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NET METERING POLICY OPTIONS FOR WOLFEBORO, NH

Presented to Wolfeboro Energy Committee

PRS Policy Brief 1819-01
March 7, 2019

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EXECUTIVE SUMMARY

Because there is an interest among residents and businesses in expanding local generation of renewable energy, the Town of Wolfeboro, New Hampshire implemented a pilot net metering program in 2008, and the Wolfeboro Municipal Energy Department is now exploring the economic feasibility of expanding this program for more of its residents. This report presents a wide range of net metering policy options for Wolfeboro to consider. To that end, this report first provides background on net metering and supplemental technologies. From there, the report describes "value of solar," battery storage, large scale solar arrays, and modified power purchasing agreements in detail, drawing on the experiences of other towns and utilities that have implemented similar policies and technologies. We end with a discussion of possible next steps the Town of Wolfeboro may consider to create a net metering policy that is equitable for all stakeholders.

1. INTRODUCTION: TOWN OF WOLFEBORO

In April 2008, the Wolfeboro Municipal Energy Department (MED) introduced the *Wolfeboro Municipal Energy Department Net Metering Pilot Program* to promote more sustainable energy practices. Forty-one participants are currently enrolled in the pilot program. The MED customers enrolled in the program are allowed to set up renewable technology on their own property within the MED's franchise area, although the resource capacity of that energy source cannot exceed 25 kWh.[1] Excess energy produced beyond what is consumed can be exchanged for credit to buy energy from the MED at a later time, providing incentive for Wolfeboro residents to participate in the program. In 2018, of the 41 participants in the program, 30 participants delivered more energy to the grid than they received.

The primary barrier to expanding the current Pilot Program to a larger-scale policy is ensuring the economic viability for the MED of implementing a widely used net metering program. The MED currently negotiates with Constellation Energy to buy Wolfeboro's energy. If the MED customers begin to generate their own energy, and/or store their own energy on their premises, demand for traditional energy could drop, thereby potentially reducing the MED's negotiating power when purchasing from Constellation. This could possibly raise energy prices for those who could not afford a renewable generation unit. However, this concern might be overemphasized in the case of Wolfeboro because of available options to address the problem, such as using battery technologies to offset higher prices; section 3.2 outlines battery technologies in detail. That being said, Wolfeboro is considering ways to work around these barriers to achieve increased renewable energy sources given its proposed goal of working towards 100 percent renewable sources of energy.

2. NET METERING BACKGROUND

This section describes net metering in general terms and delineates the different types of net metering that are relevant to Wolfeboro.

2.1 What is Net Metering?

Net metering is a policy that allows individuals or businesses to generate their own renewable energy, most often in the form of solar energy, and receive compensation for it. In a standard energy market, a utility supplies energy to a customer through the grid; the customer is charged a standard rate for this energy. Under a net metering system, the customer can install a solar array to generate energy for their home or business instead of buying it from the grid. The customer buys a meter from the utility to measure how much energy their solar array is generating. At the end of a billing period, the customer is reimbursed for how much energy their solar array generated. If a customer produces more energy than they use for a billing period, then they receive a credit for the next billing period.[2] On the energy provider side, having many customers who produce energy for the grid also decreases reliance on big contracts and shaves peaks if paired with battery technologies.

An important aspect of this policy is how much the customer gets reimbursed for their energy. Are they being reimbursed more than the market value of the energy that they are producing? Currently, Wolfeboro reimburses its customers for their energy production at the same rate that a customer would pay to purchase that same amount of energy from the MED; due to administration and distribution costs, this is often more than what the MED would pay Constellation to supply that same amount of energy. This topic is important for understanding the challenges associated with net metering, and it will be discussed further in section 3.1. For the utility, considerations must include how customers that do not participate in net metering will be impacted and how current energy purchasing contracts will be affected. The answers will depend on the size of the utility and the structure of their net metering policy. This will be discussed in greater depth in section 2.3.

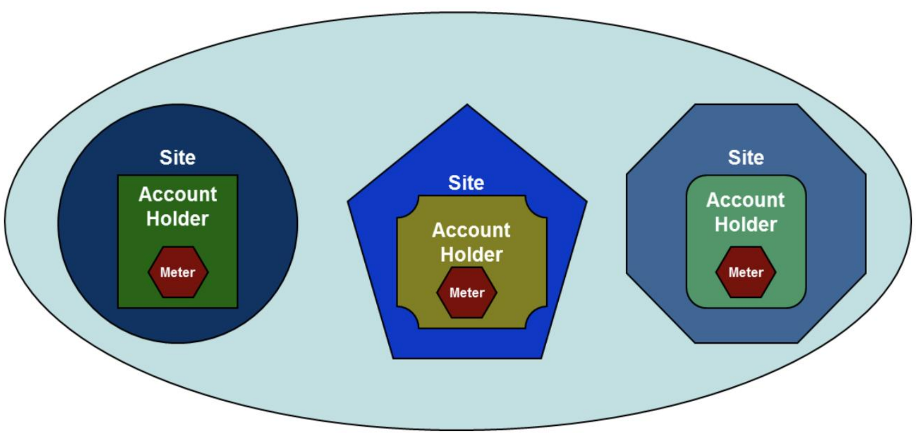
2.2 Types of Net Metering

There are a couple of different ways of implementing net metering policies. Wolfeboro's pilot program uses the most common type of net metering, which is known as "conventional" net metering. Under this method, the solar array must be connected to a meter for the property that it will be producing energy to offset the energy use. To make this even simpler, Wolfeboro's pilot program limits the amount of generating sources to one per property and one meter per property.[3] In other words, the town does not allow participants to have multiple solar arrays or use a single solar array to offset multiple meters. The limited scope of conventional net metering above makes it easy to implement and monitor.[4]

Other states and municipalities have experimented with more complex forms of net metering. Seventeen states, including New Hampshire, allow for different forms of "aggregate" net metering policies.[5] The specifics of each policy vary from state to state, but the main idea is that consumers can expand their net metering capabilities past a single array or meter. For example, a customer in an aggregate net metering community could have multiple solar arrays to generate energy, and these arrays do not have to be connected to the main property. This flexibility allows customers to experiment with combinations of energy generation that works best for their needs, rather than being confined to a conventional policy.

The most complex type of net metering is called "virtual" net metering. Under this policy, participants pool energy together from different properties and equally reap the benefits. Essentially, it is a shared energy program, and it is sometimes referred to as a "Community Solar Project."[6] The figure below shows how such a system might be set up. Each outer box represents a different site for generation, and each inner box represents a different account holder:

Figure 1: Virtual Net Metering



Source: North Carolina Solar Center

2.3 Net Metering Concerns

A primary concern of net metering is that it can raise energy rates for people not participating in the program by acting as a subsidy for net metering customers' energy. This occurs because there is no consensus on what the fairest way is to compensate customers for their solar energy. A possible concern with Wolfeboro's current reimbursement system is that it does not take into account the administrative costs of running the system, nor does it include costs associated with connection to the grid. If the utility has to bear these costs, then it may be forced to raise rates, which is a burden to all customers.[7] For example, in 2016 Green Mountain Power ("GMP") announced a five percent rate increase for its customers, and it cited its customers' extensive use of net metering as a reason for this rate increase.[8] Though Sterling, Massachusetts opted not to raise rates, a memo from 2012 notes that the town lost money by reimbursing net metering customers at a rate higher than market value. To limit the total amount of subsidies, the Sterling Municipal Light Department (SMLD) recommended instituting a cap on the amount of energy that can be produced by non-commercial entities.[9] The goal of this cap was to limit the total amount of subsidies offered by the department and help the utility cover its administration costs. On the state level, Massachusetts passed law in 2016 that cut reimbursements for commercial (25 kWh or greater) net metering units by 40 percent to mitigate this issue that was arising in other communities as well. This move was decried by clean energy advocates, as they feared it would reduce investment in solar energy.[10]

Proponents of net metering argue that a quasi-subsidy for net metering is an appropriate trade-off for cleaner energy. Opponents say that the ultimate goal of a utility should be to provide energy at the lowest rate possible. Technology firms like Tesla argue that combining net metering with new storage technology can make it possible to subsidize solar while at the same time, lowering rates for all ratepayers through reducing peak load costs, which will be discussed further in section 3.2.

Net metering can also pose the potential problem of reducing the size of purchasing contracts utilities sign with energy generators. While concerns over of purchasing power are not entirely unfounded, for smaller utilities that are already purchasing small amounts of energy relative to other utilities, this concern is perhaps overemphasized.

3. POLICY OPTIONS

The policy options described below are informed from several interviews and on-site visits with industry experts including Sean Hamilton of the Sterling Municipal Light Department (Sterling, MA) and Dan Mackey of Green Mountain Power (Rutland, VT), as well as options that we found through our own research. This report presents the ones that we thought were most relevant to the town of Wolfeboro. An important note is that the policy options described below are not mutually exclusive. Wolfeboro may choose to implement one of these options, a combination of these options, or none of these options at all.

3.1 Valuing Solar

One of the ways to mitigate potentially increased costs associated with net-metering is valuing the energy produced by net-metering arrays at a different rate from market value. This is known as a "Value of Solar Tariff" ("VOST"). This pricing methodology was designed to reflect potential externalities not captured in the market price for clean energy, such as reduced pollution. To determine this rate, some municipalities employ complex models that determine a fair rate to pay consumers. Other municipalities simply choose a VOST that works best for the municipal energy department's finances. The different types of VOSTs are discussed below.

3.1.1 Complex Value of Solar Tariff

There are a number of different variables that can go into a complex VOST. The VOST used by Austin, Texas takes into account six components to determine a fair rate of compensation for net metering customers. These six components are: loss savings, energy savings, generation capacity savings, fuel price hedge value, transmission and distribution (T&D) capacity savings, and environmental benefits. These factors comprise the Photovoltaic Value Calculator, which informs Austin regulators regarding the rebate level for each fiscal year.[11]

It should be noted that such a system will require a more complex billing system than the Wolfeboro MED currently uses. As the MED Director Barry Muccio noted in a recent report, he thought that the functions necessary for calculating a VOST type rate would, "[be] cumbersome from a billing perspective." Additionally, using this sort of rate calculation brings more uncertainty for the MED in terms of how much they will be reimbursing customers for their solar net-metering. If variable inputs change significantly, then it will be harder for the MED to predict what the reimbursement rates will be. In a perfect world with unlimited resources, a complex VOST is the first best way to price energy for optimal social impact. However, because resources are limited, implementing a complex VOST is not always possible, and municipalities turn to a simpler VOST.

3.1.2 Simple Value of Solar Tariff

A simple VOST does away with the complex calculations described above. Instead, the MED would choose a rate of reimbursement that suits the needs of the department. This could mean adopting a rate that would take into account distribution costs but would still incentivize consumers to adopt solar energy. For example, if the customer's current retail cost for energy at a given hour is ten cents per kilowatt hour, then the MED could choose to reimburse net-metering customers eight cents per kilowatt hour to recoup the approximate two cents of distributive and administrative costs.

This system is similar to what the Massachusetts state legislature decided to implement in 2016. As discussed in section 2.3, the legislature slashed reimbursement rates by 40 percent for systems that produce more than 25 kWh of energy. While critics decried the move, our interview with Sean Hamilton of the Sterling Municipal Light Department (SMLD) in Massachusetts suggested that this was not as big of an issue as it was made out to be. Mr. Hamilton said that when the MED takes time to explain to customers why it is prudent to subtract administrative costs from the reimbursement, they generally understand.[12] If Wolfeboro decides to utilize a simple VOST below market rate, then it should probably provide customers with a justification for why their reimbursement rates are cut. A market rate that is inclusive of distribution costs would yield an equation like this:

MARKET RATE - DISTRIBUTION COSTS = COMPENSATION TO CUSTOMERS

3.2 Battery Storage Systems

One of the primary challenges with net metering (and solar energy in general) is that energy is produced during hours when energy usage is low. Ideally, excess solar energy produced during off-peak hours should be stored for use during peak energy hours. This would not only dramatically reduce energy costs for ratepayers because market prices for traditional generators are high during peak demand, but it would also significantly reduce carbon emissions during peak consumption.

Until recently, energy storage technology was too expensive and not advanced enough to make this a reality. However, advancements in technology and lowered prices have allowed utilities and net metering customers to store more energy than ever before. Batteries capable of storing more than three MWh of energy are being made available to utilities. On a consumer and commercial level, home battery packs like the Tesla Powerwall are capable of storing 10-90 kWh of energy.[13] While the up-front costs of these storage technologies are still significant, they are options that should be explored in any considered expansion of solar energy policy.

3.2.1 Residential

Green Mountain Power is an example of a utility that uses residential batteries to shave peaks in Rutland, VT. They recently subsidized Tesla Powerwalls in the homes of over 2,000 net metering customers.[14] They asked customers to pay $1,500 for installation instead of the retail value of $7,000. In exchange for this subsidy, the customer allows their net metering solar array and Tesla energy storage unit to be connected to GMP’s grid. During times of peak energy usage, the utility can tap into these home storage units and use this energy, paid for at a fixed rate, instead of purchasing energy from the grid. The savings that this “Virtual Power Plant” program is providing are significant. Over just one hot week during Summer 2018, GMP saved over $500,000 by drawing on this stored energy, offsetting up-front battery costs.

Wolfeboro’s current net metering program is such that energy is drawn from consumers as it is produced. Under a model that includes batteries in the homes of consumers, Wolfeboro would be able to choose when to draw energy from net metering customers at a given rate (fixed or dynamic), thereby shaving peak costs substantially. In this way, residential batteries could support a net metering policy that is equitable for all stakeholders. If the Wolfeboro Municipal Energy

Department were to pursue virtual net metering paired with batteries, its leaders may wish to consider the following variables when crafting their policies and programs:

Up-front Costs and Incentives: The cost of batteries is somewhat high and serves as a barrier for many people considering more advanced solar technology in their homes. To encourage more participation from Wolfeboro residents and ultimately have more net metering homes from which to draw energy during peak demand, the Wolfeboro Municipal Energy Department could think about helping customers cover up front costs. This can take the form of a direct subsidy that helps pay for batteries and connections to the grid in Wolfeboro homes. The economic justification for such a subsidy would be the money saved by shaving peaks with these batteries. Incentives can also take the form of loans, with the MED buying the batteries up-front, and then allowing customers to pay for the batteries in installments, with or without interest.

Rate/kWh: As described in Section 3.1, Wolfeboro can choose to calculate the net metering rate in a variety of ways. Regardless of their choice, the Wolfeboro MED should keep this rate in mind when creating policies or programs in which energy is drawn from customers. Transparently including the rate for energy drawn from batteries during peak demand in any contract signed by a customer would protect the Wolfeboro MED in legal situations and build trust with consumers. Clarifying how the rate is determined is also a part of transparency. In the case of Sterling, MA, a net metering rate that initially seemed low was ultimately acceptable to the majority of customers after an explanation of market rates.[15] Not including the rate in such a policy or program contract could cause confusion and/or distrust in the Wolfeboro MED.

3.2.2 Commercial

On a commercial scale, batteries can be tied to Wolfeboro's grid in exactly the same was as in residential sites, but because of the nature of commercial sites, there will probably be much more energy involved and a much higher up-front cost. To alleviate the monetary barrier to entry, entities like the Sterling Municipal Light Department and Green Mountain Power have allowed for *Power Purchasing Agreements*, or PPAs. See section 3.4 for more details.

3.2.3 Municipality-Owned

Large, utility-scale solar arrays supported by utility-scale batteries are another use of batteries in solar energy production. In these cases, the batteries are capable of storing more than three MWh of energy. Utility-scale batteries today are most often lithium ion batteries. One factor of concern with this technology is that the batteries are built to only cycle, or be fully charged, once per a day. This limits the amount of energy that can be stored and later deployed from these batteries. Regardless, there are still many benefits to these batteries, and advancements in technology are only making them a better option for resolving the issue of solar not producing during peak energy hours.

Just as pairing batteries with solar generation can contribute to cost savings for residential generators, similar benefits are seen for utilities that invest in batteries. Sean Hamilton of the Sterling Municipal Light Department (SMLD) attributed $146,000 in savings for the utility in 2018 as a consequence of using batteries to offset peak hours.[16] Dan Mackey of Green Mountain Power (GMP) in Rutland, Vermont also cited large savings from using batteries in the same manner, including both residential and their utility batteries.[17] More specifics on GMP's savings can be found in Section 3.2.1. In Rutland, GMP uses three lead utility batteries and three lithium ion batteries; the utility has plans to decommission the lead batteries and replace them with lithium ion batteries. Mr. Mackey noted that the costs of the utility-scale batteries are significant but ultimately prove worthwhile for GMP. The batteries have an approximate life span of 10 years, depending on the demand placed on the batteries. More frequent cycles in a shorter time frame can reduce the estimated life span as well as reduce the efficiency of the batteries themselves.[18]

Pursuing an investment in utility-scale batteries will inevitably require discussions concerning financing the up-front purchase of the batteries. However, the return-on-investment can be quick, as both the SMLD and GMP reported.

3.3 Larger-Scale Solar Arrays

Larger-scale solar arrays are defined in New Hampshire as facilities that generate more than 100 kilowatts (kW) and up to the state maximum of 1,000 kW (which is equivalent to one megawatt).[19] Utilities or commercial energy customers, such as retail companies, can choose to build arrays of this size. The benefits of utilities and commercial entities opting to develop such projects include potential savings on energy and helping reach renewable energy portfolio requirements.

Our interview with Dan Mackey of Green Mountain Power (GMP) in Rutland, Vermont, provided insight into the large-scale solar array that exists in Rutland and is owned and operated by GMP. In 2016, GMP finished building a 2.5 megawatt-hour (MWh) solar field on Stafford Hill, an old landfill. Mackey and his associates chose to build the array on non-arable land to make the land economically productive. The total cost of the project was $13 million; the utility saw its return-on-investment within 3.5 years of beginning energy generation at the array.[20] It is critical to note that a significant portion of these savings are due to the use of batteries to offset peak energy demands. See section 3.2.3 for more information on GMP's use of the batteries.

Such larger-scale arrays are most cost-effective when connected to batteries, especially when located in climates with less sun across the year. Once the array and the batteries are successfully connected to the local electrical grid, the array can provide significant energy with greater reliability than they offered just a few years ago. While large-scale arrays can prove cost-effective over time and be consistent source of energy, their sizeable up-front costs totaling millions of dollars is a significant barrier to overcome, especially for smaller utilities. For communities with lower energy demands, large-scale arrays may not be worth the costs when smaller-scale options can sufficiently provide the energy needs for customers.

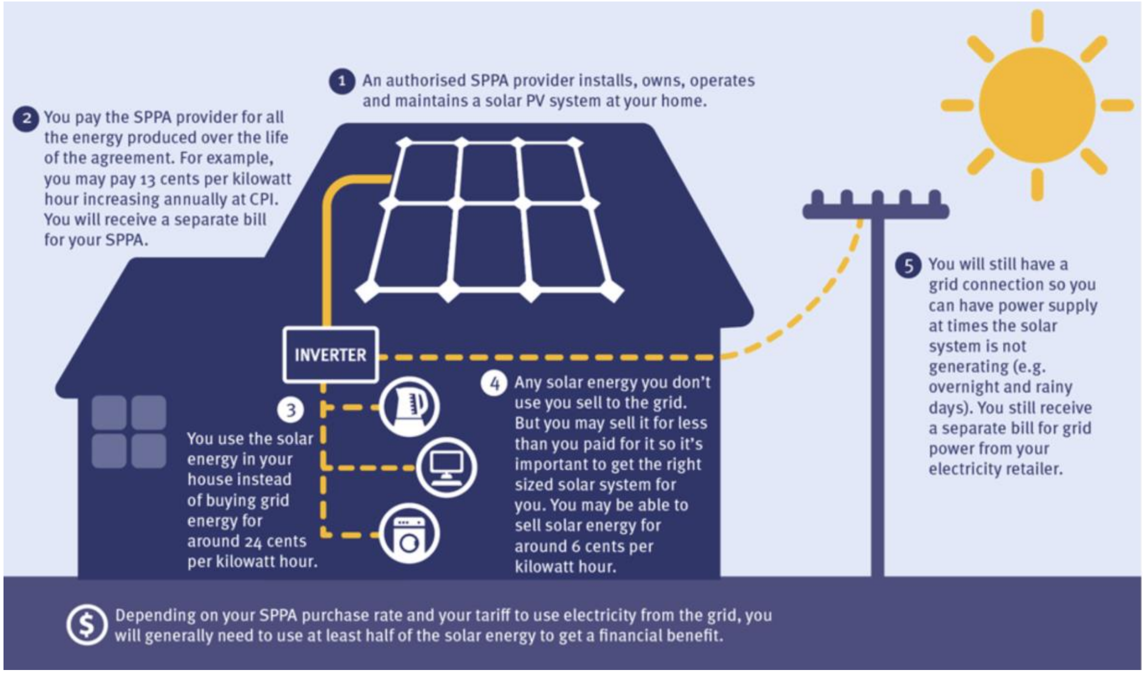
3.4 Power Purchasing Agreements

A power purchasing agreement ("PPA") in this context is a contract between a town and an energy corporation to set up a solar array. In this contract, the corporation pays for all of the set-up of a solar array and all the maintenance costs. In exchange, the town pays the energy corporation a set rate for the energy that this solar array provides. For example, an energy corporation may get paid a constant ten cents per kilowatt hour for energy produced by this array. When the array is not producing energy or there are excess energy needs, that energy is provided by the town at a normal market rate.

A substantive example of this is the Sterling Municipal Light Department in Massachusetts. Their system is unique with its combination of community solar projects and individual net metering units. Recently, the SMLD partnered with Origis Energy to create the Sterling Community Solar and Energy Storage project. Under this agreement, Origis Energy installed 1.7 MWh of rooftop solar energy alongside a two MWh battery pack. In return, the SMLD entered a power purchasing agreement with Origis Energy where they have agreed to buy the solar energy at a specified rate.[21] This solar project will increase Sterling's already sizeable renewable energy portfolio, and the town hopes that the inclusion of a battery pack will help lower costs during peak energy consumption.

For Wolfeboro, the only way this type of agreement would be possible is if the current contract with PSEG allows it. The town should consult with their lawyer and PSEG to determine whether it is legal through their contract. Of course, the town would also have to find a willing corporation for this program.

Figure 2: Small-scale PPA Example



Source: Amanda Energy Solutions

4. POSSIBLE NEXT STEPS

Below are three examples of possible ways for Wolfeboro to move forward with regard to net metering policy and strategy. The three example paths are *not* exhaustive, and they are not mutually exclusive. They vary in the breadth of change required for the MED and show how possible policy options can be combined in different ways.

4.1 Example Path A

One policy option for Wolfeboro would provide numerous incentives for customers to become involved in the net metering program. The first step would be to remove the 25 kWh cap on the amount of energy allowed to be generated by a customer. This would provide incentive for more those customers more committed to producing large quantities of renewable energy to do so, which would in turn likely provide more renewable energy for the MED to purchase and include in its energy portfolio, aiding Wolfeboro in achieving its 100 percent renewable energy goal. Another part of this policy approach would entail continuing the reimbursement rates currently being offered to customers for the electricity that they generate, meaning continue compensating at the market value for the renewable energy kWh. To further incentivize participation in net metering, the MED could also offer a subsidy on residential batteries, such as the Tesla Powerwalls that were discussed in greater detail in section 3.2. The subsidy could range from paying for the entirety of the battery to only covering a portion of the cost, with no expectation of the customer repaying the utility for the costs. While the Tesla Powerwall is one of the more residential-friendly and cheaper options for batteries currently on the market, the costs can exceed $10,000 after all hardware is purchased and the battery is installed. Making such a large investment would increase the effectiveness of the net metering program and allow the MED to better shave the energy demand at peak hours, potentially resulting in increased savings for the utility. These savings may then make the more customer-oriented policies more financially feasible for the utility while also setting Wolfeboro on a strong path to meeting its energy goals. It is hard to predict exactly what would happen in this scenario. In the best case, many customers would install batteries in their homes that are connected to Wolfeboro's grid, which would help shave peaks and possibly even lower rates for all customers. In the worst case, not enough participation would mean that ratepayers who do not participate in the net metering program could disproportionately bear the burden of increased rates.

4.2 Example Path B

Another possible way in which Wolfeboro could proceed with regard to net metering policy is to be slightly more economically conservative but still provide incentives for customers to transition to more sustainable sources of energy. In terms of VOST, this could mean using a simple value of solar tariff to compensate net metering customers by crediting them with the market rate value for their energy with distribution costs taken into account. Wolfeboro could also keep the residential cap of 25 kWh, which is currently not binding to most of pilot program participants. However, the town could consider increasing the ceiling for commercial entities such as the library and allow for PPAs to facilitate up-front purchases. On the battery front, the MED could incentivize battery installments (specifically, Tesla Powerwalls) in the home by offering customers the opportunity to install batteries with a low up-front cost, or no up-front cost at all, and then have the customers pay for the battery over a long period of time with no or low interest. The MED could use reserve funds or take a loan from a bank to fund such a program. Because Tesla is very aware of its public image, it could be worthwhile to contact Tesla to gauge interest in doing a larger scale deal that could cut the cost for the Town of Wolfeboro and provide good press for both parties.[22] These steps would pave the way for Wolfeboro increasing its renewable energy sources but does not require serious fiscal change for the MED. In that vein, Wolfeboro would opt not to build a larger-scale solar array in this scenario.

4.2 Example Path C

Another policy option for Wolfeboro would be to make minimal changes to the current program. This would mean keeping the cap on solar array size at 25 kWh for all customers, commercial or residential. Alongside this cap, Wolfeboro could cut reimbursement rates to cover administrative and distributive costs associated with the program as well as to promote lower rates for non-net-metering customers. Unlike Path B, in this case, the energy department would go farther than just subtracting distribution costs from the reimbursement rate. Instead, the energy department would simply choose a constant rate to reimburse customers for their energy, regardless of what the market value dictates. In terms of a battery program, the energy department would not subsidize the purchase of these batteries; customers would be free to install them as they wish. Lastly, in terms of the library solar project, the energy department could carve out an exception to let the library have a larger array. However, in this path, the energy department would arbitrarily choose a rate to reimburse the library for its excess energy; it would not be determined by market value.

5. CONCLUSION

Moving forward, the Wolfeboro Municipal Energy Department has many considerations to keep in mind when crafting further policies and programs related to net metering. How will customers be reimbursed? Will batteries be a part of any new programming? If so, to what extent, and will there be incentives to purchase them? Will private sector corporations beome involved through PPAs? These questions are important to consider. This report aims to be a resource for MED as its leaders seek to address these questions. We present several policy options that have been used in other municipalities to successfully promote equitable outcomes for net metering customers, traditional ratepayers, and utilities. As Wolfeboro moves forward with crafting net metering policy, keeping the public in the loop will forge a connection and foster understanding between the department and customers.

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