Renewable Energy Committee

A Mayor-Appointed Blue Ribbon Committee of the City of Portsmouth

Final Report and Recommendations

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INTRODUCTION

The 2025 Master Plan included a strong desire for the City of Portsmouth to be more proactive in reducing Greenhouse Gas Emissions and for the development of a local energy policy to move towards a 'net zero' Carbon Dioxide Emissions goal to help mitigate the impacts of climate change for future generations. These local energy policy recommendations (the "Policy Recommendations") accompany the Renewable Energy Policy (the "Policy") to provide suggestions for guidance the City Manager can give City Boards, Committees, and Departments to attain the 2025 Master Plan's vision.

The Policy adopted a 'Net Zero Energy' Community definition similar to the Department of Energy's definition of a Zero Energy Community, which it defined as *an energy-efficient community where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy*.[1] The 'Net Zero Energy' Community definition adopted by the City of Portsmouth is *where, on a source energy basis, the actual annual energy consumed is less than or equal to locally generated renewable energy.* The Policy went on to adopt the following concurrent phases that each rely on improving energy efficiency, increasing renewable energy for electricity, and, over time, increasing renewable and clean energy for both heat and transportation:

Phase I focuses on Municipal Government Operations achieving Net Zero Energy.

Phase II focuses on the Portsmouth Community, including residences, business, and other non-municipal energy users such as the Pease Development Authority ("PDA") (collectively, the "Community") achieving Net Zero Energy. Phase II will also seek to examine low-income residents and environmental justice-related issues within the context of the Policy. The scope of Phase II is commensurate with the Community's electricity consumption.

Phase III focuses first on all vehicles originating in and second on vehicles traveling through the City of Portsmouth achieving Net Zero Energy. Phase III is distinct from Phase II as an acknowledgement of the amount of time that may be required to accomplish this phase.

The ultimate goal of the phased Policy is to reduce Greenhouse Gas Emissions, yet the Policy's definition of Net Zero Energy Community deliberately measures the use of delivered energy against on-site renewable energy instead of focusing on Greenhouse Gas Emission targets. The National Renewable Energy Laboratory ("NREL") has developed a hierarchy of preferences for such communities seeking to achieve Net Zero Energy.[2] First, the hierarchy recommends offsetting energy use from renewable energy sources available within the community's built environment such as unusable brownfield sites. A brownfield site is a location where the redevelopment or reuse may be complicated by the presence, or potential presence, of a hazardous substance, pollutant, or contaminant. Next, the hierarchy recommends offsetting energy use from renewable energy sources on either green space within the community or

[1] A Common Definition for Zero Energy Buildings: Prepared for the U.S. Department of Energy by The National Institute of Building Sciences, September 2015

[2] Definition of a "Zero Net Energy" Community Nancy Carlisle, AIA Otto Van Geet, PE Shanti Pless Prepared under Task No. FE09.3410 Technical Report NREL/TP-7A2-46065 November 2009

located outside the community boundary, but within the region and brought into the community. Only then does the hierarchy recommend the purchase of Renewable Energy Certificates ("REC") from off-site renewable energy sources outside of the region.

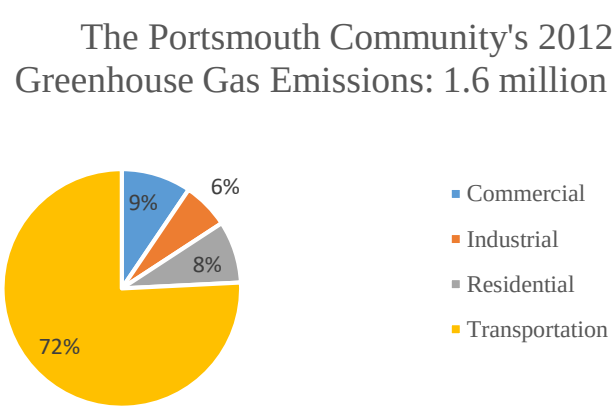
The phased Policy leaves the flexibility required to become a Net Zero Energy Community through a combination of approaches. Therefore, these Policy Recommendations concentrate on the following three strategies: increase residential & commercial building energy efficiency; increase renewable energy production; and decrease conventional automobile use. Each strategy is broken down into recommendations by Phase for the City of Portsmouth to consider like the following recommendations:

Phase I Recommendation:

Recommendation 1: The City of Portsmouth should consider adopting its own version of the NREL hierarchy such as first striving for renewables sited on the built environment within the Community and then seek to bring renewable energy into the Community from areas located outside of the Community boundary but within the region.

A. The Community's Greenhouse Gas Emissions

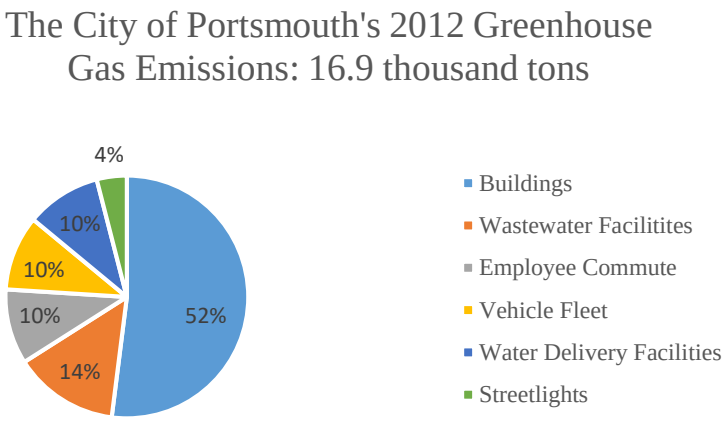
In 2017, the Portsmouth City Council voted unanimously to authorize the Mayor to sign a letter promoting the Paris Climate Agreement's goals calling for increasing efforts to cut Greenhouse Gas Emissions, create a clean energy economy, and stand for environmental justice. The 2015 Paris Climate Agreement is the most recent organized international effort to reduce Greenhouse Gas Emissions. Negotiators estimated that global Greenhouse Gas Emissions would have to reach net zero sometime in the second half of the century to keep global warming to less than two degrees Celsius by 2100 with a goal of limiting it to 1.5 degrees Celsius.



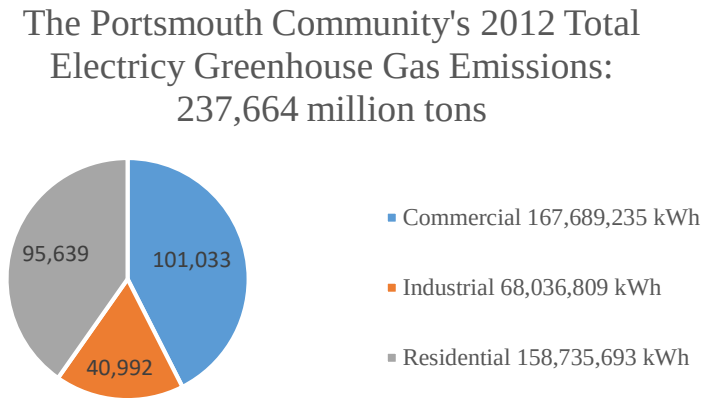
The City of Portsmouth has measured the Community's Greenhouse Gas Emissions in 2006 and in 2012. However, the Policy Recommendations will only reference the most recent data because different metrics were used for each inventory. The 2012 Greenhouse Gas Inventory found that the City of Portsmouth generated 16,997 tons of Greenhouse Gas Emissions, or roughly one percent, of the total 1,571,947 tons of Greenhouse Gas Emissions generated by the Community.[3] Of note, in 2017 the City of Portsmouth replaced all 1,610 High Pressure Sodium ("HPS") streetlights with Light Emitting

[3] 2012 Greenhouse Gas Inventory, Portsmouth, NH by the City of Portsmouth, NH, August 2013

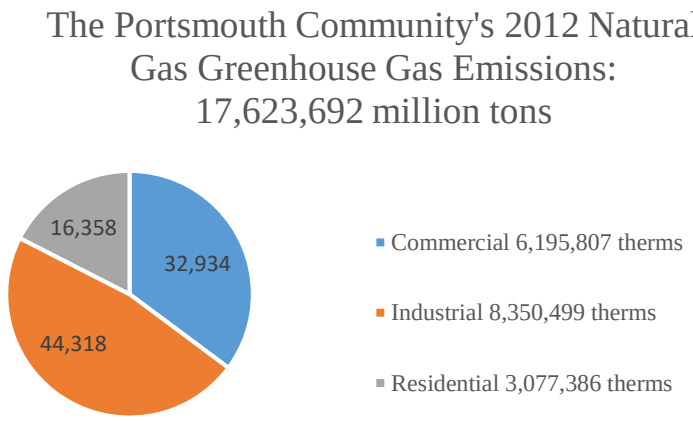
Diode (“LED”) lights saving $120,000, 494,000 kilowatt-hours (“kWh”) of electricity, and 300 metric tons of Greenhouse Gas Emissions annually.



The watt (W) is a derived unit of power in the International System of Units (“SI”) that expresses the rate of energy conversion with respect to time. Most energy usage is measured with the kWh which measures one of hour of using electricity at a rate of 1,000 watts. For example, a new energy-efficient refrigerator uses about 300-400 kWh of electricity per year.



In 2012, the Portsmouth Community’s combined commercial, industrial, & residential electric energy usage was 394,461,737 kWh of electricity that resulted in 237,664 tons of Greenhouse Gas Emissions. Meanwhile, in 2012, the Community’s combined commercial, industrial, and residential natural gas usage was 17,623,692 therms that resulted in 93,610 tons of Greenhouse Gas Emissions, the Community’s commercial & residential combined fuel oil use was 322,050 barrels that resulted in 3,525 tons of Greenhouse Gas Emissions, and the Community’s commercial & residential combined propane use was 57,855 barrels that resulted in 13,718 tons of Greenhouse Gas Emissions.



In order to become a Net Zero Energy Community where on a source energy basis the actual annual delivered energy is less than or equal to the on-site renewable exported energy, the Community will have to increase energy efficiency and increase renewable production.

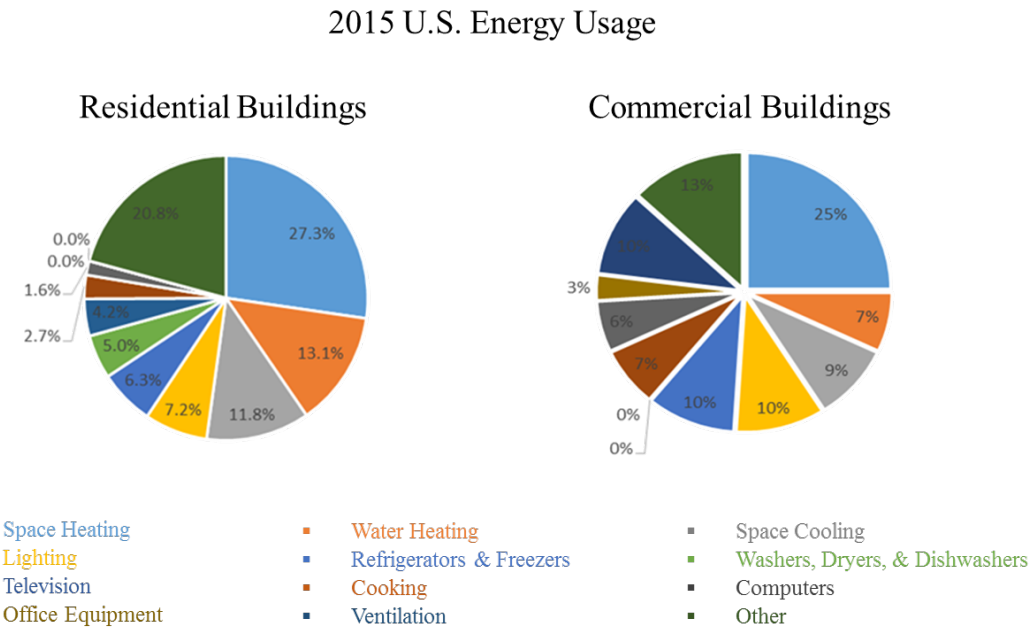
Phase I Recommendations:

Recommendation 2: The City of Portsmouth should consider measuring Greenhouse Gas Emissions in 2018 and use similar or better metrics that the 2012 measurements can be converted into.

Recommendation 3: Using similar or better metrics that the previous data can be converted into, the City of Portsmouth should consider increasing the frequency of the Greenhouse Gas Emissions measurements.

STRATEGY 1: Increase Building Energy Efficiency

The total amount of energy used has to be reduced for renewable energy to be effective. In the United States, buildings and construction materials account for almost half of all energy used. Inside of residential buildings, heating and cooling use the most energy followed by electronics such as lighting, refrigerators, and washers/dryers. Energy usage in commercial buildings is similar, but the plug loads are worse, partially due to the heavy use of artificial lighting.[4]

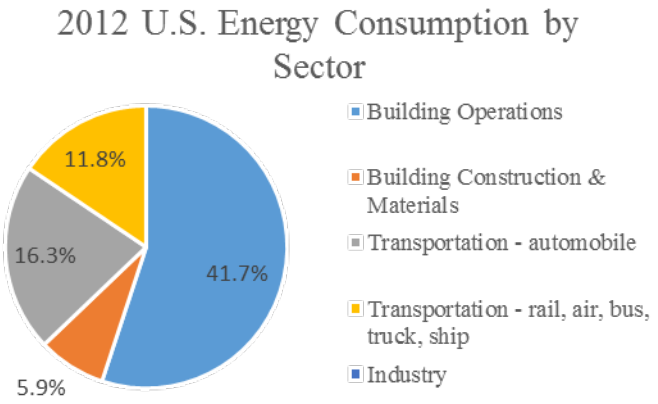


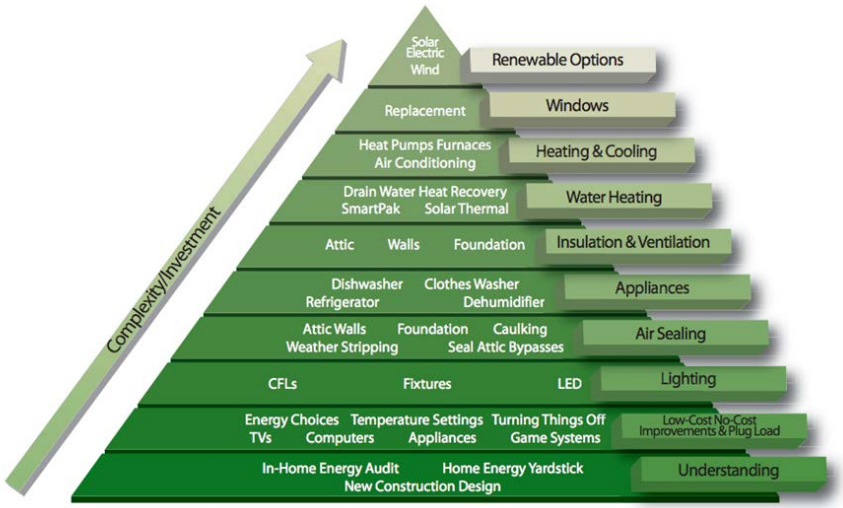
A. Existing Buildings

The biggest challenge for the Community to address when it comes to energy efficiency is reducing the energy load of the existing building stock. However, one of the most impactful ways to decrease energy usage are the least expensive beginning with simply changing occupant behaviors such as turning off electronics, being cognizant about temperature settings, and installing LED lights. Then the building should have an energy audit conducted and any areas that are losing energy to air leaks such as windows, doors, vent and piping penetrations, & walls with connections to floors and roofs should be sealed using membranes and caulking. As a next step, buildings should be retrofitted by adding insulation to roofs, walls, and floors, and

[4] Energy Usage in the U.S. Residential Sector in 2015: U.S. Energy Information Administration (EIA), a sub-agency of the US Dept of Energy.

providing storm or replacement windows. Appliances, and then more expensive mechanical heating and cooling devices should all be replaced with more energy efficient models before options for renewable energy generation are considered.[5]





Comprehensive energy projects are infrequent today because they are rarely cash-positive due to lenders reducing their risk by requiring large down payments, short term loans, & high interest rates in order to account for building owners selling their properties every five to seven years. Property-Assessed Clean Energy ("PACE") is an innovative and nationally recognized financing model that encourages investment in energy efficiency and renewable energy projects to reduce energy costs, address deferred maintenance, & increase property values. PACE programs offer loans that are tied to the property through a lien that is junior to existing mortgages, not tied to the property owner, so the next owner makes subsequent payments. One requirement to qualify is that projects must be comprehensive enough for the energy cash savings to be greater than the PACE loan/lien repayment. Comprehensive projects often include any combination of air sealing to energy efficiency to biomass for heat to solar for hot water or electricity. [6]

New Hampshire does have an enabling statute that allows municipalities to create Commercial PACE ("C-PACE") districts in which only private funds are allowed to finance projects. Commercial building owners of non-public buildings, such as office buildings, hotels, convention centers, retail, & apartment buildings with five or more units are allowed to participate if they are in a C-PACE district. Quality control steps are included before, during, and after each project, including an energy audit to determine baseline energy use and energy-project viability. The statute does not require a down payment and allows terms up to 30 year loans for

[5] 2013 2030, Inc. / Architecture 2030. Data Source: U.S. Energy Information Administration (2012)

[6] The Pyramid of Conservation, Minnesota Power, an ALLETE Company, 2017

qualifying projects. Unfortunately, due to a flaw in the legislation itself, New Hampshire municipalities are reluctant to adopt the enabling legislation. However NHSaves, a collaboration between the New Hampshire Public Utility Commission ("PUC"), utilities, & other interested parties, is a program that helps fund up to half of the energy efficiency initiatives of residential, commercial, industrial, & municipal customers. NHSaves is primarily funded by New Hampshire utility customers paying a monthly charge based on their use of electricity and natural gas.

Phase I Recommendations:

Recommendation 4: The City of Portsmouth should consider conducting an updated energy audit of all municipal facilities and implement energy conservation measures where needed, or implement a retro-commissioning program of facilities in which upgrades were enacted within the last five years.

Phase II Recommendations:

Recommendation 5: The City of Portsmouth should consider requiring / facilitating energy audits and encourage implementing energy conservation measures where needed.

Recommendation 6: The City of Portsmouth should consider engaging the public by having resources for residents who want to find out more about energy efficiency programs like NHSaves on the City's website's landing page.

Recommendation 7: The City of Portsmouth should consider supporting amendments that improve the C-PACE enabling statute, N.H. R.S.A. 53-F, and then adopt the enabling legislation to create C-PACE districts.

Recommendation 8: The City of Portsmouth should consider using its bond rating to explore offering financing options similar to PACE for retrofits or renewable energy distributed generation systems at a lower rate than individuals could obtain.

Recommendation 9: The City of Portsmouth should consider removing any barriers in the land use ordinances to enable the addition of exterior insulation and improve the efficiency in renovations to existing buildings while being sensitive to both historic preservation and fire & life safety.

B. New Buildings

Current land use regulations in the City of Portsmouth encourage, but do not require, the use of sustainable design practices or certifications. The better known national sustainable design certification standards are the Leadership in Energy and Environmental Design ("LEED"), Passive House Institute United States ("PHIUS"), Living Building Challenge, Sustainable SITES Initiative, and Energy Star. Each of these certifications uses modeling when it comes to energy efficiency. The 2025 Master Plan says the City of Portsmouth should consider land use regulations that mandate sites pursue such a certification or require that building and site measures be consistent with an equivalent level of sustainable development without having to

actually apply for the national rating standard. Of note, some certifications prohibit this practice claiming copyright infringement and it would be infeasible for City Staff to adequately review and verify equivalent applications. Further, the City of Portsmouth mandating national sustainable design certifications standards without enabling legislation may not be possible under New Hampshire law. However, New Hampshire municipalities are allowed to enact more stringent version of codes than the State requires and enacting a more stringent version of the International Energy Conservation Code ("IECC") could meet the same energy efficiency objectives.

The State of New Hampshire has codified the 2009 family of codes written by the International Code Council ("ICC"), an association that releases every three years a single set of comprehensive and coordinated model construction codes that reference one another. The State is in the process of adopting all of the 2015 codes with the exception of the 2015 IECC. The IECC establishes prescriptive and performance related provisions in building regulations, is fully compatible with the ICC's family of codes, and is used or adopted in 47 states, the District of Columbia, and several U.S. territories. The 2018 IECC addresses the design of energy efficient building envelopes and the installation of energy efficient mechanical, lighting, and power systems. One provision of the 2018 IECC would require commercial buildings to set aside roof space for future photovoltaic solar array installations and provide the connections & wiring to allow them to be integrated in the buildings systems. Another provision would require heating, ventilation, and air condition ("HVAC") systems in hotel guest rooms to automatically adjust when the room is unoccupied. A third provision would require lighting controls such as occupant sensor, daylight response, and time based controls.

The City of Portsmouth has adopted the 2009 IECC, while since 2011, the Town of Durham has adopted the most stringent editions of the IEC available including the 2018 IECC last fall. Further, all of the IECCs offer a performance compliance option, in addition to a prescriptive compliance option. When performance compliance modeling is used, the results show that some building shapes are more energy efficient than others when factors such as solar orientation, wind exposure, and shading from nearby buildings are considered. Some of the most energy efficient shaped buildings, such as those shaped as a cylinder, are currently not allowed in portions of the City of Portsmouth. In addition, the Federal Emergency Management Agency's flood insurance program penalizes participants for new construction that is not built to 2015 IECC standards, adding future costs to building owners within Portsmouth's flood zone.

The 2025 Master Plan states that land use regulations could provide incentives for designing consistent with national sustainable design certification standards. For example, under N.H. R.S.A. 674:16 and 674:21 the City of Keene created a Sustainable Energy Efficient Development ("SEED") Overlay Zoning District, which requires energy efficiency certifications from a list of four options as height, density, and use incentives. The City of Portsmouth's land use regulations currently allow for both floor area ratio bonuses and building height relaxations as incentives for developers to provide public open space or affordable housing, but no such incentive exists for buildings that exceed energy efficiency requirements. Such requirements could be scaled by order of project magnitude, much like the building permit fees schedule &

land use review process are currently graded, and require minimum performance requirements such as Energy Star for smaller projects and actual certifications for larger projects. In addition to the national rating standards listed earlier, the ICC codes offer the International Green Construction Code ("IgCC") for sustainable buildings which is modeled loosely on the LEED certification system and is predicted by some to replace LEED entirely in the future.

Another systematic approach to increase energy efficiency in new or renovated buildings and sites that are being developed or subdivided, is using mandatory checklists to encourage Planning Board members, developers, and applicants to use during site plan, subdivision, or building permit review. The Town of Durham uses such a checklist which causes an early discussion of mandatory or optional energy efficiency measures which can result in both energy and cost savings. Further, trees are and greenery are a natural way to reduce Greenhouse Gas Emissions. The City of Portsmouth currently requires review by the Trees & Public Greenery Committee for input specific to trees and greenery on the public right-of-way or on public lands and the site plan approval process that primarily involves private property.

Phase I Recommendations:

Recommendation 10: The City of Portsmouth should consider adoption of a known national sustainable design certification standard as the design and construction minimum for the renovation or construction of all municipal facilities.

Phase II Recommendations:

Recommendation 11: The City of Portsmouth should consider adopting a more recent version of the IECC than required by state law.

Recommendation 12: The City of Portsmouth should consider supporting legislation that adopts the 2015 IECC, 2018 IECC, or any future IECC updates.

Recommendation 13: The City of Portsmouth should consider creating an Energy Efficiency Chapter in the Zoning Ordinance that either creates a SEED Overlay Zoning District that allows for floor area ratio bonuses and building height relaxations as incentives for new buildings that achieve a known national sustainable design certification or adds the same incentives to current Zoning Overlay Districts.

Recommendation 14: The City of Portsmouth should consider scaling any incentives for obtaining a national sustainable design certification standard by order of project magnitude.

Recommendation 15: The City of Portsmouth should consider providing for reductions in permit fees for projects that incorporate exceptional sustainable design standards.

Recommendation 16: The City of Portsmouth should consider allowing the approval of buildings that are less traditionally shaped for energy efficiency purposes due to performance compliance modeling.

Recommendation 17: The City of Portsmouth should consider developing a mandatory checklist to encourage Planning Board members, developers, and applicants to use during site

plan, subdivision, or building permit review to systematically encourage the energy efficiency of new or renovated buildings and sites that are being developed or subdivided.

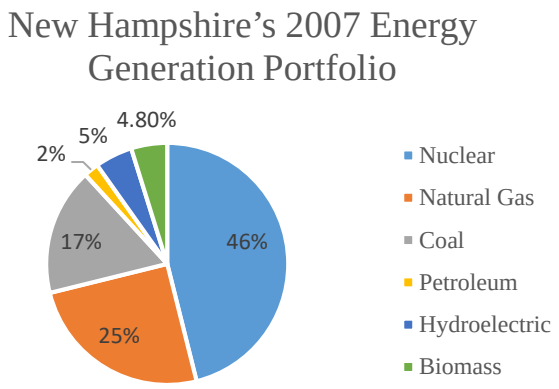
Recommendation 18: The City of Portsmouth should consider strengthening landscaping requirements for new site plan, subdivision, or building permit review by the Trees & Public Greenery Committee to systematically encourage the planting of trees and greenery around new or renovated buildings and sites that are being developed or subdivided.

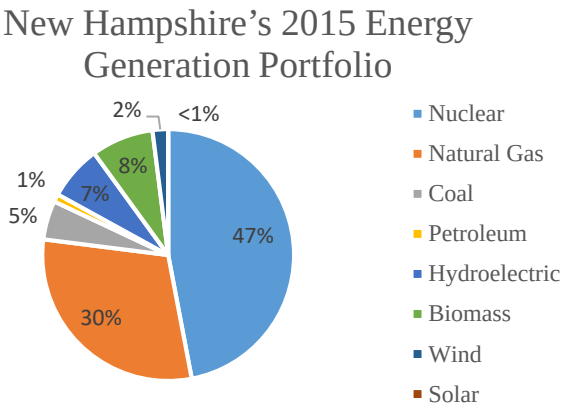
Recommendation 19: The City of Portsmouth should consider engaging the public by having resources for developers who want to find out more about national sustainable design certification standards on the City's website's landing page.

Recommendation 20: The City of Portsmouth should consider engaging the public by having resources for building owner, occupant, and developer energy efficiency education on the City's website's landing page.

STRATEGY 2: Increase Renewable Energy Production

Renewable energy comes from an energy source that is rapidly replaced or renewed through a natural process. The United States Energy Information Administration ("EIA") projects that energy generation from renewable and nuclear sources is likely to go from 13% in 2015 to 23% in 2025.[7] New Hampshire generates more electricity from its generation facilities than it consumes from the wholesale electricity market that ISO New England (ISO-NE) administers. In 2007, approximately 10% of New Hampshire's electricity generation came from renewable sources. In 2015, eight years after the enactment of New Hampshire's Renewable Portfolio Standard ("RPS"), roughly 17% came from renewable energy sources, including large-scale projects that are not certified to participate in the Renewable Energy Certificate market.[8] New Hampshire's RPS currently requires 24.8% of energy generation to come from renewable energy sources by 2025.



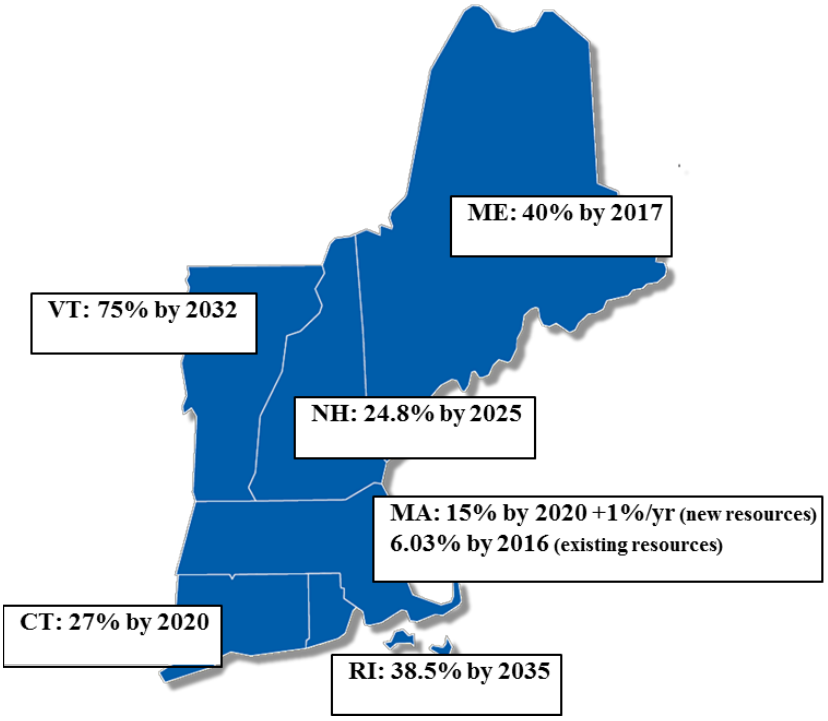


[7] U.S. Energy Information Administration, Today in Energy, "Renewable Share of North America Electricity Mix Expected to Rise" (August 2, 2016).
[8] U.S. Energy Information Administration, Electricity Data Browser

A. Utility Scale Renewable Energy Generation Facilities

On July 10, 2007, the New Hampshire legislature enacted the state's RPS that requires retail electricity providers to produce a minimum amount of electricity from renewable energy generation sources and increases the minimums gradually. The policy provides fuel diversity, lowers fossil fuel dependence, and stimulates investment in renewable energy generation. Electric service providers began complying with the RPS in 2008 with an obligation to obtain 4% of their annual electric load from qualified renewable sources. The minimum has been gradually increasing until it will reach 24.8% in 2025.

As of 2016, all New England states have enacted their own unique RPS.[9] Compliance is verified using an electronic record called a REC. Each REC shows that one megawatt-hour (MWh) of eligible renewable electricity generation, or an equivalent amount of thermal energy (3,412,000 Btu) generation, has been created from a qualified renewable source. New Hampshire distinguishes four classes of renewable energy technologies and under the RPS electricity providers are required to obtain RECs in varying percentages for each class.



Renewable energy facilities apply to the New Hampshire PUC to become RPS-certified and can register purchases or sales of RECs on the New England Power Pool Generation Information System ("NEPOOL GIS"). The New Hampshire PUC is an independent state body that has regulatory authority over utility providers. Electricity providers that do not produce or purchase sufficient RECs to comply with the RPS, are required to make an annual Alternative Compliance Payment ("ACP") on July 1 for the prior calendar year. ACP rates are defined by statute and adjusted annually in relation to the Consumer Price Index by the New Hampshire PUC. The ACP rate often functions as the REC's price ceiling because electric providers will not pay more than the ACP to be RPS compliant.

State-specific RPS obligations or ACP rates can cause REC price fluctuations in the regional market. Once RECs are purchased by an electric provider and the transaction is registered on NEPOOL GIS, they are retired. However, RECs produced in one state can be purchased by providers in another state to meet their obligations if the renewable energy provider acquired

[9] Information from Database of State Incentives for Renewables & Efficiency (DSIRE)

proper certification from the respective state of purchase. In 2014, New Hampshire electric providers purchased roughly eight percent (8%) of the total RECs in the NEPOOL GIS, compared to Massachusetts electric providers who purchased the highest percentage of all RECs in the NEPOOL GIS at thirty-seven percent 37%.[10] Examples of New Hampshire renewable energy utility scale facilities that have come online and can sell RECs are Groton Wind (48 MW), Lempster Wind (24 MW), and the Burgess BioPower plant (76.5 MW). Of note, there are currently no utility scale Photovoltaic ("PV") Solar Arrays in New Hampshire, however in 2016, 72% of all solar capacity installed nationally was utility-scale, and numerous interconnected residential and commercial PV Solar Arrays installations do exist throughout the state.[11]

RPS requirements only apply to investor- or cooperatively-owned retail electric supplying utilities and not to municipal utilities. However, municipal utilities with renewable energy generation facilities are eligible to sell RECs to help fulfill retail electricity provider RPS requirements. Therefore, if the City of Portsmouth formed a municipal utility and became a renewable energy generator to assist in becoming a Net Zero Energy Community, the ability to sell RECs would produce an extra revenue stream making the investments that much more economical. An example from 2014 of a municipal utility helping its community achieve 100% renewable energy is the municipal utility of the City of Burlington, Vermont, purchasing the 7.4 MW Winooski River hydropower facility.[12] Burlington's energy portfolio now consists of hydropower (50%), biomass from wood chips (30%), and landfill methane, wind, & PV Solar Arrays (20%). As a retail choice state, New Hampshire residents are not required to purchase energy from vertically-integrated utilities like they are in traditionally regulated states like Vermont. Formation of a municipal or cooperative utility may lead a retail electricity provider to stop servicing the area making the municipal or cooperative utility the only available option for residents to purchase electricity from. Likewise, implementing a Community Choice Aggregation ("CCA") program for renewable energy could have a similar impact as creating a municipal utility. A CCA program is when municipalities, counties, or other organizations purchase and/or generate electricity for residents and businesses located within the boundaries of their jurisdiction. Three utility scale renewable energy generation facilities the City of Portsmouth could consider pursuing as a municipal utility are a waste-to-energy Regional Anaerobic Digester, biomass at Schiller Station, and offshore wind.

Phase I Recommendations:

Recommendation 21: The City of Portsmouth should consider not just supporting, but strengthening the RPS during the statutory 2018 and 2025 reviews.

Recommendation 22: The City of Portsmouth should consider various options to procure or produce increasing amounts of RECs.

[10] New Hampshire Renewable Portfolio Standard Retrospective 2007 – 2015, August 19, 2016, University of New Hampshire Sustainability Institute, Kristina Harrold, Fellow
[11] Solar Energy Industries Association: https://www.seia.org/solar-industry-data
[12] Cities are ready for 100% clean energy: 10 case studies, Sierra Club, 2017, page 4

Phase II Recommendations:

Recommendation 23: The City of Portsmouth should consider investigating and analyzing opportunities for the City of Portsmouth to develop, promote, or otherwise encourage the production of renewable electricity for use by the Community.

Recommendation 24: The City of Portsmouth should consider exploring for future study forming a municipal or joining a cooperative utility and becoming a utility scale renewable energy generator.

Recommendation 25: If the City of Portsmouth forms a municipal or cooperative utility and becomes a utility scale renewable energy generator, it should consider retaining and retiring or selling excess RECs to other entities through the NEPOOL GIS.

Recommendation 26: The City of Portsmouth should consider exploring Community Choice Aggregation to purchase and/or generate electricity.

1. Waste-to-Energy Regional Anaerobic Digester:

A waste-to-energy Regional Anaerobic Digester will help fulfill the City of Portsmouth's 2025 Master Plan's call for a reduction in landfill diversion rates for government, commercial, & residential users, increased recycling of resources, and increased production of renewable energy. Wastewater Treatment Facilities ("WWTF"), including both the City of Portsmouth's Pierce Island and Pease WWTFs, produce wastewater sludge ("sludge") as a byproduct. The majority of sludge in New England is disposed of in landfills or incinerators. The only WWTFs with anaerobic digestion facilities in New Hampshire are in Nashua, Hanover, and the New Hampshire Department of Environmental Services-run Winnipesauke River Basin Treatment Plant in Franklin.

A waste-to-energy Regional Anaerobic Digester would reduce sewer operating costs for sludge disposal and potentially generate revenues through cogeneration of electricity and tipping fees. Waste organics are ingredients for a sustainable energy source with sludge containing 75 – 85% volatile solids ("VS") that has the biochemical methane potential of 180-220 mL Methane/gram. Further, Fats, Oils, & Grease ("FOG"), dairy waste, and food waste contain 200-600 mL Methane/gram. Such waste is abundant from the Community's restaurant industry, lodging industry, & residential households to help power a waste-to-energy Regional Anaerobic Digester. Further, such a facility may become necessary if the State of New Hampshire bans food wastes from disposal in landfills or incinerators like Vermont, Massachusetts, Connecticut, and Rhode Island have done. Of note, the waste from the City of Portsmouth's expanded food waste composting program that began a residential curbside composting pilot in June 2017, could also be a rich source of energy for a waste-to-energy Regional Anaerobic Digester.

The FY 2018 – 2023 City of Portsmouth Capital Improvement Plan ("CIP") calls for $50,000 to be spent in FY18, $1,500,000 in FY20, and $16,500,000 in FY22 on a Regional Anaerobic Digester at the Pease WWTF. The purpose of the facility is to stabilize the Community's sludge, food wastes, & FOG. Any determination to place a Regional Anaerobic Digester at Pease would require Pease tenant input and approval of the PDA Board of Directors. Among the federal

regulations applicable to land development at Pease is a requirement that land acquired from the Air Force through the Public Benefit Transfer program be used for the sole purpose of supporting the Portsmouth International Airport ("Airport"). Any proposed use that does not bring an economic benefit to the Airport cannot be approved. The onsite generation of renewable energy and the production of excess steam/heat would both likely be an economic benefit to the Airport.

Brown and Caldwell Engineers did a biosolids projection study of twenty nearby entities that produced approximately 25,000 tons (5,280 dry tons of biosolids) in 2017 and could produce nearly 40,000 tons (7,356 dry tons) by 2030.[13] However, significantly more tonnage of biosolids could be available from the region today from both government and private entities that are currently traveling further to have their sludge disposed of in landfills. These entities may be interested in traveling a shorter distance to have their sludge converted into energy instead. The FY18 CIP feasibility study requirement calls for a market assessment of feedstock materials for a Regional Anaerobic Digester at Pease to identify and estimate quantities and types of available organic waste. The FY18 CIP feasibility study requirement also calls for a determination of the sizing, regional participation, and development tipping fee estimates & long term contracts for a Regional Anaerobic Digester at Pease. Further, the FY18 CIP feasibility study requirement also says to consider a public private partnership to share the costs for the construction, operation, & maintenance of the facility.

Phase II Recommendations:

Recommendation 27: The City of Portsmouth should consider beginning discussions on the economic benefits of the generation of onsite renewable energy and the production of excess steam/heat to the Airport with the PDA Board of Directors and collaborate to gain input from Pease tenant units.

Recommendation 28: The City of Portsmouth should consider spending the CIP-allocated funds in FY18 to survey other feasibility studies on anaerobic digestion facilities in the public domain, and then on a feasibility study specifically for a Regional Anaerobic Digester at the Pease WWTF that could at a minimum: conduct a market assessment of feedstock materials to identify and estimate quantities and types of available organic waste; determine the sizing, regional participation, & development tipping fee estimates and long term contracts; and consider a public private partnership to share the costs for the construction, operation, & maintenance of the facility.

Recommendation 29: Staff from the City of Portsmouth should also consider visiting anaerobic / co-digestion facilities like those at the Greater Lawrence Sanitary District in Lawrence, MA, the Lewiston-Auburn Water Pollution Control Authority in Lewiston, ME, and the Village Green private/commercial digester in Brunswick, ME.

[13] Renewable Energy Production from Wastewater Bio-solids - Anaerobic Digestion and Combined Heat and Power, Brown and Caldwell Engineers, August 15, 2017 Presentation to the Renewable Energy Committee

Recommendation 30: Using information from the FY18 feasibility study, the City of Portsmouth should consider spending the CIP allocated funds in in FY20 to design the Regional Anaerobic Digester at the Pease WWTF with input from the PDA.

Recommendation 31: Using the FY20 designs, the City of Portsmouth should consider spending the CIP allocated funds in FY22 to begin construction of a Regional Anaerobic Digester at the Pease WWTF once it has been approved by the PDA.

Recommendation 32: The City of Portsmouth should consider continuing a curbside composting program pilot until it can either independently, or through a contract with an entity, provide curbside composting services to all residential households that receive Municipal Solid Waste and recycling services.

2. Biomass as Schiller Station:

A highly regulated public auction to divest energy generating assets has been ongoing throughout New Hampshire as a result of State legislative efforts in 1996 to restructure the State's electricity markets and become a restructured state. The divesture process is being overseen by the New Hampshire PUC that regulates utility providers such as Eversource New Hampshire, formerly Public Service of New Hampshire ("PSNH") and the state's largest utility. The New Hampshire PUC recently approved Eversource New Hampshire's sale of its three large fossil fuel electric generation facilities and two remote combustion turbines to Granite Shore Power for $175 million.

The sale included the Newington Station, which generates 416 MW through oil and natural gas, and Schiller Station in Portsmouth, which generates 171.1 MW through coal, oil, and biomass. The agreement requires the new owners to keep the plants in service for at least eighteen months, including Units 4 – 6 that are currently active at Schiller Station. Units 4 & 6 have dual residual oil and low sulfur coal capabilities and Unit 5 was retrofitted to burn wood chips, woody biomass, & wood waste products. PSNH had created a special entity for Unit 5 called Northern Wood Power that has been an operational and financial success for PSNH, producing about 50 MW of electricity, and for the local forest products industry, burning 400,000 tons of well-sourced greenhouse gas neutral wood annually.

Municipalities often enter into Power Purchase Agreements ("PPA") with energy providers to purchase energy for Municipal Government Operations. The City of Portsmouth previously met with a Schiller Station prequalified bidder to inquire about entering into a PPA, but specifics regarding the sale of biomass energy from Unit 5 were not discussed because most bidders were interested in the wholesale electricity market and not the retail electricity or REC markets. Further, it is possible that the new owner of Schiller Station may determine that the facility should be repurposed for a different use. However, keeping Schiller Station's existing infrastructure intact could be beneficial.

Phase I Recommendations:

Recommendation 33: The City of Portsmouth should consider entering into PPAs to purchase energy only from renewable sources.

Recommendation 34: The City of Portsmouth should consider entering into a PPA with the owners of Schiller Station to purchase biomass renewable electricity generated from Unit 5.

Phase II Recommendations:

Recommendation 35: The City of Portsmouth should consider for further study purchasing Schiller Station if it goes on the market again, converting Units 4 and/or 6 to biomass like Unit 5, and become a municipal utility that generates sustainably-sourced biomass renewable energy.

Recommendation 36: The City of Portsmouth should consider further studying rezoning the area to ensure that the existing power infrastructure remains capable of future beneficial uses such as energy storage.

3. The Piscataqua River and the Gulf of Maine:

The Piscataqua River and the Gulf of Maine are assets that could potentially produce renewable energy from various technologies such as tidal and offshore wind.

The Piscataqua River's tidal currents between Little Bay and the Gulf of Maine are almost three knots on the incoming tide and four on the ebb. The bipartisan New Hampshire Tidal Energy Commission was established in 2007 to study the feasibility of tidal power generation in the Piscataqua River specifically under the Little Bay & General Sullivan Bridges where there is a big difference between full moon current velocity and neap tide current velocity. In 2008, the commission determined that the technology was too new to install a commercial tidal energy project under the Little Bay & General Sullivan Bridges and that further research on their suitability for tidal rivers with multiple commercial and recreational uses was required.[14] With assistance from the National Oceanic and Atmospheric Administration's ("NOAA") National Sea Grant College Program, the Tidal Power Team at the University of New Hampshire took the lead in researching the development of the first stage of a tidal power generation system for the Piscataqua River.[15] Currently, the University of New Hampshire's Living Bridge Project on the Memorial Bridge is exploring tidal power generation.

NREL has determined that the Gulf of Maine has significant potential wind power capacity in excess of 50 GWs within fifty miles of the coasts of New Hampshire, Maine, & northeast Massachusetts. A bipartisan 2015 New Hampshire legislative study committee concluded that "the wind resource off of New Hampshire's coast has the potential to generate significant amounts of electricity," and that services supporting "offshore wind development has the potential to generate significant economic activity within Portsmouth Harbor."[16] The same 2015 New Hampshire legislative study committee recommended that the Governor explore cooperative offshore wind industry development with Maine and Massachusetts, including regional long-term resource planning facilitated by the federal Bureau of Ocean Energy

[14] Final Report of the NH Tidal Energy Commission, (HB 694, Chapter 222, Laws of 2007), November 2008
[15] Tidal power generation in the Piscataqua River (2008). Zachary Annino, Brian Campelia, Lindsay Coppa, Susan Gagliardi, Sara Lincoln, Robert O'Meara Jr., Issam El Ayadi and Garrett Partridge. Advisors: Kenneth Baldwin and M. Robinson Swift.
[16] Final Report of the Committee to Study Offshore Wind Energy and the Development of Other Ocean Power Technology, (HB 1312m Chapter 180, Laws of 2014), 2015

Management. Such federal involvement requires the Governor to request formation of an intergovernmental Task Force and stakeholder process to plan for regional offshore wind development. In October 2017, the City of Portsmouth passed a resolution supporting efforts to develop wind power off the New Hampshire coast and urged the Governor of New Hampshire to engage other regional leaders and make a formal request to the federal Bureau of Ocean Energy Management to form a Task Force and stakeholder process.

Renewable energy development from the Piscataqua River or the Gulf of Maine would be an economic development opportunity for the region, however it should be noted that environmental concerns are associated with each possible technology.

Phase I Recommendations:

Recommendation 37: The City of Portsmouth should consider encouraging organizations to explore all forms of renewable energy associated with the Piscataqua River or the Gulf of Maine.

Recommendation 38: Upon the establishment of a Task Force by the Bureau of Ocean Energy Management for regional long-term resource offshore wind planning, the City of Portsmouth should consider seeking to become or encouraging others to become a stakeholder and remain active throughout the process.

Phase II Recommendations:

Recommendation 39: Upon completion of the Task Force by the Bureau of Ocean Energy Management, the City of Portsmouth should consider for further study the use of renewable energy from the Piscataqua River or the Gulf of Maine through a PPA or as a municipal utility.

Recommendation 40: If any form of renewable energy associated with the Piscataqua River or the Gulf of Maine is pursued, the City of Portsmouth should also consider studying any related environmental impacts.

B. Commercial Scale Renewable Energy Distributed Generation

The number of commercial scale renewable energy distributed generation facilities in New Hampshire continues to increase and interconnect to the grid.

Revenue from the payment of the ACP in New Hampshire is the sole source of funding for the New Hampshire PUC-administered Renewable Energy Fund ("REF") which offers grants and rebates for renewable energy projects. Since its inception in July 2009, this dedicated, non-lapsing fund's annual competitive grant program has provided around $8 million in grants for twenty-nine industrial or commercial renewable energy projects ranging from the City of Portsmouth receiving $450,000 for the $1,741,392 High School and Madbury Water Treatment Plant's PV Solar Arrays to Berlin receiving $1,000,000 for their $20,048,000 Jericho Power LLC wind turbine project.[17] Of note, the Portsmouth High School is currently just one of eighteen

[17] New Hampshire Renewable Portfolio Standard Retrospective 2007 – 2015, August 19, 2016, University of New Hampshire Sustainability Institute, Kristina Harrold, Fellow

schools in New Hampshire with a PV Solar Array.[18] When funds are available, the REF also offers varying rebates for the following categories: residential PV Solar Arrays or wind turbine for electrical renewable energy; residential PV Solar Arrays for hot water heating; residential central wood pellet boiler / furnace heating system; commercial & industrial PV Solar Array technologies; and commercial & industrial central wood pellet boiler / furnace heating systems.

Examples of commercial scale renewable energy distributed generation facilities include Solar PV at the Peterborough Wastewater Treatment facility, Plymouth Wastewater Treatment facility, & Durham Town Solar, as well as small scale hydro facilities such as Steels Pond Hydro in Antrim and Spaulding Avenue Industrial in Rochester.

Phase I Recommendations:

Recommendation 41: The City of Portsmouth should consider not just supporting, but strengthening the REF during the statutory 2018 and 2025 reviews.

Recommendation 42: The City of Portsmouth should consider continually having commercial scale renewable energy distributed generation facility applications ready for when ACP grant funds become available.

Recommendation 43: The City of Portsmouth should consider installation of additional renewable energy generating or energy storage technologies on public land and buildings.

Phase II Recommendations:

Recommendation 44: The City of Portsmouth should consider advertising the ACP rebates on the City's website's landing page.

C. Residential Scale Renewable Energy Distributed Generation

Solar PV is currently one of the most popular forms of renewable energy distributed generation and is growing at a record pace. According to the Solar Energy Industries Association ("SEIA"), installations in 2016 created 39% of all new electric generating capacity, more than any other technology for the first time, total Solar PV electrical generation in the United States has gone from just 0.1% in 2010 to 1.4% today, & by 2020 Solar PV is expected to surpass 3% of total electrical generation reach 5% by 2022. Further, one million PV Solar Arrays installations occurred in 2016, two million are anticipated to be achieved in 2018, and four million in 2022. Part of the reason for this is the cost to install PV Solar Arrays has become more competitive, dropping by more than 70% since 2010 and, depending on segment, from 3 - 11% over the last 12 months.[19] New Hampshire is a viable market for PV Solar Arrays given that in the third quarter of 2017 neighboring Massachusetts received the sixth highest SEIA state ranking by producing 1,898 MW.

[18] Solar Energy Industries Association: https://www.seia.org/solar-industry-data
[19] Solar Energy Industries Association: https://www.seia.org/solar-industry-data

State	SEIA 2015 50 State Ranking	SEIA 2016 50 State Ranking	SEIA 2017 Q3 50 State Ranking
Massachusetts	3	8	6
Connecticut	14	21	15
New Hampshire	27	27	24
Vermont	16	24	25
Rhode Island	42	40	37

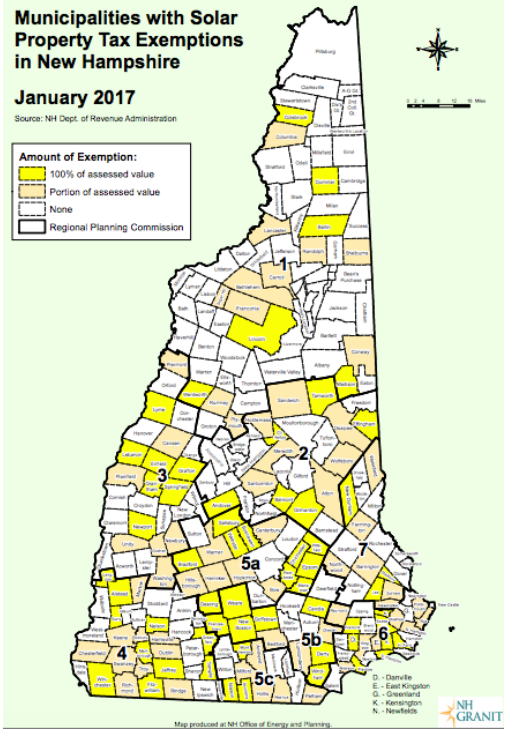
The typical payback for a Solar PV Array installation is around six years, for an individual or for-profit business. A non-profit has a longer payback if it cannot take advantage of the federal tax credit, however creative financing solutions such as PPAs are popular solutions for non-profits and municipalities. It is noteworthy that although there are currently no utility scale PV Solar Arrays in New Hampshire for a PPA, nationally utility scale PV Solar Array PPAs sell electricity from $28 to $45 per MWh. Of note, technology advancements have allowed three to five acres of Solar PV Arrays to be capable of generating 1 MW of electricity output and a single watt of Solar PV electricity now costs less than a dollar to generate.

Net metering is a popular benefit of being a renewable energy distributed generator connected to a public-utility power grid. Net metering is a term used for receiving credit for offsetting consumption and potentially transferring surplus electricity onto the public-utility grid. At the end of 2015, approximately 27 MW (over 3,400 customers) of net metered, distributed PV Solar Arrays was interconnected to New Hampshire distribution utilities.[20] The New Hampshire PUC recently stabilized the net metering market by eliminating New Hampshire's 100 MW limit on PV Solar Arrays power eligible for net metering. Residential systems in New Hampshire still receive a monthly credit at one hundred percent of retail energy and transmission rates, but only twenty five percent of the distribution rates. Further, the New Hampshire PUC ruling grandfathered all existing net metering systems through 2040 at current rates. In addition to benefiting from traditional net metering electricity, residential renewable energy generators can install a group net metering system and sell excess net metered power to neighbors or anyone in the same utility. Further, residential renewable energy generators can also produce and sell RECs.

Under New Hampshire law, cities and municipalities can incentivize commercial and residential scale renewable energy distributed generation with property tax exemptions. The two current property tax exemptions are only for PV Solar Arrays and wind energy systems. Under each exemption, the city or municipality can exempt the assessed value of the system from the

[20] New Hampshire Renewable Portfolio Standard Retrospective 2007 – 2015, August 19, 2016, University of New Hampshire Sustainability Institute, Kristina Harrold, Fellow

property owner's property taxes. Some cities and municipalities chose to only exempt a portion of assessed value of the systems using various methodologies. The City of Portsmouth has currently only adopted the PV Solar Arrays exemption, but has limited the PV Solar Arrays exemption to an assessed value of $25,000 and five years.



Under New Hampshire law, cities and municipalities can also adopt zoning ordinances to encourage the installation of renewable energy distributed generation systems. Such ordinances can protect access to energy sources by regulating building orientation, establishing maximum building heights, and encouraging PV Solar Arrays sky space easements. For example, the zoning ordinance of Hollis includes definitions, conditional use permits conditions, and standards of review. Further, the City of Portsmouth's Historic District Commission currently makes ad hoc Solar PV array decisions based on factors such as their visibility, profile, and color consistency, despite telephone poles, transformers, and power lines being allowed in Portsmouth's Historic District. The NREL recommends the adoption of Historic District Solar Array policies that allow for more visible PV Solar Arrays in Historic Districts after other energy efficiency upgrades have been made.[21]

Phase I Recommendations:

Recommendation 45: The City of Portsmouth should consider investigating a routine load-sharing program whereby peak demand energy use is reduced and operational changes are instituted to lessen overall energy demand year-round.

Phase II Recommendations:

Recommendation 46: The City of Portsmouth should consider supporting legislation that both protects net metering and is more favorable to renewable energy distributed generation.

Recommendation 47: The City of Portsmouth should consider supporting group net metering.

Recommendation 48: The City of Portsmouth should consider expanding the Solar Energy Systems Exemption under N.H R.S.A. 72:62 by eliminating the self-imposed five-year time limit and $25,000 maximum deduction.

[21] Implementing Solar PV Projects on Historic Buildings and in Historic Districts, National Renewable Energy Laboratory, A. Kandt, E. Hotchkiss, and A. Walker, September 2011

Recommendation 49: The City of Portsmouth should consider enacting the Wind-Powered Energy Systems Exemption under N.H. R.S.A. 72:66.

Recommendation 50: The City of Portsmouth should consider supporting legislation for similar exemptions for other sources of renewable energy distributed generation such as geothermal or wood pellets.

Recommendation 51: The City of Portsmouth should consider adopting a Renewable Energy System Zoning Ordinance under N.H R.S.A. 674:17 to encourage and protect energy access.

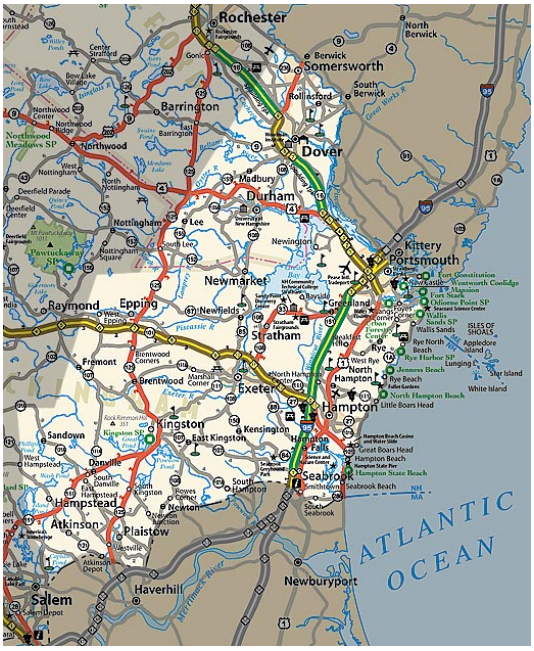
Recommendation 52: The City of Portsmouth should consider revisiting recent limitations that were placed on rooftop solar arrays with the adoption of the 2015 International Fire Code in any Renewable Energy System Zoning Ordinance.

Recommendation 53: The City of Portsmouth should consider expediting the building permit and inspection process as well as lowering permitting fees for renewable energy distributed generation systems.

Recommendation 54: The City of Portsmouth should consider adopting a policy that allows more visible PV Solar Arrays in the Historic District.

Recommendation 55: The City of Portsmouth should consider engaging the public by having resources for residents who want to install renewable energy distributed generation systems on the City website's landing page.

STRATEGY 3: Decrease Conventional Automobile Use



Portsmouth is located within a highly developed regional transportation network that is accessible by water, air, rail, and road. The City is home of the Port of New Hampshire, the Pease International Tradeport, and the Portsmouth International Airport. Further, Portsmouth has freight rail service on the 3.5-mile Newington Branch and the 10-mile Portsmouth Branch that connects the City to the main line in Newfields. Transportation options in Portsmouth however are predominantly automobile dependent with Interstate 95, US Route 1, and NH Route 16 making the City a gateway to New Hampshire's lakes, mountains, and coast. Private automobiles remain the primary mode of travel, although COAST, Wildcat Transit, C&J, and Greyhound all provide public access along primary corridors to Portsmouth, other Seacoast communities, and the wider region.

The City of Portsmouth encourages car-lite lifestyles with the adoption of the recent Gateway Mixed Use Zoning Districts, a bicycle share program, and the Complete Streets, Bicycle Friendly, & Walk Friendly Policies. However, the car-dependent lifestyle is unlikely to change in

the near future, making Electric Vehicles ("EV") the best way to reduce Portsmouth's Greenhouse Gas Emissions from transportation. As noted, Phase III focusing on all vehicles traveling in and through the City of Portsmouth achieving Net Zero Energy is distinct from Phase II as an acknowledgement of the amount of time that may be required to accomplish this goal. However, Massachusetts, Maine, and Vermont have all adopted California's Low Emission Vehicle and Zero Emission Vehicle Regulations that are challenging automakers to produce hundreds of thousands of EVs by 2020 and Portsmouth relies on tourists from these states. Further, Massachusetts is aggressively pursuing these targets by offering an additional $2,500 rebate to buyers at the time of purchase and Portsmouth is within ninety miles from most towns around Boston whose residents may soon start planning their vacations based around EV charging infrastructure.

Fuel efficiency gains in conventional automobiles have diminishing returns because only twenty percent of their energy expended powers their drivetrains. Meanwhile, EVs immediately lower Greenhouse Gas emissions and are significantly more energy efficient converting sixty percent of the energy expended towards powering their drivetrains. Current EVs on the market are reliable, require minimal associated maintenance, and can be affordable with the federal income tax credit of up to $7,500. The traditional four door, five person, EV sedan is not for everyone and new EVs are coming to market to meet the unique demands of those that drive minivans, Sport Utility Vehicles, or light trucks. In addition to the Battery only EV ("BEV"), less expensive Plug in Hybrid EVs ("PHEV") use their batteries for local transit and their fuel efficient gasoline engines for highway or long distance commutes. PHEVs have a very high miles per gallon rating for blended city/highway compared to traditional Hybrids. Consumer EV research can be time consuming and in response to EV buyers often reporting that automobile dealerships were often uninformed about their EVs, manufacturers are now beginning to require their dealerships designate, train, and certify specific agents to sell their new EV models. Anyone interested in EVs should be encouraged to attend events like National Drive Electric Week in September, which in 2017 Portsmouth joined over 260 similar events across the country to participate in.

Single family homeowners with off street parking are the best targets for early EV adoption. The 110 volt Level 1 charger that comes free with most EVs can plug into the typical alternating current ("AC") three prong outlet, allows a PHEV to travel three to five miles per hour charged, and after ten hours will fully charge a PHEV parked overnight. Likewise, a Level 1 charger can fully charge overnight the battery of a BEV that only travels the national automobile average of thirty miles a day. However, a BEV that commutes between thirty and sixty miles on weekdays would require a $500 Level 2 charger and require installation of a $600, 240 volt AC circuit to a 200 amp garage service panel, eliminating the gasoline savings from the first year of EV ownership. Even more challenging is the common scenario in Portsmouth of a homeowner driving over sixty miles on weekdays to work or owning an old home with a minimal 100 amp service panel that could require $1,600 – 3,000 of electrical work to upgrade. Level 3 480 volt direct current ("DC") chargers, or DC Fast Chargers, can charge an EV in less than thirty minutes, but can cost $40,000 – 90,000, require commercial installation, and are not compatible with all EVs. However, the greatest challenge in Portsmouth are homeowners that lack off street parking, those that live in condominiums, and tenants renting apartments.

Eighty percent of EV charging occurs at the home, but destination, workplace, and public EV charging stations will play an increasingly important role in expanding EV adoption. Many municipalities committed to increasing EV electrification have adopted building codes that require preinstalled circuits for EV chargers because the cost and effort is significantly reduced during construction or remodels. Incentives for the installation of EV charging stations, or at least the installation of wiring circuits, could encourage large hotels, retail stores, or employers to install EV charging stations for their guests, customers, or employees. Smaller businesses that do not have the means to install their own EV charging stations may be interested in sponsoring public EV charging stations. Municipal workplace EV charging stations are great for employee charging during the workday and the municipal fleet charging overnight, although dedicated stations that use some form of Radio-frequency identification ("RFID") are also often needed for a municipal fleet. Finally, public EV charging stations both attract business and provide options for homeowners without off street parking, condominium owners, and apartment tenants.

Different types of public EV charging stations exist such as combinations of Level 1, Level 2, and DC Fast Chargers being located in parking garages, easily accessible distributed parking lots, and highly visible on street parking locations near popular attractions. DC Fast Chargers stations are becoming common near major travel corridors that are collocated with suitable amenities such as food, rest rooms, & recreation options. Municipalities often use a phased installation approach to expand electrical capacity, collect utilization feedback, and accompany planned street work, renovations, or new construction. Different payment options exist for the users of public EV charging stations such as free electricity on a first come first serve basis, free electricity coupled with parking rates like in the High Hanover Garage, or Durham's network fee. Meanwhile, fee structures can charge by time, electricity usage, or a combination of both with costs rising when the charge is complete to incentivize sharing. Of note, the State of New Hampshire has filed to become a beneficiary for approximately $31 million in environmental remediation from the Volkswagen emissions settlement that could potentially go towards public EV charging stations in Portsmouth given it is an automobile gateway.

Not all EV charging stations are the same with some characteristics being more desirable like cable-suspended systems that are much cleaner, easier to maintain, and provide a better user experience than the less expensive loose cable systems. Data monitoring is a feature that can help acquire critical information like how Durham's Small Town EV Pilot obtained two years of information on utilization, return on investment, and the geographical characteristics of users. Arguably more important are communication and network discovery features for the EV charging station to be located by common smartphone apps including PlugShare and other EV network maps. Further, text and email capabilities can notify users when charging is complete and manage waitlists. Finally, web based, multi-user configuration helps identify station problems, while well designed web interfaces allow pricing and other tasks to be performed quickly. In addition, the installation of Solar PV arrays combined with battery storage or other renewable energy sources greatly improve the profile of electrification. A highly visible EV

charging station promotes EV adoption, offsets potential EV buyer concern about where they will be able to find public charging, and makes a statement that Portsmouth is committed to reducing Greenhouse Gases.

Phase I Recommendations:

Recommendation 56: The City of Portsmouth should consider adopting a green fleet policy for new and replacement municipal vehicle acquisition.

Recommendation 57: The City of Portsmouth should consider installing additional Level 1, Level 2, and DC Fast Charger stations for the green fleet.

Phase III Recommendations:

Recommendation 58: If needed, the City of Portsmouth should consider ways it could help C&J Bus Lines provide additional parking for commuters.

Recommendation 59: The City of Portsmouth should consider continuing the bicycle share program, expanding it to neighborhoods, and explore the possibility of expanding into Kittery, ME.

Recommendation 60: The City of Portsmouth should consider supporting increased passenger rail.

Recommendation 61: The City of Portsmouth should consider helping promote ride and drive events like National Drive Electric Week.

Recommendation 62: During vehicle registration, the City of Portsmouth should consider helping educate drivers about the EV federal income tax credit, especially to residents already driving compact fuel efficient automobiles to transition them to PHEVs.

Recommendation 63: The City of Portsmouth should consider engaging the public by having resources on the City vehicle registration web page that offers links that help explain the different types of EVs and charging stations.

Recommendation 64: The City of Portsmouth should consider reaching out to neighborhood groups to help educate single family homeowners with off street parking about home charging options.

Recommendation 65: The City of Portsmouth should consider forming a focus group comprising current EV owners to better understand what it will take to increase EV ownership in different use scenarios.

Recommendation 66: The City of Portsmouth could consider reaching out to local automobile dealerships and inform their management of Portsmouth’s plan and encourage EV ownership.

Recommendation 67: The City of Portsmouth should consider ensuring that the EV charger installation permitting process is streamlined for electricians and communicated to homeowners and businesses.

Recommendation 68: The City of Portsmouth should consider incentivizing workplace EV charging stations consisting of Level 1, Level 2, and DC Fast Chargers or at least the installation of wiring circuits.

Recommendation 69: The City of Portsmouth should consider allowing businesses to sponsor public EV charging stations consisting of Level 1, Level 2, and DC Fast Chargers.

Recommendation 70: The City of Portsmouth should consider increasing the profile and wayfinding signage for existing and new EV charging stations.

Recommendation 71: The City of Portsmouth should consider installing the wiring of circuits for Level 1, Level 2, and DC Fast Chargers when maintenance is performed on public parking lots.

Recommendation 72: The City of Portsmouth should consider installing high visibility public EV charging stations consisting of Level 1, Level 2, and DC Fast Chargers with possible charging incentives for residents.

Recommendation 73: The City of Portsmouth should consider installing Solar PV arrays, other renewable energy sources, or battery storage at municipal EV charging stations to improve the profile of transportation electrification.

Recommendation 74: If the State of New Hampshire is certified as a beneficiary of the Volkswagen emissions settlement, the City of Portsmouth should consider requesting funding for EV charging stations.

CONCLUSION

These Policy Recommendations provide suggestions for guidance the City Manager can give City Boards, Committees, and Departments to obtain the 2025 Master Plan's vision of becoming a Net Zero Energy Community. The Policy Recommendations' three strategies of increasing residential & commercial building energy efficiency, increasing renewable energy production, and decreasing conventional automobile use leave the flexibility required to achieve the concurrent Policy phases that focus on Municipal Government Operations, the Community, and all vehicular travel through the City of Portsmouth each achieving Net Zero Energy. The City Manager is not limited by the Policy Recommendations and is encouraged to pursue additional means to achieve the Policy's vision.

Recommendation 75: The City of Portsmouth should consider updating the Policy Recommendations with new recommendations by a successor committee to the Renewable Energy Committee or at the direction of the City Manager.

APPENDIX A

RENEWABLE ENERGY POLICY RECOMMENDATIONS BY PHASE

PHASE I: Municipal Government Operations achieving Net Zero Energy

Recommendation 1: The City of Portsmouth should consider adopting its own version of the National Renewable Energy Laboratory's ("NREL") hierarchy such as first striving for renewables sited on the built environment within the Community and then seek to bring renewable energy into the Community from areas located outside of the Community boundary but within the region.

Recommendation 2: The City of Portsmouth should consider measuring Greenhouse Gas Emissions in 2018 and use similar or better metrics that the 2012 measurements can be converted into.

Recommendation 3: Using similar or better metrics that the previous data can be converted into, the City of Portsmouth should consider increasing the frequency of the Greenhouse Gas Emissions measurements.

Recommendation 4: The City of Portsmouth should consider conducting an updated energy audit of all municipal facilities and implement energy conservation measures where needed, or implement a retro-commissioning program of facilities in which upgrades were enacted within the last 5 years.

Recommendation 10: The City of Portsmouth should consider adoption of a known national sustainable design certification standard as the design and construction minimum for the renovation or construction of all municipal facilities.

Recommendation 21: The City of Portsmouth should consider not just supporting, but strengthening the Renewable Portfolio Standard ("RPS") during the statutory 2018 and 2025 reviews.

Recommendation 22: The City of Portsmouth should consider various options to procure or produce increasing amounts of Renewable Energy Credits ("REC").

Recommendation 33: The City of Portsmouth should consider only entering into Power Purchase Agreements ("PPA") to purchase energy from renewable sources.

Recommendation 34: The City of Portsmouth should consider entering into a PPA with the owners of Schiller Station to purchase biomass renewable electricity generated from Unit 5.

Recommendation 37: The City of Portsmouth should consider encouraging organizations to explore all forms of renewable energy associated with the Piscataqua River or the Gulf of Maine.

Recommendation 38: Upon the establishment of a Task Force by the Bureau of Ocean Energy Management for regional long-term resource offshore wind planning, the City of Portsmouth

should consider seeking to become or encouraging others to become a stakeholder and remain active throughout the process.

Recommendation 41: The City of Portsmouth should consider not just supporting, but strengthening the Renewable Energy Fund ("REF") during the statutory 2018 and 2025 reviews.

Recommendation 42: The City of Portsmouth should consider continually having commercial scale renewable energy distributed generation facility applications ready for when Alternative Compliance Payments ("ACP") grant funds become available.

Recommendation 43: The City of Portsmouth should consider installation of additional renewable energy generating or energy storage technologies on public land and buildings.

Recommendation 45: The City of Portsmouth should consider investigating a routine load-sharing program whereby peak demand energy use is reduced and operational changes are instituted to lessen overall energy demand year-round.

Recommendation 56: The City of Portsmouth should consider adopting a green fleet policy for new and replacement municipal vehicle acquisition.

Recommendation 57: The City of Portsmouth should consider installing additional Level 1, Level 2, and DC Fast Charger stations for the green fleet.

Recommendation 75: The City of Portsmouth should consider updating the Policy Recommendations with new recommendations by a successor committee to the Renewable Energy Committee or at the direction of the City Manager.

***PHASE II:* the Portsmouth Community achieving Net Zero Energy**

Recommendation 5: The City of Portsmouth should consider requiring / facilitating energy audits and encourage implementing energy conservation measures where needed.

Recommendation 6: The City of Portsmouth should consider engaging the public by having resources for residents who want to find out more about energy efficiency programs like NHSaves on the City website's landing page.

Recommendation 7: The City of Portsmouth should consider supporting amendments that improve the Commercial PACE ("C-PACE") enabling statute, N.H. R.S.A. 53-F, and then adopt the enabling legislation to create C-PACE districts.

Recommendation 8: The City of Portsmouth should consider using its bond rating to explore offering financing options similar to PACE for retrofits or renewable energy distributed generation systems at a lower rate than individuals could obtain.

Recommendation 9: The City of Portsmouth should consider removing any barriers in the land use ordinances to enable the addition of exterior insulation and improve the efficiency in renovations to existing buildings while being sensitive to both historic preservation and fire & life safety.

Recommendation 11: The City of Portsmouth should consider adopting a more recent version of the International Energy Conservation Code ("IECC") than required by state law.

Recommendation 12: The City of Portsmouth should consider supporting legislation that adopts the 2015 IECC, 2018 IECC, or any future IECC updates.

Recommendation 13: The City of Portsmouth should consider creating an Energy Efficiency Chapter in the Zoning Ordinance that either creates a Sustainable Energy Efficient Development ("SEED") Overlay Zoning District that allows for floor area ratio bonuses and building height relaxations as incentives for new buildings that achieve a known national sustainable design certification or adds the same incentives to current Zoning Overlay Districts.

Recommendation 14: The City of Portsmouth should consider scaling any incentives for obtaining a national sustainable design certification standard by order of project magnitude.

Recommendation 15: The City of Portsmouth should consider providing for reductions in permit fees for projects that incorporate exceptional sustainable design standards.

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Recommendation 46: The City of Portsmouth should consider supporting legislation that both protects net metering and is more favorable to renewable energy distributed generation.

Recommendation 47: The City of Portsmouth should consider supporting group net metering.

Recommendation 48: The City of Portsmouth should consider expanding the Solar Energy Systems Exemption under N.H. R.S.A. 72:62 by eliminating the self-imposed five-year time limit and $25,000 maximum deduction.

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Recommendation 50: The City of Portsmouth should consider supporting legislation for similar exemptions for other sources of renewable energy distributed generation such as geothermal or wood pellets.

Recommendation 51: The City of Portsmouth should consider adopting a Renewable Energy System Zoning Ordinance under N.H. R.S.A. 674:17 to encourage and protect energy access.

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***PHASE III*: Vehicles originating in and traveling through the City of Portsmouth achieving Net Zero Energy**

Recommendation 58: If needed, the City of Portsmouth should consider ways it could help C&J Bus Lines provide additional parking for commuters.

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Recommendation 70: The City of Portsmouth should consider increasing the profile and wayfinding signage for existing and new EV charging stations.

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Recommendation 72: The City of Portsmouth should consider installing high visibility public EV charging stations consisting of Level 1, Level 2, and DC Fast Chargers with possible charging incentives for residents.

Recommendation 73: The City of Portsmouth should consider installing Solar PV arrays, other renewable energy sources, or battery storage at municipal EV charging stations to improve the profile of transportation electrification.

Recommendation 74: If the State of New Hampshire is certified as a beneficiary of the Volkswagen emissions settlement, the City of Portsmouth should consider requesting funding for EV charging stations.

APPENDIX B

RENEWABLE ENERGY POLICY RECOMMENDATIONS BY STRATEGY

INTRODUCTION

Recommendation 1: The City of Portsmouth should consider adopting its own version of the National Renewable Energy Laboratory's ("NREL") hierarchy such as first striving for renewables sited on the built environment within the Community and then seek to bring renewable energy into the Community from areas located outside of the Community boundary but within the region.

Recommendation 2: The City of Portsmouth should consider measuring Greenhouse Gas Emissions in 2018 and use similar or better metrics that the 2012 measurements can be converted into.

Recommendation 3: Using similar or better metrics that the previous data can be converted into, the City of Portsmouth should consider increasing the frequency of the Greenhouse Gas Emissions measurements.

STRATEGY 1: Increase Building Energy Efficiency

Recommendation 4: The City of Portsmouth should consider conducting an updated energy audit of all municipal facilities and implement energy conservation measures where needed, or implement a retro-commissioning program of facilities in which upgrades were enacted within the last five years.

Recommendation 5: The City of Portsmouth should consider requiring / facilitating energy audits and encourage implementing energy conservation measures where needed.

Recommendation 6: The City of Portsmouth should consider engaging the public by having resources for residents who want to find out more about energy efficiency programs like NHSaves on the City's website's landing page.

Recommendation 7: The City of Portsmouth should consider supporting amendments that improve the Commercial PACE ("C-PACE") enabling statute, N.H. R.S.A. 53-F, and then adopt the enabling legislation to create C-PACE districts.

Recommendation 8: The City of Portsmouth should consider using its bond rating to explore offering financing options similar to PACE for retrofits or renewable energy distributed generation systems at a lower rate than individuals could obtain.

Recommendation 9: The City of Portsmouth should consider removing any barriers in the land use ordinances to enable the addition of exterior insulation and improve the efficiency in renovations to existing buildings while being sensitive to both historic preservation and fire & life safety.

Recommendation 10: The City of Portsmouth should consider adoption of a known national sustainable design certification standard as the design and construction minimum for the renovation or construction of all municipal facilities.

Recommendation 11: The City of Portsmouth should consider adopting a more recent version of the International Energy Conservation Code ("IECC") than required by state law.

Recommendation 12: The City of Portsmouth should consider supporting legislation that adopts the 2015 IECC, 2018 IECC, or any future IECC updates.

Recommendation 13: The City of Portsmouth should consider creating an Energy Efficiency Chapter in the Zoning Ordinance that either creates a Sustainable Energy Efficient Development ("SEED") Overlay Zoning District that allows for floor area ratio bonuses and building height relaxations as incentives for new buildings that achieve a known national sustainable design certification or adds the same incentives to current Zoning Overlay Districts.

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STRATEGY 2: Increase Renewable Energy Production

Recommendation 21: The City of Portsmouth should consider not just supporting, but strengthening the Renewable Portfolio Standard ("RPS") during the statutory 2018 and 2025 reviews.

Recommendation 22: The City of Portsmouth should consider various options to procure or produce increasing amounts of Renewable Energy Credits ("REC").

Recommendation 23: The City of Portsmouth should consider investigating and analyzing opportunities for the City of Portsmouth to develop, promote, or otherwise encourage the production of renewable electricity for use by the Community.

Recommendation 24: The City of Portsmouth should consider exploring for future study forming a municipal utility to become a utility scale renewable energy generator.

Recommendation 25: If the City of Portsmouth forms a municipal utility to become a utility scale renewable energy generator, it should consider selling excess RECs through the New England Power Pool Generation Information System ("NEPOOL GIS").

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Recommendation 33: The City of Portsmouth should consider only entering into Power Purchase Agreements ("PPA") to purchase energy from renewable sources.

Recommendation 34: The City of Portsmouth should consider entering into a PPA with the owners of Schiller Station to purchase biomass renewable electricity generated from Unit 5.

Recommendation 35: The City of Portsmouth should consider for further study purchasing Schiller Station if it goes on the market again, converting Units 4 and/or 6 to biomass like Unit 5, and become a municipal utility to generate biomass renewable energy.

Recommendation 36: The City of Portsmouth should consider further studying rezoning the area to ensure that the existing power infrastructure stays intact for a future uses such as energy storage.

Recommendation 37: The City of Portsmouth should consider encouraging organizations to explore all forms of renewable energy associated with the Piscataqua River or the Gulf of Maine.

Recommendation 38: Upon the establishment of a Task Force by the Bureau of Ocean Energy Management for regional long-term resource offshore wind planning, the City of Portsmouth should consider seeking to become or encouraging others to become a stakeholder and remain active throughout the process.

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Recommendation 42: The City of Portsmouth should consider continually having commercial scale renewable energy distributed generation facility applications ready for when Alternative Compliance Payments ("ACP") grant funds become available.

Recommendation 43: The City of Portsmouth should consider installation of additional renewable energy generating or energy storage technologies on public land and buildings.

Recommendation 44: The City of Portsmouth should consider advertising the ACP rebates on the City's website's landing page.

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STRATEGY 3: Decrease Conventional Automobile Use

Recommendation 56: The City of Portsmouth should consider adopting a green fleet policy for new and replacement municipal vehicle acquisition.

Recommendation 57: The City of Portsmouth should consider installing additional Level 1, Level 2, and DC Fast Charger stations for the green fleet.

Recommendation 58: If needed, the City of Portsmouth should consider ways it could help C&J provide additional parking for commuters.

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CONCLUSION

Recommendation 75: The City of Portsmouth should consider updating the Policy Recommendations with new recommendations by a successor committee to the Renewable Energy Committee or at the direction of the City Manager.

APPENDIX C

RENEWABLE ENERGY POLICY RECOMMENDATIONS BY STAKEHOLDER

DEPARTMENT OF PUBLIC WORKS

Recommendation 1: The City of Portsmouth should consider adopting its own version of the National Renewable Energy Laboratory's ("NREL") hierarchy such as first striving for renewables sited on the built environment within the Community and then seek to bring renewable energy into the Community from areas located outside of the Community boundary but within the region.

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FINANCE DEPARTMENT

Recommendation 8: The City of Portsmouth should consider using its bond rating to explore offering financing options similar to PACE for retrofits or renewable energy distributed generation systems at a lower rate than individuals could obtain.

Recommendation 48: The City of Portsmouth should consider expanding the Solar Energy Systems Exemption under N.H. R.S.A. 72:62 by eliminating the self-imposed five-year time limit and $25,000 maximum deduction.

Recommendation 49: The City of Portsmouth should consider enacting the Wind-Powered Energy Systems Exemption under N.H. R.S.A. 72:66.

Recommendation 62: During vehicle registration, the City of Portsmouth should consider helping educate drivers about the Electric Vehicle ("EV") federal income tax credit, especially to residents already driving compact fuel efficient automobiles to transition them to Plug in Hybrid EVs ("PHEV").

Recommendation 74: If the State of New Hampshire is certified as a beneficiary of the Volkswagen emissions settlement, the City of Portsmouth should consider requesting funding for EV charging stations.

Recommendation 75: The City of Portsmouth should consider updating the Policy Recommendations with new recommendations by a successor committee to the Renewable Energy Committee or at the direction of the City Manager.

CITY WEBSITE

Recommendation 6: The City of Portsmouth should consider engaging the public by having resources for residents who want to find out more about energy efficiency programs like NHSaves on the City's website's landing page.

Recommendation 19: The City of Portsmouth should consider engaging the public by having resources for developers who want to find out more about national sustainable design certification standards on the City's website's landing page.

Recommendation 20: The City of Portsmouth should consider engaging the public by having resources for building owner, occupant, and developer energy efficiency education on the City's website's landing page.

Recommendation 44: The City of Portsmouth should consider advertising the ACP rebates on the City's website's landing page.

Recommendation 55: The City of Portsmouth should consider engaging the public by having resources for residents who want to install renewable energy distributed generation systems on the City's website's landing page.

Recommendation 63: The City of Portsmouth should consider engaging the public by having resources on the City vehicle registration page that offers links that help explain the different types of EVs and charging stations.

LEGISLATION

Recommendation 7: The City of Portsmouth should consider supporting amendments that improve the Commercial PACE ("C-PACE") enabling statute, N.H. R.S.A. 53-F, and then adopt the enabling legislation to create C-PACE districts.

Recommendation 12: The City of Portsmouth should consider supporting legislation that adopts the 2015 IECC, 2018 IECC, or any future IECC updates.

Recommendation 21: The City of Portsmouth should consider not just supporting, but strengthening the Renewable Portfolio Standard ("RPS") during the statutory 2018 and 2025 reviews.

Recommendation 41: The City of Portsmouth should consider not just supporting, but strengthening the Renewable Energy Fund ("REF") during the statutory 2018 and 2025 reviews.

Recommendation 46: The City of Portsmouth should consider supporting legislation that both protects net metering and is more favorable to renewable energy distributed generation.

Recommendation 50: The City of Portsmouth should consider supporting legislation for similar exemptions for other sources of renewable energy distributed generation such as geothermal or wood pellets.

Recommendation 60: The City of Portsmouth should consider supporting increased passenger rail.