other states."[11]

Class III obligations have been adjusted by PUC order since 2012. Public comments were received during public hearings, and in 2012 it was noted that electricity providers paid an unprecedented amount of ACPs for compliance in calendar year 2011, largely because of the scarcity of New Hampshire certified Class III RECs available in the market. It was found that: "the lack of availability of New Hampshire Class III RECs and the unprecedented amount of ACPs deposited in the REF for compliance year 2011 (over $15 million in ACPs for Class III alone) present good cause to modify the RPS requirements for Class III RECs, particularly given that higher RPS compliance costs result in higher rates for New Hampshire electric ratepayers."[12]

Class III RECs experienced a scarcity in part because of the higher REC prices offered in other states participating in the regional market, such as Connecticut where the ACP rate is fixed at $55, whereas New Hampshire rates started at $28.72 in 2008. Therefore, New Hampshire generators could often sell their Class III RECs at a greater profit in states with higher ACP rates, leading to a scarcity of Class III RECs for New Hampshire electricity providers to purchase.[13] Through a legislative amendment (HB 542), the Class III ACP is now set at $45 until 2018.

Based on analysis and public comment, the Commission has modified the Class III requirements in 2012, 2013, 2014, 2015 and 2016; and delayed the Class I Thermal obligation in 2013 through the following orders:

- Order No. 25,484 dated April 4, 2013 under Docket No. DE 13-021, the Commission changed the Class III obligations in 2012 and 2013 and the Class I and Class I thermal obligations in 2013.
- Order No. 25,674 dated June 3, 2014 under Docket No. DE 14-104, the Commission changed the Class III obligations in 2013.

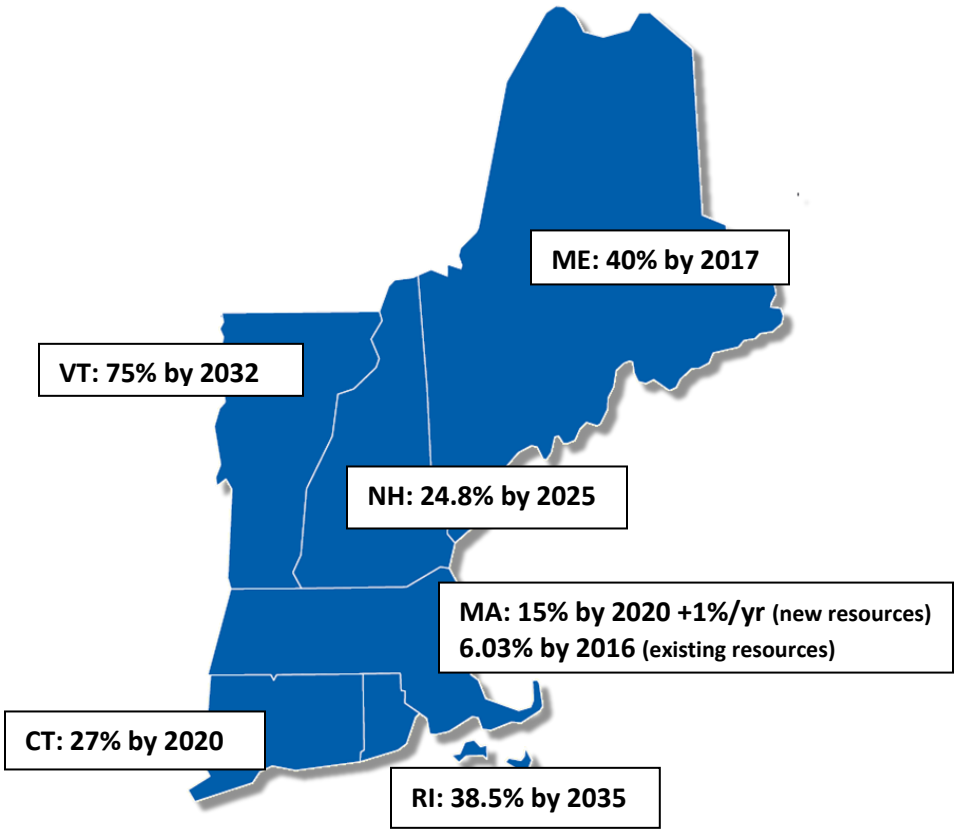
[11] RSA 362-F:4, VI
[12] Order No. 25,484 under Docket No. DE 13-021
[13] The ACP rate will often act as an informal price ceiling, as is described in regards to Renewable Energy Certificates starting on page 10.

- Order No. 26,768 dated March 13, 2015 under Docket No. DE 15-035, the Commission changed the Class III obligations in 2014 and 2015.
- Order No. 25,844 dated December 2, 2015 under Docket No. 15-477, the Commission changed the Class III obligations in 2016.

Regional Renewable Portfolio Standards

In 2016, all New England states have enacted renewable energy standards. Each state has individual eligibility requirements and varying compliance obligations: no two states share identical renewable standards when considering targets, class definition or ACP rates. However, each state has an ultimate electric provider renewable obligation goal, expressed in individual policies. Refer to Appendix A for a complete map of the United States that highlights each state's RPS goals.

New England Renewable Portfolio Standards Goals by State[14]



[14] Information retrieved from Database of State Incentives for Renewables & Efficiency (DSIRE).

Renewable Energy Certificates

RPS compliance is verified using a renewable energy certificate (REC), which is "an electronic record showing that one unit of eligible renewable electricity has been generated"[15]; in New Hampshire and surrounding states, the unit is equal to one MWh. Renewable Energy Certificates are managed through the New England Power Pool Generation Information System (NEPOOL GIS). The certificates created from eligible renewable energy generation are sold on this regional market, and are retired throughout New England.

The structure of the RPS in New Hampshire, as in many other state RPS programs, creates an effect that may produce a binary market. For example, when the demand for RECs is greater than the supply, the price of a REC rises to approach the ACP. When the supply of RECs substantially exceeds the RPS-obligated demand, the REC price may drop to a price approaching zero, because if every entity that must comply with an RPS requirement has met that requirement, then the remaining unsold RECs have no market value, other than banking RECs for future compliance periods.[16] Generally, an RPS program's REC supply is generated in a "lumpy" fashion, while the requirements tend to increase at a steady rate.[17]

In addition, REC prices fluctuate depending on the regional market and state-specific RPS obligations or ACP rates. Demand for RECs might be responsive to changes in ACP rates, especially if the rates are particularly high and paying ACPs are especially disadvantageous. If a facility is certified to sell RECs for multiple state RPS programs, then the available RECs are generally sold in the states where the ACP rates are highest, with the ACP rate acting as an informal price ceiling.

Renewable Energy Certification in New Hampshire

Renewable energy facilities may apply to the New Hampshire PUC to become RPS-certified and have the ability to sell RECs on the NEPOOL GIS market. New Hampshire, along with many other states, distinguishes various renewable energy technologies into classes, and electricity providers are required to purchase RECs in varying percentages for each class. Specific certification eligibility requirements vary by class and are defined in the PUC 2500 rules.

According to the current New Hampshire RPS statute, RSA 362-F, class distinctions occur as follows:

- Class I resources include generation facilities that began operation after January 1, 2006 and produce electricity from: wind energy; geothermal energy; hydrogen derived from biomass fuel or methane gas; ocean thermal, wave, current, or tidal energy; methane gas; eligible biomass technologies; solar thermal

[15] Clean Energy States Alliance, *Potential RPS Markets for Renewable Energy Generators*.
[16] REC banking will be further explained in regards to REC retirement, starting on page 11.
[17] New Hampshire Public Utilities Commission 2011 RPS Review.

energy; and Class II sources to the extent that they are not otherwise used to satisfy the minimum portfolio standards of other classes.

- Class II sources include generation facilities that produce electricity from solar technologies and began operation after January 1, 2006.
- Class III sources include generation facilities that began operation on or before January 1, 2006 and produce electricity from eligible biomass technologies having a gross nameplate capacity of 25 megawatts or less or methane gas facilities.
- Class IV: SB 218, enacted in June 2012 modified the definition of a Class IV source. Class IV sources are now defined as: hydroelectric generation facilities that began operation on or before January 1, 2006, and when required, have documented applicable state water quality certification under section 401 of the Clean Water Act, and either A) have a capacity of 5 megawatts or less and has actually installed upstream and downstream diadromous fish ladders, or B) have a capacity of one megawatt or less , are in compliance with applicable FERC fish passage restoration requirements, and are interconnected with an electric distribution system located in New Hampshire.[18]

In 2012, New Hampshire became the first state to add thermal renewable projects as an eligible supply for Class I RECs with the passing of Senate Bill 218. Thermal renewable energy is not tracked by ISO-New England, and the PUC was required to establish procedures for including such sources, including behind the meter production, into the certificate program provided the sources are located within New Hampshire.[19]

In 2013, House Bill 542 established combined heat and power units as eligible for Class I biomass certificates when existing thermal energy units are upgraded or replaced.

Biodiesel for thermal use was added as a RPS compliance mechanism in 2016, whereby the production of biodiesel,[20] produced by any facility in New Hampshire, may be used to meet no more than 1/8 of a provider's non-thermal Class I requirements in any given year. The production facility must meet all applicable air emission and water discharge standards, document the sale of the biodiesel into the thermal energy market and the end-user efficiency rating, or where such documentation is not practicable, assuming the average end-user efficiency rating by customer class. Per statute, the PUC must establish rules for the metering, verification, and reporting of useful thermal energy output for producers of biodiesel no later than December 31, 2017.

REC Retirement

Once RECs are purchased by an electric provider on NEPOOL GIS, they are retired. Certificates shall only be used by providers of electricity for compliance with the requirements of RSA 362-F:3 in the year in which the generation represented by the certificate was produced, except that unused certificates of the proper class issued for production during the prior two years may be used to meet up to 30% of a provider's requirements

[18] RSA 362-F:4,
[19] RSA 362-F:6, II.
[20] As defined in RSA 362-A:1-a, I-b.

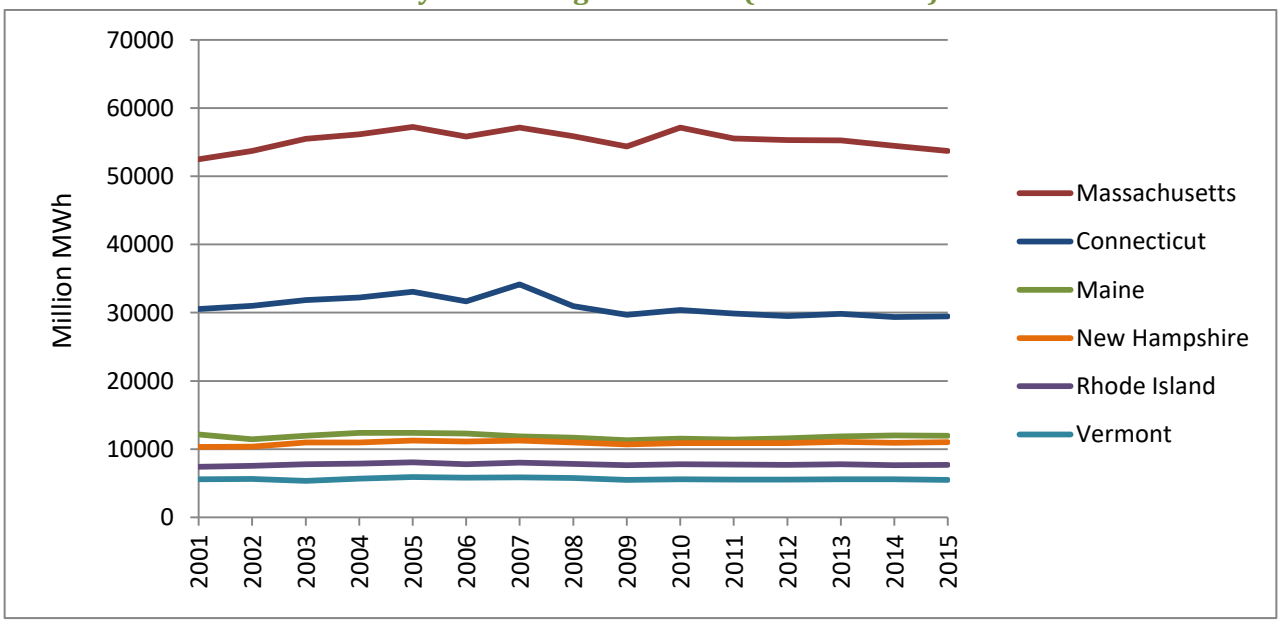
for a given class obligation in the current year of compliance (i.e. banking).[21]

A facility must obtain a state-specific RPS certification to produce RECs that may be purchased by electricity providers to satisfy the state-specific RPS compliance obligations. RECs can be produced in one state and purchased to meet provider obligations in another state, as long as the renewable facility has been certified to satisfy RPS obligations in that state. Given this caveat, complying electric providers may choose which facilities to purchase qualifying RECs from based on competitive market prices. Most states certify renewable energy generators with few barriers, with one exception being the Massachusetts Solar Carve-Out Program: solar facilities outside of Massachusetts are not eligible to be certified for the Massachusetts' Solar Carve Out, and external facilities are unable to sell RECs for compliance of Massachusetts utilities' Solar Carve Out requirement.

Renewable facilities in New England that would like to sell RECs to New Hampshire electric providers seeking to fulfill RPS requirements must become certified through the New Hampshire Public Utilities Commission. If they are certified, the New England renewable energy facility may sell RECs on NEPOOL GIS for New Hampshire RPS compliance.

In 2014, New Hampshire electric providers purchased roughly eight percent (8%) of the total RECs produced and registered in the NEPOOL GIS. During that same year, Massachusetts electric providers purchased and retired approximately 37% of all RECs retired in NEPOOL GIS. REC requirements are a function of the total amount of retail electricity sales (load) in the state and the RPS obligation imposed upon that load. The graph below illustrates annual retail electricity sales in each New England state between 2001 and 2015.

Annual Retail Sales of Electricity in New England States (Million MWh)[22]



[21] RSA 362-F:7, I
[22] U.S. Energy Information Administration, *Electricity Data Browser*

Alternative Compliance Payments

Electricity providers must obtain RECs from each of the four classes in a certain mandate-established percentage of their annual retail sales load. If electricity providers cannot, or choose not to, purchase or obtain sufficient RECs to comply with the RPS law, they must make alternative compliance payments (ACPs), the rates of which are defined in statute and adjusted annually by the PUC in relation to the Consumer Price Index for the given year.

Alternative Compliance Payment Rates

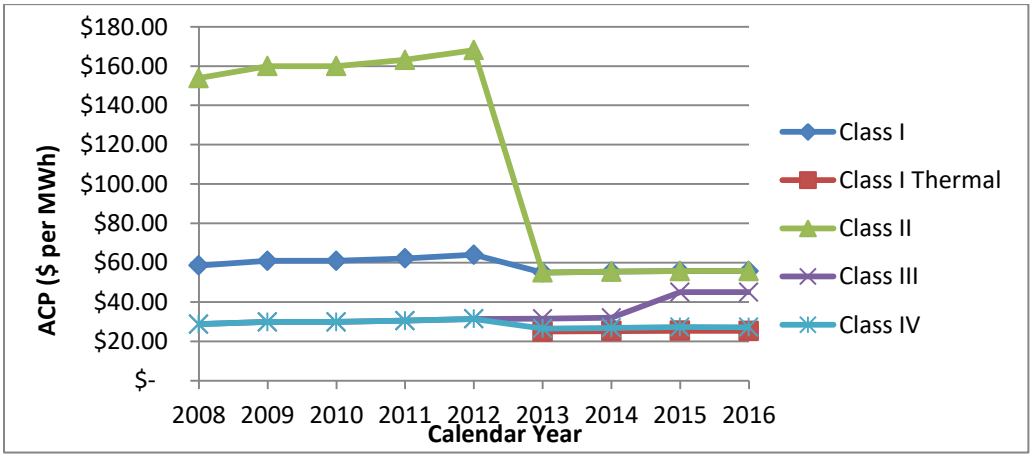
The ACP rates are differentiated by class and are defined in statute and in accordance with RSA 362-F:10, III, which states that the ACP rates for Class III and Class IV are adjusted annually by the Consumer Price Index (CPI), and for Classes I and II by ½ of the Consumer Price Index. In accordance with RSA 362-F:10, III (b), the Class III ACP is set at $45 for 2015, 2016, and 2017. In 2018, the Class III ACP rate will equal the rate that would have resulted in 2018 by the application of the full CPI to the 2013 rate and each subsequent year's rate to 2018.

The ACP rate often functions as a price ceiling for the REC prices because electric providers are disinclined to pay more than the ACP for RPS compliance.

New Hampshire ACP Rates: 2008-2016[23]

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Class I	$ 58.58	$60.92	$60.93	$ 62.13	$ 64.02	$ 55.00	$ 55.37	$ 55.75	$55.72
Class I Thermal						$ 25.00	$ 25.17	$ 25.34	$25.33
Class II	$153.85	$ 159.98	$ 160.01	$ 163.16	$ 168.13	$ 55.00	$ 55.37	$ 55.75	$55.72
Class III	$ 28.72	$ 29.86	$ 29.87	$ 30.46	$ 31.39	$ 31.50	$ 31.93	$ 45.00	$45.00
Class IV	$ 28.72	$ 29.86	$ 29.87	$ 30.46	$ 31.39	$ 26.50	$ 26.86	$ 27.23	$27.20

New Hampshire ACP Rate Trend: 2008-2016



[23] Retrieved from http://www.puc.nh.gov/Sustainable%20Energy/RPS/Historical%20ACP%20rates.pdf.

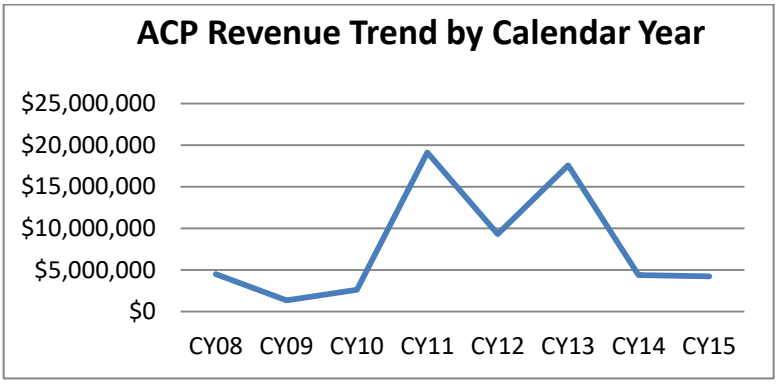
New Hampshire Alternative Compliance Payment Revenues

Alternative compliance payments (ACPs) from electricity providers are made annually by July 1, for the prior calendar year. Entities paying ACPs include New Hampshire's electric distribution utilities, as well as competitive electric power suppliers. New Hampshire's municipal electric utilities are not required to comply with the RPS. ACPs are paid to the Renewable Energy Fund (REF) and are the fund's sole source of revenue.

Revenue stream for the Renewable Energy Fund from ACPs is highly dependent on a number of factors, namely the ACP rate and the regional demand for RECs. The influence of these varied factors can be seen with the trend of REF revenue.

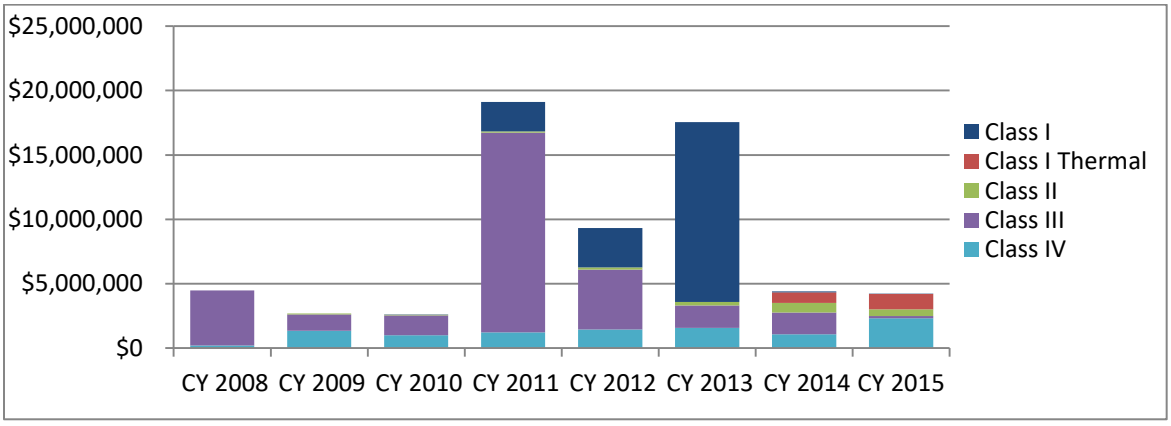
ACP Revenues and Trend

ACP Paid by July 1st for Calendar Year	Amount
July 2009 for CY 2008	$ 4,483,917
July 2010 for CY 2009	$ 1,348,294
July 2011 for CY 2010	$ 2,625,499
July 2012 for CY 2011	$19,121,853
July 2013 for CY 2012	$9,323,198
July 2014 for CY 2013	$17,458,196
July 2015 for CY 2014	$4,406,804
July 2016 for CY 2015	$4,224,339



The first few years of the New Hampshire RPS program, the majority of ACPs were paid in regards to Class III RPS requirements, but the trend changed in 2012 and 2013 when the Commission adjusted the Class III obligation requirement. Class I payments were a significantly smaller portion of the revenue stream in 2014 most likely due to the large biomass plant Burgess BioPower coming online increasing the number of available RECs for Class I compliance.

New Hampshire ACP Revenue by Class[24]



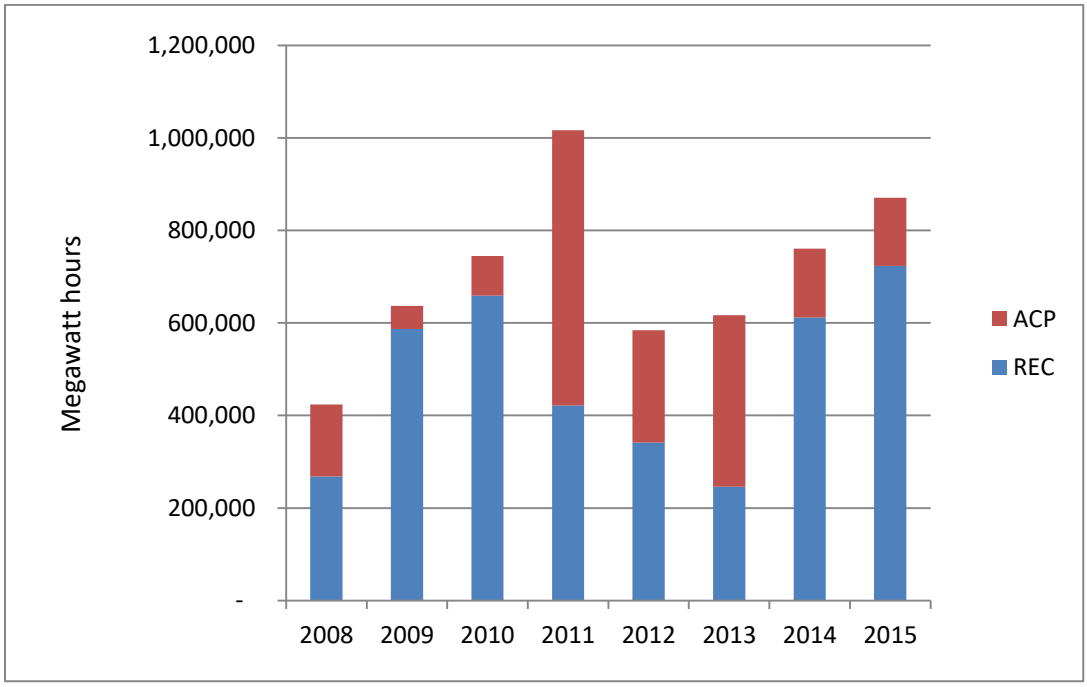
[24] Information retrieved from Renewable Energy Fund Annual Reports, 2008-2015.

New Hampshire Renewable Portfolio Standard Compliance

The total cost of RPS compliance is a combination of the REC purchases and the ACPs. Compliance costs change every year, based on a number of factors: electricity retail sales load, number of RECs available from certified renewable sources, legislative changes to RPS obligation requirements, ACP rates in New Hampshire and regionally, and the mix of REC and ACP payments made by electricity providers. The variability of REC and ACP rates makes a year-to-year comparison difficult, but megawatt hour compliance can eliminate that variable. Megawatt hour compliance is affected by the total annual electric sales of a provider and the RPS obligations, but the unit of measurement for obligations remains constant.

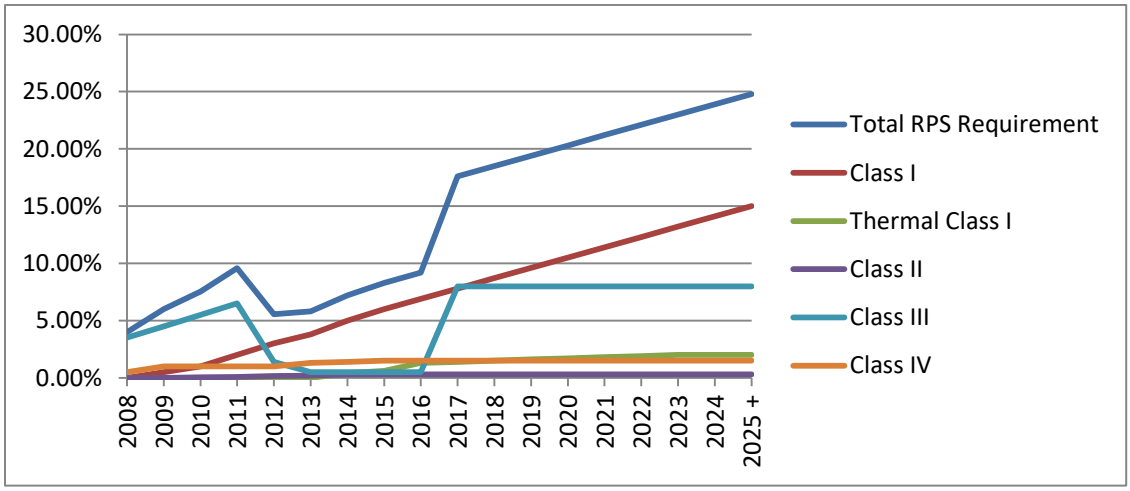
The megawatt hour compliance is shown below.

Total Megawatt hour RPS Compliance (MWh): 2008-2015



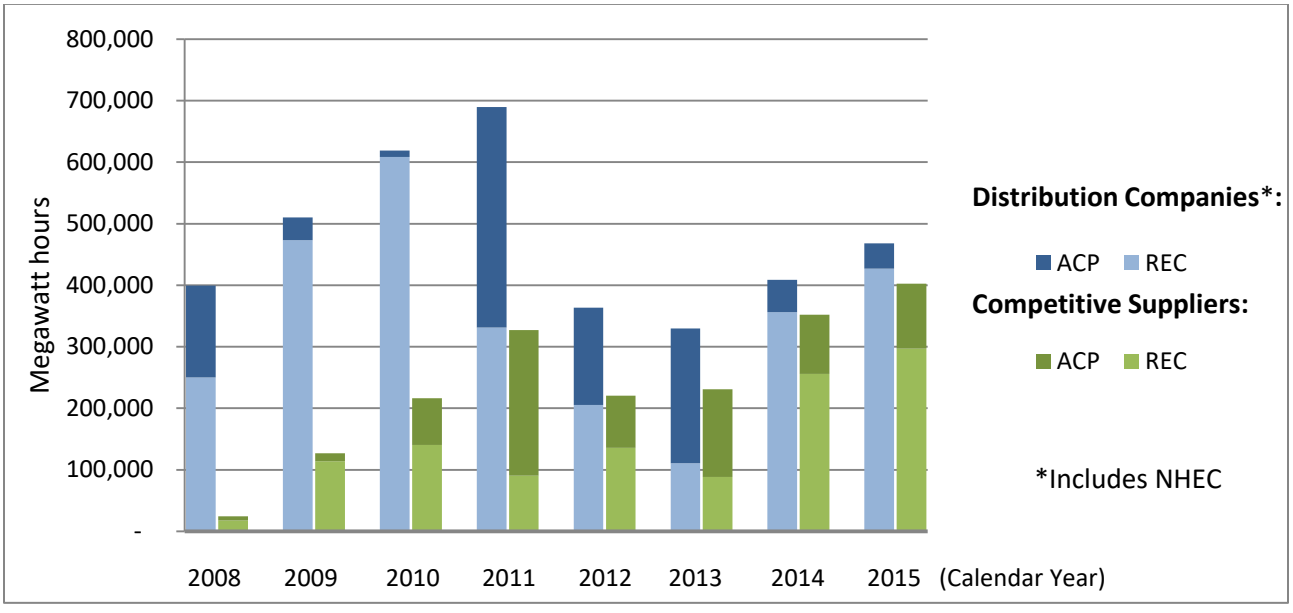
Annual differences in megawatt hour compliance are heavily dependent upon two factors: total annual electric provider sales, and the yearly RPS mandated obligation. The changes and trends in compliance percentages are reflected below:

New Hampshire RPS Obligations by Class



Regulated electric distribution utilities and competitive electric suppliers operate differently, which may be reflective in their behaviors in the REC market. Year to year, providers may choose to purchase RECs or pay ACPs depending on market prices and availability. Megawatt-hour compliance for distribution utilities and competitive suppliers, and ACPs or REC compliance is shown below.

Total Compliance of Distribution Companies* and Competitive Suppliers (MWh)[25]



[25] Aggregated data from annual RPS compliance reports submitted to the PUC.

Renewable Energy Fund

The RPS encourages growth and advancement of the renewable energy sector, as well as providing a funding platform for renewable energy projects in New Hampshire with the revenue from alternative compliance payments made to the Renewable Energy Fund.

The REF enables innovative renewable energy projects in the State of New Hampshire through incentive and grant programs. Since its inception in July 2009, the Renewable Energy Fund has established six grant and rebate programs that have experienced substantial demand and growth over time. The Renewable Energy Fund has disbursed close to $20 million in rebates for renewable energy systems to New Hampshire homeowners, businesses, schools, towns, non-profit organizations, and other eligible entities. In addition, the Commission's competitive annual grant program has provided more than $8 million in funding for 29 renewable energy projects for schools, businesses, and municipalities, featuring technologies from biomass heating systems to hydroelectric project upgrades to photovoltaic arrays and solar hot air, among others.

Rebate and grant funds have been leveraged with over a hundred million dollars in private investment, providing a boost to the state's economy and creating jobs for electricians, plumbers, and renewable energy businesses, among others. In addition, there has been substantial growth in distributed generation renewable energy systems that serve to diversify energy sources, reduce reliance on fossil fuels, reduce greenhouse gas emissions, and increase energy independence.

Rebate Programs

The Renewable Energy Fund (REF) currently supports five rebate programs:

- Residential Electrical Renewable Energy: This program offers rebates to qualifying homeowners who install photovoltaic (PV) or wind turbine electrical generation systems 10kW or smaller. Rebate levels are currently $0.50 per watt of panel or turbine rated power up to $2,500, or 30% of the total facility cost, whichever is less.
- Residential Solar Hot Water Heating: This program offers rebates ranging from $1,500 to $1,900, depending on system size, for qualified solar water heating and space heating systems on primary residences in New Hampshire.
- Residential Central Wood Pellet Boiler/Furnace Heating System: The program provides a rebate payment of 40% of the system and installation cost, up to a maximum of $10,000, for New Hampshire residents who invest in high-efficiency (80% or greater), bulk-fuel fed, wood-pellet central heating boilers and furnaces serving designed intent and installer-certified on or after July 9, 2016.
- Commercial and Industrial Solar Technologies: This program offers rebates for solar energy systems in

two eligible project categories. Category 1 is for solar electric and thermal systems rated less than or equal to 100 kW (AC) or thermal equivalent. Category 2 is for solar electric systems greater than 100 kW (AC) but less than or equal to 500 kW (AC). In each category, rebates are limited to 25% of the total project cost if less than the AC per watt incentive payment otherwise calculated. The program is available to non-residential structures with a commercial electric meter located in New Hampshire.

- Commercial and Industrial Central Wood Pellet Boiler/Furnace Heating Systems: This program offers a rebate payment of 40% of the heating appliance(s) and installation cost, up to a maximum of $65,000, for investments in non-residential bulk-fuel fed wood pellet boilers and furnaces of 2.5 million BTU or less, that become operational, serving designed intent and installer-certified on or after July 9, 2016. The following additional rebates are also available: A rebate of 30% of the cost of the thermal storage tank and related components, up to $5,000; a rebate of $5,000 to assist in the cost of meters for systems that become REC eligible. This program is open to businesses, non-profit organizations, educational institutions, governmental or municipal entities, and multi-family residences of 4 units or greater, that do not qualify for a rebate under the residential wood pellet rebate program.

As of June 30, 2016, the Renewable Energy Fund has funded close to 4,000 rebates for renewable energy systems to New Hampshire homeowners, businesses, schools, towns, nonprofit organizations, and other eligible entities.

Competitive Grant Program

The Renewable Energy Fund provides a competitive grant opportunity for commercial and industrial renewable energy projects in New Hampshire. In past years, the grant awards have ranged from under $40,000 to over $1 million, and have covered a large array of renewable technologies. Over the past seven years, the REF has provided more than $8 million in funding for 29 renewable energy projects for schools, business, and municipalities with over $35 million in applicant investment.

One particular project that went live in 2016 was a small-scale hydroelectric plant in Antrim, New Hampshire at the Northern Branch of the Contoocook River. The facility has been owned and operated by Steels Pond Hydro Inc. since 2013. In the fall of 2014, the President of Steels Pond Hydro Inc. submitted an application to the Sustainable Energy Division in response to the annual Request for Proposals. The proposal listed the desire to expand the Steels Pond facility from three turbine/generators (T/G) to five, with the addition of two 300 kW T/G units. The addition would bring the facility to a total capacity of 900 MW and represented the possibility for greater REC creation.

The application noted the added economic and environmental value that the expansion would provide, including the contracted and part time job opportunities, as well as the avoidance of 743 tons of CO2 and the displacement of 157,072 gallons of fossil fuel per year based on 2,066 MWh of generation. The project was approved for a grant in the amount of $187,000 in 2014 and came online in 2016.

A complete listing of all grants awarded since program inception is provided in Appendix B.

Looking Forward: 2018 RPS Review

Pursuant to RSA 362-F:5, a mandated review of the class requirements and other aspects of the electric renewable portfolio standard program will be conducted in 2018, and again in 2025. The review will commence in January and the Commission shall make a report of its findings to the General Court by November 1st including any recommendations to the class requirements or other aspects of the RPS program. The statute further outlines nine specific areas for review:

I. The adequacy or potential adequacy of sources to meet the class requirements of RSA 362-F:3;
II. The class requirements of all sources in light of existing and expected market conditions;
III. The potential for addition of a thermal energy component to the electric renewable portfolio standard;
IV. Increasing the class requirements relative to classes I and II beyond 2025;
V. The possible introduction of any new classes such as an energy efficiency class or the consolidation of existing ones;
VI. The timeframe and manner in which new renewable class I and II sources might transition to and be treated as existing renewable sources and if appropriate, how corresponding portfolio standards of new and existing sources might be adjusted;
VII. The experience, with and an evaluation of, the benefits and risks of using multi-year purchase agreements for certificates, along with purchased power, relative to meeting the purposes and goals of this chapter at the least cost to consumers and in consideration of the restructuring policy principles of RSA 374-F:3; and
VIII. Alternative methods for renewable portfolio standard compliance, such as competitive procurement through a centralized entity on behalf of all consumers in all areas of the state.
IX. The distribution of the renewable energy fund established in RSA 362-F:10.[26]

In the 2018 review, there are a number of specific topics that could be considered for exploration in their relationship to the RPS and the aforementioned statutory analysis requirements. These include: features of the Class II obligations, peak load reduction, grid modernization, and storage in the development of renewable technology capacity. A brief description of these topic areas and developments being considered elsewhere in the nation are provided below.

Class II Obligations

Class II includes solar technologies that became operational and began producing electricity after January 1, 2006. Currently, as the RPS stands, the obligations for purchasing Class II RECs became 0.30% in 2014 and remains at 0.30% until 2025 and thereafter. The non-escalating obligation for Class II may not be reflective of

[26] RSA 362-F:5

the growing solar industry and facility installations, nor the supply of eligible Class II RECs created from these facilities.

The Solar Energy Industries Alliance reports that:

- In 2015, New Hampshire installed 16 megawatts of solar electricity capacity, ranking it 24th nationally. Installed solar capacity in New Hampshire has grown by 399% over the last year.
- Over the next five years, New Hampshire is expected to install 241 megawatts of solar electric capacity.[27]

By contrast, ISO New England through its Distributed Generation Forecast Working Group estimates New Hampshire's solar PV installed capacity to be approximately 80 MW in 2025.[28]

Given the predictions for growth, the REC market may see incongruent levels in the supply and demand of Class II RECs. The price may be driven down, in which case Class II RECs may be used to satisfy Class I obligations or may be sold out of state.

Grid Modernization

In 2015, the Commission opened an investigation into grid modernization (Docket No. IR 15-296), exploring ways to use the electricity grid more efficiently and ways to reduce system peaks through new pricing structures and installation of more advanced meters: "Grid modernization encompasses many elements, including replacement of aging infrastructure, outage management, the integration of distributed generation, and education of customers on how to manage their energy use for the benefit of the electric delivery system and to minimize costs."[29]

"The Commission believes that grid modernization can spur the development of cost-effective distributed energy resources, including energy efficiency, demand response, distributed generation, storage technologies, and more. The Commission expects the benefits of grid modernization will include the following:

- Improving the reliability, resiliency, and operational efficiency of the grid.
- Reducing generation, transmission, and distribution costs.
- Empowering customers to use electricity more efficiently and to lower their electricity bills.
- Facilitating the integration of distributed energy resources". [28]

The results of the investigation should be considered during the 2018 RPS review.

Peak Load Reduction

Peak load reductions are processes where consumers or electric providers can save electricity during periods of high demand. Opportunities for consumer opt-in programs have been growing across the country.

[27] Solar Energy Industries Association, *Solar Spotlight: New Hampshire,*
[28] ISO New England, *Final 2016 PV Forecast*.
[29] Order No. 25,877 under Docket IR 15-296

In 2016, Public Utilities Commission Order No. 25,919 called for parties to develop target peak reduction levels in 2016 of 8,789 kW for summer savings and 9,033 kW for winter savings. It also recommended that "more targeted behavioral demand response programs be established" following the report required in the grid modernization report.[30] The Order directed parties to incorporate proceedings from Docket No. DE 15-137 and Docket No. IR-296. DE 15-137 relates to the energy efficient resource standard (EERS), and can be used as "a vehicle for increased peak reduction as an indirect result of reductions in overall use through efficiency measures". Docket No. IR 15-296 relates to grid modernization as a way to reduce system peaks.

Storage Capacity

Developments in storage technologies and accessibility of storage capacity have developed the potential for it to be a consideration in the 2018 RPS review. New Hampshire "may be interested in storage for numerous reasons, including a desire to increase the value of renewable energy, address "duck curve" ramping and integration issues, provide resilient power to critical infrastructure, increase the reliability of electrical grids, or support grid modernization efforts." [31] The 2018 review may want to evaluate if storage technologies are suitable to assist in the RPS policy goals, grid modernization objectives and peak load reductions targets.

Zero Emissions Credits (ZEC) for Nuclear

In July 2016, New York regulators proposed Zero Emissions Credits to incentivize retention of the state's existing nuclear power plants largely based on the greenhouse gas emissions they help avoid as part of a new clean energy standard. The 2018 review may further research the status and impacts of New York's ZEC proposal and consider if ZECs may be beneficial to New Hampshire's RPS.

Clean Power Plan

As the development and passage of the EPA's Clean Power Plan (CPP) progresses, the 2018 review may consider the relationship between CPP and New Hampshire's RPS. More specifically, it may identify what role the RPS program has in helping New Hampshire achieve emission targets under the CPP, and if modifications to the policy are deemed necessary to achieve those targets. A report was prepared for the Clean Energy States Alliance (CESA) RPS Collaborative by Edward A. Holt of Ed Holt & Associates, Inc. entitled "The EPA Clean Power Plan and State RPS Programs" that can be used as a reference for this topic (see page 27, "References and Additional Resources").

Measurement of RPS Success

As stated in RSA 362-F:1, the purpose of the RPS is to "lower regional dependence on fossil fuels", having the potential to "keep energy and investment dollars in the state to benefit our own economy". Additionally, lowering emissions to improve air quality and public health" can help mitigate against the risks of climate change". With these listed as the RPS purpose, changes in the economy and environment in New Hampshire and regionally can be assessed to measure the success of the policy.

1. Economy

[30] Order No. 25,919 under IR 16-714
[31] Clean Energy States Alliance, "Does Storage Fit in an RPS?".

In the analysis conducted by University of New Hampshire researchers in 2007, the potential economic benefit of a Renewable Portfolio Standard in New Hampshire was assessed. The claim was made that "…(a)cross a broad range of scenarios, the renewable energy sector generates more jobs per average megawatt of power installed, and per unit of energy produced, than the fossil fuel-based energy sector."[32] An updated analysis of the changes in the "green job" sector could indicate the effectiveness of the RPS as a tool to expand economic development and investment in renewable energy. Other indicators of the RPS impact upon the economy could also be beneficial in the assessment of the policy's success. Studies regarding the construction of new renewable energy facilities, investments in renewable energies, and shifts in the regional market that support renewable energy could yield compelling conclusions about the effectiveness of the RPS as a driver for economic growth.

2. Environment

In 2013 New Hampshire was ranked fifth in the nation for lowest carbon emissions according to EIA[33] with power plants accounting for the nearly 85% of the greenhouse gas emissions.[34] Information on environmental changes since the RPS was enacted could be connected to the success of the RPS in various regards, including the reduction of greenhouse gas emissions or changes in the mix of renewable energy opportunities within New Hampshire or New England. Studies of conservation and rehabilitation of the New Hampshire environment could be connected to the role the RPS plays in reduction of carbon emissions and investment in renewable energies.

New England States Harmonization of RPS Policies

As this report has discussed, the market for RECs is regional and policy changes made in one state may impact the policy goals and RPS costs in another state. There are also currently definitional differences amongst the regional states regarding the renewable technologies included in the RPS classes, the definition of the various classes and ACP rates established for the classes. As renewable energy continues to grow, it may be beneficial to coordinate with other regional states in areas such as ACP rates and harmonizing the class definitions across the states.

[32] Kammen, Daniel M., Kamal Kapadia, Matthias Fripp. "Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?". UC Berkeley. 13 Apr. 2004, http://rael.berkeley.edu/old_drupal/sites/default/files/very-old-site/renewables.jobs.2006.pdf.
[33] U.S. Energy Information Administration, *Rankings: Total Carbon Dioxide Emissions, 2014.*
[34] U.S. Environmental Protection Agency, *My Environment: New Hampshire*.

References and Additional Resources

Legislation:

1. Public Utilities Commission Rules, Chapter 2500: Electric Renewable Portfolio Standard. http://www.puc.nh.gov/Regulatory/Rules/Puc2500.pdf.
2. New Hampshire Statute 362-F: Electric Renewable Portfolio Standard. http://www.gencourt.state.nh.us/rsa/html/NHTOC/NHTOC-XXXIV-362-F.htm.
3. New Hampshire Statute 362-A: Limited Electrical Energy Producers Act. http://www.gencourt.state.nh.us/rsa/html/NHTOC/NHTOC-XXXIV-362-A.htm.
4. Senate Bill 386: adding biodiesel to electric renewable energy sources (2016) https://legiscan.com/NH/text/SB386/id/1426987.
5. House Bill 542: relative to electric renewable portfolio standards (2013). http://www.gencourt.state.nh.us/legislation/2013/HB0542.pdf.
6. Senate Bill 218: relative to electric renewable portfolio standards (2012). http://www.gencourt.state.nh.us/legislation/2012/SB0218.pdf.
7. Senate Bill 148: relative to electric renewable portfolio standards (2013) http://www.gencourt.state.nh.us/legislation/2013/SB0148.pdf.
8. Dockets and corresponding Orders:
    a. DE 13-021; Order No. 25,484. http://www.puc.nh.gov/Regulatory/Docketbk/2013/13-021.html.
    b. DE 14-104; Order No. 25,674. http://www.puc.nh.gov/Regulatory/Docketbk/2014/14-104.html.
    c. DE 15-035; Order No. 26,768. http://www.puc.nh.gov/Regulatory/Docketbk/2015/15-035.html.
    d. DE 15-477; Order No. 25,844. http://www.puc.nh.gov/Regulatory/Docketbk/2015/15-477.html.
    e. IR 15-296; Order No. 25,877. http://www.puc.nh.gov/Regulatory/Docketbk/2015/15-296.html.
    f. DE 15-137. http://www.puc.nh.gov/Regulatory/Docketbk/2015/15-137.html.
    g. IR 16-714; Order No. 25,919. http://www.puc.nh.gov/Regulatory/Docketbk/2016/16-714.html.

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1. Sustainable Energy Division. http://www.puc.nh.gov/Sustainable%20Energy/SustainableEnergy.htm.
2. Renewable Portfolio Standard (RPS). http://www.puc.nh.gov/Sustainable%20Energy/Renewable_Portfolio_Standard_Program.htm.
3. 2011 Renewable Energy Portfolio Standard Review. 2011 Renewable Energy Portfolio Standard Review.

4. Renewable Energy Fund Annual Reports. http://www.puc.nh.gov/Sustainable%20Energy/RenewableEnergyFund.html.

U.S. Energy Information Administration (eia.gov)

1. New Hampshire State Profile. http://www.eia.gov/state/?sid=NH.
2. Electricity Data Browser. http://www.eia.gov/electricity/data/browser/.
3. State Renewable Electricity Profiles 2010. http://www.eia.gov/renewable/state/pdf/srp2010.pdf.
4. Rankings: Total Carbon Dioxide Emissions, 2014. http://www.eia.gov/state/rankings/?sid=NH#series/226.
5. Annual Energy Outlook. http://www.eia.gov/outlooks/aeo/.
6. International Energy Outlook. http://www.eia.gov/outlooks/ieo/.
7. Today in Energy, "Renewables Share of North America Electricity Mix Expected to Rise", http://www.eia.gov/todayinenergy/detail.php?id=27332.

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1. My Environment: New Hampshire. https://ofmpub.epa.gov/myenv/MyClimate.html?minx=-77.67334&miny=41.96766&maxx=-65.47852&maxy=45.99696&ve=6,43.68552,-71.57760&cLat=&cLon=&pSearch=New%20Hampshire#a.
2. Clean Power Plan informational page: https://www.epa.gov/cleanpowerplan.

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1. New Hampshire State Programs. http://programs.dsireusa.org/system/program?state=NH.
2. Renewable Portfolio Standard. http://programs.dsireusa.org/system/program/detail/2523.
3. Renewable Portfolio Standard Policies. http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2014/11/Renewable-Portfolio-Standards.pdf.

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1. "Potential RPS Markets for Renewable Energy Generators". (July 18, 2016). http://www.cesa.org/assets/2016-Files/Potential-RPS-Markets-Report-Holt.pdf.
2. "Does Energy Storage Fit in an RPS?" (July 29, 2016). http://cesa.org/assets/2016-Files/Energy-Storage-and-RPS-Holt.pdf.
3. "The EPA Clean Power Plan and State RPS Programs". (May 18, 2016). http://cesa.org/assets/Uploads/CESA-RPS-CPP-report-May-2016.pdf.

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assets/documents/2016/04/2016_pvforecast_20160415.pdf.

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Appendix A

Renewable Portfolio Standard Policies[35]

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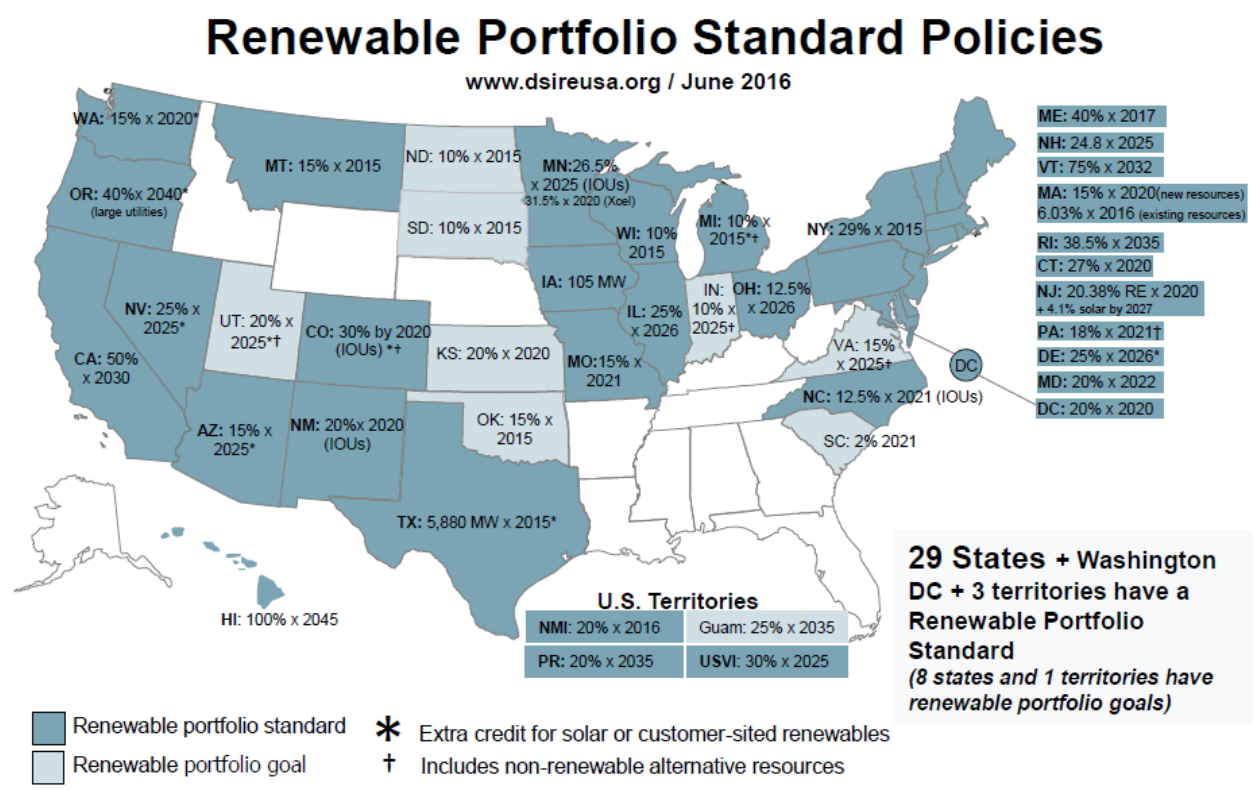

[35] Database of State Incentives for Renewables and Efficiency, *Renewable Portfolio Standard Policies.*

Appendix B

Renewable Energy Fund's (REF) C&I Competitive Grant Program Awards

Municipality	Award Recipient	Renewable Source	Grant Amount	Total Project Cost
Antrim	Steels Pond Hydro	Hydro	$187,000	$243,600
Ashland	Northwood Renewables	Hydro	$125,000	$227,225
Bedford	Bedford Town Library	Geothermal	$387,842	$888,842
Bennington	Monadnock Paper Mills	Hydro	$151,040	$151,040
Berlin, Jericho Mt.	Jericho Power LLC	Wind	$1,000,000	$20,048,000
Charlestown & Walpole	Fall Mountain Regional School District	Wood Pellet Boiler	$100,000	$492,000
Claremont	Claremont Fire Department	Pellet Boiler	$52,000	$65,000
Dover	Walker Wellington (Dover Wastewater Treatment)	Micro-Hydro	$100,000	$129,500
Durham	University of New Hampshire, Kingsbury Hall	Solar Thermal (Air)	$59,750	$119,500
Durham	University of New Hampshire, Steam Turbine	Landfill Gas	$200,000	$600,000
Durham	ReVision Energy (Town of Durham)	Solar PV	$501,600	$2,100,000
Greenville	Mascenic Regional School District	Pellet Boiler	$51,850	$86,883
Harrisville	Historic Harrisville	Pellet Boiler (3)	$150,000	$231,185
Hinsdale	Fiske Hydro	Hydro	$225,000	$362,000
Holderness	Holderness School	Biomass District Heat	$300,000	$3,950,000
Littleton	Cartographic Associates	Pellet Boiler	$43,000	$65,762
Milton	Milton Town Solar LLC	Solar PV	$580,757	$2,709,566
New London	Colby Solar LLC	Solar PV	$100,000	$474,662
Peterborough	Froling Energy, LLC	Dried Chip - Biomass	$300,000	$627,000
Peterborough	Water Street Solar (Peterborough Wastewater Treatment Facility)	Solar PV	$1,220,000	$2,626,495
Pittsfield	Ever Better Hydro	Hydro	$200,000	$600,000
Portsmouth	Portsmouth H.S. & Madbury Water Treatment Plant	Solar PV	$450,000	$1,741,392
Plymouth	PAREI (Plymouth Village District Sewage Treatment Plant)	Solar PV	$317,890	$427,000
Plymouth	Plymouth High School	Biomass Thermal	$325,000	$1,100,000
Rochester	Spaulding Ave. Industrial	Hydro	$165,000	$315,000
Somersworth	Favorite Foods	Solar PV	$100,000	$728,000
Sullivan County	Sullivan County Complex	Wood Chip Boiler	$300,000	$3,181,000
Wilton	Xylogen LLC (High Mowing School)	Pellet Boiler	$200,000	$525,000
Totals	***28 Grant Awards***		***$7,892,729***	***$44,815,652***