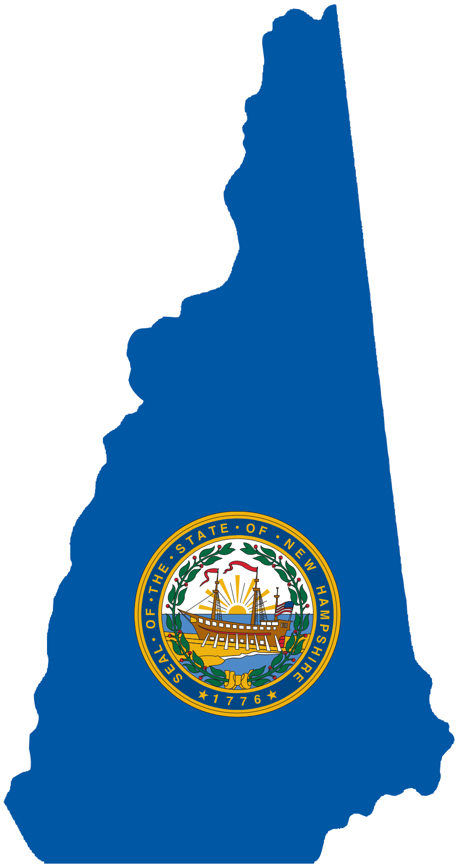

New Hampshire 10-Year State Energy Strategy

NEW HAMPSHIRE OSI OFFICE OF STRATEGIC INITIATIVES

New Hampshire Office of Strategic Initiatives

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Acronyms

Alternative Compliance Payments	ACP
Competitive Auctions with Subsidized Policy Resources	CASPR
Distributed Energy Resources	DERs
Distributed Generation	DG
Demand Response	DR
Energy Efficiency	EE
Energy Efficiency Resource Standard	EERS
Energy Efficiency and Sustainable Energy	EESE
Energy Information Administration	EIA
Electric Reliability Council of Texas	ERCOT
Electric Vehicles	EV
Federal Energy Regulatory Commission	FERC
Gigawatt hours	GWh
Independent System operator New England	ISO-NE
Kilowatt	kW
Levelized cost of electricity	LCOE
Minimum Offer Price Rule	MOPR
Megawatt	MW
Megawatt hour	MWh
National Association of State Energy Officials	NASEO
Office of Strategic Initiatives	OSI
Public Utilities Commission	PUC
Photovoltaics	PV
Renewable Energy Credits	RECs
Renewable Energy Portfolio	RPS
Revised Statue Annotated	RSA
Regional Transmission Organization	RTO
Site Evaluation Committee	SEC

Preface

New Hampshire faces a myriad of energy challenges. New Hampshire has the third highest electricity rates in the contiguous United States. On average, each New Hampshire resident spent $3,934 on energy in 2015. The purpose of this State Energy Strategy is to inform decisions about these challenges and the state's energy future. This update reworks the original 2014 Strategy to reflect changed circumstances, expanded stakeholder input, and new policy directives. The 2014 Strategy reflected a step in the ongoing development of a New Hampshire energy policy that fits our state's needs and goals. This update is another step toward those objectives.

To produce this update, the Office of Strategic Initiatives convened 6 public comment sessions, solicited written commentary, and reached out to numerous stakeholders. It is anticipated that this Strategy will continue to be adapted as technology, market realities, and policy goals evolve over the coming years. The broadest goal of this update document is to provide a platform to improve energy policies and programs to best serve New Hampshire's needs.

Legislative Charge

RSA 4:E (codifying SB191; 2013) directed the Office of Energy and Planning (OEP), in consultation with a State Energy Advisory Council, to develop a 10 year Energy Strategy for the state.[1] The statute also calls for updates to the Strategy every three years, beginning in 2017, with opportunity for public commentary and consultation with the House Science, Technology, and Energy Committee and the Senate Energy and Natural Resources Committee.[2]

Stakeholders

Energy policy impacts everyone in New Hampshire. This Strategy should reflect the diversity of needs across the state, and seeks to do so by appreciating the interests of distinct stakeholders.

Disclaimer

The energy goals listed in this strategy are not numbered by policy preference or priority. The energy goals are intended to work in conjunction with each other. Numbering the goals is solely a means of labelling and not prioritization.

[1] New Hampshire RSA 4:E; http://www.gencourt.state.nh.us/legislation/2013/SB0191.pdf.

[2] "The office shall review the strategy and consider any necessary updates in consultation with the senate energy and natural resources committee and the house science, technology and energy committee, after opportunity for public comment, at least every 3 years starting in 2017." Ibid. [Link: (RSA 4-E:1)]

Executive Summary

NH energy prices are among the highest in the nation.[3] On average, each NH resident spent $3,934 on energy in 2015.[4] The cost of energy is particularly impactful on lower wage-earners, who often spend more than a third of their income on purchasing energy.[5] Commercial and industrial consumers in NH purchased nearly two-thirds of all retail electricity sales, and the high cost can make competition harder against businesses in lower-cost regions of the country. The fact that NH energy costs are so high is striking, because electricity generation costs are low compared to prior decades.

Addressing energy costs is a critical goal for New Hampshire. Expensive energy – or pursuing policies that raise the cost of energy – directly and negatively impacts New Hampshire families and businesses and the quality of life in our state. As such, the priority of this Strategy is to organize goals around cost-effective energy policies.

However, there are numerous goals that should be pursued to improve state energy policy to better meet consumer needs. These goals are:

1. Prioritize cost-effective energy policies.
2. Ensure a secure, reliable, and resilient energy system.
3. Adopt all-resource energy strategies and minimize government barriers to innovation.
4. Maximize cost-effective energy savings.
5. Achieve environmental protection that is cost-effective and enables economic growth.
6. Government intervention in energy markets should be limited, justifiable, and technology-neutral.
7. Encourage market-selection of cost-effective energy resources.
8. Generate in-state economic activity without reliance on permanent subsidization of energy.
9. Maximize the economic lifespan of existing resources while integrating new entrants on a levelized basis.
10. Protect against neighboring states' policies that socialize costs.
11. Ensure that appropriate energy infrastructure is able to be sited while incorporating input and guidance from stakeholders.

Outcomes of this strategy will enable business and consumer cost savings, job creation, economic growth, industry competitiveness, environmental protection, and a reliable and resilient energy system.

This document identifies strategic goals and recommends policy and program actions to support those goals. This Strategy represents a significant revision of the 2014 State Energy Strategy, this being necessary to reflect evolutions in the energy landscape over the past few years. Likewise, this document will need to be updated to reflect future developments.

This Strategy is not intended to be an exhaustive policy overview. It is designed to highlight policy goals that are to the point and effective in focusing discussion. The Strategy is designed to focus on the most critical energy issues facing New Hampshire. In doing so, the intent is to establish a framework for engaging with these issues by identifying guiding principles that will steer the development and evolution of energy policies.

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[3] "The state has among the highest retail electricity rates in the nation." U.S. Energy Information Administration, "New Hampshire State Profile and Energy Estimates" (Profile Analysis, Energy Information Administration, 2017), https://www.eia.gov/state/analysis.php?sid=NH.

[4] U.S. Energy Information Administration, "Total Energy Price and Expenditure, Ranked by State, 2015" (Energy Information Administration, 2015), https://www.eia.gov/state/seds/sep_sum/html/pdf/rank_pr.pdf.

[5] Dan Boyce and Jordan Wirfs-Brock, "High Utility Costs Force Hard Decisions For The Poor." Inside Energy, May 2016, http://insideenergy.org/2016/05/08/high-utility-costs-force-hard-decisions-for-the-poor/.

Section Summaries

Energy Overview

New Hampshire is a net energy importer, a net electricity exporter, and faces increased costs for a myriad of reasons. Among these include the policy preferences of neighboring states seeking above-market-cost energy resources, lack of supply for low-cost resources, uncertainty in national and international markets, inadequate infrastructure, and geographic realities. These challenges contribute to an environment that is ill-suited for low electric rates. Without a paradigm shift in public policy, New Hampshire is unlikely to see lower electric rates in the near term or in the future.

New Hampshire's energy system does not exist in a vacuum. New Hampshire is connected to its fellow New England States. The electric grid is run by ISO New England, a non-profit organization with a tripartite mandate to operate the grid, administer the wholesale market, and plan for future electricity needs. As a part of this New England grid run by ISO-NE, New Hampshire shares decision-making authority with our regional neighbors, and is also responsible for shared costs. Regional policy reforms are necessary if New Hampshire is to avoid increasing energy costs.

Every aspect of New England's energy rates are costly. The main components that make up the cost of electricity are generation, transmission, and distribution and each are more expensive in New England than the US average as seen in Figure E1.

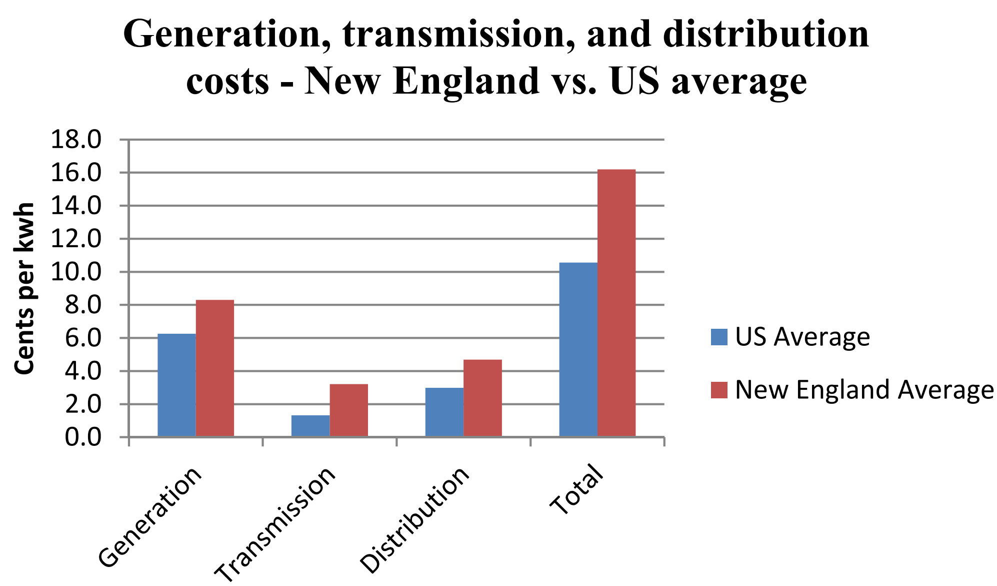

Figure E1

Source: EIA AEO 2018, reference case tables 55 and 55.5

Even if the cost for electric transmission in New England was zero, just the combined cost of generation and distribution would exceed the US average cost of transmission, generation, and distribution.

Fuel Diversity

New Hampshire will be best served by fostering technologies and solutions that are tailored to our state's needs. Having a diverse resource mix can help ensure a secure, reliable, and resilient energy system.

Investments and policies should prioritize the most cost-effective energy production and delivery. New Hampshire can foster a sustainable and dynamic energy economy by ensuring a favorable regulatory environment, not a regulatory and statutory environment based on favoritism. Resources should compete in the market, not compete for government policy preferences.

Renewables have an important role to play in our resource mix. Some regions possess environmental advantages that make intermittent renewable resources more efficient.

Delivering cost-effective electricity to consumers means measuring the economic lifespan of an existing resource and its ability to deliver value to the market through competitive pricing rather than through government mandate. Natural gas and renewables will likely make up an increasingly sizeable fraction of NH's fuel mix. To achieve cost-effective energy delivered to consumers, New Hampshire policy should encourage the siting and construction of new generating assets that have a low levelized cost of electricity (LCOE).[6]

Nuclear Power

It is essential that New Hampshire's energy strategy account for nuclear power. It is important to ensure that Seabrook Station's economic lifespan is not artificially shortened by state policy decisions. It is likely that New England's carbon emissions would increase significantly if Seabrook Station were to stop generating at capacity. Preserving Seabrook Station as a source of zero-carbon energy is the most realistic and cost-effective means of managing emissions in New Hampshire at scale.

Nuclear generation should be allowed to compete to deliver electricity into competitive wholesale markets, and should also be recognized as a component in New Hampshire's environmental goals and policy frameworks.

Natural Gas

Electricity reliability is tightly connected to natural gas markets and availability. New Hampshire's energy policy must be realistic about the necessity of natural gas into the foreseeable future while ensuring that infrastructure projects or expansions are in keeping with natural resource protection. United States carbon dioxide emissions have fallen to the levels of the early 1990's due to the market driven replacement of coal and oil by natural gas.[7] This has contributed to much of the progress that the U.S.

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[6] The levelized cost of electricity (LCOE), is the net present value of the unit-cost of electricity over the lifetime of a generating asset, and often reflects the average price that a resource must earn to break even over its lifetime. LCOE metrics are a valuable way of comparing electricity generation sources that may have significantly different costs to build and costs to maintain. New Hampshire stakeholders should seek to limit reciprocal harm. For example, if electricity demand were steadily increasing, it would make sense to encourage investments furthering long-term policy aims where no reciprocal harm would be inflicted on current investments. However, as demand is flat or potentially falling, introducing new resources into the mix (beyond the rate of retirement) by mandate means that existing resources will face increased competitive pressure. It contradicts the principle of conservation and full-resource-utilization for government to subsidize a resource such that it is rendered economic where that competition then puts another resource out of business.

[7] U.S. Energy Information Administration, "U.S. Energy-Related Carbon Dioxide Emissions, 2016," (Energy Information Administration), https://www.eia.gov/environment/emissions/carbon/.

has made towards emissions reduction goals. It is essential that any infrastructure improvements or expansions fit with New Hampshire sensibilities and needs. New Hampshire must answer the questions of what resources and infrastructure will best protect its citizens, economy, and natural resources.

Renewable Energy

Renewable energy is highly likely to continue to grow as a percentage of total electricity generation in New England. Federal and state energy policies, not competitive markets, are the primary drivers of the construction of renewable resources in New England. Nationally, the growth in renewable energy has been largely driven by preferable tax treatment, subsidies and government mandated preferences.

Lazard's national assessment shows that certain forms of solar and wind are cost competitive with conventional generation technologies in certain situations.[8] In Texas, wind is quickly becoming a lowest-cost resource--at least when accounting for federal incentives--and investments are responding to that fact.[9] While there is currently greater potential for cost-effective wind generation in New Hampshire than for solar, a buildout of the technology sufficient to surpass the generation of other renewables would necessitate extensive land use and stakeholder input concerning the impact on our state's scenery and natural resources.

Mass storage of electricity offers promise for improving the integration and utility of intermittent resources, but will not of itself make those resources cost-effective.

The risk with any policy is that it misidentifies the most efficient source of achieving the policy aim. Renewable technologies will continue to grow in importance and market impact, and market selection should steer those investments, not government sponsorship.

It should not be controversial to seek an ultimate outcome where production technologies are not subsidized by ratepayers or taxpayers. Uneconomic resources would not exist absent subsidization, yet those same resources may be wise investments in the near future when cost curves are more favorable. The end goal with energy infrastructure should be unaided market competition where the technology competes on the merits, not one that depends on taxpayer support.

New Hampshire energy policy should not seek to mimic neighboring state renewable energy policies. Instead, New Hampshire should seek the most appropriate investments and goals given our state's geographic location, environmental considerations, land use requirements, and need to deliver cost-effective energy.

Distributed Energy Resources

Distributed Generation (DG) represents a shift from a utility-dominated and large centralized system to a diffuse, smaller-scale generation infrastructure design. With net metering, it is important to provide predictability to stakeholders, protect investments made by all stakeholders, and avoid cost-shifting among ratepayers.

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[8] Lazard, "Lazard's Levelized Cost of Energy Analysis-Version 11.0" (Lazard, 2017), https://www.lazard.com/media/450337/lazard-levelized-cost-of-energy-version-110.pdf.

[9] However, wind producers still benefit from federal energy policies such as the Production Tax Credit, which significantly impacts cost-competitiveness.

Renewable Portfolio Standard

The RPS framework depends on mandates that segment renewable technologies from each other and from the broader competitive electricity market. If reducing emissions is a primary objective, then in order to have conceptual consistency, the RPS should be redefined to include other zero-carbon or low-carbon resources. If the goal is to pursue the most cost-effective low-carbon options, then segmenting energy technology types thwarts that outcome. Using an infinitely replenishable fuel is only one component of sustainable energy production.

Energy Efficiency

Energy Efficiency

Energy efficiency (EE) is the cheapest and cleanest energy resource. New Hampshire should prioritize capturing cost-effective energy efficiency in all sectors, including buildings, manufacturing, and transportation.

The primary goal of the PUC order approving an Energy Efficiency Resource Standard (EERS) is to achieve cost-effective energy efficiency. Successful implementation of the EERS draft plan will enhance cost-effective energy efficiency programming in New Hampshire. The State should continue to coordinate and support energy efficiency programming, such as weatherization, to achieve cost-effective savings.

Demand Response

Demand Response is a method of incentivizing energy users to reduce power use during specific peak periods when energy is most expensive. It involves a suite of services that encourage an immediate reduction in peak load. ISO New England has integrated demand response into the forward capacity market as a way to help encourage reductions in peak load. ISO New England is further looking into new programs that can be dispatched economically. The development of new structures and programs that economically integrate demand response resources represents a successful growth of competitive markets, and, as opposed to state action, is likely to be the most cost-effective mechanism to incentivize demand response adoption.

Siting

Siting energy infrastructure is both challenging and necessary. Delivering this appropriate energy infrastructure requires predictability, defined processes, good communication, and clear standards for achievement. Responding to these issues is difficult and requires balancing numerous interests, but does not remove the necessity of siting appropriate energy infrastructure to meet New Hampshire needs.

Process Considerations

- Predictability in state policy and review processes allows stakeholders to more accurately gauge the likelihood of outcomes.
- Clear standards for achievement and defined processes enhance predictability.
- Good communication with all stakeholders is essential to appropriate outcomes, even if those outcomes are not agreeable to all participants in the process.
- Clear and defined timelines which do not allow delays to deter infrastructure investments.

Transmission: factors driving the need to construct or rebuild capacity[10]

- Replacement
- Reliability
- Interconnection of new load or generation
- Economics

There is usually a tension between residents' understanding the justification for infrastructure development and the reality that it may be built in proximity to one's home, workplace, or community. The current need for natural gas infrastructure and future need for renewable and distributed generation integration are complementary. Renewable resource technologies have yet to realize the low cost and low land usage combination achieved by conventional fuel resources. Shifts in demand and the ability of technologies to deliver on market needs will continue to evolve, and there will be corresponding pressures on land use.

Transportation

Transportation activity is generated by individuals and entities engaging in social and economic endeavors. New Hampshire should seek to reduce the energy intensity of transportation activities, without discouraging the activities themselves. It is important to protect consumer-preferred forms of transportation, even where lowering energy intensity of travel is an important goal.

Energy use largely reflects infrastructure availability, and investments shape energy use patterns for decades. The most effective near-term energy management strategy for New Hampshire is to efficiently and fully utilize existing infrastructure. Maximizing infrastructure utilization improves efficiency while helping reduce environmental impacts. New Hampshire needs to accommodate a market that is rethinking public and private transportation, and the blurring of lines between the two.

Policymakers should prioritize function over form. It is unlikely that large public transit infrastructure projects will deliver energy efficient transportation for New Hampshire travelers.

Cost-shifting to support legacy infrastructure does not adequately incentivize the utilization of that infrastructure. With highway vehicle miles projected to climb over the next decade, it is not sustainable long-term to scale highways directly proportional to the number of vehicles traveling them. Commuter travel is significantly impacted by land use policies and the availability of housing to workplaces.

New Hampshire does not require a wholesale rethinking of transportation infrastructure to achieve energy efficiency gains.

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[10] Stanton W. Hadley and Alan H. Sanstad, "Impacts of Demand-Side Resources on Electric Transmission Planning" (Oak Ridge National Laboratory, managed by UT-Battelle for the US Department of Energy, 2015), https://energy.gov/sites/prod/files/2015/04/f21/Impact_DSR_on_Transmission_Planning_Final.pdf .

Mass Transit

Energy expended per passenger-mile has fallen by nearly half for passenger cars over the past forty years, while that for transit buses has increased by more than 60%.[11] There are certain concentrated areas of New Hampshire that can benefit from mass transit, and many more areas where mass transit is not an economically advantageous method of providing transportation.[12] Mere availability of mass transit is not beneficial to New Hampshire – utilization and cost-effectiveness should determine where and when mass transit modes are merited and necessary.

Passenger vehicles

Personal vehicles are by far the dominant transportation mode in New Hampshire and nationally. There are no mass market personal vehicle technologies currently available that are transformative in reducing the per-mile energy intensity of travel. While EVs and plug-in hybrids are energy-efficient on a per-mile basis and are likely to become an increasing fraction of new vehicle sales, those vehicle types will remain a minority of vehicles on the road for decades, even under optimistic projections.

Any government investments should be carefully assessed, and if possible drawn from available non-taxpayer or ratepayer funding sources to avoid cost shifting to benefit a small user base.

Government should avoid speculative investments with taxpayer dollars focused on a fraction of the consumer base, but may be able to leverage non-taxpayer funding sources to spur private investment.

In the short term energy consumption is more likely to be driven by consumers' behavior than by the equipment they are operating.

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11 Stacey C. Davis, Susan E. Williams, and Robert G. Boundy, Transportation Energy Data Book, 36st ed. (Oak Ridge National Laboratory, Managed by UT-Battelle for the US Department of Energy, 2017), 2-20. http://cta.ornl.gov/data/tedb36/Edition_36_Full_Doc.pdf.

12 "Rail transit is somewhat better in terms of energy use per passenger-mile, but apart from New York City and a few other densely populated cities that have heavy ridership during both peak and nonpeak hours, transit rail is also characterized by light usage for much of the day and thus high average energy use per rider." "Real Prospects for Energy Efficiency in the United States," 2010, 127. https://www.nap.edu/read/12621/chapter/5#127.

Section 1: Energy Policy Goals

This section identifies major energy policy goals to establish a framework for pursuing policy mechanisms. The purpose of this section is not to describe a singular statutory and regulatory outcome, but to describe critical goals such that they can be discussed and implemented.

Goals

1. Prioritize cost-effective energy policies.
2. Ensure a secure, reliable, and resilient energy system.
3. Adopt all-resource energy strategies and minimize government barriers to innovation.
4. Maximize cost-effective energy savings.
5. Achieve environmental protection that is cost-effective and enables economic growth.
6. Government intervention in energy markets should be limited, justifiable, and technology-neutral.
7. Encourage market-selection of cost-effective energy resources.
8. Generate in-state economic activity without reliance on permanent subsidization of energy.
9. Maximize the economic lifespan of existing resources while integrating new entrants on a levelized basis.
10. Protect against neighboring states' policies that socialize costs.
11. Ensure that appropriate energy infrastructure is able to be sited while incorporating input and guidance from stakeholders.

Goal 1: Prioritize cost-effective energy policies.

New Hampshire energy prices are among the highest in the nation.[13] In 2015, New Hampshire spent $3,934 per resident on energy.[14] The cost of energy has a disproportionate impact on lower wage-earners, who often spend more than a third of their income on purchasing energy.[15] Commercial and industrial consumers in New Hampshire purchased nearly two-thirds of all retail electricity sales, and the high cost can make competition more difficult against businesses in lower-cost regions of the country.

Addressing energy costs is a critical goal for New Hampshire. Expensive energy – or pursuing policies that raise the cost of energy – directly and negatively impacts New Hampshire families and businesses and the quality of life in our state. As such, the primary goal of this Strategy is to pursue cost-effective energy policies.

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[13] "The state has among the highest retail electricity rates in the nation." U.S Energy Information Administration, "New Hampshire State Profile and Energy Estimates."

[14] EIA, "Total Energy Price and Expenditure, Ranked by State, 2015."

[15] Boyce, Dan and Jordan Wirfs-Brock.

Goal 2: Ensure a secure, reliable, and resilient energy system.

Cybersecurity

It is federal policy to protect critical infrastructure from both physical and electronic threats.[16] American energy infrastructure assets must be paid specific attention as they are repeated targets of cyber-attacks,[17] and are also among those least protected from cyber intrusions.[18] There is no reason to believe that New Hampshire infrastructure is not being targeted, or will not be targeted in the near future.

Cybersecurity is growing in importance as critical infrastructure is increasingly interdependent, and as "Smart Grid" electric power network modernizations continue to incorporate information technology systems and capabilities. Cybersecurity threats are constantly evolving and mitigating those threats is a continual challenge for energy infrastructure operators. Critical infrastructure failures could have devastating consequences for New Hampshire citizens.[19]

While the regional and national nature of energy infrastructure results in an "unclear delineation of responsibility and leadership, divergent risk perceptions, lack of transparency, and liability concerns...", New Hampshire stakeholders have a role to play in improving cybersecurity.[20] Notably, the New Hampshire Department of Safety, Division of Homeland Security & Emergency Management is responsible for coordinating the State's response to major disasters. Additionally, the Safety Division of the New Hampshire Public Utilities Commission maintains information on critical infrastructure and cybersecurity.[21]

New Hampshire stakeholders should pursue available synergies with regional and national partners to identify and respond to cyber threats in real time.

Grid Modernization

Grid modernization refers to the utilization of new technologies, equipment, and controls to make energy systems more resilient, efficient, and reliable. "Smart grid" improvements have the potential to reduce the frequency of power outages, minimize storm impacts, restore electricity service faster when outages occur, and enable stakeholders to more efficiently manage electricity use.

The PUC's "Investigation into Grid Modernization" docket[22] produced a final report on March 20, 2017.[23] The overarching goals contained in the report are to (1) improve reliability, resiliency, and operational efficiency of the grid; (2) reduce generation, transmission, and distribution costs;

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[16] Congressional Research Service, "Cybersecurity: Critical Infrastructure Authoritative Reports and Resources" (Congressional Research Service, 2017), https://fas.org/sgp/crs/misc/R44410.pdf.

[17] "Advanced Persistent Threat Activity Targeting Energy and Other Critical Infrastructure Sectors, Alert (TA17-293A)," United States Computer Emergency Readiness Team, October 20, 2017, https://www.us-cert.gov/ncas/alerts/TA17-293A.

[18] Blake Sobczak, "Acting DHS chief gives 'lowest grade' to energy cybersecurity," EnergyWire, September 28, 2017, https://www.eenews.net/energywire/stories/1060061965/feed.

[19] As an example of the potential disruptive and destructive power of cyber attacks, see the December 2015 "BlackEnergy" malware attack on Ukraine's power grid. "Cyber-Attack Against Ukrainian Critical Infrastructure," ICS-CERT, February 2016, https://ics-cert.us-cert.gov/alerts/IR-ALERT-H-16-056-01

[20] Jennifer F. Sklarew, "Cyber Security of Energy Systems: Institutional Challenges" (George Mason University, Center for Infrastructure Protection & Homeland Security, 2016), https://cip.gmu.edu/2016/06/07/cyber-security-energy-systems-institutional-challenges/

[21] New Hampshire Public Utilities Commission, "Emergency Preparedness and Emergency Response," New Hampshire Public Utilities Commission, http://www.puc.state.nh.us/safety/Emergency_Preparedness_and_Emergency_Response.html.

[22] New Hampshire Public Utilities Commission, "IR 15-296 Electric Distribution Utilities Investigation into Grid Modernization," New Hampshire Public Utilities Commission, https://www.puc.nh.gov/Regulatory/Docketbk/2015/15-296.html.

[23] Grid Modernization Work Group, "Grid Modernization in New Hampshire," (New Hampshire Public Utilities Commission, 2017.) http://www.raabassociates.org/Articles/NH%20Grid%20Mod%20Final%20Report%203-20-2017.pdf.

(3) empower customers to use electricity more efficiently and to lower their electricity bills; and (4) facilitate the integration of distributed energy resources (DERs). As the Grid Modernization report pertains to a specific area and stands on its own, it is not necessary to revisit its materials in this Strategy.

Stakeholders should continue the development of grid modernization in New Hampshire in keeping with the 2017 Grid Modernization report and consistent with the broader policy goals outlined in this State Energy Strategy.

Goal 3: Adopt all-resource energy strategies and minimize government barriers to innovation.

No single energy resource will solve New Hampshire's energy challenges. Some resources are plentiful but expensive, while others are cheap but pose logistical or technical challenges that limit applications or usefulness. What is certain is that the mix of energy resources upon which New Hampshire relies will continue to evolve over time.

Government policies should be technology neutral to enable the cultivation of cost-competitive resources. Public policymakers and regulators should not discriminate on the basis of technology when pursuing cost-effective energy. Energy policy should not seek to artificially preserve incumbent technologies nor should it artificially create a market share for new technologies.

While some states may attempt to drive innovation through mandates and subsidization, New Hampshire should not engage in a competition of subsidies with neighboring states. Instead, our state should enable creativity and entrepreneurial endeavors by refraining from picking winners and losers among energy technologies.

New Hampshire policymakers should pursue market-based mechanisms for achieving cost-effective energy, while avoiding preferential quotas and mandates.

Goal 4: Maximize cost-effective energy savings.

Energy efficiency (EE) is often the cheapest and cleanest energy resource. Investing in efficiency boosts the state's economy by creating jobs and reducing energy costs for consumers and businesses. New Hampshire should prioritize capturing more efficiency in all sectors, including buildings, manufacturing, and transportation.

New Hampshire has modest, but evolving EE programming. New Hampshire's utility efficiency programs must be "cost effective" as determined by the PUC, meaning that each dollar spent on the programs yields at least one dollar in savings. Efficiency benefits more than just those customers who participate in efficiency programs. Reducing our energy use, especially during expensive peak times such as the hottest and coldest days of the year, saves money for everyone on our energy systems. For reliability purposes, we build our energy infrastructure to meet our needs during peak demand. Reducing that peak means spending less on expensive transmission, distribution, and generation infrastructure.

Regional EE efforts are projected to significantly impact both peak demand and gross energy usage. ISO-NE projects that EE measures will shave 1,582 megawatts (MW) off peak demand, with an average annual peak reduction of about 264 MW, and a regional energy usage being reduced from growth of 1% to a 1% decrease of gross consumption.[24] This is derived from an estimated $3.5 billion in EE investments from 2009 to 2014, and anticipated investments across New England of $1.2 billion annually 2021 through 2026.[25]

Energy Efficiency Resource Standard (EERS)

The PUC has furthered energy efficiency work through "Core" programs, with savings goals largely based on funding availability. On August 2, 2016, the New Hampshire PUC issued Order No. 25,932, approving an Energy Efficiency Resource Standard (EERS) settlement agreement.[26] The primary goal of the order is to achieve cost-effective energy efficiency, with an order effective date of January 1, 2018. Utilities will administer the EERS for the first three years of operation.

The legislature created the Energy Efficiency and Sustainable Energy (EESE) Board to promote and coordinate energy efficiency, demand response, and sustainable energy programs in the state.[27] The Energy Efficiency and Resource Standard (EERS) Committee of the EESE Board has been working to further the development of the 2018-2020 NH Statewide Energy Efficiency Plan.[28] The Committee submitted a report to the EESE Board on July 21, 2017.[29]

The PUC is continuing to develop the EERS docket and the draft EERS plan, as submitted on September 1, 2017. Outstanding areas of stakeholder disagreement include valuing non-energy impacts, access to capital, EM&V (evaluation, measurement, and verification of energy data), pilot programs, and performance incentives.[30]

Successful implementation of the EERS draft plan will enhance cost-effective energy efficiency programming in New Hampshire. New Hampshire should **continue to coordinate and develop energy efficiency programming to achieve cost-effective savings.**

Goal 5: Achieve environmental protection that is cost-effective and enables economic growth.

Environmental and health concerns are increasingly a factor in discussions of our energy supply. We must protect and conserve New Hampshire's natural resources while at the same time balancing energy needs. Protecting public health and our natural resources can be accomplished while pursuing cost-effective energy solutions. New Hampshire should seek to eliminate burdens on innovation and open up competition to all energy solutions that can deliver value to ratepayers and New Hampshire citizens.

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24 ISO New England, "Energy-Efficiency Forecast," (ISO New England, May 2017), https://www.iso-ne.com/system-planning/system-forecasting/energy-efficiency-forecast/#related-documents.

25 Id.

26 New Hampshire Public Utilities Commission, "DE 15-137 Gas and Electric Utilities Energy Efficiency Resource Standard," New Hampshire Public Utilities Commission, https://puc.nh.gov/Regulatory/Docketbk/2015/15-137.html.

27 New Hampshire RSA 125-O:5-a; October 1, 2008

28 New Hampshire Public Utilities Commission, "2018-2020 New Hampshire Statewide Energy Efficiency Plan," (New Hampshire Public Utilities Commission, May 2017), https://www.puc.nh.gov/EESE%20Board/NHSaves%202018-2020%20Draft%20EE%20Plan.pdf.

29 Don Kreis and Christine Donovan. "EESE Board Meetings." Energy Efficiency and Resource Standard Committee, July 2017. https://www.puc.nh.gov/EESE%20Board/Meetings/2017/072117Mtg/EERS%20Committee%20Report%20to%20EESE%20Board%207-21-17%20Final.pdf.

30 "EESE Board Minutes," (Energy Efficiency and Sustainable Energy Board, July 2017), https://www.puc.nh.gov/EESE%20Board/Meetings/2017/072117Mtg/EESE%20Board%20Minutes%20-July%2021%202017%20FINAL.pdf.

The most successful way of reducing emissions and protecting our environmental resources from climate change is to achieve a market where low-emission resources are economically competitive without government mandates and subsidies. Achievement of this objective is more likely if government action focuses on actual, rather than symbolic, costs and benefits. This assessment may be easier for acute environmental problems such as air and water pollution, but becomes more difficult when weighing long-term actions to respond to climate change. Regardless of the mechanism, action should be driven by the need for efficient investments--solutions should have a meaningful impact, rather than merely an aspirational one. Energy policy is an important component of this discussion, and should be driven by the same need for cost-effective and meaningful outcomes.

While some energy technologies have promise in being able to deliver inexpensive energy with relatively minor environmental impacts, a single point solution does not exist. Many low-emission resources are expensive on a levelized basis, or negatively impact natural resources through a larger land use footprint. Other resources produce varying degrees of emissions at low cost and operate on an energy-dense footprint.

This combination of realities can create counterintuitive results if applying government mandates, or simply as a result of market economics. After several years of falling emissions, the closure of the Vermont Yankee nuclear plant caused carbon dioxide emissions to increase 7% regionally in 2015.[31] With a nameplate capacity of 620 MW (55% of the state's total generating capacity), the closure of Vermont Yankee resulted in the loss of a greater amount of carbon-free electricity generation capacity than all renewables in Vermont combined (590 MW as of 2017).[32] Vermont Yankee's annual generation was more than 4,700 GWh, while all Vermont solar, wind, and geothermal generation totaled 27 GWh in 2016.[33] Additionally, Vermont now imports more than 65% of its electricity.

While low-carbon renewable resources will undoubtedly increase as a percentage of our fuel mix, the transition to such resources should not inflict unnecessary economic harm on generators and ratepayers. Instead, **New Hampshire can continue to safeguard natural resources and achieve emissions improvements without relying on government-mandated market distortions.**

Goal 6: Government intervention in energy markets should be limited, justifiable, and technology-neutral.

Energy policy is rife with subsidies and preferences. While many policy interventions may have been laudable when originally crafted, too often they outlast their usefulness, turning from target mechanisms into near-permanent props for the chosen segment. These features distort market efficiencies and confound the prioritization of critical goals in that government intervention and subsidization often works at cross-purposes.

Significant numbers of impactful policy preferences are created at the federal level, but states maintain broad discretion to pursue energy goals. The exercise of that discretion should be specific and calibrated to the minimum effective intervention. An unregulated energy market should not be an end goal, yet policy interventions should be limited in time and scope, justifiable economically, and without admiration of or animus toward any particular technology.

[31] Patricio Silva, "Environmental Update," (ISO New England, February 2016), https://www.iso-ne.com/static-assets/documents/2016/02/a5_environmental_update.pdf.

[32] U.S. Energy Information Administration, "Vermont State Energy Profile," (Energy Information Administration, 2017), https://www.eia.gov/state/print.php?sid=VT.

[33] The vast majority of Vermont's renewable generation comes from hydroelectric dams, followed by biomass facilities. Id.

Many well-intentioned policies deliver concentrated benefits with diffuse costs. That is, a small pool of stakeholders significantly benefit while the costs of that benefit are spread among many, whether ratepayers or taxpayers. A collection of incremental costs in aggregate can amount to a significant burden on ratepayers and taxpayers. Too many of these costs are hidden, or brushed off as only cents on the dollar, even when in total the cost of energy is inflated because of inefficient or rent-seeking mechanisms.

Policy, by its very nature, yields more benefit for some than others. For example, conventional fuels (categorized into coal, natural gas, petroleum, and nuclear) received a total of $3.25 billion in 2013 in direct federal financial interventions and subsidies.[34] On the other hand, renewables received $11.68 billion in subsidies. That means renewables "received 72% of all electricity-related subsidies and support in [2013] yet accounted for 13% of total generation...."[35] The risk with any policy preference is that it misidentifies the most efficient path to achieve policy goals. Policymakers are often poorly positioned to identify technological advancements, and technology-specific subsidization often bolsters inferior technologies at the expense of efficient marketplace development. It is highly likely that the most impactful new energy technology of the 21st century has not yet been brought to market. **New Hampshire should seek to foster an environment where new and emerging technologies can flourish by virtue of the value they may bring to the market**, rather than through political preferences.

Clearly, it is anticipated that investments in renewables will yield returns in future years commensurate with the high degree of current support. At the same time, the degree of support is not sustainable if it scales with the growth of renewables in the marketplace. As such, subsidies, if necessary, should be responsive to need by a nascent industry or policy goal, and adaptive to the evolution of that sector or goal. Policy preferences should not be static. Taxpayer or ratepayer subsidization should not be a permanent component of any technology's bottom line. **The exercise of government power to economically advantage one technology over another should be time-limited, narrow, and necessary to achieve a specific policy goal**.

This Strategy is not the appropriate platform for an exhaustive review of policy preferences and benefits. However, organizing and crafting policy through rigorous discussion of the most efficient means of government intervention that will appropriately limit action to core needs, while reducing the likelihood of a disproportionate benefit to a single stakeholder group.

Additionally, the structure, mandate, and autonomy of government entities concerned with energy issues can impact the nature and degree of state intervention. Other states manage energy policy and regulation through a variety of governmental structures: some have consolidated departments of energy, while others include an energy mandate within an agency with a broader portfolio. New Hampshire divides energy regulation, policy development, and management among several entities. No single structural arrangement is appropriate for all states – fragmentation or centralization of energy regulation and policymaking may deliver effective energy policy outcomes. New Hampshire's management of energy issues should be periodically assessed to ensure it is capable of delivering for citizens and consumers.

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[34] U.S. Energy Information Administration, "Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2013," (Energy Information Administration, March 2015), https://www.eia.gov/analysis/requests/subsidy/.

[35] Id.

Goal 7: Encourage market-selection of cost-effective energy resources.

New England wholesale electric energy prices are primarily determined by the price of natural gas. Natural gas made up 49 percent of ISO-NE's resource mix in 2016, and based on proposed new generation, reliance will increase to 56 percent by 2025.[36] Natural gas remains the most significant fraction of New England's resource mix, and will continue to grow in absolute terms for years.[37]

At the same time, pipeline capacity constraints result in price volatility, largely when weather-related demand exhausts supply. Public policies that discourage the utilization of natural gas, or restrict adequate supply, will drive up electricity prices. Increasing RPS mandates coupled with natural gas supply restrictions will result in increased ratepayer costs.

All infrastructure expansions create a tension between the utilization of natural resources and delivery of market-demanded energy. Natural gas pipelines or high capacity power lines must run from point to point in corridors. Wind turbines will shape our skylines. Solar panels require adequate acreage to generate at scale. Even if total energy demand is flat, there will still be the ongoing needs to maintain, replace, or upgrade infrastructure capacity. Ideally, market selection of cost-effective energy resources will result in lower ratepayer costs than government-selected generation resources. At the same time, the inability to build out infrastructure to accommodate market demand will raise costs.

Importantly, appropriate infrastructure development can be achieved while still pursuing decarbonization obligations. However, state selection of out-of-market contracts for provisions of significant amounts of renewable energy distorts the competitive wholesale electricity market. Notably, Massachusetts' procurement of renewable energy generation and renewable energy credits (RECs) totaling 9,450,000 MWh annually will shape the New England energy landscape.[38] This procurement will necessarily be above current wholesale electricity market rates. Massachusetts policymakers determined environmental goals justified the imposition of these additional costs on Massachusetts ratepayers, yet costs will ripple through New Hampshire and the entire New England market.

The segmentation of the electricity generation market will likely force generators to artificially reduce their prices. At face value, this price reduction will initially benefit consumers through lower rates as producers compete for a smaller share of the market. However, the unintended consequences of that artificial competition will not just include energy generating resources that were economically competitive prior to market segmentation, but also consumers will have to rely on expensive generating resources. These expensive generating resources must now cover the demand placed on the market by intermittent and variable resources. It is clear that Massachusetts ratepayers will be paying more for electricity, but it is not yet clear what costs other New England ratepayers will bear based on one state's segmentation from the wholesale markets.

The Massachusetts renewable procurement is only one example of a move away from wholesale markets. Though different in structure, Renewable Portfolio Standards (RPS) also segment markets by mandating that utilities purchase certain fractions of generation from selected resource types.

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[36] ISO New England, "Resource Mix," (ISO New England), https://www.iso-ne.com/about/key-stats/resource-mix.

[37] "13,351 MW of new generating capacity, mostly natural gas and wind, proposed to be built through 2024, though many projects ultimately withdraw (source: August 1, 2017, ISO Interconnection Queue)," Id.

[38] Massachusetts Clean Energy, https://macleanenergy.com/.

This fragmentation through mandate eliminates cost pressures between technology types within the RPS market, and further limits that percentage of total market demand that can be served by competitive wholesale markets. Many New England RPS mandates are approaching a quarter of electricity consumption, and with additional out-of-market contracts, it is not unthinkable to see a competitive wholesale market that serves only a minority of total demand. <u>If market segmentation trends continue, the wholesale markets will become increasingly meaningless tools to deliver cost-effective energy to consumers</u>.

<u>**New Hampshire energy policies should avoid market segmentation while protecting the veracity of competitive wholesale markets to deliver cost-effective energy to meet consumer demand.**</u>

Goal 8: Generate in-state economic activity without reliance on permanent subsidization of energy.

<u>**The exercise of government power to economically favor one technology over another should be limited, and justifiable**</u>. Subsidies should be responsive to need, if necessary. This means that they should not be static. Subsidized resources too often rely on the benefit of being a permanent component of the bottom line. This reliance is not sustainable.

As with Goal 6, economic development can be achieved without resorting to the delivery concentrated benefits with diffuse costs. <u>Subsidization to support economically inefficient entities merely for the preservation of their operation ignores reciprocal costs</u>. That is, subsidization of any particular industry or technology type may preserve specific economic activity in the short run, but only by imposing the costs of inefficiencies on ratepayers and taxpayers.

Reliance on mandates or subsidization necessarily means that an energy-related activity is not economically viable absent government support. While short-term market disturbances may justify limited intervention to preserve long-term viability, continued reliance on ratepayer and taxpayer funds is not sustainable or justifiable.

<u>Government support for energy industries or sectors should be based on quantifiable data demonstrating consumer benefit</u>. Subsidization will nearly always help the entity being supported, but the immediate and long-term cost to ratepayers and taxpayers must be included in order to properly weight public policy decisions. If no benefit is shown, then it is highly likely ratepayer or taxpayer dollars could be more efficiently spent elsewhere, and alternative actions should be considered.

Goal 9: Maximize the economic lifespan of existing resources while integrating new entrants on a levelized basis.

<u>Properly functioning markets should deliver cost-competitive resources while selecting against uneconomic resources</u>. There is uncertainty in future energy markets, consumption, generation technology, and risk is a part of every investment. At the same time, political distortion of markets--even for well-intended purposes--introduces additional risk factors.

Energy policy changes can abruptly make certain resources uncompetitive. The marginalization of particular energy resources through the subsidization of competitor technologies or mandates imposes costs on ratepayers by raising the price of the last-available resource into the supply chain. Not only are ratepayers asked to pay more for energy, the operators of formerly-competitive resources are left with stranded assets. Failure to maximize the useful competitive lifespan of energy investments represents economic waste.

New Hampshire stakeholders should seek policies that limit economic waste, maximize the useful competitive lifespan of energy infrastructure, and avoid policy preferences that select for technologies or resources without regard to cost.

Goal 10: Protect against neighboring states' policies that socialize costs.

Every state has the right to pursue its own energy policy agenda. And while the integration of renewables into competitive markets is necessary, such integration must address additional costs associated with resources competitive only with subsidization. Compared to other New England states, New Hampshire does not have as aggressive renewable mandates or subsidy programs. Neighboring state renewable mandates create upward pressures on electricity prices from higher-cost renewables by increasing their share of the regional fuel mix. As such, there is a significant risk that those increased costs will be passed to New Hampshire ratepayers even though New Hampshire policy is not driving those costs.

States should be free to impose above-market costs on their citizens for policy reasons. However, one state should not shift above-market costs onto a neighboring state's ratepayers by distorting the wholesale market. As such, **New Hampshire should seek regional policies that allocate costs according to each state's preference for higher-cost resources**. States should be able to pursue their own policies impacting fuel mix, but should also bear the cost to the degree such policies increase energy rates.

Goal 11: Ensure that appropriate energy infrastructure is able to be sited while incorporating input and guidance from stakeholders.

Siting energy infrastructure is both challenging and necessary. An affordable energy resource is rendered either expensive or irrelevant if the cost to utilize it is high or it can't be sited. New Hampshire requires energy systems that meet current and future needs with minimally disruptive impact and at low cost. **Delivering appropriate energy infrastructure requires predictability, defined processes, good communication, and clear standards for achievement**.

Section 2: Energy Overview

New Hampshire energy prices are among the highest in the nation.[39] On average, each New Hampshire resident spent $3,934 on energy in 2015.[40] Yet the distribution of costs has shifted. Over the past decade generation costs have fallen while transmission costs have increased.[41] Generation still makes up the majority of total delivered cost, but policy choices that impact the fuel mix shown in Figures 2.1 and 2.2 below could be more significant cost drivers than fluctuations in fuel costs or transmission investments.

New Hampshire 2016 Generation		
Total (thousand MWh)	**19,284**	100.00%
Nuclear	10,761	55.80%
Natural gas	4,744	24.60%
Biomass	1,689	8.76%
Hydro	1,145	5.94%
Wind	432	2.24%
Coal	422	2.19%
Solar	52	0.27%
Petroleum liquids	39	0.20%

Figure 2.1

Source: EIA Data Browser

New England 2016 Generation		
Total (thousand MWh)	**108,113**	**100.00%**
Nuclear	32,751	30.29%
Natural gas	53,631	49.60%
Biomass	7,220	6.68%
Hydro	6,161	5.69%
Wind	2,646	2.45%
Coal	2,544	2.35%
Solar	2,467	2.28%
Petroleum liquids	693	0.64%

Figure 2.2

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[39] "The state has among the highest retail electricity rates in the nation." U.S Energy Information Administration, "New Hampshire State Profile and Energy Estimates."

[40] EIA, "Total Energy Price and Expenditure, Ranked by State, 2015."

[41] Even while generation makes up a larger fraction of the delivered cost, transmission costs have increased by 374% over the past 11 years, and distribution costs have increased by 73%. Bob Sanders, "Electric transmission costs scrutinized at NH Energy Summit," (NH Business Review, 4 October 2016), http://www.nhbr.com/October-14-2016/Electric-transmission-costs-scrutinized-at-NH-Energy-Summit/.

Projected Consumption Demand

New Hampshire remains reliant on oil as a source of home heating as shown in Figure 2.3. New Hampshire ranks second in the nation in oil heating per capita, with 46.4% of New Hampshire citizens using oil as their primary source of heat in 2015. New Hampshire households also rely on wood as a primary source of home heating, with over 10% of households. Correspondingly, New Hampshire has a much lower share of households using natural gas and electricity for heating.[42]

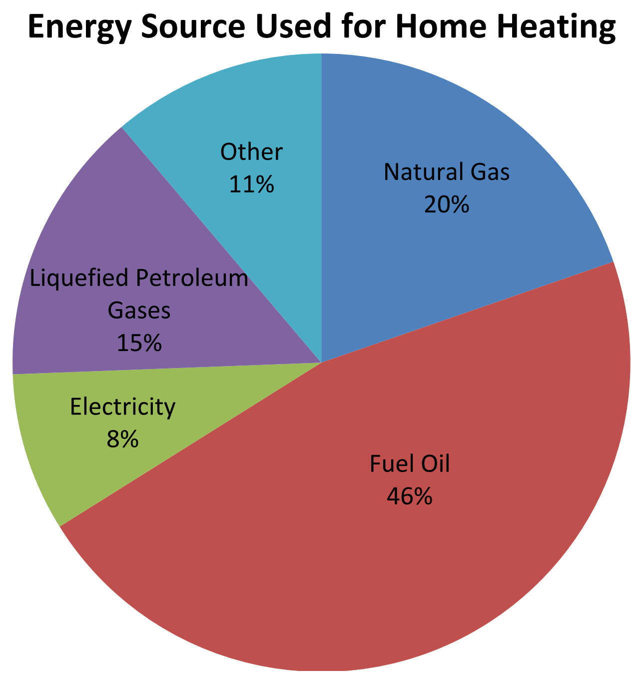

Figure 2.3

EIA projects relatively flat consumption demand for heating energy needs nationwide, although shifts may be forthcoming in fuel type demanded, according to EIA. Although the Nation's population and commercial floor space are growing, "improved equipment and efficiency standards contribute to residential and commercial consumption remaining relatively flat or declining slightly from 2016 to 2040." EIA also projects the "[u]se of petroleum-based fuels such as propane and heating oil [to] continue to decline in the residential sector and remain relatively flat in the commercial sector."[43]

New Hampshire is less likely to see a parallel decline in the use of home heating oil. The dearth of new natural gas capacity and high electricity costs limit their attractiveness for heating customers who could potentially transition away from heating oil. Energy efficiency improvements and improved technology could serve to offset the increased demand of a growing population and business community.

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[42] U.S. Energy Information Administration, "New Hampshire State Profile and Energy Estimates." (Energy Information Administration, February 2018), https://www.eia.gov/state/data.php?sid=NH#ConsumptionExpenditures.

[43] U.S. Energy Information Administration, "Annual Energy Outlook 2017 with projections to 2050," (Energy Information Administration, 2017), https://www.eia.gov/outlooks/aeo/pdf/0383(2017).pdf.

Energy Infrastructure

In 2016, New Hampshire generated approximately 19 million megawatt hours of electricity. Nuclear power, specifically Seabrook Station, accounted for about 10.7 million megawatt hours of that generation, or approximately 56%. Natural gas accounted for about 25% of New Hampshire's generation, with renewables representing about 17%. Of that 17%, about 9% comes from biomass, 6% from hydropower, with the remainder coming from solar and wind generation.

New Hampshire customers receive electricity from three regulated investor owned utilities (Eversource, Liberty, and Unitil), one electric cooperative, and several municipally owned electric companies. New Hampshire's electric industry is partially restructured. This means that the ownership of electric generating plants has largely been separated from the distribution of electricity.

The move towards the full restructuring of New Hampshire's energy industry is continuing on the course towards a more competitive market. Following the 2015 restructuring and rate stabilization agreement approved by the PUC, Eversource has taken the action of selling their remaining fossil-fuel assets. The divestiture of Eversource's remaining assets is an ongoing process, and the effects that the sales will have on the market have yet to become fully realized. As divestiture continues to develop and the impacts become clearer, New Hampshire must be vigilant and responsive to new challenges, including the potential for resource retirements.

New Hampshire will not be immune to the effects of future resource retirements. ISO-NE projects that about 4,200 MW of the region's approximately 30,000 MW of 2018 generating capacity has or soon will come offline. ISO-NE further states that, "[o]ver 5,500 MW of additional oil and coal capacity are at risk for retirement in coming years, and uncertainty surrounds the future of 3,300 MW from the region's remaining nuclear plants."[44] These potential retirements risk overstraining New Hampshire's baseload assets, which will contribute to high and volatile energy prices.

New Hampshire and Regional Electric Markets

New Hampshire is a net energy importer, a net electricity exporter, and faces increased costs because of the policy preferences of neighboring states seeking above-market-cost energy resources. New Hampshire stakeholders should seek to empower competitive wholesale electricity markets in order to protect New Hampshire energy infrastructure investments, incentivize low-cost energy, and guard against cost-raising policy impacts from neighboring states.

New Hampshire ratepayers are increasingly at risk of funding neighboring state public policies. New England state actions to achieve public policy objectives are interfering with regional competitive wholesale markets. Decarbonization efforts are the key drivers of this reality. Competitive markets are not currently structured to decarbonize based on competitive pricing principles, yet states continue to implement policies that mandate decarbonization. This has caused great tension by displacing a significant portion of energy from wholesale competitive markets into parallel markets such as Renewable Energy Portfolio (RPS) mandates.

[44] ISO New England, "2017 Regional Electricity Outlook," (ISO New England, January 2017), 27, https://www.iso-ne.com/static-assets/documents/2017/02/2017_reo.pdf.

Decarbonization is not valued equally among Northeastern states. Each state has a distinct mandate and ancillary programs to encourage or subsidize zero-carbon or low-carbon resources. Yet even with authority to pursue an energy agenda, New Hampshire policies alone cannot insulate our state against cost-drivers from our neighbors. Regional policy reforms are necessary if New Hampshire is to avoid increasing energy costs.

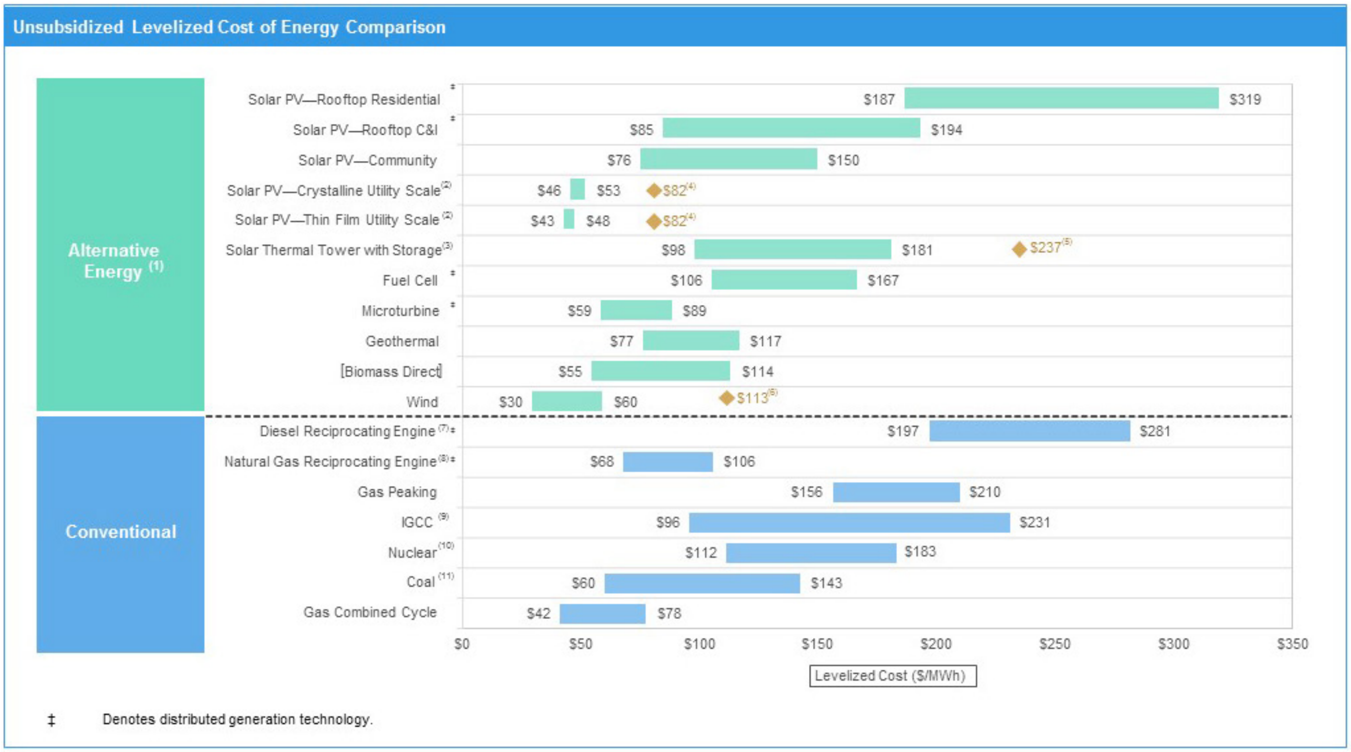

Figure 2.4

Source: Lazard

The entity responsible for operating New England's wholesale electricity market is ISO-NE, an independent Regional Transmission Organization. ISO-NE's structure, programs, and integration of state public policy greatly impact New Hampshire ratepayers.

ISO-NE's tripartite mandate is operate the grid, administer the wholesale market, and plan for future electricity needs. All three of those objectives are complicated when states develop policies that distort wholesale market performance, typically by subsidizing certain resource types. While general subsidization of generation by other states could have a positive impact on New Hampshire ratepayers (by artificially reducing the market price of electricity), the most challenging subsidization dilemmas states now face is the integration of renewable resources.

In the vast majority of use cases, renewable resources are more expensive than the generation resources currently making up ISO-NE's fuel mix. The levelized costs of various fuel types can are shown above in Figure 2.4. As such, state policy decisions to incentivize renewable investments raise the effective cost of electricity. The effective cost increase could be felt either through the combined cost of rates and additional tax burden (that funds subsidization), or directly through rates if policy creates a technology preference mandate.

There is a fair bit of latitude for states and regions to craft energy policy. FERC's power is limited by states' ability to pursue legitimate state policy objectives.[45] Renewable technology can be exempted from competitive market mechanisms, but states are also free to respond to the consequences of insulating generation resources from competitive pressures.

Significant out-of-market energy contracts are likely to destabilize the competitive wholesale market by segmenting and satisfying a portion of demand with the out-of-market resources. Existing in-region generators will have the same capacity but less demand, forcing downward pricing pressure. This could benefit ratepayers through cheaper wholesale rates, but is also likely to force out of business generation resources equivalent to the out-of-market contract additions. There will not be net savings to ratepayers as the out-of-market resources are more expensive to begin with, otherwise they would already be competing in wholesale markets.

CASPR

As cost is not ISO-NE's primary mandate, the organization isn't necessarily opposed to state-driven policies that favor the integration of expensive generation resources into the fuel mix. Indeed, as the client of the states, ISO-NE can be seen catering to state policy efforts. ISO-NE's Competitive Auctions with Subsidized Policy Resources (CASPR) proposal is designed to utilize a two-tier capacity auction that allows subsidized resources that are ineligible to compete in capacity auctions to nevertheless procure a capacity contract by buying out an existing resource's capacity contract. The incumbent resource would be required to retire and the subsidized resource takes its place.

CASPR was driven by the tension between state policies putting in place renewable mandates and New England generator concerns that out-of-market renewables would displace in-region resources in the markets, suppressing prices in capacity markets, and threatening the economic viability of in-regional generators. CASPR provides an option for in-region generators to be bought out while still nominally keeping in place the Minimum Offer Price Rule (MOPR), which bars subsidized resources from participating in capacity auctions.

A laudable goal behind CASPR is to try to keep as much generation in competitive markets as possible--competition is likely to benefit ratepayers through the selection of cost-effective resources. If current policy trends continued, between RPSs and other renewable mandates, it would not be unthinkable to have a majority of generation insulated from competitive markets in the near future. Such an outcome would mean that electricity costs could be determined more by government action than by market forces.

The CASPR proposal has faced criticism, but is still working its way toward implementation,[46] despite the skepticism of some observers.[47] <u>While CASPR may better integrate renewables into competitive markets, it fails to address the additional cost associated with running resources that are competitive only with subsidization</u>. As compared to other New England states, New Hampshire does

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45 NESCOE v. ISO New England Inc., 142 FERC ¶ 61,108 (2013), 35.

46 NESCOE has commented on the CASPR proposal. NESCOE notes that there won't be a market for CSOs (capacity supply obligations) if the timing doesn't work out where potentially retiring resources agree to participate when renewable resources are also looking to take over a CSO. NESCOE's suggestion is to allow all new resources that receive a CSO in the primary auction to retain their CSO--that is, the renewable resource would step into the shoes of the retiring resource from the perspective of the duty to supply capacity at a given date. NEPOOL Markets Committee. "CASPR Proposal: New England States' Initial Thoughts." (New England States Committee on Electricity, July 2017), http://nescoe.com/wp-content/uploads/2017/07/NESCOE_CASPR_InitialThoughts_11Jul2017.pdf.

47 Michael Kuser, "New England Strives for CASPR Consensus," RTO Insider, November 2017, https://www.rtoinsider.com/iso-ne-caspr-consensus-80221/.

not have aggressive renewable mandates or subsidy programs. Neighboring state renewable mandates create upward pressures on electricity prices from higher-cost renewables by increasing their share of the regional fuel mix. As such, there is a significant risk that those increased costs will be passed to New Hampshire ratepayers even though New Hampshire policy is not driving those costs. Further, there is concern that by letting less reliable resources attain capacity contracts, the New England states are risking overall system reliability without taking on additional responsibility.[48]

States should be free to impose above-market costs on their citizens for policy reasons. However, one state should not shift above-market costs onto a neighboring state's ratepayers by distorting the wholesale market. As such, New Hampshire should seek regional policies that allocate costs according to each state's preference for higher-cost resources. States should be able to pursue their own policies impacting fuel mix, but should also bear the cost to the degree such policies increase energy rates.

[48] Powelson's dissent. Federal Energy Regulatory Commission, 162 FERC ¶ 61,205 (2018), https://iso-ne.com/static-assets/documents/2018/03/er18-619-000_3-9-18_order_accept_caspr.pdf, 60- 64.

Section 3: Fuel Diversity

NH 2016 Generation		
Total (thousand MWh)	**19,284**	**100.00%**
Nuclear	10,761	55.80%
Natural gas	4,744	24.60%
Biomass	1,689	8.76%
Hydro	1,145	5.94%
Wind	432	2.24%
Coal	422	2.19%
Solar	52	0.27 %
Petroleum liquids	39	0.20%

Figure 3.1

Source: EIA Data Browser

"Technology is neither good nor bad; nor is it neutral."[49] The impact of a technology depends on its geographic and economic context. And to enable or protect cost-effective energy, stakeholders must figure out how to deliver the best products with the most impact, not merely new technology with limited impact. New Hampshire will be best served by fostering technologies and solutions that are tailored to our state's needs.

To deliver cost-effective energy to consumers, New Hampshire needs all-of-the-above energy policies. That means Energy Efficiency (EE), Demand Response (DR), Distributed Generation (DG), renewable energy, and conventional resources. Diversity of available resources can limit cost spikes posed by fuel price swings or interruptions, better cover the generation gaps of intermittent resources, and mitigate some cyber threats. Having a diverse resource mix can help ensure a secure, reliable, and resilient energy system. Figure 3.1 shows generation resources in New Hampshire in 2016.

Where taxpayer or ratepayer dollars are at stake, investments and policies should prioritize economic efficiency in order to achieve cost-effective energy production and delivery. Technology neutral policies will let the most competitive economically viable solutions succeed. Additionally, where overall electricity demand is flat, new resources added to the region should be selected by market performance, not based on mandates calling for a particular technology. Replacing competitive resources with subsidization-reliant resources is a recipe for increased ratepayer and taxpayer burdens.

49 Melvin Kranzberg, "Technology and History: Kranzberg's Laws," Technology and Culture 27, no. 3 (July 1986): 544- 560.

While some states may attempt to drive innovation through mandates and subsidization, New Hampshire will never win a battle of subsidies. Instead, our state should enable creativity and entrepreneurial endeavors by refraining from picking winners and losers among energy technologies. New Hampshire can foster a sustainable and dynamic energy economy by ensuring a favorable regulatory environment, not a regulatory and statutory environment based on favoritism.

New Hampshire should not seek to achieve renewable power market penetration merely to achieve parity with neighboring states or regions. Some states may choose to accept significant above-market costs in order to achieve a particular resource mix. With some of the highest energy costs in the nation, New Hampshire should be particularly sensitive to policy-imposed costs on ratepayers. Additionally, some regions possess environmental advantages that make intermittent renewable resources more efficient. There are increasingly large areas of the country where renewables are competitive. This should be recognized without jumping to the conclusion that all areas of the country can support similar levels of renewable infrastructure at similar costs. The degree of penetration of technologies should be determined by the competitive market. Otherwise, policy may create investments that may never be sustainable absent subsidization.

Renewables have an important role to play in our resource mix. As will be discussed in more detail later, in some regions of the country certain forms of solar and wind resources are becoming cost competitive with conventional generation technologies. However, many of these resources are currently unable to deliver at scale in New Hampshire without significant subsidization. While there should be pathways for all resources to achieve market penetration, such expansion should be accomplished by relying on the market value of power generation. Resources should compete in the market, not compete for government policy preferences.

Fossil fuels are currently the dominant fuel type in New Hampshire for electricity generation, heating, and transportation. While renewable resources will undoubtedly continue to grow, carbon-based fuels are likely to remain the most prominent elements of New Hampshire's resource mix for decades. And regardless of what generation types are added to the resource mix, policies should let existing resources compete for market share. Delivering cost-effective electricity to consumers means measuring the economic lifespan of an existing resource by its ability to deliver value to the market rather than through government mandate. Similarly, new resource entrants should compete on a levelized basis.

Natural gas and renewables will likely make up an increasingly sizeable fraction of New Hampshire's fuel mix. Our state's electricity prices remain among the highest in the nation,[50] and those costs will remain high or increase if policies limit the utilization of natural gas or expand the subsidization of high-cost resources. "High-cost" in this policy setting refers to the levelized cost – the cost of energy accounting for subsidies – not the apparent end cost to a consumer.[51] If the goal is to reduce energy costs for consumers, then the focus must be on the all-in cost of resources, which includes burdens from taxes and mandates. To achieve cost-effective energy delivered to consumers, New Hampshire policy should encourage the siting and construction of new generating assets that have a low levelized cost of electricity (LCOE).[52]

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[50] U.S Energy Information Administration, "New Hampshire State Profile and Energy Estimates."

[51] For more on levelized costs, Lazard, "Lazard's Levelized Cost of Energy Analysis- Version 11.0."

[52] The levelized cost of electricity (LCOE), is the net present value of the unit-cost of electricity over the lifetime of a generating asset, and often reflects the average price that a resource must earn to break even over its lifetime. LCOE metrics are a valuable way of comparing electricity generation sources that may have significantly different costs to build and costs to maintain. New Hampshire stakeholders should seek to limit reciprocal harm. For example, if electricity demand were steadily increasing, it would make sense to encourage investments furthering long-term policy aims where no reciprocal harm would be inflicted on current investments. However, as demand is flat or potentially falling, introducing new resources into the mix (beyond the rate of retirement) by mandate means that existing resources will face increased competitive pressure. It contradicts the principle of conservation and full-resource-utilization for government to subsidize a resource such that it is rendered economic where that competition then puts another resource out of business.

Nuclear power

Seabrook Station is the largest electricity generating asset in New Hampshire. With 1,250 MW of generating capacity, the nuclear plant produced more than 55% of all electricity generated in New Hampshire in 2016, and it is one of only a few nuclear plants in New England, which together supply 30% of the region's electricity.

It is essential that New Hampshire's energy strategy account for nuclear power. Seabrook Station produces the majority of our state's electricity, it has a significant impact on the local and state economy,[53] it delivers zero-carbon energy into New England's grid, and the stability of production--also known as capacity factor--is valuable for regional grid management.[54] Given these realities, it is important to ensure that Seabrook Station's economic lifespan is not artificially shortened by state policy decisions.

With regard to emissions, wholesale markets currently lack a mechanism to value nuclear power's carbon-free attributes.[55] It is likely that New England's carbon emissions would increase significantly if Seabrook Station were to stop generating at capacity. For example, after several years of falling emissions, the closure of the Vermont Yankee nuclear plant was a driving cause in carbon dioxide emissions increasing 7% regionally in 2015.[56] With a nameplate capacity of 620 MW (55% of the state's total generating capacity), the closure of Vermont Yankee resulted in the loss of a greater amount of carbon-free electricity generation capacity than all renewables in Vermont combined (590 MW as of 2017).[57]

There are no cost-effective or practical solutions to cover current nuclear power generation capacity with other zero-carbon assets. For example, replacing Seabrook with an equivalent generation capacity through residential rooftop solar, even under the most favorable cost conditions, could cost $3.8 billion or more.[58] And this does not account for the likelihood that those solar panels would have a low capacity factor, producing electricity on average 14.4% of the time, with highs of 20% during the summer and lows of 6% during the winter.[59] This is an essential fact impacting grid management, as Seabrook has a capacity factor of nearly 90%. As such, there is value in factoring nuclear generation's zero-carbon emission product into state efforts to manage emissions. Preserving Seabrook Station as a source of zero-carbon energy is the most realistic and cost-effective means of managing emissions in New Hampshire at scale.

New reactor construction is often not economically viable in current conditions, although there may be opportunities in the future related to innovations with small modular reactors. Currently however, there is significant value to New Hampshire and the regional electricity supply in maintaining Seabrook's generating capacity. Nuclear generation should be allowed to compete to deliver electricity into competitive wholesale markets, and should also be recognized as a component in New Hampshire's environmental goals and policy frameworks.

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53 Nuclear Energy Institute, "Economic Impact of NextEra Energy's Seabrook Station," (Nuclear Energy Institute, November 2013), http://www.nexteraenergyresources.com/pdf_redesign/nei_seabrook.pdf.; NextEra Energy Seabrook, "NextEra Energy Seabrook Station An Economic Engine for New Hampshire," (November 2013), http://www.nexteraenergyresources.com/pdf_redesign/infographic.pdf.

54 Mary Louise Nuara, "ISO New England Update Consumer Liaison Group Meeting," (ISO New England, March 2017), 7. https://www.iso-ne.com/static-assets/documents/2017/03/clg_meeting_nuara_iso_update_presentation_march_02_2017.pdf.; ISO-NE: "Despite declines in capacity, nuclear generators typically provide around 30% of the region's energy and, along with oil- and coal-fired generators, are critical on the coldest winter days when natural gas supply is constrained... ." ; ISO New England, "Resource Mix."

55 Gordon van Welie, "State of the Grid: 2017," (ISO New England, January 2017), 28. https://www.iso-ne.com/static-assets/documents/2017/01/20170130_stateofgrid2017_presentation_pr.pdf.

56 Patricio Silva, "Environmental Update."

57 U.S. Energy Information Administration, "Vermont State Energy Profile."

58 Lazard, "Lazard's Levelized Cost of Energy Analysis- Version 11.0," 11. Replacing Seabrook's nameplate capacity of 1,250 MW with solar PV-residential rooftop at a capital cost of $3,100/kW. 1,250 MW = 1.25 million kW x $3,100 per kW = $3.875 billion.

59 ISO New England, "Final 2017 PV Forecast," (ISO New England, May 2017), https://www.iso-ne.com/static-assets/documents/2017/05/2017_solar_forecast_details_final.pdf.; Roger Andrews, "Solar PV capacity factors in the US- the EIA data," Energy Matters, September 2016, http://euanmearns.com/solar-pv-capacity-factors-in-the-us-the-eia-data/.

Natural gas

Natural gas produced nearly 42% of all electricity consumed in New England in 2016.[60] That represents an increase from 18% of electricity consumed in 2000 as shown in Figure 3.2. Energy markets continue to turn to natural gas as often the lowest-cost option for new generation, and as among the most cost-competitive source types. ISO-NE notes: "The availability of low-cost natural gas from the nearby Marcellus Shale formation was the main driver of a 44% decrease in the average price of New England's wholesale electricity between 2004 ... and 2016."[61]

The EIA estimates that natural gas production will account for nearly 40% of U.S. energy production by 2040.[62] The growth is likely in New England as well, as ISO-NE predicts that with expected resource retirements "[a]bout 4,200 MW – an amount equal to almost 15% of the region's current generating capacity – will have shut down between 2012 and 2020 and is being replaced primarily by new natural-gas-fired plants and wind resources."[63]

Chart: Total System Capacity by Fuel Type

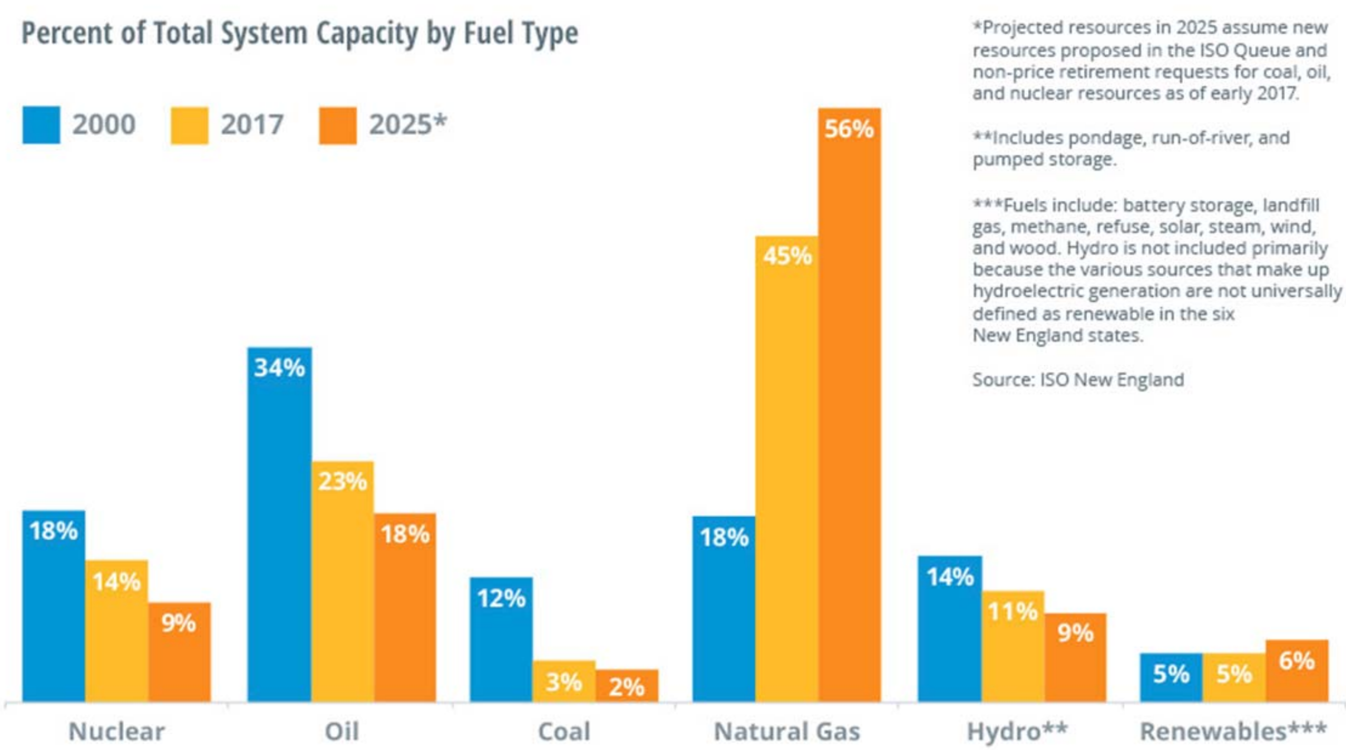

Figure 3.2

Source: ISO-NE

[60] ISO New England, "Resource Mix."

[61] ISO New England, "2017 Regional Electricity Outlook," 12.

[62] U.S. Energy Information Administration, "Annual Energy Outlook 2017 with projections to 2050."

[63] Id.

Chart: Wind and Natural Gas are the two resources dominating new generation proposals; NH has almost no expectation of significant new generation capacity as shown in Figure 3.3

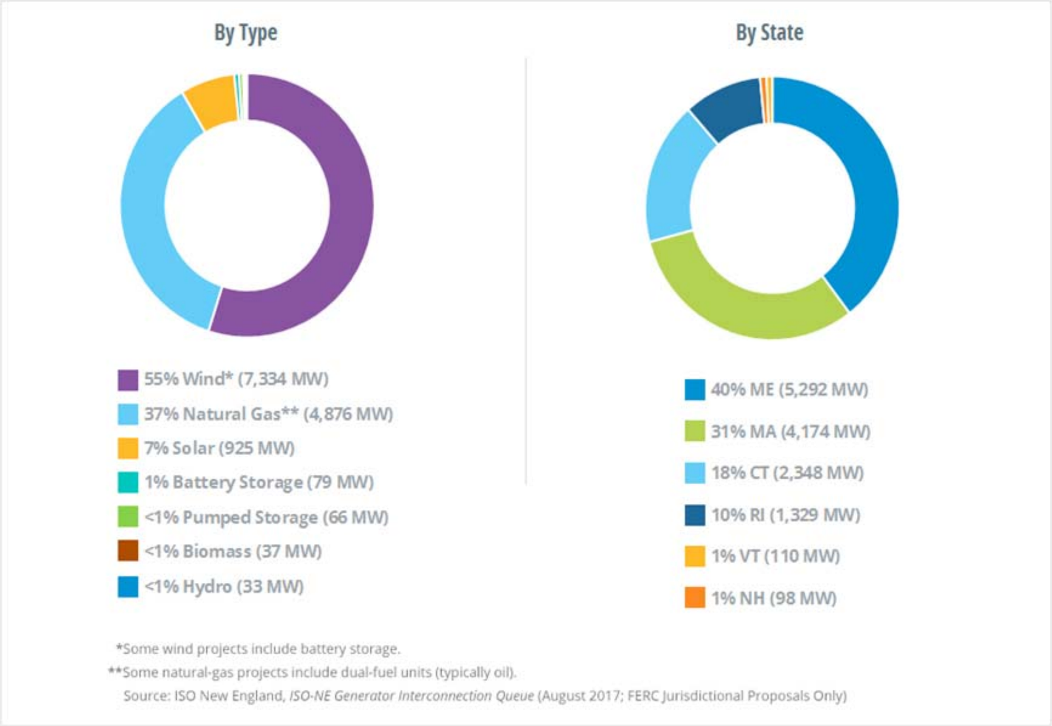

Figure 3.3

Natural gas has delivered benefits beyond cost-competitive energy. The growth of natural gas production at the expense of other conventional fuel resources has contributed greatly to emissions reductions in the United States. According to EIA data, U.S. carbon dioxide emissions have fallen to the levels of the early1990's due to the market driven replacement of coal and oil by natural gas.[64] This has contributed to much of the progress that the U.S. has made towards emissions reduction goals.

Relatively quick construction times and on-call production improve system reliability. At the same time, New England's reliance on natural gas raises questions of price and production stability. ISO-NE persuasively argues that electricity reliability is tightly connected to natural gas markets and availability.[65]

There is tension between the increasing demand for low-cost natural gas, the countervailing risk of dependence on the fuel, and production alternatives should natural gas supply infrastructure remain a chokepoint. There are few if any resources currently available at scale in New Hampshire that offer natural gas' blend of cost-effectiveness and flexibility. Even though renewable projects are on a percentage basis the fastest growing segment of electricity generation, those resource types are not yet low cost and are constrained by environmental conditions--when the sun shines and the wind blows. New Hampshire energy policy must be realistic about the necessity of natural gas into the foreseeable future while ensuring that infrastructure projects or expansions are in keeping with natural resource protection.

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[64] U.S. Energy Information Administration, "U.S. Energy-Related Carbon Dioxide Emissions, 2016."

[65] ISO New England, "2017 Regional Electricity Outlook," 24.

Infrastructure projects are often stymied by permitting and siting barriers or delays. It is essential that any infrastructure improvements or expansions fit with New Hampshire sensibilities and needs. At the same time, interventions that discourage the utilization of low-cost resources such as natural gas raise prices for ratepayers. Inflicting additional costs on New Hampshire residents and businesses has consequences, and those burdens must be weighed against the pursuit of other policy goals.

New Hampshire must answer the questions of what resources and infrastructure will best protect its citizens, economy, and natural resources. There are reciprocal costs associated with all infrastructure decisions, so interests and goals must be balanced to achieve equitable and pragmatic outcomes. Simplistic assertions in opposition of a fuel type's utilization in New Hampshire and New England will not resolve these hard questions, but will make viable solutions more difficult to attain.

Renewable energy

In 2016, 17% of electricity generated in New Hampshire was from renewable resources.[66] Biomass was the largest renewable resource type at 8.7%, followed by hydroelectric generation at 5.8%, wind at 2.3%, and solar at 0.28%.[67] As far as trends, over the past five years biomass production has grown and hydroelectric generation has fallen as shown in Figure 3.4. Concerning hydroelectric generation, in 2011 New Hampshire had a wetter than usual year and in 2016 New Hampshire was suffering from a statewide drought and lost two hydroelectric generation plants.[68] The 28.66 percent reduction is potentially anomalous because the generation between 2012 and 2015 were constant. Wind and solar have expanded rapidly, but from negligible production to 2.6% combined of New Hampshire electricity generation.

Chart: Renewable Power in New Hampshire: 2011 to 2016

Renewable Power in New Hampshire: 2011 to 2016		
Source	2011	2016
Biomass	1,025	1,689
Hydro	1,605	1,145
Wind	66	432
Solar	*	52

Figure 3.4

Source: EIA Data Browser; *Generation not sufficiently large to be captured by EIA.

Just as the scale and makeup of renewable energy production has changed significantly in past years, it is likely to continue to shift in coming years. Renewable energy is highly likely to continue to grow as a percentage of total electricity generation in New Hampshire. That shift will also impact New Hampshire's economy, as jobs associated with renewable technologies will likely continue to make up a larger fraction of New Hampshire's workforce.

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66 U.S. Energy Information Administration, "Data Browser," (Energy Information Administration), https://www.eia.gov/electricity/data/browser/#/topic/0?agg=2,0,1&fuel=vvvvu&geo=001&sec=g&freq=A&start=2001&end=2016&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin= ; U.S. Energy Information Administration, "New Hampshire State Profile and Energy Estimates."

67 Id.

68 National Oceanic and Atmospheric Administration, "National Climate Report- October 2011," (National Oceanic and Atmospheric Administration, 2011), https://www.ncdc.noaa.gov/sotc/national/201110.

Regionally, renewables will make up an increasingly prominent fraction of our fuel mix. At the same time, if cost-effective energy is a critical goal, it is also important to ensure that generation markets maintain the ability to deliver pricing signals to resources in the market or entering the market. Currently, federal and state energy policies, not competitive markets, are the primary drivers of the construction of renewable resources in New England. Renewable portfolio standards reshape the market to guarantee an increasing fraction of generation to a designated set of technologies.

Nationally, the growth in renewable energy has been largely driven by preferable tax treatment.[69] At scale in New Hampshire, renewable technologies are not at rate parity unless factoring in subsidization, credits, incentives, or mandates.[70] This reality negatively impacts the operation of wholesale energy markets, and threatens the economic viability of otherwise-competitive conventional generators.[71] Low wholesale prices or low bids into wholesale markets do not necessarily mean a low cost of production. In the case of many renewables, it means a high rate of subsidization, where negative bids reflect incentivization to produce energy regardless of the actual cost of production, or at least the ability to submit negative bids to the extent commensurate with the level of subsidization.

Where federal and state energy policies lower the effective cost of renewable resources, energy market prices will decrease.[72] This may benefit ratepayers in terms of the price of electricity, but there is no free lunch--artificially low prices achieved through subsidization are paid for through other tax or ratepayer mechanisms. And there are additional harms associated with artificially low prices:

> The participation of large quantities of state-subsidized renewables in the capacity market... will also undermine accurate capacity market prices – thereby accelerating the retirement of the very power plants that the region still needs to ensure a reliable electricity supply.[73]

If intermittent resources displace other generation sources in the wholesale market, absent cheap storage capacity, on-call resources will still need to be maintained to run when the intermittent resource is not generating. This infrastructure reality imposes costs on consumers: first, in the form of taxes or rates to cover the incentivization of the construction of particular technologies; and second, in maintaining on-call generation infrastructure to be utilized when intermittent resources are not able to produce.

Analyzing the Cost-Effectiveness of Renewable Energy Technologies

Intermittent resources have different strengths and weaknesses as opposed to conventional generation sources. Most prominently for renewables, capital demands are high, capacity factors are low, and fuel costs are near or at zero. In other words, the investment to build a renewable energy source is expensive per kW, that capital cost is only producing electricity a low percentage of the time, but there are low or no fuel costs associated with operating the resource.

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[69] Brad Plumer and Jim Tankersley. "Renewable Energy Is Surging. The G.O.P. Tax Bill Could Curtail That," New York Times, 7 December 2017. https://www.nytimes.com/2017/12/07/climate/tax-overhaul-energy-wind-solar.html.

[70] "Even with low to no fuel costs, most renewable resources are still relatively expensive to build and connect to the grid, so they aren't competitive in the wholesale marketplace." ISO New England, "2017 Regional Electricity Outlook," 34.

[71] "State policies that subsidize renewable resources can interfere with accurate pricing in the energy markets because these subsidies offset operating costs. This enables subsidized resources to sell energy for artificially low prices, putting traditional generators that New England needs for reliability at a price disadvantage." ISO New England, "2017 Regional Electricity Outlook," 36.

[72] "As more renewable resources come on line, energy market prices will decrease significantly because of renewables' low fuel costs and state subsidies." ISO New England, "2017 Regional Electricity Outlook," 7.

[73] Id.

Market analyst company Lazard produces assessments of the Levelized Cost of Energy (LCOE), a measure that allows comparisons among generation resources absent subsidies. Lazard's national assessment shows that certain forms of solar and wind are cost competitive with conventional generation technologies in certain situations.[74] However, it is important to parse this analysis more carefully. The costs for wind and solar are higher in the Northeast, although this relative premium is tempered by the region's high energy costs.

Relative to other renewable technologies, the Northeast enjoys more cost competitive wind potential, but is the most expensive (that is, the least efficient) region for solar. Residential rooftop solar is among the most expensive generation resources available measured nationally, with a cost in the range of $187 to $319 per MWh, more than three times the cost of Gas Combined Cycle plants ($42 to $78), and at least four times the cost of onshore wind resources ($30 to $60).[75] While there may be energy independence or other factors that convince homeowners to install rooftop solar arrays, from the standpoint of seeking cost-effective energy on a levelized basis, such systems are not generally advantageous.

Even if uncompetitive on a levelized basis, mandates will boost the presence of particular resources in the regional fuel mix. However, mandates are not necessary in order to achieve renewable market penetration. For example, ERCOT, Texas' RTO, has no centralized zero-carbon goals but the market is delivering significant growth in renewables, particularly wind. In Texas, wind is quickly becoming a lowest-cost resource – at least when accounting for federal incentives – and investments are responding to that fact.[76]

Solar and wind are abundant resources, but in many geographic areas the technologies are not yet cost-effective absent taxpayer or ratepayer support. New Hampshire does not have Texas' wind or solar intensity. Striving to mirror Texas' resource mix would require market intervention to support resources that are not economically competitive because of geographic and environmental differences. For example, the average solar capacity factor in New England is 15%. That means that on average a solar array will be producing the equivalent of full capacity only 3.6 hours of every day.[77] This reality makes the economic justification difficult, as on an unsubsidized, levelized basis residential rooftop solar may cost twice the delivered retail electricity rate.

Solar represents only a small fraction of generation in NH at 0.28%, and is expensive absent significant subsidization. In the near-term under current market and technological conditions it is unlikely to meaningfully address New Hampshire energy needs. Wind is a larger producer in-state at 2.3% of total generation, but is limited in some cases by cost and also by siting concerns. While there is currently greater potential for cost-effective wind generation in New Hampshire than for solar, a buildout of the technology sufficient to surpass the generation of other renewables would necessitate extensive land use and stakeholder input concerning the impact on our state's scenery and natural resources.

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74 Lazard, "Lazard's Levelized Cost of Energy Analysis- Version 11.0."

75 Note that offshore wind is significantly more expensive than onshore wind. Lazard, "Unsubsidized Levelized Cost of Energy Comparison," Lazard, "Lazard's Levelized Cost of Energy Analysis- Version 11.0," 2.

76 However, wind producers still benefit from federal energy policies such as the Production Tax Credit, which significantly impacts cost-competitiveness.

77 Actual production may occur whenever there is sunlight, but on average over the course of a year the generation will equal only 15% of the nameplate capacity of the installation.

An important qualification is that the relative cost of solar and wind technologies have been falling per installed MW. Utility-scale solar has seen an 86% decline in cost over the past eight years, and wind's cost has dropped by 67%.[78] It is likely that costs will continue to fall, even if not at the same rate. It is a natural outcome of development that the pace of improvement slows when constrained by the laws of physics. Solar and wind technologies are likely experiencing diminishing returns, and while improvements are undoubtedly forthcoming, the rate at which the technologies become cost-competitive on an unsubsidized levelized basis will vary.

Mass storage of electricity offers promise for improving the integration and utility of intermittent resources, but will not of itself make those resources cost-effective. Storage infrastructure imposes additional costs on top of generation. Therefore, price parity can only be achieved when the unsubsidized levelized cost of energy plus storage reaches market rates. There are several applications, such as offsetting peaking generation in some scenarios, where battery storage is currently cost-competitive.[79] However, widespread adoption of storage capacity is unlikely to significantly alter cost limitations in the near future.

Biomass is the largest renewable energy technology in New Hampshire, producing 8.7% of our state's electricity generation. The industry also touches many aspects of New Hampshire's economy. At the same time, recent history has shown that the biomass industry has struggled to maintain competitive absent state policy interventions to preserve market share. Unsurprisingly, ISO-NE does not project expansion in biomass contribution to New England's resource mix.[80] While there is no doubt that biomass plants drive economic activity in New Hampshire, protectionist policies always have reciprocal costs. Mandates to preserve biomass generation impose higher energy costs on ratepayers, and are not a sustainable mechanism to achieve cost-competitive and economically viable energy resources in New Hampshire.

Hydroelectric generation is the second largest renewable resource technology in New Hampshire, with 5.8% of total state electricity generation. Production has fallen by 30% over the past five years, but still generates more than a third of all renewable energy in our state. While New Hampshire's hydroelectric fleet is likely to remain producing, the plants are capital intensive, closely regulated, and depend on price insulation from the Renewable Portfolio Standard mandate. Given relatively low wholesale market prices and high construction costs, it is unlikely that hydroelectric plant generation will increase significantly. However, there is abundant excess hydroelectric capacity available out-of-market, particularly in Canada. Access to such resources could be an effective method of delivering zero-carbon electricity into New England at cost-competitive prices.

Opportunities for New Hampshire

The risk with any policy is that it misidentifies the most efficient source of achieving the policy goal. New Hampshire energy policies have often promoted the value of renewable energy technologies without corresponding concern for cost. New Hampshire needs efficient and cost-effective electricity generation that preserves our state's natural resources. We should encourage competition from new entrant technologies without segmenting production types into price-insulated silos with mandates. Additionally, state policy should refrain from picking winners and losers by subsidizing

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[78] Lazard, "Lazard's Levelized Cost of Energy Analysis- Version 11.0," 10.

[79] Lazard, "Levelized Cost of Storage 2017," (Lazard, November 2017), https://www.lazard.com/perspective/levelized-cost-of-storage-2017/.

[80] Gordon van Welie,"Transformation of the New England Electric Grid and the Importance of Competitive Markets and Regional Stakeholder Discussions," (ISO New England, November 2017), 3. https://www.iso-ne.com/static-assets/documents/2017/11/neca_power_markets_conference_van_welie_presentation_november_14_2017_FINAL.pdf.

certain technologies on the backs of ratepayers and at the expense of healthy market pricing pressures. Renewable technologies will continue to grow in importance and market impact, and market selection should steer those investments.

It should be an objective to seek an ultimate outcome where production technologies are not subsidized by ratepayers or taxpayers. However, we should recognize the difficulties with rapid shifts in public policy, taking care when altering policies and incentives that impact existing investments and resources. That said, a status quo that uses preferential policy to allow incumbents – of any technology type – to freeze out competition should be unacceptable.

Some argue that subsidization is essential to the continued growth of renewable power.[81] We must distinguish between subsidization-created infrastructure, and investments justified by market conditions. Uneconomic resources would not exist absent subsidization, yet those same resources may be wise investments in the near future when cost curves are more favorable. A crucial question therefore is whether New Hampshire taxpayer and ratepayer support is essential for a particular technology, at a particular time.

An undesirable outcome would be for energy developers to pursue uneconomic investments that *require* ongoing subsidization in order to participate in energy markets. We should be especially wary where the entirety of a resource's production life depends on subsidization to operate. The end goal with energy infrastructure should be unaided market competition where the technology competes on the merits, not survives on taxpayer largess.

Other New England states are pursuing various policies to expand renewable energy footprints and market presence. While New Hampshire stakeholders can learn from the successes and failures of such policies, we should not be beholden to those particular visions of infrastructure design. New Hampshire energy policy should not seek to mimic neighboring state renewable energy policies. Instead, New Hampshire should seek the most appropriate investments and goals given our state's geographic location, environmental considerations, land use requirements, and need to deliver cost-effective energy.

Distributed Energy Resources

Distributed Generation (DG) represents a shift from a utility-dominated and large centralized system to a diffuse, smaller-scale generation infrastructure design. DG has been increasingly studied and implemented as benefits include greater flexibility in system designs and resilience. While there is the potential for duplication and vulnerability, DG brings opportunities and the possibility of designing an electric grid that meets New Hampshire's needs moving deeper into the 21st century. Advancements in technologies like blockchain and energy storage have the potential to contribute to a grid that is decentralized and open for rapid innovation.

A critical issue with DG is how to value generation. It may be easy for a single producer to measure a DG investment against offset costs, but the value of grid-tied resources is not easily discerned. Dynamic pricing mechanisms appear to be essential to DG integration at scale to adequately value the power provided by DG assets based on real-time market conditions.

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[81] "[T]ax credits are still critical in maintaining renewable energy's expansion... . Whenever they expire, the industry stops and waits for them to be re-authorized." James Conca, "Renewable Energy Tax Credits-Forever?" Forbes, 26 September 2017, https://www.forbes.com/sites/jamesconca/2017/09/26/how-long-will-renewable-tax-credits-be-around/#2d5808c24ccd.

Net Metering

New Hampshire's net metering regime is evolving to reflect new entrants, new information, and new management structures. The PUC's net metering docket[82] produced an order on June 23, 2017.[83] In summary, the Commission accepted common elements in two settlement proposals, resolved several differences between those two settlements, and provided for an interim alternative net metering tariff.

Over the next several years the Commission and stakeholders anticipate collecting and analyzing data to better understand NH-specific net metering features, implementing pilot programs, and producing a distributed energy resource (DER) valuation study. All existing net metered systems are grandfathered through 2040 at current rates. The Commission will open a new proceeding in the future to revisit its order and reform it as necessary given the anticipated additional data available.

These recent proceedings indicate the need for more research and assessment to best understand the impacts and design of current and future policies. As a result, statutory and policy regimes should further the goals of the PUC order in keeping with the broader goals of this State Energy Strategy. In assessing this interim regime and in the design of the next iteration, it is important to provide predictability to stakeholders, protect investments made by all stakeholders, and avoid cost-shifting among ratepayers.

Renewable Portfolio Standard

The RPS was established in 2007 as a tool to increase the use of renewable energy for producing electricity and to protect and enhance fuel diversity. The RPS requires that electric service providers, including distribution utilities and competitive suppliers, must acquire a certain percentage of supply from renewable energy sources. In total, the 2018 RPS mandate calls for 18.5% of electricity sold to retail electric customers to be generated by renewable energy sources, with a goal of 25.2% by 2025. Under the New Hampshire RPS structure, applicable renewable energy sources are organized into four classes:

- Class I: New (after 2008): wind; hydrogen derived from biomass fuel or methane gas; ocean thermal, wave or tidal energy; methane gas; or biomass. Thermal energy from biomass, solar, and ground source heat pumps (geothermal) was recently added to this class.
- Class II: New solar electric (PV) generation.
- Class III: Existing biomass or methane facilities that meet air emission criteria.
- Class IV: Existing small hydroelectric facilities that meet fish passageway criteria.

Service providers have three options for satisfying RPS requirements:

1. Purchase Renewable Energy Credits (RECs) from eligible projects, 1 REC equals 1 MWh;
2. Make an Alternative Compliance Payment (ACP), the amounts of which are set by the State;
3. In certain situations, directly invest in eligible renewable projects (such as through RSA 374 G).

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[82] New Hampshire Public Utilities Commission, "DE 16-576 Electric Distribution Utilities Development of New Alternative Net Metering Tariffs and/or other Regulatory Mechanisms and Tariffs for Customer-Generators," New Hampshire Public Utilities Commission, https://puc.nh.gov/Regulatory/Docketbk/2016/16-576.html.

[83] New Hampshire Public Utilities Commission, "DE 16-576 Electric Distribution Utilities Development of New Alternative Net Metering Tariffs and/or other Regulatory Mechanisms and Tariffs for Customer-Generators, Order No. 26,029," New Hampshire Public Utilities Commission, https://puc.nh.gov/Regulatory/Docketbk/2016/16-576/ORDERS/16-576_2017-06-23_ORDER_26029.PDF.

The RPS framework depends on mandates that segment renewable technologies from each other and from the broader wholesale electricity market. Achievement of the goals underpinning the establishment of the RPS therefore necessitates administrative selection of technology types that will be afforded varying degrees of protection from market pressures. This reality runs the risk of favoritism, inefficiency, and a constant tension among RPS-eligible resources for relative benefit.

In addition to fuel diversity, a prominent goal of the 2007 RPS statute is "employing low emission forms of such technologies [as] can reduce the amount of greenhouse gases, nitrogen oxides, and particulate matter emissions transported into New Hampshire and also generated in the state...."[84] If reducing emissions is a primary objective, then in order to have conceptual consistency, the RPS must include other zero-carbon or low-carbon resources. Additionally, while in tension with the goal of fuel diversity, the pursuit of emissions reductions would justify breaking down artificial barriers between classes that restrict competition. If the goal is to pursue the most cost-effective low-carbon options, then siloing energy technology types thwarts that outcome.

As drafted, the RPS excludes nuclear power under the assumption that it is not a renewable fuel. This is correct under a mechanistic definition where "renewable" means an energy source/fuel type that can regenerate and can replenish itself indefinitely. However, it is somewhat artificial to draw a distinction between a fuel that can replenish itself indefinitely even where there may be significant resource and environmental impact to capture the energy in that fuel. Solar panels, wind turbines, biomass plants, methane gas, thermal infrastructure, and hydroelectric dams all require non-renewable material to capture the value of their associated fuel type. For example, many solar panels need the rare earth element tellurium, which is three times rarer than gold.[85] Hydrogen fuel cells rely on platinum, which is only mined in South Africa.[86] Many renewable technologies depend on acquiring scarce resources, and the interruption of supplies limits production. Additionally, production of the material for, and construction of the sites themselves for all these infrastructure types has natural resource and environmental impacts.

Clearly, indefinitely replenishable fuel is only one component of sustainable energy production. Where in actuality resource needs for capturing any particular energy form exist on a continuum, achieving the more concrete RPS goal of emissions reductions would be served by making eligible zero-carbon resources currently excluded. **In summary, the RPS should be redefined to include other zero-carbon resources and to pursue the most cost-effective low-carbon options. Segmentation of the RPS to limit competition among energy technology types should be eliminated**.

[84] NH 362-F:1 Purpose

[85] Nicola Jones, "A Scarcity of Rare Metals Is Hindering Green Technologies," Yale E360, 18 November 2013, https://e360.yale.edu/features/a_scarcity_of_rare_metals_is_hindering_green_technologies.

[86] Id.

Section 4: Energy Efficiency

Demand-side resources refer to mechanisms that modify consumer demand for energy, whether a capacity product, equipment, system, service, practice, or behavior. The definition includes anything that measurably reduces end-use demand for electricity from the power system. Demand resources include energy efficiency (EE), demand response (DR), and distributed generation (DG).

Energy Efficiency

Energy efficiency (EE) is the cheapest and cleanest energy resource. Investing in efficiency boosts the state's economy by creating jobs and reduces energy costs for consumers and businesses. New Hampshire should prioritize capturing cost-effective energy efficiency in all sectors, including buildings, manufacturing, and transportation.

New Hampshire has modest, but evolving EE programming. New Hampshire's utility efficiency programs must be "cost effective" as determined by the PUC, meaning that each dollar spent on the programs yields at least one dollar in savings. Efficiency benefits more than just those customers who participate in efficiency programs. Reducing energy use, especially during expensive peak times such as the hottest and coldest days of the year, saves money for everyone on our energy systems. For reliability purposes, we build our energy infrastructure to meet our needs during peak demand. Reducing that peak means spending less on expensive transmission, distribution, and generation infrastructure.

Regional EE efforts are projected to significantly impact both peak demand and gross energy usage. ISO-NE projects that EE measures will shave 1,582 megawatts (MW) off peak demand, with an average annual peak reduction of about 264 MW, and a regional energy usage reduction from growth of 1% to a 1% decrease of gross consumption.[87] This is derived from an estimated $3.5 billion in EE investments from 2009 to 2014, and anticipated investments across New England of $1.2 billion annually 2021 through 2026.[88]

Energy Efficiency Resource Standard (EERS)

The PUC has furthered energy efficiency work through "Core" programs, with savings goals largely based on funding availability. On August 2, 2016, the New Hampshire PUC issued Order No. 25,932, approving an Energy Efficiency Resource Standard (EERS) settlement agreement.[89] The primary goal of the order is to achieve all cost-effective energy efficiency, with an order effective date of January 1, 2018. Utilities will administer the EERS for the first three years of operation.

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87 ISO New England, "Energy-Efficiency Forecast."

88 Id.

89 New Hampshire Public Utilities Commission, "DE 15-137 Gas and Electric Utilities Energy Efficiency Resource Standard."

The legislature created the Energy Efficiency and Sustainable Energy (EESE) Board to promote and coordinate energy efficiency, demand response, and sustainable energy programs in the state.[90] The Energy Efficiency and Resource Standard (EERS) Committee of the EESE Board has been working to further the development of the 2018-2020 NH Statewide Energy Efficiency Plan.[91] The Committee submitted a report to the EESE Board on July 21, 2017.[92]

The PUC is continuing to develop the EERS docket and the draft EERS plan, as submitted on September 1, 2017. Outstanding areas of stakeholder disagreement include valuing non-energy impacts, access to capital, EM&V (evaluation, measurement, and verification of energy data), pilot programs, and performance incentives.[93]

Successful implementation of the EERS draft plan will enhance cost-effective energy efficiency programming in New Hampshire. This State Energy Strategy will withhold additional recommendations pending the ongoing consideration of the EERS draft plan by the PUC and stakeholder groups.

New Hampshire should continue to coordinate and develop energy efficiency programming to achieve cost-effective savings.

Demand Response

Demand Response (DR) refers to a suite of services that focus on getting energy users to reduce power use during specific peak periods when energy is most expensive. DR has grown with the introduction of deregulated markets, the development of capacity markets, and the introduction of Smart Grid technology allowing for automated control of appliances and heating and cooling systems. DR directly targets particular users, buying usage management with payment, which enables reductions in load that are requested at specific times by the utility or grid operator.

ISO-NE manages DR resources. ISO's DR programs started in 2001, and participation has grown from 63 megawatts (MW) to thousands of megawatts, largely through integration with the forward capacity market.[94] DR is eligible to participate in the forward capacity market alongside traditional generators, and receives payment for reducing load when requested by ISO. While very large customers can bid directly into the market, it is more common for aggregators to contract with groups of companies in the commercial and industrial sectors and bid into the market on their behalf.

DR resources can be active or passive. Active resources are those that offer the real-time ability to reduce electricity use within 30 minutes of receiving ISO dispatch instructions, while passive resources reduce electricity consumption during peak hours.[95] Peak load reductions (referred to as "peak shaving") results in savings across the entire regional energy grid for all customers by reducing the need to run older, more expensive generation facilities during peak periods, and by deferring or avoiding the need to build new generation and transmission infrastructure.

90 NH RSA 125-O:5-a; October 1, 2008

91 New Hampshire Public Utilities Commission, "2018-2020 New Hampshire Statewide Energy Efficiency Plan."

92 Don Kreis and Christine Donovan. "EESE Board Meetings."

93 "EESE Board Minutes."

94 ISO New England, "About Demand Resources," (ISO New England), https://www.iso-ne.com/markets-operations/markets/demand-resources/about.

95 ISO New England, "About Demand Resources."

ISO-NE is rolling out a Price-Responsive Demand program in June 2018, where DR resources will be dispatched economically – committed through day-ahead and real-time markets – just like other supply resources.[96] The increasing maturity and flexibility of DR markets is likely to continue to allow energy stakeholders to respond to demand through the pricing signals of competitive markets.

While DR has largely focused on commercial and industrial customers, with the increasingly digital sophistication of homes there is the potential to facilitate widespread residential DR programs and services. Increasing DR utilization by New Hampshire's utilities and customers would enhance energy efficiency and grid management goals. The development of new structures and programs that economically integrate DR resources represents a successful growth of competitive markets, and, as opposed to state action, is likely to be the most cost-effective mechanism to incentivize DR adoption.

[96] Doug Smith, "Price-Responsive Demand (PRD) Overview," (ISO New England, November 7, 2017), https://www.iso-ne.com/static-assets/documents/2017/11/20171107-webinar-prd-overview.pdf.

Section 5: Siting

Siting energy infrastructure is both challenging and necessary. A cheap energy resource is rendered either expensive or irrelevant if the cost to utilize it is high or it can't be sited. New Hampshire needs energy systems that meet current and future needs with minimally disruptive impact and at low cost. Delivering this appropriate energy infrastructure requires predictability, defined processes, good communication, and clear standards for achievement.

Energy system infrastructure requires continual investment, whether to maintain access to existing resources or for the integration of new resources. This reality necessitates ongoing consideration of siting – where and what assets can be built to deliver energy as needed. The questions of what and where often highlight tensions between individual or small community interests, and collective interests. For example, the cost of infrastructure that benefits a smaller group may be socialized across a larger population, or infrastructure necessary to deliver a collective benefit may impose unequal costs or burdens on a smaller group or community. Responding to these issues is difficult and requires balancing numerous interests, but does not remove the necessity of siting appropriate energy infrastructure to meet New Hampshire needs.

Process considerations

Predictability in state policy and review processes allows stakeholders to more accurately gauge the likelihood of outcomes. Uncertainty in how a proposal, investment, or action will be received creates instability and inefficiency. Investments become riskier, products or projects may become less valuable or outdated, and stakeholders bear the burden of ambiguity. Siting processes should be efficient, timely, and as straightforward as possible.

Clear standards for achievement and defined processes enhance predictability. Too often in public dialogue the merits of a project or proposal are debated outside the context of statutory or regulatory guidelines. This discussion can be healthy, but debate in the public square should not cloud the procedural duties of governmental reviewing authorities. While statutory structures may impose requirements on assessments, state authorities should endeavor to frame energy system siting reviews within the context of energy infrastructure needs. As complexity obscures thresholds for achievement, governmental bodies should seek simplicity in execution to enable streamlined processing.

Communication with all stakeholders is essential to appropriate outcomes, even if those outcomes are not agreeable to all participants in the process. Impacted individuals and groups should have opportunity to express their opinions, but governmental review must still be limited to the often narrow questions imposed by law. Executive entities are bound by statute and rulemaking, so frustration with review structures should be directed at later legislative or administrative amendment rather than mid-process modifications. In-review shifts – moving the goalposts – are more likely to corrupt the defensibility of outcomes. Review processes should enable the pursuit of New Hampshire's needs and values, the definition of which for government action necessarily resides in law.

To facilitate infrastructure investments, clear and defined timelines should be established to deter delays. A fair and transparent business and regulatory environment must exist in order to encourage investment in New Hampshire. To ensure that projects can be built, the state must prevent unnecessary delays and a climate of uncertainty.

Transmission: factors driving the need to construct or rebuild capacity[97]

Replacement: Transmission infrastructure wears out. Investments are necessary to replace old, worn-out, and obsolete equipment, and the replacement may require a different footprint in order to deliver on new needs or to meet current standards.

Reliability: Transmission costs in New England have quadrupled[98] on the back of $10 billion in investments over the past fifteen years.[99] A significant portion of that cost growth has been driven by the need to meet reliability standards.[100] However, ISO-NE reports that reliability improvements have lowered the risk of blackouts, reduced air pollution, lowered wholesale electricity costs, and allowed for the interconnection of new resources.[101]

Interconnection of new load or generation: New England has 9,000 miles of high-voltage transmission lines, and has added 746 transmission components to the grid since 2002.[102] 17% of electricity consumed in New England is imported from outside the region. Connecting new resources to the grid requires new infrastructure, which raises transmission costs, but which can be offset for consumers if the resource is cost-competitive.

Economics: Moving electricity, whether generated in-region or out, requires a capable transmission grid that is balanced to inflows and demand. This infrastructure provides access to the lowest-cost resources by allowing competition on price, not merely on proximity to demand.[103] It also lowers congestion costs, and reduces the burden of supply interruptions. Additionally, many of the most scalable renewable resources sites such as hydroelectric and wind are distant from population centers. If these resources are able to compete based on price, and not through mandate, then getting this potentially low-cost energy into the market will require new or expanded transmission infrastructure.

Resources: siting infrastructure to meet current and future capacity needs

Current demand will shift the utilization of generation resources based on market factors. In particular, variation in the price of fuels (conventional) or subsidies (renewables) increases or reduces infrastructure demand for delivered capacity.[104] There is no certainty in predicting the most cost-effective technology stretching decades into the future. For example, few accurately predicted the impact of natural gas on energy markets.

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97 Stanton W. Hadley and Alan H. Sanstad.

98 Robert Scott, "Competition in Transmission," (New Hampshire Public Utilities Commission, 2016), http://necpuc.org/wp-content/uploads/2016/06/NECPUC_2016_Competition-in-Transmission_RScott.pdf.

99 ISO New England, "Transmission," (ISO New England), https://www.iso-ne.com/about/key-stats/transmission.

100 "Facilities required to meet standards such as those of the North American Electric Reliability Corporation (NERC) and regional reliability councils, but primarily the NERC Planning Standards (1997)."

Stanton W. Hadley and Alan H. Sanstad.

101 ISO New England, "Transmission."

102 Id.

103 Gordon van Welie, "State of the Grid: 2017," 8.

104 U.S. Energy Information Administration, "Short-Term Energy Outlook Natural Gas," (Energy Information Administration, February 2018), https://www.eia.gov/outlooks/steo/report/natgas.cfm.

It is clear that New Hampshire and the Northeast region have not developed the infrastructure to support the most plentiful and cost-effective energy resource currently available--natural gas. Current pipeline infrastructure has not kept pace with gas-fired generation. Natural gas production is expected to continue to increase,[105] while in the reference case prices will increase gradually as well.[106]

Consumers are hit with higher energy prices when low-cost resources are unable to enter the market. Failure to develop market-demanded infrastructure will only make the Northeast less competitive for businesses, and raise the cost of living for residents. The effective quality of life will decline if energy costs surge due to capacity constraints and backfilling by high-cost resources.

> The dependable performance of New England's fleet of power resources is the cornerstone of a reliable supply of electricity, but that performance hinges on adequate arrangements for and access to fuel. This fuel-security issue has been a growing concern over recent winters, particularly for generators that run on natural gas....[107]
>
> Without timely investment to expand natural gas or LNG infrastructure, the region should expect significant energy market price volatility when the gas pipelines are constrained. Plus, the region may soon be forced to take stronger – and likely costly – steps.[108]

The most critical current infrastructure need is for natural gas capacity, and as cost curves become more favorable on a levelized basis, a prominent future infrastructure need is the integration of Distributed Generation and renewable resources at scale. The current need for natural gas infrastructure and future need for renewable and DG integration are complementary. Natural gas pairs well with the increasing integration of intermittent resources such as wind and solar because of the "ability of many natural-gas-fired plants to change output quickly helps to balance an increasing amount of generation from intermittent power resources...."[109] Siting this needed infrastructure should be driven by market signals, not by governmental guesses at what resources should be preferred over the coming decades.

Resource Land Use

There is sufficient land in New Hampshire and New England to house numerous generation types. However, there are competing uses for that land, as well as the community and visual impact of different types of development. Importantly, there is usually a tension between residents' understanding the justification for infrastructure development and the reality that it may be built in proximity to one's home, workplace, or community. There is no easy answer to this tension.

Understanding land use impacts from various electricity generation technologies can help put burdens and benefits on communities in perspective. While not determinative in delivering cost-efficient energy to consumers, the land use of conventional fuel generators is often significantly lower than for renewable resources as shown in Figure 5.1.

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105 "[N]atural gas production over the 2016–20 period is projected to grow at about the same rapid rate (nearly 4% annual average) as it has since 2005..." and roughly 1% per year through 2040. U.S. Energy Information Administration, "Annual Energy Outlook 2017 with projections to 2050," 54.

106 U.S. Energy Information Administration, "Annual Energy Outlook 2017 with projections to 2050," 56.

107 ISO New England, "Natural Gas Infrastructure Constraints," (ISO New England), https://www.iso-ne.com/about/regional-electricity-outlook/grid-in-transition-opportunities-and-challenges/natural-gas-infrastructure-constraints

108 Id.

109 ISO New England, "Natural Gas Infrastructure Constraints," (ISO New England), https://www.iso-ne.com/about/regional-electricity-outlook/grid-in-transition-opportunities-and-challenges/natural-gas-infrastructure-constraints

Chart 1: Land Use by Electricity Source in Acres/MW Produced

Electricity Source	Acres per Megawatt Produced
Coal	12.21
Natural Gas	12.41
Nuclear	12.71
Solar	43.50
Wind	70.64
Hydro	315.22

Figure 5.1

Source: Strata[110]

While it is technically correct that New Hampshire could produce the necessary electricity to meet our state's demands with wind and solar (on a sunny or windy day), the land use consequences of such an achievement would be enormous. And even actions taken to mitigate land use – for example siting solar panels on rooftops – are expensive on a $/MWh basis. Renewable resource technologies have yet to realize the low cost and low land usage combination achieved by conventional fuel resources.

Shifts in demand and the ability of technologies to deliver on market needs will continue to evolve, and there will be corresponding pressures on land use. There is no outcome where energy infrastructure burdens will be eliminated.

Site Evaluation Committee

The Site Evaluation Committee (SEC) reviews, approves, monitors and enforces compliance in the planning, siting, construction and operation of energy facilities. This function is essential in engaging local, state, and regional interests to consider energy needs, supply, the economy, environment, and public health and welfare. It is critical that the SEC accomplish prompt and thorough review of proposals. Strong review processes protect values and ensure that siting energy infrastructure balances broader public benefits and individual or community burdens.

For a comprehensive overview of the SEC, see 2014 Plan Appendix D

110 Landon Stevens, Barrett Anderson, Colton Cowan, Katie Colton, and Dallin Johnson, "The Footprint of Energy: Land Use of U.S. Electricity Production," (Strata, June 2017), 1. http://www.strata.org/pdf/2017/footprints-full.pdf.

Section 6: Transportation

Transportation activity is generated by individuals and entities engaging in social and economic endeavors. This activity is significant. In 2015, nearly one third of New Hampshire's energy consumption was in the transportation sector.[111] Simply lowering transportation energy usage is a blunt goal that ignores the importance of travel and transport to our lifestyle and economy. Instead, New Hampshire should seek to reduce the energy intensity of transportation activities, without discouraging the activities themselves.

It is important to protect consumer-preferred forms of transportation, even where lowering energy intensity of travel is an important goal. With an economy that is fueled by tourism and with few areas in our state having the population density to support extensive public transportation options, it is likely that passenger vehicles will remain the dominant transportation mode for the foreseeable future. However, the energy usage required for car passenger-miles is likely to continue to fall, offering opportunities to reduce energy intensity in the transportation sector without drastic disturbances in consumer behaviors and expectations.

Energy use largely reflects infrastructure availability, and investments shape energy use patterns for decades. 92% of national transportation energy was derived from petroleum in 2016, falling from just under 96% in 1973.[112] New capital-intensive infrastructure, limiting transportation options, increasing movement friction, or artificially raising costs are not consumer-friendly policies that play to New Hampshire's strengths and sensibilities. Instead, optimizing infrastructure is a light-touch energy management strategy that can support consumer choosing more energy efficient transportation options. For example, congestion management permits travel at more constant speeds, reducing energy-intensive accelerations and idling. The most effective near-term energy management strategy for New Hampshire is to efficiently and fully utilize existing infrastructure.

Maximizing infrastructure utilization improves efficiency while helping reduce environmental impacts. Tourism travel is driven by the desire to experience New Hampshire's natural resources. Transportation development should further New Hampshire citizen and visitors' interests in protecting the environmental integrity of our state. Doing so does not mean abandoning private vehicles in favor of public transportation modalities.

New Hampshire needs to accommodate a market that is rethinking public and private transportation, and the blurring of lines between the two. We have seen a shift in consumer expectations and behavior with the rapid expansion of ride-sharing services such as Uber and Lyft. Business models that allow for on-demand, point-to-point transportation could serve both urban and rural communities well, particularly if fleet vehicles are energy efficient models.

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[111] U.S. Energy Information Administration, "New Hampshire State Profile and Energy Estimates" (Profile Analysis, Energy Information Administration, 2017), https://www.eia.gov/state/?sid=NH.

[112] Stacy C. Davis, Susan E. Williams, and Robert G. Boundy. Transportation Energy Data Book, 2-4.

Policymakers should prioritize function over form. The goal should be efficient transportation reflecting consumer preferences, not centralized planning with the hope that building infrastructure will force individuals into new travel patterns. It is unlikely that large public transit infrastructure projects will deliver energy efficient transportation for New Hampshire travelers. Instead of new capital-intensive publicly-funded infrastructure such as extensive commuter rail systems, enabling personal vehicle options combined with on-demand fleets can deliver high-utilization travel. Transportation energy efficiency is more likely to be achieved with full car seats, not train cars.

Given this reality, policymakers should be especially careful with taxpayer investments. Distorting investment incentives through subsidization or mandates – picking winners and losers – obligates ratepayer or taxpayer dollars to particular technologies. Instead, allowing market demand to drive infrastructure investment decisions is more likely to deliver cost-effective energy to consumers over the long term.

Delivering traveler-preferred transportation modalities also means deriving infrastructure funding based on consumer decisions. Cost-shifting to support legacy infrastructure does not adequately incentivize the utilization of that infrastructure. For example, while highway networks are a public good, they are not uniformly utilized by all New Hampshire residents and visitors. If efficient utilization is the goal, where highway infrastructure experiences capacity limits, consumers should be price conscious. With highway vehicle miles projected to climb over the next decade, it is not sustainable long-term to scale highways directly proportional to the number of vehicles traveling them.[113]

Commuter travel is significantly impacted by land use policies and the availability of housing to workplaces. Highly dispersed development and lower-density residential growth will proportionally increase vehicle miles. Policies making transportation more difficult or expensive can cut against consumer living preferences. At the same time, transportation costs should not be disassociated from housing preferences. Cost-shifting to support long commutes leads to inaccurate pricing of living decisions.

New Hampshire does not require a wholesale rethinking of transportation infrastructure to achieve energy efficiency gains. Incremental improvements in traveler behaviors and purchasing decisions can continue to improve the energy intensity of passenger-miles, even if determining how to best avoid cost-shifting poses a challenge to properly allocating transportation infrastructure costs.

Mass Transit

Mass transit can perform essential functions in certain circumstances, notably, where population density allows infrastructure to be highly utilized. There are certain concentrated areas of New Hampshire that can benefit from mass transit, and many more areas where mass transit is not an economically advantageous method of providing transportation.[114] Mere availability of mass transit is not beneficial to New Hampshire – utilization and cost-effectiveness should determine where and when mass transit modes are merited and necessary.

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113 "U.S. highway vehicle-miles-traveled (VMT) is projected to grow 28% by 2030, substantially outpacing population growth and overwhelming our already overburdened road network." American Council for an Energy-Efficient Economy, "Transportation System Efficiency," ACEEE, https://aceee.org/topics/transportation-system-efficiency.

114 "Rail transit is somewhat better in terms of energy use per passenger-mile, but apart from New York City and a few other densely populated cities that have heavy ridership during both peak and nonpeak hours, transit rail is also characterized by light usage for much of the day and thus high average energy use per rider." "Real Prospects for Energy Efficiency in the United States," 2010, 127.

Particularly as on-demand transportation options are more widely available, mass transit systems should be carefully analyzed to ensure that transportation objectives are being achieved. From an energy use perspective, low utilization of capacity results in poor energy intensity. So even while optimal use cases for mass transit have remained steady, the ridership trends, expectations, and energy efficiency gains have changed such that relative energy consumption among transportation modes has shifted. Passenger rail's popular routes have the lowest per-passenger-mile consumption rates of major transportation modes, but transit buses are on average more energy intensive than passenger cars, personal trucks, and motorcycles.[115] Energy expended per passenger-mile has fallen by nearly half for passenger cars over the past forty years, while that for transit buses has increased by more than 60 percent.[116]

Even while delivering energy efficient transportation in certain conditions, rail infrastructure is expensive, immobile once built, and rarely delivers passengers to their end destination. Rail passengers often utilize another mode of transportation at each end of a rail trip. System changes to respond to new or diminished demand are often difficult. Rail may offer a subset of travelers an energy efficient mode of transportation, but is more likely to serve a niche population. Extensive strategic community planning and feasibility studies would be required prior to a decision to create rail and other mass transit options. Construction and maintenance of rail and other large scale mass transit projects offer citizens value. However, there are numerous risks involved in implementation.

New Hampshire should seek low-cost, flexible, and consumer-focused solutions that recognize our state's population densities. For travelers not utilizing personally-owned vehicles, this will likely be through on-demand, small scale transportation options that leverage existing investments.

Passenger Vehicles

Personal vehicles are by far the dominant transportation mode in New Hampshire and nationally.[117] With the average age of personal vehicles in operation at more than 11 years, new technologies take a considerable amount of time to propagate through the fleet.[118] However, the energy expended per passenger-mile has been falling for decades.[119] Improving personal vehicle energy efficiency is most likely to continue to come from incremental improvements in mainstream power trains and gradual replacement with more fuel-efficient vehicles.[120] A wholesale replacement of technology is unlikely and replacing vehicles before their economic end of life in favor of marginally less energy intensive options risks resource waste, thwarting the purpose of broader efficiency goals.

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[115] Btu per passenger-mile: rail (1,187); motorcycles (2,462); cars (3,034); personal trucks (3,345); and transit buses (4,025). Stacy C. Davis, Susan E. Williams, and Robert G. Boundy. Transportation Energy Data Book, 2-19.

[116] Stacy C. Davis, Susan E. Williams, and Robert G. Boundy. Transportation Energy Data Book, 2-20.

[117] "In 2009, 83.4 percent of trips and 88.4 percent of person-miles traveled were by personal vehicle." U.S. Department of Transportation, Bureau of Transportation Statistics, "Passenger Travel Facts and Figures 2015," (Bureau of Transportation Statistics, 2015), https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/PTFF_Complete.pdf.

[118] U.S. Department of Transportation, Bureau of Transportation Statistics, "Passenger Travel Facts and Figures 2015." Table 1-26, Average Age of Automobiles and Trucks in Operation in the United States.

[119] Table 2.9 Highway Transportation Energy Consumption by Mode, 1970–2015. Stacy C. Davis, Susan E. Williams, and Robert G. Boundy. Transportation Energy Data Book, 2-11.

[120] "Real Prospects for Energy Efficiency in the United States," 2010, 124.

There are no mass market personal vehicle technologies currently available that are transformative in reducing the per-mile energy intensity of travel. Transportation infrastructure is overwhelmingly centered on gas-powered vehicles, and while there is market potential for non-internal combustion vehicles, but that potential has not yet been realized. Some technologies – such as hybrids, plug-in hybrids, and EVs – offer energy savings, but the impact is largely in shifting generation from an internal combustion engine to a power plant. Battery power will largely reflect the resource mix of the electric grid, so reducing gasoline usage is not necessarily equivalent to reducing energy usage. Additionally, the energy savings in a fleet shift from internal combustion to electric could be erased if drivers turned per-mile cost savings into more miles driven, though there could be external benefits such as a reduction in emissions.

However, incumbent and new entrant car companies are racing to diversify their electric fleets. Given the potential cost savings for both fuel and upkeep, the market could be enormous, and if it materializes as expected competition will be fierce. While EVs and plug-in hybrids are energy-efficient on a per-mile basis and are likely to become an increasing fraction of new vehicle sales, those vehicle types will remain a minority of vehicles on the road for decades, even under optimistic projections.[121] These market dynamics indicate that the consumer is likely to benefit without government subsidization to encourage adoption of a particular technology. The growth of EVs and plug-in hybrids in the total passenger-miles traveled should inform what government policies and investments can efficiently improve personal transportation energy intensity.

EV charging infrastructure will continue to grow. That growth is likely to scale to the degree of EV adoption and consumer demand for charging availability. There is also the challenge of the feedback loop of adoption and infrastructure – consumers don't want to buy cars if there isn't sufficient charging availability, and investors won't build charging stations unless there is a large enough market to serve. This reality means that private EV infrastructure development faces economic challenges. The National Association of State Energy Officials (NASEO) writes:

> Private investment in public charging stations is typically not profitable under current market conditions, as the revenues earned from offering public charging services do not offset the costs of purchasing, installing, and operating the stations within a typically attractive payback period of five years.[122]

There are business plans for EV charging stations, but few projects can achieve payback within five years.[123] Some might argue that such market conditions necessitate government action. While publicly-funded EV charging stations only demonstrate viability when adders for non-economic values are incorporated into a cost-benefit analysis, seed funding for infrastructure may have a knock-on effect promoting private investment.

Any government investments should be carefully assessed, and if possible drawn from available non-taxpayer or ratepayer funding sources to avoid cost shifting to benefit a small user base. There are more than 530,000 registered automobiles in New Hampshire.[124] There are

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[121] The EIA projects that electric vehicles could account for 8% of new vehicle sales by 2025. U.S. Energy Information Administration, "Annual Energy Outlook 2017 with projections to 2050."; Table 1: Forecasts of the fleet population of PEVs from a range of sources, U.S. Department of Transportation Federal Highway Administration, "Feasibility and Implications of Electric Vehicle (EV) Deployment and Infrastructure Development," (Federal Highway Administration), https://www.fhwa.dot.gov/environment/sustainability/energy/publications/ev_deployment/es.cfm

[122] NASEO, "Strategic Planning To Implement Publicly Available EV Charging Stations: A Guide For Businesses And Policymakers," (NASEO, July 2015), https://www.c2es.org/site/assets/uploads/2015/11/strategic-planning-implement-publicly-available-ev-charging-stations-guide-businesses.pdf.

[123] Challenges include "high initial investment costs, low and uncertain near-term demand for publicly available charging, and commercial charging competing with home charging." Id.

[124] "Number of registered automobiles in New Hampshire in 2015," (Statista, 2015), https://www.statista.com/statistics/196058/number-of-registered-automobiles-in-new-hampshire/.

slightly more than 1,400 electric cars in New Hampshire, so less than 1/3 of one percent of the total automobile fleet.[125] These facts should inform the need and efficiency of government-funded EV charging infrastructure. Government should avoid speculative investments with taxpayer dollars focused on a fraction of the consumer base, but may be able to leverage non-taxpayer funding sources to spur private investment. Private entities are better positioned over the long-term to invest in charging infrastructure that will economically deliver in the market, and state programming may have a role in encouraging early investments.

There are also other mechanisms to improve transportation energy efficiency. Energy gains equivalent to those available through EV and plug-in hybrids are achievable through behavioral, rather than hardware, improvements. Driver behavior can be a bigger determinate of energy efficiency than the type of vehicle driven. For example, aggressive accelerations and braking can lead to efficiency losses of 15% to 30%.[126] That is similar to the efficiency gains in moving from a conventional to hybrid vehicle. Modifying other behaviors, such as reducing unnecessary idling, can further improve the energy efficiency of personal transportation.

Given that few policies or investments would meaningfully alter personal vehicle utilization absent drastic cost shifting, in the short term energy consumption is more likely to be driven by consumers' behavior than by the equipment they are operating. New Hampshire will benefit from continued improvements in the energy intensity of passenger-miles, and should refrain from obligating taxpayer dollars to technology-specific infrastructure investments.

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[125] "Electric Vehicles in New Hampshire," (Plug in America, May 2017), https://pluginamerica.org/wp-content/uploads/2017/04/New_Hampshire_Electric_Vehicle_Factsheet_May_2017.pdf.

[126] U.S. Department of Energy, "Driving More Efficiently," (Department of Energy), https://www.fueleconomy.gov/feg/driveHabits.jsp

Conclusion

This Strategy is designed as a tool for legislators, state agency employees, and other policymakers and stakeholders. It is not a comprehensive listing of every conceivable scenario or policy question. Rather, it is a set of principles and goals from which energy policy can be created. There are any number of factors and circumstances that can arise, and this strategy strives to provide a guiding philosophy to address them.

New Hampshire's policies should be focused first and foremost on New Hampshire, and seek to insulate us from ramifications of external factors. We must make sure the New England electric grid can continue to reliably provide quality electric service. We must protect New Hampshire's environment in an efficient and cost-effective manner. We must remain open and flexible so that new technologies and sources of energy can be brought to bear. And most importantly, we must do the above while remaining ever-vigilant of the burden on New Hampshire's ratepayers. It should be our priority to ease those costs and bring them in line with the rest of the nation.

This is not an easy path to navigate. So much depends upon our neighbors, upon the development of new technologies, and upon the availability of resources. But New Hampshire can do its part. New Hampshire can lead the way to find responsible, transparent, market-based solutions and to apply them vigorously. If we work to achieve the goals outlined in this strategy, the next decade will see lower electricity rates, more secure energy infrastructure, a cleaner environment, and a marketplace that can allow future technologies to thrive.

Appendix A

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Appendix B

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Appendix C

Further Reading

2014 State Energy Strategy

2014 State Energy Strategy Appendices A-C: Baseline Forecast, Energy Vision, and Resource Potential

2014 State Energy Strategy Appendix D: Energy Facility Siting in NH

2014 State Energy Strategy Appendix E: Public Comments

ISO New England 2017 Regional Electricity Outlook

ISO-NE Operational Fuel Security Analysis

Natural Gas Infrastructure Constraints

Grid Modernization in New Hampshire

New Hampshire Statewide Energy Efficiency Plan 2017

New Hampshire Statewide Energy Efficiency Plan 2018-2020 Draft

Cybersecurity: Critical Infrastructure Authoritative Reports and Resources

Public Utilities Commission DE 16-576 Development of New Alternative Net Metering Tariffs and/or Other Regulatory Mechanisms and Tariffs for Customer-Generators

Final Report of the Committee to study Transmission, Distribution, Generation, and Other Costs in the State's Electricity System (Senate Bill 125, Chapter 83:1, Laws of 2017)

Final Report of the Committee to Study Subsidies for Energy Projects Provided by the Renewable Portfolio Standard (Senate Bill 51, Chapter 81:1, Laws of 2017)

Appendix D

2014 State Energy Strategy New Hampshire Energy Facilities Siting Process

The New Hampshire Site Evaluation Committee (SEC) was established by the legislature to review and approve the siting, construction and operation of energy facilities, and to monitor and enforce compliance of approved facilities with the terms and conditions of their approval certificates.[127]

In 2013 the legislature passed Senate Bill 99, which required the Office of Energy and Planning to undertake a study of the SEC,[128] and for the SEC to adopt rules on siting criteria, as discussed in Section IV below. Following the completion of the OEP study and public process in 2014, the legislature passed Senate Bill 245, which made changes to the SEC's composition and its review process. [129] This document is reflective of the composition and operation of the SEC following those legislative changes.

Information on the SEC, including all current dockets and information on past case (back to 1985) can be found at http://www.nhsec.nh.gov/projects/index.htm.

I. STRUCTURE AND AUTHORITY

A. SEC Membership includes 9 members:

- The three PUC commissioners (chairperson of PUC will be chairperson of the SEC)
- DES commissioner (who will be Vice Chairperson of the SEC)
- BEA commissioner
- DOT commissioner
- Department of Cultural Resources commissioner, or Director of Division of Historical Resources
- Two members of the public appointed by the Governor and confirmed by the Executive Council; one an attorney in good standing with the NH Bar Association, both with expertise and experience in area(s) relevant to siting, planning, business or finance.

Agency members may designate appropriate staff within their agencies to perform their duties on subcommittees of the SEC. A designee assumes the full authority of the designating member on a subcommittee. For energy facility applications, the chairperson may designate a subcommittee of no fewer than seven members, including both public members, to consider the application.[130] This subcommittee has full authority to make decisions and issue a certificate for a proposed energy facility.[131] In addition to the nine members of the SEC, an administrator position exists to be filled as an unclassified state employee hired by the chairperson.

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[127] New Hampshire RSA 162-H, http://www.gencourt.state.nh.us/rsa/html/XII/162-H/162-H-mrg.htm.

[128] Office of Strategic Initiatives, "Site Evaluation committee Study (SB99)," https://www.nh.gov/osi/energy/programs/sb99.htm.

[129] New Hampshire RSA 217, http://www.gencourt.state.nh.us/legislation/2014/SB0245.pdf.

[130] New Hampshire RSA Chapter 162-H:4-V.

[131] Once a subcommittee is appointed by the chairperson, subcommittee members may designate a senior administrative employee or staff attorney from their respective agencies to sit in their places on the subcommittee. See New Hampshire RSA 162-H: 4-a, II.

B. Powers and Duties

The SEC has the following powers and duties:[132]

1. Evaluate and issue certificates for an energy facility;
2. Determine the terms and conditions of any certificate issued;
3. Monitor the construction and operation of any facility granted a certificate to ensure compliance with such certificate;
4. Enforce the terms and conditions of certificates; and
5. Assist the public in understanding the requirements of the SEC

C. Funding: The SEC has a newly established fund to pay for its operating costs, with temporary funding available from the Renewable Energy Fund. SEC costs include the administrator position and other staffing to manage caseload and public education needs, as well as compensation for the public members. The SEC must develop a long term funding plan and submit it to the Governor and the Legislature by December 1, 2014.[133]

D. Jurisdiction: The SEC has jurisdiction over all electric generating stations greater than 30 MW, as well as certain renewable energy facilities between 5 and 30 MW; new electric transmission lines greater than 200 kilovolts (kV); certain transmission lines of 100 kV or more; natural gas and other energy transmission pipelines that are not considered part of a local distribution network, and certain energy refineries, storage and loading facilities. Renewable energy facilities subject to the SEC's jurisdiction include those projects between 5 and 30 MW which the SEC has decided it should oversee, either on its own motion or at the request of two or more petitioners.[134] The SEC may also review other projects under certain circumstances if it finds that a proposed project requires a certificate, consistent with the findings and purposes set forth in the purpose clause of the statute. Those findings and purposes include:

- Maintaining a balance among potential significant impacts and benefits in decisions about the siting, construction, and operation of energy facilities in New Hampshire, including impacts and benefits on the economy, environment, natural resources, historic sites, private property, and public health and safety;
- Providing full and timely consideration of environmental consequences;
- Avoiding undue delay in the construction of new energy facilities;
- Ensuring that all entities planning to construct facilities in the state be required to provide full and complete disclosure to the public of such plans; and
- Ensuring that the construction and operation of energy facilities are treated as a significant aspect of land use planning in which all environmental, economic, and technical issues are resolved in an integrated fashion.

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132 New Hampshire RSA 162-H:4.

133 New Hampshire RSA 162-H:21.

134 New Hampshire RSA 162-H:2, XII.

II. PROCESS

A. Filing Requirements: Each application must include information necessary to meet the requirements of each state and federal agency having permitting or other regulatory authority over the proposed facility. Upon the receipt of an application the committee must circulate a copy to each state agency having permitting or other regulatory authority over the proposed facility. Each applicant must include a description in reasonable detail of each of the following items:[135]

- Type and size of major components of the facility;
- Preferred choices, as well as other available alternatives, for the site and configuration of each major component of the proposed facility, and the applicant's reasons for selecting the preferred choice;
- Impacts of each major part of facility on the environment for each site proposed;
- Proposals for studying and resolving any environmental problems;
- Financial, technical and managerial capability for construction and operation of the proposed facility;
- Documentation that written notification regarding the proposed facility has been given to all governing bodies of communities in which the proposed facility is located;
- Elements of and financial assurances for a facility decommissioning plan;

B. Deadlines: A certificate decision is required within 365 days of acceptance of an application. An exemption decision is required within 60 days of acceptance of an application or filing of a request for exemption. State agencies having permitting or other regulatory authority over a facility must submit a progress report and draft permit conditions to the committee within 150 days of application acceptance, with a final decision by each agency's review due within 240 days of application acceptance.

C. Process for Decision Making: In addition to the SEC members, any state agency having permitting or regulatory authority over a proposed facility may participate in committee proceedings by reviewing proposals and permit requests, recommending conditions to the committee, identifying conditions of concern, specifying additional data requirements, and designating witnesses to appear before the committee during hearing.[136] All proceedings and deliberations of the SEC members are open to the public. They comply with and are conducted according to the rules and procedures governing adjudicative hearings. Decisions are made by majority vote of the full SEC, or the full subcommittee where permitted and established, and must be supported by the record in the proceedings. All deliberations and decisions are made in public by a quorum of the committee or subcommittee. Decisions are subject to judicial review by the state Supreme Court.

D. Public Engagement: A series of public hearings are required to take place throughout the review of a proposed energy facility.

- At least 30 days prior to application filing, applicants must hold at least one public information session in each county where the proposed facility is to be located. At these sessions applicants present information and receive public comments on the proposed facility. Transcripts of each session must be filed with an application.

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[135] New Hampshire RSA 217.

[136] Id.

- Within 45 days after the SEC's acceptance of an application, applicants must hold another public information session, with the SEC administrator or other designee presiding, in each county where the proposed facility is to be located. Information on the location and plans for the proposed facility, as well as public education regarding the SEC application review process, are to be presented at these sessions.
- Within 90 days after acceptance of an application, a public hearing will be jointly held by the SEC and other state agencies in each county where the proposed facility is to be located.
- Subsequent hearings are conducted as adjudicative proceedings and may be held in Concord, or in the county or one of the counties in which the proposed facility is to be located, as determined by the committee or subcommittee, as applicable.
- The SEC must consider and weigh all evidence presented at public hearings and all written information and reports submitted to it by members of the public before, during, and subsequent to public hearings until the record of the proceeding is closed.[137]

E. Role of Municipalities: The SEC must give "due consideration" to the views of municipal and regional planning boards and commissions and municipal governing bodies with respect to the potential effect of the proposed facility on the orderly development of the region.[138] Municipalities in which the proposed facility is to be located may request that the committee or subcommittee order the applicant to provide additional information sessions to inform the public of a proposed project.[139]

F. Monitoring and Enforcement: A certificate of site and facility will provide for reasonable monitoring procedures by the SEC. The SEC may delegate authority to the SEC administrator or other state agency or official to monitor the construction or operation of any energy facility granted a certificate.[140]

III. FINDINGS AND CRITERIA

A. Findings necessary for approval of a certificate: The SEC must find based on the record that:

- The applicant has adequate financial, technical, and managerial capability to assure construction and operation of the facility in continuing compliance with the terms and conditions of the certificate;
- The site and facility will not unduly interfere with the orderly development of the region, with due consideration having been given to the views of municipal and regional planning commissions and municipal governing bodies;
- The site and facility will not have an unreasonable adverse effect on aesthetics, historic sites, air and water quality, the natural environment, and public health and safety; and
- Issuance of a certificate will serve the public interest.

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[137] New Hampshire RSA 162-H:10.

[138] New Hampshire RSA 162-H:16, IV (b).

[139] New Hampshire RSA 162-H:10, I-b.

[140] New Hampshire RSA 162-H:4, III.

B. **Orderly Development:** The SEC must consider whether the proposed facility would unduly interfere with orderly development of the region. The relationship between energy facility development and economic development is also recognized in the purpose section of RSA 162-H. Applicants submit and the SEC reviews information regarding the projected economic impacts of the proposed facility. Under SEC rules, application filing requirements include "information regarding the effects of the facility on the orderly development of the region, including the applicant's estimate of the impacts of the construction and operation of the facility on:

(1) Local land use;

(2) Local economy; and

(3) Local employment."[141]

IV. RULES

A. **Organizational and Procedural Rules:** The SEC's Chapter 100 and Chapter 200 rules describe the requirements and procedures of the SEC in reviewing and acting upon applications to construct energy facilities.[142,143] The SEC's Chapter 300 rules detail the requirements relating to the filing and review of applications.[144]

B. **Siting Rules:** Senate Bill 99 of 2013 required the SEC to adopt rules "relative to criteria for the siting of energy facilities."[145] Additional requirements regarding the siting of wind energy facilities were added in HB 1602 of 2014. Rules must be adopted by July 1, 2015, and the SEC will begin the formal rulemaking process in late 2014.[146]

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141 See Site 301.03(j). New Hampshire Site Evaluation Committee, "Chapter Site 300 Certificates of Site and Facility," https://www.nhsec.nh.gov/rules/documents/chapter200.pdf, 17-23.

142 New Hampshire Site Evaluation Committee, "Chapter Site 100 Organizational Rules," https://www.nhsec.nh.gov/rules/documents/chapter100.pdf

143 New Hampshire Site Evaluation Committee, "Chapter Site 200 Practice and Procedure Rules," https://www.nhsec.nh.gov/rules/documents/chapter200.pdf, 1-16.

144 New Hampshire Site Evaluation Committee, 17-23.

145 New Hampshire RSA 99, http://www.gencourt.state.nh.us/legislation/2013/SB0099.pdf.

146 New Hampshire Site Evaluation Committee, "Projects 2011-2021," https://www.nhsec.nh.gov/projects/2021.htm. Office of Strategic Initiatives, "Senate Bill 99 Pre-Rulemaking Process," https://www.nh.gov/osi/energy/programs/sb99pre-rulemaking.htm.