CADMUS

City of Keene Renewable Energy Transition Analysis

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Prepared for:

The City of Keene

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Introduction and Background

Keene Renewable Energy Goals

In January 2019, the Keene City Council adopted a goal to achieve:

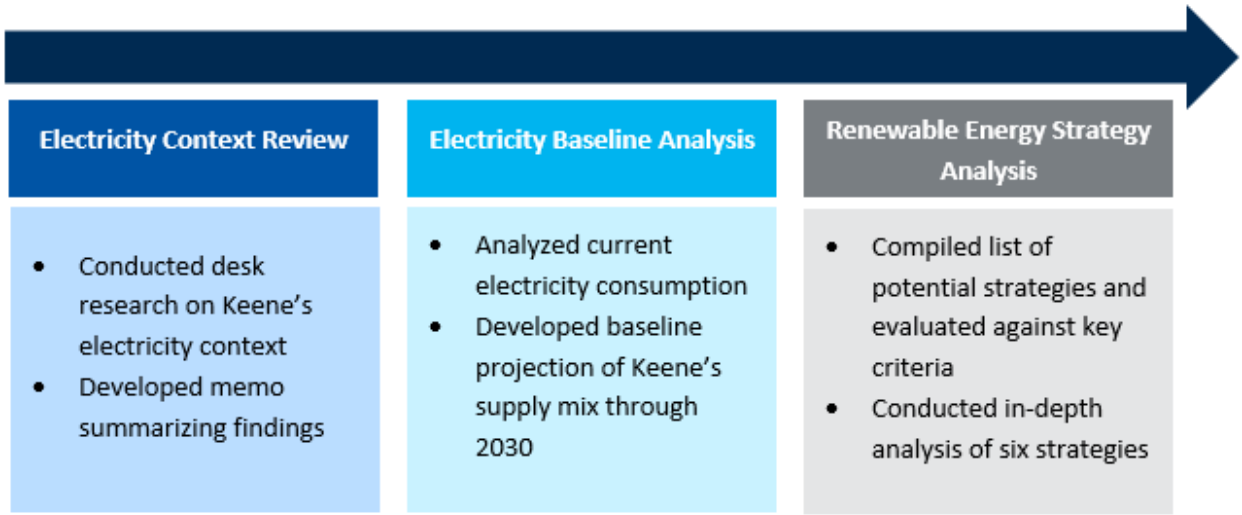
- 100% of all electricity consumed in the City will come from renewable sources by 2030
- 100% of all thermal energy and energy used for transportation will come from renewable sources by 2050

The resolution further calls for the City to develop a strategic plan by December 2020 to meet these renewable energy goals through a transparent and inclusive stakeholder process. As such, the City of Keene hired The Cadmus Group to identify and evaluate renewable energy strategies to achieve the City's 2030 renewable electricity goal.

Objective and Approach

Local governments across the United States are employing a wide range of strategies to achieve their renewable energy goals. However, the viability and impact of a given strategy across communities depending on contextual factors, such as state-level regulation, utility type, and local factors. The purpose of this report is to provide the City of Keene with actionable strategies given their specific policy and regulatory context to achieve their renewable electricity goals along with targeted implementation guidance for pursuing the selected strategies. The Cadmus Team's process for identifying these strategies is summarized in Figure 1 below:

Figure 1: Summary of Cadmus Process



1. **Electricity Context Review**. At the outset of the project, the Cadmus Team conducted a review of Keene's electricity context, including state, utility, and local electricity market context, as well as key renewable energy policies, to provide a foundational understanding of Keene's local barriers and opportunities related to increased renewable energy deployment. The findings of this review supported the development of the electricity baseline scenario and the identification of strategy options Keene could leverage to achieve 100% renewable electricity. For more information, see the Electricity Context section.
2. **Electricity Baseline Analysis**. Next, the Cadmus Team analyzed current electricity consumption in Keene and developed a baseline, or business as usual, scenario forecast of likely changes in the electric power mix during the planning period (present-2030) without any further action from the City. This analysis helps the City to better understand the magnitude of change that will be necessary to meet its 2030 goals. For more information, see the Electricity Baseline section.
3. **Renewable Energy Strategy Analysis**. Lastly, the Cadmus Team identified a list of 16 strategies that are actionable and appropriate in the City of Keene and analyzed them against key criteria identified through conversations with City staff. With insights from this prioritization exercise, the Keene Energy and Climate Committee selected six strategies for the Cadmus Team to explore in more detail. For each strategy, the Cadmus Team developed a description, key benefits and challenges, implementation steps, and relevant examples. For more information, see the Strategy Analysis and Findings section.

Electricity Context

At the outset of the project, the Cadmus Team reviewed Keene's state, utility, and local electricity market context, as well as key policies, to provide a foundational understanding of Keene's local barriers and opportunities related to increasing renewable energy deployment. This section outlines key findings from this review.

State Regulatory Context

New Hampshire is one of 17 states in the United States with a deregulated electricity market. In deregulated electricity markets, investor-owned utilities, including Eversource, are not permitted to own and operate power plants that generate electricity. Retail customers are free to purchase energy from a competitive supplier, while the utility continues to provide transmission and distribution services.

There are currently four electric distribution investor-owned utility companies in the State of New Hampshire,[1] with Eversource serving as the main electric utility in Keene. Additionally, there are a number of competitive energy suppliers active in New Hampshire, offering customers a range of electricity sourcing options and prices. There are approximately 15 residential[2] and 25 commercial/industrial[3] energy suppliers currently active in Eversource's territory. Eversource reported that approximately 22% of its residential customers and 58% of total customer load in New Hampshire had migrated to the competitive supply market by the end of the third quarter in 2019.[4] Having the ability to select a competitive supplier provides residents, businesses, and local governments with greater control over their energy mix and the opportunity to increase renewable energy supply.

Governor Hassan signed House Bill 614[5] in 2015, which aims to modernize the grid and draws from the goals outlined in the 2014 NH Energy Strategy.[6] The New Hampshire Public Utilities Commission worked alongside industry experts to develop a report titled *Grid Modernization in New Hampshire.*[7] The report detailed a number of energy initiatives and an updated 2018 State Energy Strategy,[8] which focused on building a more flexible and efficient grid capable of supporting the State's evolving energy goals more effectively than currently possible given the failing and outdated grid infrastructure in place today. Grid modernization is essential to support the growth of New Hampshire's economy and must rely on the effective integration of distributed energy resources, such as solar photovoltaic (PV) systems, which bolster resilience to grid disruptions and power outages, reduce costs, and encourage further development of clean renewable resources. The Public Utilities Commission (PUC) has continued their efforts to encourage all stakeholders to actively contribute to grid modernization,[9] with recent efforts focused on increasing the availability of consumer's utility data to make the State's energy system more responsive, dynamic, and consumer focused.[10]

Some state-level policies and programs in New Hampshire support renewable energy development, while others could benefit significantly from drawing on precedent provided by other New England states. For example, New Hampshire can increase the requirements currently outlined under the Renewable Portfolio Standard (RPS) by ratcheting up the requirements for the percent of total electricity supplied by renewable sources and ratcheting up "carve outs" that mandate what portion of the RPS must be met by

specific technologies, such as solar PV. Similar measures have already been incorporated into the Vermont Renewable Energy Standard,[11] Massachusetts' RPS,[12] and New York RPS.[13] For example, the New Hampshire RPS requires 25.2% of electricity to come from renewables by 2025, and mandates that only 0.7% of that electricity generation come from new solar by 2020. Conversely, the Vermont RPS requires 75% of electricity to come from renewables by 2032[14] and Massachusetts obtained over 13% of all electricity generated from solar in 2019[15] and is continuing to aggressively incentivize further solar expansion through the Solar Massachusetts Renewable Target (SMART) Program.[16] Beyond Massachusetts, other northeastern states have developed their own solar incentive programs to facilitate new PV development, including Rhode Island's Renewable Energy Growth Program[17] and New York's NY-Sun Solar Initiative.[18] These programs are implemented by the state to help alleviate the cost of solar for consumers and promote the adoption of renewable energy resources in accordance with aggressive state targets.

Examples of key state-level policies in New Hampshire include:

- **The New Hampshire GHG Targets and Climate Plan**: In 2009, New Hampshire established statewide carbon reduction and renewable energy goals within its Climate Action Plan (CAP). These goals include an 80% reduction in greenhouse gas emissions by 2050 below base year 1990 levels and 25% of statewide energy to be sourced from renewables by 2025. Additionally, the GHG Targets and Climate Plan called for investment in and incentivization of renewable energy via the state renewable portfolio standard (RPS) and participation in the Regional Greenhouse Gas Initiative (RGGI).[19] As of 2017, based on power plants physically located in the State, New Hampshire reported a 61% reduction in GHG levels from the electricity sector below 1990 levels, with renewables comprising 19.7% of the State's energy portfolio. This is largely a result of New Hampshire's transition away from a reliance on coal and petroleum for electricity production and the adoption of more natural gas and renewable energy resources in their place. Natural gas, despite being a fossil fuel, produces significantly less GHG emissions per unit of electricity generated in comparison to coal and petroleum. In 1990, coal and petroleum made up roughly 43% of the State's electricity generation supply mix and accounted for 98% of electricity generation GHG emissions, while in 2017 coal and petroleum comprised approximately 2.3% of the supply mix and accounted for 23% of electricity generation emissions. In 1990, no natural gas power plants were operational in New Hampshire, but, as of 2017, natural gas plants account for 73% of in-state electricity generation emissions.[20]
- **State Renewable Portfolio Standard (RPS):** New Hampshire's RPS requires private electricity providers to utilize renewable energy according to a compliance schedule with a goal of 25.2% of all electricity provided to be renewable by 2025.[21] As of 2019, the RPS mandated that 19.7% of energy consumed in New Hampshire be sourced from renewable energy.[22] Eversource currently fulfills their obligations under the State's RPS primarily through the issuance of periodic RFP's for the purchase of Class I Renewable Energy Certificates (RECs)[23] from Burgess BioPower and Lempster Wind.[24]
- **Net Metering**: Utility customers that generate electricity on-site are eligible for net metering credits when they produce more electricity than they consume in a given month. Within

Eversource territory, "each kilowatt-hour of Net Sales will earn a monetary bill credit equal to the sum of the Default Energy Service charge, the Transmission Charge, plus 25 percent of the Distribution Charge. Customers who take energy supply service from a competitive retail supplier are not eligible for the Default Energy Service portion of this credit".[25] The PUC distinguishes between small customer-generators (up to 100 kilowatts) and large customer-generators (greater than 100 kW and up to 1 MW), with slightly varied rules for each. The aggregate statewide capacity limit for all net metered systems is 100 MW, with 50% specifically held for the state's investor-owned utilities as upheld by HB 1116.[26] There have been recent motions to amend net metering, such as SB 365 (2019),[27] which would have expanded the net metering size limit for eligible customer-generators from 1 MW to 5 MWs,[28] but was vetoed. A similar bill, SB 159,[29] was passed by the legislature, but was vetoed by the governor. The state Senate overrode the veto in March 2020, but it is unclear if the House will override the veto as well.[30] Currently in New Hampshire, all municipal and residential solar PV systems wishing to net meter are guaranteed interconnection, without requirement of additional payments in the form of fees, tests, or insurance. However, some efficiency and safety requirements must be met during the interconnection process, which is upheld by New Hampshire Statutes § 362-A:9.[31]

- **Group Net Metering:** Group net metering is permissible per SB 98,[32] which allows a customer-generator (e.g. solar PV array owner) to act as a group host for non-generator customers and distribute the kWh credits generated by the host system among the group. The group host would then receive compensation from the utility, and pay members based upon their contractual agreement for their portion of the array. The challenge is that group net metering places an administrative burden on the group host and creates taxable income for members. SB 165,[33] which recently became law in NH, will allow for more traditional community solar through on-bill credits.

- **Third-Party Ownership:** The state permits third-party ownership in the form of power purchase agreements (PPAs), pending independent approval. Limitations for approval are listed in New Hampshire Statute Ann. §362-A:4-c.[34] A PPA allows for the procurement of electricity through a private third-party contractor. In this scenario, the private third-party pays for the cost of the system and bears the burden of operation and management. The consumer then purchases the energy produced by the system directly from the third-party, usually at a discounted rate compared to the default utility. There are several potential benefits to utilizing a PPA. For example, if a public or non-profit entity wishes to realize some of the Federal Investment Tax Credit (ITC) for solar installations, they can partner with a private third-party that qualifies for such lucrative incentives.

- **Community Power Program (CPP):** Also known as a community choice aggregation (CCA), this option allows New Hampshire communities to pool their electricity load and encourages the purchase of clean and renewable energy on behalf of participating customers. Communities may also implement cost-saving measures and reallocate funds towards other renewable energy-based projects as well. With the passing of New Hampshire *Senate Bill 286-FN-Local* in June 2019, New Hampshire municipalities and counties are permitted to develop plans for electric aggregation

programs for the first time.[35] In addition, the bill also allows cities and towns to implement community power on an opt-out basis, meaning customers are automatically enrolled, giving local governments far more bargaining power.[36] Development of CPPs enables communities to pursue more aggressive renewable energy goals than otherwise possible through default utility providers.

- **Financing Mechanisms and Incentives**: The state of New Hampshire offers a number of financial incentives for residents, businesses, and commercial customers interested in installing a renewable energy system. More details on these tax incentives, rebates, loan programs, and other financing mechanisms can be found in **Appendix A**.

Utilities in Keene

There are currently four electric distribution companies operating in New Hampshire, with each serving a mutually exclusive franchise territory. Eversource is the primary distributor, serving about 70% of retail customers, Unitil and New Hampshire Electric Cooperative (NHEC) serve roughly 11% each, and Liberty Utilities serves about 6% of customers.[37]

The City of Keene is located within Eversource's territory for electricity service. Eversource is an investor-owned utility that provides electricity and natural gas service to customers in New Hampshire, as well as Connecticut and Massachusetts. Eversource provides a few programs to help promote renewable energy resources in New Hampshire and comply with the state RPS requirements, such as net metering and the provision of educational materials. Additionally, Eversource owns a number of renewable generation sources across its service territory, including a 51-kW solar array in Manchester.[38] Eversource also offers a range of energy efficiency-focused programs, including their Residential Energy Efficiency Rebate Program,[39] New Equipment & Construction Schools Standard,[40] and their Commercial New Construction Energy Efficiency Rebate Program.[41] The New Hampshire PUC regulates investor-owned utilities within New Hampshire, including Eversource, and is responsible for ensuring reliable service at reasonable rates.

Eversource customers receive electricity from the New England power grid. In 2019, the NEPOOL system mix was approximately 20.1% renewable and 79.9% non-renewable. The 20.1% of renewable energy was comprised of hydropower (8.9%), refuse/other (3.5%), wind (3.4%), wood (2.4%), and solar (1.8%).

Local Policies and Initiatives

In addition to state-level policies, the City of Keene has taken steps locally to support the deployment of renewable energy. In 2018, Keene passed a resolution setting aggressive community-wide energy goals, including (1) 100% of all electricity consumed in the City from renewable sources by 2030, and (2) 100% of all thermal energy and energy used for transportation from renewable sources by 2050.[42] The City of Keene has also developed several planning documents to guide renewable energy and sustainability efforts, including:

- **Adapting to Climate Change: Planning a Resilient Community (2007)[43]:** This climate resilience action plan outlines the expected impacts of climate change in the Northeast and New Hampshire,

identifies Keene's vulnerabilities to these impacts, and lays out key goals and targets for increasing resilience along with implementation steps.

- **Local Action Plan (2004)[44]:** This climate action plan provides an overview of climate change and its impacts, and outlines key municipal, residential, and commercial/industrial opportunities for reducing greenhouse gas emissions to support efforts to mitigate the impacts of climate change.
- **Greenhouse Gas Emissions Inventory Report (2015)[45]:** This report provides an inventory of 2015 community-wide and 2015 municipal GHG emissions to help the City track progress against its emissions reduction goals and inform climate action planning.

Furthermore, the City has completed a number of projects to support renewable energy and the reduction of greenhouse gas emissions. Some key highlights include the installation of a solar PV system and geothermal HVAC system at the Public Works Department, the installation of hydropower at the water treatment facility, replacing the methane-to-gas system at the transfer station with a biodiesel generator, the installation of a solar PV system on City Hall, the conversion of all City lights to LEDs, and providing tax incentives for residential wood, wind, and solar installations.[46] Additionally, the City has entered a two-year contract with Constellation Energy to procure Green-e® Certified Renewable Energy Certificates equivalent to 100% of municipal electricity use beginning in 2020. For more information on the City's renewable energy accomplishments, please see the Energy and Climate Program Brochure.

Innovative Action in New Hampshire

A number of communities in New Hampshire have taken innovative action to support renewable energy deployment. A few key highlights are summarized below:

- The **City of Lebanon** is currently planning a CPP pilot program in hopes of realizing some of the benefits a program of this type can have for a community. This originally was an opt-in pilot program; however, the model may change with the passage of SB 286.

- Several New Hampshire communities have already leveraged their group purchasing power by participating in a Solarize campaign. During a Solarize campaign, a community partners with one or several developers, who can offer residents and small businesses competitive pricing due to anticipation of a large number of installations in one area over a condensed period of time. Communities participating in Solarize campaigns to expedite the adoption of solar include **Nashua, the Monadnock Region, and New Hampshire's Upper Valley**.

- **The City of Concord** has also taken action recently, pledging its own commitment to pursuing 100% renewable electricity by 2030 and 100% renewable energy for the thermal and transportation sectors by 2050. In July of 2019, Concord released a strategic plan outlining strategies and action steps to achieve their goals.[47]

- **Energize 360[48]** was a one-year, community-led effort in New Hampshire that took advantage of similar bulk discount incentives as leveraged through Solarize. Energize 360 allowed citizens in participating communities to request a free site visit to their home or business, providing them useful information about their energy consumption and opportunities to weatherize their property, install solar or other technologies, and implement energy efficiency measures, among other

strategies. Communities that participated in the Energize 360 campaign included Dover, Durham, Exeter, Hampton, Kensington, Lee, Madbury, New Castle, Newmarket, Northwood, Portsmouth, Rye, Somersworth, Strafford, and Stratham. The six-month campaign resulted in 251 clean energy and energy efficiency projects, which will collectively result in a reduction 1,015,937 pounds of carbon per year for the lifetime of those projects.[49]

- **Vital Communities** is a nonprofit organization that offers a range of economic, environmental, and civic-oriented programs and resources to support in the Upper Valley region of New Hampshire and Vermont. Their energy programs include Weatherize and Solarize Upper Valley campaigns, as well as a Green Real Estate Network to educate home buyers and sellers on energy efficiency.[50]

Electricity Baseline

Context

The objective of an electricity baseline is to understand the starting point of electricity consumption within the City and the mix of generation resources producing the consumed electricity. The baseline draws from a combination of available state-level data, Keene-specific utility data provided by Eversource, and insights provided by the City and the current regulatory landscape to estimate an electricity baseline for the City. Given that City-specific information is limited, much of the assumptions made are based on State-level information and scaled down to apply to the City of Keene. As part of the baseline analysis, the Cadmus Team also developed a business as usual estimate of the projected 2030 electricity supply mix, assuming no further action from the City is taken between now and 2030. This analysis allows Keene to better understand the gap between the business as usual projection and the City's target of 100% renewable electricity by 2030. The electricity baseline will serve as a starting point for the City, giving decision-makers a better understanding of what their electricity supply mix will likely be if no action is taken between baseline year 2019 and 2030. The following section outlines current consumption, energy supply, and key assumptions within the electricity baseline.

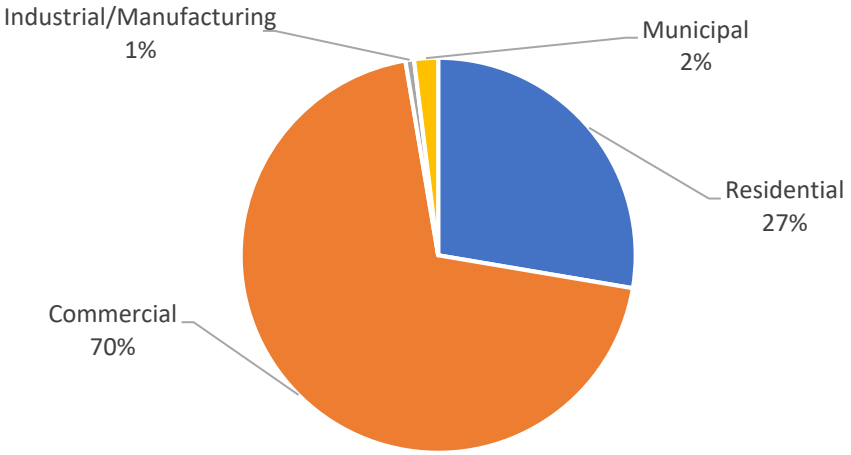
Electricity Consumption in Keene

In 2019, electricity accounts across the City of Keene consumed over 222 gigawatt-hours of electricity. On average, in 2019, a residential account used 4,089 kWh of electricity, a commercial account used 69,478 kWh, and a manufacturing/industrial facility used 28,930 kWh of electricity.

The commercial sector was the largest consumer of electricity, accounting for 70% of total community usage. Residential accounts made up 27% of usage in 2019, while municipal and industrial/manufacturing accounts made up the remaining 3% of electricity consumption in Keene (see Figure 2).[1]

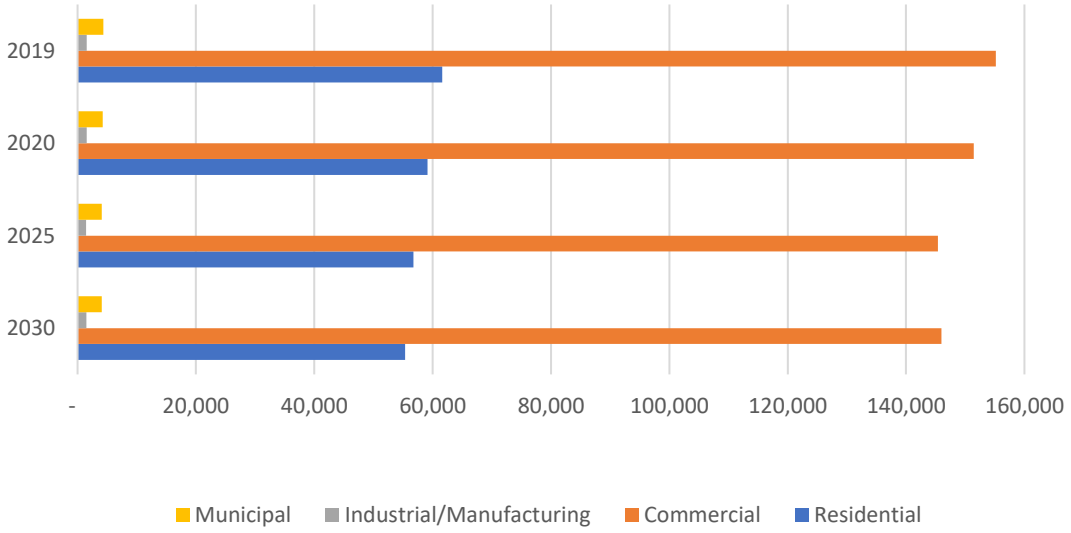
[1] Data provided by Eversource. Industrial accounts are those that have peak electricity demand greater than 1,000 kW.

Figure 2: Electricity Consumption by Sector 2019



Over time, consumption is expected to shift due to the impacts of population growth and the increasing effectiveness of energy efficiency. In 2030, 78,315 people are expected to live in Cheshire County, representing an overall growth of 1.25% from 2015.[51] Factoring in both energy efficiency[52] and population growth, it is estimated that overall electricity consumption will decrease by approximately 7% by 2030. However, this analysis does not consider new potential sources of load growth through building electrification, electric vehicle infrastructure, or new capital assets that could drive demand.

Figure 3: Estimated Changes to Electricity Consumption in Keene (MWh)



Renewable Energy in Keene

Currently, there are a number of systems in Keene that generate renewable electricity. Keene is home to a micro-hydropower system of 90 kW and over 3,300 kW of installed solar photovoltaic (PV) capacity across local homes and businesses.

Figure 4: Interconnected Solar PV in Keene[2]

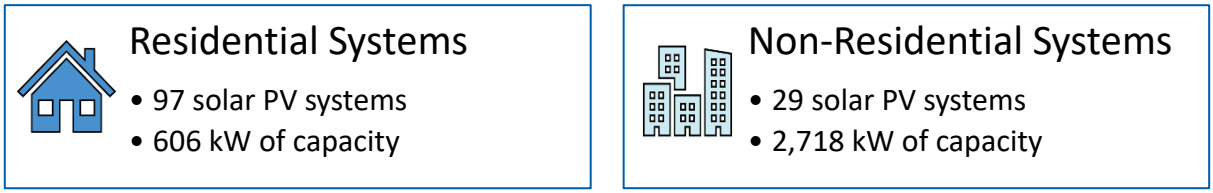


Figure 4 only includes interconnected systems and does not include off-grid systems within Keene. While distributed generation penetration is expected to grow over time, the 2030 forecast conservatively assumed the number of local renewable energy installations will stay constant over time.

New Hampshire Energy Supply Mix

As mentioned above, Eversource has divested its generation assets and relies on the New England Power Pool (NEPOOL[53]) and local energy generation to meet its customer demand for electricity and RPS requirements. The RPS ratchets up the renewable energy requirements every year (see **Table 1: New Hampshire RPS**Table 1**Error! Reference source not found.**). By 2025, in order to comply with the RPS, 25.2% of all electricity provided by Eversource will need to be generated using renewable sources. Currently, the RPS is projected to stay constant at 25.2% in 2025 and thereafter. The 2030 forecast conservatively assumes that the percentage of renewable generation mandated by the RPS will not increase after 2025.

Table 1: New Hampshire RPS[54]

Year	Annual Percent Increase	Renewable Energy Supply as Percent of Total Supply
2019	Baseline	19.7%
2020	1.0%	20.7%
2021	0.9%	21.6%
2022	0.9%	22.5%
2023	0.9%	23.4%
2024	0.9%	24.3%
2025 & thereafter	0.9%	25.2%

Conservatively, the default electricity supply provided by Eversource will need to comply with the RPS. In actuality, the electricity supply that Eversource purchases may exceed this requirement. Eversource interacts heavily with the New England Power Pool (NEPOOL) to source electricity supply. In 2019, the New England-based generation that feeds into the NEPOOL to serve the electricity load was 20.12%

[2] Distributed generation information was provided by Eversource.

renewable, up from 18.3% renewable in 2018.[55] While the regional 2019 level of 20.12% renewable supply exceeded the New Hampshire 2019 RPS requirement of 19.70%, the conservative RPS projections were the foundation of the Keene electricity baseline analysis. As Eversource's default supply changes periodically, the RPS provides a conservative baseline for understanding renewable and non-renewable supply over time, assuming the electric utility is compliant.

Table 2. NEPOOL Generation Sector 2019[56]

Generation Type	Natural Gas	Nuclear	Coal	Oil	Hydro	Refuse /Other	Wind	Wood	Solar	All Renewables
Capacity (MW)	16,563	4,025	917	7,139	3,393	462	415	503	440	5,213
Net Energy for Load (GWh)	39,725	25,182	369	117	7,305	2,895	2,794	2,004	1,474	16,472
% of Total Generation	**48.5%**	**30.8%**	**0.45%**	**0.14%**	**8.9%**	**3.5%**	**3.4%**	**2.4%**	**1.8%**	**20.1%**

As of 2019, the regional grid relies heavily on natural gas (48.5% of total generation) and nuclear (30.8%), despite the recent closures of nuclear plants across the region, including the 2014 closure of Vermont Yankee Nuclear Power Plant in Vermont and the 2019 closure of the Pilgrim Nuclear Power Plant in Massachusetts. Renewable energy resources, including hydropower, refuse, wind, wood, solar and other renewables sources made up a combined 20.1% of total regional generation.

A Note on Competitive Suppliers

In New Hampshire, customers have the option between default electricity supply from the utility and choosing supply from a competitive supplier. In both scenarios, electricity is still delivered to customers through the electric utility's transmission and distribution grid. In 2018, Eversource noted that 42% of customer load in New Hampshire was served through default service, while 58% of customer load had migrated to competitive energy suppliers. Competitive suppliers are still subject to the state's RPS, but may offer products to customers that exceed this requirement by offering contracts with higher renewable energy mixes than the default service from the utility. Competitive supplier contracts are typically short-term (12-36 months) and can offer fixed or variable pricing to customers for their electricity.[57] In 2020, the City of Keene entered into two competitive supply agreements for 100% renewable electricity for all but one of its municipal facilities. One contract is subject to a one-year term, and the other is two years. The New Hampshire Public Utilities Commission does not regulate the prices offered by competitive suppliers. However, it does provide questions that consumers should ask competitive suppliers while assessing options.[58]

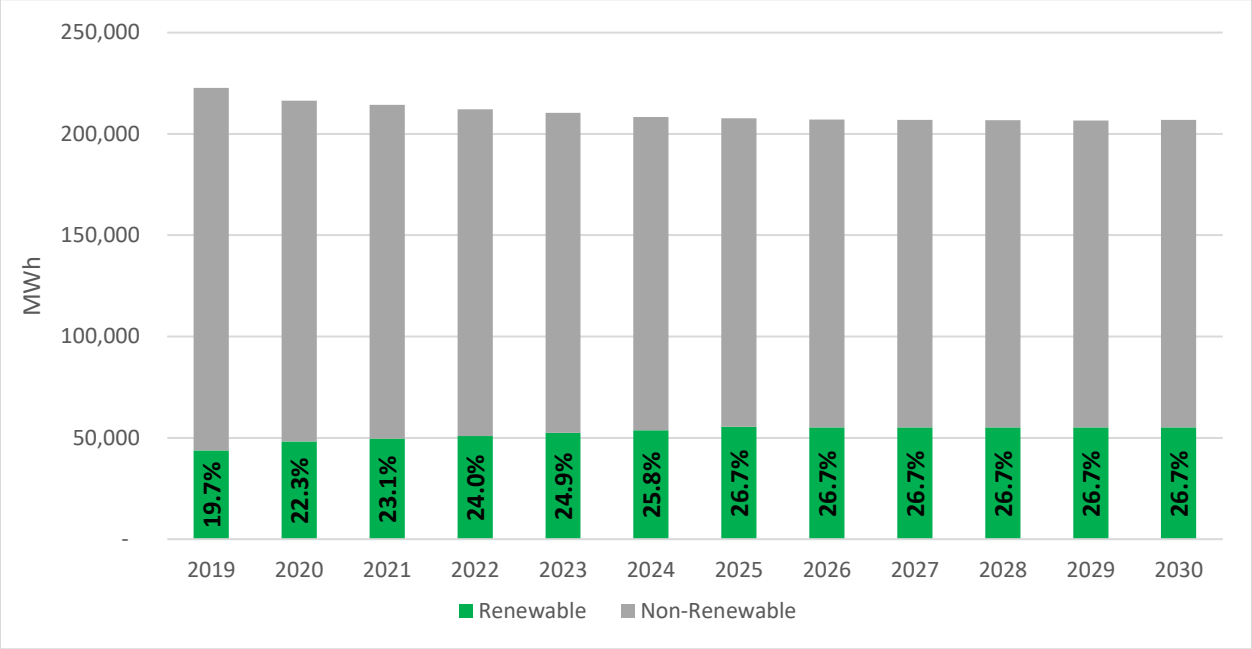
What this means for 2030

Overall, the business as usual case conservatively estimates that electricity consumption in the City of Keene will be 27% renewable by 2030. The baseline points to a steady increase in renewable electricity supply, largely driven by RPS compliance. Despite population growth, electricity consumption is anticipated to decrease slightly, driven primarily by expected energy efficiency improvements (see Figure 5).

Table 3: Electricity Consumption by Sector

Sector	Energy Type	Consumption 2019 (MWh)	Consumption 2030 (MWh)
Residential	Renewable	12,137	13,945
	Non-Renewable	49,471	41,393
Commercial	Renewable	30,563	36,781
	Non-Renewable	124,580	109,176
Industrial/Manufacturing	Renewable	308	370
	Non-Renewable	1,254	1,099
Municipal	Renewable	860	4,109
	Non-Renewable	3,507	0[59]

Figure 5. Business as Usual Electricity Consumption and Supply in Keene



This baseline assumes that the City continues sourcing 100% renewable electricity for its municipal accounts through 2030 from competitive supply agreements. If the municipality chooses not to extend these agreements and default back to the utility supply, then the overall community renewable electricity mix is expected to decrease slightly.

In 2030, it is estimated that the commercial and residential sectors will be the largest consumers of electricity (71% and 27% of electricity consumption, respectively), but that a larger proportion will be sourced from renewable energy due to the RPS. Without further action, it is estimated that the City will achieve 26.7% of its 100% renewable electricity target by 2030.

Strategy Analysis and Findings

Strategy Analysis Methodology

There are numerous strategies that the City of Keene could undertake in an effort to achieve its renewable electricity, workforce development and educational goals. To identify a subset of strategies that would be appropriate and impactful in the Keene context, the Cadmus Team first compiled an initial list of 16 strategy options based on conversations with City staff; the Cadmus Team's prior work with municipal governments nationwide; and desk research on Keene's state, utility, and local policy context, outlined in the Electricity Context section.

For each of the 16 strategies, the Cadmus Team then qualitatively assessed and ranked each strategy against key criteria, summarized below.

Criteria	Description
Scale of Impact	Includes the extent to which a strategy will increase the level of renewable energy within the electricity mix.
Local Impact	Includes the extent to which a strategy promotes renewable energy generation locally and whether it supports resiliency.
Local Environmental and Social Goals	Includes the extent to which the strategy contributes to local job growth and works to reduce greenhouse gas emissions.
Inclusion and Social Equity	Includes the extent to which the strategy is expected to be affordable for all-income levels, alignment with other community initiatives, and extent to which the benefits of the strategy are equitable.
Feasibility	Includes timeframe for implementation, costs to the City for implementation and support, and technical feasibility for implementation.

With the insights of this prioritization exercise, which can be found in **Appendix C**, the Keene Climate and Energy Committee selected six strategies for the Cadmus Team to explore in further depth, listed below:

1. Establish a community power program
2. Engage in virtual power purchase agreements
3. Collaborate with the utility to develop a pilot program related to energy storage
4. Partner with a local financial institution to offer a renewable energy loan product
5. Implement a building benchmarking ordinance
6. Adopt solar and EV ready guidelines

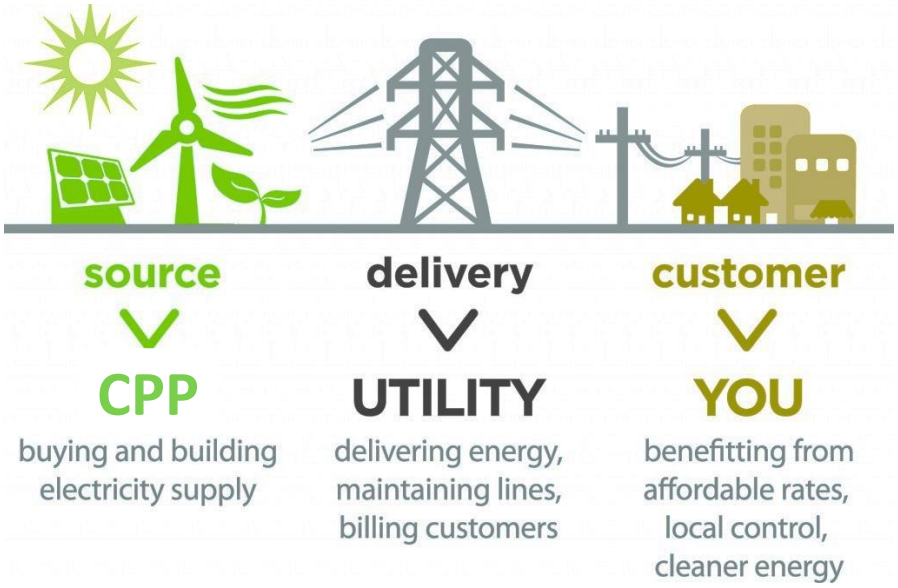
The following section summarizes key information related to each strategy, including a description, expected benefits and challenges, initial implementation steps, and examples of communities where the strategy has been implemented.

Strategy 1: Establish a Community Power Program

Overview

A community power program (CPP), also known as community choice aggregation (CCA), enables a local government (or multiple local governments) to **pool the electricity load of residents and small businesses and procure electricity on their behalf,** while the utility continues to be responsible for electricity delivery, transmission, and distribution and maintenance of poles and wires. Community power programs (CPP) are "opt-out", meaning that residents and businesses would participate in the program by default, but would have the option to "opt-out" if they preferred to receive basic service from Eversource or purchase electricity from a competitive supplier. This is an impactful strategy because it provides New Hampshire communities with **greater control over their energy mix and the opportunity to increase the percentage of renewables** within the mix at potentially lower energy prices.

Figure 6: How Community Power Programs (CPP) Work[60]



Source: Adapted from LEAN Energy

Keys Benefits and Challenges

Key benefits and challenges associated with establishing a community power program are summarized below:

Key Benefits	Key Challenges
Increases local control over the energy supply mix	**Political and regulatory uncertainty** in New Hampshire
Provides the ability **to increase the percentage of electricity from renewables** through RECs	**Limited ability to achieved "additionality"** due to reliance on RECs (see description below)
Potential **cost savings** to the community	Some **administrative burden** on city staff to set up program and identify a broker
Potential expansion in the future **to drive local renewables, energy efficiency, and other innovative offerings**	**Political coordination required** with neighboring communities if Keene wants to enhance economies of scale

When implementing this strategy, it will be important to have a strong understanding of renewable energy credits, or RECs. RECs are tradeable, market-based instruments that represent the legal rights to one megawatt-hour (MWh) of renewable electricity generation. There are two main types of RECs:

Unbundled RECs: Unbundled RECs are those that are sold, delivered, or purchased separately from physical electricity. Many CPPs rely on unbundled RECs as the primary means of increasing the renewable percentage of the electricity product delivered to customers. The key advantage of unbundled RECs is they can be sourced from renewable energy projects across the country, are relatively low cost and simple to procure. However, Unbundled RECs are often criticized for capitalizing on the presence of existing renewable energy projects and not driving the development of new renewable energy projects that would not have otherwise been built. Thus, unbundled RECs are generated by renewable energy projects that are referred to as "**non-additional"**.

Bundled RECs: In contrast to unbundled RECs, bundled RECs are sold together with the physical electricity generated by a specific renewable energy project. Bundled RECs, and their associated clean electricity, are typically procured by CPPs through PPAs or VPPAs (see Strategy 2 below). Advantages of bundled RECs are that they drive the development of new (or "**additional**") renewable energy projects that would not have otherwise been built (i.e. **achieving additionality**). However, identifying and contracting electricity that is bundled with RECs can often be more administratively burdensome, and sometimes more expensive, for CPPs.

CPPs, especially in early stages, often rely on unbundled RECs to increase the renewable percentage of the electricity product delivered to customers; however, it is possible to shift towards bundled RECs over time as the CPP program generates revenue and potentially partners with neighboring communities to increase scale.

Implementation Steps

Initial implementation steps for establishing a Community Power program are listed below:

	Implementation Steps
✓	**Conduct research** on community power and its potential role in achieving local RE goals.
✓	**Form an electric aggregation committee** or designate an existing committee to develop a Community Power Plan.
✓	**Gain local approval** for the finalized Community Power Plan from the local legislative body (e.g. City Council).
✓	**Select a supplier** and enter into a short-term (1-3 year) contract to supply residents and businesses with a greater amount of renewable electricity.
✓	**Notify residents & businesses** about newly formed program and ability to opt-out prior to service beginning.

Key Examples from Other Communities

A number of communities are establishing community power programs across the country and within the region. As of 2017, there were approximately 750 operational CPPs procuring electricity on behalf of about 500 million customers.[61] While these programs operate differently across states due to state-level regulation, CPPs in Massachusetts operate similarly to how they would operate in New Hampshire. Although there are no New Hampshire towns or cities that have actually launched a CPP, state legislation does allow this method of energy procurement and there is growing interest across several communities, with some in the advanced stages of the planning process. New Hampshire communities have the ability to pursue a CPP through the standard single procurer model, and there is some interest in a regional approach that would involve multiple communities combining their energy purchasing power to achieve economies of scale. This latter type of CPP is referred to as the alternate or "joint-office" model.

Cambridge Community Electricity: Cambridge, Massachusetts[62]

One example is the Cambridge Community Electricity (CCE) program, a city-run aggregation program established in 2017. CCE selected Direct Energy as the program's electricity provider from January 2019-2021 and will offer fixed electricity prices throughout this contract duration. This type of CPP program, where city staff interact with a single electricity broker, is the most simplified and the least administratively burdensome. The program currently offers Cambridge residents and businesses two electricity products, including Standard Green and 100% Green Plus. The Standard Green option provides an electricity product that is similar in renewable energy content to the regional grid, about 20%, while the 100% Green Plus option offers a 100% renewable electricity product. As with most CPPs, customers "opting up" to the 100% renewable electricity product pay a slight price premium per kWh compared to the standard electricity product offering. Additionally, as of April 2020, both electricity products offered through Cambridge's CCE have lower rates for residential and small business customers than the standard Eversource offering.[63] However, these savings are subject to change as Eversource rates change every six months for residents and small businesses. One unique aspect of the Cambridge's CCE is that both rate

options include a small fee, knows as an "operational adder", that will go towards the development of new solar projects within the City of Cambridge.

Community Power New Hampshire[64]

Community Power New Hampshire[3] (CPNH) is a municipal and county-led initiative working with Clean Energy New Hampshire and local governments throughout the state to offer an alternative to the standard CPP model, which typically involves a single community contracting with an energy broker to procure renewable energy through the purchase of RECs. Under this alternative model, also known as the joint-office CPP model, cities can form their own community power program and then join the centralized CPNH network. The intention of a combined-joint office is to expand the communities' technical capacity, reduce and centralize administrative costs, leverage pooled revenue to develop and administer innovative energy efficiency, demand response, and renewable energy programs, and bolster the group's purchasing power. CPNH is still in the planning phase of development, but many New Hampshire communities are hopeful it will enable accelerated grid modernization and renewable energy adoption in the near future.

[3] For more information on the structure, goals, and services of CPNH, please visit: Community Power New Hampshire (CPNH).

Strategy 2: Engage in Virtual Power Purchase Agreement (VPPAs)

Overview

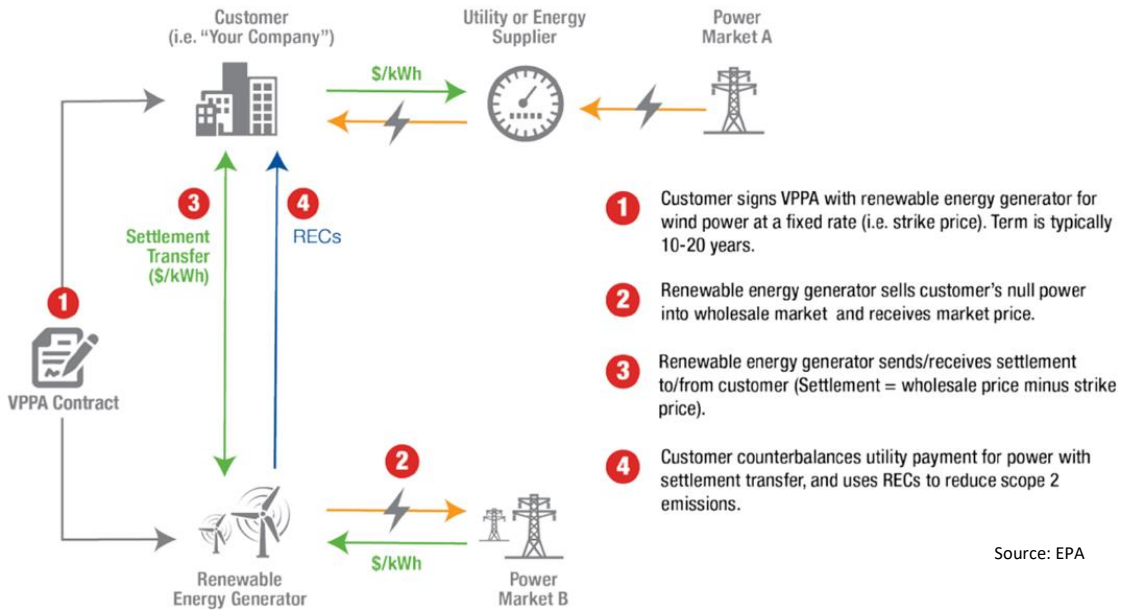
Cities and community power programs can **support the creation of additional renewable energy by entering into long-term contracts with renewable energy generators** in the form of a power purchase agreement (PPA) or virtual power purchase agreement (VPPA).

A **PPA** is a contract between a buyer and renewable energy generator where the buyer takes ownership of the electrons and RECs produced by the renewable energy project.

A **VPPA** is a financial transaction where the buyer does not own the electrons produced by the renewable energy project, but receives titles to the RECs.

Both contracting instruments, but especially VPPAs, allow both the buyer and the generator to hedge against electricity market price volatility and allow the buyer to benefit from long-term price stability. Another key advantage of VPPAs over traditional PPAs is their geographic flexibility. With PPAs, the renewable energy generator and the consumer must be physically connected to the same regional grid. However, with VPPAs, this is not the case, increasing the diversity of renewable energy generators a customer can contract with. If Keene were to launch a CPP, there are strong potential synergies between a CPP and VPPAs. Leveraging VPPAs, the City could transition their CPP away from unbundled RECs and towards bundled RECs over time, driving the development of renewable energy projects that would not have otherwise been constructed.

Figure 7: How a Virtual Power Purchase Agreement (VPPA) Works[65]



The above figure demonstrates the step-by-step process for how a VPPA works. There are a few notable takeaways from the above graphic. First, **the power market that the renewable energy generator is selling electricity into ("Power Market B") does not have to be the same as the power market that the customer (e.g., Keene CPP) is physically connected to ("Power Market A")**. In practical terms, this means that the Keene CPP could sign a VPPA with, for example, a wind farm project in Iowa that may have more favorable financial terms than a similar renewable energy project in New England. Secondly, step 3 in the above figure demonstrates the **price hedge value of a VPPA**. By entering into a VPPA, the customer (e.g., Keene CPP) locks in a fixed price, or strike price, for Bundled RECs from the renewable energy generator. If the wholesale price of electricity rises, the customer will be insulated from these price increases because of the long-term nature of the VPPA. Conversely, if the VPPA strike price is greater than the wholesale market price, the customer would pay the net difference to the renewable energy generator. In this way, the VPPA acts as a price hedge against potentially volatile future energy costs.

Keene could consider entering into a VPPA with a renewable energy generator within NEPOOL to support the development of local/regional renewables and resilience. However, it is possible that the financial terms will not be as favorable as they could be in another power market.

Keys Benefits and Challenges

Key benefits and challenges associated with engaging in virtual power purchase agreements are summarized below:

Key Benefits	Key Challenges
Supports the development of **new, additional renewable energy projects with no upfront cost**	The commitment of a small CPP program to purchase the energy **may not be sufficient to cover the financing of a project**
Provides the opportunity to **increase the community's % of electricity from renewables** without unbundled RECs	**Contracts can be complex and may be challenging to navigate** without additional legal support
Enables the community power program to **purchase large volumes of electricity** in a single transaction **from generators located across the country**	By committing revenue to a long-term project, the CPP is **limiting its ability to implement other initiatives** in that timeframe
Hedge against electricity market price volatility, **long-term price stabilit**y, and **potential cost savings** to the community	By locking into a long-term contract, **risk that basic supply rate will dip** below CPP rate

Implementation Steps

Initial implementation steps for engaging in virtual power purchase agreements are listed below:

	Implementation Steps
✓	Customer signs a VPPA with a renewable energy generator for wind power at a fixed rate (i.e. strike price). Term is typically 10-20 years.
✓	Renewable energy generator sells customer's null power into wholesale market and receives strike price.
✓	Renewable energy generator sends/receives settlement to/from customer (settlement = wholesale price – strike price).
✓	Customer counterbalances utility payment for power with settlement transfer and uses RECs to reduce scope 2 emissions[4].

Key Examples from Other Communities

This section includes an example of how one Virginia community is utilizing a VPPA to reach their renewable energy goals.

Amazon Arlington Solar Farm: Arlington County, VA[66]

Arlington County, in partnership with Dominion Energy and Amazon, recently agreed to purchase 31.7% of the energy generated by a Dominion owned solar farm in Pittsylvania County, VA. The solar farm is projected to cover 1,500 acres of agricultural land and produce 250 million kWh annually upon completion in 2022. Procuring 31.7% of the electricity produced by the solar farm equates to more than 79 million kWh and will offset 83% of the electricity currently used by the county government to operate its buildings, streetlights, water pumping station, and wastewater treatment facility. For reference, annual electricity consumption across all of Keene is equivalent to approximately 222 million kWh. This VPPA agreement is key to Arlington County reaching the targets outlined in their Community Energy Plan, including a goal to use 100% renewable energy for government functions by 2025.

[4] Scope 2 emissions are indirect emissions from the generation of purchased energy. For most cities, the vast majority of scope 2 emissions come from electricity that is generated outside of the city boundary but consumed inside the city boundary.

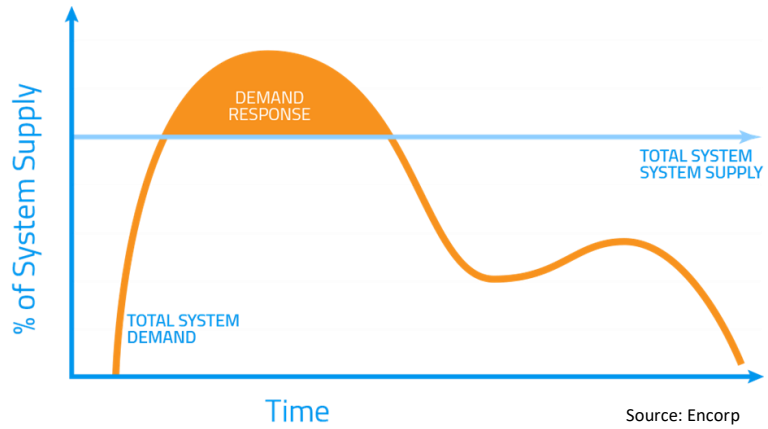
Strategy 3: Collaborate with the Utility to Develop a Pilot Battery Storage Program

Overview

This strategy involves the City of Keene establishing a close working partnership with their local utility, Eversource, to develop a pilot battery storage program. This could include efforts to collaboratively develop ideas with the utility that support battery storage initiatives and build on preexisting Eversource programs. Existing battery storage programs in other regions or operated by other utilities have utilized **rebates, demand response incentives, or a combination of the two to increase proliferation** of battery storage systems.

Battery storage is a rapidly developing technology that can be **coupled with solar and other renewable energy resources**. This strategy has the potential to significantly benefit residents, businesses, the City, and the utility by **reducing demand on the grid during peak times**. Through the strategic deployment of electricity stored in batteries during peak times, **local businesses can significantly reduce their demand charges**. Demand charges for commercial customers are based on the highest level of electricity supplied by the grid at one time during the billing period and can make up a large portion of total electricity expenses for some businesses. From an environmental perspective, the ability of batteries to reduce peak demand on the grid also **reduces the reliance on natural gas "peaker" power plants**, which generate a large amount of greenhouse gasses, to meet this peak demand. As battery costs continue to decrease over time, implementing a pilot battery storage program will position Keene well to take advantage of the environmental, cost, and resiliency benefits of modernizing the grid, which will be key in the City's efforts to achieve 100% renewable electricity by 2030.

Figure 8: How Battery Storage Helps Reduce Demand Charge Peaks[67]



The above figure highlights the costs saving and environmental potential of battery storage systems paired with solar PV. When total electricity demand on the grid (orange line) exceeds the total electricity being supplied by power plants currently on line (the horizontal blue line), electricity stored in batteries can be deployed (orange shaded region) to reduce electricity demand charges for local businesses and reduce the need for polluting natural gas power plants to come online to meet peak demand.

Keys Benefits and Challenges

Key benefits and challenges associated with this strategy are summarized below:

Key Benefits	Key Challenges
Takes advantage of **utility funding, technical expertise, and preexisting infrastructure and programs**	City not in direct control of program development and implementation + **success is largely dependent on Eversource being an active + willing participant.**
Reduces electricity costs for consumers and the utility by minimizing peak demand	Need to **identify the right points of contact** at both organizations. Partnership may require connection at the upper management/admin level.
Modernizes the grid, **boosts resilience**, and **reduces the need for gas "peaker" plants**	Utility **priorities can shift** during a project
Pilot program is a **low-cost strategy for the City** to pursue	Third-party complexity is introduced, as **battery vendors (i.e. Tesla, LG, Generac) often play a role in demand response**
Potential to expand the pilot program by partnering with other local governments, nonprofits, and businesses in the future	Keene is at the forefront of exploring battery storage pilot program models in New Hampshire, with **minimal in-state precedent to leverage**
Provides a **cleaner and cheaper alternative for back-up power**, which can be deployed to **support essential infrastructure**	

Implementation Steps

Initial implementation steps for collaborating with the utility to develop a pilot battery storage program are listed below:

	Implementation Steps
✓	**Discuss potential opportunities to partner with Eversource on a pilot battery storage program.** Given the preexisting demand response thermostat program Eversource has already made available in New Hampshire and the demand response battery storage program deployed by the utility in Massachusetts, there is already proven interest and precedent that the City of Keene can build from.
✓	**Invest in battery storage at municipal facilities through Eversource's pilot program, potentially providing City co-funding.** The City can serve as an example, showing the benefits of utilizing battery storage while reducing electricity costs and minimizing the environmental footprint of municipal operations. Installing battery storage as an alternative to diesel generators for essential infrastructure could be explored.
✓	**Seek opportunities to expand and publicize the pilot battery storage program to local businesses and residents**, leveraging strong interest in the strategy expressed during both the community presentation and Environment and Climate Committee meetings.

Key Examples from Other Communities

This section includes examples of how communities and their local utility have implemented best practices related to the implementation of battery storage technology. Utility administered battery storage incentives typically compensate utility customers in one of two ways. Demand response programs pay customers for the energy their battery contributes to the grid during periods of high demand, while other programs simply provide a rebate to customers for installing battery storage at their home or business. Examples of demand response, rebate, and a hybrid program options are explained in more detail below.

ConnectedSolutions Demand Response Program: Eversource, Massachusetts[68]

The ConnectedSolutions Demand Response Program is a program run by Eversource in Massachusetts that enables participating residents to be compensated for allowing the utility to use the energy stored in their batteries during periods of high demand on the grid. Residents with battery storage can also choose not to be enrolled in the program, saving the electricity stored in their battery as a personal back-up generator instead.

Bring Your Own Device Program: Green Mountain Power, Vermont[69]

Developed in partnership with Renewable Energy Vermont, the Bring Your Own Device Program enables participating utility customers with onsite battery storage to choose between an upfront payment from the utility or a compensation rate for demand response use. The level of compensation is determined by the size of the customer's battery storage system.

Home Battery Storage Pilot: Liberty Utilities, New Hampshire[70]

The Home Battery Storage Pilot was recently approved by the New Hampshire PUC. This program will allow residents to sign up for a home battery installation in partnership with the utility and qualify them for varying time-of-use rates.

Strategy 4: Partner with a Local Financial Institution

Overview of the strategy

Renewable energy loans, particularly for distributed solar PV systems, can help make the installation of renewable energy projects more affordable for Keene residents and businesses by **minimizing the up-front capital costs** required to complete an installation and offering low-interest, fixed rates with flexible terms. With limited renewable energy financing options currently available for residents and businesses, the City of Keene could potentially partner with a local financial institution to offer **competitive financing for renewable energy projects**. By financing projects with more capital from local banks or credit unions, Keene can **maximize the number of renewable energy installations** within the City, as well as the economic and environmental benefits associated with deployment of these technologies.

Keys Benefits and Challenges

Key benefits and challenges associated with this strategy are summarized below:

Key Benefits	Key Challenges
Increased financing access for local residents and businesses to overcome financial barriers to renewable energy adoption	**City not in direct control of program development** and implementation. Success is largely dependent on local banks and co-ops being an active and willing participant
Opportunity to **support local economy** by engaging with local banks credit unions	Keene is at the forefront of exploring partnering with local financial institutions to finance solar in the state of New Hampshire, with **minimal in-state precedent to leverage**
Equitable solution that **increases ability of low-income residents to install solar**	Potentially **high administrative burden** on City staff engage with local banks and co-ops to establish program
Established best practices to draw on for engaging with local banks and co-ops to develop similar programs	

Implementation Steps

Initial implementation steps for partnering with a local financial institution to offer a renewable energy loan are listed below:

	Implementation Steps
✓	Conduct a review of local financial institutions that may serve as a potential partner based on current or past offerings.
✓	Conduct outreach to local institutions and provide educational materials on the benefits of offering loans for renewable energy. Keene could further support private sector lending by offering to provide a loan loss reserve or credit enhancement program.
✓	In parallel, considering advocating for the expansion of existing state or regional loan offerings, such as NH Saves, to include renewable energy or energy storage offerings.

Key Examples from Other Communities

This section includes examples of other communities and organizations that have implemented innovative financing solutions to accelerate clean energy adoption.

Milwaukee Shines: Milwaukee, Wisconsin[71]

The City of Milwaukee, Wisconsin partnered with Summit Credit Union to create "Milwaukee Shines," a special loan program for city residents. With a $2 million budget, the program offers eligible customers up to $20,000 at a low-interest, fixed-rate with flexible terms. Financing can be applied to solar electric systems up to 6 kW and solar hot water systems of 1-8 panels in size. Eligible expenses include all equipment, labor, permits, and interconnection fees, as well as structural re-enforcement and re-roofing expenses, if needed.

Admirals Bank & Solarize: Multiple Locations[72]

Admirals Bank, a Boston-based bank active in lending for residential solar projects, has partnered with local governments and non-profits administering Solarize programs in Connecticut, Massachusetts, and North Carolina to provide financing options for participants. For example, during the Solarize Connecticut Durham Pilot Project, the selected installer referred customers to Admirals Bank, which worked with homeowners to put together a loan package that allowed customers to participate in the program and purchase the system. Admirals Bank Relationship Managers and Solar Financing Experts have also attended town information sessions to educate homeowners on available lending products for other campaigns they have participated in.

New Hampshire Examples

Several New Hampshire banks and credit unions offer energy efficiency loans and could potentially expand to provide renewable energy loans as well.

- BCCU[73] is a credit union with locations in Manchester, Nashua and Bedford offering energy efficiency loans.
- NHSaves[74] is a utility-run program that has partnered with local savings banks/credit unions to offer energy efficiency loans.

Strategy 5: Implement a Building Benchmarking Ordinance

Overview of the strategy

A municipal and commercial building benchmarking ordinance is an effective strategy that enables building owners to **measure the energy efficiency of their building** against comparable buildings from across the country and **identify buildings that could benefit most from energy efficiency improvements**. The vast majority of building benchmarking ordinances rely on the use of the Environmental Protection Agency's (EPA's) **ENERGY STAR Portfolio Manager**, **a free online benchmarking tool** that helps building managers track data and measure progress. Portfolio Manager allows building managers to compare their building to similar buildings using the 1-100 ENERGY STAR score. Achieving a score of 50 would be considered the median, while a score of 75 would indicate that the building is performing better than 75% of its peers and may be eligible for ENERGY STAR certification. Portfolio Manager allows building managers to compare their building to similar buildings across the country, using the 1-100 ENERGY STAR score. Achieving a score of 50 would be considered the median, while a score of 75 indicates that the building is performing better than 75% of its peers and is eligible for ENERGY STAR certification.

Through the identification of inefficient buildings, a benchmarking ordinance can be effective in **driving increased participation in already existing energy audit and energy efficiency programs**, such as those offered through Eversource. These programs can accelerate the path towards decreased energy consumption, energy cost, and GHG emissions. Many benchmarking programs feature a public disclosure component, which can have beneficial impacts such as empowering prospective tenants to make informed decisions before entering into a lease agreement. Benchmarking programs can be **voluntary or mandatory**, include energy and/or water consumption, and can be customized by square footage and building type. For example, many benchmarking ordinances have **stricter reporting requirements for larger commercial buildings** that exceed a certain square footage threshold. Some benchmarking ordinances also link the program to mandatory energy audits or energy efficiency improvements for inefficient buildings. Since over 70% of total electricity consumption in Keene is associated with commercial and municipal buildings, a benchmarking ordinance has significant potential to reduce electricity consumption in Keene's existing building stock.

Figure 9: Example Dashboard Screenshot from ENERGY STAR Portfolio Manager[75]

Source: EPA

The above image displays a screenshot of the type of information building managers would see when logging into the ENERGY STAR Portfolio Manager platform, including the building's overall energy score and trends in the energy use intensity associated with their building.

Keys Benefits and Challenges

Key benefits and challenges associated with implementing a building benchmarking ordinance are summarized below:

Key Benefits	Key Challenges
Identifies commercial and municipal buildings in Keene that could benefit most from **energy efficiency improvements**	Potential **political hurdles** associated with passing a mandatory ordinance through City Council
Drives participation in existing energy audit and energy efficiency programs offered through Eversource	Mandatory benchmarking **does not guarantee energy-efficiency upgrades** and improvements
Encourages utilization of, and recognition from, EPA's ENERGY STAR Portfolio Manager, a **free online benchmarking tool**	Potential issues with **data access, quality, and accuracy**
Opportunity for Keene to **lead by example** by benchmarking municipal buildings	**Compliance** with, and **enforcement** of, mandatory ordinance
Potential to link **financial incentives** to energy-efficient upgrades (see South Portland example below)	**Administrative burden** associated with ongoing support and management of the program

Implementation Steps

Initial implementation steps for developing a building benchmarking ordinance are listed below:

	Implementation Steps
✓	Review EPA's list of *Benchmarking Programs and Policies Leveraging ENERGY STAR*[76] to get a sense of program design, requirements, and incentives being utilized by other localities.
✓	Consider a voluntary program to precede a mandatory ordinance.
✓	Draft ordinance language and pass through City Council.
✓	Develop or enhance a webpage to host relevant resources and materials.
✓	Determine which metrics will be disclosed publicly.

Key Examples from Other Communities

This section includes communities that have implemented best practices related to implementation of municipal and commercial building benchmarking ordinances in the US. Each example includes a few key points and differentiating factors as well as a hyperlink to each ordinance. For additional examples, the EPA's ENERGY STAR program developed an interactive map[77] to track benchmarking programs in the US that are utilizing Portfolio Manager in their ordinance. All of the ordinances listed below involve mandatory reporting requirements and utilize Portfolio Manager as the primary benchmarking platform.

Energy & Water Benchmarking Ordinance: South Portland, Maine[78]

Adopted in 2017, the Energy & Water Benchmarking Ordinance in South Portland, Maine requires all municipal, school, and commercial buildings larger than 5,000 square feet to benchmark and disclose their annual energy and water consumption to the city each year. The ordinance also applies to residential multifamily buildings with more than 10 units. In order to encourage increases in energy efficiency, the ordinance mandates that each covered property subject to reporting requirements must complete a building energy audit once every five years. However, while disclosure of the building energy use and periodic audits are required, the policy does not mandate buildings to meet certain levels of energy efficiency, reach energy reduction targets, or make energy-related improvements. Typically, it's uncommon for mandatory benchmarking ordinances to offer incentives, but in the case of South Portland, they offer a $5,000 compliance incentive that can be used as a credit for future expenses stemming from city application, review, or inspection fees associated with construction or redevelopment projects at the property.

Building Energy Saving Ordinance: Berkeley, California[79]

Adopted in 2015, the Building Energy Saving Ordinance (BESO) in Berkeley, California requires that all covered buildings report their annual energy consumption. The BESO phases in reporting requirements by building size so that larger buildings over 50,000 square feet must report first in 2018 while smaller buildings, such as those below 5,000 square feet, are not required to report until 2022. Similarly, covered buildings over 25,000 square feet must conduct an energy assessment every five years while covered buildings below that threshold must only conduct an energy assessment every ten years. Berkeley also

operates an Energy Efficiency Inventive Program that complements the BESO and encourages building upgrades and improvements.

Building Energy Use Disclosure Ordinance: Cambridge, Massachusetts[80]

Adopted in 2014, the Building Energy Use Disclosure Ordinance (BEUDO) in Cambridge, Massachusetts is a time-tested ordinance that provides a wealth of resources and data that can be leveraged by those looking to create ordinances in other jurisdictions. Covered buildings include all buildings over 25,000 square feet, residential buildings with over 50 units, and municipal buildings over 10,000 square feet. Each of these building subsets are required to report energy and water usage to the city on an annual basis. The results of the reporting are publicly disclosed on a building-level basis on the Cambridge Open Data Portal. Cambridge also publishes annual reports, summary statistics, and compliance maps.

Strategy 6: Adopt Solar and EV Ready Guidelines for All New Commercial Developments

Overview of the strategy

The City of Keene can adopt solar PV and electric vehicle (EV) ready guidelines that encourage or require new developments to be built in a manner that accommodates future solar and EV charging station installations. Designing new buildings with future installations of these technologies in mind, opposed to installing them at existing buildings not designed to accommodate the required infrastructure, can significantly reduce total costs associated with the installation. For example, one study found that installing an EV charging space at an existing commercial building is 2.8 to 4.0 times more costly than installing the same EV charging space at a new commercial building.[81] Preemptively reducing cost barriers to entry for these key technologies can accelerate community-wide adoption of solar and EV charging in commercial developments. Access to EV charging, especially at the workplace, is key to the widespread adoption of EVs. This policy could also serve as a foundation for more far-reaching guidelines in the future that could, for example, require new residential buildings to also be built solar and EV ready.

Source: City of Keene

EV charging stations, like the ones pictured above at the Commercial Street parking lot in Keene,[82] will be more cost effective to install if new construction is designed to accommodate future installation by taking steps such as installing all necessary electrical infrastructure, pulling conduit and wire to the appropriate locations, and ensuring concrete work accommodates mounting of charging stations.

Keys Benefits and Challenges

Key benefits and challenges associated with adopting solar and EV ready guidelines are summarized below:

Key Benefits	Key Challenges
Reduces technical and financial barriers to solar and EV infrastructure implementation over the medium/long-term	Limited direct energy impacts expected as **the strategy does not directly generate clean energy** and is limited to the new construction market
Facilitates community adoption of EVs by increasing access to publicly available charging infrastructure	**Limited precedent**, with few examples of extensive solar and EV ready guidelines currently implemented in New England
Low-cost step for building owners, positioning them to take advantage of **lower infrastructure costs in the future**	**Additional upfront construction costs** to ensure solar and EV readiness may need to be reconciled
Several **resources outlining best practices** are already available via **SolSmart**[83] and other sources	**Administrative burden** associated with development of guidelines or ordinance.
Establishes a foundation for future action in the residential market and surrounding communities	

Implementation Steps

Initial implementation steps for establishing a Community Power program are listed below:

	Implementation Steps
✓	**Leverage the City's ability to adopt more stringent building regulations or (stretch codes).** Local governments in New Hampshire have the ability to adopt stretch codes, which can be used to implement stricter guidelines than those explicitly outlined by the New Hampshire State Building Code. Stretch codes are a tool Keene can use to require higher building standards that coincide with solar and EV readiness guidelines.
✓	**Evaluate if solar and EV ready guidelines will be a recommendation or requirement for new construction.** For example, some communities opt to make solar and EV readiness a recommendation at first, then transition to a requirement later.
✓	**Consider if Keene's solar and EV ready guideline requirements will vary based on size, function, and financial ability of the building owner.** For example, communities may require larger commercial buildings to follow building guidelines and relax the guidelines for smaller entities.

Key Examples from Other Communities

This section includes examples from communities that have implemented best practices related to the implementation of solar and electric vehicle readiness guidelines in the United States. Each example includes a few key points and differentiating factors.

Commercial Buildings Solar Requirement[84]: Watertown, Massachusetts

In 2018, Watertown's Planning Board amended their zoning language, requiring all developments greater than or equal to ten thousand (10,000) gross square feet or containing ten (10) or more residential units to include a solar energy system that is equivalent to a minimum of 50% of the roof area of all buildings. In cases where a site includes an uncovered parking structure, the structure will also be required to have a solar energy system installed.

Solar Friendly Best Planning Practices[85]: Southern New Hampshire

The Southern New Hampshire Planning Commission (SNHPC) created this resource to assist New Hampshire communities interested in facilitating solar PV adoption. This includes guidance on how to develop solar friendly land use and zoning regulations and the policies and planning practices that remove barriers to development and reduce burdensome soft costs.

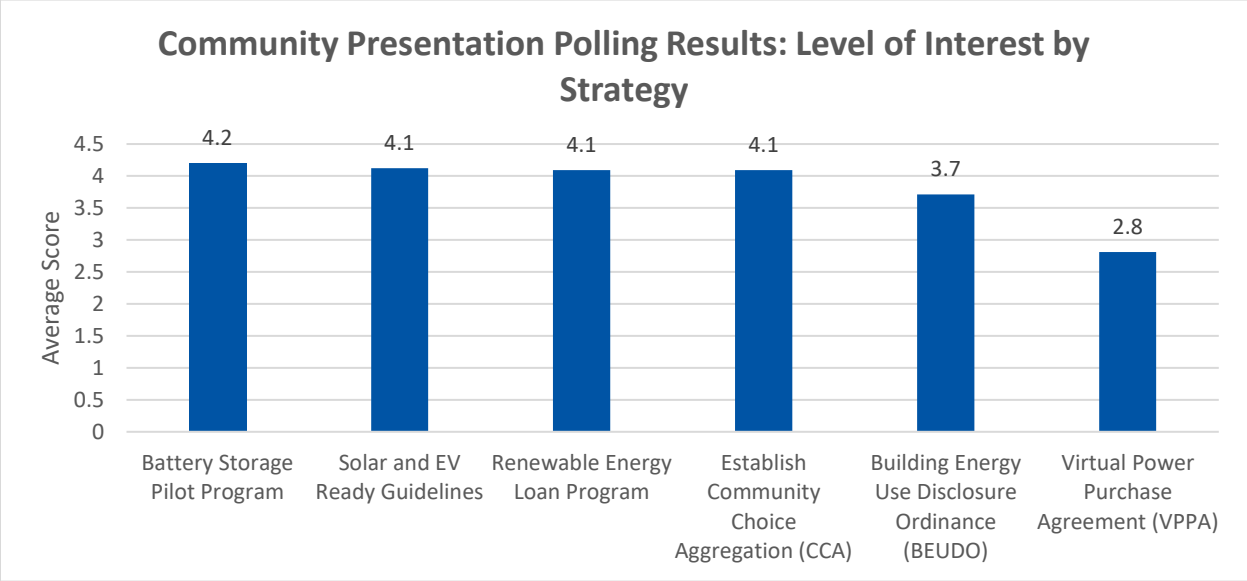
Solar and EV Readiness Reach Codes[86]: San Mateo, CA

The City of San Mateo has effectively leveraged their ability to implement reach codes to facilitate solar and EV infrastructure adoption in their community. The City requires all new construction to install a minimum size solar PV or solar thermal system in addition to requiring a minimum number of EV capable spaces or charging stations at qualifying sites. San Mateo has found that establishing minimum requirements often results in owners and developers far exceeding what is required in order to maximize cost-effectiveness.

Community Feedback

The Cadmus Team hosted a webinar entitled *City of Keene Renewable Energy Transition Analysis* on the afternoon of April 2nd, 2020 and presented a similar, condensed presentation to City Council later that evening. The community webinar provided an overview of the analysis included in this report and was open to the public, with over 30 community members in attendance. Those who joined the webinar were encouraged to actively participate throughout the presentation, with the opportunity to submit questions throughout and answer poll questions gauging their general level of interest on each of the six strategies described.

Community participants were asked to express their level of interest in Keene pursuing each strategy on a scale of 1-5, with a **score of 1 equating to a "Low" level of interest and a score of 5 equating to a "High" level of interest**. The figure below summarizes the average score each strategy received from the public polling exercise, ordered from the highest to lowest priority.



Conclusion

Keene has taken substantial action to date to support the development of renewable energy in the community and the recent adoption of the ambitious 100% community-wide renewable electricity by 2030 goal demonstrates the City's commitment to remaining a leader in climate mitigation efforts. The development of this Renewable Energy Transition Analysis lays a foundation for Keene to continue making strides towards the overarching 100% renewable electricity goal. As outlined above, Keene has multiple effective strategy options that could be leveraged to help meet this goal, while simultaneously achieving other community priorities including resilience, creating local jobs, reducing energy costs to local businesses and providing equitable access to clean electricity for all residents.

While all six strategies have the potential to drive increased reliance on renewable energy in Keene, the combination of Strategy 1 (Establish a Community Power Program) and Strategy 2 (Engage in a Virtual Power Purchase Agreement), in particular, have significant potential. The establishment of a CPP would enable Keene to offer electricity products that have a high renewable energy content to all residents and local businesses and a VPAA between the CPP and a renewable energy generator would reduce the CPP's reliance on unbundled RECs. The VPPA would ensure that the electricity products being offered to the Keene community through the CPP were driving 'additional' renewable energy products that would not have been built in the absence of the VPAA. While some residents and businesses would continue to procure their electricity from Eversource or other competitive suppliers, the City could still expect a high enrollment rate in the CPP due to competitive pricing and the "opt-out" nature of CPPs. Although still recommended for implementation, many of the other strategies detailed in this report are simply not as likely to achieve the same scale as the complimentary strategies of CPP formation coupled with a VPPA. For the four other strategies, limitations on achieving scale include reliance on partnerships and funding outside the direct control of the City (Strategy 3 and 4), programmatic focus on overall building energy goals without a direct path to increasing renewable energy supply (Strategy 5), and applicability being limited to new construction projects (Strategy 6).

Achieving a 100% renewable electricity supply is a critical step in the path towards achieving Keene's 2050 goal of having all thermal energy and energy used for transportation come from renewable sources by 2050. The two goals are directly linked – achieving 100% renewable electricity unlocks the potential for technologies including air source heat pumps and electric vehicles to be truly carbon neutral. The findings of this report provide the City with key information to support the implementation of six priority strategies, including key benefits and challenges, implementation steps, and examples from other leading communities. Next steps for Keene include reviewing and discussing the findings of this report with the Keene Climate and Energy Committee, along with other key stakeholders, to determine a course of action for implementation.

Appendix A. State-Level Incentives

Tax Incentives

- **Local Property Tax Exemption**. Local property tax exemptions vary by city across New Hampshire. For example, the City of Keene set the solar exemption to "equal the total assessed value attributed to the solar energy system."[87] Similar local exemptions can also be applied to wood heating and wind systems as well.

Rebate Programs

- **Residential Small Renewable Energy Rebate Program**. Residential solar customers are eligible for the State rebate program on a first come, first serve basis. They may receive up to $2,500, granted they complete the pre-approval and final application. This is upheld by HB 1628.[88]
- **Residential Solar Water Heating Rebates**. Residential solar water heating customers are eligible for the State rebate program on a first come, first serve basis. They may receive up to $1,900, granted they complete the pre-approval and final application. This is upheld by New Hampshire Statutes, Chapter 362-F:10 and NH PUC Order No. 25,092.[89]

Loan Programs

- **Enterprise Energy Fund Loans**. Business and non-profit owners may apply for a loan through the New Hampshire Community Loan Fund and the New Hampshire Community Development Finance Authority. Loan amounts range from $50,000 to $500,000, with interest rates between 2% and 2.5% for non-profits, and 2.75% and 4% for for-profit businesses.[90]

Appendix B. Renewable Electricity Baseline: Consumption and Percentages

Renewable Energy Mix Percentage	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total Renewable	**19.7%**	**22.3%**	**23.1%**	**24.0%**	**24.9%**	**25.8%**	**26.7%**	**26.7%**	**26.7%**	**26.7%**	**26.7%**	**26.7%**
Total Non-Renewable	**80.3%**	**77.7%**	**76.9%**	**76.0%**	**75.1%**	**74.2%**	**73.3%**	**73.3%**	**73.3%**	**73.3%**	**73.3%**	**73.3%**

Renewable Energy Consumption (MWH)	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Residential	12,137	12,241	12,680	13,111	13,511	13,902	14,307	14,195	14,133	14,070	14,008	13,945
Commercial	30,563	31,347	32,394	33,342	34,406	35,372	36,634	36,583	36,612	36,641	36,671	36,781
Industrial/Manufacturing	308	316	326	336	346	356	369	368	369	369	369	370
Municipal	860	4,263	4,221	4,171	4,139	4,097	4,092	4,086	4,090	4,093	4,096	4,109
Total RE Consumption (MWH)	43,868	48,166	49,621	50,959	52,403	53,727	55,402	55,233	55,203	55,174	55,144	55,205

Appendix C. Renewable Energy Strategy Prioritization Exercise

In consultation with the City of Keene, Cadmus developed an initial list of potential strategies for the City to consider exploring in further depth. To help the City select up to six strategies to be included within the renewable energy plan, the Cadmus Team evaluated strategies against high-level criteria. Full details of this analysis are summarized in the table below:

Strategy	Description	Targeted Impact	Scale of Impact Score	Local Impact Score	Local Environmental and Social	Inclusion and Social Equity Score	Feasibility Score	Timeline
Establish a Community Choice Aggregation Program (municipal)	Establish a community choice aggregation	Municipal, Residents, Businesses, Organizations within City of Keene	High	Low	Low	Medium	Medium	~12 months to establish/start operating Municipal participation will depend on when current contracts expire
Establish a Community Choice Aggregation Program (Joint Office)	Work with other entities to consolidate demand and establish a community choice aggregation	Municipal, Residents, Businesses, Organizations in Keene and in the region	High	Low	Low	Medium	Medium	~12-18 months to establish/start operating Municipal participation will depend on when current contracts expire

Strategy	Description	Targeted Impact	Scale of Impact Score	Local Impact Score	Local Environmental and Social	Inclusion and Social Equity Score	Feasibility Score	Timeline
Virtual Power Purchase Agreements (VPPAs) by City	Agree to a contract for differences (CfD) with a renewable energy developer at a given strike price to receive the RECs from a project. The renewable energy system developer sells the energy generated into the normal power market and uses the CfD as a hedge on the variable price of power.	Municipal, and potential partners (local businesses or organizations)	Medium	Low	Medium	Medium	High	~3-6 months to identify a RE project and negotiate a contract ~10-20 year term
Host a renewable energy bulk purchasing program (e.g. Solarize Campaign)	Support solarize-style campaigns in the City to expand solar capacity	Residents, businesses, organizations in Keene or region	Low	Medium	Low	Medium	High	~8 months to organize and run a bulk purchasing campaign
Purchase Renewable Energy Credits or enter into competitive supply agreement for renewable energy	Allows municipality to purchase renewable energy that matches consumption. RECs tend to be annual purchases and competitive supply agreements tend to be short-term.	Municipal	Low	Low	Low	Medium	Medium	~2 months to identify/negotiate contract ~1-3 year contract term

Strategy	Description	Targeted Impact	Scale of Impact Score	Local Impact Score	Local Environmental and Social	Inclusion and Social Equity Score	Feasibility Score	Timeline
Encourage residents and businesses to purchase RECs or enter into competitive supply agreements	Encourage community members to purchase RECs or enter into competitive supply agreements.	Residents, businesses, organizations in Keene	Low	Low	Low	Low	High	If implemented - could include a marketing campaign, creation of resources (webpage, fliers, one pagers), workshops, with ongoing updates ~3 months-3 years
On-Site Generation - Direct Ownership	Install renewable energy projects on City facilities and City-owned lands; City would own the project(s) and the RECs.	Municipal	Low	Low	Medium	Medium	Low	~12-18 months to install on-site system Would be ongoing as opportunities arise for procurement.
On-Site Generation – Third-Party Owned	Generation is installed on City Property, but rather than owning the PV system, the City uses solar leasing or PPA to pay a fixed price for electricity generated by PV panels on city property	Municipal	Low	Low	Medium	Medium	Medium	~12-18 months to install on-site system ~10-20 year contract term with potential opportunity to purchase the system
Local Renewable Energy Requirements	Require renewable energy installations in certain cases, such as new construction.	Businesses	Low	Medium	Low	Medium	Medium	~3 months-1 year Largely dependent on political capital needed to pass mandate

Strategy	Description	Targeted Impact	Scale of Impact Score	Local Impact Score	Local Environmental and Social	Inclusion and Social Equity Score	Feasibility Score	Timeline
Adopt Solar Ready Guidelines	Encourage or require new buildings to be built in a way that accommodates future solar installations	Businesses	Low	Low	Low	Medium	High	~2-3 months to develop and encourage solar ready guidelines Adopting mandatory guidelines may take additional time
Local Renewable Energy Non-Financial Incentive Programs	The City establish programs to incentivize renewable energy for residents and businesses. Such programs could include creating local competitions where the primary incentive would be public recognition of achievement.	Residents, Businesses	Low	Low	Low	Medium	High	~12-18 months to design and run an incentive program

Strategy	Description	Targeted Impact	Scale of Impact Score	Local Impact Score	Local Environmental and Social	Inclusion and Social Equity Score	Feasibility Score	Timeline
Local Renewable Energy Financial Incentive Program(s)	The City establishes programs to incentivize renewable energy for residents and businesses. Such programs could include local tax rebates for renewable energy installations, tax credits, exemptions from property taxes, and zero interest and forgivable loans.	Residents, Businesses	Low	Medium	Medium	Medium	Low	Largely dependent on available capital and political capital needed. Could be 1-3 years.
Reduce permitting, zoning, and inspection barriers to Renewable Energy	The City streamlines the permitting, zoning and inspection processes so that processing time and expenses are reduced. This may include streamlining permitting processes for specific technologies that meet certain standards, and eliminating redundancies from inspection protocols.	Residents, Businesses	Low	Medium	Medium	Medium	High	~2-3 months to identify and reduce barriers through permitting, zoning, and planning improvements Timeline may vary depending on community's process for changing zoning language.

Strategy	Description	Targeted Impact	Scale of Impact Score	Local Impact Score	Local Environmental and Social	Inclusion and Social Equity Score	Feasibility Score	Timeline
Lease City property for renewable energy development	Offer City property for lease to utilities or developers to host renewable energy projects.	Utility RE Supply	Low	Medium	Low	Medium	Medium	~3-12 months to negotiate land leases and contracts.
Community / Shared Solar Projects	Organize community / shared solar projects in which multiple utility customers can subscribe to community solar and benefit from lower rates	Municipal, residents, businesses	Medium	Medium	Medium	Medium	Medium	~6-24 months to identify a site, select a project developer, develop the solar array, and identify customers
Revolving Investment Program	City establishes a revolving fund where proceeds from existing RE projects are reinvested into new RE projects	Municipal (if internal), or residents/businesses if loan fund	Low	Low	Medium	High	Medium	~18-24 months to establish a fund and generate sufficient revenue to invest in RE projects (assumes capital is available to start fund) Ongoing support of RE projects
Partner with a local bank to offer a solar loan program	Create a partnership with a local financial institution to create a loan product to finance renewable energy	Residents, Businesses	Low	Medium	Low	Low	Medium	~12-24 months to develop a partnership

Strategy	Description	Targeted Impact	Scale of Impact Score	Local Impact Score	Local Environmental and Social	Inclusion and Social Equity Score	Feasibility Score	Timeline
	installations targeted at businesses or residents							
Work with the utility to develop a pilot incentive program for renewable energy or storage	Engage electric utility on providing potential incentives for renewable energy installations or energy storage by residents or businesses in Keene	Residents, businesses	Low	Low	Low	Medium	Medium	~6-12 months before a pilot program is implemented, ongoing KPI/metrics tracking
Re-establish the Ecovation Hub	Work with local colleges, vocational schools in the region to reestablish the Ecovation hub to create course content focused on renewable energy	Residents	Low	Low	Low	Medium	Medium	~12-18 months to develop a workforce training program Ongoing workforce training

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