Town of Concord
Energy Future Task Force
Revised Draft Report for Public Comment
March 1, 2017

NOTE: All comments received from the public will be considered for incorporation into the Final Report.

Energy Future Task Force Draft Report

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Cover Photo: Aerial view of the solar array located at the closed and capped landfill on Route 126 and Route 2 looking west provided by Steven Ng, member of the Concord Select Board.

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I. Executive Summary

The Select Board established the Energy Future Task Force (Task Force) in February 2016 and charged it broadly with creating a framework for the design and implementation of a town-wide energy plan that will minimize Concord's carbon footprint and that will be sustainable in the near- and long-term future. The framework is to include short- and long-term energy goals. (See Appendix.) This Final Report is the product of the Task Force's fact-gathering, public outreach, and deliberations. It is comprised of goals and recommendations, with supporting information.

A key rationale for the Task Force's recommendations is a clean energy strategy including the following ideas:

1. Through education and raising public awareness, the Town is in a position to advocate for and incentivize customers to shift away from fossil fuel use in heating systems and transportation to electricity.
2. By investing in renewable and other non-emitting generation in the New England region and in Concord through photovoltaic installations and purchase of renewable and other non-emitting sources, the Concord Municipal Light Plant may reduce greenhouse gas emissions from its electricity thereby decreasing the community's emissions.
3. By increasing energy efficiency and reducing energy use throughout the community, Concord will reduce emissions for all energy that is conserved.

A. Goals

The Task Force's recommendations align Concord's Energy Future with the goals of the MA Global Warming Solutions Act of 2008 and are informed by the Paris Climate Agreement of 2016. The Task Force recommends the following goals:

25% reduction in greenhouse gases by 2020
80% reduction in greenhouse gases by 2050.

These are town-wide goals applicable to all sectors. The baseline is 2008.

B. Recommendations

1. Immediately (Spring 2017)

a) Make the goals available at the 2017 Annual Town Meeting; and start educating our citizens about the goals so that they may take individual actions to help Concord achieve them;

b) Issue a policy statement from the Select Board and Town Manager that firmly establishes these recommended greenhouse gas reduction goals as responsibilities of the Town Manager and states that decreasing emissions shall be considered and advanced in all deliberations and decisions of all Town departments and committees;

c) Expeditiously hire a Director of Energy [or other title] and a consultant to assist him/her to guide the Town in designing and implementing a sustainable energy future consistent with the recommendations in this Report. See Appendix for Position Description core.

d) Appoint a new advisory group to assist the Town Manager, the Energy Director, and the consultant in interpreting the Task Force Report and recommendations and in helping to acclimate the Director on how best to work within the Town of Concord. With respect to the Concord schools, The Task Force recommends that the future citizen committee have at least one school representative to be appointed by the School Committees.

e) Integrate the goals and recommendations of the Task Force report into CMLP's current strategic planning effort, allowing for an open and transparent citizen engagement process.

f) Integrate the goals and recommendations of the Task Force report into the Comprehensive Long Range Plan effort also underway.

2. Longer term

a) Education: Make the goals available and provide annual updates on the Town's progress in meeting them at all future Town Meetings; and continue to educate our citizens about the goals so that they may take individual actions to help Concord achieve them;

b) Measurement: Confirm that the 2008 town wide database for tracking Concord's carbon footprint is complete with a recognized methodology that can be updated annually, and maintain this as the baseline for measuring progress toward the GWSA goal of an 80% reduction in GHG by 2050.

c) Best practices: Direct the Director of Energy to develop integrated implementation strategies with systems thinking across all departments and to use improvements in low carbon electricity to make rapid progress towards meeting the goals.

d) Communication: Maintain communication among the Director, Town Manager, Select Board, CMLP, the Light Board, the school committees, and other town boards and committees, to advance the goals and implementation strategies for achieving a low carbon-future in Concord.

e) CMLP: Because Concord has control of the power purchase portfolio at CMLP (that is, the aggregate amount of all energy purchased from various sources to meet the demands of the CMLP grid), it is in a strong position to advance the reduction of greenhouse gas emissions from the electricity it sells to its customers. It is this rationale that forms the basis of many of the Task Force recommendations and the focus of this report on the energy sector.

Moreover, the Concord Municipal Light Plant (CMLP) is a valuable asset for the Town. CMLP's participation will be essential to achieving the goals stated in this Report. Appropriately, the Charge to the Task Force focuses on the CMLP. Consistent with this, the Task Force recommends that CMLP:

i) consider alternatives to reduce barriers to the adoption of energy efficiency measures including eliminating the practice of having separate energy audits from Massachusetts investor-owned utilities.

ii) work to offer a comprehensive set of cost-effective energy efficiency incentives and measures that meet or exceed those offered by Massachusetts investor-owned utilities.

iii) as a short-term goal, retire Class I Renewable Energy Certificates (RECs) from renewable energy purchases or purchase Class I RECs to allow CMLP to achieve the Massachusetts Renewable Energy Portfolio Standards (RPS) goals that apply to suppliers of the customers of Massachusetts investor-owned utilities.

iv) shift CMLP's electricity supply to non-emitting resources with RECs or certificates for associated environmental attributes retired with a target of achieving 100% from non-emitting resources by 2030 with measurable phased interim benchmarks to track progress.

v) employ smart meters town wide and consider adopting a time of use rate structure.

vi) shift to revenue decoupled approach to rate-setting.

vii) encourage CMLP to empower its customers to make informed choices by adopting enhanced Time of Use rates.

viii) consider Distributed Energy Resources and battery storage to assist the Town in achieving its GHG emissions reduction goals.

ix) develop incentives to encourage users to exchange fossil fuels for electricity powered by renewables in their homes and vehicles.

f) Other sectors: The Task Force's recommendation for an integrated systems approach to reducing greenhouse gas emissions will require a strategy for change within sectors beyond the energy sector. During the next year, the Task Force recommends that attention be given to developing integrated strategies for reducing greenhouse gas emissions from these other sectors, such as water and waste water management, transportation, agriculture, commercial, and open space, and to engaging the public in determining opportunities for individual action. In addition, the Task Force recommends that the Comprehensive Long Range Planning Committee be encouraged to include engaging the public for individual action consistent with the support shown in the Town-wide survey for energy efficiency and sustainability. See Appendix for survey analysis.

g) Personal responsibility: The Task Force recommends that the Town Manager charge the Director and consultant to develop a methodology for community education and engagement to help citizens achieve reductions in their carbon footprints.

h) Framework: See goals above.

II. Climate Change Background

Since about 1950 the world has experienced an unprecedented increase in global temperature and greenhouse gas emissions. The clear scientific consensus, confirmed by the Intergovernmental Panel on Climate Change among other leading scientific bodies, is that the warming is human-caused and driven by greenhouse gas emissions from developed countries such as the United States and western European nations, and recently, from countries trying to transition from the status of developing to developed, such as China and India. The effects of this anthropogenic warming are already being observed and they will inevitably affect future generations much more than they are affecting us, although it is we in the industrialized world, including Concordians, an affluent, high-consuming demographic, who are mostly responsible.

As demonstrated by the extraordinary collective global attention to this crisis at the Paris Conference in 2015, and the Paris Agreement that followed, climate change response cannot wait. Countries, cities, and individuals all over the world are acting to mitigate climate change; and if mitigation alone is not sufficient (which it appears not to be), to adapt in various ways.

III. The Energy Future Task Force

The Select Board established the Energy Future Task Force (Task Force) in February 2016. Task Force members were appointed by the Town Manager with the Select Board's approval. The Task Force was charged broadly with creating a framework for the design and implementation of a town-wide energy plan that minimizes Concord's carbon footprint and that is sustainable in the near and long-term future. The framework was to include short and long-term energy goals. (See Appendix for the Charge.) This Final Report is the product of the Task Force's fact-gathering, public outreach, and deliberations. It is comprised of goals and recommendations, with supporting information.

A. Task Force Approach

Necessarily, the work of the Task Force is grounded in the economic, social, and political world as it is today, and in current widely-accepted scientific projections on climate change. But important variables may affect future greenhouse gas emissions and Concord's ability to achieve the ambitious emissions reduction goals the Task Force recommends. For example, the market for renewable energy is rapidly growing and may over time substantially ease the Town's ability to migrate toward renewable energy sources and commensurate lower greenhouse gas emissions. Moreover, there is little doubt among economists that the cost of addressing climate change will greatly increase over time and will become a crushing financial as well as social and ecological burden on future generations if we don't invest in greenhouse gas mitigation immediately. That is, it is much cheaper to act now than to act later, and it is a moral imperative. In fact, the Task Force's recommended goals reflect not only the urgency of the climate crisis, but also the opportunities available to address it.

The goals and recommendations of the Task Force are guided by the following:

1. International commitments for greenhouse gas reduction expressed in the 2015 Paris Agreement on climate change and Massachusetts' goals for greenhouse gas reduction expressed in the 2008 Massachusetts Global Warming Solutions Act (GWSA) and implementing regulations. See Appendix for Paris Agreement and GWSA.

2. A commitment to bold approaches and actions to achieve greenhouse gas reduction consistent with the urgency of the current global anthropogenic climate crisis, and with Concord's long history of leadership and of stewardship of our natural world.

3. A recognition that Concord is part of, and should actively contribute to, the fast-paced global, national, state, and municipal transformation from an economy powered by fossil fuels to an economy powered by clean energy.

4. A commitment to Concord's sustainability principles.

In order to make the changes required to implement these ideas, the Task Force has concluded that Concord and its citizens will need to invest significant financial resources, and will need to alter, and sometimes abandon, familiar institutional and personal practices and behaviors. The recommendations of the Task Force reflect these challenges.

B. The process the Task Force followed

The Task Force met first in April 2016, and since then, with few exceptions, has met every other week for two hours. All meetings have been attended by members of the public who have had opportunities to comment at each meeting. The Task Force has held three public meetings: in June 2016, October 2016, and February 2017. Each meeting was attended by approximately 50 Concord citizens. Public engagement has been robust and insightful.

The Task Force also conducted in-person interviews with several stakeholders. See list of interviewees in the Appendix. In addition, an on-line survey was distributed on the Town website with 129 responses received. See the Appendix for survey instrument. Finally, the Task Force maintained an email account for citizens to submit comments at any time. XXX substantive emails were received.

The Task Force identified five areas of focus based on directions in the Select Board Charge: stakeholders; energy and emissions; other cities and towns/best practices; government documents; and Concord Municipal Light Plant. Each area was led by a Task Force member and is described in detail later in this Final Report. Relevant materials gathered during this work are included in the Appendix. These materials may be of interest to those who succeed us.

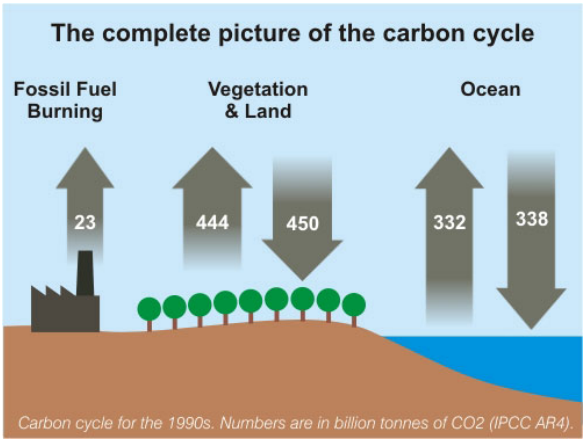
The goals stated by the Task Force are intended to apply town wide to all sectors. However, the Task Force focused most of its attention on the energy sector and especially the Concord Municipal Light Plant (CMLP). This too reflected the Select Board's Charge. This focus also reflects the view of the Task Force that the greatest near-term opportunity for greenhouse gas reductions in Concord are offered by CMLP and that CMLP offers the greatest potential to change residential, municipal, and commercial energy-consumption behavior. Notwithstanding this CMLP focus, the Task Force also strongly recommends GHG reductions in other sectors.

IV. Concord Today

A. What are greenhouse gases (GHG)?

Carbon dioxide CO_2, Methane CH_4, Nitrous Oxide N_2O and other compounds[1] are called "Greenhouse" Gases because, like glass, they are transparent to visible light and opaque to parts of the infrared spectrum. Visible light emitted from the sun passes easily through the atmosphere to the surface of earth. That energy is then absorbed by the surface and emitted as infrared energy (heat). This infrared energy is then reflected by these greenhouse gases in all directions until it is released into space. The amount of Greenhouse Gas concentration in the air determines how quickly heat escapes into space and how warm the planet becomes.

The concentration of these greenhouse gases in the atmosphere had reached an equilibrium with the natural cycles of earth over millions of years. This balance kept global temperatures relatively stable. The amount of greenhouse gases emitted from the occasional volcano, seasonal plant decay or other natural GHG sources were absorbed by new plants and the oceans. This was until humans began digging up sequestered fossil fuels and adding them to the atmosphere by burning and overwhelming this natural balance.



Anthropogenic (human caused) CO_2 emissions have increased dramatically after World War II. The post–World War II economic expansion which lasted from 1945 to 1970 brought with it suburban development and urban sprawl, aided by automobile ownership. Oil was cheap and the new highway system allowed people to live miles away from where they worked. Between 1945 and 1975, Concord's population doubled from 8,382 to 17,270[2] as people moved from cities and farms to suburban areas.

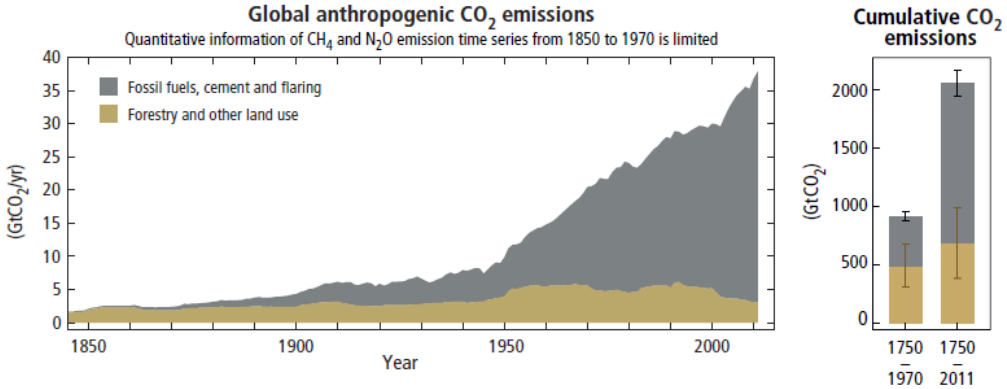
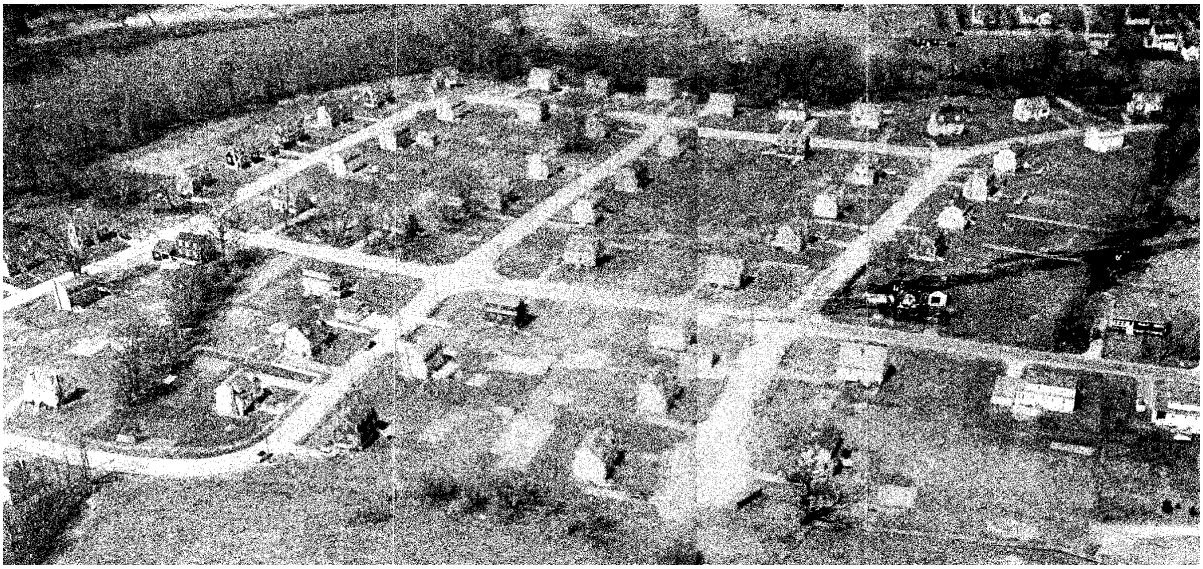


Figure 1.5 | Annual global anthropogenic carbon dioxide (CO_2) emissions (gigatonne of CO_2-equivalent per year, $GtCO_2$/yr) from fossil fuel combustion, cement production and flaring, and forestry and other land use (FOLU), 1750–2011. Cumulative emissions and their uncertainties are shown as bars and whiskers, respectively, on the right-hand side. The global effects of the accumulation of methane (CH_4) and nitrous oxide (N_2O) emissions are shown in Figure 1.3. Greenhouse gas emission data from 1970 to 2010 are shown in Figure 1.6. *(modified from WGI Figure TS.4 and WGIII Figure TS.2)* Source: IPCC Climate Change 2014 Synthesis Report SYR_AR5

[1] GHG GWP values WG1AR5_Chapter08_FINAL page 731-737 or GHG Protocol, GWP Values

[2] Concord's Population History

The US and other developed countries became, in the words of George W. Bush, "addicted to"[3] the benefits of cheap fossil fuel. Some of the country was ignoring or denying[4] the harm to our climate. The car had become a dominant means of transportation while trolleys, passenger rail service and other forms of mass transit did not meet the needs of a population spread across large areas of land. Forests and grasslands were cleared for homes.



South Meadow neighborhood just after its construction in the mid 1950's. Source: ???

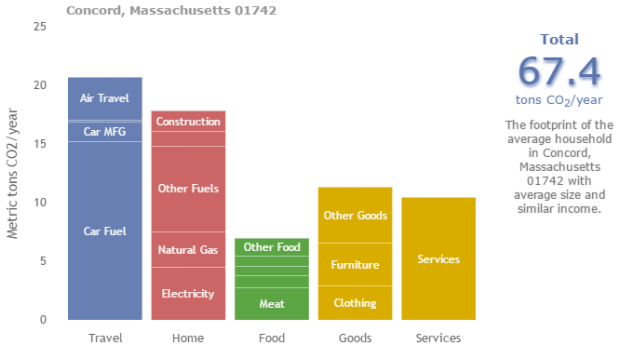
The challenge we face is how can we continue to enjoy the standard of living we have today while reducing the pollution it creates. Energy efficiency, renewable energy and energy storage, and responsible conservation of open space are just some of the many solutions[5] available.

What many fail to consider is just how much energy we consume. When we fill up at the pump or pay our home's utility bills we only see the energy we are directly consuming without calculating the total impact from producing the energy. As a wealthy suburb, Concord's per capita energy consumption is greater than the average as a result, in part for example, of larger, air conditioned homes and newer, larger vehicles that burn more fuel as we commute to jobs in the city.

This is what people think of when asked "what is your carbon foot print?" yet this is an incomplete picture. In addition to direct energy consumption, indirect energy consumption from the services we hire, vacations we fly to, the products we buy and the food we eat and the production of these goods and services, all emit large amounts of GHG to fulfill our needs. Unlike direct energy purchases, the environmental impact of these decisions is very hard to quantify. The embedded energy consumed within these products and services can be far greater than what we see in our utility bills.

[3] 2006, State of the Union address by President Bush
[4] Frontline, Investigation Finds Exxon Ignored Its Own Early Climate Change Warnings
[5] The Future Arrives for Five Clean Energy Technologies – 2016 Update

For example, the Berkeley Carbon Footprint Calculator shows the US household national average of 48.5 tons of CO_2 emitted per year. Concord's average household emits 67.4 tons of CO_2 emitted per year or 139%[6] of the US national average. Additionally, as a country the US is the world's second largest CO_2 emitter. While China's total CO_2 emissions are higher than the US their population is larger too. The average US citizen emits 170%[7] more CO_2 than the average citizen in China and Concord is 39% higher than the US average.



Setting a goal to reduce Concord's carbon footprint will require measurement of energy units consumed and to establish a baseline year. This will clearly define what we hope to accomplish in quantifiable terms. When considering "Concord's carbon footprint" the Task Force is referring to the municipal buildings and services as well as all other sectors and all individuals who live and work in town.

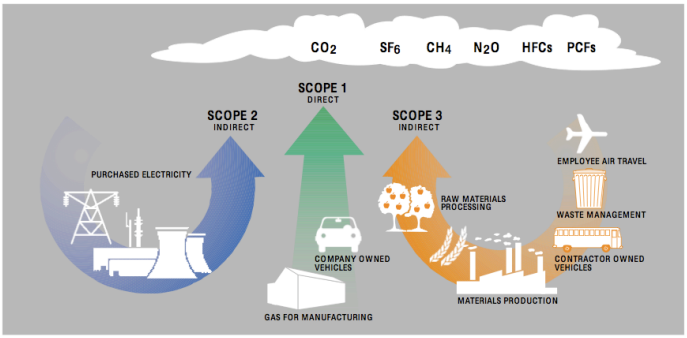
B. How do we measure GHG?

The Greenhouse Gas Protocol offered a good way to separate the accounting of emissions into three categories[8].

1. **Direct GHG** (scope 1). These are the fuels we buy and combust in town like home heating fuel and gasoline.

2. **Energy Indirect GHG** (scope 2). These are the fuels we buy like electricity where the combustion happens far from town.

3. **Other Indirect GHG** (scope 3). These are the products or services we buy.



Concord has direct control over and the ability to measure scopes 1 and 2. Direct GHG emissions can be tracked as fuel is purchased by residents, businesses and town government. Town government already tracks its GHG through the Massachusetts Green Communities[9] program. In addition, Concord is uniquely positioned to directly control the emission that comes from electrical generation[10] through the Light Plant's power supply portfolio and

[6] Berkeley Carbon Footprint Calculator values - Concord 67.4 tons / national average of 48.5 tons = 139%
[7] Each Country's Share of CO_2 Emissions - Tons of CO_2 per Person US 17.62 / China 6.52 = 170% more
[8] High level examination of The Greenhouse Gas Protocol use of scope
[9] Massachusetts Green Communities
[10] Concord Light power supply portfolio

management of Class I Renewable Energy Certificates (REC) in the Massachusetts' Renewable Energy Portfolio[11] Standard (RPS).

It is difficult to accurately measure the GHG emitted from the things we buy and the services we hire. The best Concord can hope to do is educate residents and business owners to identify products and services have more (or less) embedded energy (GHG emissions) in them.

C. Concord's Carbon Footprint

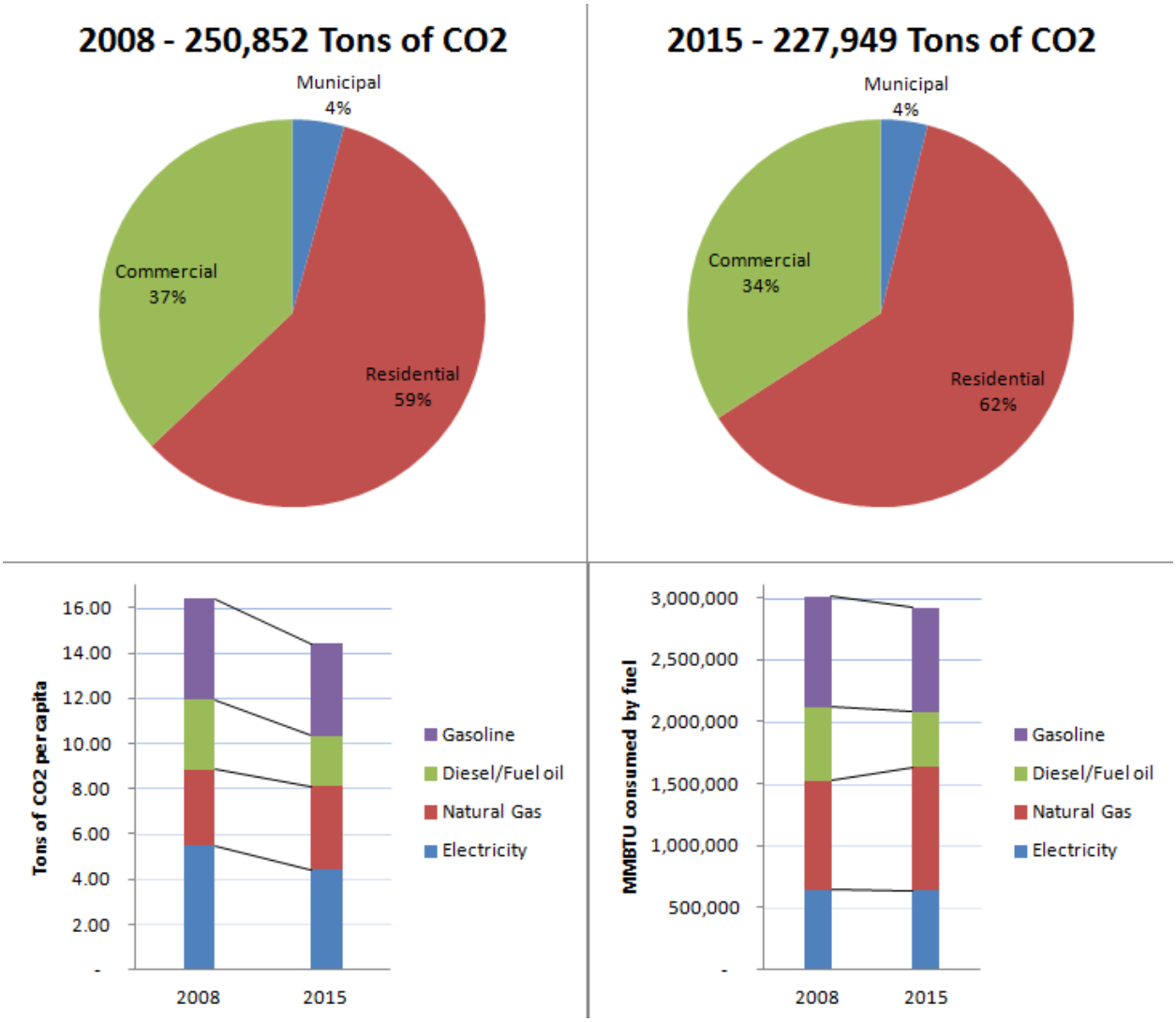
Using the data collected from many sources, the Comprehensive Sustainable Energy Committee (CSEC) has restated the 2011 Concord Master Energy Plan findings of Concord's 2008 town wide carbon footprint and compared this to Concord's 2015 town wide carbon footprint. The comparison showed a 9.9% reduction in measurable CO_2 emissions over 7 years. This is not Concord's total carbon footprint as data on some direct fuel purchases are not accounted for and the GHG emissions impact of the products and services we buy is too difficult to quantify.

Measured CO_2	**2008 restated**	**Tons of CO_2**	**2015**	**Tons of CO_2**	**7 Year Change**
Scope 1					
Natural Gas	8,827,929	51,643	10,001,119	58,507	+6,863 / +13.3%
Diesel/Heating Oil	4,239,267	47,056	3,174,281	35,235	-11,821 / -25.1%
Propane	*Complete Data*	*Not Available*	*Complete Data*	*Not Available*	
Gasohol E10	7,208,673	68,302	6,814,625	64,569	-3,734 / -5.5%
Scope 2					
Electricity	188,427,559	83,850	182,541,437	69,640	-14,211 / -16.9%
Scope 3					
Goods & Services	*Complete Data*	*Not Available*	*Complete Data*	*Not Available*	
Total CO_2		**250,852**		**227,949**	**-22,902 / -9.9%**
Population	15,300	16.40	15,798	14.43	-1.97 / -12%

To better understand Concord's carbon footprint, consider the 227,949 Tons of CO_2 each year as a minimum value. The calculations used represent only the CO_2 content and do not give full weight to the fugitive CH_4, and N_2O emissions. Additionally, they do not incorporate the purchasing data on direct energy consumption of vehicle transported fuels. (Propane, Diesel/Heating Oil and Gasohol E10) 227,949 Tons is equivalent to over 11 Concord Carlisle High Schools[12] each year by weight.

The Berkeley Carbon Footprint Calculator estimates that the average Concord household generates 67.4 tons of GHG per year when using all three scopes of the GHG Protocol. That is a carbon footprint of 437,021 tons per year[13] for only the residential sector which accounts for 62% of Concord's total GHG emissions.

[11] Massachusetts' Renewable Energy Portfolio Standard (RPS)
[12] According to the CPS Facilities the Concord Carlisle High School weighs approximately 40,000 tons
[13] 437,021 Tons is calculated using the 2010 census data of 6,484 households in Concord times 67.4 Tons.



The charts above are from the Comprehensive Sustainable Energy Committee's (CSEC) restated the 2011 Concord Master Energy Plan findings.

Emissions Database

With the help of a consultant, the Task Force recommends Concord establish a town wide database for tracking Concord's carbon footprint and maintain this to monitor progress toward the GWSA goal of an 80% reduction in GHG by 2050. Many carbon tracking programs exist.

Concord is currently using the Mass Energy Insight web-based tool[14] for tracking direct fuel purchases in the municipal sector as part of the state Green Communities program. This is an excellent tool for tracking direct fuel and electricity purchases (scope 1 and 2) but is limited to the municipal sector that accounts for approximately 4-7% of Concord's energy use.

[14] Municipal Carbon Footprint Reports and Mass Energy Insight web-based tool

In 2009, Concord became a member of the International Council for Local Environmental Initiatives (ICLEI).[15] The ICLEI offers the US Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. This is a comprehensive methodology for tracking town wide GHG emissions. The ICLEI protocol offers GHG Protocol compliant emissions inventories, emissions forecasting, cost and benefit analysis for GHG reduction initiatives and guidance and training through a web portal.

Massachusetts Greenhouse Gas Emissions Reporting Program also offers many resources for creating a GHG inventory for Concord that is compliant with the GWSA. For data on the Commonwealth's progress toward the GWSA see the Massachusetts Greenhouse Gas (GHG) Emissions reports. Once a GHG reporting system similar to Mass Energy Insight or the ICLEI protocol is fully implemented Concord can better track progress toward the GWSA goal of an 80% reduction in GHG emissions by 2050.

Using Renewable Energy Certificates (REC) and Carbon Offsets

When renewable sourced electricity is generated two products are created: the electricity and a Renewable Energy Certificates (REC). The REC as defined by the Massachusetts Renewable Energy Portfolio Standard (RPS) is "*The positive environmental attributes associated with this clean energy production.*" (See the appendix for more information.) A utility can purchase the electrical production or REC or both from the generator. Only the REC can be used to offset the emissions related to electrical generation. If a utility purchases only the electrical production, it cannot claim that it is renewable as the owner of the associated REC is making that claim. To do so is double counting.

Carbon Offsets, like RECs, represent a reduction in greenhouse gas (GHG) emissions from an individual project that can be used to reduce emissions from other sources. Though both represent emissions reductions, Carbon Offsets are commonly used to offset emissions from direct fuel purchases (Scope 1) but can be used to offset emissions from electricity (Scope 2). RECs can only be used to offset emissions from electricity (Scope 2). For more information on the proper use of carbon offsets and renewable energy certificates, see The Center for Resource Solutions report titled "Renewable Energy Certificates, Carbon Offsets, and Carbon Claims".

[15] The International Council for Local Environmental Initiatives (ICLEI) Greenhouse Gas (GHG) Protocols

Below is an example of how to properly use RECs and Carbon Offsets.

Fuel	Used	Rate	Fuel Units to lb. CO2	lb. CO2	
Electricity	11,426	0.726	lbs CO2/kWh	8,295	
REC Retired (not sold)	12	-726	lbs CO2/MWh	-8,712	**<-- claim of 100% Renewable Electricity**
Net Electricity				0	<-- Can't go below zero lb.
Electricity after REC Retired				0	
Gasoline	195	19.6	lbs CO2/gallon	3,822	
Natural Gas	321	11.7	lbs CO2/therm natural gas	3,756	
Oil	0	22.61	lbs CO2/gallon oil	0	
Propane	5	12.43	lbs CO2/gallon propane	62	
CO2 Footprint				7,640	
CO2 Footprint				7,640	
Purchased Carbon Offsets	3.5	-2205	Metric Tons of CO2	-7,718	**<-- claim of Net Zero CO2**
Offset CO2 Footprint				-78	

D. Municipal and sustainability planning

Concord has a track record of taking energy conservation seriously. In addition to the focused energy conservation strategies employed by the Concord Municipal Light Plant and conservation initiatives supported by other Town departments noted below, there are many volunteer citizen groups working to raise public awareness for choices that citizens of Concord will make together to improve the environment and decrease the speed of climate warming. In particular, Mothers Out Front and Concord Climate Action Network (Concord CAN) provide educational opportunities for citizens. The League of Women Voters is committed to providing coverage of local political activities and research available to citizens in advance of town meetings and elections.

In addition, citizens regularly propose Petition Articles at the annual town meeting focused on energy and sustainability issues. These have included initiatives to ban single serve plastic water bottles and plastic bags, and polystyrene packaging. In 2016, Article 46 was proposed to support Concord becoming a net-zero greenhouse gas community. The petitioners did not move this article at the Town Meeting when the Select Board established the Energy Future Task Force.

Notwithstanding this consistent level of activity over the past decade, greenhouse gas emissions have only decreased approximately 10%. This progress is too slow to meet the goals of the Massachusetts Global Warming Solutions Act. A summary of Concord's recent actions follows.

Sustainability Principles

To acknowledge the responsibility of the Town of Concord to plan for a resilient and sustainable future, on July 25, 2011, the Concord Select Board voted to adopt the following four sustainability principles (based on the American Planning Association's Four Sustainability Objectives- see Appendix):

1. Reduce dependence upon fossil fuels, underground metals, and minerals;

2. Reduce dependence upon synthetic chemicals and other manufactured substances;

3. Reduce encroachment upon nature; and

4. Meet human needs fairly and efficiently; and to ask the Town Manager and Department Heads to report on methods and successes in implementing sustainable principles and balancing reductions in order to meet human needs fairly and efficiently.

These Sustainability Guidelines have been used as a filter for decision-making by town officials. This act raised general citizen awareness of the importance of making sustainable choices as the Town invests in the future. Concord's governance structure controls the municipal sector and it is the municipal sector that the town funding directly affects. However, Concord is more than its municipality. Concord is a "system" that supports all of the people who live within its boundaries as well as the natural and physical environment they enjoy. Accomplishing the bold goals that are recommended herein will require a systems approach, recognizing that a change to one part of the system affects every other part, to achieve the innovative integration of choices to move Concord to a low carbon future.

Municipal and Sustainable Planning Leadership
The Town Manager has provided constructive leadership engaging the municipal departments in making sustainable choices. At regular intervals, Concord's town departments develop evaluative reports and forward-looking strategies with participation and input from citizens. A sample of these include:

- Comprehensive Long Range Plan of 2005 (the Comprehensive Long Range Plan Committee was formed in 2016 to renew Concord's Long Range Plan)
- Wastewater Task Force 2008
- Building Local Food Connections 2012: Healthy Concord, Creating a Healthier Community with Stickiness 2014
- Open Space Recreation Pla
- Healthy Communities 201
- Housing Production Plan 2016
- Zoning Bylaw amended April 2016

Highlights of recent municipally sponsored sustainability activities include:

- CMLP's sustainable projects such as smart grid, LED street lighting, solar installations at Grace property and landfill, EV vehicles, EV rates, Spruce Mountain contract
- IT Department software upgrades for billing and document management to reduce paper
- Public Works Department enforces plastic bag and new polystyrene products bans
- Public Works semi-annual Drop Off/ Swap Off program to promote recycling and reusing

- Green Demolition at 51 Lawsbrook and 91 Sudbury Roads recycle 90% of construction debris
- Water conservation to reduce water use
- Public Works bioretention for storm water in many projects including Rideout Playground
- Expanded locations for public water fountains
- Police Department installed LED lights and motion sensors
- Anti-idling policy and increased foot patrols
- Hybrid vehicles for Administration
- Unused prescription drug collection
- Planning Board Trails Committee
- Sustainable farming and leasing farms
- Tree preservation bylaw
- Bruce Freeman Rail Trail construction
- Fire Department low emission fire engines
- Anti-idling policy
- Library LED lighting conversation
- Low flow toilets in Visitor Center
- Recreation Department LED lights in parking lots and Hunt Gym
- Cross Town connect regional transit buses
- Van for Council on Aging
- Added greenspace at Rideout and splash pad with recycled water
- Open Table Food Bank in Maynard
- Building Inspections enforce the Stretch Energy Code
- Resilience planning for flooding, tornadoes, ice storms
- Updated hazardous mitigation plans
- Improved safety for cyclists
- MA Cultural Council grant to support businesses by shopping locally
- Sustainable development projects such as Brookside Square, Ingham Lane and Riverwalk
- LEED certification for proposed Junction Village project

Members of the Task Force interviewed the Town Manager and the Senior Management Team including the Directors of Town departments and were briefed on the sustainability and energy conservation practices presently employed. As part of this conversation “obstacles to progress” were discussed. It was noted that the departments have distributed responsibility for their buildings. Most town buildings will benefit from more energy efficient heating and ventilation systems as well as more energy efficient building envelopes. Despite important progress on emissions reductions, there is more to do. Some obstacles to rapid progress include serial projects without an overall master plan, limited resources for regional transit, protection of historic aspects of the community, inadequate staff time to monitor progress on initiatives and inadequate funding.

The Concord Sustainable Energy Committee (CSEC)

At the municipal level, The Concord Sustainable Energy Committee (CSEC) was established in 2007 to assist the Town in identifying, designing and implementing projects in town-owned buildings to foster energy conservation, energy efficiency, and renewable energy generation. In 2009, The Sawyer Trust made a $1.7 million donation to the Town to be used to fund energy-efficient project in municipal facilities. Since that time, CSEC has worked with town officials to oversee the expenditures from this donation with the approval of the Town Manager. Over $1.5 million in energy-efficient projects have been realized with annual operational savings with reports on this progress documented in the Annual Reports of the Town. As the Sawyer Trust gift has been depleted, it has been replaced with a modest contribution in each budget cycle to a Sustainability Fund overseen by the Town Manager for use in funding on-going projects.

CSEC has sponsored community wide initiatives to improve Concord's energy performance and reduce greenhouse gas emissions such as Green Communities, Green Your Heat Project, and the Solar Concord Challenge. To achieve success with these initiatives, CSEC has applied for and received state grant funds to invest in energy savings projects in Concord. Identifying funding sources outside the traditional Town budget process has been critical to the success of these projects. Continued attention to identifying revenue sources will be a significant catalyst to Concord's ability to move rapidly in the direction of reducing greenhouse gas emissions.

Green Communities

Concord applied for and received the Green Communities designation in 2013. With this designation, it became possible for the Town to apply for grant funding to be used for sustainable initiatives. The requirements for Green Communities were adopted including 1) as-of-right siting and expedited permitting for renewable energy facilities, 2) the electric Stretch Code requirements for building construction and major renovations, 3) an Energy Reduction Plan to reduce Concord's municipal energy consumption in 5 years by 20% from 2011 baseline, and 4) purchase only fuel-efficient vehicles. The Green Communities designation has reinforced the partnership between the town and schools in the prioritization of projects for funding that will achieve the highest energy efficiency payback. This is an example of the systems approach to achieve benefit to Concord as a whole.

E. Concord Schools

Concord and Concord-Carlisle Regional School Districts

Having two separate school districts in Concord complicates the interplay on carbon emission protocols considered by the community. Concord's PK-8 grade school district, while charged first and foremost with providing the best educational experience possible to the students, is still wholly within the bounds of the community. The School Committee sets policy and budget for the district and Town Meeting passes the budget provided or an amended version. The school buildings and grounds are the property of the town. The five School Committee members are elected by the voters of Concord. So, while Concord Public Schools is a legally

separate entity for purposes of the above responsibilities, the community has significant influence over school matters.

The Regional School District (RSD) was formed under State regulations guiding the creation and operation of regional school districts. There are some significant differences relative to how community engagement may occur. The five Concord School Committee members serve with two Carlisle School Committee members to comprise a seven member board with distinct responsibilities to the RSD versus either community individually. Each town approves the proposed budget and much of the direct influence ends there. The buildings and campus are owned by the RSD.

The Schools are a meaningful portion of the community's carbon footprint. The buildings; three elementary, two middle schools, one high school and one administration, use considerable energy for HVAC (heating, ventilation and air conditioning) and electricity. There is a bus fleet of 38 buses plus support vehicles. Two meals are offered at all school buildings each day. Many students commute to the schools in private vehicles each day. Therefore, a significant carbon footprint is embedded in the operation of the town's schools.

The Districts have made great strides in making the school buildings as efficient as is economically feasible. The high school is the "greenest" one of its kind in the state. All three elementary schools were built with energy efficiency in mind. The middle schools are currently being considered for renovation or replacement with either option having energy efficiency as one of the primary goals. The first priority of the bus program is to provide safe, timely transportation to the students. The district is one of four in the Commonwealth to have received an electric school bus through a grant from the Commonwealth. This is a pilot with one aspect of the grant requiring use of the bus batteries as grid storage when possible.

All the schools have curriculum elements that cover aspects of energy efficiency and environmental stewardship. There is ongoing expansion and revision of these programs with ample opportunity to provide input regarding the town initiatives.

The Task Force recommends the future citizen committee have at least one school representative, depending on committee size, to be appointed by the School Committees. Initiatives and goals should be presented to the Committees for input on interest and implementation as needed. It is anticipated the Districts will be willing participants in the plans of the community relative to carbon reduction with the caveat that any related expenses will be weighed against the overall delivery of educational programming, capital needs and operational expenses.

Concord School Buildings

The Concord and Concord-Carlisle Regional School Districts have been improving buildings, vehicles and operations with an eye toward greater energy efficiency for many years. From

2003 when the newly constructed Alcott School opened its doors to today with the recently opened new CCRHS building, the Districts have taken action to build and maintain the campuses with sustainability and energy efficiency as high priorities.

Alcott (opened 2003), Thoreau (2004) and Willard (2009) Elementary Schools are each approximately 80,000 SF in size. They replaced buildings that were each approximately 56,000 SF in size. Alcott and Thoreau utilized then current energy efficient building standards resulting in, on average, the same amount of natural gas use for heating as the buildings they replaced. Willard was designed to be more efficient with a 35% decrease in the annual amount of natural gas required to heat the building when compared with the replaced building. In addition, Willard has photovoltaic panels on the roof.

The Concord Middle Schools are housed in two buildings that are each more than 50 years old. They have been maintained in good operating condition through regular maintenance and updating for energy efficiency and comfort. New boilers were installed at Peabody (’14) and Sanborn (’15) Schools using grants from the Massachusetts Green Communities Program. As a result, both schools have decreased natural gas usage of approximately 40%.

The Concord School Committee formed a Middle School Building Committee in the fall of 2016 to review options for renovating the existing buildings and to compare costs for new construction of one building. The Committee has energy efficiency as one of its primary goals for upgrading the Middle Schools.

Concord Carlisle Regional High School (CCRHS)
The new CCRHS building, opened for student occupancy in the spring of 2015, scored 61 MA CHPS (MA Collaborative for High Performance Schools) points, the highest number for any school in Massachusetts at the time. This rating indicates the high performance of the energy efficient design. An indicator of this improved performance may be seen in the comparison of natural gas fuel costs. During 2013-14 the last full year of occupancy for the previous high school the natural gas expenditure was $200,000. For the 2015-16 school year (a mild winter), the expenditure for the new school was $37,000. In the FY ’18 budget natural gas expense is budgeted at $50,000, a 75% decrease from the expenditures at the old high school.

Electricity budgets have also dropped over the same period from $321,000 in FY14 to a budgeted $285,000 proposed for FY18. Electricity usage decreased for the new building despite the addition of air conditioning and meeting all regulations for indoor air quality.

School Buses

The Districts own thirty-six diesel buses and one electric bus for transportation of students from Concord, Carlisle and Boston. The diesel buses are fueled with ultra-low sulfur diesel. The electric bus was awarded to Concord through a state grant that provided a total of four electric buses, one each to Cambridge, Concord, Acton and Amherst as a pilot program to gauge the feasibility of using full size electric school buses as replacements for diesel buses as they age

beyond their useful lifecycle. The electric buses are an expensive alternative to diesel buses. Concord's electric bus cost approximately $350,000 to purchase while each diesel bus costs approximately $90,000. Several factors must be considered to determine the breakeven point for adoption of electric bus technology as replacement to the Districts' diesel buses: fuel, maintenance, lifecycle, use as battery storage and the more subjective health risk improvements from fewer emissions. The grant will provide first-hand knowledge and experience to develop a future strategy.

The Concord School District is constructing a new transportation depot at the W.R. Grace site that will open in the Summer of 2017. This will allow bus maintenance and storage to be relocated to Concord after a period in Billerica and Acton during the construction of the new CCHS. The closer proximity of the new transportation depot will substantially lower the number of miles driven each year.

F. Regional Planning for Sustainability and MAPC, MAGIC and HATS

The following examples indicate Concord's active participation in regional initiatives.

The American Planning Association's Policy Guide on Planning for Sustainability was the basis for the Board of Selectman's Sustainability Principles adopted in 2011. Within these Principles are action items for sustainable initiatives for land use, transportation, housing and buildings, economic development, open space and recreation, infrastructure, growth management, resource conservation, floodplain management, watershed planning and management, and education.
https://www.planning.org/policy/guides/adopted/sustainability.htm

Concord participates with neighboring towns as a member of MAPC (The Metropolitan Area Planning Council) and of MAGIC (Minuteman Advisory Group on Interlocal Coordination), a regional subgroup of MAPC representing 14 towns in the SUASCO (Sudbury Assabet and Concord rivers) watershed area.

The Metropolitan Area Planning Council (MAPC) supports initiatives by its members.
The Sustainable Communities Program supported land use studies and sustainable initiatives within member towns funded by a grant from HUD resulting in action plans across sectors to improve equitable access to housing and jobs and practice in regional solutions.
http://www.mapc.org/sites/default/files/Sustainable%20Communities%20Accomplishments.pdf

In addition, The MAPC Regional Climate Change and Adaptation Strategy advises each municipality to "consider climate change adaptation and mitigation given the magnitude of climate change impacts on the environment, developed areas and infrastructure, the economy and public health in the Boston Metropolitan region".
http://www.mapc.org/regional-climate-change

In May 2015 the 14 cities and towns of the Metropolitan Mayors Coalition (of which Concord is not a member) pledged to achieve Net Zero Carbon-free status by 2050 with interim implementation steps.
Importantly, the sectors identified within this agreement include Buildings, Transportation, Renewables, Energy Efficiency, Municipal Facilities, and Waste.
http://www.mapc.org/metro-mayors-coalition

In October 2016 the MAGIC Climate Resilience working group focused on the vulnerabilities of our communities in the areas of water infrastructure, transportation, energy, land use, habitat, health and welfare, healthcare, agriculture, tourism, and local government. All are integrated sectors that together maintain the security, safety and abundance of the life we share in Concord.
http://www.mapc.org/sites/default/files/VA_AM_Discussions.pdf

Additionally, Concord engages with neighboring towns in setting goals and developing programs to meet sustainability goals through. The Hanscom Area Towns Committee (HATS) is an alliance of Concord, Lincoln, Bedford, and Lexington dedicated to addressing matters of common concern, especially with regard to development at Hanscom Field. Collaborating on sustainable energy practice is gaining momentum among these towns.
www.hanscomareatownscommittee.com

V. Concord Municipal Light Plant: A Critical Role in Enabling Realization of GHG Reduction Goals

Concord is one of forty-one communities in Massachusetts with a municipally owned electric utility. This provides Concord with a unique opportunity to ensure that the town's electric utility, the Concord Municipal Light Plant (CMLP), is appropriately aligned with the town's GHG emission reduction goals and provides the community with an effective lever for realizing these goals in a financially prudent manner.

CMLP is a cornerstone of the Task Force's recommendations for Concord to realize its desired energy future and GHG reduction goals. CMLP's role in these recommendations is consistent with the role of the electricity sector more broadly in reducing GHG emissions. The Clean Power Plan, which targeted the US electricity sector, was a critical element of the federal government's strategy to meet commitments made in the Paris Agreement. Similarly, Massachusetts has relied significantly on the electricity sector to achieve the GHG reduction targets outlined in the Global Warming Solutions Act and last July the legislature passed An Act to Promote Energy Diversity, which called upon Massachusetts electric distribution companies to procure 9.45 million MegaWatt hours (MWh) of clean energy (non-GHG emitting) and 1,600 MW of off-shore wind.

Fundamentally, achieving these goals means transitioning to a clean energy economy. The World Resources Institute has described this transition in terms of three pillars, all of which CMLP can have a critical role in promoting:

1) switching from fossil end-use fuels [such as oil, coal, and natural gas] to cleaner electricity focusing in particular on heating and transportation;
2) decarbonization of electricity – increasing the proportion of CMLP's power supplies provided by renewable and non-carbon emitting resources; and
3) energy efficiency- reducing electricity and overall energy consumption.

Our review of the opportunities offered by CMLP to assist the Town in achieving the GHG emission reduction goals presented in this report, is framed in terms of these three pillars, which are described later in this section.

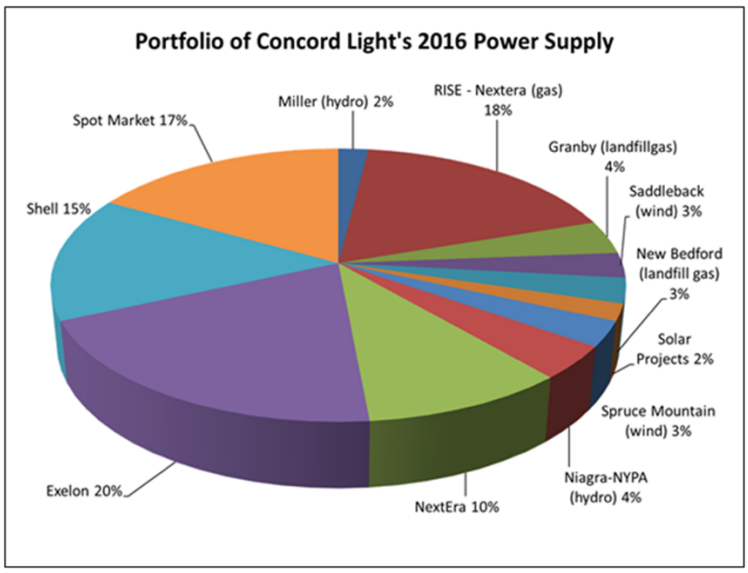
A. Overview of CMLP

CMLP has two classes of customers: Residential and Commercial. The Commercial segment includes Institutional and Municipal customers. In 2016 Residential sales made up approximately 45% of the total sales, while Commercial and Municipal made up the remaining 55% as measured by revenues. CMLP's totals sales were approximately $24,509,000 or 171,000 MWh.

CMLP presently has 8,300 customers. There are 260 net metering customers with approximately 2.5 Mega Watt (MW) of total capacity of privately owned solar arrays, which represents 22% of the total solar capacity in town. The town currently contracts with third party

vendors though power purchase agreements (PPA) totaling 9MW of solar. This represents 78% of total solar capacity in town.

CMLP doesn't own any generation facilities; it purchases all of its electricity supply from third parties or the market. The pie chart below illustrates the power supply resources that CMLP utilized in 2016. CMLP currently purchases approximately 21% of its energy requirements from non-carbon emitting sources.[16] CMLP is considering creating a Green Power purchase option which will enable customers to purchase and retire Renewable Energy Credits (RECs). CMLP's renewable energy procurement practices are discussed further below.



B. Rates

1. Current rate system explained

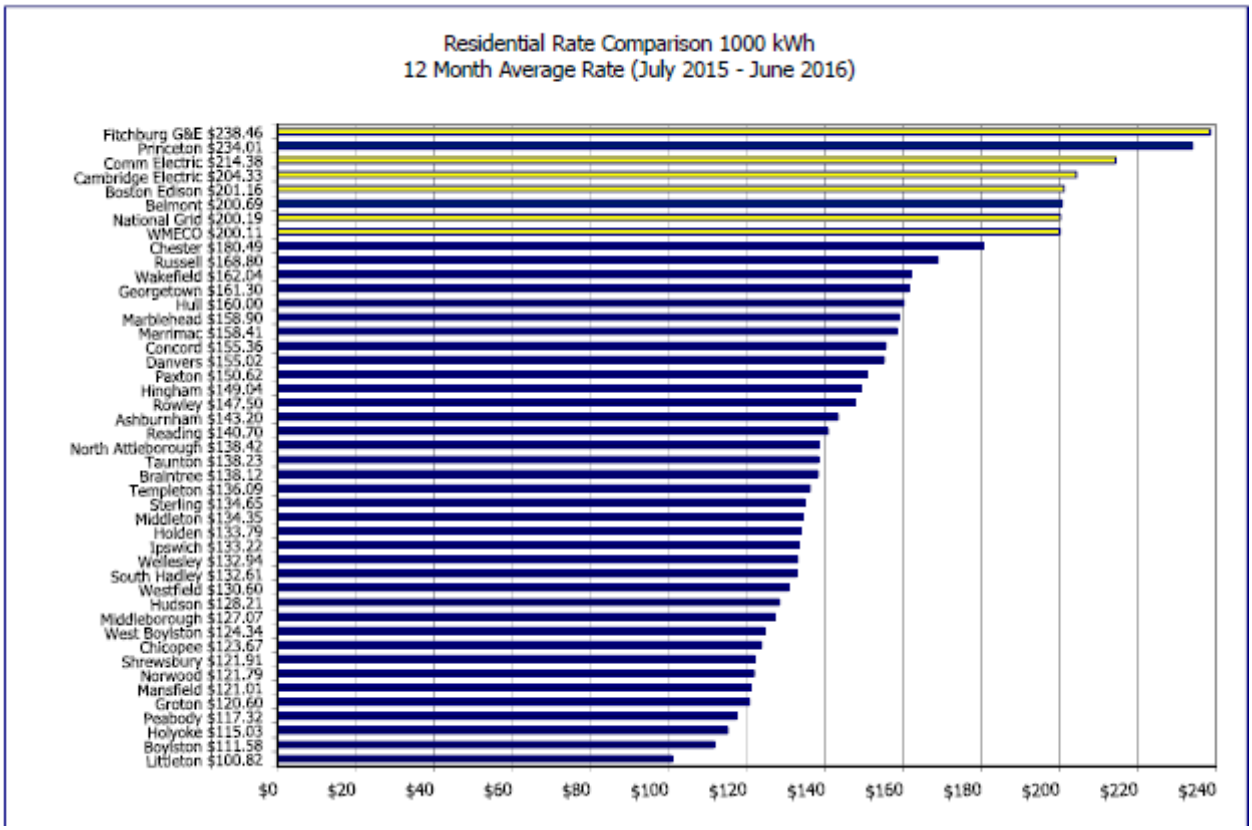
CMLP relies on the revenue from the sale of electricity to cover the cost of operations and energy purchases. As a municipal light plant, CMLP is subject to Chapter 164 of the Massachusetts General Laws, which among other things limits the profit that can be realized in any year. The purpose of rate setting is to match total annual revenues with the total cost of operations including a modest profit. CMLP has a Light Board composed of town residents, who are appointed by the Town Manager to oversee CMLP's electric rates and budget. The Town Manager hires and oversees the Light Plant Director. The Town Manager serves as the Light Plant "manager" as the term is used in Chapter 164 of the Massachusetts General Laws. On a day-to-day basis, however, the Light Plant Director is responsible for overall plant operations. To ensure revenues and costs are aligned, CMLP has undertaken a cost of service study every 3 to 5 years. The most recent study was completed by Energy New England (ENE) in January of 2015.

[16] CMLP does not presently retire the Renewable Energy Credits for the renewable resources which it purchases. The implications of this is discussed below.

2. The rationale for our current rate system

When setting rates, consideration is given to reliability, efficiency, cost of energy, fairness and the long term financial sustainability of the Light Plant. In addition, CMLP has tried to avoid abrupt rate increases. To do so CMLP has undertaken two strategies: Power Cost Adjustments (PCA) and Rate Stabilization Funds employed throughout the year and from year to year.

In 2006, 2008, 2010, 2012, and 2014, the Town conducted a survey of Concord residents to gauge the level of satisfaction and overall impression of the cost of electrical service (the rates). This included the question: "What is your opinion of the price of electric rates?" In 2014, 29% of the responders thought that the price is a Good Bargain and 60% thought that it is Reasonably Priced, while 11% thought it was Excessively Priced. Historically, CMLP rates consistently rank in the middle of the pack when compared to other municipal light plants state wide. The figure below indicates that at a consumption level of 1,000 kWh per month, CMLP's rates are at about the top one-third (16 out of 45), but almost 25% below National Grid and Eversource (serving Carlisle) the two largest investor-owned utilities that serve much of Massachusetts.[17] In addition, CMLP is the only municipal light plant whose rates include a cost for undergrounding all electrical and communications utilities.



In 2013, at the request of the Light Board, the Light Plant unbundled the components of the monthly utility bills so that customers could better understand the origin and nature of costs. For a detailed explanation of the rates see the Appendix.

[17] The average CMLP residential customer uses about 859 kWh per month. At lower consumption levels, CMLP rates are more competitive.

C. New Realities

Given the threat posed by climate change and the need for Concord to reduce our GHG emissions, it is essential that CMLP's rate structures promote conservation and reduce the reliance on carbon emitting fuels. The 2015 Paris Agreement and the adoption of the 2008 Global Warming Solutions Act (GWSA) demonstrates that the debate has shifted from: is climate change real to what are we going to do about it. Therefore, the Task Force recommends we acknowledge the true cost of our energy decisions and adjust our behaviors accordingly. To accomplish this the Task Force thinks we must educate, empower and embrace a rate system that rewards energy conservation efforts and provides CMLP's customers with the tools to make informed decisions. This new rate system must also ensure the long term financial viability of CMLP.

D. CMLP's Strategic Planning Process

In July 2015 CMLP's Strategic Planning Team initiated a strategic planning process to consider how to deliver similar, reasonably-priced, highly reliable, socially responsible and friendly services (for which it is known) to its customers in the 21st century. In October 2016 CMLP engaged an energy industry consulting company to expedite and guide this effort. The consultant's job is to suggest a list of sequenced strategic alternatives that will best meet CMLP's stated goals and to provide examples of how other utilities have planned and implemented selected strategic initiatives. The consultant is directed to consider throughout the process the short and long term goals and principles developed by the Task Force as well as CMLP's goals.

The first meeting with the consultant was held in mid-November. The project was scheduled for approximately 22 weeks, and anticipated to conclude in May 2017. In light of the scope and timeline for this work and its likely impact on CMLP operations and priorities the Task Force strongly recommends that the goals and recommendations of this report be integrated into CMLP's current strategic planning effort, allowing for an open and transparent citizen engagement process.

E. Suggested Tools for achieving Concord's goals

1. Consumer rate empowering tools
   To facilitate the goals laid out in the GWSA and empower CMLP customers to make informed decisions, the Task Force recommends that CMLP adopt the following customer rate empowering tools:
   a) Employ smart meters town wide
      In November 2016, the Light Plant recommended and the Light Board voted to recommend that the Town Manager request town approval to install smart meters town wide. Consideration of town-wide deployment of smart meters will be taken up in the

2017 Annual Town Meeting. Smart meters would enable CMLP to better manage customers' electricity needs in four important ways:

i. Allow customers to report outages on line which would expedite the resolution of the outage.
ii. Simplify the billing process.
iii. Enable the Light Plant to optimally design the distribution system and balance the load.
iv. Promote Demand Side Management (DSM), through which CMLP can engage with customers to help lower their bills with a centrally operated direct load control (DLC) system.

b) Employ revenue decoupling

Recently several CMLP customers have requested the Light Plant and Light Board to change to a revenue decoupled approach to rate setting. Revenue decoupling separates fixed costs (such as billing) from those that vary by sales revenue (such as kWh sold). Each cost is in turn billed separately. In the revenue decoupling approach, all distribution system costs that change with sales volume would be collected with a per kWh charge. Revenue decoupled rates ensure the long term financial viability of the Light Plant regardless of total sales or resulting reductions of sales due to conservation measures and increased adoption of distributed generation such as solar arrays.

Once Smart meters have been deployed town wide and revenue decoupling has been initiated, then the town can implement the following rate options:

c) Employ a Time of Use (TOU) rate structure

The Task Force recommends that CMLP empower its customers to make informed choices by adopting enhanced TOU rates. Time of Use Rates, as the name implies, vary based on the time-of-day, recognizing that the costs of serving customers vary over the course of the day and based on the total demand on the power grid. The objective is to set rates that reflect these cost differences and to allow customers to shift their energy usage to lower cost periods when possible. CMLP currently has a Residential (R-1) TOU rate that is used by 16 customers.

d) Employ Distributed Energy Resources (DERs) and battery storage. These are smaller power sources that can be aggregated to provide power necessary to meet regular demand and help balance out the load throughout the day. As the electricity grid continues to modernize, DERs such as battery storage and advanced renewable technologies can help facilitate the transition to a smarter grid. Conventional power stations, such as coal-fired, gas and nuclear-powered plants, as well as hydroelectric and large-scale solar powered stations, are centralized and often require electricity to be transmitted over long distances. By contrast, DER systems are decentralized, modular and more flexible technologies that are located close to the load they serve. These systems may comprise multiple generation and storage components. The Task Force suggests small scale, non-carbon emitting, DERs

could play an important role in Concord's ability to lower its carbon emissions and transition to a more renewable, locally generated power grid.

2. The three pillars

Pillar 1: End-use Fuel Switching with Increasing Electrification

As discussed in the introduction to this section, increasing the reliance on electricity is a critical strategy to reducing GHG emissions. This includes displacing fossil fuels with electricity for heating and in the transportation sector. The following are recommended approaches:

a) Shift homes from fossil fuels to heat by electricity: Concord's Comprehensive Sustainable Energy Committee (CSEC) has initiated an effort to encourage homeowners to change from oil or gas fired heating to efficient electricity heat sources such as mini-split heat pumps through the Green Your Heat program. This strategy will enable CMLP to provide a lower carbon emitting alternative, with greater carbon emission reductions as it shifts its power supply portfolio to non-carbon emitting power supplies.

b) Shift more transportation energy demands to the electrical grid: As more Concord residents shift from internal combustion engine vehicles to electric vehicles the opportunity exists to provide that energy from lower emitting, CMLP-provided resources. Given New England's existing electricity supply mix, which is composed of over 40% non-emitting resources and limited amounts of coal-fired electricity, the miles per gallon (mpg) equivalent of electric vehicles in terms of GHG emissions is about 86 mpg.[18]

Pillar 2: Decarbonizing Electricity Through Renewable Energy Procurement

Concord's Comprehensive Sustainable Energy Committee (CSEC) estimates that 31% of the Town's total GHG emissions in 2015, the largest from any fuel source, were attributable to electricity consumption within the Town.[19] A common and practical strategy for reducing these GHG emissions is to increase the proportion of CMLP's electricity supply provided by renewable energy resources such as wind, solar, hydroelectric, or landfill gas. However, for CMLP to claim the emission reductions associated with the production of this renewable energy it must purchase and retire the renewable energy certificates (RECs) that are generated by these renewable energy resources.[20] CMLP currently sells, rather than retires,

[18] http://blog.ucsusa.org/rachael-nealer/gasoline-vs-electric-global-warming-emissions-953
[19] Brad Hubbard-Nelson Presentation to Task Force, Concord Energy Baseline 2015, October 20, 2016.
[20] Massachusetts adopted a renewable portfolio standard (RPS) in the late 1990s when it restructured its electricity market. The objective of the RPS was ensure that environmental objectives were furthered with industry restructuring. The RPS puts an obligation on parties that serve electricity customers to ensure that an increasing proportion of their electricity supply is provided by renewable energy resources. The RPS obligated these suppliers to purchase and retire (they are retired so that they can only be used for compliance once) renewable energy

those RECs that it receives when purchasing qualifying renewable energy.[21] By reselling these RECs CMLP customers avoid paying the premium associated with renewable energy resources, but by doing so they aren't able to claim any credit for promoting the development of these resources. To claim such credit and to promote the development additional Class I renewable energy resources CMLP would need to purchase and retire the Class I RECs. In CMLP's 2011 *Renewable Energy Strategy*, the Light Board recommended: "that CMLP commit to increase the renewable energy portion of its energy supply portfolio from 10% in 2010 to 20% by 2015 and 30% by 2020" (p. 4).

As shown in the table below about 15% of CMLP's power supply is provided by Class I renewable resources. CMLP only purchases the RECs for the wind plants. The RECs for the landfill gas plants are sold to other parties by the owner of these units.

Project	**% of Supply**	
Miller Hydro	2%	
Granby	4%	
Saddleback	3%	
New Bedford	3%	**Class I**
Spruce Mountain	3%	**15%**
Solar Projects	**2%**	
Niagara - NYPA	**4%**	
Total All Renewables	**21%**	

Under the Massachusetts RPS, suppliers of customers of investor-owned utilities (IOUs) must purchase Class I RECs equivalent to 12% of the electricity requirements of these customers as of 2017. This percentage increases by 1% per year, i.e., the requirement will be 13% in 2018. Customers of municipally-owned utilities (e.g., CMLP) don't have an RPS obligation. Recognizing that electricity supply in New England is provided on a regional basis and Concord residents benefit from the cleaner electricity that this procured for the benefit of customers of investor-owned utilities, a case can be made that Concord is a "free-rider" and not paying its fair share by not participating in the Massachusetts RPS. (All six New England states have RPS programs and as such are contributing to the expansion of renewable energy in the region.) To address this, one option would be for CMLP to commit to purchasing Class I renewables at same level as if it were serving customers of the Massachusetts IOUs. The Task Force estimated that CMLP's rates would have to increase by about 3.8% if CMLP were to purchase and retire Class I RECs for 12% of its electricity supply. Recall that CMLP's residential rates are currently about 25% less than those of investor-owned utilities. For an

certificates that would be generated by these renewable energy resources. If these RECs are resold then they can be used by another party to satisfy its RPS obligations and there is no incremental benefit attributable to the reseller of the RECs from the production of renewable energy.

[21] There are a range of classes of renewable energy resources. In Massachusetts the highest value class of renewable resources is Class I, other than solar PV, which is a "carve-out" or portion of the Class I program. Class I resources include wind, small hydro under certain conditions, landfill gas, and various other technologies (e.g., tidal, wave power).

average residential customer this would be a bill increase of about $4.93 per month.[22] This bill impact on an annual basis would represent less than .05% of the median reported annual household income in Concord.

Another alternative would be to allow customers to elect to purchase and retire RECs (renewable energy) and pay a premium for this. This is an opt-in approach and similar to a program that the town of Wellesley has implemented. This approach may be appropriate, but only after CMLP has at least achieved the state's existing RPS obligation. Simply put, the Task Force recommends that CMLP commit to achieve the same renewable energy procurement obligations that the suppliers of customers of the Massachusetts IOUs meet.

In December 2016, the Massachusetts Department of Environmental Protection (MassDEP) issued draft regulations calling for a Clean Energy Standard that would put an obligation on retail suppliers of customers of all Massachusetts distribution companies to ensure that clean energy resources (i.e., non-GHG emitting) represent an increasing portion of electricity supplies. The regulation calls for clean energy to represent 80% of customers' electricity supply by 2050. Importantly, the Clean Energy Standard regulation would apply to Municipal Light Plants (MLPs) such as CMLP. However, it recognizes that these MLPs are not currently subject to the state's RPS and as such proposes a phase-in schedule whereby MLPs do not have to achieve the same clean energy standard as the customers of IOUs until 2050. In particular, the MassDEP has proposed that by 2021 MLPs be required to achieve a clean energy standard of 6% plus a small fraction (1/30th of the 16% RPS requirement) of their electricity supply from qualifying clean energy resources. Prior to 2021, the clean energy requirement for MLPs will be zero. This clean energy requirement will increase by 2% per year with the proportion of the 16% represented by customers of IOUs increasing by 1/30th per year such that by 2050 MLPs would be subject to the same standard as customers of IOUs (80%). Except in cases where RECs are sold, MassDEP is proposing to allow MLPs to subtract MWh generated by zero-emissions generation sources (e.g., NYPA hydroelectric generation) from the calculation of the number of clean energy credits required for compliance.

Therefore, the Task Force recommends that as a short-term goal CMLP should retire Class I RECs from renewable energy purchases or purchase Class I RECs to allow it to achieve the Massachusetts Clean Energy Standard goals that apply to suppliers of the customers of Massachusetts investor-owned utilities.

As indicated, CMLP would be able to comply with this recommendation by just purchasing Class I RECs. Therefore, this doesn't require fundamental changes to CMLP's power supply plan and given the available supply of Class I RECs this goal should be achievable in relatively short order.

[22] This is based on an assumed for of a Class I REC of $35 and based on Concord's current customer requirements. Massachusetts Class I REC prices for 2016 compliance year on December 28, 2016 were reported to be $19 and $24 for 2017 compliance year, suggesting that this cost and rate impact estimate may be too high.

As discussed, the Massachusetts Class I RPS is scheduled to increase by 1% per year so that by 2030, Class I RECs would be required for about 25% of the electricity requirements of customers served by IOUs. In addition, the Massachusetts legislature in July 2016 passed legislation calling on these IOUs to procure 9.45 million MWhs of clean electricity generation and 1,600 MW from off-shore wind projects. These two procurement obligations are projected to represent about 40% of Massachusetts' total electricity requirements. Clearly, an increasing proportion of Massachusetts customers' electricity supply is to be provided by non-emitting resources.

The Sierra Club reports that Aspen, Colorado, Columbia, Maryland, and Greensburg, Kansas, are powering their cities today with entirely renewable sources. Palo Alto, California has been "100 percent carbon neutral" since 2013 when the city signed long-term contracts for clean energy resources, including solar, wind, hydroelectric generation and renewable gas from landfills. Palo Alto's utility rates have remained extremely competitive with surrounding areas. A dozen additional cities have made commitments to reach 100% clean energy in the next 15-20 years.[23] In addition, the city of Austin had a renewable energy goal of 35% of renewables by 2020 and 55% by 2025. However, a 2015 solar purchase will allow the city to realize 40% renewables by 2020. Texas wind and solar resources are much more favorable, resulting in lower costs for these renewable resources and lower costs to realize such a target. Fort Collins, Colorado has a goal for an 80% reduction in GHG emissions from utility-scale electricity by 2030. Boulder, Colorado has a goal to rapidly transition to an energy system and economy that is powered 80 percent or more by renewable, clean energy, with 50 percent or more produced locally.

This raises the question as to what is an appropriate long-term goal for Concord. As discussed, CMLP is one of the most effective vehicles that the Town has for realizing its GHG emission reduction goals. With CMLP able to purchase energy from the New England grid and RECs a convenient tool to promote the development of renewable energy resources. CMLP can increase its purchases of Class I RECs as a viable renewable energy procurement strategy. Consistent with our broader goals the aggressive actions that they dictate, the Task Force recommends that by 2030, as an interim target, 100% of CMLP's electricity supply should be from non-emitting resources with RECs or certificates for associated environmental attributes retired.

The Task Force has estimated that realizing this goal would require electricity rate increases of approximately 20 to 30%.[24] This increase in rates would be over a twelve- to thirteen-year period and doesn't consider rate increases that other electric utilities in the region are likely to experience. The Task Force estimates that the average annual required increase in rates directly attributable to achieving this target could be kept below 2% per year assuming that

[23] Sierra Club, *Cities Are Ready for 100% Clean Energy: 10 Case Studies.*

[24] This analysis takes no credit for the clean energy resources (e.g., nuclear and existing hydroelectric power) that already exist in New England and provide about 45% of the region's total energy requirements. The availability of this non-carbon emitting generation will reduce the amount of fossil generation that will be displaced.

CMLP increases the proportion of renewable energy that it purchases at a relatively consistent rate over this period. This is based on projected costs for Class I RECs of about $35/MWh and assumes that electricity requirements would grow by 1% per year and total costs by 2.5% per year.[25] CMLP may wish to consider strategies to mitigate adverse rate impacts from this procurement strategy to low income customers.

The cost of realizing this goal would be reduced with major cost reductions in the clean energy technologies that would provide this energy. As a point of reference, solar costs today are one-third of what they were six years ago, and many experts project wind costs to decline by over 20% by 2030. Similar dramatic cost declines are being experienced and are forecast to continue for energy storage technologies, which can play a critical role in reducing the costs of integrating additional amounts of renewable energy.[27]

To ensure that the annual rate increases from pursuing this target are manageable and assuming that CMLP pursues this goal by increasing its proportion of renewables at a consistent rate, the Task Force notes that the Light Board could employ a 2% annual maximum rate increase threshold for the rate impacts directly attributable to the REC or renewable energy procurement decisions.[28] With these annual rate increase threshold applied after Concord achieved the same renewable levels as required of the Massachusetts investor-owned utilities. CMLP could consider any rate increases less than 2% in prior years when applying the 2% threshold. For example, if the rate increase attributable to renewables commitment in 2020 was only 1.5% that would be considered when assessing the rate increase limit for 2021 such that the .5% below the 2% cap in 2020 could be carried forward so that up to a 2.5% increase would be allowed in 2021.

One risk to such a procurement strategy would be the loss of large customers to other communities with lower power supply costs and the potential for shifting of the fixed costs paid by the lost customers to the remaining CMLP customers. The cost impact that we have estimated doesn't consider the likely increases in costs in other communities as they comply with state clean energy (non-GHG emitting generation) mandates or pursue their own clean energy procurement strategies. [29] For example, the Massachusetts Clean Energy Standard is

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[25] This 1% growth in requirements is high if CMLP aggressively pursues energy efficiency measures as the Task Force has recommended. Furthermore, this analysis doesn't account for the fact that Massachusetts has aggressive targets for the procurement of non-emitting resources that could reduce the incremental amount of clean energy that CMLP would need to procure to achieve this target.

[27] One major energy storage developer recently indicated that the costs of lithium-ion batteries have dropped 70% in the 18-month period ending in June 2016.

[28] A 2% per annum rate increase over thirteen years is equivalent to 29% when compounding is considered.

[29] This 1% growth in requirements is high if CMLP aggressively pursues energy efficiency measures as the Task Force has recommended. Furthermore, this analysis doesn't account for the fact that Massachusetts has aggressive targets for the procurement of non-emitting resources that could reduce the incremental amount of clean energy that CMLP would need to procure to achieve this target.

[29] One major energy storage developer recently indicated that the costs of lithium-ion batteries have dropped 70% in the 18-month period ending in June 2016.

scheduled to increase to 40% by 2030 and Massachusetts has called for the procurement of 9.45 TWh of clean energy generation by 2022 along with an additional 1,600 MW of off-shore wind. The net effect of these policies will be increased proportions of clean energy in other towns, with increases in electricity rates to achieve these targets. Therefore, the Task Force thinks that the risk of major customer losses is low.

Another issue that has been raised with respect to this goal is whether it is achievable, i.e., can CMLP procure 100% of its energy requirements from such clean energy sources? CMLP's energy requirements are a miniscule percentage (slightly more than 0.001%) of New England's total electricity requirements. This implies that early action by CMLP will not affect the broader New England electricity market and there might in fact be first mover advantages, with the ability to lock in attractive opportunities (e.g., a long-term supply agreement with a hydroelectric supplier) when there is less competition from other buyers. Experience indicates that achieving higher penetration levels of renewables is easier for larger, better interconnected, and more diverse electricity systems. Finally, with the purchase and retirement of Class I RECs an effective strategy for promoting the development of non-emitting Class I renewable resources, CMLP could achieve this goal by purchasing and retiring RECs. Alternatively, CMLP doesn't need to assemble a power supply portfolio that provides renewable energy in all hours of the year; it can use the purchase and retirement of RECs as a compliance strategy. The Appendix includes a memo demonstrating that this target can readily be achieved.

Pillar 3: Promote Increased Energy Efficiency

Energy efficiency can mean many things. The Task Force has defined energy efficiency broadly, encompassing the full range or measures, behaviors, and programs that reduce energy consumption. Electric utilities such as CMLP have had a role in the delivery of energy efficiency programs since the 1980s. With dramatic increases in the costs of fossil fuels in the 1970s and large capital investments that significantly increased rates to electricity customers, regulators and policy makers have sought to ensure that energy efficiency is considered alongside other traditional investments (i.e., the construction of large power plants) or procurement alternatives.

Energy efficiency is often the least cost "supply source", i.e., it can cost less to implement energy efficiency measures than more traditional power supplies. In fact, the design of energy efficiency programs is focused on ensuring that they are "cost-effective" or that the value of savings is greater than the costs of the program and the costs incurred by customers for the measures.

Energy efficiency has a critical role to play in assisting Concord in achieving its GHG emission reduction goals given that energy efficiency avoids CO_2 emissions from fossil fuels that otherwise would be burned. Fossil fuels are typically the "marginal resource" in terms of electricity supply, i.e., the highest cost supply source and the resource that would be displaced by energy efficiency. A recent study by an energy efficiency advocacy organization

indicated that through energy efficiency some states could meet over 25% of the GHG emission reduction goals in the U.S. EPA's Clean Power Plan.

Furthermore, among the lowest cost forms of energy efficiency can be the purchase of more efficient appliances (e.g., high efficiency air source heat pump). With many of these appliances and investments having long-useful lives, it is important to ensure that energy efficiency receives appropriate attention now to assist Concord in achieving its long-term GHG emission reductions goals at the lowest possible cost. Therefore, for Concord to achieve the GHG emission reduction goals, we are recommending that CMLP's energy efficiency programs be highly effective and promote the adoption of energy efficiency measures where cost-effective recognizing the social cost of carbon[30]

CMLP offers energy audits whereby customers can have their home evaluated for possible energy efficiency measures. This program is administered by Energy New England (ENE), whom CMLP funds and has an ownership interest. These ENE administered energy audits only cover electric end uses and in some instance oil heat. Customers must contact the Mass Save program administrators to have an energy audit that is focused on natural gas end-uses. Requiring a second call is a barrier to the delivery of energy efficiency. To ensure that customers take advantage of these programs they should be simple to participate in, e.g., require one phone call for all possible energy efficiency measures to be considered. Customers are likely to focus on the fuels that represent the biggest cost. For CMLP customers with natural gas heat, this is likely to be natural gas and result in the customer calling the Mass Save program for an energy audit. The Mass Save audits for Concord residents don't address electricity end-uses (e.g., lighting, refrigeration, air conditioning, etc.). Requiring a second audit reduces the likelihood that customers will take advantage of these services and realize the energy efficiency savings offered. While this could be viewed as a "cost" of being served by a Municipal Light Plant, with many offsetting benefits, the Task Force recommends that this barrier to the development of Concord's cost-effective energy efficiency potential should be addressed. Interestingly, Wellesley Municipal Light Plant partnered with National Grid, the local natural gas supplier and an investor-owned utility, to offer no-cost energy audits to 400 customers.

Therefore, the Task Force recommends that CMLP consider alternatives to reduce barriers to the adoption of energy efficiency measures such as having separate energy audits from Massachusetts investor-owned utilities.

Massachusetts investor-owned utility[31] energy efficiency programs are administered jointly and cover all end uses. These programs are funded through: (1) a .25 cent/kWh System Benefits Charge (SBC); (2) revenues from the Regional Greenhouse Gas Initiative ((RGGI) a

[30] The social cost of carbon has been estimated by the US Environmental Protection Agency to be $39/ton

[31] Massachusetts investor-owned utilities include Eversource Energy (formerly known as NStar) and National Grid. These two utilities are owned by private investors and have shares that are publicly traded.

CO_2 cap and trade program for the electricity sector);[32] and (3) other possible revenues including an energy efficiency surcharge where necessary. In 2016, the total statewide program funding from electricity customers was about $692 million, with about 17% from the SBC, 8% from RGGI, 8% from other sources and 67% from additional on-bill charges of about 1 cent/kWh. In contrast, CMLP's Energy Conservation Charge is about .52% of the total current charges billed excluding the finance charge and sales tax. This compares to 1.5% for the Underground Surcharge. CMLP raises about $120,000 through this charge; contributes another $30, 000 from power factor charges and provides an additional $150,000 for conservation purposes[33]. The $300,000 equates to about 0.18 cents/kWh, indicating that Massachusetts investor-owned utility (IOU) energy efficiency funding is about eight times the amount on per kWh basis spent by CMLP. The higher funding for these IOU programs has an appreciable impact on electricity rates. However, it is important to differentiate between electricity rates (cent/kWh) and the total electricity bill ($). If the energy efficiency measures are cost-effective, over time customers will have higher electricity rates, but pay lower total bills. This indicates that customers will likely be better off since they are paying less for electricity in total and presumably receiving the same or better service.

Energy efficiency programs offered by the Massachusetts IOUs are highly rated. These energy efficiency programs have for the last six years been ranked first among the 50 states by the American Council for Energy-Efficient Economy (ACEEE). ACEEE is a highly-regarded energy efficiency advocacy organization and its ranking for the state of Massachusetts is a testament to the quality of the energy efficiency programs offered.

The quality of these programs is evident in the depth of service offerings and their comprehensiveness. Reflecting the quality of these programs and the level of investment Massachusetts total electricity consumption is forecast to decline by -0.3% through 2025. CMLP's programs are developed by a well-qualified team, but one which doesn't have the same level of resources as the Massachusetts IOUs. Given the lower level of funding and the inability to realize the economies of scale available to the IOUs, the scope of programs available to Concord residents is more modest than available to those of customers of the IOUs. However, the Town does benefit from shared resources for the design of energy efficiency programs with CMLP. Specifically, the capability that these individuals provide to CMLP with respect to the design and evaluation of energy efficiency programs is also available to the Town and to support its energy efficiency programs.

Therefore, the Task Force recommends that CMLP consider a comprehensive set of cost-effective energy efficiency incentives and measures that meet or exceed those offered by Massachusetts investor-owned utilities. Recognizing that this investment will increase CMLP's rates, the Task Force suggests this will be an essential investment if the Town is to

[32] CMLP is only able to access RGGI Funding through grants. However, CMLP customers effectively fund RGGI. This is an inequity for municipal light plants in Massachusetts.

[33] February 2, 2017 email from Jim Terry, Concord Light Board.

achieve its GHG goals and to do so in a least cost manner. Furthermore, higher rates will be offset by lower overall electricity bills as customers use less electricity.

VI. Best Practices/Governance Opportunities

A. Other cities and towns

The Task Force's scan of "best practices" exhibited by other towns and cities identified many sources of information providing learning for Concord. Excerpts of these climate action plans developed by other cities and towns that may inform Concord's choices to plan for a low carbon future may be found in the Appendix. In general, these action plans were developed with robust community input developed over several months and emphasize the importance of education to raise public awareness to initiate behavior change.

B. Energy and other sectors

1. Energy Sector

Concord is one of 41 municipalities in the Commonwealth that owns its municipal electricity plant. The value of independent municipal (muni) electricity has been lower cost power to rate payers and improved service as well as fair distribution of costs. A white paper published by MAPC in July 2016 spotlighted clean energy initiatives within the "muni" communities and offered several "lessons learned" and recommendations for communities with municipal electric plants. The conclusion that the success of clean energy initiatives depends on community involvement and that communities with municipal electric plants have the potential to implement "pioneering strategies" in renewable energy and energy conservation is pertinent to Concord.
www.mapc.org/sites/default/files/**MAPC_MLPWhitePaper_Jul2016.pdf**

Because Concord has control of the power purchase portfolio at CMLP it is in a strong position to advance the reduction of greenhouse gas emissions from the electricity it sells to its rate payers. By advocating that users migrate away from fossil fuels to electricity and that CMLP reduce greenhouse gas emissions from its electricity power supply is the most effective and expedient means to decrease emissions within the community. It is this rationale that forms a key basis of the Task Force recommendations and why the Task Force focused largely on the energy sector.

To achieve this overarching goal implementation tactics will be required including:

1. Establish community-wide goals and expectations
2. Prioritize adapting buildings that use the most energy
3. Generate solar energy in town without "paving over paradise" – use already developed sites and rooftops
4. Identify and utilize opportunities for carbon sequestration.

2. Other Sectors

Adapting to a warming climate is important for Concord to anticipate and recover from events such as droughts, floods, tornadoes, fire. Increased resiliency to climate change throughout Concord and the region will require strategic attention to sectors beyond the energy sector.

Within Concord's Sustainability Principles are implied action items for land use, transportation, housing and buildings, economic development, open space and recreation, infrastructure, growth management, resource conservation, floodplain management, watershed planning and management, and education. The Task Force recommendation for an integrated systems approach to reducing greenhouse gas emissions will require a strategy for change within sectors beyond the energy sector. During the next year, we recommend that attention be given to developing integrated strategies for reducing greenhouse gas emissions from these other sectors and to engaging the public in determining opportunities for individual action.

- Built Environment including permitting for new construction and renovations for municipal, schools, hospital, airport, commercial, industrial, residential structures
- Water Management including infrastructure
- Waste Management including transportation and reducing pollution
- Habitat including biodiversity and carbon sequestration
- Mobility including public transportation and alternative fuels and improved air quality
- Land Use Planning including Zoning, Smart Growth, Safe Streets and access to Affordable Housing
- Safety, Health and Welfare including street lighting, walkable streets
- Local Food sources including sustainable agriculture
- Municipal procurement
- Community Engagement including Education and Resources for residents
- Funding including grants and independent funding sources

ADD commentary regarding net zero, zoning, and building codes.

C. Legislation and regulation

The Task Force catalogued government documents with implications for success in reduction greenhouse gas emissions. These are documented in the Appendix. Additionally, the Massachusetts Building Code and supplemental regulations are enforced in Concord. Legislation and Regulations enacted in the Commonwealth have direct implications for emissions. Following is a partial list of legislation and regulation that has had positive implications for greenhouse gas emissions in Massachusetts.

- MA Brownfields Act 1998 – created financial and liability incentives for cleanup and redevelopment of contaminated property
- MA Green Communities Act 2008 – created funding opportunities for communities complying with energy use reduction
- MA Stretch Energy Code 2009 – designed to improve energy efficiency by 20 percent over the base energy code
- MA Global Warming Solutions Act 2008

Looking ahead to the 2017-2018 legislative session, possible Legislative Advocacy Efforts may include:

- Revenue Neutral Carbon Tax sponsored by Senator Michael Barrett
- An Act promoting Zero Net Energy buildings sponsored by Senator James Eldridge
- An Act providing for Comprehensive Adaptation Management Plan in response to climate change sponsored by Senator Mark Pacheco
- An Act fueling job creation through energy efficiency sponsored by Senator Brian Joyce
- An Act promoting the use of total energy impact analysis sponsored by Senator James Eldridge
- An Act directing the state to set targets for renewable growth in all sectors of the economy, with the goal of deriving all energy from renewable sources by 2050 sponsored by Representative Sean Garbally.

VII. What We Heard from the Public

The importance of public input to the work of the Task Force cannot be overstated. Any effort to make large gains on carbon reduction is dependent upon willing public commitments. From the outset, the Task Force invited participation from people attending regular Task Force meetings and the three public meetings, through email, and participation in the on-line citizen survey. Response was strong with several dedicated attendees at regular meetings, between forty and sixty people at each community meeting and 129 respondents to the on-line survey. In addition to the above, the committee conducted five individual interviews with people of specific interest to the committee's work: Chris Whelan, Town Manager & Kate Hodges, Assistant Town Manager; Eric Stastny, VP of Operations at Emerson Hospital; John Flaherty, Deputy Superintendent of Concord Public & Concord-Carlisle Regional Schools; Brad Hubbard-Nelson, CSEC Board Chair; and Jane Obbagy, Concord Chamber of Commerce.

The notes from the public meetings and the results of the survey are included in the Appendix.

A. At public meetings

The public meetings provided the Task Force the opportunity to engage in two-way conversation with stakeholders. Several themes flowed through the meetings as well as specific carbon emission mitigation recommendations.

The first public meeting was held at the Harvey Wheeler Community Center on June 22nd, 2016. After offering some insight into the Task Force plans and initial thinking, groups were formed to have brainstorming sessions. An overarching sentiment to "Be Bold" in recommendations for attacking GHG emission reduction was emblematic of the discussions. The notes from the group discussions are included in the appendix. Here are a few of the big themes recorded from the meeting:

- Focus on emission of all GHG not just carbon
- Utilize the opportunity to have direct control of electricity source via CMLP
- Address all sectors not just municipal aspects of Concord
- Identify goals that move toward a "net-zero" energy paradigm
- Move toward more low emitting electricity use – less fossil fuel use (i.e. electric vehicles, home heat pumps, electric yard equipment)
- Incentivize transitions to clean energy production and use
- Ensure citizen ability to produce energy through solar
- Have area of Town Operations specified to focus on these efforts

The Task Force's second public meeting was held October 20, 2016 at Harvey Wheeler Community Center. The Task Force presented nine "Draft Recommendations" at the outset of the meeting:

1. Align Concord's Energy Future with the goals of the MA Global Warming Solutions Act of 2008 and with the Paris Climate Agreement of 2016.

2. Sustain CMLP.

3. CMLP should work to offer a comprehensive set of cost-effective energy efficiency measures comparable to those being offered by MA investor-owned utilities.

4. CMLP should consider alternatives to reduce barriers to adoption of energy efficiency measures including having separate energy audits from MA investor-owned utilities.

5. CMLP should retire Renewable Energy Credits (RECs) from renewable energy purchases or purchase RECs to allow it to achieve MA Renewable Portfolio Standards (RPS) goals that apply to investor-owned utilities.

6. By 2030, 100% of CMLP's electricity supply should be from non-emitting resources with REC's or certificates for associated environmental attributes retired.

7. Identify and pursue opportunities for similar reductions in greenhouse gas emissions in other sectors of the economy.

8. Empower residents and businesses to be energy-wise.

9. Employ a Director of Energy to be accountable to the Town Manager for establishing policy and measuring progress toward meeting these goals and tracking and assessing new energy technologies and funding opportunities.

There was a consensus that the "Draft Recommendations" were in tune with where the audience wanted to take things, as far as they went. Several comments had to do with expanding the effort to include aspects of Concord's emissions profile that were outside the scope or effect of CMLP and town operations. A consideration of the built environment—housing, business buildings, conservation efforts within the built environment, preservation of open space and more public transportation—were all common themes. Most of the thoughts from the first meeting were existent in the discussion as well. Some of the newer ideas recorded include:

- Consistent interest in the Director of Energy/Sustainability/Emissions
- Varying ideas of how to reach 100% clean energy for CMLP's power supply
- Concerns about cost of various recommendations
- Consideration for opportunities to work with other towns and districts to expand the positive effects
- "Citizens have to be willing to change behaviors and step up – we are responsible for our own behavior and what we do makes a difference"
- A very small percentage of townspeople have participated in this effort to date. We need buy in from most citizens to have truly impactful results.
- Strong interest in requiring stronger energy efficiency building codes
- Build out every bit of renewable energy generation capacity possible without damaging our environment
- Educate citizenry on what can and needs to be done
- "I feel like one thing I want to see is a philosophical direction to the next group. I'm not saying you must disrupt things for the sake of being disruptive. Let's manage how the disruption works. One day it's going to get really disruptive. I understand the dilemma. I want something here that says we might have to break some things; that how we interact as citizens might have to change."

B. In the on-line survey

The Task Force created an on-line Citizen Survey. The survey included nine scale, six multiple choice, and two open response questions. The Task Force goal was to allow a larger number of people the opportunity to weigh in on some of the work being done. The survey received 129 responses. The two open response questions received 53 responses on one and 37 on the other. The full survey result data is in the appendix.

The aggregate data is shown in the table below;

QUESTION	**AVG RESPONSE (scale 1-5, 5= most agree)**
1. Align Concord's energy future with the goals of the Massachusetts Global Warming Solutions Act of 2008 and with the Paris Climate Agreement of 2016: 25% reduction in GHG emissions by 2020 and 80% reduction by 2050.	4.33
2. Sustain Concord Municipal Light Plant (CMLP) into the future.	4.46
3. CMLP should work to offer a comprehensive set of cost-effective energy efficiency measures comparable to those being offered by MA investor-owned utilities.	4.25
4. CMLP should consider alternatives to reduce barriers to adoption of energy efficiency measures including having separate energy audits from MA investor-owned utilities.	3.61

5. CMLP should retire Renewable Energy Certificates (REC) from renewable energy purchase REC's to allow it to achieve MA Renewable Portfolio Standards (RPS) goals that apply to investor-owned utilities.	3.05
6. By 2030, 100% of CMLP's electricity supply should be from non-emitting resources with REC's or certificates for associated environmental attributes retired.	3.80
7. Identify and pursue opportunities for similar reductions in Green House Gases (GHG) emissions in other sectors of the economy.	4.30
8. Empower residents and businesses to be energy-wise.	4.68
9. Employ a Director of Energy to be accountable to the Town Manager for establishing policy and measuring progress toward meeting these goals and tracking and assessing new energy technologies and funding opportunities.	3.61

The clear majority of respondents track or review their energy usage. Natural gas and home heating oil are the most prevalent means for heating homes. The average number of drivers in each household is 2.11. 19% of respondents' primary vehicle is full electric, plugin or standard hybrid. 50-60% of primary or second vehicles achieve 20-30 mpg. If CMLP offered time of use discounts respondents said 49% definitely, and 49% maybe, would change their usage patterns. As for whether people would pay more for electricity and by how much, the numbers are:

- 11% would pay 50% or more
- 14% would pay 25% more
- 27% would pay 15% more
- 28% would pay 5% more
- 19% would pay no more

All the open responses are listed in the appendix. In large part, they were similar to the comments made in the public meetings.

C. Through emails

Most emails the Task Force received were from people who also attended meetings and the public meetings. The comments were helpful in providing thoughtful, documented commentary on the Task Force's proceedings and the results of those proceedings. Emails are in the appendix, and included here are some sample comments:

- The Task Force could consider organizing the work into the following categories:
  - Energy Supply and Alternatives (This includes the Light Plant Business Model, green energy generation on and offsite, etc.)
  - Regulation and Policy (This includes measures like a Building Energy Use and Disclosure Bylaw, building codes, zoning, requirements for efficiency upgrades at the time of sale, requirements for making new construction solar-ready, etc.)
  - Financing and Incentives
  - Community Engagement, Education and Behavioral Change

- Pain motivates us to change—but we won't feel it until it's too late. So, your work—our work—our efforts need to be very clearly on behalf of those people who will directly experience the pain in its full force. We are the last of those who will get off so easily. Yes, we are afraid about the future, but our lives are still easy for the most part.
- Energy covers a very broad spectrum, and as mentioned by numerous previous commenters last night, includes many other sectors in addition to electricity, such as transportation, most home heating, water, agriculture, construction and more. My suggestion is to divide and conquer. Task forces are needed in each of these sectors to reduce carbon emissions and will require sector specific focus and expertise to find solutions.
- A focus on electricity makes sense for two reasons: electricity is the biggest source of carbon in Concord and green electricity is going to be the best way to deal with the other two large sectors - heating and transportation. A related point is that any progress we make with electricity is both measurable and immediately reduces CO2 emissions.
- At a high level, our group urges a focus for the Town's effort on CO2 emissions from electricity, natural gas, diesel fuel, and natural gas and we see electricity as the gateway to greener transportation and heating. We need to do two fundamental things: replace fossil electricity with green electricity and transition fossil devices to greener devices: EVs, heat pumps, LEDs, etc. This is a daunting effort and focus through measurable objectives is going to be critical. This seems to be consistent with the Recommendations of the Committee but there's always the temptation to add other areas which could make it more difficult to succeed with the overall mission.
- The goals that the Select Board will need to approve include both Town-wide emissions reductions (Paris agreement and GWSA) and 100% decarbonization of the CMLP by 2030. While the Town-wide emissions reduction goals are challenging, we are most concerned about the CMLP decarbonization goal. Examples of some of the challenges:
    - Purchase of RECs to take credit for green attributes of existing and planned solar installations in Concord
    - Purchase RECs to cover electricity purchases from fossil sources
    - Rapid expansion of solar in Concord on both public and private property (beyond Landfill, Grace, and planned public rooftops)
    - Investment in wind power and other renewable sources in New England along with long-term power contracts and retirement of RECs
    - Competitive policies and incentives to grow supply of renewables and to encourage efficiency/reduced use ('meet or exceed IOU's')
- These things are difficult and need to be moved on quickly and the CMLP may feel they don't have the support of the Town to proceed. And, these items are critical as the best strategy for Concord is to lead from the electricity segment. On the other hand, if the Select Board and the Town Manager feel it is possible to proceed aggressively without an explicit Town vote on the goals, that would certainly be the best route to follow.
- There are at least two critical dependencies. First, because this is a process that will be transformative in Concord, it is inconceivable that this function could be successful without the active participation and support of Concordians. The only way to ensue this

is through a GHG Committee which meets monthly, holds hearings, listens to input, and advises the Director and Town Manager. Second, there have been comments at multiple meetings about conflict between this function and various Town departments. Because this is a function that does not fit under any one department, it needs to stand alone, under the Town Manager, and we need to count on the Town Manager, acting as the Town CEO, to resolve any differences that may arise.

- First, we would recommend a bolder and more forceful statement of the overall committee recommendation to frame your discussion. It's safe to say at this point (a) that Concord needs to reduce its GHG emissions by 80% by 2050, (b) that Concord will need to transform itself to a clean energy economy to achieve this result, and (c) that this transformation bel electricity-led. There is no other way to achieve desired mitigation outcome. There are other contributors to this outcome, e.g. carbon sinks, but clean energy via an electricity-led transformation is the prime mover.

D. At Task Force meetings

The Task Force had a steady group of attendees who engaged often on topics under consideration. Comments are in the minutes. Some samples follow:

- Carbon price should be considered by the light plant. Carbon price is also known as shadow price or social cost of carbon. Decisions could include carbon price.
- The important thing about Renewable Energy Credits and offsets is that it means we can have goals that are either 100% renewable or 100% clean energy with 0% greenhouse gas emissions.
- There is value in targeting 80% reduction by 2030 (rather than more) because things will be discovered that we don't know now that may make the puzzle easier to finish.
- The idea of 100% reduction could begin with new buildings or municipal buildings that undergo a certain extent of renovation.
- The Task Force should look at GWSA as a minimum and Paris as the goal.
- Straight lines to achieving reduction goals is ill advised. Climate change has tipping points and waiting could mean reaching those tipping points sooner which is why it is important to act as early as possible.
- Need to create a means to track progress toward the goal in addition to having a dedicated staff member for this effort. Concord spends $60M annually on fuel; $25M on electricity, a staff member is approximately .01% of that.
- The Director of Energy must not become the "scapegoat in chief". The Select Board needs to hold the Town Manager accountable to implement these goals.
- Respect for future generations should be your call to action.
- Consultant may be needed to work with "EFTF2" to define strategy to meet 80% reduction number; to prioritize what pieces to work on and how to fund.
- The Task Force should identify core elements for meeting the goal to decrease greenhouse gas emissions and should employ systems thinking to make sure the town is doing everything possible to reduce carbon in this system.

- Funding report should cite the social cost of carbon for justifying investments in the program
- CMLP cannot argue that goals are not feasible. Load does not have to be matched hour by hour – miscommunication perhaps.
- Load growth is an opportunity for CMLP
- Avoid or minimize investment in
- more carbon emitting structure/vehicles etc.

VIII. Personal Choice and Responsibility

It is important to note that many other communities, in Massachusetts and across the country, as well as internationally, are already far ahead of Concord in finding a path to GHG reduction. It is the hope of the Task Force that soon Concord will join these communities and even become a leader among them.

Accepting the goals and recommendations in this report will be a starting point to acknowledge the intergenerational responsibility we each have to support and perpetuate the opportunity for health and prosperity for future generations as well as this current generation. These goals signal a responsibility for everyone in Concord to consider the long-term implications of our choices and to move toward reducing emissions that have a deleterious effect on the earth's climate.

Other towns and municipalities have included education components in their Climate Action Plans and the Task Force recommends that the charge to the Director and consultant include developing a methodology for community education and engagement to help citizens achieve reductions in their carbon footprints. Tools for education may include accessible, reliable information, and incentives to help citizens shift their decision making to include consideration of GHG emission levels, as well as easy access to information detailing the extensive options available to make choices for purchases and lifestyles based on reduced GHG emission levels. Starting with decreasing direct emissions that occur in our town from our choices will begin the behavior change that ultimately will transform our environment.

IX. Recommended Framework Going Forward

A. Goals

The Task Force recommends that the Town focus on achieving:
a 25% reduction in greenhouse gases by 2020 and
an 80% reduction in greenhouse gases by 2050.
These are town-wide goals applicable to all sectors. The baseline is 2008.

The Task Force's recommended goals align Concord's Energy Future with the goals of the *MA* Global Warming Solutions Act of 2008; and they are informed by the Paris Climate Agreement of 2015.

1. The Global Warming Solutions Act

As described by the Massachusetts Executive Office of Energy and Environmental Affairs, "the Global Warming Solutions Act (GWSA), signed in August of 2008, created a framework for reducing heat-trapping emissions to levels that scientists believe give us a decent chance of avoiding the worst effects of global warming. It requires reductions from all sectors of the economy to reach a target of a 25% reduction of Greenhouse Gas (GHG) emissions by 2020 and an 80% reduction by 2050."
http://www.mass.gov/eea/air-water-climate-change/climate-change/massachusetts-global-warming-solutions-act/

2. The Paris Agreement

The 2015 Paris Agreement does not prescribe specific quantitative GHG reduction goals. Rather, it speaks broadly for the global community in "recognizing…the urgent threat of climate change." (Preamble). And it calls upon developed countries to "take the lead by undertaking economy-wide absolute emissions reduction targets." (Article 4, 2).
The Agreement "aims to strengthen the global response to the threat of climate change by: (a) Holding the increase in average global temperature to well below 2^0 C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5^0C above pre-industrial levels…"(Article 2, 1).

The Agreement recognizes several important principles that inform all the recommendations of this report, especially the following directly quoted from the preamble:

a) "The principle of equity and common but differentiated responsibilities and respective capabilities, in the light of different national circumstances";
b) "the importance of education, training, public awareness, public participation, and public access to information and cooperation;"
c) "the importance of engagement at all levels of government;"

d) the recognition that "sustainable lifestyles and sustainable patterns of consumption and production, with developed countries taking the lead, play an important role in addressing climate change;"
e) respect for, promotion of, and obligations on "intergenerational equity."

By invoking the Paris Agreement, the Task Force is embracing a solemn responsibility that the Task Force does not take lightly, especially the responsibility of leadership by high-consuming industrialized populations, and the responsibility of intergenerational equity.

B. Where responsibility should reside

To meet the goals, Concord also needs governmental leadership. Concord's municipal governance, with leadership from the Select Board and Town Manager, derives from several town departments, volunteer committees, and individual entities. Some of them have complicated governance structures, such as the Concord Library's mixed public/private structure or the Concord-Carlisle Regional High School, governed by two jurisdictions. All of them are loosely connected often operating independently. The recommended goals can be accomplished only with a systemic, unified approach. In order to achieve this, the Task Force recommends that the Town expeditiously hire a Director of Energy [or other title] to guide the Town in designing and implementing a sustainable energy future consistent with the recommendations in this Report. See Appendix for Position Description core elements. The Director would have overarching authority, under the direction of the Town Manager, to establish an emissions baseline, measure progress, set policy, educate the public and Town officials, and implement and coordinate actions required to meet the goals. In instances where line authority does not exist (such as authority over the Concord-Carlisle Regional School District) the Director would be a key liaison and advocate for emissions reduction strategies that could be advanced by such an entity.

Because GHG reduction is such a complex endeavor, and because action is urgent, the Task Force also recommends that a consultant be hired expeditiously to assist the Director of Energy.

Because the issues requiring attention raise novel and important questions of public policy, the Task Force further recommends that the Select Board expeditiously appoint a new advisory group to assist the Town Manager, the Energy Director, and the consultant as the Town sets out to achieve its GHG reduction goals.

Other actions recommended to create a framework to enable systemic progress include:

a) Issuing expeditiously a policy statement from the Select Board and Town Manager that firmly establishes these recommended greenhouse gas reduction goals as responsibilities of the Town Manager and that states that decreasing emissions shall be

considered and advanced in all deliberations and decisions of all Town departments and committees; and

b) Stating the goals and providing annual updates on the Town's progress in meeting them at all future Town Meetings; and educating Concord's citizens about the goals so that they may take individual actions to help Concord achieve them.

Of course, the ultimate responsibility for achieving the Town-wide goals recommended by the Task Force rests with the citizens of Concord.

C. Baseline data and measurement tools [section to be added]

Appendices [incomplete]

Appendix I: Energy Future Task Force Charge

Energy Future Task Force

Established by the Concord Select Board (appointed by the Town Manager with the approval of the Select Board in February, 2016)

Background:

The historic global commitment to climate and energy solutions emanating from the 2015 Paris COP21 summit calls on nations and communities to develop plans for a low-carbon energy future and a 2^0 World. The Town of Concord should set goals and targets for the community that
will guide future energy supply and energy use planning and ensure that these goals are incorporated into the 2016-17 Comprehensive Long Range Plan. In so doing, Concord will benefit from active partnership with CMLP in identifying opportunities to meet the changing marketplace and the global demand for a reduced carbon economy. CMLP will continue to play a central role in Concord's ability and commitment to achieve its future energy goals.

The Task Force's charge is to create the framework for the development of an energy and sustainability plan for Concord, to identify short and long-term energy goals, and to identify the means for effective controls and measurement of stated goals. The framework will be the basis of a multi-year, stakeholder engagement process to develop a long-range plan for a low-carbon future.

Purpose:

The competitive energy landscape is rapidly changing with widespread consumer-driven interest
and adoption of distributed generation. The Task Force will identify current energy and sustainability planning activities in Concord, review planning efforts already undertaken by communities in Massachusetts and elsewhere, and make recommendations for how Concord could proceed to develop an energy plan. The Task Force will advise the Town Manager and Select Board on organizational efficiencies among town departments and committees and make recommendations for where the energy plan will reside within Concord's organizational structure to assure long term accountability of it goals and effective implementation of the plan.

The task force shall make its recommendations, with rationale, to the Select Board within six months after the committee is fully established.

In carrying out its charge, the Task Force should address several strategic questions:

- What should be Concord's short and long-term energy goals and principles? Consideration should be given to core principles of reliability, equity, environmental stewardship, cost, and service.
- How should energy and its use be incorporated into the Comprehensive Long Range Plan with the knowledge that an energy plan may have a longer time horizon than the CLRP?
- How can and/or should the mission of CMLP evolve to address new market competition, emerging opportunities and new business models for operations?
- How do we ensure that efficiency and conservation continue to be priorities?
- What local governance structures need to be amended to support an energy transition plan?

Responsibilities and Duties:

1. Identify and review current enabling legislation or acts, charge and mission of departments and committees in Concord involved with energy and sustainability planning for Concord;
2. Identify and inventory Concord's current energy uses and develop a baseline for future initiatives.
3. Meet with all town departments to look for areas of mission overlap, synergies, and capacity for overseeing implementation of a long-range energy plan for Concord;
4. Host a public meeting or forum early in the process to solicit public input on matters concerning Concord's energy future;
5. Review and evaluate investor-owned and municipal utilities' development of an energy service model and non-wires alternatives, CSEC plans and contributions, Green Communities goals, national carbon and Net-Zero planning efforts, and other plans to make recommendations to the Select Board and Town Manager for future energy goals that Concord should seek to achieve;
6. Make recommendations to the Town Manager and Select Board as to where, within the structure of Town government, an energy future plan would reside to ensure accountability and effective implementation;
7. Prepare a draft report of recommendations, with rationale, including the Task Force's findings; and, hold a public hearing to review the report before it is finalized and submitted to the Select Board;

Task Force Membership:

1. Member recommended by the Light Plant and Light Plant Board
2. Member recommended by the Department of Planning and Land Management
3. Member recommended by School Committee and School Administration
4. Two members at-large with expertise in energy and utility matters, and local government.
5. As the Task Force carries out its charge, if it believes additional expertise is necessary, the Select Board may modify its membership.

Task Force Term of Office:

The members of the Task Force shall be appointed by the Town Manager, subject to approval of the Select Board. It is expected that the work of the task force be complete within 6 months of the time that it is fully seated.

Other Considerations:

The Task Force shall conduct its business in full conformance with the Open Meeting Law, Public Records Law, Conflict of Interest Law and other state and local rules encouraging openness and transparency in governance. The membership shall elect its own chair. *The Task Force chair shall consult with the Town Manager to discuss the need for staff or financial support for the Task Force's activities.*

Appendix II: Concord Sustainability Principles

On July 25, 2011, the Concord Board of Selectmen voted to adopt the following four sustainability principles (based on the American Planning Association's 4 Sustainability Objectives):

1. Reduce dependence upon fossil fuels, underground metals, and minerals;

2. Reduce dependence upon synthetic chemicals and other manufactured substances;

3. Reduce encroachment upon nature; and

4. Meet human needs fairly and efficiently, and ask the Town Manager and Department Heads to report on methods and successes in implementing sustainable principles and balancing reductions in order to meet human needs fairly and efficiently.

Appendix III: What are RECs

Electricity produced by new renewable energy generators qualified for the RPS program is broken into two products:

1) The electricity production that is used on-site or delivered to the grid

2) The positive environmental attributes associated with this clean energy production.

RECs represent the second product. One REC is created each time a qualified system generates 1 megawatt hour (MWh) of electricity. In order for Suppliers to meet their compliance obligations as set by the RPS, they must purchase a number of RECs equal to the percentage for that particular compliance year. For example, in 2010 all Suppliers are required to purchase an

amount of RECs equal to 5% of the total load they serve in Massachusetts in order to comply with the RPS Class I requirement.

RECs are created on the New England Power Pool Generation Information System (NEPOOL GIS). However, before a REC can be created on NEPOOL GIS, a generator must first apply to DOER and receive a Statement of Qualification to sell RECs.

In order to determine the prices for RECs, DOER sets an Alternative Compliance Payment (ACP) Rate. This rate serves as a ceiling price and exists as a penalty payment that Suppliers must pay if they do not meet their RPS compliance obligation in a given year. Essentially, for every MWh they are short of meeting their obligation, they must provide an alternative payment to the DOER. Thus, the incentive is for RES to purchase RECs from qualified projects for something less than the ACP in order to meet their compliance obligation and avoid ACP payments.

For more information visit;

http://www.mass.gov/eea/energy-utilities-clean tech/renewable-energy/rps-aps/rps-and-aps-program-summaries.html

Appendix IV: Paris Agreement

Paris Agreement: essential elements

The Paris Agreement builds upon the Convention and – for the first time – brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort.

The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. Additionally, the agreement aims to strengthen the ability of countries to deal with the impacts of climate change. To reach these ambitious goals, appropriate financial flows, a new technology framework and an enhanced capacity building framework will be put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives. The Agreement also provides for enhanced transparency of action and support through a more robust transparency framework. Further information on key aspects of the Agreement can be found here.

Nationally determined contributions

The Paris Agreement requires all Parties to put forward their best efforts through "nationally determined contributions" (NDCs) and to strengthen these efforts in the years ahead. This includes requirements that all Parties report regularly on their emissions and on their implementation efforts.

Further information on NDCs can be found here.
In 2018, Parties will take stock of the collective efforts in relation to progress towards the goal set in the Paris Agreement and to inform the preparation of NDCs.

There will also be a global stocktake every 5 years to assess the collective progress towards achieving the purpose of the Agreement and to inform further individual actions by Parties.

For more information visit;
http://unfccc.int/paris_agreement/items/9485.php

Appendix V: Global Warming Solutions Act Background

In August 2008, the Global Warming Solutions Act (GWSA) was signed into law, making Massachusetts one of the first states in the nation to move forward with a comprehensive regulatory program to address Climate Change.

The GWSA required the Executive Office of Energy and Environmental Affairs (EOEEA), in consultation with other state agencies and the public, to set economy-wide greenhouse gas (GHG) emission reduction goals for Massachusetts that will achieve reductions of:

- Between 10 percent and 25 percent below statewide 1990 GHG emission levels by 2020.
- 80 percent below statewide 1990 GHG emission levels by 2050.

To ensure that these goals will be met, the Global Warming Solutions Act required the Commonwealth to:

- Establish regulations requiring reporting of greenhouse gas emissions by the Commonwealth's largest sources by January 1, 2009. These reports will provide important data about the actual types and levels of GHG emissions in the Commonwealth.
- Establish a baseline assessment of statewide GHG emissions in 1990, which will be used to measure progress toward meeting the emission reduction goals of the Act. The Legislature chose 1990 as the base year for these measurements because it is the base year used by many local, state and international climate agreements (including the Kyoto Protocol).
- Develop a projection of the likely statewide GHG emissions for 2020 under a "business as usual" scenario that assumes that no targeted efforts to reduce emissions are implemented. This projection estimates the levels of greenhouse gas emissions that will come from Massachusetts sources if no government action is implemented to require reductions, and will be used to analyze the extent of emission reductions that will be required to achieve the 2020 target established in the Act.
- Establish target emission reductions that must be achieved by 2020, and a plan for achieving them. The GWSA requires that these must be established by January 1, 2011.
- Through an advisory committee, analyze strategies and make recommendations for adapting to climate change. The GWSA requires that the committee reports to the Legislature by December 31, 2009.

EOEEA established two advisory committees to provide input on the implementation of the GWSA:

- The Climate Protection and Green Economy Advisory Committee to advise the Executive Office of Energy and Environmental Affairs on measures to reduce greenhouse gas emissions in accordance with the GWSA.
- The Climate Change Adaptation Advisory Committee to study and make recommendations on strategies for adapting to climate change.

Also in August 2008, the Green Communities Act (GCA) was signed, a comprehensive reform of the Massachusetts energy marketplace that will greatly improve the state's ability to meet the GWSA targets. The GCA promotes a dramatic expansion in energy efficiency, supports the development of renewable energy resources, creates a new greener state building code, removes barriers to renewable energy installations, stimulates technology innovation, and helps consumers reduce electric bills. It also created the Green Communities Program, providing Massachusetts cities and towns with energy efficiency and renewable energy opportunities.

For more information visit;
http://www.mass.gov/eea/air-water-climate-change/climate-change/massachusetts-global-warming-solutions-act/global-warming-solutions-act-background.html

Appendix VI: Your monthly CMLP bill explained

The **Meter Charge** – This includes the costs to monitor the electrical system, read the meters, billing and customer service. The Light Plant has a modern operations center to facilitate this task. The Meter Charge is a fixed amount charged per month designed to cover a portion of the Light Plant's operating costs. Currently this charge primarily covers the cost of monthly billing. More recently CMLP and the Light Board have discussed increasing the fixed charge to cover a higher proportion of the fixed cost of operations and decouple the reliance on sales. The Director has reservations about the impact to rate payers who are on fixed income or limited means who typically consume less electricity and would see their rates increase.

Purchased power expenses are comprised of two components: energy and capacity. Energy represents the consumption over time (measured in MWh or kWh) while capacity measures the maximum amount of electricity delivered at any one moment (measured in MW or kW). CMLP must purchase both. Capacity and Transmission Charges are the costs to get the energy from the generating source to the substation in Concord as well as the cost to ensure Concord has access to sufficient power supplies (Capacity) to meet our needs on the warmest day in the summer, known as peak demand.

The **Energy Charge** – Since the Light Plant does not own generating capability, it purchases power from suppliers. The Energy Charge is the cost to purchase the energy (MWh) and typically is based on fuel and variable operating costs and by regulation is designed to be revenue neutral, meaning the cost of purchasing the energy is what the customer is charged. The cost of purchased power makes up approximately 74% of the total Light Plant expenditures.

The **Tier I, II & III Capacity/ Transmission Charge** – In 2008 a decision was made by the Select Board, Town Manager and the Light Board to promote energy conservation by introducing a 3-tiered rate structure for Residential customers. The goal was to shift load away from peak demand periods and promote energy conservation by charging customers an increased rate based on 3 progressive thresholds usages (under 600, 600 to 916 and above 916 kilo Watt hours(kWh)).[34]

The **Distribution Charge** – to distribute electricity, the CMLP operates three substations along with distribution facilities. The power lines are maintained by CMLP line workers. The Distribution Charge is the cost to get the energy from the substations in Concord to individual homes, buildings and devices. This includes the costs to connect and maintain our local grid and recover from power outages.

The **Net Metering Distribution Charge** (only applies to customers with a solar array) is a charge to net metered customers to compensate for the revenue lost from the energy they generate on site and the resulting reduction of energy consumed.

The **Rate Stabilization Fund** When energy costs fluctuate, CMLP accumulates the excess or recovers the shortfall of rates relative to energy costs in the Rate Stabilization Fund so these accumulated amounts can be refunded or recovered from customers in the future. This ensures rate payers pay the actual energy cost. The Rate Stabilization Fund is a fee levied to each customer based on total energy consumed and which is designed to help smooth out and avoid abrupt swings in rates during the year and as a result of seasonal variations in the energy markets. Power Cost Adjustments are used in a similar manner.

The **Underground Surcharge** is a 1.5% charge to cover the cost of undergrounding our local distribution grid. It was put in place by the direction of the Select Board and Town Manager after a successful vote at Town Meeting to ensure the reliability of the grid and enhance the overall town streetscape.

The **Energy Conservation Charge** is a .52% surcharge to cover the cost of energy conservation programs and rebates the Light Plant offers throughout the course of the

Appendix VII: Summary of CMLP Power Purchases

Last update:	2.22.17				
				166.01	
Vendor	**Source**	**GHG**	**% of total**	**MWh (thousands)**	**Term**
Solar Projects	Sun	NE	5%	8.30	Landfill 2033, Solect 2036, WR Grace 2037
Niagara Hydro	Water	NE	4%	6.64	past 2050
Brown Bear Hydro	Water	NE	3%	4.98	2021
Spruce Mountain Wind	Wind	NE	3%	4.98	2030
Grandby Landfill	Methane	?	3%	4.98	2017
Saddleback Wind	Wind	NE	3%	4.98	2033
New Bedford Landfill	Methane	?	2%	3.32	2018
Shell Energy	Natural Gas	E	24%	39.84	2021
Exelon	Natural Gas	E	19%	31.54	2019
RISE	Natural Gas	E	18%	29.88	2018
ISO Energy Purchases	Fossil fuels	E	16%	26.56	
Subtotal			100%	166.01	
Total from non-emitting sources			18%	29.88	
Total from renewable sources			23%	38.18	
Old Wardour	Solar				2040
Vuelta	Solar				2040

Appendix VIII: A Summary of CMLP recent accomplishments

In 2010 the Light Board authorized the Light Plant staff to draft a report on the renewable energy strategy. The purpose of this document was to present the Light Board's current understanding of renewable energy opportunities and considerations and to recommend a strategy for increasing renewable energy sources within Concord's energy supply.
The focus of the report was on power *supply* as opposed to *demand*.
As of 2010, CMLP's renewable energy portfolio was about 10%, including hydropower facilities.
In 2010, the current Massachusetts Renewable Portfolio Standard (RPS) was 5% and increased 1% per year to 15% in 2020.
The (CMLP) objective was to consistently meet or exceed the Massachusetts Renewable Portfolio Standard.

The Light Board recommends that CMLP commit to increase the renewable energy portion of its energy supply portfolio from 10% in 2010 to 20% by 2015 and 30% by 2020. Each 10% increase in renewable energy will reduce CO2 emissions by 15 million pounds (7,500 tons) annually.

Specific strategies to achieve the goal stated above included the following:

1. Implement in-town solar power generation at all levels
2. Take an active role in developing wind power sources
3. Work with Energy New England (ENE) to aggressively pursue other cost-effective renewable energy contracts
4. Monitor emerging technologies
5. Implement a formal Energy Conservation strategy
6. Develop a financial strategy
7. Monitor developments in plug-in electric vehicles.
8. Update the CMLP Power Supply Manual as appropriate

The total annual carbon dioxide emission from this portfolio is roughly 150 million pounds (75,000 tons) based on an emissions rate of .952 lbs CO2/kWh (the on-peak marginal emission rate for the Northeast electric grid) multiplied by the annual non-renewable kilowatt hours of CMLP's current power supply (156,000,000).
System limitation considerations Peak Demand:

CMLP Mission: CMLP's mission is to provide reliable electricity at a reasonable cost to its customers. According to a residential customer survey completed in 2008, CMLP's residential customers consider reliability, cost and environmental sensitivity to be equally important. An informal survey of selected commercial customers indicates a bias toward reliability and cost

but with concern for the environment. CMLP's challenge is to incorporate renewable energy sources into its portfolio at a cost that does not result in an unreasonable price to customers and at the same time provides enough revenue to fund CMLP operations.
The Light Board recommends that CMLP commit to increase the renewable energy portion of its energy supply portfolio from 10% in 2010 to 20% by 2015 and 30% by 2020. Each 10% increase in renewable energy will reduce CO2 emissions by 15 million pounds (7,500 tons) annually. It appears that this goal is achievable with the addition of 10 MW of solar energy and 7MW of wind energy over a 10-year period.

Renewable Energy Strategy

1. Move rapidly to implement in-town solar power generation at all levels: residential, municipal, commercial, institutional and utility-scale
2. Research and evaluate opportunities to develop modest scale wind power facilities in New England
3. Work through ENE to aggressively pursue other renewable energy contracts that make sense financially
4. Develop and implement a formal Energy Conservation strategy
5. Monitor emerging technologies and assess potential for use in Concord
6. Develop a financial strategy that supports energy conservation and renewable energy plans
7. Monitor developments in plug-in electric vehicles
8. Review contract policy implications and update the CMLP Power Supply Manual as appropriate.

Since that time CMLP has accomplished several of the recommendations including, but not limited to:

- Installed 7MW of solar through Power Purchase Agreements with third party vendors
- Facilitated another 2.5MW of roof top mounted solar through a Solar Challenge program
- (?) years of supporting various conservation measures through CARES program
- Created a net metering program
- Converted(?) % of electric service to under ground
- Created ETS program to help shift load to off peak times and reduce peak demand
- Created Time of Use rates to reduce peak demand
- Converted % of total power purchase to renewable
- Created commercial lighting program
- Converted to LED street lights

- Installed(?) # of Smart meters town wide
- Other?

IX: Feasibility of Achieving EFTF's Recommendation that 100% of Light Plant's Power Supply be Provided by Non-emitting Resources by 2030

One of the key recommendations in the EFTF report is that by 2030 100% of CMLP' electricity supply should be from non-emitting resources with RECs or certificates for associated environmental attributes retired. The EFTF has estimated the rate impact from this recommendation to be a 20 to 30% increase in electricity rates. The lower end of the range was calculated by the EFTF and the higher end of the range by Laura Scott. These rate impacts assume that Class I renewable energy certificates (RECs) are purchased for compliance and is based on a cost for these RECs of $35. Current market prices for RECs are $19 to 24. The cost of realizing this goal would be reduced with major cost reductions in the clean energy technologies that would provide this energy. As a point of reference, solar costs today are one-third of what they were six years ago and continued declines in solar costs are projected. In addition, many experts project wind costs to decline by over 20% by 2030.

We understand that there's concern with the feasibility of achieving this recommendation. The primary purpose of this memo is to address this concern. One possible concern is where would CMLP procure this amount of non-emitting generation? Concord's total electricity requirements could be provided by one 50 MW wind project. (The EFTF fully understands that it would be imprudent, in fact foolish, for CMLP to purchase its total electricity supply from one intermittent wind project. Reference is made to the size wind project to provide the volume of CMLP's required electricity purchases in context. Our recommendation has been deliberately drafted to avoid the issues associated with the challenges of assembling a power supply composed of all non-emitting resources by allowing for the procurement of RECs. Therefore, the question is what's the incremental requirement for the non-emitting generation that would allow Concord to achieve its target.) Alternatively, Concord's total electricity requirements are about one-sixth of the increase in Class I renewable resources mandated by all of the six New England states' renewable portfolio standards from 2017 to 2018. This clearly suggests that the Light Plant or Energy New England shouldn't have difficulty purchasing sufficient RECs or non-emitting generation to satisfy the EFTF's recommendation.

In addition, CMLP's energy requirements are a miniscule percentage (slightly more than 0.001%) of New England's total electricity requirements. This indicates that early action by CMLP (i.e., achieving the 2030 target) to eliminate GHG emissions from its power supply will not affect the broader New England electricity market. In fact, there might in fact be first mover advantages, with the ability to lock in attractive opportunities (e.g., a long-term supply agreement with a hydroelectric supplier) when there is less competition from other buyers. Experience indicates that achieving higher penetration levels of renewables is easier for larger, better interconnected, and more diverse electricity systems. This implies that CMLP as a small portion of the New England electricity market should be to source the non-emitting generation from this broader New England electricity market. We note that Hawaii also has a target of moving to 100% renewable electricity, but by 2040. As a relatively small island, it is

dramatically more difficult for Hawaii to pursue a 100% renewables target than Concord. First of all Hawaii doesn't have the benefit of geographic diversity (CMLP is able to draw from all of New England and interconnected markets for its renewable requirements) which makes it easier to integrate larger amounts of variable generation (solar and wind) given that some of this variability will be smoothed by the broader area as variations in wind speed and solar radiation are averaged out. Furthermore, with no electrical interconnections Hawaii is unable to balance swings in output by relying on trade with its neighbors. New England which is part of the broader Eastern Interconnect swings in output and demand are facilitated by its interconnections with New York, Quebec and New Brunswick.

Finally, with the purchase and retirement of Class I RECs an effective strategy for promoting the development of non-emitting Class I renewable resources, CMLP could achieve this goal by purchasing and retiring RECs. Alternatively, CMLP doesn't need to assemble a power supply portfolio that provides renewable energy in all hours of the year; it can use the purchase and retirement of RECs as a compliance strategy.

Appendix X: –
Summary of MLPs

Municipal light plant research

Last update: 1.19.17

Town	Belmont	Concord	Hingham	Mansfield	Shrewsbury	Sterling	Wellesley
# of customers	11,287	8,211	10,000	9,773	15,616	3,700	10,153
# of meters	?	?	?	?	?	?	?
% Residential/ % Commercial & Muni	90/10	84/16	72/28	81/19	79/21	70/30	88/12
Mission	To deliver safe, reliable electric power service to the community of Belmont by embracing new technology and providing superior customer service	To supply reliable and cost effective energy services, in a responsible and courteous manner, which meets the current and future needs of our customers	The Light Plant celebrates a century of service to the people of Hingham. We're proud of our utility's 100-year tradition of local control and local service, and are grateful for the opportunity to carry on that tradition.	To deliver reliable, affordable and safe public power to our ratepayers, while maintaining a tradition of dependable service town wide	Could not find one	To provide smooth, clean, reliable power at a reasonable price while staying abreast of society's technological advances for the benefit of its customers.	To establish a safe working environment for its employees and to provide, subject to applicable laws and regulations, reliable and efficient electric power at fair, reasonable and competitive rates to its ratepayers, and to provide benefits to its owner, the Town of Wellesley

# of outages/ duration	>15,000	>15,000	?	?	?	?	?
Total annual sales MWH	180,000	175,000	208,000	257,467	?	52,711	236,712
% of renewables	Goal 80% by 2050 presently 29% of which .3% locally generated	Goal: 30% by 2020, presently 15-17%	10%	?	?	25-35%	Goal: 25% by 2020, presently?
Retire REC's?	Yes, once it is retired it is registered in a database and can no longer be traded.	No	?	Not mentioned	?	Not mentioned	Opt in option, Power to choose program
Capacity of town owned PV	280 kW	8MW	?	?	?	?	?

Capacity of privately owned PV	300kw	2MW	HMLP will offer a rebate in the form of a credit on the bills of customers who install and own a photovoltaic system at their homes in Hingham. The amount of the rebate will vary according to the capacity of the photovoltaic system. There is a cap of $5000 per account. The HMLP will rebate $1000/kW x the rated output of the system or $5000, whichever is less. For example, an HMLP customer who installs a photovoltaic system at their home in Hingham and whose system has a rated output of 2.5kW will receive a rebate of $2500.	MMED offers a Net Metering rate for **commercial customers** with solar installations until the total capacity of all the installations reaches 2% of MMED's system peak demand. ***As of June 1, 2014, that capacity has been reached and MMED cannot offer additional net metering for commercial customers unless the Board of Light Commissioners formally raises that cap.***		?	?

Net metering policy	Provided for in 2011 EFR DG Tariff, current phase of operation as of June 2014, changed/credited/valued at retail rate	Limited banking, rate tied to avoided average monthly day ahead locational marginal price	Yes	Yes, for commercial customers with solar installations until the total capacity of all the installations reaches 2% of MMED's system peak demand. As of June 1, 2014, that capacity has been reached	Yes	Yes, implemented changes in 2012 for distribution system, due to .08kWh PV in their market of .04 to .06kWh	Yes
Battery storage capacity	None mentioned	0	None mentioned	None mentioned	?	Project proposed, with "500KW units / capable of operating at nameplate rating for 2 hours, up to an additional 1MW - 2 hour as alternate bid"	None mentioned
Battery storage programs	None mentioned	None	None mentioned	None mentioned	?	Project proposed	None mentioned
Energy conservation program	Yes, see below	Yes, see below	Yes	Yes	Yes	Yes	Yes

Rebate programs	Energy star appliance, free home energy audits, green choice, energy efficient lighting program & several financial assistance programs	Residential: energy audits, LED, HP, Elec heat weatherization & solar PV. Commercial: Facility energy audits, Lighting program, Participant recognition costs	See above	Yes, appliance calculators, energy home audits, tips, and rebates	Yes, Solar rebates available	Yes	Home energy assessment, appliance rebate, voluntary renewable energy enrollment programs
Green energy program	Yes, Green choice, $6/100kW	Not presently	in process	Not mentioned	In process	None mentioned	Renewable energy, $30/750kW
Strategic plan		In process	In process	In process	?	In process	?
Web site emphasis	Separate from town, easy to navigate, engaging	Incorporated into Town's web site, utilitarian emphasis	separate website, slightly difficult to navigate	Separate website, contained "internal service errors"	Part of the towns website, not easily accessible from website	Separate website, easy to navigate	Incorporated into town website, combined utilitarian & energy conservation
Org structure/ governance	General manager	5-member light board, TM & Director	General manager, lighting board, business manager, accountant, IT manager, Line Division manager, engineering managers, customer service reps, line operations, metering department, stock room and purchasing reps	7 office staff and 14operating staff	General manager, 6 fellow managers, officer, customer service and help desk reps	General manager, 5 staff members, customer service	Director & Board of Commissioners

Director of Energy	None mentioned	Not presently	None mentioned	None mentioned	None mentioned	None mentioned	Researched by sustainable energy committee mentioned in 10/15 meeting minutes
Rate structures	1 Res/ 7 Com	8 Res/ 6 Com Tiered (3) residential rates to encourage energy conservation	3 Res/ 3 Com	3 Res/3 Com	2 Res/1 Com/2 Gen/1 Mun/ 1 Net	4 Res/3 Gen	1 Res/5 Com Tiered (4) rates to encourage energy conservation
Rate stabilization	Yes	Yes	Yes	?	?	Yes	Yes
TOU/ CPP	None identified	Some	None mentioned	None mentioned	None mentioned	Residential and Farm TOU service	None identified
Cost of power	$0.13164/kWh	$.14/kWh	$0.1471/kWh	$0.112/kWh	$0.11556/kWh	$.1588/kWh	$0.9488/kWh
Purchase Power Adjustment clause	Yes	Yes	Yes	Not specified	Not mentioned	Not mentioned	Yes
Other services	None identified	HS broadband	Outdoor lighting rental rate	Energy appliance rebates, tips for energy saving	HS broadband & cable	Audits, energy usage monitors	Energy Hotline

Initiatives	Smart Hub online bill pay & account access, Smart Grid, Distributed Generation Host program. • Free home energy audits. You'll get a written report you can keep that includes recommended. measures, estimated payback periods, and other information to help you choose the best ways to make your home more energy efficient. Demand side management program offered	.52% CARES fund & 1.5% undergrounding surcharge	HMLP going green program	• Free home energy audits. Our customers can call toll-free 888-772-4242 to make an appointment for a	Tips for electrical safety on website, rebates, loans	Battery Storage plan	Wellesley's Green Collaborative program, Distributed antennas

Appendix XI: Mitigation Plans from other Cities and Towns

A sample of the climate action plans that have been developed by other cities and towns may inform Concord's choices to plan for a low carbon future.

Acton 2020 Comprehensive Community Plan, April 2012 – membership in ICLEI, Green Community: key findings in Water Quality and quantity, Agricultural land, Biodiversity, Reducing Waste and the Accumulations of Toxins in the Environment, Conserving Energy and Reducing Carbon Emissions:
http://doc.acton-ma.gov/dsweb/Get/Document-35852/ActonCommunityPlan%20-%20Volume1.pdf

California Title 24, 2014 – all new residential buildings must be Zero Net Energy by 2020, and commercial buildings by 2030
http://www.title24express.com/what-is-title-24/

Cambridge, MA Plan for Net Zero Communities 2014 – Focus on new construction targets for net zero beginning in 2020; targeted retrofit energy metrics; increase renewable energy generation; coordinated community engagement
https://www.cambridgema.gov/cdd/projects/climate/~/media/6087ff675ade4d51a6677e689d996465.ashx
Carlisle, MA Energy Use Plan - Green community. Focus on energy use in town buildings, land use, vehicle use, sustainable resources for residents, educational programs.

Lexington, MA Climate Action Plan 2014 – Resolved: That the Town (a) consider climate change in all appropriate decisions and planning processes; (b) take action to prepare for the impacts of a changing climate; (c) reduce greenhouse gas emissions; (d) develop and implement a comprehensive climate action plan; all with the goal of making Lexington a truly sustainable community. Focus on better buildings, energy, water / public health and safety, appropriate town decisions, community engagement.
http://www.lexingtonma.gov/sites/lexingtonma/files/uploads/climatechangebos2-24-2014_r3.pdf

Chicago, IL Climate Action Plan – by 2020 reduce emissions below 1990 levels; by 2030 80% reduction goal for new and renovated buildings. Focus on five strategies: energy efficient buildings, clean and renewable energy sources, improved transportation options, reduced waste and industrial pollution, adaptation. http://www.chicagoclimateaction.org/

Austin, TX Climate Plan – Net Zero community-side greenhouse gas emissions by 2050.
Focus on electricity and natural gas sectors, transportation and land use sectors, materials and waste management sectors.

http://austintexas.gov/sites/default/files/files/Sustainability/OOS_AustinClimatePlan_032915_SinglePages.pdf

Burlington, VT Climate Action Plan – Goal: stop the increase of emissions and bring 2016 emissions down to 2010 levels for all sectors (municipal, airport, community-wide). Focus on compact mixed use development, reduce VMT by 10% by 2025, policies to support local food production, increase energy efficiency in buildings, clean and renewable energy sources, carbon storage and sequestration, reduce waste sent to landfills, annual assessment.
http://carbonn.org/uploads/tx_carbonndata/Burlington_Climate_Action_Plan.pdf

Fort Collins, CO included the following sectors in its resiliency plan.

- Building Efficiency
- Alternative Transportation and Electric Vehicle Adoption
- Distributed and Renewable Energy Sources
- Waste Reduction and Diversion
- Carbon Sequestration and an Increased Urban Forest
- http://www.fcgov.com/environmentalservices/pdf/cap-framework-2015.pdf

Middlebury College in Vermont defined carbon neutral:
Middlebury followed the same simple carbon reduction plan as many other projects:

1. Reduce energy use
   - New LEED building and more efficient mechanicals in older buildings
   - B20 in vehicles
   - Locally grown organic food
   - School policies (habit change)
2. Generate the energy needed with renewables:
   - Solar
   - Wind
   - BioMass
3. Support other renewable projects through carbon off sets and REC retirement.

http://www.middlebury.edu/sustainability/our-commitment/carbon-neutrality

Appendix XII: Important Documents (INCOMPLETE)

Document Title	Enacted	Access/URL	Relevant Section	Description/**Relevance**
Community Preservation Committee Bylaw	2004	Concordma.gov, Important Documents, Bylaws, Town Bylaws	Chapter 2.2	Tasks the committee with recommending acquisition, creation, preservation, and use of open space, community housing, and historic resources. **These recommendations could include use of space for energy initiatives or repurposing a space for more efficient energy usage.**
Inspector of Gas Piping and Gas Appliances Bylaw	1964	Concordma.gov, Important Documents, Bylaws,Town Bylaws	Sections 1, 2, 4, 5	Designates Town Manager as responsible for appointing an Inspector of Gas Piping and Gas Appliances for the town each year. Outlines the responsibilities of the inspector and his/her access to buildings within Concord. **Inspector can examine buildings that have high or inefficient energy usage.**
Land Fund Bylaw	1986	Concordma.gov, Important Documents, Bylaws, Town Bylaws	Section 3b	Allows the town manager to designate funds from the Land Fund to acquired real estate for engineering and planning purposes. **Fund could be used to improve energy efficiency in affordable housing or historic buildings.**
No New Construction of Utility Poles or Overhead Wires Bylaw	1987	Concordma.gov, Important Documents, Bylaws, Town Bylaws	Sections 1, 2	Prohibits the addition of any utility poles (unless through replacement) or overhead wires on public and private ways in Concord.
Planning Board Bylaw	1932	Concordma.gov, Important Documents, Bylaws, Town Bylaws	Sections 4, 5, 6,	Requires that all plans to create or change public buildings be submitted to Planning Board for their opinion. Assigns Planning Board the duty of investigating any petitions to alter Zoning Bylaws and submit a recommendation to the Board of Selectmen. **This board could be tasked with assuring that any changes made to public buildings do not increase energy usage.**

Records Management Bylaw	1990	Concordma.gov, Important Documents, Bylaws, Town Bylaws	Entire Document	Outlines the management of town records and how they are to be archived. **If the town's energy use is recorded and archived, it could be beneficial for the Task Force to look at to understand a baseline.**
Underground Fuel Storage Systems Bylaw	1993	Concordma.gov, Important Documents, Bylaws, Town Bylaws	Sections 2, 3, 4	Prohibits installation of underground fuel tanks and requires registration of existing underground fuel tanks for the purpose of preventing contamination of groundwater and surface water, and the environment generally. **Could affect initiatives towards alternative fuel use in households.**
Water Bottle Bylaw	2012	Concordma.gov, Important Documents, Bylaws, Town Bylaws	Sections 1,2	Prohibits sale of single serving water bottles except under emergency circumstances. **Can be cited as an town mandate that benefits energy reduction and sustainability.**
Zoning Bylaw	1928	Concordma.gov, Important Documents, Bylaws, Zoning Bylaws	Table I, Table II, Sections 4, 5, 7-10	These tables denote what structures and uses are permitted in each district within the town of Concord. Sections 4 & 5 define each type of use. Sections 7-10 outline special uses and how rules may be different for these uses**. These restrictions would need to be consulted if the energy plan called for new infrastructure or repurposing existing buildings.**
Inclusionary Housing Bylaw	1987	Concordma.gov, Important Documents, Bylaws, Town Bylaws	Sections 2, 3	Defines rules for land reservation and design for housing developments and subdivisions. **Could be amended to require certain energy efficiency standards for new housing developments.**

Progressive Removal of Utility Poles and Overhead Wires Required Bylaw	1987	Concordma.gov, Important Documents, Bylaws, Town Bylaws	Sections 1, 3	Requires that any utility with poles or overhead wires must remove these structures by the given timeline. This can be avoided if an agreement between the town and the utility are met.
Solid Waste Disposal Fund Bylaw	1989	Concordma.gov, Important Documents, Bylaws, Town Bylaws	Sections 2, 3	Establishes a revolving fund for the Solid Waste Disposal Department and the manner of establishing rates and schedules. Allows funds to be used for improvements. **This could be a way to estimate energy used through waste by the town.**
Historic Districts Act – Updated Design Guidelines	2015	Concordma.gov, Boards and Committees, Historic Districts Commission	Pg. 17	Historic Districts Commission (HDC) supports property owners' and town's efforts to reduce environmental impact, especially through preservation rather than re-building. **HDC acknowledges importance of environmental impact, therefore may be open to any efforts to reduce impact.**
			Pg. 27, 67-69	HDC's rules on doors/windows in Historic Districts state that the original design/materials should always be maintained when modifying/replacing. Architectural character and appearance are prioritized over energy efficiency, and improvements are always encouraged over replacement. **HDC does not seem very open to replacing windows in Historic District buildings.**
			Pg. 28-29, 45-46	HDC policy on solar panels and 'modern equipment' (HVAC, utilities, etc.) generally limits equipment from being visible from public ways. **Modifications/additions in Historic Districts related to energy usage/production must be approved by HDC and visual components can be strict.**
			Pg. 56	Roofs on buildings within the Historic District must maintain the appropriate slope, style, and texture of its period, but the HDC does recognize the importance of the functionality of a roof in preventing freeze/thaw cycles. **Seems as though the HDC wants roofs that insulate heat well to prevent ice dams and other effects that would affect a building.**

			Pg. 39-40	Changes to lights and light fixtures (seemingly outdoor, though not explicitly stated) must maintain appropriate color, intensity, and light distribution as deemed by HDC. **HDC is concerned with light pollution and glare for drivers, may have opinions on new energy efficient bulbs.**
APP #59 – Energy Management Policy	June 2011	http://www.concordnet.org/documentcenter/view/3241	Entire Document	Very general, non-specific document that establishes Concord's intent to focus on good energy management that will reduce operating expenses and pollution. **Does not offer anything tangible for the Task Force.**
Comprehensive Sustainable Energy Committee – Committee Charge	April 2007	http://www.concordnet.org/DocumentCenter/Home/View/3526	Purpose, Duties and Responsibilities	Establishes committee's purpose of helping town to identify, design, and implement projects that support energy conservation, efficiency, and renewables across entire spectrum of uses. Important duties include establishing mechanisms to measure energy consumption across the community, recommending short and long-term energy goals to Town Manager, and to explore funding options for energy related projects. **Shows some overlap with Task Force duties, and their findings/recommendations could be used by Task Force to build upon.**
Concord Energy Master Plan	2011	http://www.concordnet.org/DocumentCenter/Home/View/3527		
APP #63 - Fuel Efficient Vehicle Policy	October 2013	http://www.concordnet.org/documentcenter/view/2147	Entire Document	Sets a floor for efficiency levels required for newly purchased town vehicles and encourages retirement of least efficient vehicles. **Town must keep an inventory on all town vehicles, including fuel consumption. This could help Task Force in assessing town's emissions and/or setting levels of emissions in any vehicle recommendations for town.**
Municipal Energy Use Reduction Plan	August 2011	http://www.concordma.gov/DocumentCenter/View/3238	Policy Statement (pg. 1)	BOS established goal to reduce municipal energy consumption for town buildings/facilities and streetlights from 2008 levels by 20% by 2015. **Investigate if this goal was accomplished, and if not, what prevented it from being accomplished?**

Municipal Energy Use Reduction Plan Cool Trends – ISSP	August 2011 N/A	http://www.concordma.gov/DocumentCenter/View/3238 https://www.sustainabilityprofessionals.org/files/Cool%20Trends.pdf	Four Sustainability Objectives (pg. 1)	Objectives are to reduce Concord's dependency on fossil fuels, chemicals/manufactured substances that accumulate in nature, and activities that harm life-sustaining ecosystems, and to meet the hierarchy of present *and future* human needs fairly and efficiently. **Objectives were not implemented at time of this document, and if they have been implemented, these provide opportunity to create new programs to complete these goals.**
			Baseline Data & Tracking Software (pg. 2-3)	In 2009 Concord joined the ICLEI, which allowed them to implement their Clean Air & Climate Protection (CACP) software to calculate town's carbon footprint from 2008. In 2010 Concord signed up for Mass Energy Insight (MEI) tool, which tracks energy use in municipal buildings. **These tools, if still in use, can be used to find baseline data and track progress of further energy-reducing efforts.**
			Getting a Greener Focus, Recommendations (pg. 9-28)	Multiple sub-sections in this topic outline 2011 state of progress on specific areas of energy reduction, followed by recommendations for how to further improve on these areas. **It would be helpful to review which of these recommendations have been implemented to understand which would be helpful to focus on moving forward.**
			Transportation	Gives concrete methods to reduce individuals car use towards public transportation, biking, and car-sharing programs. **Some methods could be feasible for Concord with regards to bike use and a car-share program (zipcar).**
Cool Trends – ISSP	N/A	https://www.sustainabilityprofessionals.org/files/Cool%20Trends.pdf	Energy	Gives recommendations of ways to decrease energy use and increase energy efficiency such as light bulb replacement, changes to infrastructure, and committing to renewable energy sources.
			Waste	

Documents checked:

- Civil Defense Bylaw
- Conservation Commission Bylaw
- Farming Bylaw
- Internal Combustion Engines on White Pond Bylaw
- Personnel Bylaw
- Regulation of Vehicles Bylaw
- Sale of Real Property Bylaw
- Unregistered Motor Vehicle Bylaw
- Comprehensive Long Range Plan – 2005

Appendix XIII: Director of Energy PD

Director of Energy [or other title]
PD Core Elements
draft

Responsibilities

-Establish GHG baseline and GHG tracking and reporting system
-Develop strategic plan and related action and implementation plans to meet Town GHG reduction goals; plans will include, among others, land use and zoning elements
-Develop corollary plan to educate citizens, enabling them to make GHG reductions in their individual lives and participate in Town GHG policymaking
-Oversee, and engage all stakeholders in, planning and implementation process
-Maintain relationships with, coordinate with, and guide relevant Town staff, departments, boards, and committees in areas of responsibility
-Keep apprised of relevant state, federal, scientific, and policy developments concerning GHG reduction; develop relationships and coordinate with municipal, state, and other officials and stakeholders working to reduce GHG emissions.

Requirements

-Minimally, Bachelor's degree in Environmental Studies, Energy or Environmental Policy, or another related discipline; preferred, graduate degree (masters or PhD) in a relevant field
-Five to 7 years' relevant work experience or equivalent
-Demonstrated management experience, with ability to provide direction to senior staff and consult with elected and other Town officials
-Strong analytic, writing, speaking, and collaboration skills; demonstrated creative and innovative thinking

Reporting and accountability

-Reports directly to the Town Manager
-Is accountable to the Town Manager
-Is responsible for interfacing with a new energy committee of citizen members appointed by the Select Board as directed by the Town Manager, and with the Concord Public and Concord-Carlisle Regional School Committees.