

## Part III

### RECOMMENDATIONS

## **BELMONT, we have a problem. Our spaceship Earth is in trouble, and it is trouble of our own making.**

### **Reducing Humans' Impact on Climate Change**

Climate change scientists have said an 80% reduction of carbon dioxide (CO<sub>2</sub>) emissions will be required to have a significant impact on mitigating the effects of climate change. Numerous business groups and government initiatives have established the goal of reducing our nation's CO<sub>2</sub> emissions by sixty to eighty percent by the year 2050. Although this goal is daunting, it is one that can be achieved. An average reduction of CO<sub>2</sub> emissions by four percent each year will, in forty years, yield a reduction to twenty-one percent of the original amount.

The following chapters, provide suggestions of things Belmontians can do to move toward being a community more in harmony with a sustainable future for the planet. There are many simple things that people can do immediately, saving money and energy at little or no expense. Nevertheless, in the long run, achieving the forty-year objective will require vigilance, innovative new technologies, and changes in the way we live. There are two basic ways of moving forward. One is to utilize sources of energy that do not produce CO<sub>2</sub> emissions: Green Energy. The second is to consume less energy through conservation and improved energy efficiency. A feasible plan for the future will have to aggressively employ both approaches.

As the emissions inventory shows, the majority of Belmont emissions come from how individuals live and move around. For example, nationally, electric power currently comes seventy percent from burning fossil fuels (coal, oil, and gas), twenty percent from nuclear plants, and ten percent from renewable energy

sources such as hydroelectric plants, wind power and geothermal. By reducing our consumption by fifty percent through conservation and improved energy efficiency, and by doubling the total contribution from renewable energy sources, the goal of an eighty percent

**Recommendation: Reduce CO<sub>2</sub> emissions to 80 percent below 2007 levels by the year 2050.**

reduction in emissions from the electricity sector would be achieved. Because lighting accounts for a high percentage of residential electricity usage, simply switching from incandescent bulbs to CFLs

would be a significant step toward a fifty percent reduction in residential electricity usage.

Will there be support for government policies that encourage actions consistent with moving toward a green, sustainable economy? Some facts stand out: The public is unlikely to take steps that are economically unsound (in the near term). Consequently, a sufficient global reduction in fossil fuel consumption, to avoid disastrous climate change, will not happen unless the prices of coal, gas and oil increase. Removing subsidies and other tax advantages these industries presently enjoy would help to "level the playing field," making Green Energy companies more competitive.

Two kinds of legislative proposals to control carbon emissions are being considered: "Cap and Trade" arrangements, and the "Carbon Tax". These proposals will require international cooperation to succeed. Many industries are reforming now in anticipation of a future of CO<sub>2</sub> regulation and are already enjoying the financial benefits of improved energy efficiency.

Mounting an effort in Belmont that is sustainable for the next four decades will require an unprecedented continuity of leadership and commitment to meet the

goal. An 80 percent CO<sub>2</sub> emissions reduction must become a municipal goal as fundamental as providing for schools, maintaining the roads, and delivering police and fire services or water and electricity. Of course this goal will only be met with the active and vigorous involvement of the citizenry and commercial sector.

Early reduction of CO<sub>2</sub> emissions will largely be met by improving energy efficiency and conservation of energy derived from fossil fuels. Later gains will be made as new technologies become available that replace energy derived from fossil fuels and as improvements in the sequestration of greenhouse gases are achieved.

In the future, those gains are likely to be substantial but will clearly have to wait until society and technology evolve such capacities. Additional technological breakthroughs are possible, and with the proper funding and incentives in place, perhaps inevitable.

“I feel strongly about reducing fossil fuel consumption for several reasons. We tend to focus on climate change, but fossil fuel dependence also weakens our economy, pollutes our air, makes us beholden to hostile nations and draws us into conflicts in which we have no other national interest. The good thing about cutting fuel dependence and saving carbon emissions is that it saves money.

With CFLs and a little attention to turning things off, we have cut our electric bill by 40%. On our gas bill, we’ve found that weather stripping and discipline on things like keeping the door to our enclosed porch closed can make a huge difference. On the transportation side, driving a smaller car saves gas and reduces environmental impact. We have gone down to one car—a six-year-old Honda Civic Hybrid. We cycle when we can and have reduced our driving considerably.”

—Will Brownsberger, State Representative,  
24th Middlesex District

There is no need to worry now about where future cuts in emissions will come from. What is needed now are the first confident steps that will move the community along a path toward the goal. Belmont must be focused and aggressive about implementing strategies available today to improve energy efficiency and conservation in the short run—and be open to innovation and new opportunities as they evolve in the future. We must have faith and optimism that reaching the goal is possible. Many scientists and others feel as though the technology required to meet our CO<sub>2</sub> reduction goals already exist. What the nation has lacked is the leadership and will to change.

Sustaining the vision, the leadership, and the will to change may be the greatest challenge of all. While success in meeting the goal is not guaranteed, let it be written in history that Belmont is a community that summoned the courage to try.

### Calculating Carbon Footprint

In 2006, the average American emitted 20 metric tons of carbon annually, more than those in any other country in the world. For comparison, Germans emitted nearly 11 annual metric tons per capita, while those in the United Kingdom emitted about 9 annual metric tons per capita, according to the U.S. Energy Information Administration. One of the first actions that households and businesses should take is to calculate the annual metric tons of carbon emitted, creating a baseline. After calculating one’s carbon footprint, then set target reduction goals and monitor regularly to determine success in reducing carbon. There are many free online carbon calculators available. Here is one website that includes calculators for both homes and businesses: [www.carbonfootprint.com](http://www.carbonfootprint.com)

## The Residential Sector

Emissions generated from energy use in homes account for 48 percent of Belmont’s carbon footprint, and this is where the greatest change is needed. It is primarily individual decisions that will lead to progress. These emissions result from energy use in our houses and apartments, and include emissions from electricity use, and from the burning of natural gas and heating oil. Most of the emissions come from energy used to keep warm in the winter, and secondly, to keep cool during the hot spells of summer. Appliances (washers, dryers, etc.) and lighting account for the remainder. As with other sectors, the emissions produced can be reduced by a combination of conservation, efficiency, and a shift to non-fossil fuel sources to meet our energy needs.

The primary emphasis must be on conservation—consuming less energy. The ways to accomplish this are to cut down the heat loss in our homes, to improve the efficiency of our heating systems, and to arrange for comfort at a lower (higher in summer) ambient temperature.

### Reducing Heat Loss

#### Recommendation: Reduce residential heat loss.

- As an initial step, residents should conduct an energy audit of the home or apartment (see Box page 44).

In most homes, cutting heat loss by 50 percent or more is feasible. If you are building a new house or doing a major remodel, then the following construction features are likely to prove well worth the investment, given that energy is destined to become ever more costly..

- Insulate walls to R19 and ceilings below attic space to R40. This includes basement walls of basement living space, and attic entryways, for

“Our house abuts one of the most unique features of Belmont, Sergi Farm—owned by the Ogilby family, farmed by the Sergis and home to Community Supported Agriculture on a small portion of the farm. This gives us the opportunity to eat a lot of locally grown produce, and we don’t even have to drive to get it! We are lucky to live here. With our old gas boiler, the service company said that it was 85% efficient. But, an energy auditor said that the boiler was like using a bulldozer to dig a small hole; it was way more than was needed. The efficiency of our new gas boiler is estimated at 96%. And we’ve saving money too. We also use a programmable thermostat to adjust the temperature of the house for different times of day. This keeps the amount of gas we use down as well.”

— David and Miriam Weil

example, around pull-down attic ladders.

- Install energy efficient double-pane windows mounted in non-conducting window frames, or installing storm windows over single pane windows, a less expensive and less efficient alternative.
- Add moisture sealing (a “vapor barrier”) to reduce air infiltration loss. (But be sure there is adequate ventilation.)
- Use a heat-recovery ventilation system so the heat in warm ventilation exhaust is used to warm incoming air. In the summer cooler exhaust air is used to pre-cool incoming air.
- Use two or more heating/cooling zones so energy is not wasted on conditioning spaces not in use.

- Build air locks at the most used building entrances.
- Seal all openings where air could leak out from living spaces: places where plumbing, ducting, or electrical wiring pass through exterior walls; gaps around chimneys or the means of attic access.
- Supply combustion air for gas/oil/wood fuel heating units and fireplaces/wood stoves from outside heated spaces.
- Include an attic fan that can effectively cool the house on cool evenings and nights.

It may be practical to make some of these improvements without major reconstruction of the house, for example the addition of an attic fan, or implementing heating/cooling zones.

If these major steps are too costly or must be deferred, there are many things residents can do to help reduce unnecessary heat loss:

- Caulk and weather-strip doors and windows, including storms. Caulk and seal leaks where plumbing, ducting, or electrical wiring

penetrates through exterior walls, floors, and ceilings. Some common examples are mail slots in doors (use an exterior mail box instead), bathroom vents, and kitchen hoods. Look for products labeled low or no VOC (volatile organic compounds) as VOCs react with nitrous oxides to form ozone, and some are carcinogenic or neurotoxic.

- Use a flue plug in the fireplace and close the fireplace damper—except during fireplace use.<sup>21</sup> Consider sealing the fireplace if it's not being used.
- Place radiator reflectors between the radiator the wall to redirect heat away from the wall and into living spaces.
- Open shades/drapes/blinds by day to let the sun's heat in; at night, draw them closed to keep the heat in.
- Be certain to use storm windows.
- Rugs on floors will help insulate and prevent heat from leaking through the floor to unheated space below.
- Plant leafy (deciduous) trees on the sunny side (usually west and south sides) of the house. During the summer they provide shade, and in the winter they will shed their leaves to let the warming sunshine through. Pine or fir trees on the north side provide an energy-saving windbreak. Alternatively, use awnings to keep the house cooler during summer.
- For those with ceiling fans, change the direction of the blades in the summer and winter.
- Insulate heating pipes that pass through unheated spaces.

If uncertain about what changes to make that will have the greatest benefit for the cost, have an independent energy audit done. Look for services such as a heat loss scan, infrared heat loss inspection, infrared thermal scan, and blower door air infiltration

test. Follow the resulting recommendations.

If living in an apartment or condominium, your options require cooperation of the landlord or condominium association, but the principles to be applied are the same. If moving to a new residence, check that the needed improvements are already in place or are feasible to implement.

### Energy Audits

An energy audit is the first step to assess how much energy one's home or place of business consumes and to evaluate what measures to take to improve a building's energy efficiency. An audit reveals problems that, when corrected, should save significant amounts of energy, money, and lower one's carbon footprint. During the audit, areas where a house is losing energy are pinpointed. Audits can determine the efficiency of a home's heating and cooling systems and may also indicate ways to conserve hot water and electricity. Individuals can perform a simple energy audit, or have a professional energy auditor carry out a more thorough audit. Often payback times are included to help prioritize improvements.

A professional auditor uses a variety of techniques and equipment to determine the energy efficiency of a structure. Thorough audits often use equipment such as a blower door test, which measures the extent of leaks in the building envelope, and infrared cameras that reveal hard-to-detect areas of air infiltration and missing insulation.

Electric and natural gas utilities in Belmont conduct free residential energy audits. The Belmont Municipal Light Department (BMLD) offers free energy audits through a partnership with Energy New England. To schedule an audit, call 1-888-772-4242.

### Heating System Efficiency

**Recommendation:**  
**Increase heating system efficiency.**

Energy efficiency in space heating is the ratio of thermal energy delivered to living spaces to the thermal energy available from the fuel consumed. Improving the energy efficiency of your heating plant will reduce the amount of natural gas or heating oil homes and commercial businesses

use. Not only will CO<sub>2</sub> emissions be lowered, but monthly bills will also decrease, and the life of equipment will be extended.

In most residences, space heating is provided either by circulating hot water from a boiler through radiators, or by circulating hot air through ducts from a furnace. The boiler or furnace is fueled by either natural gas or fuel oil. The efficiency of a boiler or furnace is measured by its annual fuel utilization efficiency (AFUE), which is the fraction of heat produced from fuel combustion that is transferred to the water or air being heated, the remainder being wasted in exhaust gases.

<sup>21</sup> For an example of a flue plug, see <http://www.batticdoor.com/fireplacedraftstopper.html>.

Energy Star certified boilers and water heaters currently have a minimum AFUE rating of 85%, while Energy Star oil and gas furnaces currently have minimum AFUEs of 83% and 90%, respectively. Furnaces and boilers over 10 years old typically have an AFUE of 60 to 70%,<sup>22</sup> so replacing one of these older units with a high-efficiency natural gas heating system would yield as much as a 30% reduction in fuel consumption. If an oil burning unit is replaced with one using natural gas, the reduction in CO<sub>2</sub> emissions could be as high as 50%. If you don't know the AFUE of your current system, a service technician should be able to determine it.

Other measures to increase heating efficiency in residences include:

- Insulate heating pipes that pass through unheated spaces.
- Remove obstructions from radiators and clean heating registers regularly. Create some space between heating elements and furniture or drapes to improve heat circulation. Use floor level deflectors for more efficient forced hot air heating and cooling.
- The temperature of the water in a boiler is regulated by a device called an aquastat. Usually set at 180°F, the aquastat can be set to a lower temperature, say 140°F, when heating demand is low.
- Have certified maintenance personnel check and service your furnace regularly—every two years for gas fired furnaces and annually for fuel oil furnaces. Replace furnace filters according to manufacturer's instructions.
- Inspect hot water radiators and bleed trapped air as necessary. This problem shows itself in radiators that are not evenly warm.

## Summer Cooling

The use of air conditioning is responsible for the peak in electrical energy consumption that occurs every summer. Measures you can take to reduce energy used for summer cooling include:

- Install air conditioning units that are Energy Star certified and have the highest Energy Efficiency Rating (EER). New room air conditioners are available with an EER as high as 12 in comparison with an EER of eight for typical older units. The saving in energy use (and of

emissions at the power plant) is 33 percent.

- Reduce heat gain from air infiltration through leaks, and loss of cooling through leaky ducts of central air conditioning systems.
- Install insulation and energy conserving windows to reduce heat loss in winter and reduce heat gain in the summer.
- Insolation, solar energy coming in through south-facing windows, is a major source of heat gain—very welcome in winter, but costly in the summer. Passive solar design using overhangs on south-facing walls are very effective, permitting energy gain from the sun in winter while blocking it in the summer.
- Deciduous trees that shade the south side of a house in the summer reduce the need for air conditioning. The presence of trees around a house also reduces heat transfer from the wind, both in summer and in winter.
- Add awnings to redirect sun from windows and reduce cooling costs in summer.

### **Recommendation: Use heating/cooling only where and when it is needed.**

An important way to save energy for space heating and cooling is to refrain from heating or cooling parts of the residence not in use or when space is unoccupied. A good way to help achieve this goal is to divide the residence into several heating/cooling zones, with separate thermostats for each zone. As this might present an unaffordable expense, here are some alternate recommendations.

- Programmable thermostat(s). Buy a clock-thermostat, and during the heating season, program it to 65 to 68° F when the house is occupied. At night or when the house is unoccupied, set it back by as much as 10° F. On vacation, set it back to 50 to 55° F. Note that these recommendations may not apply for radiant heating systems.
- Close doors to unused rooms and shut off heat registers and radiators in them.
- Use local heating appliances, so the whole room does not need to be kept as warm.
- Use door “snakes” and other insulation devices in areas with troublesome drafts.

## Appliance Efficiency

### **Recommendation: Use energy-efficient appliances and lighting.**

<sup>22</sup> <http://www.trane.com/Residential/Products/Furnaces/abc.aspx>, January 7, 2008

### On Demand Water Heating

Conventional water heaters, whether gas-fired or electric, continuously lose energy from the storage tank full of hot water. Also energy is wasted heating the water that sits in pipes running from the heater to points of use. Both of these problems are solved with an “on-demand” water heater placed near points of use. The best choice for energy efficiency is a gas-fired unit as shown above, but these require a gas line and venting to the outside, which could make installation in existing buildings difficult.



Gas-fired on-demand water heater.  
Photo: Oregon Department of Energy

**The Water Heater.** Water heating is a major use of energy in residences. In most homes a central water heater is installed using either electricity or natural gas as the energy source. Sometimes, the water heater may be integral with the heating system boiler, or may be an oil fired unit. In these installations, water is piped to points of use in the bathrooms and kitchen.

- Use of an “on demand” water heater eliminates losses from the hot water tank and long plumbing lines to fixtures.
- A water heater fueled with natural gas is much more efficient than electric units and

significantly more efficient than one fueled with oil.

- Insulate pipes that convey hot water to points of use.
- Wrap the water heater with an insulating blanket, unless it is already insulated. If the tank is warm to the touch, it can use additional insulation.
- A water heater that operates “on demand” and heats water only as it is being drawn for use will eliminate heat losses from the water heater, and if placed at or close to the points of uses, will eliminate losses from piping.
- Solar water heating is an economically sound way of providing domestic hot water. Solar collectors may be installed where there is good southern exposure and the heated water is circulated to a hot water storage tank. A gas-fired heater can be used to supplement the solar energy over periods with little sunshine.
- Set water heater temperature to a lower water temperature; 120° F is recommended. Turn hot water heater off when on vacation.
- Use less hot water. Install low flow showerheads. Less hot water requires less energy to heat the water. Look for aerators that have an on/off lever.

**Laundry and Dish Washing.** Energy used in washing clothes and dishes is a significant source of CO<sub>2</sub> emissions. In clothes washers and dryers, and in dishwashers, the prime use of energy is for heating—hot water for washing, and air for drying. As with space heating, the most favorable fuel for these heating applications is natural gas. Of course, savings can result from using the minimum amount of heat feasible. Here are some suggestions:

- Front-loading clothes washers generally use less water and energy than top-loading models. Also, they can handle partial loads using less water and energy than a full load.
- Wash your clothes in cold or warm water. Rinse clothes in cold water. A whopping 85–90 percent of the energy used by washing machines is for heating the water! Use cold or warm water for the wash cycle, instead of hot water. Hot water shrinks and fades clothes and wears them out more quickly. Using warm or hot water for the rinse cycle does not get clothes any cleaner.
- Don’t hand pre-rinse dishes. Just scrape off food and load. Run only when full because most dish

washers do not alter their operation for partial loads.

- Air drying clothes on an outside clothesline will avoid a lot of emissions.

**Home Lighting.** Lighting is a surprisingly large consumer of electrical energy, yet people are used to the idea that lighting is so cheap that it is not worth worrying about conserving its use. However, lighting is responsible for roughly one-fourth of household requirements. Today, light sources are available that provide three times as much light for the energy used than the familiar incandescent light bulb. Fluorescent lighting is currently the primary choice, and compact fluorescent bulbs are generally available that can directly replace incandescent bulbs in typical fixtures and lamps. Another choice is LED lighting devices, which are very efficient; however they remain relatively expensive and have special installation requirements. An advantage of LEDs is that they are dimmable, whereas many current CFLs are not.

- Replace all incandescent bulbs with compact fluorescent lights.
- Turn off lighting not in use.

**Other Appliances.** Of the remaining appliances found in the home, the biggest consumer of energy is the computer, video, or television screen. Aside from choosing the most efficient models, the most important recommendation is to turn them off when not being used.

**Phantom Energy.** Many electronic devices in the home, including computers, televisions, and communications equipment, draw small amounts of electrical energy, even when nominally turned off. Energy can be saved by disconnecting these equipment from the power source when they will not be needed for a long period of time.

### **Alternative Heating Methods**

**Recommendation: Employ alternative energy sources where feasible.**

Emissions from natural gas and heating oil usage can be reduced by using alternative forms of heating, some of which are complementary or supplementary to other sources.

- **Passive Solar:** Passive solar building design exploits the sun's radiation as a source of energy. This involves taking full advantage of the sun's

## **Energy Star**

Energy Star is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy helping consumers save money and protect the environment through energy efficient products and practices. Through its partnerships with more than 12,000 private and public sector organizations, Energy Star delivers the technical information and tools that organizations and consumers need to choose energy-efficient solutions and best management practices.

Energy Star has successfully delivered energy and cost savings across the country, saving businesses, organizations, and consumers about \$16 billion in 2007 alone. Over the past decade, Energy Star has been a driving force behind the more widespread use of such technological innovations as efficient fluorescent lighting, power management systems for office equipment, and low standby energy use.



Energy Star also provides easy-to-use home and building assessment tools to help homeowners and building managers work toward greater efficiency and cost savings (see <http://www.energystar.gov>).

energy during the colder seasons while sheltering the building from the sun in the warmer seasons. During the winter when the sun is lower in the sky, the sun's energy is allowed to enter unobstructed through large south-facing windows. During the summer when the sun is higher in the sky, an overhanging roof prevents the sun from directly entering the building, thereby reducing energy input and the need for cooling. Passive solar design also includes the use of massive interior structures such as masonry walls and brick fireplaces that can even out daily temperature variation by absorbing heat during the day and releasing it at night, and vice versa in the summer.

- **Active Solar Heating:** This method is most commonly used for heating hot water using rooftop solar collectors to heat water which is piped to an insulated storage tank. Installation requires space for the storage tank, pumps and controls, a suitable location for the collectors with good solar exposure, and the possibility of running pipes between them. A back-up heater is provided to cover long periods without sunshine. As the cost of energy increases,

solar water heating is increasingly practical and cost-effective. Solar collectors can also be used to heat water or air for space heating. It takes a substantial area of collectors to absorb sufficient energy, and a large storage capacity—either a water tank or a bin of rocks. The investment is substantial, but reducing heating expense and carbon emissions to near zero has a big attraction.

- **Photovoltaics:** Photovoltaic cells come in sheets that may be placed in a location with good solar exposure to produce electricity with no carbon emissions.
- **Heat Pumps:** A heat pump system is an electrically powered refrigeration system that can provide cooling during the summer, and, by operating in reverse, can provide heating in the winter. Heat pumps generally use the outside air as the sink for heat when cooling and as the source for heat when heating. Heat pumps are becoming more popular in building construction because they can provide heating and cooling in a single unit. As a cooling system a heat pump has the same efficiency characteristics as an air conditioner and is rated by its EER (energy efficiency ratio). As a heating system, a heat pump works best if the source of heat is no colder than about 50°F. Consequently, they are not very attractive in the coldest climates. However, a heat pump system that uses the earth for its heat source (which maintains a steady temperature of around 55°F year round) can be a very effective heating system, with a substantial reduction in associated CO<sub>2</sub> emissions (from electricity use) in comparison with direct use of fossil fuels. Such systems are known as geothermal heat pumps.

We can expect that most houses will be subject to remodeling or replacement over the next forty years, so, over time, a major reduction in carbon emissions is possible.

- Sign up for the Belmont Municipal Light Department's "Green Choice" program to purchase electricity that comes from renewable sources (wind, solar, and biomass).

### **LEED for Residential Buildings**

Leadership in Energy and Environmental Design (LEED) is a voluntary set of criteria established by the Green Buildings Council to encourage building construction practices more respectful of environmental effects.<sup>23</sup> The LEED program

23 LEED programs are the work of the United States Green Building Council. Further information may be

### **Capturing Solar Energy**

Solar panels can be used to absorb heat from solar radiation and/or to generate electricity. As a source of heat, solar collectors are already economical for water heating in most parts of the United States, including Massachusetts. Solar space heating requires more panels than most people would care to have on their roofs unless their home is very well insulated. Electricity is generated using photovoltaic panels, which are becoming increasingly cost-effective with advances in technology and manufacturing techniques. Installations will have an economic benefit with the availability of net metering, as exchange of energy with the power grid avoids any need for expensive energy storage.



This residence in Missouri has five 4' X 8' solar panels installed. The panels, together with the solar green house, provide 40%-50% of the heating needs for the home during the winter and a year-round supply of domestic hot water. Photo: Ken Riead/NREL

found at the USGBC website at [www.usgbc.org](http://www.usgbc.org). defines a variety of criteria relating to conservation practices, energy efficiency, use of local and/or reusable materials, and effects on the local ecoculture, and so the goals of LEED do not relate just to the carbon footprint of the building. Satisfaction of each criterion earns the builder points toward a level of LEED certification; the levels currently provided are Certified, Silver, Gold and Platinum. The original LEED program applies to public and commercial buildings, and requires inspections by qualified examiners to verify that the claimed criteria have been met before certification can be given. LEED is now available for residential construction. However, the program is more applicable to development projects and multi-unit housing than for the individual owner/

### A Model Green Home

Tufts University Professor William Moomaw and his wife, Margot, have built a retirement home in Williamstown, in Western Massachusetts, that is designed from the ground up with the environment in mind. From the original site selection and house orientation to the 63 solar panels that adorn its roof, Moomaw's home is a model of sustainability.

Their goal is to live in a home that produces more energy than it uses. In the winter, when days are short and direct sunlight is scarce, the Moomaws will draw from the power grid to supplement their energy production, but in the sunny summer, due to a net metering arrangement with the local power provider, they will sell energy back to the grid. The house is super insulated, with a very tight building envelope, and heated using a ground source heat pump. Appliances have been carefully selected that are not energy hogs, and this also makes a significant contribution toward meeting their goals.

While the house employs a lot of special technology, the first rule is that their residence must look and feel "normal." The architecture matches turn-of-the-century New England-style houses in the area. And the home will have a TV, computers, a washer/ dryer, and other typical amenities. "We're not going into a cave and using candles," says Bill. "We want to show that you can [be energy-efficient] by buying common brands," adds Margot. "You just have to do careful shopping."



builder due to the inspection requirements. Note that no defined level of carbon emissions is guaranteed by any level of LEED certification; the results depend on which of the criteria have been satisfied. However, points toward LEED certification are awarded for all of the recommendations provided above.

### Greening Lawn Care

One way to reduce carbon emissions is literally in back (or front) yards. Traditional fertilizers are derived from petroleum-based products. Although fast acting, they draw nutrients from the soil. A better choice, both for the lawn, as well as reduction of carbon emissions, is to use a natural fertilizer, such as corn gluten, which can also be purchased as a pre-emergent weed killer. Corn gluten (available locally at garden supply stores) is more expensive than conventional fertilizer/ weed killer but it's also healthier for the lawn and is nontoxic for pets and humans.

Switching from gas-powered to electric lawn equipment (mowers, trimmers, leaf blowers, etc.) also makes a significant difference in carbon reduction, reduces air pollution (it's estimated that mowing, trimming, and blowing contributes up to 10 percent of the nation's air pollution every summer), is much quieter, and saves money. See below for just one example.

Gas-powered Lawn Mower Running 45 minutes	Electric Lawn Mower Running 45 minutes	Push Mower Running 45 minutes
BTUs of energy used: 50,000	BTUs of energy used (in Kwh): 2,500	BTUs of energy used: 0
Estimated cost to run for season (gas/oil): \$45	Estimated cost to run for season (electricity): \$5	Estimated cost to run for season: \$0
	Bonus: 90% less polluting than gas mower*	Bonus: 100 % less polluting than gas mower*
*Based on hydrocarbons, particulate matter, carbon monoxide, and greenhouse gases emitted		

Source: SafeLawns.org

### Energy Savings Programs

The main natural gas provider (National Grid,) offers a number of energy saving programs for Belmont homes and small businesses.<sup>24</sup> These include rebates up to \$1,000 for high efficiency boilers, furnaces and water heaters, and rebates for clock thermostats and Energy

<sup>24</sup> See [http://www2.nationalgridus.com/pshome/energy/saving\\_ma\\_kedma.jsp](http://www2.nationalgridus.com/pshome/energy/saving_ma_kedma.jsp).

Star windows. Through the Residential Weatherization Program, National Grid will pay a portion of the cost of weatherizing homes using an approved contractor. This program includes attic, crawlspace and wall insulation, ductwork leakage testing and sealing and other energy efficient measures. The full cost (up to \$4,500) is covered for low-income residents. National Grid should be encouraged to mail/e-mail out rebate forms biannually to Belmont customers with utility bills. These rebates and immediate cost savings from lower utility bills due to high efficiency appliances

and behaviors should be marketed throughout the Belmont community. Note that rebate programs may change. Some information resources are provided in Appendix G.

One of the largest complaints received from those wishing to make energy efficient improvements is that they are often cost prohibitive. One must be able to look at conservation and efficiency improvements as long-term investments that will prove their worth over time in reduced energy expense.

## Transportation

In Belmont, transportation is one of the two largest contributors to the Town's total CO<sub>2</sub> emissions. Whether measured by fuel use or vehicle miles traveled, emissions caused by transportation increased between 2001 and 2006. Transportation-related emissions generated by the residential sector far outnumber those by the municipal sector. However, reducing transportation-related emissions from Town-owned vehicles may have an influence on changing behavior in the private sector. The recommendations are aimed at reducing carbon emissions by reducing fuel consumed in all sectors. Reducing automobile use by encouraging carpooling, public transit, walking to school and other alternative means of transportation is one goal. Another is to increase fuel efficiency and reduce carbon emissions by encouraging use of hybrids and other fuel efficient vehicles and vehicles that use alternative, cleaner fuels. In the long run, transportation costs will be reduced by people living closer to where they work, and living in more compact communities close to transportation centers.

### **Personal Transportation**

**Recommendation: Practice conservation and energy-efficiency in choice and use of personal vehicles.**

Most of the time people drive vehicles that are too big for the job they are doing, most commonly taking one person from home to the job or to the store for groceries. With increased cost of fuel, it may be best to use two cars, a small vehicle for single person travel and a second vehicle for family outings and vacation travel. The second vehicle could be a rented car or a shared vehicle.

- Use the model of vehicle that is the right size for the job and contributes the least pollution per mile of operation.
- Maintain and operate a vehicle so as to achieve the most economical performance. Keep the engine tuned and tires properly inflated. Refine your driving habits to conserve energy.

**Recommendation: Walk or bicycle whenever feasible.**

**Recommendation: Reduce use of private automobiles**

In choosing where to live and where to work, the emissions cost of commuting to work should be an important factor. Telecommuting when feasible and use of conference calls for meetings can make a significant difference. Make each trip count for more by chaining errands.

**Recommendation: Eliminate use of private automobiles. Households should consider using ZipCar.**

**Recommendation: Use shared transportation: car pools, vans and public transit.**

Using an online ride-sharing service, such as Go-LoCo ([www.goloco.com](http://www.goloco.com)) would encourage carpooling. Businesses and the Town could promote van pools. As Belmont is fortunate to have both commuter rail and bus service within walking distance of many homes, businesses and government offices, individuals should make better use of these services, especially for work commutes.

**Recommendation: Consider CO<sub>2</sub> emissions in planning personal travel.**

Personal travel for business and pleasure is a significant area where choices made by Belmont residents can

### **Idling Reduction**

Idling of vehicle engines is a significant source of unnecessary emissions. Scientific studies show that the optimum time, from an economic viewpoint and for the vast majority of automobiles on the road, is 10–30 seconds, that is, if the vehicle will be used within thirty seconds of the time it is stopped, it is better to leave the engine running. Otherwise, turning the engine off will reduce engine wear, decrease fuel use and avoid emissions. If idling time is reduced, a corresponding reduction in CO<sub>2</sub> emissions will be achieved. For information about idling facts and myths as well as Sustainable Belmont's Cleaning the Air Campaign (anti idling initiative), see the Healthy Homes/Healthy Community section at <http://www.sustainablebelmont.net>.

affect the amount of CO<sub>2</sub> emissions generated. Tables 11 shows average emissions cost for several popular travel modes.<sup>25</sup> Two tables are used because airline travel includes fixed costs per flight for ground operations, take-off and landing. Therefore emissions-per-mile for travel by air depends significantly on the distance traveled. Travel by car is the only mode for which the traveler can decrease emissions-per-passenger-mile by bringing along companions. When planning a personal trip, the traveler should give preference to the transportation mode that has the lowest emissions cost.

### **Food and Transportation**

#### **Recommendation: Consider production and transportation CO<sub>2</sub> emissions in food purchases.**

An area that is a very significant source of carbon emissions is the transportation of food from its point of production to the point of use—a distance estimated to average 1500 miles. If informed about the transportation component in food, Belmont residents could make choices that reduce the carbon emissions cost of their food purchases.

### **Town Programs**

There are several possibilities for Belmont to help residents get around with less dependence on private cars.

**Town Shuttle:** Public transportation available to Belmont residents serves those who wish to travel to Cambridge or Boston. There is no convenient public means for residents to travel between parts of Belmont or to adjacent communities such as Arlington or Watertown. It may be feasible to implement a town shuttle service that would connect business centers, metropolitan and regional transportation facilities, and residential areas. The goal would be to replace the use of automobiles for travel around town or to reach public transportation. At a minimum this town-wide service should connect Waverley, Cushing Square, Belmont Center, and the Alewife MBTA station. The Town could identify the appropriate vehicles, routes, and timetables

<sup>25</sup> *Getting There Greener: The Guide to Your Lower-Carbon Vacation.* Union of Concerned Scientists, 2008. Online at <http://www.ucsusa.org/gettingtheregreener>.

### **Food and Greenhouse Gas Emissions**

A 2006 report from the United Nations found that worldwide production of animal products for consumption as food accounts for 18 percent of greenhouse gas emissions. In the United States, food production, processing and distribution accounts for 17 percent of all fossil fuel use and is comparable to the energy consumed by our private cars.

Let us define diet energy efficiency as the ratio of gross diet calories to the energy used to produce the food. Energy efficiencies for several food categories are shown in the table, as reported by a 2006 study from the University of Chicago.

<b>Food Category</b>	<b>Energy Efficiency Ratio (%)</b>
Milk	20.6
Eggs	11.2
Beef	6.4
Pork	3.7
Poultry	18.1 (chicken)
Fish	0.9 (shrimp) 5.7 (farmed salmon) 110 (herring)
Plants	123 (potatoes) 500 (oats)

In the average American diet 72 percent of calories are from plant-based foods, the remainder coming from a mixture of animal sources. The University of Chicago study shows that changing to a totally vegetarian diet would yield a 78 percent reduction in energy used for food production, with a corresponding reduction in CO<sub>2</sub> emissions. This calculation does not include emissions from transporting food to the consumer and ignores methane and other emissions associated with livestock production.

The National Sustainable Agriculture Information Service of the U.S. Department of Agriculture recommends that individuals eat less red meat, buy locally grown foods, plant a garden, and eat foods that are minimally packaged and processed and are “in season.”

for a “Town Shuttle.” This would provide a basis for evaluating its feasibility and deciding what type of cost-recovery mechanism to use to fund the capital and operating needs of the service.

**Safe Routes to School:** Safe Routes to School (SRS) is a program implemented by Walk Boston that looks to increase the number of children walking or bicycling to school. The Town of Belmont and the Belmont School Committee should encourage children to walk, bicycle or use public transportation to

travel to school and also provide education to them about how to do this safely. Using alternate forms of transportation to school teaches children that walking and bicycling are legitimate transportation alternatives to driving (see box on page 64).

**Road and Intersection Improvement:** In road and intersection design much can be done to make our town friendlier to pedestrians and cyclists. In addition, careful design should lead to less idling of vehicles.

**Transportation Information Center:** A Belmont Transportation Information Center would help residents and visitors learn about the variety and ease of travel alternatives available in Belmont. The Center would include brochures highlighting alternative modes of transportation, maps and schedules of bus routes that travel through Belmont, information regarding the best and safest walking and bicycle paths through the downtown as well as information about car sharing options. The Center should have a highly visible and readily accessible physical location as well as a presence on the internet. The information provided should help residents make informed transportation choices that favor lowering town emissions. The Center could sponsor a phone center manned by volunteers to supplement an internet-based rideshare program.

**Ride Share Program:** A Belmont rideshare program offered through a public internet site would encourage the use of carpools and vanpools for trips and daily commuting. A rideshare and carpooling website would increase mobility, reduce air pollution, decrease fuel consumption, decrease traffic congestion, and offer an alternative to the single occupant vehicle. The Vermont Public Transportation Association maintains a ride share and carpooling website<sup>26</sup> that demonstrates the workability of a rideshare system to improve transportation and reduce emissions.

**Zipcar:** The Town should contact the Zipcar company to find out if it would be economically viable to have Zipcar locations in Belmont for residential, business, 26 Vermont Rideshare, <http://www.vermontrideshare.org>.

**Table 13. Carbon Emissions from Travel by Car, Train, or Bus**

Mode	Pounds of CO <sub>2</sub> per 100 Passenger-Miles		
	Number of Passengers		
	1	2	4
Heavy SUV	208	212	221
Typical SUV	139	142	151
Typical Car	108	112	121
Efficient Car	78	81	89
Hybrid Car	54	56	60
Train–Diesel	45		
Train–Electric (Northeast Corridor)	37		
Inter-city Bus (Motor Coach)	17		

and town employee use. Households and individuals could consider using Zipcar to replace a second car or to use as a primary vehicle. This is a good option for those who primarily rely on public transportation or walk or bike. A car or truck can be reserved minutes or months in advance in increments as little as an hour. This is a pay as you go system. The company estimates that each Zipcar takes 15–20 personal vehicles off the road. Currently there are several Zipcar locations in Cambridge. [www.zipcar.com](http://www.zipcar.com)

**Bike racks:** Installing additional bike racks at Town Hall, public schools, commercial centers, and other destination points to reduce carbon and help decrease traffic congestion. Cost could be supplemented or completely offset through grants. The Town should also assess current bike rack locations to determine if they are in appropriate places or should be relocated.

## Government Programs

**State and Federal Subsidies:** The Transportation Equity Act for the 21st Century, known as TEA-21, is the federal authorizing legislation for surface transportation. The funds are allocated and administered through the states. Under TEA-21, funds can be spent on pedestrian and bicycle facilities and on public transportation. TEA-21 also includes some programs that fund projects to provide clean air

benefits. The major programs are:

- The Congestion Mitigation and Air Quality Improvement (CMAQ) program, which funds projects to help meet the requirements of the Clean Air Act, e.g., transit improvements and public fleet conversion to cleaner fuels.
- The Transportation Enhancement Program, which can pay for bicycle, pedestrian and transit facilities and improvements.

**Clean Cities Program:** The Town of Belmont should take advantage of the Clean Cities Program. Under this federal program, Belmont can be reimbursed for the difference in cost between a conventional and an alternative fuel vehicle. The Division of Energy Resources (DOER) offers \$2,000 grants to offset the incremental cost of purchasing each additional alternative fuel vehicle. The program also provides assistance for creating the infrastructure needed for alternative fuel vehicles.

## Business and Institutional Sector

The business and institutional sector forms a small but important part of the town of Belmont. “Business” refers to businesses and industry; “Institutional” refers to hospitals and nursing homes, independent schools, clubs, houses of worship and meeting halls. Together, the commercial and institutional sectors generate approximately 16% of the total carbon emissions from Belmont.

### Geothermal Heat Pumps

Besides being an attractive large-scale energy source, geothermal heat can be exploited for energy-efficient heating systems in buildings such as the Cambridge Savings Bank Office in Belmont Center shown above. Geothermal heat pumps exploit stable ground or water temperatures near Earth’s surface to control interior building temperatures. While temperatures above ground change a lot from day to day and season to season, soil, rock and water a few feet below the Earth’s surface hold a nearly constant temperature between 50 and 60°F.

In general, heat pumps transfer heat from a thermal source into buildings in winter and reverse the process in the summer. Normal heat pumps use the outside air as a source or sink for heat. Geothermal heat pumps use the Earth’s mass as a source or sink for space heating and cooling. The difference is that geothermal heat pumps transfer the heat across a smaller temperature difference and therefore operate with greater efficiency.

According to the U.S. Environmental Protection Agency (EPA), geothermal heat pumps are the most energy-efficient, environmentally clean, and cost-effective systems for temperature control and are increasingly being used. In recent years, the U.S. Department of Energy along with the EPA have partnered with industry to promote use of geothermal heat pumps.

In 2007 Sustainable Belmont conducted a “limited sample” survey of commercial and institutional entities in Belmont to obtain data relating to carbon emissions that were not available from public sources. Sustainable Belmont had received comprehensive data from the Belmont Municipal Light Department, but also sought data relating to natural gas and fuel oil consumption, amount of waste generated and its disposal, vehicle use for business purposes and employee commuting practices. Businesses and institutions that reflected diversity of size and mission were selected. Forty-one businesses and institutions participated, of which three were houses of worship and six were other kinds of institutions.

The survey showed that most businesses and institutions are very aware of the challenge to reduce energy consumption and lower carbon emissions. An impressive example is the new Belmont offices of the Cambridge Savings Bank, where the use of a geothermal source/sink for heating and air conditioning has been installed. Noted, too, was the commitment of McLean Hospital to provide a shuttle bus for its employees traveling between the hospital and Waverley Square, as well as its recent decision to establish a “green committee.”

Belmont’s business and institutional community mirrors that of the residential sector: the preponderance of energy is used in heating, cooling and lighting the buildings. Most recommendations for residential buildings, stated earlier in this report (page 43), also apply to commercial and institutional buildings—with some differences. For example, large retail operations tend to use a lot of electricity for lighting and refrigeration, and less energy per square foot for heating due to the size of buildings. Electricity use supplies a significant portion of the heating needed in winter, but increases the air conditioning load in summer.

### ***Efficiency and Conservation to Save Energy***

**Recommendation: Get an energy audit of the building(s).**

An energy audit is a very good place to begin. Whether the audit concerns one or many buildings, the cost-payback analysis of and recommendations from the

audit will guide the development of a plan for energy savings.

Energy audits can be arranged through the National Grid gas company, the Belmont Municipal Light Department and private energy companies. At least a portion of the BMLD program may be subsidized. Large institutions, with several buildings, may wish to consider undertaking an ESCo-type project to reduce energy use.

One caveat to keep in mind when committing to an energy audit by a utility company: most energy audits focus on short-term solutions—that is, most recommend immediate and affordable steps to take, suggesting that the second level of actions is more expensive. However, particularly if the business owner also owns the building, it may be prudent to consider long-term, more expensive solutions as well, with the intention of addressing them sooner. Though more expensive, their payback is possibly more substantial and their impact greater. Additionally, some energy audits tend not to suggest alternative technologies, even though some of them may be well worth considering. To help its commercial customers save energy, Belmont Municipal Light Department (BMLD) currently (2009) offers a \$2,000 discount on commercial energy audits. Audits are conducted through a BMLD partnership with Energy New England. Call 1-888-772-4242.

**Recommendation: Take advantage of as many no-cost energy-savings practices as possible.**

These might include: use window shades as passive-solar devices; avoid “phantom” energy use by turning computers and other equipment completely off at night—rather than putting them in “sleep” mode; lower the temperature of hot water heaters at night and on weekends; consume less electricity overall. Not all energy-savings steps need to cost money. Many personal behaviors and practices result in wasted energy and could be changed.

**Recommendation: Emphasizing conservation and improved efficiency, take all reasonable and appropriate steps to reduce energy use.**

These might include: immediately install energy-efficient lighting (e.g. replace incandescent light bulbs with compact fluorescent lights), improve insulation, increase the efficiency of the heating and air conditioning systems, and—when replacing appliances

and computers—purchase Energy Star models or their equivalent. These steps will make a significant difference in energy bills while also reducing the CO<sub>2</sub> emissions of a business or institution. The energy audit will inform about what specific steps are appropriate and payback period a building’s needs.

**Recommendation: Educate employees about energy-saving behaviors at work.**

Employees can help reduce energy use in a variety of ways. They might ensure: that heat vents and radiators are not blocked; that computers and other electronic devices are both turned off and unplugged at night; that fresh air is used as an appropriate alternative to air conditioning for much of the year. Employees themselves may have sound suggestions to offer; consider an incentive or reward for good ideas that are implemented. Establishing target reduction goals—and celebrating or rewarding employees’ achievement—encourages shared responsibility and team effort.

**Transportation**

**Recommendation: Select and operate business vehicles and equipment for conservation and efficiency.**

Businesses and institutions in Belmont operate a total of approximately 302 vehicles in their activities, the greatest number being used by landscape contractors and construction companies. Efforts should be made to select, maintain and operate vehicles for highest fuel efficiency, and to minimize the miles traveled to perform jobs. Retrofitting heavy equipment to use biofuel cuts emissions and fuel costs significantly; business owners should investigate this option. Additionally, new technologies are being developed to help reduce idling on heavy trucks. As these technologies become available, significant savings in energy and emissions will be possible.

**Recommendation: Encourage energy-conscious commuting choices for employees.**

The survey showed that the great majority of employees of town businesses travel to work in single-occupant personal vehicles. A significant emissions reduction could be achieved through carpooling, more walking and biking, and increased use of public transportation. Larger businesses may wish to investigate reduced T-cards for employees. The installation of bicycle racks and showers, where feasible, also encourages biking to work.

**Recommendation: Offer flexible hours and encourage telecommuting.**

Some businesses and institutions may be able to offer their employees the opportunity to work a full work-week but on a four-days-a-week schedule. Some employees may have jobs that are essentially sitting at workstations, and could telecommute for a given number of days. Such arrangements, where feasible and appropriate, cut down on the number of automobile trips the employee makes, resulting in energy conservation.

**Recommendation: Comply with the state’s anti-idling law<sup>27</sup> and encourage others to do so as well.**

This state-wide law, on the books for more than 30 years, prohibits the unnecessary operation of the engine of a motor vehicle, while stopped, for a period of time in excess of five minutes. The law helps to protect the health of our citizens, particularly the children, and reduces CO<sub>2</sub> emissions. It applies to all vehicles with a few exceptions (e.g., refrigeration trucks). It is gaining increasing public attention and should be of particular interest to vehicle owners because idling is wasteful of gas, reduces the life of the vehicle, has significant health impacts on the population, and contributes to global warming. But implementing it is a challenge. Businesses with fleets should make clear that their drivers understand the benefits of not idling and are expected to obey the law. Additionally, all business owners should expect delivery trucks to adhere to it.

***Purchasing Practices and Negotiated Contracts: Using Your Greenbacks***

Utilizing purchasing practices that favor green sustainable options, including the negotiation of future contracts, offers significant potential to influence CO<sub>2</sub> emissions by commercial enterprises.

**Recommendation: Consider adopting a policy that all bids and contracts will include language that requires or encourages vendors to adopt sustainable, energy saving practices.**

Choosing where and how we spend our dollars is one of the most effective means to change the behavior of others. For example, consider giving a priority

to doing business with companies that use or sell recycled paper products; companies that reject excess packaging and/or that use carbon-neutral packaging materials; companies that use carbon-neutral shipping; companies that specialize in using or selling products made with local resources or from recycled materials.

***Opportunities for Collaboration***

**Recommendation: Organize a trash-collection and recycling program for businesses and institutions in Belmont, either through the Town or as a separate organizational entity.**

A major opportunity exists in the handling of commercial waste. Much recyclable waste is currently disposed of as trash. The business survey revealed that many businesses would welcome (and pay for) a town service that would collect recyclable materials from businesses and institutions. Of note is the fact that much commercial waste is cardboard boxes which, if segregated, have a significant value in the recyclables trade, suggesting the possibility that other recycling and trash-collection costs might be partially offset.

**Recommendation: Provide incentives to landlords to take energy-saving measures.**

Businesses “sharing” a landlord (especially renting space in the same block from the same landlord) may wish to arrange an energy audit together, perhaps saving on the cost of the audit and putting the businesses in a stronger position to negotiate with the landlord regarding energy-saving steps. They may also wish to collaborate on more than an energy audit: for example, they may make a proposal to share the cost of energy-saving alterations with the landlord, with agreements on both sides regarding such question as tax deductions (if applicable) and extended contracts without increase in rent; discussions with realtors about the enhancement of property values may help owners to see the financial advantage in investing in energy upgrades. In other words, work for a “win-win” agreement—solutions that bring savings and benefits to both owner and renter.

**Recommendation: Organize informational meetings and workshops for businesses in Belmont to share the results of the business survey, discuss options, and learn more about ways to increase energy conservation and efficiency.**

Opportunities to learn collaboratively may be

<sup>27</sup> MGL, Chapter 90, 16A and 310 CMR, 7.11.

especially useful to busy business owners for whom it is inefficient and discouraging to research energy matters and take action in isolation. Such collaborative efforts may produce additional benefits for the Belmont business community as a whole. Business owners may wish to consider joining the Greater Boston Sustainable Business Leader program (<http://www.sustainablebusinessleader.org>). The Belmont/Watertown Chamber of Commerce may be another good source of information.

### **Food and Energy**

**Recommendation: Purchase local foods; compost appropriate organic waste where feasible.**

The survey informs us that several restaurants in town purchase local produce; and a couple of food stores engage in a limited form of composting off-site to dispose of appropriate organic waste. These practices, when feasible, should be encouraged.

### **Recommendations to Institutions**

Larger institutions will all benefit from considering the recommendations made above. Additionally, here are a few recommendations particularly appropriate for them.

**Recommendation: For multi-building complexes, consider an ESCo-type program in lieu of a standard energy audit. (See description on page 22 of this report.) Such a program enables the financing and implementation of multiple energy-saving steps all at once, thereby ensuring that the loan is paid back from cost savings in a systematic manner.**

The challenge with such a program is to remember that much of the work will address the “low-hanging

fruit “through which payback begins as soon as the renovations are complete. The model is an effective way to address multiple energy problems and to finance the changes required. However, implementing this model leaves still to be addressed some of the larger, more expensive and long-lasting renovations—including alternative energy technologies—necessary for a sustainable future, yet whose payback may exceed the length of the traditional contract.

**Recommendation: Provide shuttle buses or van pools for transportation from hubs.**

This is an option for institutions that are not located near transportation centers and that have a large work force, particularly groups of employees who work on regular “shifts.” It greatly reduces carbon emissions, air pollution, and traffic congestion.

**Recommendation: Houses of worship are encouraged to investigate and join Massachusetts Interfaith Power and Light.<sup>28</sup>**

This is an organization that specializes in and is designed specifically to assist houses of worship in addressing their energy needs. The organization’s web site gives this description: “A non-profit initiative offering Massachusetts congregations of every religious tradition a comprehensive means of reducing energy consumption, lowering operating costs, and promoting clean, renewable energy in houses of worship and related buildings. In short, we are a mutual ministry working with the community of faith toward environmental justice and care of creation.”

**Rcommendation: Businesses and Institutions should conduct an energy audit.**

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<sup>28</sup> Online at <http://www.mipandl.org>.

## Town Government

This section includes recommendations for the municipal sector including both general government and the schools. **Note:** In some case the Town (including the Belmont Municipal Light Department) is in process of implementing some of the recommendations.

### **Municipal Sector**

The single most important step that the leadership of the Town can take is to make clear to both residents and employees—by word and by deed—that it is committed to the goal of reducing greenhouse gas emissions to 80 percent below 2007 levels by 2050. Commitment to this goal should be made clear by its explicit adoption, by taking visible steps to launch its implementation and by giving maximum visibility to steps taken toward the achievement of the goal. Belmont’s government—both on the “town” side and on the “school” side—must be an exemplar of conservation and energy efficiency and must help us all anticipate a fossil-free future by using alter-native fuels whenever possible. Through policy initiatives and actions, it can facilitate progress by the other sectors of the community in meeting the Town’s goal.

### **Implementation and Oversight**

#### **Recommendation: Hire an Energy Manager.**

The Energy Manager will have responsibility for guiding implementation of this climate action plan and monitoring progress.

**Funding:** It is acknowledged that this recommendation is a “tough sell,” given the perilous financial times in which we live. The decision to recommend this position is not lightly taken; creating such a position ensures accountability in the quest to reduce energy use and carbon emissions throughout the Town.

Town leadership is encouraged to explore a variety of financing possibilities for this position, for example:

- Time sharing the job with another community;
- Initial staffing by a qualified volunteer working for the first year for a stipend, on a basis similar to that of the Selectmen, with an understanding that after savings are achieved and documented, it would become a salaried position;
- Contributed funding by the BMLD;

- Securing grant money to assist in funding this position initially;
- Incentivizing the compensation by tying it to the results sought (saving money and CO<sub>2</sub>).

#### **Responsibilities:** The Energy Manager could:

- Oversee, monitor, and report on the Town’s progress in reducing the carbon footprint of the entire community;
- Work with town departments, committees, and resident groups to provide general and technical information and conduct public education programs and workshops for residents, employees, institutions and businesses regarding reduction of carbon emissions and conservation of such resources as water;
- Learn about and assess the suitability to Belmont of new technology for energy reduction and water conservation;
- Provide information to businesses, institutions, and residents regarding rebate pro-grams and subsidies for various kinds of energy-related and water-conservation initiatives;
- Reach out to other communities to share resources and information;
- Work with state officials and foundations to secure funding for energy-reduction projects;
- Review the Town’s bids and proposed contracts to ensure the inclusion of language and conditions that reflect the Town’s commitment to work with vendors who support the reduction of carbon emissions and promote a sustainable future;
- Create future updates of the Climate Action Plan.
- Oversee a new Energy Committee (see below).

#### **Recommendation: Establish an Energy Committee.**

The Energy Committee will work with the Energy Manager toward implementation and monitoring of appropriate carbon reduction actions across all sectors of the community, as outlined in the Climate Action Plan. The committee will represent a cross-section of the major “stake holders”—including Town employees, public schools, residents, houses

of worship, the business community, and private institutions—and also will include individuals with significant knowledge about energy issues.

### **Recommendation: Investigate implementing a second ESCo project**

The first ESCo project was initiated in 2003 and was completed in April 2006. Measurement of a full year of the dollar savings was carried out between August 2006 and July 2007. The measured savings of \$218,581 exceeded the projected savings of \$202,834. This first ESCo project focused on electric lighting efficiency, water conservation, and some improvements to the heating and cooling plant. The resource and dollar savings are shown below.

**Table 14a. First ESCo Project Savings Summary**

Resource	Dollars	
Type	Saved	Percent
Electric	\$137,732	63%
Oil	\$49,140	22%
Water	\$35,044	16%
Nat Gas	\$1,228	1%
<b>Total</b>	<b>\$218,582</b>	<b>102%</b>

These savings were calculated using average commodity prices in the period of Jan 2004 to Dec 2004, which were:

**Table 14b. ESCo Baseline Costs**

Resource	Jan/2004 to Dec 2004
Type	Ave Cost
Electric \$/kwhr	\$0.079
Oil #4 \$/gal	\$0.930
Oil #2 \$/gal	\$0.930
Nat Gas \$/therm	\$1.140

This initial ESCo project did not include insulation or weatherization (window and door stripping) to reduce building energy loss in cold weather, nor time-of-day temperature controls to allow for the more optimum heating of buildings to match periods of occupation. Research for this document shows that in the 2006 – 2007 heating year, the town consumed 689,989 therms of heating oil and natural gas to heat 915,000 sq feet of floor space. This results in an average

across all town floor space of 0.75 therms per sq foot for heating energy use. This ratio of 0.75 compares favorably with some entities in the town that have large heating loads, and not with others. If the town were to improve building heating efficiency to 0.6 therms per sq foot, then, under the assumption of \$2.30 per gal cost of oil, the town could save over \$200,000 per year in heating costs. For these reasons it is recommended that the town form a second ESCo committee to investigate whether a second ESCo project is viable. Additionally, several town buildings were not included in the first project (Town Hall, Town Hall Annex (Homer Building), School Administration Building, and two fire stations) and should be assessed for potential retrofits.

### **Employee Education and Engagement**

#### **Recommendation: Inform and engage Town employees by conducting mandatory in-service programs.**

The purposes of such programs include:

- To inform the employees of the Town's emissions-reduction goal and to enlist their support, participation, and cooperation;
- To ensure that all employees understand and implement best energy-reduction practices at work;
- To elicit suggestions from employees about other steps that could be taken by them and by the Town to reduce or conserve energy use, which will also save money.

The program should include workers in outsourced custodial services. In addition, contracts for outsourced custodial services should include encouragement for compliance with established energy-saving and recycling procedures.

### **Heating and Cooling of Buildings**

Although the total emissions of Town buildings is not large compared to that of the residential sector, the buildings provide an opportunity for the leadership of the Town to articulate and demonstrate its commitment to energy reduction. The following recommendations are aimed at conserving energy, increasing the efficiency of its use, and increasing the use of new, renewable sources of energy.

#### **Recommendation: Take aggressive steps to reduce heat loss and energy efficiency in Town-owned buildings through conservation**

## and improved heating and cooling systems.

The first steps should be to ensure that all buildings are brought to highest feasible level of heat conservation. These steps include:

- Install energy-efficient double pane windows mounted in non-conducting window frames.
- Ensure that the highest practical level of wall and ceiling insulation is installed and that air infiltration is limited.
- Install heat-recovery ventilation systems. (This allows the heat in warm ventilation exhaust to be used to warm incoming air; in the summer months, cooler exhaust air is used to pre-cool incoming air.)
- Provide air locks at the most-used building entrances.

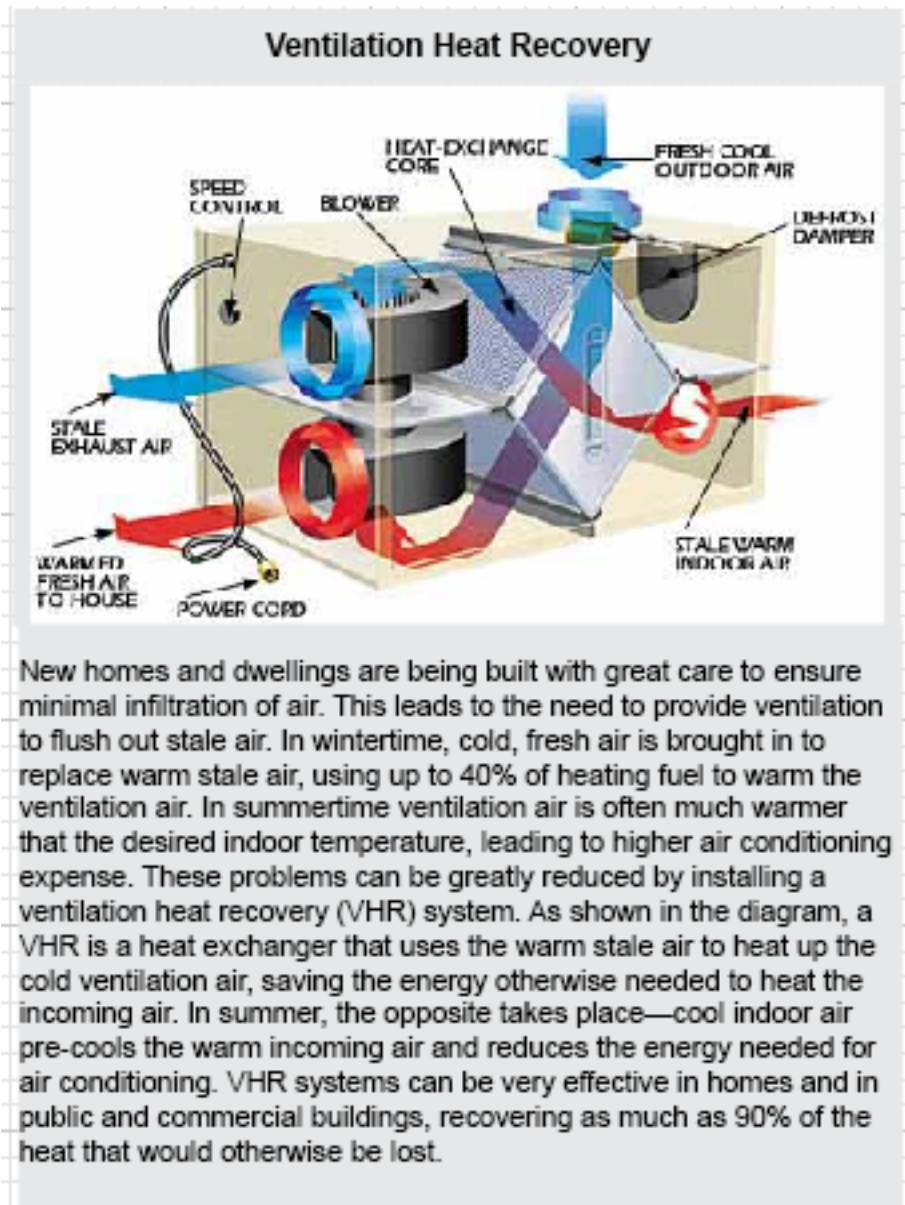
Then retrofit or replace building HVAC equipment to match heating and cooling capacity to the reduced load and to operate with highest efficiency. Consider installing building control systems.

A project similar to the recent ESCo project, but chartered to consider longer-term changes to buildings could be useful in selecting the most economical sequence for undertaking recommended changes. Some of the larger-item modifications in the original ESCo buildings whose payback did not fit into the 10-year ESCo framework could be reconsidered. It would be appropriate to give special attention to buildings not included in the original ESCo project, in particular, the Town Hall, the Homer Building, the School Administration Building and the two fire stations.

While waiting for major conservation and efficiency improvements to be made, many of the suggestions listed in “The Residential Sector” are also appropriate for municipal buildings.

### ***New Building Construction***

In new building construction, additions and major



renovations in the municipal sector, maximize energy efficiency and introduce renewable sources of energy.

**Recommendation: Establish a policy that new municipal buildings, additions and major renovations be built to meet eligibility criteria for LEED certification at the silver level or higher.**

Massachusetts regulations require public schools to be built to the CHPS standards,<sup>29</sup> so many of the criteria for LEED certification already must be met in the case of schools.

<sup>29</sup> Collaborative for High-Performance Schools. Online at <http://www.chps.net>.

Buildings constructed according to green building design principles can be more expensive to build, yet their life-cycle costs should show net savings in the form of reduced operating and maintenance expenses.

### **Building Construction and the Environment**

“Buildings account for 38 percent of U.S. carbon emissions, 40 percent of raw-materials use, and 30 percent of waste output. Any comprehensive attempt to curb climate change needs to acknowledge these facts and transform our approach to construction, old and new.”

**Recommendation: Formally adopt a commitment to the “total life-cycle” concept of building construction, in new building and site design, and in major additions and renovations.**

The Town’s Building Committees should consider fully the life-cycle costs of a building when determining the project’s budget and design, giving special consideration to long-term operating costs, including future utility costs, and to the environmental costs. For example, use of geothermal and solar options for all or part of the energy requirements should be seriously considered.

**Recommendation: In demolition necessary to make way for new construction of municipal buildings, mandate disposal of waste debris in ways that are environmentally sound.**

Such disposal strategies are often found to be financially advantageous to the contractor.

### **Reduction of Electricity Use**

**Recommendation: Reduce the Town’s use of electricity.**

This will be achieved through conservation, increased efficiency, and the use of alternative sources. Today, fluorescent lighting provides three times as much light for the energy used as the familiar incandescent light bulb. LED lighting is even more efficient and, although expensive, has a life-cycle cost that is favorable for municipal buildings. Other actions include:

- Continue work with the BMLD to reduce

electricity used in streetlights.

- Ensure that municipal and school computers do not draw power when not in use.
- Install motion sensors in all hallways and rooms in Town buildings to shut off lighting when it is not needed.
- Reduce outdoor lighting.
- Exploit the benefits of photovoltaic cells to produce free electricity with no carbon emissions on Town buildings where feasible. Apply for grant funds as appropriate.

### **Trees**

**Recommendation: Restore funding for the Town’s shade tree planting program.**

By sequestering carbon and providing shade, trees give value in two ways. But trees take time to grow. The Town should restore and expand its municipal tree-planting program. It is recommended that the Town plant a variety of deciduous tree species, particularly those that are drought-resistant. They should be planted along roadways, paths and playing fields, in parks and around and in parking lots (to reduce the heat-island effect).

### **Land Conservation**

Green space is valuable to our quality of life in Belmont. Many citizens enjoy the benefits of the green space provided by protected areas such as Mass Audubon’s Habitat Wildlife Sanctuary and the Beaver Brook Reservation. Land conservation provides recreational, aesthetic, artistic, educational, spiritual, and scientific value and further offers critical habitat for a variety of resident and migratory species. Healthy ecosystems also provide a variety of other services and functions, including temperature and precipitation regulation, storm protection, flood control, and drought recovery. Healthy ecosystems help regulate hydrological flows, store and retain water resources, aid retention of soil and soil formation processes, aid in the treatment of wastes, contribute to the recycling of nutrients and nutrient storage--including carbon sequestration--and help to provision pollinators for the reproduction of natural and agricultural plant populations.

### **Transportation**

Transportation produces a higher percentage of CO<sub>2</sub> emissions than any other single source. The Town

can take many steps to reduce its own emissions from transportation, thereby setting an example through leadership. The Town also has many opportunities to enable and facilitate emissions reductions by residents and employees.

**Recommendation: Reduce the carbon emissions generated by the municipal fleet in the conduct of town business.**

- Ensure ongoing commitment to Belmont’s Fuel Efficient Procurement Policy for Town Vehicles, which was approved by the Belmont Board of Selectmen, within the Policy on Use of Municipal Vehicles (Dec. 2, 2002). This policy establishes the principle that the Town shall strive to procure the most fuel efficient and economical vehicles necessary for the purpose for which they are intended.
- Investigate converting Town diesel trucks to biodiesel fuel. Biodiesel is a clean, renewable diesel fuel produced from agricultural resources, and can be burned in any standard, unmodified diesel engine. Changing the fueling of the Town’s heavy trucks and equipment to biodiesel would eliminate 327 tons of CO<sub>2</sub> emissions annually.
- The Commonwealth of Massachusetts has mandated a five-minute maximum idling time for vehicles.<sup>30</sup> Belmont should consider an educational program and incentives for town employees to minimize idling of town vehicles. It has been estimated that reducing the amount of time that Town vehicles idle could eliminate an annual 25 tons of CO<sub>2</sub> emissions.
- In developing bids for vehicle contracts such as school bus and waste-collection companies, the Town can include the requirement that the buses be retrofitted for reduced emissions or that the buses reflect the highest standards for fuel efficiency in their class.
- Promote the use of bicycles and encourage walking beats by Belmont police.

**Recommendation: Reduce the carbon emissions generated by town employees in commuting to work and in their conduct of**

<sup>30</sup> *Massachusetts General Law*, Chapter 90, Section 16A. Online at <http://www.mass.gov/legis/laws/mgl/90-16a.htm>.

**Town business.**

Data from the employee transportation survey (Appendix B) reveal that ninety percent of our Town employees drive to work alone. Approximately half commute more than five miles, and approximately one quarter commute more than 10 miles. Reducing the number of vehicle trips is a reasonable goal. The Town can assist in reducing employee use of private vehicles in the following ways:

- Offer transit passes pretax to municipal employees; consider also partially subsidizing the passes.
- Promote flexible hours: enable 25 percent of Town employees to telecommute or work compressed schedules at least one day every two weeks.
- Institute a four-day workweek schedule for employees during one or two months each summer. (The employees would work longer hours each day to compensate.)
- Promote car-pooling and ride-sharing. (The employee transportation survey indicated that 16.2% of Town employees suggested that an organized car or vanpool would be helpful.)
- Encourage employee use of bicycles.

**Recommendation: Help residents and Town employees reduce carbon emissions from private automobile use.**

**Encourage use of public transportation.**

- Investigate economics of providing a town shuttle that would connect business centers, metropolitan and regional transportation facilities, and residential areas.
- Encourage use of public transportation into Boston by providing resident-only parking facilities for cars and bicycles near transportation centers.
- Work with the MBTA to provide safe and attractive shelters at all T stops.
- Reserve some parking spaces for commuter in town public lots to encourage use of public transportation

**Encourage the use of bicycles and walking throughout Town.**

- Assess current bike rack locations in public areas throughout the Town and assess if any should be relocated; invite review of plans by Town’s bicycle and pedestrian committees and

groups.

- Add additional bike racks where appropriate.
- Work toward creating a pedestrian and bicycle connection crossing the railroad tracks near the High School.
- Ensure that appropriate accommodation for bicycles and pedestrians are part of any road-improvement plan.
- Promote the benefits of bicycle paths that connect to a larger network of paths or to transportation hubs.
- In winter weather conditions, ensure pedestrian access to safe walkways throughout the town.

### **Food and Energy**

**Recommendation: The Town should promote and publicize the availability and use of composters for residents.**

### **Pavement**

**Recommendation: Investigate adopting a policy requiring that all paved driveways, sidewalks, alleys, and parking lots be made of pervious material.**

With storms of increasing frequency and intensity, Belmont’s flooding problems will become worse. Pervious material allows more water to seep into the ground and replenish the water table, rather than contribute to over-burdened storm water drains.

### **Increasing Public Awareness of Success and Opportunities**

**Recommendation: Provide information and examples to encourage environmentally aware choices and behavior.**

Encourage homeowners, businesses, and institutions to follow the lead of others who have already taken action toward sustainable living. Publicize successful actions by the Town and in the private sector.

### **Schools**

The Town’s public school system implicitly sets an example to the public and to its pupils by the actions and attitudes it exhibits regarding environmentally responsible behavior. Therefore it is especially important that the recommendations for Town buildings and employees also be adopted by the schools. The Schools also teach environmentalism explicitly through the curriculum, the behavioral

standards to which they hold the children and communications with parents. For children, mitigating climate change and taking adaptive measures are

### **Safe Routes to School**

Safe Routes to School (SRTS) is a national program designed to help schools make walking and bicycling to school safer for children and to increase the number of children who choose to walk and bicycle. SRTS programs can enhance children’s health and well-being, ease traffic congestion near the school and improve air quality. Safe Routes to School promotes a variety of support programs to help communities raise the fraction of children walking and biking to school, including the following:

A “Walking School Bus” organizes children, parents, and neighbors to walk or bicycle to school together from a designated location. The “driver” of the school bus is a volunteer who leads the group. Currently, there are about 15 walking buses organized in Belmont neighborhoods.

Through the Traveler Ticket program, students earn check marks each time they walk to school and may be eligible for a reward or entered into a raffle. Both the Wellington and the Winn Brook elementary schools have participated in a version of this program.

Massachusetts Walk to School Days are led by a local “celebrity” walker. Currently, all of the Belmont public elementary schools and Chenery Middle School participate in this program one day each fall and one day each spring.

On the Web: <http://www.saferoutesinfo.org>

essential to their future.

**Recommendation: Teach by example, through direct instruction and by collaborative investigation, the understandings and behavioral changes that all people alike must acquire to mitigate and adapt to climate change.**

Steps the Belmont Schools can take:

- Engage staff and students in developing ways to help the school become more environmentally responsible.
- Emphasize waste reduction and reuse in the

- schools; promote and expand recycling.
- Find ways to diminish the paper flow.
  - Encourage purchasing practices that use reduced packaging and/or that consider the miles traveled.
  - Introduce climate change curriculum at all levels (causes; evidence; mitigation—including energy conservation and efficiency, adaptation). Grasping the global impact of climate change will help students to appreciate the consequences of their own actions.
  - Plant trees around schools—Engage children in activity and educate on reasons.
  - Develop a food-composting program for vegetable matter.
  - Review and revise menus of school lunch programs to become healthier and to include more local foods, and to reduce packaging.
  - Ensure compliance with the state’s anti-idling law by school buses and vans to reduce CO<sub>2</sub> emissions and promote good health in children.
  - Work with PTOs to encourage environmental actions and behavioral change at home.
  - Encourage walking to school and bicycling by older children.
  - Encourage the driving school that offers driver education to high school students to cover driving strategies that lower fuel consumption in their teaching.
  - Discourage students from driving automobiles to school.
  - Encourage the Minuteman High School to adopt recommendations similar to those of the Belmont Climate Action Plan.
  - Promote ridership of school buses and work to reduce cost to individuals to encourage use of school buses as an alternative to private cars

## Town Policy

### Cushing Square Redevelopment

At a special town meeting in 2006, planning guidelines were adopted for a Cushing Square Overlay District that apply to building rehabilitation and new construction in the neighborhood surrounding the intersection of Trapelo Road and Common Street. The guidelines offer incentives to business owners and developers to contribute to “smart growth” by creating mixed use projects with greater housing density and shared green space.

The goal is to “promote the redevelopment of under utilized properties in a coordinated and well-planned manner” so as to provide a more pedestrian-oriented environment while “remaining sensitive to abutting residential districts, environmental impacts, and historic preservation.” Uses envisioned for new projects include retail sales and services, restaurants, office space, and residences. Building designs are to be “pedestrian oriented and shall reflect community preference for moderate-scale structures that reflect the residential character of the Town.” Designs also “... shall incorporate best-practices in energy efficiency, environmental protection, and storm water management; [and] shall address current Leadership in Energy and Environmental Design (LEED) standards (or other comparable standards), as promulgated by the U.S. Green Building Council ... .”

This step by the Town is a positive move toward a future of mixed use development around transportation centers and is in the direction of creating a society with a smaller carbon footprint.

transportation systems, new approaches to housing arrangements and reconfiguration of roads, intersections, housing and open spaces. New zoning and other regulations will be needed to facilitate the implementation of this intention.

Locating new commercial and large-scale residential projects near transportation centers reduces the need for and use of automobiles. Mixed-use projects should be encouraged and also be clustered near commercial and transportation centers because engaging and productive street life, both day and night, creates a positive and pedestrian-friendly atmosphere, possibly mitigating energy use for transportation. Open spaces located near densely inhabited areas also contribute to satisfaction with urban living.

**Recommendation: Give priority to needs of public transport, pedestrians and cyclists in road design planning and related issues.**

Through actions of the Town Meeting and policy-making committees and boards, Belmont can influence the course of development in the town and provide leadership through enlightened management to bring municipal operations in line with a sustainable future.

### Town Planning

Town-wide planning, including the recently launched development of a new Comprehensive Master Plan, must address community challenges that impact our shared carbon emissions.

**Recommendation: Ensure that the new Comprehensive Master Plan for Belmont will promote low-carbon living and mobility.**

In the spirit of this Climate Action Plan, a new master plan for Belmont should include such elements as the redesign of commercial centers,

Belmont and the nation must shed our dependence on private automobiles powered with fossil fuels. The town can facilitate use of public transportation by increasing public parking near transport centers, by revising our on-street parking regulations (perhaps introducing resident parking stickers); and by providing convenient and safe protective shelters at transport stops and nearby covered bicycle racks.

Bicycling and walking can be encouraged and supported through careful planning, including pedestrian-friendly intersections, frequent pedestrian crossings, well-marked bicycle lanes, efficient off-road bicycle paths, the establishment of additional one-way streets, and systematic planting of healthy, drought-resistant shade trees along the roadways, paths, parks and parking lots.

**Recommendation: Evaluate the U.S. Green Building Council’s LEED Guidelines for Neighborhood Development.**

The U.S. Green Building Council’s LEED Guidelines for Neighborhood Development is expected to launch in 2009. These guidelines include such topics as facilitating mixed-use development; protecting threatened species by reducing habitat fragmentation through compact development patterns; ensuring proximity to water and wastewater infrastructure; ensuring wetland conservation and restoration; and other elements such as school proximity, brown field development, reduced auto dependence, bicycle path networks, and more.<sup>31</sup> The Town should determine which of these are applicable for Belmont, and integrate them into Town policies and procedures.

**Energy Zoning**

**Recommendation: Incorporate the State’s zoning exemptions for renewable energy into the local zoning codes.**

The state has enacted changes to the Commonwealth’s zoning regulations that exempt some types of renewable energy sourcing systems from some local zoning regulations.<sup>32</sup> Eliminating zoning-related barriers to introducing new residential renewable energy sourcing systems will encourage introduction of these systems leading to a reduction in CO<sub>2</sub> emissions.

**Recommendation: Adopt a bylaw that would use the state’s Stretch Code legislation allowing local building code standards to increase energy efficiency of new construction and major renovations to all buildings (municipal, commercial, and residential) in town.**

The Stretch Code is state legislation passed in 2009 that allows cities and towns to adopt more stringent building codes promoting greater energy efficiency for new construction and major renovations beyond that required at the state level. Once adopted, the stretch code would be the new mandatory base code for the city or town on building projects within its jurisdiction.

<sup>31</sup> For more information, see <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148>.

<sup>32</sup> M.G.L. Chapter 40A, Section 9B.

**New Building Construction and Major Renovations**

Old buildings reflect the accepted standards of the period when they were designed and built, including whatever standards for energy use were considered relevant at that time. Buildings have a long life and, if left unchanged, will continue to consume energy as though those standards still prevail; therefore retrofitting them—in this “new age” of energy reduction—should be a first priority for any owner.

New building construction in both the municipal and private sectors presents new opportunities that will serve us well as the climate changes, will have environmental benefits, will have positive health effects in the community by improving air, thermal, and acoustic environments, will enhance the health and comfort levels of the occupants, and will have a positive economic effect for the owner/developer.

The Sustainable Building Design Policy statement (approved, Select Board, March 2007;) applied only to municipal buildings. We assume, but have not verified, its implementation by the Town’s building committees.

**Recommendation: The Sustainable Building Design Policy, coupled with new building standards, should apply both to municipal and private sector development.**

If, the community is committed to reducing our energy CO<sub>2</sub> emissions by 80% by 2050, then new building construction must not add to the Town’s total emissions levels. There will always be new construction in Belmont, both municipal and private. There are still buildable sites in the town, others may materialize, and old buildings—municipal, commercial, residential—will be gradually replaced. The need for establishing new and rigorous building standards is urgent.

In view of the development of LEED certification and the Energy Star designation of the EPA, it is time for Belmont to consider stronger requirements for new construction and renovation projects in town.

**Recommendation: Adopt a policy that all new residential construction and substantial renovation projects over 1,000 square feet and all new commercial and industrial real estate construction minimize, to the extent feasible, the life-cycle cost of the facility by utilizing energy conservation and efficiency, water conservation and alternative energy technologies.**

The requirements for energy and water conservation and efficiency would be based on the criteria for LEED certification of the US Green Building Council, and standards established by the EPA.

This recommendation is offered on its own merits, regardless of whether the Town decides to pursue Green Community designation. If the Town does decide to qualify for such designation, then adopting the recommendation above is an essential step.<sup>33</sup> Although the language of the Act addresses projects over 3,000 square feet, our recommendation applies to those over 1000 square feet, and will cover the construction of large residences and many conversions to condominiums.

**Recommendation: Adopt a policy that provides incentives for developers to build to standards that exceed conservation and energy efficiency code requirements.**

<sup>33</sup> Green Communities Act, Chapter 25A, Section 10.

Incentives such as reduced permit fees or tax benefits might be appealing to developers. For example, building to LEED gold or platinum standards—and having the building certified as such—might be a viable option if the incentives were appealing.

**Green Communities Act**

In 2008, Massachusetts enacted the Green Communities Act (Chapter 169), a comprehensive energy reform law intended to lead to a reduction in electric bills, increase the use of renewable energy and stimulate the clean energy industry currently being cultivated in Massachusetts. Part of this law establishes the “Green Communities Program”, which will provide funding and technical assistance for energy efficiency and renewable energy efforts to qualifying communities that make a commitment to efficiency and renewable energy. The program will be funded from a variety of sources including emissions allowance trading programs, utility efficiency charges and alternative

compliance payments generated by the renewable Portfolio Standard and the Renewable Energy Trust Fund.

**Recommendation: Investigate the pros and cons of being designated a “Green Community” under the Green Communities Act in a timely manner and, if appropriate, apply to become a Green Community.**

Does Belmont wish to apply for designation as a Green Community? The town should give serious consideration to this opportunity, to the benefits that would accrue to the Town under the Act and to the steps and actions that would be required should we wish to qualify for such a designation. The municipalities that

**Small Wind**

Small wind-powered electric systems sized for homes, farms, and small businesses have experienced major growth in popularity during the past decade. These turbines, of 100 kilowatts or less in capacity, are the product of a new industry that expects to grow by 18 to 20 percent through 2010.

The turbine shown was installed at the McGlynn Middle School in Medford, MA, in February 2009. The turbine’s hub is 131 feet high and its three blades are 34 feet long; it was made by Northern Power of Vermont and is expected to generate 170,000 kilowatt hours of electricity per year which is about 10 percent of the school’s consumption. The U.S. is the leading producer of small wind turbines. Individuals can use these machines to lower their electric bills and reduce their contribution to climate change.



With net metering the user may benefit from wind energy and still be assured of power from the electric grid whenever needed. Independence from the grid is possible but requires the additional expense of a storage system to cover days of calm weather. Small wind turbines can be cost-effective today in locations with favorable wind conditions.

On the Web: <http://insidemedford.com>

are early adopters of this program are likely to have a larger pot of grant monies available to them.

## **Trees**

**Recommendation: Adopt a policy for all new construction and substantial renovation projects, both municipal and private, that requires the planting of trees in close proximity to the new structures and strategically located to maximize their shade effect.**

The crucial role of trees in efforts both to mitigate and to adapt to climate change cannot be overstated. By sequestering carbon, they reduce the amount of CO<sub>2</sub> sent into the atmosphere, and therefore contribute immediately to carbon reduction. As the planet heats up, trees will be increasingly essential, helping make human life tolerable both indoors and out by providing cooling shade. Deciduous trees planted on the south and east sides of buildings will protect the building from the sun, thereby cooling it and reducing the need for air conditioning in hot weather. The leaves drop as winter approaches, thereby allowing the warming effect of sunlight to contribute to passive solar heating.

**Recommendation: Adopt a policy that requires a builder of private property (new or substantial renovation) to replace any tree whose removal is required by the construction with a newly planted tree, either on the same property or at a municipal location.**

This recommendation extends to trees on private land an existing policy regarding Town-owned trees.

## **Purchasing Practices and Negotiated Contracts: Using our Greenbacks**

Pursuing purchasing practices that favor green sustainable options, including the negotiation of future contracts, offers significant potential for the Town to reduce CO<sub>2</sub> emissions, particularly if such practices

are enhanced through strategic alliances with other communities or institutions.

**Recommendation: Ensure that all Town bids and contracts include language that requires or encourages vendors to adopt sustainable, energy saving practices.**

Choosing where and how to spend dollars is one of the most effective means to change the behavior of others. The Energy Manager will review bids and proposed contracts to ensure the inclusion of language and conditions that make clear the Town's intention to work with vendors who support the reduction of carbon emissions and promote a sustainable future. Examples might include school buses retrofitted for reduced carbon emissions; companies that employ "carbon-neutral" shipping; companies that reject excess packaging and use carbon-neutral packaging materials; companies that specialize in using or selling products made with local resources or from recycled materials.

## **New Sources of Funding**

The Town can pursue creative approaches to conducting town business and providing services that reduce energy use and therefore carbon emissions. A clear example is the opportunity to qualify as a Green Community under the new state law.

Seeking creative energy-saving financing options—for example those utilized on the ESCo project—and applying for grants to develop and implement sustainable approaches and improvements should also be pursued. Belmont might seek grants and funding for opportunities to conduct outreach and education programs, install large-scale energy-efficient equipment, pilot new low-carbon or energy-efficient technologies in Belmont and facilitate the development of renewable and alternative energy resources.

**Recommendation: Direct the Energy Manager to seek grant and funding opportunities to facilitate the implementation of the goals and recommendations of this Climate Action Plan.**

## Belmont Municipal Light Department

The Belmont Municipal Light Department, through its responsibility for electricity supply and distribution to town residences, businesses and institutions, can provide leadership in promoting conservation and efficiency, and a shift toward renewable energy sources.

### **Rate Structure**

Electricity use in Belmont varies with the seasons and time of day. The peak load on the BMLD distribution system occurs in summer afternoons, when the air conditioning load is the greatest. Two problems arise in attempting to supply this load:

(1) Belmont's feeders from its electricity suppliers have limited capacity. To increase feeder capacity requires capital investment that is only utilized a few days of the year. Reducing the peak amount of power the system must supply will permit the system to operate more efficiently at less expense.

(2) At times of high demand for electricity, Belmont's suppliers of electrical energy turn to their least efficient power plants to meet the load. This leads to significantly greater expense per unit of energy and higher emissions because the least efficient plants are those that generate greater amounts of CO<sub>2</sub>.

The way Belmont's suppliers pass the extra cost to the town is to set their rate for electricity according to the peak demand from the town's consumers over the past several months. To get a better rate the town can lower its peak demand. The way to accomplish this is by shifting as much electricity use as possible from periods of high demand to periods of lower demand. Consumers can be encouraged to participate in making this shift by a rate scheme that charges more for consumption during peak use periods and less for consumption in periods of average or low demand.

**Recommendation: Implement a rate structure that discourages electricity consumption during periods of peak demand.**

When the load on Belmont's electricity distribution system is excessive, the BMLD must respond to the

emergency by cutting load, which means black-out for some customers. To avoid this possibility, the BMLD has made arrangements with some commercial and institutional customers whereby these customers can shed a portion of their electrical load upon request from the BMLD in an emergency.

**Recommendation: Extend load shedding in an emergency to residential customers by means of a "reverse 911" signaling system.**

### **Renewable Energy Sources for Electricity**

Currently, residential customers of BMLD receive five percent of their electrical energy from New York Hydro and a varying amount of electricity from the Seabrook nuclear plant. Otherwise, all of Belmont's electricity is generated at fossil-fueled power plants, with a corresponding contribution to the town's emissions of CO<sub>2</sub>.

**Recommendation: Work toward utilizing renewable energy sources.**

Several potential sources of renewable energy are or may become available to the Town. Two in-state wind power generation projects are at different stages of planning, Berkshire Wind and Cape Wind. Also, biomass power plants might be tapped for renewable energy supply. In the future, more of these may become available as economies and technologies evolve and government policy turns more toward favoring alternative energy sources.

- The BMLD should track progress in renewable energy sources and tap into them as progress permits.

Locally, photovoltaic installations turn solar energy into electricity and are becoming practical to install on public and commercial buildings.

- Investigate the possibilities for photovoltaic installations on Belmont public buildings, especially schools.

Photovoltaic arrays may also be installed on homes' roofs and some residents may wish to pursue this possibility.

Local wind turbine installations are another possibility. These are most effective when installed at higher elevations where the best wind exposure is found. There are few sites in Belmont where a wind turbine installation would be practical due to the built-up nature of most of the town. However, individual residents located in favorable areas might choose to invest in wind energy. With wind and photovoltaic energy sources, the supply is dependent on the weather and presence of sunshine. It is possible to install net metering so energy can be supplied to the electric grid by the consumer when there is more available than needed, and drawn from the grid when the amount of wind or solar energy is insufficient.

- Provide net metering to customers wishing to install private sources of electricity.

One step toward greater use of renewable energy is the BMLD's offer to customers of Renewable Energy Certificates (RECs) which are discussed below.

**Clean Power with RECs** The Belmont Municipal Light Department currently offers residential customers the BMLD "Green Choice" option. This allows consumers in Belmont to purchase renewable energy and contribute to the growth of renewable energy sources in New England through the purchase of Renewable Energy Certificates (RECs). Renewable Energy Certificates (RECs) is a way for BMLD customers to immediately and significantly

### Net Metering

Net metering programs provide an important incentive for consumer investment in renewable energy generation. Net metering enables customers to use their own electricity generation to offset their consumption over a billing period by allowing their electric meters to run backwards when they generate electricity in excess of their demand. With this arrangement customers receive retail prices for the excess electricity they generate.

Net metering is low-cost and easily administered. It increases the value of the electricity produced by renewable generation and allows customers to "bank" their energy and use it at a different time than it is produced, giving customers the flexibility to maximize the value of their production. Providers may also benefit from net metering because when customers are producing electricity during peak periods, the system load factor is improved. Currently, net metering is offered in more than 35 states. Present Massachusetts state law provides for net metering of farm-renewable-energy systems and combined heat and power systems, and applies only to investor-owned utilities.

Further information may be found at <http://apps3.eere.energy.gov/greenpower/markets/netmetering.shtml>.

### Compact Fluorescent Lights

Compact fluorescent light bulbs, known as CFLs, are a version of the fluorescent lamp that is interchangeable with common light bulbs. CFLs use almost 75% less energy than regular incandescent bulbs and last 10 times longer. The installation of one CFL can save over \$30 dollars in energy costs over its lifetime compared to incandescent bulbs, as well as saving 2,000 times its weight in greenhouse gases.

Lighting is estimated to account for nearly 20% of all household energy consumption, so if every home in the United States replaced one incandescent light bulb with a compact fluorescent, the energy saved could light over three million homes and avoid the emission of greenhouse gases equal to that of 800,000 cars.

Like all fluorescent lamps, CFLs use an electrical discharge through mercury vapor to produce ultraviolet radiation that excites phosphorescent material coating the glass tube to produce visible light. The filament of the incandescent lamp is absent. The amount of mercury in a fluorescent lamp is tiny, far less than the mercury released by burning coal to power an incandescent bulb. Nevertheless, in consideration of the environment, CFLs and other fluorescent tubes should be disposed of properly.



Photo: [www.energystar.gov](http://www.energystar.gov)

decrease the CO<sub>2</sub> emissions that come from electric power generation with fossil fuels. Under this program, renewable electric power is generated and put onto the national electricity grid displacing fossil fuel-based electric power on a one-to-one basis and so eliminating those CO<sub>2</sub> emissions. RECs are purchased in units of 100 Kwhr per month and cost \$6.00 per month. With the purchase of one REC, a customer who consumes 100 Kwhrs per month and pays about \$18 per month will now pay about \$24 per month (\$18 +\$6= \$24), equivalent to about a 30% premium to have green electricity generated. Customers may purchase several RECs.

For example, a customer using 450 Kwhrs per month might purchase 4 RECs, thus covering 400 Kwhrs of the total 450 Kwhrs with green electricity. In this example, the customer has decreased his/her household's electric power CO<sub>2</sub> footprint by 88% and has avoided putting, annually, 6,480 pounds of CO<sub>2</sub> into the atmosphere. (This is equivalent to eliminating a compact car getting 30 mph and doing 10,000 miles per year). The relation between the number of RECs purchased and the CO<sub>2</sub> emissions avoidance is shown in the Table below

<b>Number of RECs Purchased</b>	<b>REC Kwhr per month</b>	<b>RECs Kwhr per Year</b>	<b>Pounds of CO<sub>2</sub> Emissions Avoided per Year</b>
1	100	1,200	1,620
2	200	2,400	3,240
3	300	3,600	4,860
4	400	4,800	6,480
5	500	6,000	8,100
6	600	7,200	9,720
7	700	8,400	11,340
8	800	9,600	12,960
9	900	10,800	14,580
10	1000	12,000	16,200

Besides the opportunity to avoid CO<sub>2</sub> emissions, purchasing RECs helps increase the demand for renewable energy and thus encourages further

investment in green electricity generation. Download a brochure to purchase RECs through the Belmont Municipal Light Department's Green Choice program. Visit: [www.belmont-ma.gov/electric](http://www.belmont-ma.gov/electric). From the menu on the left, select **Programs** and click on **Green Choice** in the rollover menu.

### ***BMLD Staff Incentives***

The mission of the BMLD has been to provide reliable electricity at the least practical cost. Given the urgency of responding to the specter of disastrous climate change, it is necessary that the BMLD take on an expanded mission of stewardship for the environment. To fulfill this new mission, it is necessary that the staff of BMLD assume explicit responsibility for evolving operations and policies that will aid in lowering greenhouse gas emissions in Belmont.

**Recommendation: Provide incentives and rewards for BMLD staff to work toward reduced greenhouse emissions in Belmont.**

### ***Outreach and Education***

A major role of the BMLD is in providing information to Belmont residents and businesses to help work toward conservation and efficiency of electricity use. The means of communication available to BMLD include the monthly bills sent to consumers, which frequently include newsletters, the BMLD pages at the town website, and the presence of BMLD at town events such as the annual "Meet Belmont."

**Recommendation: Improve the BMLD's dissemination of information to the community.**

Information is needed by the community that makes consumers aware of how their behavior compares with that of others. Also, the community needs to be informed of energy conservation or efficiency initiatives adopted by the BMLD. Some questions and issues that might be addressed through BMLD information dissemination are:

- Reasons for conservation and energy efficiency measures
- Electrical appliances and phantom energy
- Reducing demand during peak times
- Energy Star and "Appliance Exchange Days"

### Cutting Phantom Energy Loss

The average U.S. home contains many products that waste electricity by continually drawing power, even when the product is turned off. Cell phone chargers, cordless phones, computers, audio and TV equipment, microwaves and clock radios with digital displays are just some of the culprits. Cutting phantom power might save as much as 10% of an electricity bill and reduce the carbon footprint.

The biggest vampires are devices that are continuously ready to receive a signal calling them into action: communications equipment such as fax machines and telephone answering machines; entertainment equipment with a remote control. Also guilty are appliances with a display that is constantly on such as the clock on a microwave, and devices powered by an external power supply.

Many of these devices use so little standby power that they likely won't be noticed in an electric bill. However, some devices and equipment are notorious offenders. Here is a list of some of the worst:

Product	Average Standby Power
Digital Video Receiver	37 watts
Set-top Box for Digital Video	37 watts
Set-top Box for Digital Cable or Satellite	18 watts
Cordless Power Tool—plugged in and fully charged	8 watts
Combination TV/VCR	6 watts
Inkjet Fax Machine	5 watts
Garage Door Operator	5 watts
Multifunction Office Device	5 watts
Cordless Phone with Answering Machine	3 watts

Also remember that most computers left on but unused still consume a lot of power. Turning them off when not in active use will save a lot of energy. If suspicious that a particular device might be a standby power hog, check it out with a power-measuring meter such as a Kill-a-Watt. Keep these figures in mind when purchasing new products, and be sure to disconnect the power when services they provide are not needed.

- Promotion of town building policies (LEED)
- Energy audits for residential and commercial users
- Energy audits for municipal users
- Explain the meaning and benefit of appliances that bear the “Energy Star” label.

Means for dissemination include:

- Comprehensive print material and interactive online resources/tools.
- A user-friendly and interactive website that will both educate and touch a broad audience.
- A sticker that people can post on their cars or windows noting they're reducing energy use and come up with a catchy slogan for the campaign.
- Structures in which homeowners, commercial, municipal buildings, etc. can “compete” publicly with each other to reduce electricity consumption and CO<sub>2</sub> production; announce “winners” on the BMLD website, the monthly bill, and the *Belmont Citizen-Herald*; provide expert BMLD “coaches” to owners who request them to help them compete better.
- Partner with the library in organizing and sponsoring climate-related events; explore similar collaborations with the schools, houses of worship, service clubs, etc.
- Launch an “ROI” reimbursement program: Replace Old Incandescents, or Replace Outside Incandescents, or Return on Investment, to encourage use of efficient light bulbs.

Here are some suggestions of information that would be useful to have available from the BMLD web pages:

- A robust CO<sub>2</sub> calculator that compares various appliance models.
- Information on energy consumption by appliances based on appliance year and model and amount of savings if replaced with the newer/newest Energy Star model.
- Average kWh usage figures and current costs for “typical” homes and businesses of varying square footage to provide consumers with a frame of reference for comparing their property to others of similar size.

The monthly electricity bill received in virtually all Belmont households should be the primary means of communicating with consumers about the town's efforts to reduce electricity consumption and CO<sub>2</sub> production:

- Suspend community messaging on the BMLD light bill and focus on delivering conservation-related information; or reserve a limited area of the BMLD monthly bill statement for “Community Messages” and dedicate the rest of the bill to BMLD conservation-specific messages.
- Use graphs only when they are very clear (i.e., when the data are graphically quantifiable); otherwise, provide comparative information in tables of numbers.
- Let consumers know the cost implications (in both dollars and CO<sub>2</sub>) of peak and non-peak usage days and provide specific strategies to reduce use during peak load periods

**Recommendation: Purchase devices, such as a Kill-a-Watt meter, that measure electric use and donate to the Belmont Public Library to make available to patrons.**

There are several devices on the market today to help homeowners monitor their electric usage real-time. Some devices measure consumption for the whole house and others measure consumption of one appliance at a time. Currently, prices range from \$25 to \$150. Some require plugging in to an outlet and others require an hour of an electrician’s time. The devices could cut the homeowner’s electric bill by up to 15% if their use prompts the homeowner to use a particular appliance less or use it at a less costly time of the day. Some of these devices are: Kill-A-Watt, Watts Up, Black & Decker Power Monitor, and The Energy Detective 5000. The Town of Lexington has such devices available for patrons through its public library.

## Waste Recommendations

The disposal of waste materials accounts for less than one percent of Belmont's CO<sub>2</sub> emissions. However, one should understand that everything we throw away was produced, manufactured and transported to satisfy our appetite for goods. Most of the energy used in industry, agriculture and transport, is related to the desire for comfortable, healthy, and fun experiences in life. Waste disposal can also release toxic materials into our environment, and a sustainable society must avoid these negative consequences.

The recommendations fall into two categories: The first group consists of ways of sending less to the waste streams; the second group consists of ways to reduce the environmental impact of the waste we must dispose of. Most of these recommendations apply equally to residents, businesses, institutions, the schools and government operations.

### **Recommendation: Reduce consumption and increase reuse.**

Live prudently: "Recycle, redeem, and sell", rather than throw away unwanted objects. Buy items that have a longer useful life. Buy goods without unnecessary packaging. Use cloth and/or recyclable plastic bags for shopping. Give or sell useful items no longer needed to others who can use or resell them. For example, give unwanted books to the Belmont Library, GotBooks.com, 1-800-GOT-JUNK, etc.; donate unwanted clothes to charitable collection agencies like Big Brother-Big Sister, the Epilepsy Foundation, and others who will pick them up from the front door, or consign them to a thrift shop. Drink tap water instead of bottled water. Invest in effective house and/or tap filters if you wish to use filtered water.

Not only do these actions reduce emissions associated with waste handling, but they yield a far greater reduction in emissions from the non-production, non-manufacture and non-transport of goods we avoid acquiring.

To reduce the flow of unwanted catalogs and junk mail, contact mail order firms directly, as well as websites such as [catalogchoice.org](http://catalogchoice.org), [dmachoice.org](http://dmachoice.org), and [ProQuo.com](http://ProQuo.com).

### **Recommendation: Reduce organic material in the town waste stream by composting food and yard waste.**

Start and maintain a compost heap for yard and vegetable waste and use the finished material on lawn and garden. The Public Works Department sells composting bins and provides instructions for effective composting.

### **Recommendation: Facilitate exchange of items for reuse.**

Operate a durable goods exchange (see sidebar "Got Stuff?"), perhaps at the Concord Avenue site, where residents may leave items of possibly continued usefulness, for others to take away. This could be staffed, in part, by volunteers from the community. Belmontians are encouraged to use the Freecycle Network online swap.

### **Recommendation: Provide for reuse or proper disposal of electronic junk.**

Electronic junk of all kinds must be kept out of the town's trash stream, primarily because of the toxic materials used in their manufacture. Some devices such as unwanted cell phones may be donated to agencies for reuse. There are active sites devoted to reuse of unwanted electronic hobby and entertainment equipment. Equipment unsuited for reuse must be processed to recover recyclable components and dispose of toxic materials, and the Town should provide means for its disposal or provide residents with information for proper disposal.

### **Recommendation: Keep toxic materials from the environment.**

Belmont must continue to provide means for safe disposal of hazardous materials. Currently the only in-town provisions are for used motor oil, which may be taken to the Town Yard, and fluorescent tubes and CFLs that may be taken to the BMLD, Public Works Department at the Homer Building, Health Department, or Hillside Garde Supply on Brighton Street.. The town should ensure that the Minuteman Hazardous Products Facility continues to be available and should encourage the state to make similar facilities available throughout Massachusetts.

Residents, businesses and institutions must be meticulous about not disposing of hazardous materials through the town's sewer or storm drain systems. Also, reduce use of chemicals to melt snow and ice on sidewalks, driveways and streets. Businesses are responsible for ensuring that any waste water released to town drains is free of contaminants.

**Recommendation: Facilitate disposal of materials not presently considered recyclable.**

Currently, many items discarded as unusable go into the trash stream and are fed to the incinerator. Much of this, such as large plastic objects, metal scrap, rags and rugs, can be usefully recycled, but are not accepted in the town's recycling program. Other towns sponsor recycle days and "drop/ swap" events where these materials can be left for exchange, reuse or recycle. Belmont should have a similar program, perhaps at the Concord Avenue site.

**Recommendation: Regulate disposal of debris from construction and remodeling projects.**

Typically, all waste material from construction and remodeling projects is put in dumpsters and hauled away by a disposal contractor. Often, masonry, metal scrap, used and scrap wood, even asphalt shingles are commingled and go to the same disposal site. The Town, in cooperation with state authorities, should investigate means for ensuring that construction waste is separated and recycled to the maximum extent feasible.

Homeowners and contractors should be aware that organizations such as the Boston Building Materials Resource Center will accept donations of reusable building materials.

**Recommendation: Provide incentives for environmentally sensitive disposal of waste.**

Consider schemes for encouraging people to recycle and reduce waste:

- Investigate joining "RecycleBank," a national effort to increase recycling in which participants earn a share of profits from recycling. In this system, each bin is weighed by a device on the truck, for which the recycler receives "points" based on the weight, redeemable at participating local and national stores.<sup>34</sup>

<sup>34</sup> More details about RecycleBank may be found at [www.recyclebank.com](http://www.recyclebank.com).

**Got Stuff? Reuse and Recycle!**

Here are some ways of seeing your unwanted items reused instead of going out with the trash.

**Freecycle Network.** Since its origin in Tucson, Arizona, in 2003, The Freecycle Network™ has grown to more than 4,500 groups with over five million members in more than 75 countries. It's a grassroots and entirely nonprofit movement of people who give (and get) stuff for free and thus keep good stuff out of landfills. Nearby there are local groups in Cambridge, Lexington, Medford, Newton and Watertown with a total of nearly ten thousand members. Members of Freecycle collectively keep more than 300 tons a day out of landfills. Sign up for the Belmont chapter or joining a nearby chapter. Online at [www.freecycle.org](http://www.freecycle.org).

Got Used Books, CDs, and DVDs? Here are two suggestions for reuse:

**Donate to the Belmont Memorial Library.**

The Friends of Belmont Public Library will resell donated books during book sales. The money raised has funded passes to museums, young adult programs, children's programs, the Belmont lecture series, a new PC for public use, and other important gifts to the library. Books can be brought to the back of the library next to the staff parking lot (see white door; inside is a room for donations).

**Donate to Got Books.** This for-profit used bookseller gives books free to libraries, schools, children's causes and other groups in need, teachers for their classrooms, and to troops overseas. Books, CDs, Videos, DVDs, and audio books are accepted at drop-off sites in Massachusetts. To schedule a pick-up, call 978-664-6555 or go online to schedule a pick-up at your home or business. The donation may be tax-deductible. For more information, visit [www.gotbooks.com](http://www.gotbooks.com).

Of course there are many charitable organizations and rummage sales that will happily accept many kinds of reusable stuff. For items of greater value, Craigslist ([www.craigslist.com](http://www.craigslist.com)) is a great way to find them a new home.

- Sponsor a competition among town groups to achieve the highest score for recycling and waste reduction.
- Revisit the possibility of instituting a “pay as-you-throw” program for solid waste collection. Such a plan would charge nothing for disposing of recyclables, but require purchase and use of bags from the Town for solid waste.
- For municipal operations, record the amount of waste and recyclables generated each week by each Town building and/or department and charge the costs of disposal to departments, providing a financial incentive to conserve and recycle.

**Recommendation: Provide information about disposal and recycling of unwanted items.**

Publish a “How to Get Rid of It in Belmont” online guide to provide residents and organizations information about disposal options for unwanted items and material. This would include lists of agencies that accept donations of unwanted goods, instructions about what is recyclable and how to get it to where it can be processed, information on composting organic material, and the disposal of hazardous waste.

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*recyclebank.net.*

**Recommendation: Encourage businesses to organize shared services for waste disposal and recycling.**

Businesses generate roughly half of Belmont’s waste and would benefit from participation in cooperative waste disposal and recycling services. The Town should encourage businesses and institutions to organize collective arrangements for these services.

**Recommendation: Explore opportunities for regional cooperation.**

Work with nearby towns to establish a cooperative waste disposal district aimed at: increased recycling and lower costs. This should be an ongoing effort.

**Recommendation: Encourage and facilitate composting of vegetable waste at all Belmont Schools.**

**Summary**

Waste contributes far less CO<sub>2</sub> to the environment than heating and cooling, transportation, or electricity generation, but direct citizen involvement in environmentally sound disposal practices can lead to deeper commitment to the Town’s overall sustainability program.

## Education and Outreach

***Public sentiment is everything. With public sentiment, nothing can fail; without it nothing can succeed. Consequently he who moulds public sentiment, goes deeper than he who enacts statutes or pronounces decisions. He makes statutes and decisions possible or impossible to be executed.***

—Abraham Lincoln  
(August 21, 1858)

For the town of Belmont to achieve its reduction goals, members of the community must understand the need for the Climate Action Plan and participate in making the necessary changes to reduce CO<sub>2</sub> emissions. Deliberate action, rethinking accustomed practices, and adopting new behaviors will be required. Reductions made in CO<sub>2</sub> emissions will directly benefit Belmont and its community members by providing savings in energy costs, improving air quality, reducing the impact of climate change, and improving the overall quality of life.

Persuading people to change their habits is a most challenging endeavor. Community members will need not only be educated about the reasons to reduce their CO<sub>2</sub> emissions, the benefits of adopting the CAP recommendations, and the various options for making those reductions, but they will also need to have demonstrations of how they as individuals and we as a community can make changes to reduce emissions.

Despite the difficulty of the challenge, other communities around the world are addressing this issue and making progress. For example, Portland, Oregon, which in 1993 became the first U.S. city to adopt a plan to reduce carbon emissions, has reduced its emissions, on a per capita basis, by 12.5% since 1993.<sup>35</sup> Salt Lake City, Utah has succeeded in reducing the carbon emissions from its municipal operations by 31% since 2001.<sup>36</sup> Much can be learned from other communities about how to address the challenge of changing behaviors.

The reduction of CO<sub>2</sub> emissions will need to be a community-wide effort and will require the involvement of all sectors of the community, including residents, businesses, municipal departments, and institutions. Therefore, a coalition of representatives from all of the sectors would be best suited to develop plans and

35 Online at <http://www.portlandonline.com/osd/index.cfm?c=41896>.

36 Online at <http://www.slcgreen.com/CAP/default.htm>.

to lead the effort to implement the recommendations. As part of this effort the coalition could oversee the development of an outreach program or programs to promote the CAP and its recommendations to the public.

### ***Oversight, Vision, Implementation, and Outreach***

One mechanism for pulling together representatives of the various sectors in the town would be for the Selectmen to form an ad hoc or a standing committee whose mission would be to oversee the implementation of the Climate Action Plan. Such a group could include representatives of town government (such as the Office of Community Development, the Health Department, and the Department of Public Works), the Municipal Light Department, the schools (including a representative of administration, faculty, and at least one high school student), the Vision Implementation Committee, Sustainable Belmont, business owners, representatives of institutions (e.g., private schools, churches, and health care facilities) and interested residents, ideally including some with experience in social marketing and technical experience in climate change and/or environmental protection.

Such a committee could develop guidelines for reductions in CO<sub>2</sub> emissions for each sector; prepare educational materials such as brochures, posters, hangtags, postcards and signs for the various constituencies; and oversee a monitoring system to track reductions and improvements. See box for an example of an educational hangtag related to Sustainable Belmont's Cleaning the Air (anti-idling) campaign. As part of this overall effort, the group could develop a plan or plans for education and outreach programs using the tools of social marketing to effectively introduce the CAP to the Belmont community.

### ***Principles of Community Based Social Marketing***

The most effective way to achieve voluntary behavior change is to change what is socially acceptable. Social science research has shown that campaigns to change people's behavior that have employed methods such as providing education and information, promoting attitude change, or even appealing to economic self-interest have not proven effective in persuading

people to adopt new behaviors. In short, research and experience have shown that simply providing people with information is not enough to convince them to adopt new behaviors or give up old ones. Social marketing is a programmatic approach to influence the voluntary behavior of a target group to achieve social goals. One methodology that has been developed and used successfully to do this is known as Community Based Social Marketing (CBSM).

Doug McKenzie-Mohr, Ph.D., an environmental psychologist in Canada, has studied and written extensively on the uses of CBSM in promoting the adoption of sustainable behaviors. Dr. McKenzie-Mohr's research has shown that there are usually three key reasons why people do not readily adopt a desired behavior. His research has found that people fall into one of three categories:

- 1) they are not aware of a desired behavior and its benefits; or
- 2) they know about the behavior and the benefits but see difficulties or barriers to adopting it; or
- 3) although they see no barriers to the behavior, they fail to see the possible benefits from it.

The CBSM approach to change behaviors and attitudes involves first doing an analysis of the population or target audience involved and their attitudes toward the desired behavior changes. The recommended analysis would include:

1. Identifying the barriers to sustainable behavior,
2. Developing a strategy or program to use tools that have proven effective in persuading people to change their behavior,
3. Running a pilot test of the program with a targeted group that will then serve as a role model to the larger community, and
4. Evaluating the strategy following its use in the community.

While it may be tempting to employ shortcuts to this system and skip the research phase, Dr. McKenzie-Mohr cautions against making assumptions about what barriers may prevent the target audience from making changes. The three tools for identifying barriers recommended are a review of relevant literature, focus groups, and telephone surveys.

After choosing a target audience and identifying barriers for that audience, McKenzie-Mohr advocates using six tools for designing effective social marketing campaigns. These tools are:

1. seeking a commitment from individuals to the new behavior,



2. providing sufficient, clear prompts to help remind them of the desired behavior,
3. creating social norms in support of the behavior,
4. developing effective communication about the behavior,
5. providing incentives to reward the behavior,
6. making certain that the new behavior can be done with convenience.

While it is not necessary to utilize all six in a given campaign, using them in combination is likely to increase effectiveness.

Perhaps the most important message that McKenzie-Mohr has to share is about the power of modeling and social diffusion. He writes:

“We believe deeply that we must do all we can to protect and preserve our limited natural resources. We also want to do whatever we can to assure that our grandchildren, and all children will raise their families in a livable environment. Toward that end:

We own a Hybrid car (Prius). We no longer use all three heating or A/C zones in our house simultaneously, closing doors to seal off areas not being used. We are careful to shut off lights when leaving a room, even for only minutes at a time. We are replacing light bulbs with CFLs.

We buy EnergyStar appliances. We participate in the Belmont Municipal Light Dept’s “Green Choice” program. We compost all possible kitchen waste. We buy “local” and use organic food when possible. We use only organic fertilizer in our garden. We recycle practically everything. We carpool to meetings when possible.”

—Paul and Phyl Solomon

*Commitment, modeling, norms and social diffusion all have at their core the interaction of individuals in a community. Commitment occurs when one individual pledges to another to carry out some form of activity. Modeling results when we observe the actions of others. Norms develop as people interact and develop guidelines for their behavior, and social diffusion occurs as people pass information to one another regarding their experiences with new activities. Recent research has documented that it is possible to harness these processes in order to have a significant impact upon the adoption of sustainable behaviors.<sup>37</sup>*

The good news about this message is that the readers of this report have it within their power to initiate and to affect real change in Belmont by reaching out to friends, neighbors, and colleagues and sharing with them an action or actions that they are taking to reduce carbon emissions.

### **What Works**

In *Communicating Sustainability*, a 2005 publication prepared for the United Nations Environment Programme by Futerra, a U.K. communications firm specializing in sustainability, authors Lucy Shea and Solitaire Townsend provide an overview of environmental public relations efforts around 37 McKenzie-Mohr, Doug, *Fostering Sustainable Behavior*. Online at <http://www.cbsm.com/pages/guide/communication>.

the world. Shea and Townsend’s recommendations for effective CBSM programs include the following:

- a. Targeting community leaders who are not the “usual suspects” who are already convinced and already employing sustainable patterns and making sustainable choices;
- b. Seeking to inspire—stirring empathy by portraying threatened people and animals. People are more likely to take action to prevent losses rather than to realize gains. However, too much fear causes paralysis and a sense of hopelessness;
- c. Providing information to raise awareness, change attitudes, and engage the public in adopting new behaviors;
- d. Making it personal and practical—providing help to people who are attempting to change their behavior;
- e. Using language carefully, making solutions sound heroic; while portraying desired actions as normal and bad actions as rare;
- f. Providing feedback to acknowledge progress and express gratitude;
- g. Using visuals to make points and act as triggers or prompts to remind people of the purpose of the desired behavior;
- h. Providing multiple reminders in varying media and locations; and
- i. If asking for pledges, making certain that the pledges are meaningful and personal.

### **Some Examples**

Groups around the country and the world are addressing climate change and finding different ways to work to change habits and decision making within the different sectors of their community.

**Commercial Sector:** An example of an outreach campaign directed at the commercial sector comes from Fort Collins, Colorado. That city’s Climate Wise Program, an award-winning voluntary program, provides businesses with technical assistance (including environmental assessments and creative solutions), public recognition, and networking opportunities to help them reduce both costs and

climate changing emissions. Begun in 2000, this growing program promotes energy efficiency, green power, solid waste management, water conservation, alternative transportation, and transportation demand management through public-private partnership. The Climate Wise Program estimates that participating businesses (now totaling over 90) have accounted for the reduction of over 70,000 tons of CO<sub>2</sub> emissions per year, which represents more than 40% of overall reductions realized in Fort Collins.

**General Public Focus:** Sweden developed its Climate Campaign in 2002–2003, and the planners named the target audience “dozing community activists”—people whom they de-scribed as being those who were open to new ideas and experiences, believed that social and environmental issues were important, and who did not mind doing their part to help as long as it was not too difficult to do so and as long as they themselves would benefit in some way. The campaign’s three main objectives were to:

- 1) increase knowledge of the causes of the accelerating greenhouse effect;
- 2) increase knowledge of the effects the accelerating greenhouse effect can have; and
- 3) change attitudes about individuals’ ability to reduce greenhouse gases. The campaign consisted of a series of public relations activities, including advertising and direct mailing, along with local events aimed at increasing knowledge about the greenhouse effect and climate change.

Six months of careful planning preceded the campaign. The realization that climate change causes great uncertainty and that that uncertainty causes the reluctance of individuals to commit to personal activities to mitigate climate change shaped the focus of the campaign. The slogan for the campaign was, “The greenhouse effect affects you; how do you affect it?” The campaign identified two key principles to keep in mind: 1) the importance of relating the information presented to people’s everyday lives, and 2) the need to associate threatening scenarios with positive actions or solutions. At the close of the campaign, an independent survey group found that 74% of the Swedish population believed that individual actions could reduce the greenhouse gas effect.

**Comprehensive Approach:** Salt Lake City, Utah, has taken a comprehensive approach to environmental protection. Under its Salt Lake City Green umbrella,

the city has developed an education plan, its **e2 program** (e2 for environmentally and economically sustainable) that includes components designed for businesses, citizens, and students. The **e2 Business** program provides support and recognition for Salt Lake City’s business community and economy. Businesses that sign onto the program must track their energy usage and work to reduce it, submitting an annual report and setting three measurable goals per year. In return, they get assistance and advice, free advertising, certification and branding as a participant. The **e2 Citizen** program asks residents to sign up to take five actions (including at least three new goals) from the seven categories they call: transportation; energy conservation; reduce, reuse, recycle; water conservation; food; health; and community education. The **e2 Student** program asks children to calculate their carbon footprints using the online calculator, set three goals for themselves, and spread the word to friends and family members.

Meanwhile closer to home, in neighboring Medford, MA, the local cable television station aired a reality show competition in 2007. The show was titled the *Energy Smackdown*,<sup>38</sup> and involved three family teams competing to see which household could decrease their carbon footprint by the greatest percentage. A member of the winning team observed, “We learned it’s not that hard to decrease your footprint but still live comfortably.”<sup>39</sup> In 2008, the *Energy Smackdown* expanded to include teams from Medford, Arlington, and Cambridge, each with ten families participating.

### **Outreach and Education in Belmont**

After studying the principles of CBSM and considering examples from other communities, an outreach and education group or CAP implementation group can develop a plan for educating the community about the CAP and programs to encourage behavior change. They might elect to employ several different campaigns to reach different segments of the community and thereby reinforce the messages to all. For example, by partnering with businesses to support their efforts to reduce energy use and recycle materials, not only would strides be made in reducing the carbon emissions from the commercial sector, but valuable messages about the importance of taking action would be reinforced to the general public. Similarly, a program in the school

38 Online at <http://www.energysmackdown.com>.

39 Online at <http://www.csmonitor.com/2008/0109/p14s04-sten.html?page=2>.

that aimed at educating students about the importance of reducing transportation-related carbon emissions would also help adults in the community to reconsider transportation options. Additionally, a well-publicized competitive reality show like the *Energy Smackdown* or Massachusetts Climate Action Network's Low Carbon Diet contest could generate interest and promote greater awareness of actions to reduce climate change among residents, town employees, and businesses.

In Belmont, there could be an overall community campaign that will aim to reduce all climate change emissions on an individual basis. An example of such a campaign is Burlington, Vermont's 10% Challenge, which is a voluntary program to help residents and businesses reduce emissions by at least 10%. The 10% Challenge provides the tools and the information necessary to implement such

a reduction. The online emissions calculator can be used to determine current annual emissions and to track the progress of emissions-reduction techniques.

The Board of Selectmen and the Chamber of Commerce could assist with the implementation of such a "challenge" campaign, providing literature and other tools to community members and businesses that wish to reduce emissions. In doing so, it is possible to educate residents on the large contribution of transportation towards their overall emissions.

On Earth Day in April, the town of Belmont could begin having a "Sustainable Commute" day where commuters in Belmont seek to use alternative, sustainable methods of transportation to go to work. Someday this could potentially turn into friendly competition with Arlington, Watertown, Newton, and other surrounding towns. Using a different method of commuting would hopefully inspire some individuals in Belmont to change the way they commute for the rest of the year and thus reduce their CO<sub>2</sub> emissions at the same time. "Sustainable Commute" day could be advertised throughout town with posters being displayed in public buildings, businesses, and on Sustainable Belmont's website.

### **Targeted Outreach: Residential Sector**

According to the 2000 United States census, Belmont

had a population of 24,194 with 9,732 households.<sup>40</sup> A marketing campaign targeted to Belmont households should be designed to increase awareness about the relationship between climate change and CO<sub>2</sub> emissions. Educational outreach should be developed to communicate suggestions for household energy efficiency, purchase of RECs, alternative transportation

"In our household, we have focused on two types of conservation. First, we look for the EnergyStar label for all appliances and light bulbs. Second, since the transportation sector is a major driver of the demand for oil, we have invested in a hybrid car, and we look forward to the next generation of hybrids (plug-ins). Electric cars can contribute to a reduction in GHG emissions, depending on the fuel source in the generation of electricity. A more immediate potential benefit is an opportunity to address the political and economic crisis created by our dependence on foreign oil."

—Ralph T. Jones, Ph.D., Belmont Selectman

choices, and the potential cost savings and positive health impacts possible with town-wide emissions reductions. (See Appendix F for suggested tips.) Small neighborhood gatherings could be held to share information and techniques, using a "sustainability kit," (which provides simple tools and suggestions for reducing one's carbon footprint) for which a prototype has been developed by Sustainable Belmont. Similarly, presentations regarding the

CAP and carbon emissions reductions could be made at local organizations, committees, the Council on Aging, and houses of worship.

Sustainability indicators could be developed and maintained by Sustainable Belmont and posted on the Sustainable Belmont website and displayed at Town Hall and the Library in the form of a regularly updated display that illustrates Belmont's progress toward its CO<sub>2</sub> emissions reduction goal.

### **Targeted Outreach: Commercial Sector**

CBSM efforts could be used to educate businesses on how they can benefit financially and improve environmental conditions in the Town by participating in Belmont's sustainability initiative. An awards program such as the *GoGreen Awards* in Cambridge would both reward responsible businesses that take action to reduce CO<sub>2</sub> emissions by giving them public recognition and provide further modeling of environmentally responsible action, increasing the awareness of the general public and reinforcing the message of steps to reduce emissions. A proposed "sustainability toolkit" containing information on implementation strategies and potential cost savings could act as a communication tool to convey

<sup>40</sup> Data Set: 2000 U.S. Census. Online at <http://www.census.gov>.

sustainability ideas to businesses and immediate assistance in employing energy-saving techniques.

### ***Targeted Outreach: Municipal Sector***

Several measures reducing CO<sub>2</sub> emissions and energy costs have already taken effect including the ESCo project and, in 2007, the adoption of the Sustainable Building Resolution affirming a commitment to use sustainable design principles and energy conservation considerations in new construction and renovation of municipal buildings. One possible future CBSM strategy would involve holding a visioning workshop for town employees to brainstorm low-cost and other measures the town can take to reduce CO<sub>2</sub> emissions.

### ***Ideas from Belmont Stakeholders***

Additional ideas for educating the public were suggested at a forum hosted by Sustainable Belmont to discuss the CAP and its presentation to the community. A group of representatives from a number

of committees, boards, and leadership groups in town suggested a numerous ideas for promoting the CAP and the adoption of sustainable behaviors throughout the town. These suggestions should be studied closely and utilized in fashioning outreach, education, and implementation programming. (For examples of some of the suggestions, see Guides to Action, Appendix F)

### ***Conclusion***

The CAP sets an ambitious but necessary goal of 80 percent reduction of 2007 carbon emissions by 2050. To achieve that goal, the Belmont community must eliminate annual emissions of 222,000 tons of CO<sub>2</sub>. Implementing the commercial, municipal, residential, and transportation CO<sub>2</sub> emissions reduction measures set forth in this plan will put us on the path to meeting this goal but to do so will require the combined efforts of the entire Belmont community and its stakeholders. Therefore the key to the Climate Action Plan's success is to engage the community in the effort.