Report on Progress to the Joint Standing Committee on Energy, Utilities and Technology

LD 658: Resolve, To Increase Energy Independence in Maine

January 15, 2020

Pursuant to Public Law 2019, Chapter 30, LD 658: Resolve to Increase Energy Independence for Maine ('the Resolve'), the Governor's Energy Office (GEO) is required to conduct an analysis of at least one scenario through which the State can become a net exporter of energy by 2030, through

> *"the development and expansion of energy generating capacity within the boundaries of the State and its coastal waters, energy conservation and energy efficiency at levels sufficient to offset the total value of the State's domestic energy consumption across all sectors. This analysis must identify economic benefits to the State from becoming a net exporter and policies that would be necessary to achieve this outcome."*

In addition, the GEO is required to,

> *"provide a report on progress regarding the state energy plan and the analysis required… along with any recommended policy initiatives, to the Joint Standing Committee on Energy, Utilities and Technology by December 31, 2019."*

This serves as the required progress update required under the Resolve.

INTRODUCTION

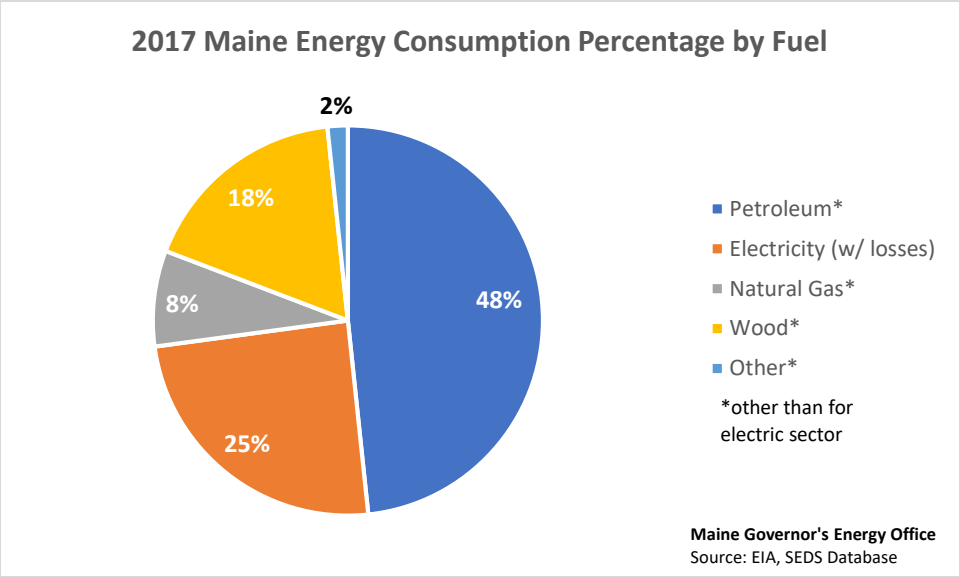
Mitigating and adapting to the impacts of climate change, and increasing renewable energy generation within the state, are priorities of Governor Mills' Administration. Working together with the Legislature, Maine has made significant progress moving forward on these issues. Reducing the State's dependence on fossil fuels and transitioning to a more diverse portfolio of clean energy resources not only reduces the State's emissions, it also helps support Maine's economy by creating local job opportunities and reducing expenditures for out-of-state fossil fuels, keeping more money in Maine's economy.

The Resolve requires a report on the progress of the analysis described above, as well as on other planning initiatives of the GEO. At this stage, to consider energy independence, it is important to understand: (a) where the State is now, and (b) recent steps that will contribute to the goal of the Resolve. Accordingly, this report focuses on these two elements. While the GEO did receive additional funding in the latest budget, those funds have gone to hiring the additional staff needed to meet our statutory obligations and not to hire a consultant to undertake the complex modeling required by the Resolve or to conduct a full economic cost-benefit analysis. We are confident; however, that Maine is achieving significant progress in transforming Maine's energy future toward one of greater energy independence for Maine.

CONSUMPTION

The Resolve directs consideration of energy independence inclusive of overall energy, which includes electricity generation, petroleum-derived fuels, natural gas, biomass fuels for heating and transportation, etc. As Figure 1 shows, for 2017, petroleum represents about 48% of Maine's total energy consumption.

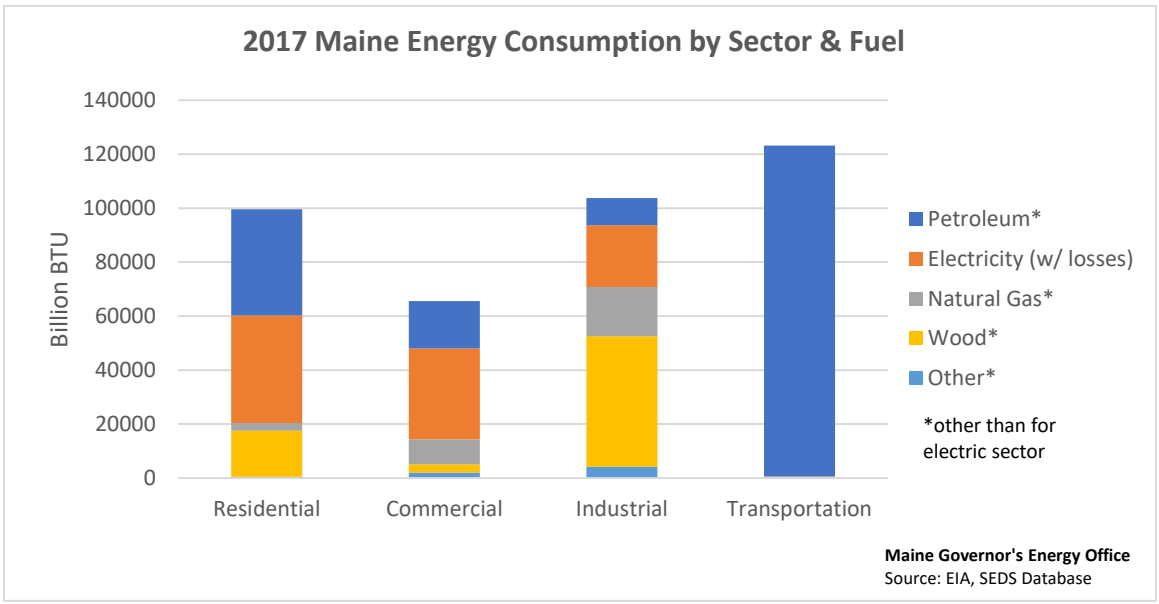
Figure 1. 2017 Maine Energy Consumption Percentage by Fuel



Fuel	Billion BTU	Percentage
Petroleum	189,448	48.3%
Electricity (w/ losses)	96,166	24.5%
Natural Gas	31,137	7.9%
Wood	68,670	17.5%
Other	6,579	1.7%
TOTAL	392,000	100%

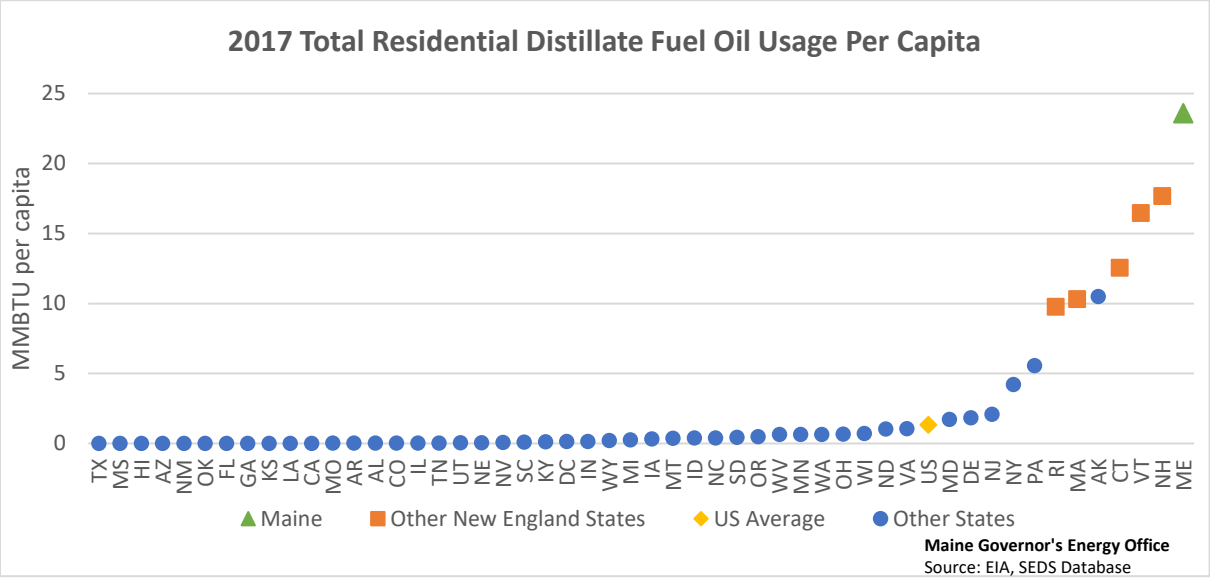
As seen in Figure 2, most of that petroleum is consumed in the transportation sector, followed by the residential sector.

Figure 2. 2017 Maine Energy Consumption by Sector & Fuel



Petroleum consumption is primarily gasoline and diesel in the transportation sector, and heating oil in the residential sector. Maine is the most heating oil dependent state in the country, with the highest residential distillate fuel oil usage per capita in 2017.[1] Maine's dependence on petroleum products in transportation and the residential sector results in high expenditures in those sectors.

Figure 3. 2017 Total Residential Distillate Fuel Oil Usage Per Capita



Aside from wood, including wood pellets, and some biofuels, Maine produces little energy besides generating electricity. There are no extracted sources of coal, crude oil, or natural gas in the state, so Maine must import all the fossil fuels it consumes. Therefore, in order to analyze a scenario in which Maine is a net energy exporter, Maine must generate more electricity and produce in-state wood and biofuel energy resources in greater quantities than it imports in fossil fuels.

ELECTRICITY

Maine is part of a regional electric grid, managed by ISO New England (ISO-NE). ISO-NE is the independent, not-for-profit corporation authorized by the Federal Energy Regulatory Commission (FERC) to perform three critical, complex, and interconnected roles for the region spanning Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and most of Maine. According to ISO-NE, its three critical roles are: (1) grid operation (coordinating and directing the flow of electricity over the region's high-voltage transmission system); (2) market administration (designing, running, and overseeing the billion-dollar markets that attract a large and diverse mix of participants to buy and sell wholesale electricity at the most competitive prices); and (3) power system planning (conducting studies, analyses, and planning to make sure New England's electricity needs will be met over the next 10 years). ISO-NE does not, however: (1) oversee retail electricity sales or delivery; (2) own, maintain, or repair any of the power grid's infrastructure including power plants, power lines, and substations; (3) enact or establish energy policy; or (4) have a financial stake in companies that own the grid infrastructure.[2]

[1] U.S. Energy Information Administration. State Energy Data System (SEDS)
[2] ISO-NE. (n.d.). *Our Three Critical Roles*. Retrieved from https://www.iso-ne.com/about/what-we-do/three-roles

In 2017, Maine consumed 11,214 gigawatt hours (GWh) of electricity (based on retail sales), which is roughly 10% of New England's total electricity consumption.[3] In that same year, Maine generated about 11,264 GWh of electricity. Of that generation, about 75 percent comes from renewable resources: 30% hydroelectric, 22% wood and wood-derived fuels, 21% wind, and 2% other biomass. Natural gas represents about 20% of the electricity generation in Maine.[4]

Figure 4. Maine Electricity Consumption, Retail Sales by Sector, 1990-2017

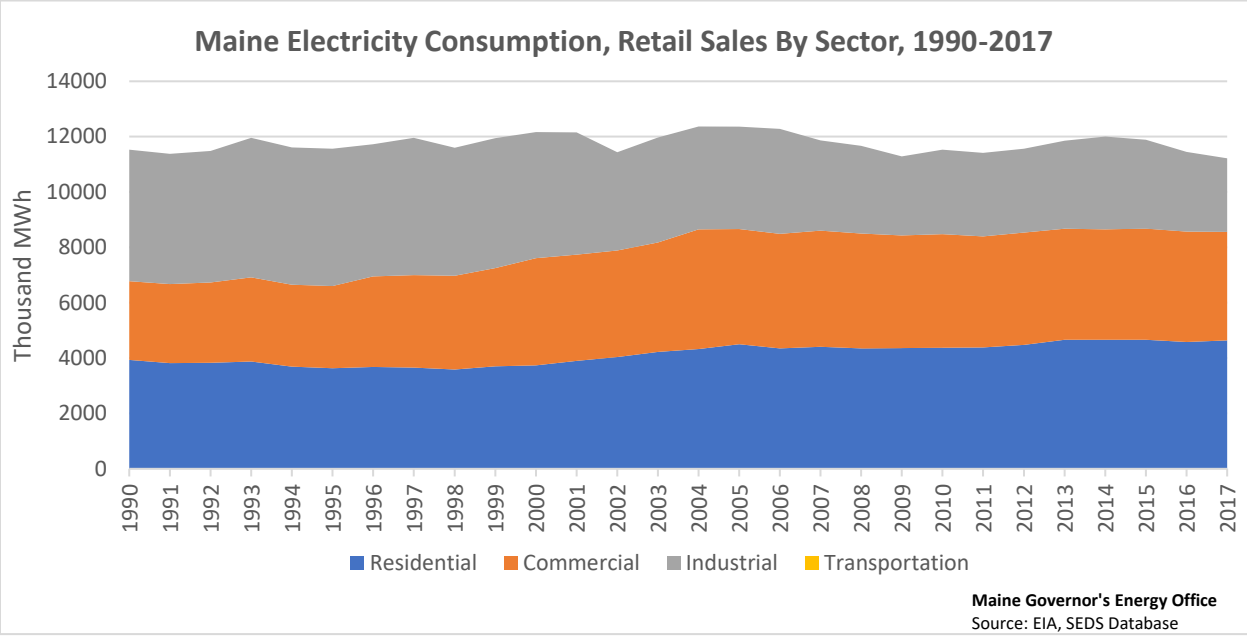
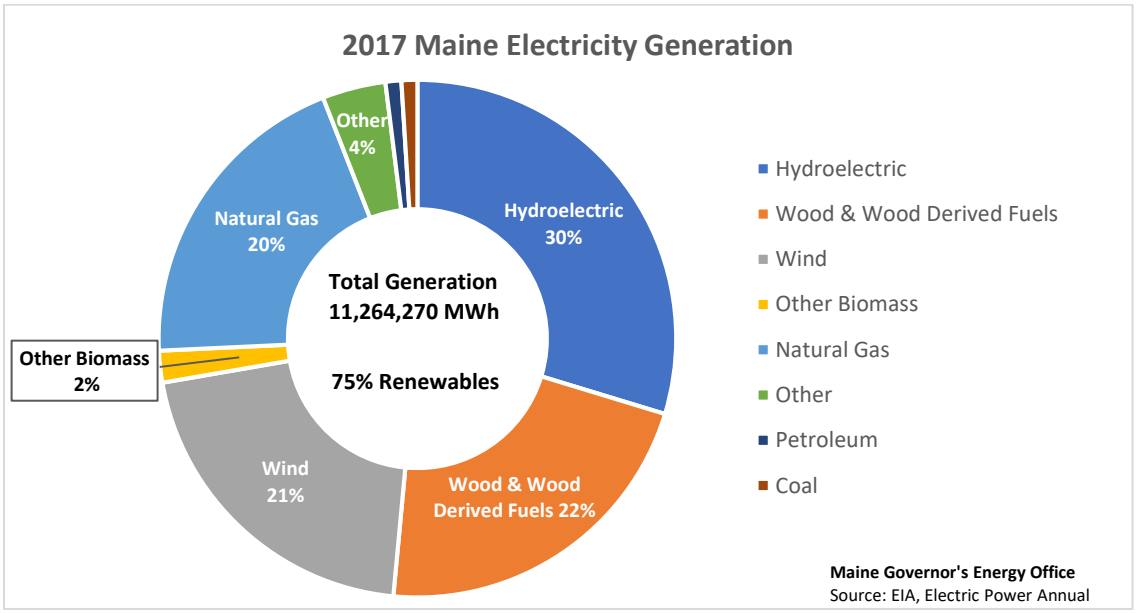


Figure 5. 2017 Maine Electricity Generation



[3] U.S. Energy Information Administration (EIA). *State Energy Data System (SEDS)*
[4] U.S. Energy Information Administration (EIA). *Electric Power Annual 2017*.

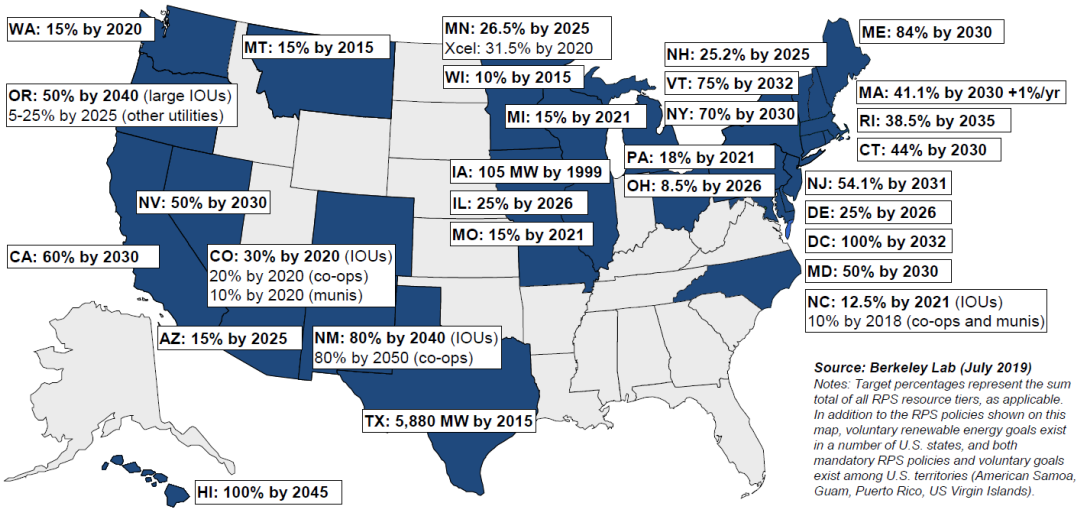
RENEWABLE ENERGY CERTIFICATES (REC) AND RENEWABLE PORTFOLIO STANDARDS (RPS)

Although roughly 75 percent of Maine's total generation comes from renewable resources, not all that generation is attributed to Maine's electricity grid and thus Maine's consumption. Given the complex nature of electricity within a regional grid, generation in one state is not necessarily consumed within that state. In particular, renewable energy generation is assigned a Renewable Energy Certificate (REC) for every megawatt-hour of electricity produced. RECs can then be sold by a Maine generator to an entity in Maine or in another state to meet Renewable Portfolio Standards (RPS). Renewable Portfolio Standards require that a certain percentage of the electricity procured by utilities comes from renewable resources – as defined by the state.

According to the Maine Public Utilities Commission (PUC), in 2017 there was about 3,200 MW of generating capacity located in Maine. As stated in the PUC's 2018 Annual Report, "Much of the energy produced by these plants is in excess of Maine's demand and, thus, serves load in other states in the region." Maine's utilities generally purchase RECs to meet their statutory RPS requirements.[5]

In June 2019, Governor Mills signed legislation into law (LD 1494: *An Act To Reform Maine's Renewable Portfolio Standard*) increasing the state's RPS from 40 percent to 80 percent by 2030, and setting a goal of 100 percent renewable electricity by 2050. In addition, a separate obligation for thermal technologies was added to the Maine RPS, requiring four percent of Maine's heating and cooling load to be met by renewable resources in 2030.The Public Utilities Commission (PUC) is slated to conduct a rulemaking for this requirement in 2020. In order to help finance energy projects, changes to Maine's RPS law require the PUC to procure 14 percent of Maine's electrical load via 20-year contracts. State RPS policies in 29 states and Washington, DC currently apply to more than half of retail electricity sales in the United States.[6]

Figure 6. Renewable Portfolio Standards in the United States

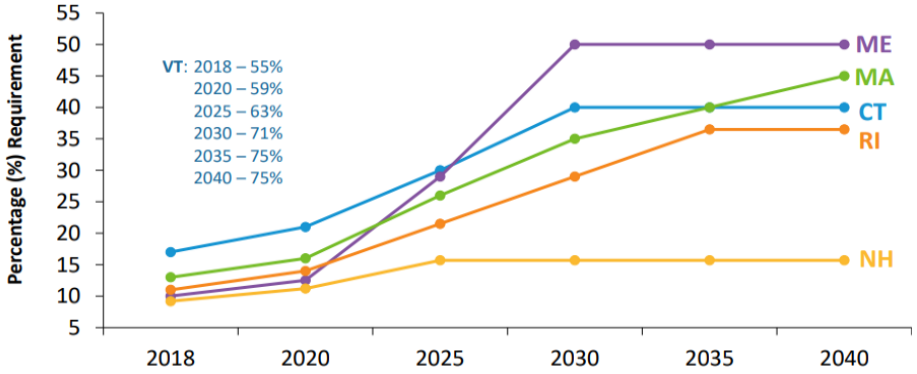


[5] State of Maine Public Utilities Commission. (February 2019). *2018 Annual Report.* Retrieved from https://www.maine.gov/mpuc/about/annual_report/documents/2018AnnualReportFinalReport4.pdf

[6] Berkeley Lab, Electricity Markets and Policy Group. (July 2019). *U.S. Renewables Portfolio Standards: 2019 Annual Status Update.* Retrieved from https://emp.lbl.gov/publications/us-renewables-portfolio-standards-2

Maine's new RPS obligation is considered one of the most ambitious in the country. It certainly reflects the most ambitious 2030 target in New England.

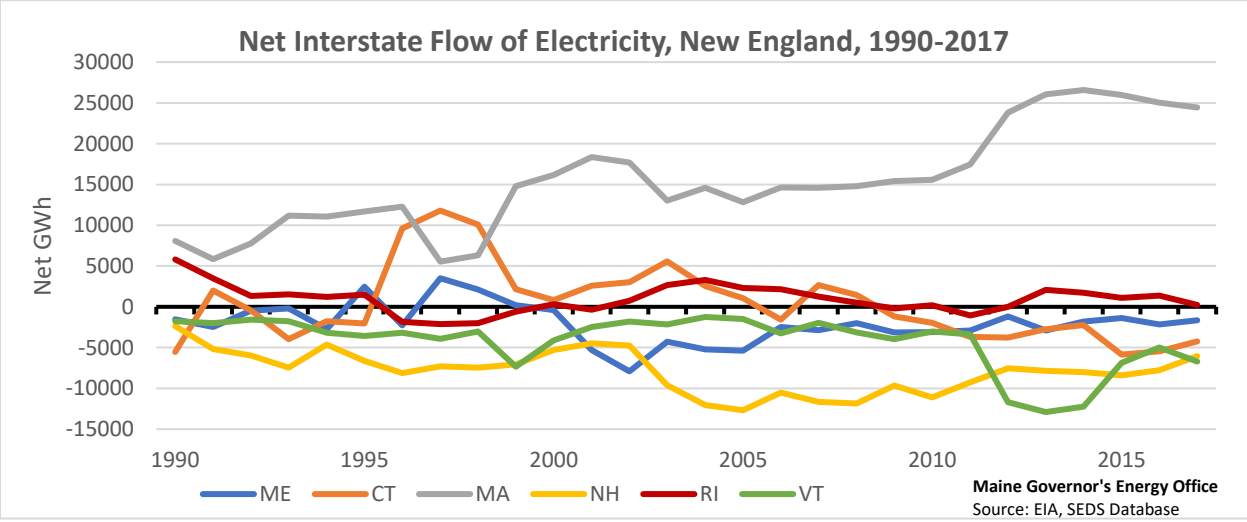
Figure 7. ISO New England: Class I Renewable Portfolio Standards in New England [7]



NET INTERSTATE FLOW OF ELECTRICITY

Net interstate flows of electricity are "the difference between the sum of electricity sales and losses within a state and the total amount of electricity generated within that state. A positive number indicates that more electricity (including associated losses) came into the state than went out of the state during the year; conversely, a negative number indicates that more electricity (including associated losses) went out of the state than came into the state."[8] The chart below, comparing in-state electricity sales to generation, shows that Maine has been an exporter of electricity since about 2000. Maine is thus an exporter of electrical energy; however, the state still imports significant amounts of energy in the form of petroleum and natural gas, as discussed above.

Figure 8. Net Interstate Flow of Electricity, New England, 1990-2017



[7] ISO New England. (October 2019). *The New England states' framework for reducing greenhouse gas emissions continue to evolve.* Retrieved from http://isonewswire.com/updates/2019/10/2/the-new-england-states-frameworks-for-reducing-greenhouse-ga.html

[8] EIA. (n.d.). *Glossary*. Retrieved from https://www.eia.gov/tools/glossary/index.php?id=N

The net interstate flow of electricity is a simplified comparison of electricity sales and total generation within a state; it does not demonstrate RPS compliance. A state that is a net exporter is not necessarily meeting its RPS requirements using only in-state generation, it may be purchasing RECs through the regional market. According to the National Renewable Energy Laboratory, a generator may sell its power through a power purchase agreement in one state, but RECs from that generation may be sold to an entity in another state. Purchased RECs may be used by utilities to meet RPS obligations, or by other entities to reach their own voluntary renewable energy targets.[9]

ENERGY-RELATED INITIATIVES

Maine is moving forward with new policies to encourage energy efficiency, increase renewable energy generation, and examine key aspects of the energy sector in Maine. Several of these efforts are highlighted below.

Distributed Generation: LD 1711: *An Act to Promote Solar Energy Projects and Distributed Generation Resources in Maine*, incentivizes distributed generation up to 5 megawatts (MW) in size. This legislation created a commercial and institutional net energy billing program which is to be reviewed in three years or when the total amount of generation capacity involved in net energy billing in the State reaches 10% of the total maximum load of transmission and distribution utilities, whichever comes first. The legislation also established commercial and institutional and community-shared declining price block procurements totaling 375 MW of distributed generation. Those programs are in addition to legislation that restored net metering for residential customers.

Energy Storage: Both the distributed generation (LD 1711) and RPS (LD 1494) legislation included provisions that allow for energy storage to be paired with generation, creating greater potential opportunity for additional storage in Maine. Pursuant to Maine Public Law 2019, Chapter 83 (LD 1614: *Resolve, Establishing the Commission to Study the Economic, Environmental and Energy Benefits of Energy Storage to the Maine Electricity Industry*), a Legislative Commission was established to examine the economic, environmental, and energy benefits of energy storage in the Maine electricity industry. This Commission submitted its final report in December 2019 which includes several findings and recommendations to enhance energy storage in Maine.[10]

Nonwires Alternatives: Recent legislation (LD 1181: *An Act To Reduce Electricity Costs through Nonwires Alternatives*) created the position of Nonwires Alternative Coordinator within the Office of the Public Advocate. This position is charged with the review of certain proposals for transmission upgrades in Maine and to provide an analysis of nonwires alternatives that could be pursued more cost-effectively instead. According to Maine Law 2019, Chapter 298, a nonwires alternative means "a nontransmission alternative or an infrastructure, technology, or application that defers or reduces the need for capital investment in the transmission and distribution system investment."

Transmission Constraints: Pursuant to Public Law 2019, Chapter 57 (LD 1401: *Resolve, To Study Transmission Solutions to Enable Renewable Energy Investment in the State*), the Governor's Energy

[9] National Renewable Energy Laboratory. (February 2015). *Quantifying the Level of Cross-State Renewable Energy Transactions*. Presentation. Retrieved from https://www.nrel.gov/docs/fy15osti/63458.pdf

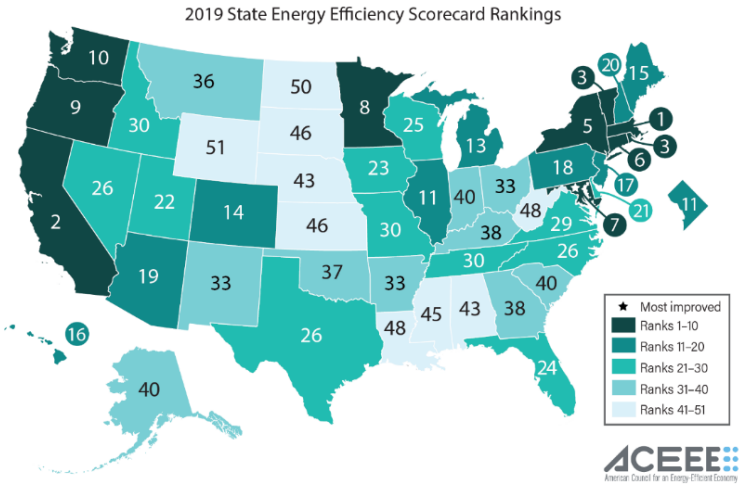
[10] Maine State Legislature. (n.d.) *Energy Storage Commission.* Retrieved from http://legislature.maine.gov/energy-storage-commission

Office convened a stakeholder group to address transmission system needs and funding strategies to support renewable energy investment in the State. The group's report explains the current transmission and distribution system and identifies electricity market opportunities, constraints, related analyses, mechanisms for funding transmission upgrades, and options for further study. The stakeholder report can be found on the Governor's Energy Office website.[11]

Offshore Wind: Governor Mills signed legislation (LD 994: *Resolve, To Require the Approval by the Public Utilities Commission of a Proposal for a Long-term Contract for Deep-water Offshore Wind Energy*) directing the approval of the contract for Maine Aqua Ventus, establishing the country's first floating offshore wind demonstration project in state waters. Additionally, Maine has joined New Hampshire and Massachusetts in the U.S. Department of Interior Bureau of Ocean Energy Management's Gulf of Maine Intergovernmental Renewable Energy Task Force to examine opportunities for the growth of offshore wind in federal waters. The Governor's Energy Office website has more information about these initiatives and the BOEM process.

Energy Efficiency: Maine is making significant energy efficiency investments through the Efficiency Maine Trust ("the Trust"), the quasi-state agency that administers state programs to improve the efficiency of energy use and reduce greenhouse gases in Maine. The Trust achieves this primarily by offering financial incentives to customers for the purchase of high-efficiency appliances and equipment or to make operational changes that will help reduce electricity, natural gas, or other fuel consumption throughout the Maine economy.[12] According to the Trust's 2019 Annual Report, its 2019 efforts alone will cost-effectively save more than 2.0 billion kWh and more than 6.9 million MMBtu for Maine citizens over their lifetime. According to the American Council for an Energy-Efficient Economy's 2019 scorecard, Maine ranks as the 15th best state in the country for energy efficiency.

Figure 9. 2019 State Energy Efficiency Scorecard Rankings[13]



[11] Maine Governor's Energy Office. (n.d.) *Governor's Energy Office Stakeholder Group.* Retrieved from https://www.maine.gov/energy/governors-energy-office-stakeholder-group.html.
[12] Efficiency Maine Trust. (n.d.) *About.* retrieved from https://www.efficiencymaine.com/about/
[13] American Council for an Energy-Efficient Economy. (October 2019). *2019 State Energy Efficiency Scorecard.* Retrieved from https://aceee.org/research-report/u1908

ENERGY INDEPENDENCE

As shown in Figure 1, 189,448 billion BTUs of petroleum was consumed in Maine in 2017, other than for the electric sector. The total electricity consumed in Maine in 2017 was 96,166 billion BTUs. Mainers consumed nearly twice the amount of petroleum than electricity. For Maine to become energy independent given its current petroleum consumption, it would need to generate, consume, and export significantly more electricity and in-state wood and biofuels in order to make up for the petroleum it consumes. This does not consider the natural gas Maine also consumed in 2017, which was 31,137 billion BTU.

Energy Efficiency measures can reduce overall energy consumption in the state, requiring less in-state energy generation to become energy independent. As the transportation and heating sectors are beginning to diversify their fuel usage significantly, including beneficial electrification, energy efficiency will play an integral role. Without complex modeling capabilities, it is difficult to determine precisely how electrical load will be impacted, whether overall electrical load will increase, or whether load-shifting and efficiency measures can prevent any significant increases. Additionally, this transition may facilitate shifting peak loads, requiring less generation capacity and energy infrastructure in the state.

As previously mentioned, in addition to generating electricity, Maine produces wood and wood products as well as biofuels, though some are currently still in the research and development (R&D) stage. One example of production is Maine Standard Biofuels which is a biorefinery that collects used cooking oil and recycles it into a variety of bio-based products. Their bioheat is a cleaner burning heating oil that can be used in any oil furnace or boiler, as well as a B99.9 biodiesel fuel for transportation.[14] One example of efforts in R&D is the University of Maine's Forest Bioproducts Research Institute which has "marshalled a broad array of scientists as well as business partnerships and research partnerships to create fossil fuel reduction solutions focused on sustainable forest management and the creation of innovative bioproducts." Their research includes finding uses for wood, as well as algae, leftover from processing plants as a source of biofuels. This research has led to the creation of a biofuel for use in military jets as well as drop-in fuels for fuel tanks and pipelines.[15] In addition to this progress in biofuels, Maine also generates energy from wood and wood pellets.

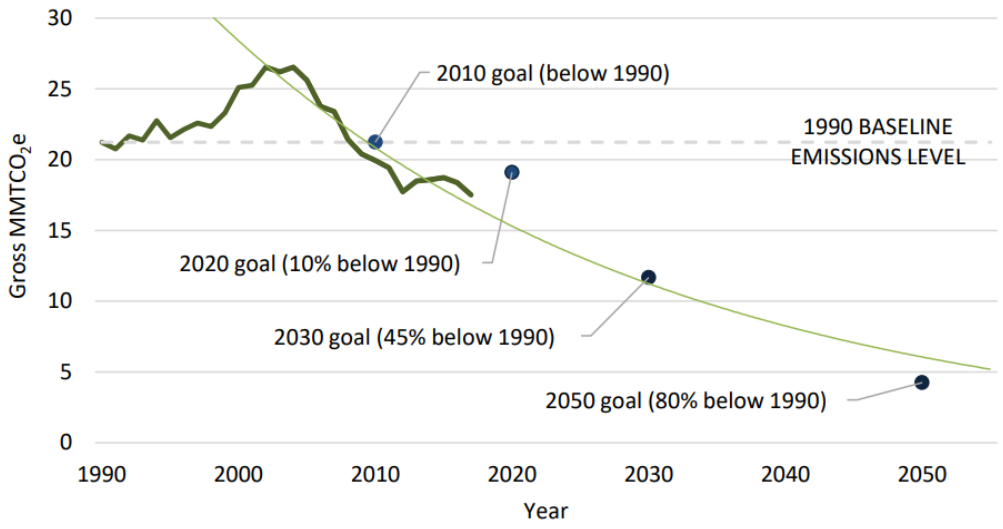
By encouraging electrification and enhancing clean fuel consumption in the transportation and residential sectors (the sectors with the highest petroleum consumption in Maine), continuing to create programs that incentivize renewable energy generation in the state, and increasing Maine's RPS to ensure the procurement of clean electricity, Maine will evolve toward in-state and regional clean energy consumption rather than importing higher-emitting energy resources from more distant sources. These steps will move Maine toward greater and greater energy independence.

PLANNING INITIATIVES

In June 2019, Governor Mills signed into law bipartisan legislation to create the Maine Climate Council. The Council is charged with leading Maine's efforts to reduce the state's greenhouse gas emissions by 45 percent below 1990 levels by 2030 and at least 80 percent by 2050.

[14] Maine Standard Biofuels. (n.d.) Retrieved from https://www.mainestandardbiofuels.com/
[15] University of Maine, Forest Bioproducts Research Institute. (n.d.) Retrieved from https://forestbioproducts.umaine.edu/

Figure 10. Maine's Greenhouse Gas Emissions 1990-2017 with 2020, 2030, and 2050 Reduction and Emissions Goals[16]



The Maine Climate Council began meeting in September of 2019 and is slated to produce an updated Climate Action Plan by December 2020, and to review and revise the plan every five years. Within its plan, the Council is specifically charged with:

Mitigation: Develop mitigation strategies to meet state emissions reduction requirements in all sectors of the economy, with a focus on Maine's transportation, electricity, and buildings sectors
Resilience: Develop strategies that will make Maine people, industries, and communities resilient to the impacts of climate change
Jobs: Recommend how to best grow good paying jobs in the transition to a lower carbon economy, and provide support and retraining for those industries and workers who will be most impacted by climate change
Transition: Develop programs to ensure Maine's rural, low-income and elderly populations are not adversely impacted in the shift to a low-carbon economy, while also delivering benefits like lower heating bills

There are currently seven different Working Groups or subcommittees that are tasked with developing recommendations on these crucial issues:

- Scientific and Technical Subcommittee;
- Energy Working Group;
- Transportation Working Group;
- Buildings, Infrastructure and Housing Working Group;
- Coastal and Marine Working Group;
- Natural and Working Lands Working Group; and
- Community Resilience Planning, Public Health, and Emergency Management Working Group.

[16] Maine Department of Environmental Protection. (January 2020). *Eighth Biennial Report on Progress Toward Greenhouse Gas Reduction Goals.* Retrieved from https://www.maine.gov/dep/publications/reports/index.html

Specifically, the Energy Working Group's (EWG) mission is: "To develop, analyze, and recommend strategies to the Maine Climate Council (MCC) to mitigate emissions from, and adapt to the impacts of, climate change in Maine's energy sector." The Working Group will work closely with the Transportation and Buildings, Infrastructure and Housing Working Groups to ensure appropriate coordination and alignment when providing recommendations.

As of the writing of this report, the EWG has met twice and has received presentations from ISO-New England on the region's electricity system, Advanced Energy Economy on renewable energy and energy efficiency trends, and from Richard Silkman, PhD., on his analysis identifying how a "Zero-Carbon Economy by 2050" for Maine can be achieved. Silkman's analysis, not endorsed by the EWG or the GEO, outlines results from modeling work that shows how Maine's energy use could be converted to electricity by 2050.

The EWG is forming a Clean Energy Economy subgroup that "will provide feedback on a clean energy economy transition plan to the Maine Climate Council that includes barriers to advancing a clean energy economy, with a specific focus on strategies for sustained job creation."[17] In addition, in December 2019, Governor Mills unveiled Maine's new 10-year strategic economic development plan. This plan, the first of its kinds in two decades, identifies three overarching goals, recommends seven core strategies, and outlines numerous actions to achieve economic growth. Combatting climate change is highlighted as an opportunity for Maine to create solutions that can position Maine as an economic leader in such innovative technologies as renewable energy and energy efficiency.[18]

The Maine Climate Council is currently seeking proposals to "provide services including: (1) economic analysis of climate mitigation and adaptation measures, (2) support for a public process underway to ensure cost-effective measures that can be implemented at state and local levels, and (3) detailed reporting on how results from (1) and (2) inform climate mitigation and adaptation activities that the State will undertake."[19] This work will be dependent on budget availability and priorities and will be at the direction of the Maine Climate Council to meet statutory requirements.

The GEO is required to file a comprehensive state energy plan with the Governor and the Legislature. In 2015, the GEO received funding from the U.S. Department of Energy (DOE) to develop a Maine Energy Roadmap. To explore the issues, gather data, facilitate stakeholder input, and develop recommendations, the GEO contracted with the Environmental and Energy Technology Council of Maine (E2Tech). A stakeholder group was developed, and meetings were held between 2016 and 2018; however, a final report was not released. The GEO has been working to update much of the data, since outdated, that was gathered during this process for inclusion in and to inform a future energy plan. The GEO does not currently have an existing budget to include in-depth modeling and analysis but intends to seek funding opportunities in the future for these efforts.

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[17] State of Maine Governor's Office of Policy Innovation and the Future. (n.d.) *Maine Climate Council, Energy Working Group.* Retrieved from https://www.maine.gov/future/initiatives/climate/climate-council/energy

[18] Maine Department of Economic and Community Development. (November 2019). *Maine Economic Development Strategy 2020-2029.* Retrieved from https://www.maine.gov/decd/sites/maine.gov.decd/files/inline-files/DECD_120919_sm.pdf

[19] State of Maine Governor's Office of Policy Innovation and the Future. (n.d.) *Maine Climate Council, Goals of the Maine Climate Council.* Retrieved from https://www.maine.gov/future/initiatives/climate/climate-council

In addition to the requirements outlined earlier in this report, the RPS legislation (LD 1494: *An Act To Reform Maine's Renewable Portfolio Standard)* requires the Governor's Office of Policy and Management and the Governor's Energy Office to "jointly conduct a market assessment study, including an in-depth analysis and review of the opportunities, potential and challenges facing the State in reaching the goal by January 1, 2030 that 80% of retail electricity sales in the State will come from renewable energy resources." The report is due by January 2021 and must include specific details outlined in statute for the market assessment study, in addition to any recommendations for possible changes or adjustments to the RPS.

CONCLUSION

Any consideration of Maine achieving energy independence must recognize that the state relies on a regional electric grid as well as both global and regional supply chains for the petroleum products that currently support our economy. For Maine to achieve our climate and clean energy goals, progress must be made in advancing renewable distributed energy resources (including storage), energy efficiency, the electrification and diversification of our heating and transportation sectors, and developing a modern grid that can support flexible demand and other new technologies. In 2019, Maine set in place nation-leading policies that are putting the state on path to meet these objectives and transform our energy sector and economy. This transformation will make Maine more independent, healthier, and more economically sound as our reliance on homegrown energy sources grows.

The GEO will continue to prioritize the goals of the Resolve, including the "development and expansion of energy generating capacity within the boundaries of the State and its coastal waters, energy conservation, and energy efficiency." In addition, the GEO will work to include an analysis of energy independence by 2030 in future studies as resources to do so become available through ongoing planning initiatives.