Excerpts from Green Ribbon Commission Recommendations on Energy Efficiency

Recommendations: Energy Efficiency

1. Residential Energy Audit Program ("REAP")

The goal of the Residential Energy Audit Program ("REAP") is to decrease residential energy use and increase building quality and performance, thereby lowering energy bills and decreasing the demand for fossil fuels for residents of Falmouth. Getting every home owner to know the Home Energy Rating System Index (HERS Index) number for their house will further this goal.

HERS is an objective rating system developed by Residential Energy Services Network that establishes a numeric grade for the performance of a house in terms of relative energy use (see www.natresnet.org). A HERS Index of 100 represents the energy use of the "American Standard Building" (The HERS Reference Home) and an Index of 0 (zero) indicates that the proposed building uses no net purchased energy (a Zero Energy Building). Energy Star ™ standards require a HERS Index of 85 in our climate zone. Each 1-point decrease in the HERS Index corresponds to a 1% reduction in energy consumption compared to the HERS Reference Home.

REAP has two parts:

- Requiring new residential construction to obtain a HERS rating:
  - A projected HERS index to be submitted with the application for a building permit.
  - Actual HERS index after construction to be submitted with request for Certificate of Occupancy.
- Adding a HERS index to the listing sheet for home sales.

Over time, a familiarity with home energy performance and a market demand for energy efficient homes will be created.

The town will not require any specific Index to be achieved. Realtors will begin to understand that this measurable and objective information on individual homes is available. Buyers can look for the HERS index before purchasing new homes, in much the same way people look for the MPG measure when buying a car.

A proven parallel to this method is the now ubiquitous radon test: law does not require it, but it's perceived by homeowners to be of great importance. Realtors have increased awareness of radon by demanding the results of the radon test. We have much the same hope for the HERS Index.

Recommendation:

Require HERS index for new home construction or major renovations.

Work with the real estate community to encourage adding HERS index to market information.

Educate the citizenry about HERS index.

Requested budget: $0.

2. Smart Meters

Innovations in technology enable the average homeowner to monitor their individual electrical usage. One such innovation is a "smart meter". Fundamentally, a smart meter allows both the homeowner and the utility to monitor usage in real time. Some are in an easy to read digital format; some show the consumption from a device, some are web based. For purposes here, we will assume that any smart meter is paired with an indoor display device or web interface. In any form, a "smart meter" provides the homeowner with greater awareness of electrical use and thus the possibility of savings based on decisions made by the user. The idea behind Smart Meters is that by giving a consumer real time data on their electricity consumption, the consumer will alter his/her behavior. Studies show that such information yields ~ 10% reduction in power consumption. (Although a smart meter is one of the components of a smarter grid, a smart meter is not the same thing as a "Smart Grid.")

In the summer of 2008 Baltimore Gas & Electric tested a new pricing system that rewarded its customers for reducing their demand during peak hours. Those in the testing program that were alerted in advance of a peak power condition via phone, email or text showed an average of 24% decreases in electricity usage.

Others were notified via "orbs" which turned red during peak times. Those customers decreased their power usage by 37%.

With both a smart meter and a properly incented "time of use" rate structure, both the user and the producer would have the capability to monitor and react to the demand in electrical load. A "time of use" rate structure prices power according to when demand is highest or lowest. This is not unlike the early days of cell phones, when users would often get "free minutes on nights and weekends". Too many calls during peak hours would have required additional cell towers to handle higher volume, and thus consumers were incented to place calls outside of "peak" demand time. If electricity were less expensive, for example, Monday after 7 pm, than it was Monday at 9 am when businesses are keeping office hours and turning on office equipment, a consumer would have an incentive to run that dishwasher in the evening before they go to bed, rather than in the morning when they get up.

Big picture benefits from the above include reduction in energy consumption and emissions; reduction of the need for peaking plants; and a more reliable grid by smoothing out power consumption.

There are a variety of ways to implement smart meters. Recently CMP has obtained a grant from the Federal Government for $96 million to install smart meters in all residences in its power district. This presents a great opportunity to provide Falmouth residents with free or low cost smart metering in the very near future. This will require CMP to invest $100 million, and it is not yet clear whether CMP will accept this grant.

Recommendation:

Communicate to and work with the Public Utilities Commission and CMP to obtain smart meters with a user friendly indoor consumer interface for Falmouth residences.

Petition the Public Utilities Commission to implement a Residential Time of Use rate that provides an incentive for the homeowner to modify their time of electricity consumption.

Requested budget: $0.

3. Cold Climate Heat Pump Demonstration Project

Currently, the majority of buildings in Maine are heated by fuel oil. A promising alternative to fuel oil may be Cold Climate (sometimes called low temperature) Heat Pumps. Heat pumps are fairly common throughout the United States, and are usually used in conjunction with electricity as the source of their energy. Until recently, in cold northern areas there was no effective heat pump that could be used in extreme conditions.

When thinking about heat pumps visualize a refrigerator. The concept is similar, but when heating the process is reversed. By using compressors and economizers the temperature of a refrigerant can be controlled to draw off heat from the air. That heated refrigerant is then pressurized making the temperature rise. At the higher temperature the heat is transferred to the air in the air handling system and distributed as heat. The refrigerant is then passed through an economizer where excess heat is drawn off and passed to the compressor as waste heat. A difference between this and geothermal heat pump systems is that in the case of a Cold Climate Heat Pump, air is used as the heat source rather than the water underground.

Regular heat pumps do not work well below 30 degrees F. The physics of the heat transfer requires supplementary heat sources rather than just compressed refrigerant (something needs to burn). In the case of the cold climate heat pump, an additional compressor is used to reheat the refrigerant with an additional stage of compression. This allows for use at temperatures below 30 degrees F.

- Advantages:
    - Reduces carbon emissions over fuel oil by 5000-7000 tons/year
    - Depending on electrical source, no carbon emissions.
    - Provides heating and air conditioning.
    - Can be retrofitted into older systems.
- Disadvantages:
    - Currently will not work with forced hot water heat.

A demonstration cold climate heat pump in a municipal facility will provide information on the operation of such units, and information could be given out to the public to educate residents on the advantages, costs and benefits and details of this equipment.

Recommendation:

Install a demonstration Cold Climate Heat Pump System in a municipal facility. Document the savings in energy costs and the reduction of CO_2 emissions. Use this information as an educational tool for the general public.

Requested budget: $0 at this time until a specific proposal is presented to Council. Cost to town of proposal: Uncertain. May be funded with grants, or a cost benefit analysis may show sufficient return on investment.

4. PACE (Property Assessed Clean Energy)

There are a number of barriers to individual's investing in energy efficiency or renewable energy, including lack of information, uncertainty about the energy savings, and high upfront costs (which is both a psychological and financial barrier for many people). Property Assessed Clean Energy (PACE) is a voluntary program which lowers the barriers to these investments.

First an energy assessment is conducted on the home. The homeowner identifies the work they want to do, selects the contractor, applies for financing and repays the investment through an additional assessment on their property tax bill for periods of up to 20 years. The homeowner benefits through reduced energy bills which offset the assessment. There is little or no upfront cost to the property owner. As the upgrades stay with the property, so does the loan. If the property is transferred or sold, the new owners are obligated to continue the remaining payments due under the assessment. PACE requires an agreement by municipality to collect and disburse these payments. The capital for the improvements can come from banks or from bonds. Because the loans are secured by priority property liens, a PACE program provides virtually no risk to the capital provider.

For homeowners, a PACE program offers many advantages including a long repayment period, potentially a lower interest rate, tax-deductible interest payments, and an easier application process than applying for a second mortgage or home equity line. Unlike most other financing options, the repayment obligation transfers when the property is sold, allowing homeowners to invest in improvements that will pay back over a longer timeframe than the owner intends to remain in the house.

For local government, a PACE program supports residents' efforts to reduce energy consumption and carbon emissions at low or no cost to itself and strengthens the local economy through job creation.

PACE requires enabling legislation at the state level. Many states have adopted PACE enabling legislation including Colorado, California, Illinois, Louisiana, Maryland, Nevada, New Mexico, Ohio, Oklahoma, Oregon, Texas, Vermont, Virginia and Wisconsin. Legislation is pending in Arizona, New York, and more recently, Maine.

For more information see www.pacenow.org.

One example of an existing program is Long Island Green Homes in Babylon NY http://www.ligreenhomes.com/page.php?Page=home:

> The Town of Babylon's Long Island Green Homes (LIGH) is a self-financing residential retrofit program for upgrading the energy efficiency of existing homes at little or no out-of-pocket cost to the homeowner. The Town will pay the licensed contractor once the work has been completed. The homeowner, who is not obliged to take on debt, will then repay the Town on a monthly basis for an amount and term agreed upon in advance. Once the obligation is satisfied, typically in six to ten years, all of the savings go directly to the homeowner. Should the homeowner move before the obligation is satisfied, it is assigned to the home.
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> The Town (Babylon) will subsidize up to $12,000 of efficiencies per home, obliging the homeowner to pay a monthly benefit assessment fee. In year one, the amount of the monthly fee is structured to be less than the monthly savings on a resident's energy bills. The Town will levy a 3% administrative fee incorporated into the monthly payments. For homes that are already energy-efficient, the Town may help fund the installation of renewable energy systems like solar, and potentially, vertical wind turbines.

Another example is Cambridge Energy Alliance (CEA) in Cambridge MA:

A city-sponsored non-profit organization, the Cambridge Energy Alliance (CEA) is investing over $100 million over the next five to six years to enable energy-efficiency retrofits of half of all city buildings, and reduce electricity demand by 15% and annual GHG emissions by 150,000 tons (10% of city's total). CEA estimates that the value of the energy savings is expected to be roughly $160 million over the next 10 years.

Under the program, CEA participants (residents and businesses) will pay for efficiency and clean energy projects directly or through CEA-arranged financing for a term of up to ten years such that loan repayments are matched or exceeded by annual energy bill savings. No upfront costs will be required for such installations, and there will be no cost to Cambridge or state taxpayers.

A homeowner investing in a cost-effective package of measures addressing heating, cooling, insulation, water use, and lighting can typically save 20-30% of his or her current utility bills. For a homeowner spending $3,000 annually for electricity, gas, oil and water, the annual savings would be $600-1,000.

For more information, see www.cambridgeenergyalliance.org.

Recommendation:

Implement a PACE program for residential energy efficiency upgrades and renewable energy installations.

Requested budget: $0.

5. Cool and Vegetated Roofs

A cool roof reflects and emits the sun's heat back to the sky instead of transferring it to the building below. "Coolness" is measured by two properties, solar reflectance and thermal emittance. Both properties are measured from 0 to 1 and the higher the value, the "cooler" the roof." Studies have shown that the benefits of cool roofs are true in cold climates not just the sunny south.

Cool roofs directly reduce green house gas emissions by conserving electricity for air conditioning therefore emitting less CO_2 from power plants. Cool roofs also cool the world by reflecting the sun's energy as light back to space, and by avoiding what is known as "heat island" effect. A Lawrence Berkeley National Laboratory study found that world-wide reflective roofing will produce a global cooling effect equivalent to offsetting 24 gigatons of CO_2 over the lifetime of the roofs. This equates to $600 billion in savings from CO_2 emissions reduction (www.coolroofs.org).

Energy Secretary Stephen Chu has stated that if all the buildings in the world had white roofs, and all the roads in the world were light colored, it would be the equivalent of taking all the cars in the world off the road for 11 years.

White roofs have been required for all commercial buildings in California since 2005.

Additional Cool Roof Resources: http://www.consumerenergycenter.org/coolroof/
http://www.facilitiesnet.com/roofing/article/Beyond-Myths-To-Solutions--7052
http://www.ornl.gov/sci/roofs+walls/facts/CoolCalcEnergy.htm
http://www.epa.gov/heatisland/mitigation/coolroofs.htm

Vegetated roofs also have environmental benefits, and should be considered as desirable roofing material.

Recommendation:

Adopt a "Cool and Vegetated Roof" ordinance which encourages or requires all new commercial roofs be white and/or vegetated, and which encourages or requires all existing commercial roofs greater than 40,000 square feet to be retrofitted as a white and/or vegetated cool roof within 10 years.

FOREST AVENUE HANNAFORD SHOPPING CENTER WITH WHITE "COOL" ROOF

Requested budget: $0.

6. High Performance, Energy Efficient Public Buildings

Well-designed, high-performance "green" buildings provide substantial economic and social benefits at minimal or no additional first cost. In these buildings, operating expenses can be dramatically reduced; commercial buildings command higher rents and result in higher productivity and reduced sick time; attendance and test scores are higher in schools. The primary obstacle to accessing these benefits today is limited expertise and experience in the design and construction of such buildings. Construction of high performance, energy efficient public buildings provides visible examples to the community and accelerates adoption of high performance building standards at the same time that the Town benefits from these advanced buildings.

The town now has experience with the LEED rating system through the new public safety building. LEED is a standardized system of the United States Green Building Council.

Another standard is provided by the American Institute of Architects, through its "2030 Challenge". The 2030 Challenge requires all new buildings, developments and major renovations meet a fossil fuel, emissions, energy consumption performance standard of 50% of the regional (or country) average for that building type, towards a goal of carbon-neutrality by the year 2030 (www.architecture2030.org/2030_challenge).

Recommendation:

Adopt an ordinance that requires all new municipal buildings, including schools, be built to meet the highest feasible LEED standard and/or meet the "2030 Challenge" energy performance standards.

Requested budget: $0.

7. Water Heaters

Hot water is a year-round need for homes and many businesses. The annual energy required to provide hot water in residences is typically exceeded only by that required for home heating and cooling. Energy requirements for producing domestic hot water in residences account for roughly 15 percent of all household energy use.

Traditional home water heaters keep a large volume of water (typically 40+ gallons) hot all the time. Maintaining the temperature of this quantity of water can represent a substantial waste of energy when actual usage may be for only a few minutes a day. The wasted energy for hot water storage, termed standby losses, include heat losses from the hot water tank. There are alternatives, including:

- Solar Water Heaters: These systems will usually have the highest initial installed cost but result in low operating costs and the greatest emission reduction. A backup energy source is required for times when solar energy is not available. However, it is often feasible to provide greater than

50% of annual hot water needs using solar heaters. Not all homes will be suitable for solar installations.

- On-Demand Water Heaters: On demand (or just demand) water heaters can be fueled by propane or natural gas (while they can be powered by electricity, in most cases this is a poor choice). On-demand water heaters operate only when there is a demand for hot water. This eliminates the "standby" losses of storage water heaters. However, long runs of water piping can result in having to fill those pipes each time before you get hot water out of the faucet, at the shower head, etc. Locating a demand water heater at or very close to the point of use is desirable.
- Heat Pump Water Heaters: Electric heat pump water heaters can provide more than twice the water heating effect per kilowatt hour as conventional resistance type water heaters. Such water heaters are more common outside the United States, particularly in Japan, for cultural as well as technological reasons. One major US equipment manufacturer is beginning to promote electric heat pump water heaters (inherently "storage" units) as part of an appliance line for household energy management / demand response usage (think smart grid). The manufacturer cites benefits for the US as a whole in the range of 15 billion kwh annual energy savings. Water heating can also be combined with space heating. Further evaluation is warranted.

While upfront costs for energy efficient systems are typically greater than for traditional "storage" water heaters, the sum of the initial capital cost plus ongoing operating costs over the life of the equipment will typically be lower, while significantly reducing emissions resulting from water heating activity.

The town of Falmouth can encourage the transition to higher performance water heating systems by educating residents and property owners. New construction should be required to use solar hot water heating, on-demand water heaters, or other energy efficient, preferably Energy Star compliant water heating equipment.

In addition, we recommend an educational campaign directed to both homeowners and realtors about the benefits of energy efficient water heating. Educational programs on energy efficient water heating should also include conservation suggestions such as:

- Reducing hot water usage: low flow shower heads, energy efficient clothes washers, dishwashers, etc.
- Set water heating temperature to the lowest appropriate temperature.
- Insulate any existing storage water heater, particularly an older unit.
- Insulate hot water distribution pipes.
- Install heat traps on storage type water heater tanks.
- Install a timer and use off peak power for an electric water heater.
- Consider installation of a drain-water recovery system.

Domestic water heating has sufficient impact on energy and emissions as to warrant inclusion in any PACE program energy efficiency measures.

Recommendation:

Adopt an ordinance with respect to codes for water heaters in new construction.

Educate the general public and the building community on cost efficient ways to provide hot water.

Requested budget: $0.

8. Streetlights & Parking lot lights

Falmouth has 614 active streetlights and 37 Streetlight Special Facilities. As most streetlights are on an average of 10 to 11 hours per day, 365 days per year, the energy consumption is significant. Jaffrey and Rindge, NH have recently decided to turn off up to 30% of streetlights, saving approximately $30,000/year. Ann Arbor, MI, is in the process of installing LED bulbs in their street lights.

Reducing energy used by streetlights is complicated. Many lights are necessary for safety or are necessary for a feeling of safety. The lights are actually owned by Central Maine Power (CMP), and the town is limited to the options offered by CMP. Ideally streetlights would be "smart"; individual lights could go on and off at different times, some lights could go dark and others stay on, etc.

Parking lot lights have many of the same attributes as streetlights, except that they are owned by the property owner. New parking lot lights should also use the most efficient lighting available, and new fixtures should be installed with the necessary controls to enable "smart lighting", rather than just lighting sensors. Parking lot lights should be minimized after closing hours to just those lights required for security.

Recommendations:

Require that any new street lights be powered by the most efficient lighting available.

Remove streetlights that are not needed for public safety.

Work with CMP to replace existing lamps with more efficient and less intensive lighting.

Monitor the "pay back" schedule for LED lamps. Invest in LED lighting conversion when the operating cost savings can pay for the capital investment, using a reasonable depreciation schedule.

Adopt an ordinance which requires that new parking lot lights use the most efficient lighting available and have controls which enable more control than just sensors.

Property owners should be encouraged to retrofit existing lights with the most efficient lighting available, and install smart lighting controls wherever financially reasonable to do so.

Requested budget: $0, but there may be a request for funding in the future.