Concord Municipal Light Plant

Strategic Plan 2018 – 2025

Version 2.0

CMLP Strategic Planning Committee
November 2017

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Overview

The Concord Municipal Light Plant (CMLP) presents our Strategic Plan which lays a path forward from 2018 through 2025. CMLP's Strategic Plan is the culmination of an initial planning process and is a living, working plan that will continue to evolve over time. We view this strategic planning effort as the first step in incorporating long-term planning into the way we guide our business here at CMLP.

CMLP's strategic planning team consists of the Director, Assistant Director, Chief Information Officer, Customer Service Administrator, Energy Conservation Coordinator, and Power Supply and Rates Administrator.

In November of 2016, CMLP hired the consulting firms Optimal Energy and Industrial Economics to support our strategic planning work. They worked closely with us on each step of the planning process. In addition to facilitating our own discussion of goals and strategic initiatives, they developed for CMLP a simulation tool that allows us to consider the impact of alternative price, supply and demand, and strategic initiative assumptions on CMLP's net operating income. The results of our collaboration with Optimal Energy and Industrial Economics are presented in this summary narrative.

CMLP's Vision

Early in our planning process, we realized it was time to update our Vision Statement to better reflect where CMLP is today and where we want to be in the near future.

We used the re-worked Vision Statement at right to inform our goals, identified a long list of possible initiatives that could be implemented to achieve those goals, narrowed that list of forty initiatives to seven, and built a strategic plan around them.

> **Vision Statement**
>
> We will partner with our customers, civic institutions, and employees to foster a vital community, in the near and in the long term, in which to live, raise a family, work, and operate a business.

We recognize the public interest imperative to protect our current and future customers from the profound consequences of climate change. CMLP applauds the ambitious goals developed by the Energy Future Task Force (EFTF) and adopted by the community in its support of Article 51 at the 2017 Town Meeting (see Appendix A). We believe that CMLP's strategic plan is a critical component of the community's efforts to reach its vision of a clean energy future.

We also know it is important to address how CMLP will remain financially viable amidst changes in the way the world generates and uses energy, which will be different than the way it has in the past. Short and long-term planning efforts are essential to complete the complex projects that will be necessary to get the results we need, and to make the course corrections that will be required in a fast-changing

world. Our strategic planning initiative has given us a way to decide among the many initiatives we could undertake to reach CMLP and community goals.

We believe this plan can serve as the heart of the town's efforts to reduce its greenhouse gas (GHG) emissions, while maintaining CMLP as a financially-healthy business that can continue to provide the reliable, high quality, and customer-friendly services for which it is known.

Setting CMLP Goals

Our first step in the strategic planning process was to ask, "What goals are important for CMLP during the next eight years?"

We identified six important goals, five of them related directly to maintaining a healthy business. Three of these are related to how our customers see us. Our remaining business goals, increasing revenue and net operating income, are related to long-run financial viability. The sixth goal is related to Concord's vision of a clean energy future. We also defined quantitative indicators and target values that will allow us to measure how well we are achieving these goals.

Graphic 1: Strategic Goals and Monitoring Indicators

	CMLP Goals	Target Value
1.	Maintain System Reliability	No change in customer rating (95.2%)
2.	Maintain or Increase Customer Satisfaction/Perception of Value	≥ 85.8%*
3.	Provide Energy Related Services to As Many Customers as Possible	25% Residential Participation 50% Commercial Participation
4.	Increase Revenue	0% to 5%
5.	Increase Net Operating Income	0% to 5%
6.	Reduce Greenhouse Gas Emissions	100% of 35% goal for 2025

In our 2015 customer survey, 95% of our customers rated our service reliability as good or very good, and we want to keep it that way. Many other businesses would envy the level of customer satisfaction that we enjoy, and our goal is to maintain or increase the level of satisfaction.

We know that customers value other aspects of our service, too. We calculated a composite score of 85.8% based on the following eight other scores from the 2015 customer survey:

- Responsiveness to customers
- Helpfulness and knowledgeability of our staff
- Community service
- Communication with customers
- Our helpfulness to customers in conserving electricity
- Rates
- The degree to which customers feel that CMLP is doing all it can to keep prices fair
- Percent describing themselves as advocates or loyal customers of CMLP

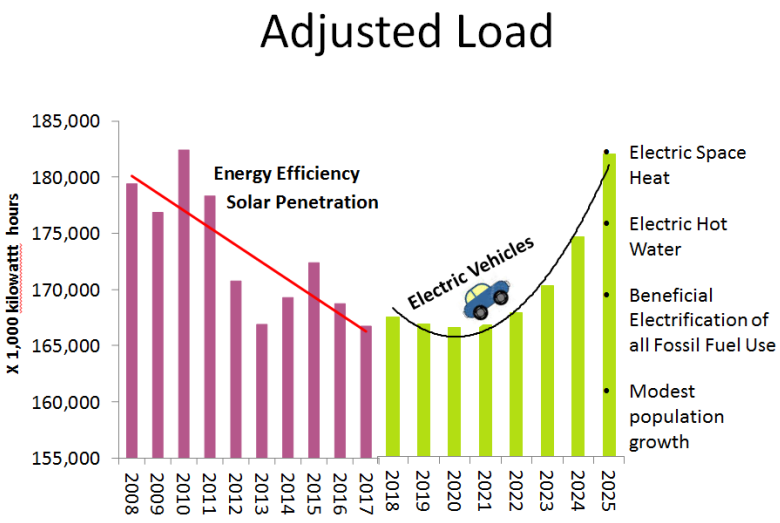
Finally, we serve everyone. We want to provide energy-related services to as many customers in Concord as possible. We set participation targets for different customer classes, defining participation as any engagement with CMLP beyond paying a bill on a standard rate. This could include a customer participating in a time-of-use rate, purchasing a heat pump or electric vehicle, or participating in an energy efficiency program, for example.

Context: Declining Load Trends

CMLP's load—that is, the volumes of electricity purchased and sold— has been declining in recent years. If we project the trend from the recent past, CMLP's future as a business does not look particularly good. We saw the risks and needed to understand what was coming.

Our consultants confirmed these risks and projected a total 5% to 10% kWh sales decline by 2025 for CMLP. The expected decline in sales is attributed to limited customer growth in Concord, increased electricity use efficiency, especially the market transformation occurring in the lighting sector, and increases in customer-sited generation – predominately solar photovoltaic (PV) systems. Our consultants projected more than $2 million in revenue will be lost to these factors.

Graphic 2: Adjusted Load



Other changes may *increase* the demand for electric power. For example, electric vehicle adoption is expected to grow rapidly over the next several decades. Moreover, as electric power is becoming

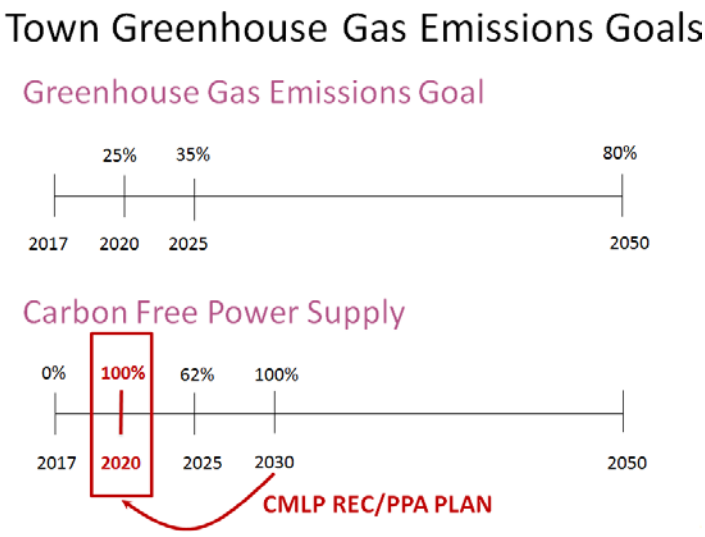
increasingly “green” through increased shares of renewable energy as part of utilities’ supply portfolios, shifting customers from carbon-emitting to non-carbon-emitting power sources for fundamental activities such as transportation and heating could fully reverse the trend of declining loads.

At CMLP, we want to position ourselves for these and other changes that are coming as part of its own and the Town of Concord’s energy future.

Context: CMLP’s Greenhouse Gas Reduction Goals

In 2017 the Town of Concord’s Town Meeting adopted recommendations of the town’s Energy Futures Task Force that called for significant reductions in greenhouse gas (GHG) emissions in coming years. CMLP’s strategy for reducing greenhouse gas emissions by 2025 will singlehandedly keep the town on track to meet its 80% emissions reduction goal by 2050.

Graphic 3: CMLP’s Greenhouse Gas Reduction Goals



To develop a greenhouse gas reduction strategy, we began by looking at the energy goals that the Town Meeting adopted for the town and CMLP. These set a greenhouse gas reduction goal (in relation to 2008 levels) of 25% by 2020 and 80% by 2050 for the entire town. In order to make steady progress towards the first goal, we assumed that by 2025, the end of our eight-year planning horizon, the town will need to reduce its greenhouse gas emissions by 35%.

Initially, we also assumed that to make steady progress towards meeting the Energy Future Task Force’s other goal of a non-emitting power supply by 2030, CMLP’s power supply would need to be 62% emissions-free by 2025. However; in June 2017, the Light Board approved a strategy to procure renewable energy certificates (RECs) that will allow CMLP to reach a 100% emissions-free supply by 2020 (see Appendix B). This policy decision has been incorporated into our strategy.

Concord’s greenhouse gas emissions were about 250,000 tons in 2008 as shown in the second column of Graphic 4 and is the baseline to which the Energy Future Task Force’s emissions reduction goal applies. The third column shows what a 35% reduction in emissions for each fuel type would look like.

Graphic 4: CMLP's Greenhouse Gas Reduction Goals

Greenhouse Gas Reduction Target

Source	2008 GHG emissions (tons)	2025 Town Reduction Goal (tons) (35%)	2025 CMLP Contribution (%)	2025 CMLP Contribution (tons)
electric	83,850	29,348	100%	83,850
gas	51,643	18,075	7.5%	1,356
fuel oil	47,056	16,470	7.5%	1,235
gasoline	68,302	23,906	5.0%	1,195
total	250,851	87,798		87,636

3,786

CMLP Contribution as % of 2025 Town Reduction Goal	99.82%

As displayed in the third column in Graphic 4, just about 88,000 tons of CO_2 would need to be avoided by 2025 to reach that 35% reduction that will keep us on track for 2050. CMLP can contribute almost 84,000 tons towards the reduction by transitioning to an emissions-free power supply by 2020. The Light Board's decision to transition to an emissions-free power supply by 2020 means that we will have reduced greenhouse gas emissions due to electricity consumption to zero before 2025.

CMLP's percentage contributions for natural gas, fuel oil, and gasoline emissions reductions are percentages, not of the 2008 baseline amount, but of the 35% 2025 reduction goal for that fuel type in the second column. During our initial goal setting process, the consultants proposed these percentages as a projection of what they thought we could achieve through strategic electrification. For example, they projected that we could reduce emissions from gasoline by 1,195 tons, or 5% of the 23,906 ton target for 2025.

By helping customers switch from natural gas, heating oil, and gasoline to electrified space/water heating and transportation, we projected that CMLP would be able to contribute about another 3,800 tons of greenhouse gas reduction. With just these two CMLP programs, Concord can meet 100% of the 2025 greenhouse gas reduction goal.

CMLP's Business Goals

We believe that increasing CMLP's revenue is desirable. Revenue is a measure of the size of a business, and we envision CMLP growing in size, not shrinking, in particular due to increased sales of electricity, as our customers transition from burning fossil fuels to using carbon-free electricity to meet their energy needs for transportation and space/water heating. Our consultants suggested that a target value of a 0% to 5% revenue increase was realistic, given the factors expected to affect electricity consumption, absent any action on CMLP's part.

Our net operating income is the difference between our revenues and our expenses. Not only are changes coming to CMLP on the revenue side, but power supply expenses are expected to fluctuate as well. There have been questions, both inside and outside of CMLP, about whether we have the proper business model to maintain our net operating income that has had a modest target of 2% - 3% annually as adopted by the Light Board since 2013. Because net operating income is such an important measure of CMLP's financial stability, we are aiming to maintain or increase it slightly.

Identifying Strategic Initiatives

Having identified strategic goals for CMLP, we began identifying the initiatives that could best help us achieve those goals. CMLP developed an initial list of 40 possible initiatives (Appendix B). This list was included in the Request for Proposals issued to the strategic planning consultants as a suggested starting point for analysis.

Each of these initial initiatives was evaluated qualitatively, based on whether it advanced our goals and on its feasibility. Initiatives were given a positive, neutral, or negative rating of the level of effort needed. For each initiative, CMLP also considered capital intensity; the feasibility of implementing the initiative within the eight-year time horizon; the risk entailed in implementing the initiative; and whether opportunities exist to leverage neighboring utility programs in order to implement the initiative.

With additional input regarding initiatives of particular interest to CMLP and the community, we narrowed the list to nine initiatives. Each of these initiatives has a positive impact on one or more of our goals. The nine initiatives are:

1. Pursue power purchase agreements (PPAs)[1] & renewal energy credits (RECs)[2] to increase purchases of non-carbon-emitting electric power
2. Re-design electricity rates (going forward, this will be split into two initiatives, focused on time-of-use rates and fixed charges)
3. Encourage fuel switching by customers to increase the role of electric power in homes' and businesses' operations
4. Promote adoption of electric vehicles
5. Promote adoption of smart thermostats
6. Invest in utility scale storage
7. Continue and expand energy efficiency programs
8. ~~Distributed Solar~~[3]

[1] A power purchase agreement is a contract between two parties, one which generates electricity (the seller) and one which is looking to purchase electricity (the buyer).

[2] Renewable Energy Credits (RECs) are tradable, non-tangible energy commodities that provide proof that 1 megawatt-hour (MWh) of electricity was generated from a renewable energy resource and was fed into the shared system of power lines which transport energy. Solar renewable energy certificates (SRECs) are RECs that are specifically generated by solar energy.

~~9. Home Energy Reports~~

Two of the initiatives under consideration—promotion of distributed solar in-town and development of home energy reports—were ultimately ruled out. Both distributed solar and home energy reports raise rates and decrease revenue and net income, while not reducing greenhouse gas emissions very much. Therefore, neither is included in our final plan.

Regarding distributed solar, CMLP expects that levels of adoption of rooftop solar will decrease in 2018 when the Solar Renewable Energy Credit program is no longer available to Concord residents. Moreover, the current solar generation only provides for an incidental reduction in Concord's greenhouse gas emissions at peak load periods, which is very small in relation to the cost of power generated and its rate impacts.

Even if a Solar Renewable Energy Credit program were available to Concord residents, selling the Solar Renewable Energy Credits, the current market practice which keeps the cost of solar power more affordable, strips the power of its solar attribute and thus prohibits us from counting that solar electricity in the carbon-free portion of the CMLP power supply. For all these reasons, CMLP decided not to include pursuit of further distributed solar as a strategic initiative.

Home energy reports tell residents how much energy they use in comparison to similar homes in their region and include tips on how to reduce energy consumption. The objective is to motivate customers to make behavioral changes and investments in efficiency upgrades. Our analysis showed that CMLP home energy reports provide information that is readily available to customers from other initiatives. We decided to de-prioritize this as well.

We also concluded that the level of difficulty involved in assessing the quantitative impact of these initiatives on customer satisfaction and system reliability was beyond the scope of our planning process at this time. However, the available information indicates that these initiatives are likely to have a positive or neutral effect on customer satisfaction and system reliability.

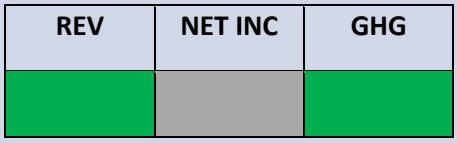
Strategic Initiatives – Impact on Goals

The following color-coded tables provide a description of each of the seven strategic initiatives and display the impact of the initiative on revenue, net operating income, and greenhouse gas reductions. Gray means no change; green represents a positive impact; yellow means it is not clear whether there will be a change; and red indicates a negative impact:

No change	Positive	Not clear	Negative

[3] Distributed generation (DG) refers to electricity that is produced at or near the point where it is used. Distributed solar can be located on rooftops or ground-mounted, and is typically connected to the local utility distribution grid. For example, individual homes, farms, or businesses may have their own solar units to generate electricity or heat for personal or business use.

PPAs & RECs for Non-Emitting Power

Description	PPAs & RECs for Non-Emitting Power
Purpose	Provide customers with a non-emitting power supply
Input Assumptions	By 2021, increase Renewable Energy Credit purchases to offset all greenhouse gas-emitting power sold By 2025, increase non-emitting power purchased through PPAs (with Renewable Energy Credit retired) to 25% of portfolio
Impacts on Goals	
Outstanding Issues	Uncertainty in future Renewable Energy Credit and power prices

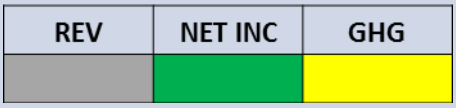
This first initiative, transitioning to a non-emitting power supply, is based upon the CMLP greenhouse gas reduction policy recently approved by the Light Board.

Based on the figures contained in the Renewable Energy Credit procurement strategy, we will purchase increasing amounts of Class I Renewable Energy Credits so that the percentage of non-emitting power in our portfolio reaches 100% by 2021. Prices for Renewable Energy Credits are assumed to escalate on the same trajectory that is projected over the next several years.

This initiative assumes that 25% of our non-emitting power will be purchased via PPAs by 2025, which will include the cost of "retiring the Renewable Energy Credits," that is, not reselling the green attribute of that power.

Rates must increase to cover the purchase of Renewable Energy Credits; therefore, CMLP revenue increases as a result of this initiative. Future Renewable Energy Credit and non-emitting power prices will determine the rate increase needed. Net operating income will not be affected, however, since it is assumed that rate increases will just offset the additional cost of clean power. Greenhouse gas emissions decline dramatically as a result of this initiative.

Rate Design – Residential Time-of-Use Rates

Description	Two–Period Time-of-Use Rate with Opt-Out Option
Purpose	Send a price signal to customers to shift their electricity consumption to off-peak periods
Proposed Parameters	Peak to Off-Peak Rate Ratio is 2.5:1 Peak is 2pm to 7pm on Weekdays
Impacts on Goals	
Outstanding Issues	More in-depth rate design research will need to be done to identify the optimal ratio between peak and off-peak rates, and the optimal length of peak period
Case Study	Reading Municipal Light Plant

This initiative involves modifying our residential rate structure to set a two-period time-of-use rate as the default for our residential customers, with an opt-out option for those customers who choose not to participate. The purpose of time-of-use rates is to send a price signal to customers to shift their consumption of electricity to off-peak periods. The key parameters to consider are the ratio of the peak to off-peak rates and the timing and duration of the peak period.

The model developed by our consultants to estimate the impacts of the initiatives assumed a 2.5 to 1 peak to off-peak ratio and a 5-hour peak. Research has shown that time-of-use rates with a substantial difference between the peak and off-peak rates do provide an incentive for customers to shift their consumption to off-peak periods. This works best when the peak period is five hours or less. However, more in-depth rate design research will be needed before we adopt time-of-use rates, so these parameters are subject to change.

A time-of-use rate would be designed to be revenue neutral. But, it reduces our capacity and transmission expenses, thereby increasing our net operating income. The impact of time-of-use rates on greenhouse gas emissions is uncertain. There may be effects on emissions resulting from changes in load patterns, but we were not able to assess that in this version of our strategic plan.

Our commercial customers have less ability or incentive to shift their consumption patterns permanently. Their demand for power is often during the work day, reducing their flexibility. Moreover, for most customers their electric bill is usually a small portion of their total costs and the savings are not

worth the disruption. Therefore, we are not proposing time-of-use rates for commercial customers at this time.

More in-depth rate design research needs to be done prior to implementation. As is the case with any contemplated rate changes, CMLP will discuss the changes with the Light Board and the Light Board will hold public rate hearings before setting new rates. The Town of Reading, MA is currently implementing time-of-use rates via its Reading Municipal Light Plant. We are watching their experience closely for reference as part of future rate design efforts.

Rate Design – Higher Fixed Charges

Description	Moves More of the Cost of Grid Connection into Higher Monthly Fixed Charge
Purpose	Sends clearer price signal to customers and grid services providers about value of the connection they are using
Input Assumptions	Residential and G1 Small General Service Charges Rise to $30 per month by 2021 G2 Medium General Service & G3 Large General Service Charges Rise to $100 and $600 per month by 2021
Impacts on Goals	
Outstanding Issues	More in-depth rate design will need to be done -- impact on greenhouse gas emissions -- impact on low use/low income customers
Case Study	Minster Electric, Minster Ohio

The Rate Design initiative has a second component, increasing the fixed amount that we charge customers each month, and lowering the variable charge. Fixed charges include the salaries, materials, and other overhead costs involved in maintaining our distribution system, and are recovered through the “meter charge” found on customers’ bills. Assuring the financial stability of CMLP through appropriate fixed charges is critical to maintaining a distribution system that allows CMLP to service its grid and off-grid customers efficiently and reliably, a key goal for CMLP. Another purpose is to send clearer price signals to customers, and eventually vendors who may provide various services to customers about the value of the electricity they are using or sending to the grid.

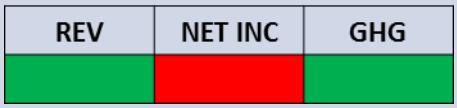
In the past, CMLP has recovered most of our fixed charges through our energy rates and maintained a low meter charge. We plan to move in the direction of more accurately allocating infrastructure and program costs into the fixed cost bucket, i.e., into a higher meter charge. In the strategic modeling tool, we assumed a gradual increase in the fixed charge from $9 per month for residential and G1 Small General Service customers to $30 per month by 2021. Complete fixed cost recovery would mean an increase to a monthly $77 fixed charge per customer. Our consultant's research found that monthly fixed charges for G2 Medium General Service would increase from $33 to $100 and G3 Large General Service customers from $325 to $600.

In its purist form, the fixed charge would be divided into two portions. A variable charge would only cover costs that vary with the amount of electricity used, and a monthly fixed charge (the meter charge) would cover all system infrastructure costs that are not affected by usage, along with all salary, administrative and energy management program costs. However, a more in-depth rate design will need to be done if we adopt higher fixed rates, so these parameters are subject to change.

The effect of higher fixed charges on CMLP's revenue and net operating income is intended to be revenue-neutral. We are simply moving some of what we currently charge in the variable kilowatt hour (kWh) portion of the rate into the monthly fixed charge portion of the rate. The impact on greenhouse gas emissions is uncertain. It depends on how customers and grid service providers react to the lower variable kWh rate that will result from higher fixed charges.

The consultants did some research for us on how higher fixed charges have been implemented by Minster Electric, a municipal utility serving the village of Minster, Ohio.

Fuel Switching

Description	**Rebates, Promotion and Technical Assistance to Foster Adoption of Air Source Heat Pumps (ASHPs) and Heat Pump Water Heaters by Residential and G1 Small General Service Customers**
Purpose	Beneficial Electrification
Input Assumptions	770 new ASHPs installed by 2025 2,362 kWh used annually per ASHP $1,500 customer acquisition cost per ASHP
Impacts on Goals	
Outstanding Issues	Program Details Timing

This initiative involves promoting the adoption of electrically-powered heat pumps and heat pump water heaters for space heating and water heating respectively, displacing the use of fossil fuels for

these purposes. Promoting these technologies involves rebates and technical assistance to foster adoption. Program costs can be expressed in terms of the customer acquisition cost per device, such as air source heat pumps.

In 2016, Sagewell, Inc., another consulting firm has CMLP partnered with, did some analysis and program design regarding heat pumps. They projected heat pump adoption rates in Concord, based on observations from other programs they administered, assuming a level of technical assistance and promotion similar to what was carried out for the Green Your Heat weatherization program in Concord several years ago.

Sagewell estimated annual kWh consumption for the average-sized heat pump expected to be installed in Concord, based on smart meter data they collected in comparable communities. Using that same smart meter data, they also estimated the impact of heat pump adoption on summer and winter peak demand in Concord. These projections, along with estimates of the costs associated with rebates and administration of a program designed to promote heat pump adoption, are incorporated in the strategic plan's assessment of the impact of increased air source heat pump use on greenhouse gas emissions, and on CMLP's revenue and net operating income.

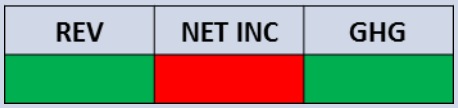
This initiative is expected to increase electricity sales and thus CMLP's revenue. The average residential customer in Concord consumes just over 10,000 kWh per year, so heat pump adoption would increase their consumption by more than 20%. The effect on our net income is negative through 2025, as we pay the customer acquisition costs of promoting heat pump adoption. However, we expect the return on our investment in fuel switching to be positive for CMLP over the life of the equipment installed. Fuel switching will reduce greenhouse gas emissions.

Our strategic planning consultants obtained analogous estimates for heat pump water heaters from MassSave program evaluation data.

Electric Vehicles

Description	**Increases number of electric vehicles (EVs) owned by residential customers, above and beyond "Business as Usual"[4] (BAU) projection**
Purpose	Beneficial Electrification
Input Assumptions	40 electric vehicle purchases per year as a result of CMLP's electric vehicle adoption programs = 320 additional electric vehicles by 2025 $1,500 customer acquisition cost (paid by CMLP) per electric vehicle 4,500 kWh average used annually per electric vehicle

[4] Business as Usual is defined as staying with the normal model of business regardless of circumstances; maintaining the status quo.

Impacts on Goals	
Outstanding Issues	Mechanisms needed to ensure that charging is done off-peak, including participation in time-of-use rates or controlled charging programs
Case Study	Belmont Municipal Light Department

This initiative aims to increase the number of electric vehicles owned by residential customers, above and beyond the Business as Usual projection. Concord already appears to be running ahead of most communities in electric vehicle adoption. This program has the same benefits as fuel switching. The key implementation decisions are going to be around how much to spend on the program, and how to make sure that charging does not adversely affect peak demand.

This initiative is expected to increase CMLP's revenue. Based on average annual electric vehicle usage in Concord, purchasing an electric vehicle would increase the average customer's bill about 45%. As with heat pumps, the effect of investment in electric vehicle adoption on our net income is negative in 2025, but positive over the longer term. Increased use of electric vehicles will reduce greenhouse gas emissions.

The Business as Usual projection is based on future growth rate equal to that required for Massachusetts to meet its 300,000 electric vehicle goal in 2025. Massachusetts state initiatives to foster this objective, such as rebates for electric car purchases, are available to Concord residents. If the state goal were achieved, it would translate to a 12% increase in kWh sales by 2025, due to 4,800 new electric vehicles in Concord.

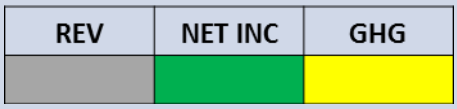
Of course, there is uncertainty associated with these projections. Recent national analyses indicate that the inflection point for electric vehicle adoption will not occur until sometime between 2025 and 2030, meaning that growth will be slower than we have estimated during our planning horizon. However, based on the state's electric car rebate data, there is one electric car per every 196 Concord residents, compared to one electric car per every 1,373 Massachusetts residents. That indicates that Concord is far ahead of mass market adoption rates.

Our consultants did some research for us on a promotional program that Belmont Municipal Light has carried out, which has increased the number of electric vehicles in Belmont and has boosted the percentage of electric vehicle owners who are charging off peak. Using Belmont Light's program outcomes as a guide, we assume that Concord will be able to realize 40 additional electric vehicle purchases per year above and beyond the Business as Usual growth in electric vehicles, for a total of 320 additional electric vehicles owned by Concord residents by 2025. Sagewell, which administers the Belmont program, indicates that the costs of electric vehicle adoption programs carried out by Belmont

and other utilities range from $1,000 to $2,000 per electric vehicle. We've used the average cost to the utility in our modeling.

Our own data on electricity consumption by separately metered electric vehicles in Concord that are on our existing time-of-use rate indicate that the average annual usage per electric vehicle is about 4,500 kWh per year. We assume that 95% of charge time for these new electric vehicles will be off peak. This assumes that the electric vehicle owners participate in a time-of-use rate, or in a controlled charging program.

Utility-Scale Storage

Description	Installation of one utility-scale battery storage system
Purpose	Reduce Monthly Peak Demand and thus ISO New England[5] Charges to CMLP
Input Assumptions	5 MW Discharges 15 MWh over 3 hours $4.5 million cost in 2017; Costs decreasing 7% per year
Impacts on Goals	
Outstanding Issues	System Engineering, Cost
Case Studies	Minster Electric, Sterling Municipal Light Department

The utility-scale storage initiative modeled in the strategic plan assumes the purchase and installation of one 5 MW utility-scale battery storage system, which can store 15 MWh, and then supply that electricity over a period of three hours. As a preliminary estimate, this capacity would allow CMLP to shave peak demand charges on a monthly basis by discharging the battery during peak demand periods instead of purchasing from the grid. At current prices, this storage capacity would cost $4.5 million. Battery storage costs are currently declining 7% per year, so the timing of our purchase will make a difference in its cost.

[5] ISO New England Inc. (ISO-NE) is an independent, non-profit Regional Transmission Organization (RTO), serving Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. ISO New England's responsibility is to ensure the constant availability of electricity, today and for future generations in New England.

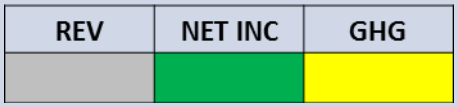
The effect of battery storage on revenue is neutral. It does improve net income by lowering our monthly peak demand and thus the price of peak demand purchases from the grid. As with other load-shifting technologies, the impact on greenhouse gas emissions is uncertain.

Engineering the system to ensure that we can hit the peak each month will be challenging. Depending on how we choose to control the battery, it is also possible that it could provide frequency regulation and other ancillary services. It is a very expensive initiative. However, because we would amortize the cost over 20 years or more, it doesn't have a negative impact on net income in 2025, as the previous initiatives did.

Additionally, several of our distribution circuits experience high levels of solar penetration which have reached a point where reliability could be impacted. Any additional solar development in Concord must be carefully analyzed to guard against power quality issues and blackouts. Storage is a potential solution where power quality could be regulated and surplus generation stored for later use. Further compounding the challenge is the simple fact that operations requiring discharging the battery (peak shaving, frequency regulation) cannot be performed at the same time as charging operations (solar storage, frequency regulation). Thus careful planning is necessary to assure the battery is operated according to the optimal strategy to balance return on investment and grid reliability.

We do have some research on utility scale storage use at Minster Electric in Ohio and at Sterling Municipal Light Department here in Massachusetts.

Smart Thermostats

Description	Promotes residential customer adoption of smart thermostats that allow control by CMLP
Purpose	Shave Monthly Peak Demand Charges
Input Assumptions	$85 up-front incentive Ongoing management costs 290 sign ups in year 1 and 90 more per year thereafter
Impacts on Goals	
Outstanding Issues	No widely adopted standards for communication/control technologies
Case Studies	Austin Energy; Green Mountain Power

Smart thermostats are currently the most popular of smart devices that people are installing in their homes. This initiative promotes residential customer adoption of "smart" thermostats that

communicate over home “WiFi” networks to allow for control by CMLP, with the objective of lowering peak demand.

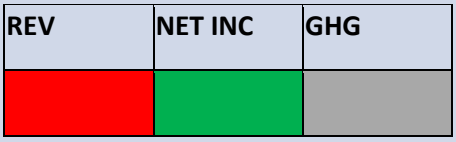
Smart devices increase net operating income by decreasing monthly peak demand charges. They do not affect revenue. Impact on greenhouse gases is uncertain.

Controlling thermostats via the Internet during peak demand events may be a possibility, but communication and control technologies are far from standardized, so that is unclear at this time. We assume an $85 one-time, upfront incentive to customers who install smart thermostats, and ongoing costs to CMLP for connection to a website portal to manage each thermostat.

We assume a big push to sign up smart thermostat users in year one of the initiative would yield 290 smart thermostat customers and about 90 additional smart thermostat customers would be added per year thereafter.

Our consultants researched a program of this type run by Austin Energy in Texas. They also researched a more comprehensive program run by Green Mountain Power, which provides customers with a suite of smart devices that allow for peak demand control, including smart thermostats, heat pumps, and hot water heaters. We hope to move towards more offerings in the future.

Energy Efficiency Programs

Description	**Efficient products and upgrades in the residential, commercial, and low-income customer sectors; lighting, HVAC, refrigeration, compressed air, process heat, and motors end-uses; and new construction, retrofit, and replacement markets.**
Purpose	Help customers reduce their electricity bills
Input Assumptions	Savings of 1.5% of sales by 2025
Impacts on Goals	
Outstanding Issues	Uncertainty regarding the nature and extent of effective energy efficiency programs over the next few years

Energy efficiency programs include initiatives supporting efficient products and upgrades in the residential, commercial, and low-income customer sectors.

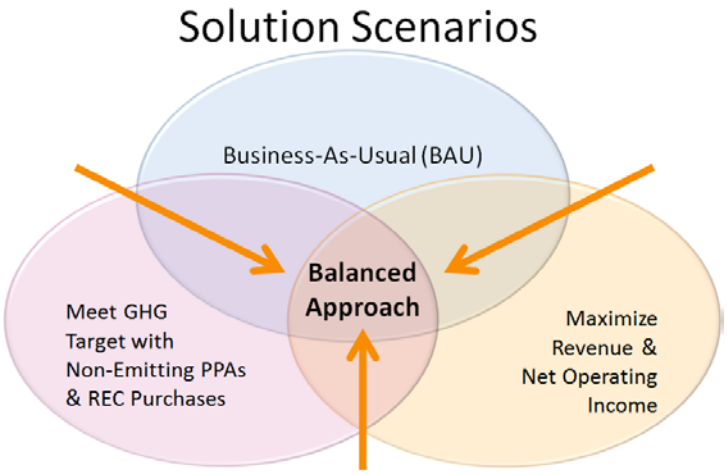
Once our electricity supply is 100% carbon-free, efficiency programs to reduce electricity consumption will not provide further greenhouse gas reductions. We do propose to pursue energy efficiency programs that reduce electricity use and mitigate upward pressure on rates. Reducing electricity consumption during peak demand periods also extends the life of our capital assets.

Energy efficiency programs decrease CMLP's revenue. However, the available data indicate that it costs less to help a customer not use a kWh than it does to buy a kWh of non-emitting power. Assuming that is the case, efficiency programs will improve our net operating income by lowering our power supply costs. Assumptions about program outcomes and costs are based on actual Eversource program results from 2016.

Creating a Plan

With seven promising initiatives identified, the next step in our process was to begin building a plan. To do so, we pursued a scenario-based planning process, in which we evaluated the outcomes of scenarios composed of different combinations of the seven individual strategic initiatives. The four scenarios we considered can be characterized as:

1. do nothing we weren't planning to do anyway (business as usual)
2. reduce greenhouse gases as much as possible
3. be the healthiest business possible, and
4. take a middle of the road approach that also controls rate impacts.



Our consultants built an Excel-based Scenario Planning Tool allowing us to explore whether our goals can, in fact, be accomplished by implementing one or more alternative scenarios. The planning tool is really a model of our entire business and includes numerous spreadsheets used to project sales and peak load through 2025 starting with our current actual figures and applying the ISO New England forecast of a slight annual decrease in sales each year, and also the additional load due to electric vehicle adoption over time. Additional spreadsheets incorporate our historical load factor, our power mix, our power purchase expenses, and our rates into the model.

The scenario summary page of the tool brings together on one page the bottom line changes in revenue, net operating income, greenhouse gas reduction, and number of customers served as a result of each initiative or as a result of combined initiatives included in a particular scenario.

The summary spreadsheet also allows us to turn initiatives on or off, so that we can use this summary page to look at the impact of various scenarios, each containing a different combination of initiatives. For example, it allows us to set a target increase in net income, and it shows us the change in rates that

will needed to be for each class, once the target net income increase and the combined changes in revenue and expenses due to the selected initiatives are taken into account.

Additionally, each of the initiatives that we shortlisted is modeled on its own spreadsheet tab in the Scenario Planning Tool.

Revealing the Strategic Plan

As a result of the work that has been done to identify goals and promising initiatives, and examine various scenarios for implementation using our new simulation tool, the strategic planning committee opted to go with the *balanced approach scenario.* This scenario includes all seven of the initiatives we have discussed in this narrative. The timing with which we implement these initiatives could change, depending on how things actually play out.

Recommended Timing and Dependencies

	Initiative	Calendar Year Projection	Dependencies
1	Non-Emitting PPAs and RECs	2017 - 2025	none
2	NISC	2017 - 2018	none
3	Electric Vehicle Adoption	2018	none
4	Smart Meters (AMI)	2018 - 2019	2
5	Utility Scale Storage	2019	4
6	Fuel Switching for Space & Hot Water Heating	2019	none
7	Time-of-use Rates and Higher Fixed Charges	2020	2,4
8	Smart Thermostats	2020	4
9	Energy Efficiency Programs	2020	none

The initiative to execute power purchase agreements and purchase Renewable Energy Credits would follow CMLP's greenhouse gas reduction policy, as adopted by the Light Board. The retirement of Renewable Energy Credits and plans to purchase them are already underway.

Critical Enabling Investments

In addition to the seven strategic initiatives, at least two enabling projects need to be completed to allow us to interact efficiently and in real time with our customers, and they with us. Indeed, some of the proposed initiatives depend on CMLP being able to do that. The two enabling projects are 1) adoption of a new integrated billing system, and 2) adoption of smart meters throughout town.

We have prioritized implementation of a new billing system that will make implementation of time-of-use rates more efficient, and provide a host of other benefits as well. CMLP has selected National Information Solutions Cooperative (NISC) as the vendor for this new billing system. It will streamline billing, freeing up staff time to promote customer participation in our other initiatives. NISC will enable

electronic billing and virtual net metering. In conjunction with smart meters, it will allow customers to see their real-time electricity usage, enhancing responsiveness to time-of-use rates. NISC also includes an enterprise management system that will allow us to analyze the town-wide smart meter data that will be available once our smart meter deployment is complete in 2019.

Time-of-use rates also require advanced metering infrastructure for implementation, and we are targeting 2018 – 2019 for smart meter deployment. Smart meters also have advantages for water and wastewater management.

More information will be forthcoming from CMLP to customers in the coming months about these critical enabling investments.

Strategic Initiative Priorities

2018-19

CMLP will prioritize the adoption of electric vehicles, following an existing trend in customer behavior and representing the biggest opportunity for electrification.

We also recommend large-scale promotion of heat pump and heat pump water heater adoption at this time. CMLP responded to a Request for Proposal recently issued by the Massachusetts Department of Energy Resources and the Massachusetts Clean Energy Center that provides an opportunity to participate in a 2018 pilot program to encourage the adoption of heat pumps. If CMLP is selected, we would reprioritize the fuel switching initiative.

In the years leading up to 2020, we would design a time-of-use rate structure in preparation for implementation in that year. We also anticipate that higher fixed charges would be explored as a part of a rate design effort, although small steps towards higher fixed rates may be taken prior to 2020.

Some initiatives that require large capital outlays require some lead time for planning and approval by the Light Board and the Town Manager. In 2019, we will recommend investing in CMLP-owned battery storage to begin lowering power expenses and help offset rate increases from other initiatives.

2020 and beyond

The promotion of smart thermostats in order to further control peak demand and related costs is another priority for 2020.

Finally, we would begin supporting expanded Energy Efficiency Programs in 2020. We would have the benefit of the most up-to-date information compiled by the investor-owned utilities on the effectiveness and costs of energy efficiency measures, as outlined in their next three-year plan, to be completed in late 2018.

Expected Results

How does the balanced approach scenario strategic plan meet the goals we laid out at the beginning of the planning exercise? As seen below, it will allow us to meet or surpass each of our target values.

Graphic 5: Balanced Approach Scenario Plan

CMLP Goal	Target Value	Projected Value
Maintain System Reliability	No change in customer rating (95.2%)	No change in customer rating (95.2%)
Maintain or Increase Customer Satisfaction	≥ 85.8%	≥ 85.8%
Provide Energy Related Services to Many Customers	25% Residential Participation 50% Commercial Participation	25% Residential Participation 50% Commercial Participation
Increase Revenue	0% to 5%	15%
Increase Net Operating Income	0% to 5%	2%
Reduce Greenhouse Gas Emissions	100% of 35% goal for 2025	98% of 35% goal for 2025

We did not assess the impact of the initiatives on customer satisfaction or system reliability. However, the available information indicates that the impacts would be positive or neutral.

The participation goal was to involve 25% to 50% of our customers in one or more initiatives. Experience from other utilities suggests about 16% of residential customers will opt out of time-of-use rates, resulting in 84% participation in that initiative for the residential sector. We are estimating residential and G1 Small General Service participation in fuel switching at about 29% of our customer base by 2025 and 4 to 9% participation in electric vehicle and smart thermostat adoption in the residential sector. We are expecting that about 13% of residential customers and about 25% of businesses will have participated in an energy efficiency program by 2025. Those numbers indicate we may fall short of our participation goal for the commercial sector. Additional efforts may be needed to boost participation.

In large part because rates must increase to cover the purchase of Renewable Energy Credits, revenue is expected to increase about 15% in our balanced scenario, significantly more than our target range. Our goal was to increase net income by 2% and our balanced scenario achieves that.

Our initial goal was to achieve 100% of the 2025 35% town-wide greenhouse gas reduction goal that will keep Concord on track to reduce greenhouse gas 80% by 2050. Now that we have assessed the greenhouse gas reduction potential of initiatives such as fuel switching and electric vehicle adoption, in

addition to the purchase of non-emitting power and Renewable Energy Credits, we find that our balanced approach plan still comes very close to achieving that goal.

The expected percentage reductions from fuel switching and electric vehicle adoption are a little lower than originally anticipated. Reduction in greenhouse gas of 1,119 tons is attributable to fuel switching from both natural gas and fuel oil heating systems. In the end, CMLP will still be able to contribute almost 100% of the town's 2025 greenhouse gas reduction goal.

CMLP will look for guidance from the Light Board on the boundaries of the rate changes we need to make to execute the plan. Renewable Energy Credit purchases will drive rates up by about 17% over 4 years. However, Renewable Energy Credits are not our long-term strategy. We will need to transition beyond Renewable Energy Credits to invest in actual non-emitting power generation facilities and that may add costs.

The other initiatives we have described will increase rates by less than 5%, and will enable us to address the complex environment in which we will be operating in the future.

Final Thoughts

CMLP's Strategic Plan is a living, working plan that will continue to evolve over time and will create benchmarks that can be tracked. Annual adjustments will be required to our programs to stay on track and respond to market conditions. Our next step is to prepare detailed plans for each initiative.

In terms of possible risks, we acknowledge that while we now have a credible plan to achieve CMLP's goals, the forward capacity, transmission, and Renewable Energy Credit markets, along with policy changes affecting those markets, could vary from our assumptions and must be watched carefully.

This plan finishes the job of reducing greenhouse gas emissions from electricity use by 2021, and begins the transition from fossil fuels to non-emitting power for space and water heating and transportation. The community's main focus needs to be on completing that transition to ensure that Concord's 2050 greenhouse gas reduction goal can be met.

A secondary focus will need to be on reducing the remaining fossil fuel use in town, so involvement by the new Director of Sustainability, other town departments, and active citizens and volunteers will be essential. Weatherization of buildings that are still partially or fully heated with fossil fuels will be important. Working on ways to reduce vehicle miles driven will help reduce greenhouse gas emissions while the vehicle stock transitions from internal combustion engines to electric vehicles.

CMLP looks forward to working with many partners to achieve this mission in the years ahead.

Appendix A

Concord's Energy Goals were adopted in the form of Article 51 by Town Meeting on April 25, 2017.

CONCORD'S ENERGY GOALS

ARTICLE 51. To determine whether the Town, informed by the Paris Climate Agreement of 2015, will vote to align the energy goals of the Town of Concord with:

(a) the Massachusetts Global Warming Solutions Act of 2008 to achieve a minimum 25% town-wide reduction in Green House Gas (GHG) emissions by 2020 and an 80% reduction by 2050 from the baseline established in 2008; and

(b) by 2030, as an intermediate goal, direct CMLP to reduce the GHG emissions of its power supply portfolio and to offset any residual GHG emissions of its electricity supply through the purchase of RECs or other offsets;

and further,

to determine whether the Town will vote to raise and appropriate or transfer from funds available in the Treasury, the sum of $100,000, or any other sum, to be expended under the direction of the Town Manager for the purpose of engaging one or more consultants for the purpose of developing and making publicly available an operational plan to achieve said goals; and further, to see if the Town will vote to raise and appropriate or transfer from available funds in the Treasury, the sum of $100,000, or any other sum, to be expended under the direction of the Town Manager for the purpose of hiring a Director of Energy, on an on-going basis, to be accountable to the Town Manager for recommending policy and measuring progress toward meeting these goals and implementing the operational plan, as well as tracking and assessing new energy technologies and funding opportunities, or take any other action relative thereto.

The Energy Future Task Force, charged by the Select Board in February 2016 to create a framework for an energy and sustainability plan for a low-carbon future in Concord, has recommended the following actions in this warrant article: to set a bold goal to reduce town-wide greenhouse gas (GHG) emissions to align with the Massachusetts 2008 Global Warming Solutions Act; to reduce GHG emissions of CMLP's electricity supply; to allocate funds to be expended under the direction of the Town Manager for the purpose of engaging a Director of Energy on an on-going basis to recommend policy and measure progress toward meeting these goals; and to allocate funds to be expended under the direction of the Town Manager for the purpose of engaging one or more consultants to advise the Town Manager and Director of Energy on the development of an implementation plan to achieve these goals.

Appendix B

The list of potential strategic initiatives as described in the Strategic Planning Consulting Services Request for Proposal (RFP #352) dated 6/9/16.

1. Demand Flexibility
    a. Time of use rates
    b. Critical peak pricing
    c. Smart devices that simplify or automate customer involvement in peak demand reduction
    d. Utility scale storage
    e. Distributed storage resources, such as batteries, ice storage systems or vehicle to grid (V2G)
    f. Variable residential demand charges
    g. Home peak electricity consumption reports with neighborhood comparison and customized peak demand reduction suggestions
2. Power Supply
    a. 10 and 20-year load projections for Concord
    b. Goal, strategy and timeline for transitioning to renewable generation sources
        i. Utility scale in-town renewable generation sources
        ii. Community solar
        iii. Distributed, net metered, in-town renewable generation sources
        iv. Distributed, net metered, in-town combined heat and power generation sources
        v. Power Purchase Agreements for in-town renewable generation sources
        vi. Power Purchase Agreements for out-of-Town renewable generation sources
            1. Hydro
                a. HydroQuebec?
            2. Wind
            3. Solar
            4. Landfill gas
    c. Acceptable pricing for various renewable generation sources

d. Renewable Energy Credit strategies, including retirement or sale to CMLP customers

e. Advantages and disadvantages of in-town vs. out-of-town generation sources, and target ratio

f. Advantages and disadvantages of owning and maintaining our own in-town renewable generation sources vs. Power Purchase Agreements with facility owner/operators, and target ratio of own vs. Power Purchase Agreement

g. Investment in new transmission infrastructure, such as from HydroQuebec

h. On-bill green power purchase option (including the possibility of purchasing Renewable Energy Credits for renewable power purchased by CMLP)

i. Equal competition between customer-side peak demand reduction solutions and traditional capacity supply solutions in power procurement

3. Credible, cost effective carbon offsets for load we cannot serve with renewable generation sources, including the possibility of local tree planting.

4. Revenue decoupling

    a. With increased fixed charges

    b. Without increased fixed charges

5. Energy efficiency programs

    a. Goals and timeline

    b. Residential

        i. Home electricity consumption reports with neighborhood comparison and customized usage reduction suggestions

        ii. Packaged home energy retrofits, such as those currently offered by Green Mountain Power and Long Island Green Homes, and expected to be offered by Fort Collins Utilities in the future.

        iii. Tiered electricity pricing

        iv. Rebate programs

        v. Technical assistance programs

    c. Commercial

        i. Executing agreements with our large commercial customers on electricity use goals and measures to be carried out at their facilities.

        ii. Using smart meter data analytics to identify low/no cost operational changes that reduce energy waste.

iii. Using intelligent efficiency techniques that combine information and communication technologies (ICT) to monitor energy consuming equipment and adjust performance as needed.

iv. Programs offered by energy services companies

v. Rebate programs

vi. Technical assistance programs

6. Revenue Enhancement

    a. Foster adoption of new electricity uses that increase revenue while reducing carbon emissions:

        i. Electric vehicles

        ii. Heat pumps that displace oil-fired or electric resistance heating systems

    b. Offer new services that increase revenue and/or help customers reduce carbon emissions, for example:

        i. Lease equipment:

            1. residential heat pumps

            2. combined heat and power (CHP) facilities

            3. Batteries

            4. Solar Photovoltaic systems

            5. Backup generators

        ii. Energy advisor services (for a fee)

        iii. Maintain electric vehicle charging stations, in Concord or beyond

        iv. Provide infrastructure construction and maintenance services outside Concord

        v. Provide broadband services outside Concord

        vi. Other business sectors we could enter that are strongly complimentary to electricity

7. Customer engagement

8. Customer behavior projection using data analytics

9. Customer communications

    a. Adopt communications methods that enable customers to receive information more conveniently, such as:

        i. Greater use of email

        ii. Social media

iii. Text messaging
iv. Mobile apps
v. Posts on local listserv
vi. Access to real time energy monitoring using smart meter/web portal technology

b. Plan for ongoing content development to foster CMLP-customer relationship, such as:

i. Information about what CMLP already does well
ii. Topics of current interest
iii. Retweets of relevant articles we've read

10. Customer service

a. Online billing
b. Online rebate applications
c. On-bill financing for adoption of energy efficiency and renewable energy measures
i. Apparently prohibited by M.G.L Ch 164, but some MA municipal utilities do this
ii. Could Property Assessed Clean Energy (PACE) loans be made with ratepayer money?
d. Better restoration time notifications during power and internet outages

11. Strategic Partnerships

a. Partner with innovators, including risk sharing between CMLP and providers of new technologies and services.

i. e.g. Pay-for-performance programs that link incentives to actual meter based savings, paving the way for the free market to value efficiency as an investible asset class, where third party aggregators sell efficiency services to customers.

b. Explore ways for new ventures to access low cost utility capital.

c. Partner with academic researchers

12. Economic Development

a. Facilitation of economic development through rates

b. Partnerships with appropriate Town government agencies

13. Adoption of appropriate cybersecurity and customer privacy measures

14. Reliability/Resiliency/Business Continuity

a. Utility scale or distributed storage devices used for outage mitigation

b. Distribution Automation

Appendix C

CMLP's Procurement Strategy to Meet Community Goals

MEMORANDUM

Concord Municipal Light Plant * 1175 Elm Street * PO Box 1029 * Concord, MA 01742-1029
978-318-3101 Fax 978-318-3105 www.concordma.gov

Date: June 21, 2017

To: Christopher Whelan, Town Manager

Via: David Wood, CMLP Director

From: Christopher Roy, Assistant CMLP Director

Subject: CMLP Strategy to Meet Community Goals

Please accept this memo in response to your request for a proposed CMLP strategy to support achievement of Town energy goals and more specifically, Article 51. To address this request I reviewed the goals set forth in the 2017 Energy Future Task Force (EFTF) Final Report, the 2011 CMLP Renewable Energy Strategy, the 2010 CMLP Utility Scale Solar Strategy and the 2011 Concord Energy Master Plan created by Comprehensive Sustainable Energy Committee (CSEC). All of these documents convey a similar message with similar goals. However, a considerable difference is that the ultimate goal for CMLP has shifted from "implement more renewable energy" to "reduce greenhouse gases". This more specific mission delivers two important messages: 1. Energy projects that sell the Renewable Energy Certificates/Credits (RECs) do not contribute to greenhouse gas reductions and 2. Achievement of greenhouse gas goals is technology agnostic thus all approaches must be given equal consideration for maximum impact (strategic electrification, new rate structures, battery storage, etc.). In this regard, the Energy Future Task Force report sets a greenhouse gas reduction goal (in relation to 2008 levels) for the entire Town of 25% by 2020, a non-emitting power supply for CMLP by 2030 and a town wide greenhouse gas reduction of 80% by 2050.

Accomplishing these goals will require CMLP to serve as the foundation for transitioning from fossil-fueled technology such as combustion engines and oil or gas furnaces to an electrical equivalent. This puts pressure on CMLP to provide a non-emitting power supply as soon as possible to create an attractive platform for conversions and marketing of electrification as the best route to maximum greenhouse gas reductions. Fortunately, in the short term, we can turn to the Renewable Energy Certificates/Credits market. Attached to this memo is a Renewable Energy Certificates/Credits market analysis performed by Laura Scott. In her memo she details the Renewable Portfolio Standard (RPS) investor-owned utilities are mandated to follow. As you may be aware, we are exempt from the RPS which should allow us to procure Renewable Energy Certificates/Credits from any of the renewable energy categories. For the purposes of this memo I will focus on costs associated with Class 1 Renewable Energy Certificates/Credits which cover several sources such as solar, hydro and wind. Using Laura's figures we can see that with today's Renewable Energy Certificates/Credits pricing we would need to collect an additional $2,958,000 in 2017 for a completely emission-free portfolio. Pricing escalates

annually resulting in an equivalent Renewable Energy Certificates/Credits purchase cost of $4,350,000 in 2020. The following are the supporting calculations:

Year	CMLP Energy Purchases (MWh)	REC Market Offer Price	Total Cost for GHG Offset	Total Cost in $ per kWh
2017	174,000	$17	$2,958,000	$0.017
2018	174,000	$21	$3,654,000	$0.021
2019	174,000	$23.50	$4,089,000	$0.0235
2020	174,000	$25	$4,350,000	$0.025

Collection of these additional funds forms the crux of our future power supply and rates strategy. These are significant additional costs and how they are collected should involve substantial input from the Light Board as the main representatives of the rate-payers. However, these increases should not come as a surprise to the community as the Energy Future Task Force report estimated a 20%-30% rate increase to reach the 2030 goal. Article 51 was somewhat less specific but emphasized the likelihood of higher rates.

Despite the goal of non-emitting power by 2030, the more immediate need to reduce the Town-wide greenhouse gas emission by 25% in the next three years is the real driver for immediate action. Electric consumption contributes 35% of the total greenhouse gas in Concord and with Article 51 fresh on people's minds, now is an ideal time to introduce a new cost recovery mechanism to cover Renewable Energy Certificates/Credits purchases. Thus I would propose the following near-term strategy to the Light Board as a catalyst for further discussion:

1. Discontinue the sale of Renewable Energy Certificates/Credits within our control.
2. Establish a new renewable energy surcharge on all bills on a per kWh basis. Three possible schedules include:

IMPLEMENTATION	OPTION A		OPTION B		OPTION C	
DATE	RATE (kWh)	REVENUE	RATE (kWh)	REVENUE	RATE (kWh)	REVENUE
JULY 2017	$0.005	$830,000	$0.010	1,660,000	$0.0180	2,988,000
JULY 2018	$0.010	$1,660,000	$0.015	2,490,000	$0.0220	3,652,000
JULY 2019	$0.015	$2,490,000	$0.020	3,320,000	$0.0245	4,067,000
JULY 2020	$0.020	$3,320,000	$0.025	4,150,000	$0.0260	4,316,000
JULY 2021	$0.025	$4,150,000	TBD		TBD	
JULY 2022	$0.030	$4,980,000	TBD		TBD	

3. Procure Renewable Energy Certificates/Credits during open trading periods using available funds collected through the Renewable Energy Certificates/Credit surcharge.
4. Direct Energy New England to seek out new renewable projects suitable to replace Renewable Energy Certificates/Credit purchases with Power Purchase Agreement contracts.
5. Revisit solar incentives and interconnection policy to address the sale of Renewable Energy Certificates/Credits by net-metered customers.
6. Begin evaluating alternative rate structures as outlined in the CMLP strategic plan.

I anticipate the step that would generate the most discussion initially is #2. Using Option B as an example, a new surcharge of $0.01 should provide about $1,660,000 in revenue based on 2017 forecasted sales. This is enough to offset about 56% of CMLP's greenhouse gas emissions. Given

electricity is over a third of the Town's greenhouse gas emissions, this 56% reduction will result in achievement of the 25% goal two years early when added to the reductions we have already made. Moving forward, if a modest $0.005 is added each year, by December 31st of 2020 we will be very close to a completely emission-free power supply. Any remaining emissions can be addressed through a rate change when the 2021 market prices are released. This is also an opportunity to incorporate a solution to item #5 and offset system losses.

For comparison purposes, Options A and C outline two alternative rate schedules. Option A is a more gradual approach that starts at $0.005 per kWh and adds the same amount in each of the next five years. Compared to Option B, achievement of the 2020 greenhouse gas reduction goal is delayed one year to 2019 and an emission-free power supply is pushed back to 2022. Conversely, Option C provides the most aggressive schedule and proposes an immediate offset of CMLP's emissions in their entirety using an initial rate of $0.018. Year to year, this schedule follows the Renewable Energy Certificates/Credit market price increases resulting in an initial rate increase of $0.004 tapering to $0.0025 and $0.0015 respectively. Also included in this rate is an additional $0.001 intended to collect additional funds for Renewable Energy Certificates/Credit purchases dedicated to system losses. While Option C clearly has the largest initial bill impact, it does achieve 100% greenhouse gas reductions in the first year including system losses and offers the smallest rate increase in each subsequent year.

There are also two important points to consider with each option outlined above. The first is the fact that these Renewable Energy Certificates/Credit purchases only offset greenhouse gas emissions corresponding to electricity delivered by CMLP. Private solar installations that continue to sell the Renewable Energy Certificates/Credits will retain their status as greenhouse gas contributors. Thus CMLP and the Light Board are tasked with developing a solution that will advance the goals of Article 51. This step is highlighted as item #5 on the previous page and the outcome of these discussions will likely have an impact on the rate schedules.

The second important point is that all three options assume level CMLP sales of 166,000,000 kWh and purchases of 174,000,000 kWh. Therefore as figures become available and forecasts are determined, each rate may need adjustment to achieve the intended goals. Similarly, as overall rate structures are modernized the method by which the Renewable Energy Certificates/Credit funds are collected could change but the total revenue requirements will not.

With all of these complex considerations in mind and by aiming to achieve a zero-emissions status years in advance of the 2030 goal outlined in the Energy Future Task Force report, one could argue this is too aggressive and costs should be spread out more gradually. I would offer an alternative perspective and reinforce the notion that we need to quickly provide and maintain a suitable carbon-free platform to achieve the greater Town-wide greenhouse gas reductions. A reduction of 80% by 2050 is going to involve slowly chipping away at individual emission sources by introducing an electric equivalent and changing consumption patterns. Thus we are going to need every day/month/year leading up to that date. It is also important to keep in mind that while $0.01 is a 16% increase on the energy portion of our bills, it is only a 6% increase overall. On an average residential bill, this represents under $10. Also, when compared to Massachusetts investor-owned utilities, CMLP rates are about 25% lower leaving room to adjust rates while keeping relocation risk minimal.

In conclusion, swiftly introducing a renewable energy surcharge and procuring Renewable Energy Certificates/Credits will not only facilitate early achievement of Town greenhouse goals but also encourage the community to adopt new electrical technologies that will boost electric sales and help

stabilize CMLP revenues. A greenhouse gas-free electric grid will allow us to properly incentivize adoption of electric vehicles, heat pumps, electric thermal storage, ice storage and any new technology introduced over the next 30 years. After these short-term policies are implemented, we will need to shift our focus to the long-term strategies including investment in projects that replace Renewable Energy Certificates/Credits with Power Purchase Agreements, modernizing our rate structures and developing complementary efficiency and incentive programs. These are complex topics with a high level of public interest making proper communication with groups such as Comprehensive Sustainable Energy Committee, Energy Future Task Force (Phase 2) and the Light Board critical to long-term success.