Cities for Climate Protection Campaign
Portsmouth, NH
Summary Report

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Introduction

This report summarizes the progress of the City of Portsmouth's pledge to the Cities for Climate Protection campaign (CCP) during the summer of 2007. The CCP campaign is one of the components of the city's commitment to becoming a sustainable community. The CCP campaign guides the city toward reducing energy consumption and corresponding greenhouse gas emissions through the establishment of a Local Action Plan. The City of Portsmouth signed a commitment to the CCP campaign on November 13, 2006. This report summarizes the completion of the first two "milestones" in the city's commitment. This first milestone includes establishing a base year, gathering base year energy consumption and waste generation data, and calculating greenhouse gas emissions for the base year. The second milestone establishes a greenhouse gas emissions reduction target. This report was researched and assembled under the supervision of Peter Britz, the city's Environmental Planner by James Ryan, an intern hired by the city during the summer of 2007. Funding for this effort was provided by the New Hampshire Charitable Foundation, Otto Fund.

The Cities for Climate Protection Campaign

The Cities for Climate Protection campaign is an international campaign organized by the International Council for Local Environmental Initiatives (ICLEI). ICLEI is an international association of local governments that have made a commitment to sustainable development. There are currently more that 250 towns, cities, counties and other organizations in the United States that are members of ICLEI. ICLEI works with its members by providing guidance and technical support for the several programs they supervise. One of the programs that ICLEI organizes is the CCP campaign

The CCP was established in 1993 at a United Nations meeting in New York where municipal leaders approved a declaration calling for local governments to reduce greenhouse gas emissions, improve air quality and enhance urban sustainability. Since its inception, over 650 local governments have pledged to take greenhouse gas emissions reduction measures as part of the CCP campaign. While local governments work to implement their new policies and practices, ICLEI provides them with guidance and technical support.

The Cities for Climate Protection campaign is a very intuitive means of reducing greenhouse gas emissions due to the dual role of cities as part of the climate change solution and part of the problem. During the industrial revolution, with the advent of concentrated energy generation and distribution, population and industry growth in cities boomed. As cities grew and energy demand increased, pollution from coal and oil turned cities into dirty and polluted places. With cheap gasoline and cars, people relocated to cleaner, more pleasant suburbs, which increased inefficiency and energy demand by introducing a large number of single family homes and extending commutes. The density of urban development provides the potential for sustainable practices in large communities. Public transportation, pedestrian travel, and common-wall housing, are reasons cities hold great potential as either part of the problem or part of the solution. The Cities for Climate Protection campaign is an effort to transform cities into part of the solution.

Cities for Climate Protection Campaign Methodology

ICLEI recommends a five "milestone" plan that serves as a standardized outline for local governments to follow as they complete their commitment to the CCP campaign. The milestones defined by ICLEI are:

> **"Milestone 1.** Conduct a baseline emissions inventory and forecast. Based on energy consumption and waste generation, the city calculates greenhouse gas emissions for a base year and for a forecast year. The inventory and forecast provide a benchmark against which the city can measure progress.
>
> **Milestone 2.** Adopt an emissions reduction target for the forecast year. The city establishes an emission reduction target for the city. The target both fosters political will and creates a framework to guide the planning and implementation of measures.
>
> **Milestone 3**. Develop a Local Action Plan. Through a multi-stakeholder process, the city develops a Local Action Plan that describes the policies and measures that the local government will take to reduce greenhouse gas emissions and achieve its emissions reduction target. Most plans include a timeline, a description of financing mechanisms, and an assignment of responsibility to departments and staff. In addition to direct greenhouse gas reduction measures, most plans also incorporate public awareness and education efforts.
>
> **Milestone 4**. Implement policies and measures. The city implements the policies and measures contained in their Local Action Plan. Typical policies and measures implemented by CCP: participants include energy efficiency improvements to municipal buildings and water treatment facilities, streetlight retrofits, public transit improvements, installation of renewable power applications, and methane recovery from waste management.
>
> **Milestone 5**. Monitor and verify results. Monitoring and verifying progress on the implementation of measures to reduce or avoid greenhouse gas emissions is an ongoing process. Monitoring begins once measures are implemented and continues for the life of the measures, providing important feedback that can be used to improve the measures over time." (taken from www.iclei.org)

This report summarizes Portsmouth's completion of milestone 1, 2, the beginnings of 3 and should serve as a guideline for future inventory development. With a detailed explanation of both the data and the methodology of the data gathering, future inventories can be assembled in the same manner to ensure a comparison of similar data sets. Explanation of how data was gathered, assumptions that were made, and missing data are explained in this report along with supplemental notation within the reports generated by the Clean Air and Climate Protection (CACP) software ICLEI provides its members.

The Clean Air and Climate Protection Software

The CACP software estimates the following air pollutants from inputted energy usage and waste generation data:

CO_2: Carbon Dioxide
NO_x: Oxides of nitrogen, primarily NO_2
SO_x: Oxides of Sulfur, primarily SO_2
CO: Carbon Monoxide
VOC: Volatile Organic Compounds
PM: Particulate Matter

To simplify the data output, the program converts all of the gases into one CO_2 equivalent value according to the relative greenhouse effect of each gas. For example, NO_2 is about 275 times more potent than CO_2 as a greenhouse gas, so the program multiplies the mass of NO_2 by 275 to obtain the CO_2 equivalent value. The program requires that the information be input based upon two primary categories: government and community. Government includes all city-owned facilities, properties, equipment, buildings, and operations. Community includes everything within the city limits (including the government). The two primary categories are then broken down further into "analysis" and "measures." Analysis is where the current usage data is entered and measures is where particular energy and waste saving measures can be implemented and their effects measured. The measures section will provide the city with an easy way of quantitatively comparing the impact of future emissions reduction plans with the economic repercussions they include. The reports generated by the Clean Air and Climate Protection software are included in the appendices of this report with notations explaining how the data was gathered.

The Municipal Analysis

The municipal analysis generates greenhouse gas emissions data for all government owned and operated facilities. Examination of the trends in the data will aid in the development of specific measures to reduce. This initial analysis serves as a valuable tool for developing a municipal action plan and a baseline inventory to compare future progress against. The data presented in the body of this report is based upon the data generated from the CCP software the specific reports generated by the software are included in the appendices to this report.

The data is divided into five categories:

- *Buildings*: Emissions resulting from municipal buildings
- *Vehicle Fleet*: Emissions resulting from city owned vehicles
- *Employee Commute:* Emissions resulting from city employees commutes
- *Streetlights:* Emissions resulting from electricity generation for street and traffic lights
- *Water/Sewage*: Emissions resulting from electricity generation for pumps, wells, and booster stations are part of the water and sewer system.

The overall summary of each category's CO_2 equivalent contribution is shown in figure 1.

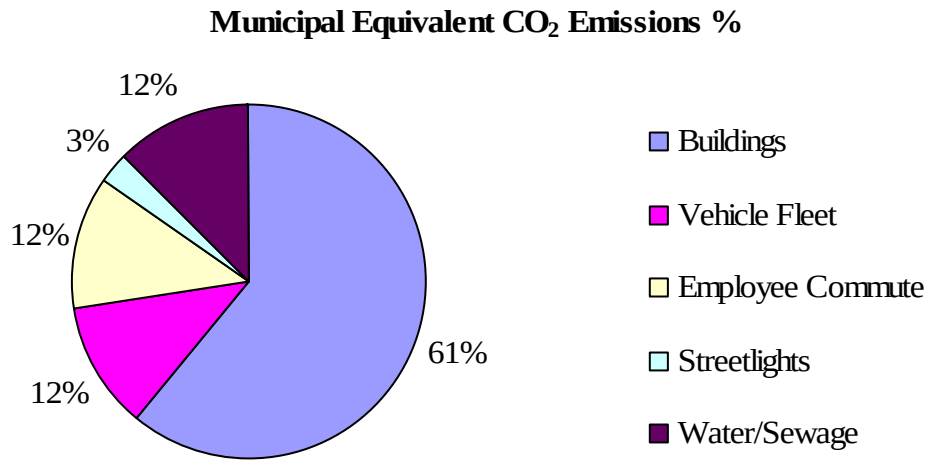

Figure 1 – Summary of Municipal Equivalent CO_2 emissions distributed by sector.

Buildings

The municipal buildings generated 61% of Portsmouth's 2006 greenhouse gas emissions; making it by far the largest contributor. The city buildings generated 3,378 tons and 5,616 tons of equivalent CO_2 emissions from electricity and natural gas respectively. The buildings in the city vary widely in size. The energy usage per 1000 ft^2 is compared in figure 2 to enable a useful comparison of each building's efficiency.

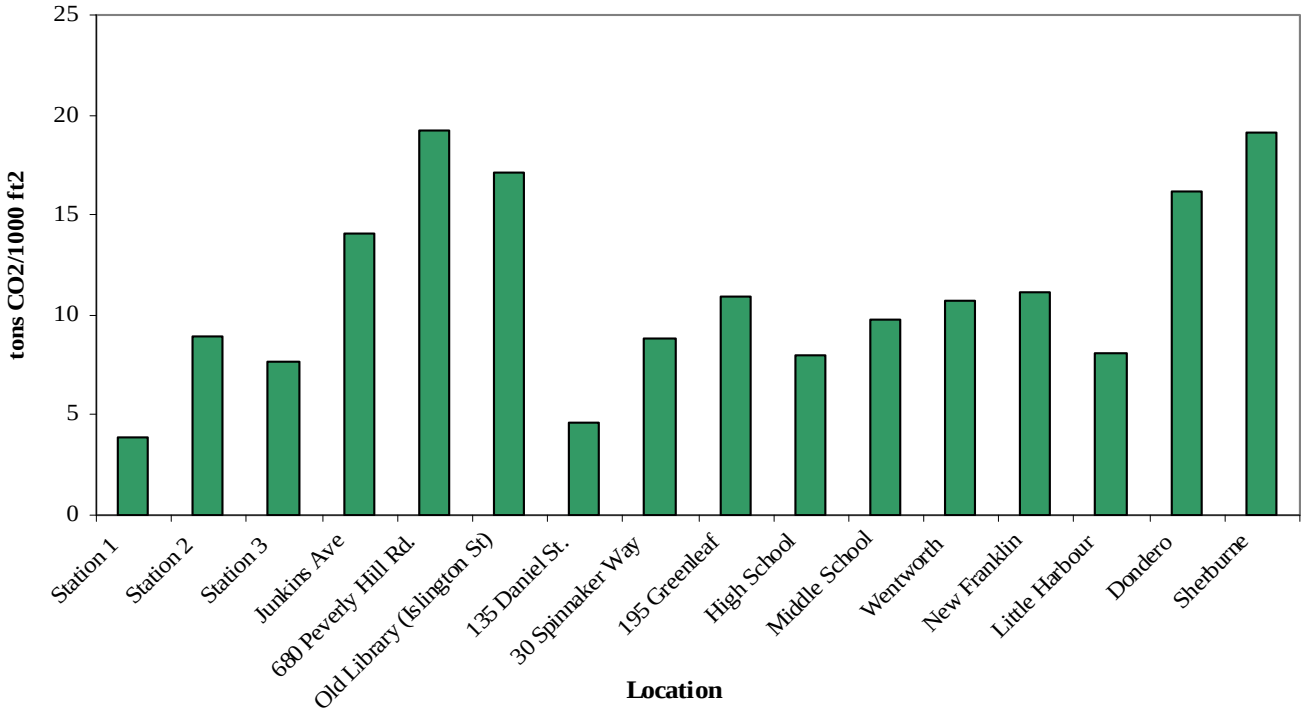

Figure 2- Tons CO_2 equivalent emissions per 1000 ft^2 versus municipal location. The locations displayed in this graph do not include facilities with energy intensive operations such as the drinking water treatment facility, wastewater treatment facility, and indoor pool.

From figure 2 it can be seen that the Public Works facility on Peverly Hill Rd. and the Sherburne school are the two most energy intensive municipal buildings. This analysis may aid in targeting the most problematic buildings for improvement. Improvements upon the most inefficient buildings could range from educating the people using the buildings about how to use energy more resourcefully, to modifying the building to improve its energy efficiency. Monitoring the city building's is relatively easy because energy usage records are updated monthly in the finance department. The city's mobile sources usage is more difficult to track.

Vehicle Fleet

The city's vehicle fleet contributed 12% of the total municipal CO_2 equivalent emissions in 2006. The fleet includes vehicles from the public works, police, fire, school, school bus, and housing authority departments. The breakdown of each department's contribution to the vehicle fleet's 1,785 tons of CO_2 equivalent emissions in 2006 is shown in figure 3. The records for each individual vehicle's fuel consumption are kept by public works and could be better organized for future monitoring. More details regarding this record keeping can be found in the detailed report Appendix A. Improved record keeping should be a priority as targets are set, so that progress can be properly monitored.

The public works department has 78 vehicles and their large contribution can be attributed to the large number of vehicles and the frequently used heavy trucks that are involved in the trash pickup, plowing, and construction that public works is responsible for. The police department has 30 vehicles and their second largest contribution can be attributed to the patrol vehicles' low fuel efficiency, and 24 hour operation. The school buses are not owned by the city, but they are used by city residents so they were included in this analysis. The fire department has 18 vehicles; the engines and ladder trucks have very low fuel efficiencies, but they are not used as regularly as most other vehicles. The housing authority has 4 senior transportation vans and 5 maintenance vehicles. The school department has 6 maintenance pickup trucks, a box truck, and 2 sedans that use a relatively small amount of fuel.

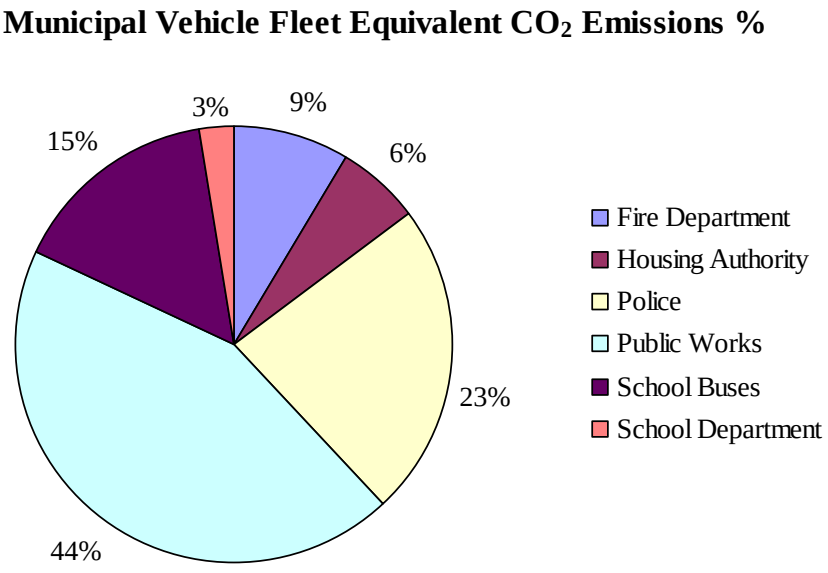

Figure 3- The percentage of the total municipal vehicle fleet's CO_2 equivalent emissions that each department's vehicles generate.

Employee Commute

The employee commute contributed 12% of the total municipal greenhouse gas emissions in 2006. The share of these emissions was divided up according to the varying amounts of annual work days each type of employee has. The emissions amounts from each type of employee are reflective of how many days each type of employee commutes. The distribution of the emissions is shown in figure 4. Average commute distances were calculated to get a better picture of how far each type of employee commutes. These distances are shown in table 1.

Employee Type	Number of employees	Average miles per commute
Full Time City	327	16.2
Part Time City	182	6.6
Full Time School	466	17
Part Time School	432	15

Table 1- Average commute distances for each employee type

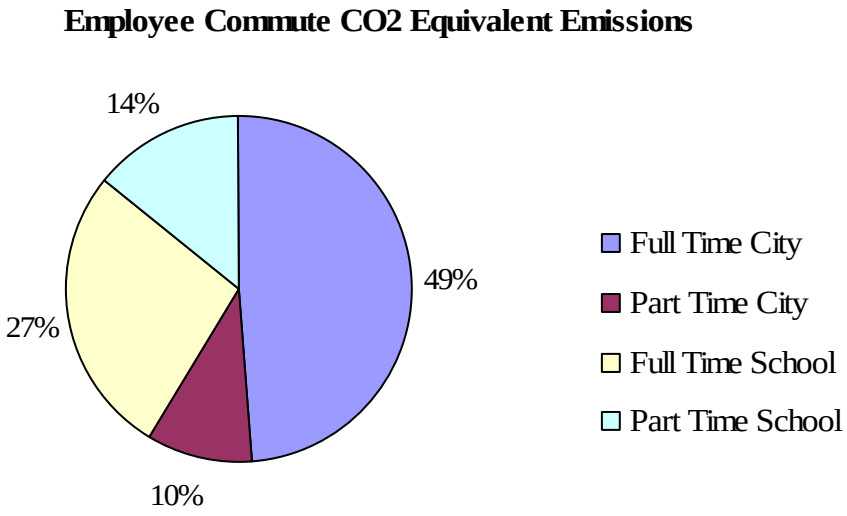

Figure 4- Distribution of CO_2 equivalent emissions from municipal employee commutes.

Streetlights

The streetlights sector includes all the streetlights and traffic lights in the city. The electricity to power these lights produces 3% of the city's total emissions. The streetlights in the city are almost entirely high pressure sodium fixtures and the traffic lights are almost entirely LED. The streetlights are owned by PSNH, and the high pressure sodium bulbs are the most efficient they install. The city's traffic lights utilize LED bulbs, which are widely accepted as one of the most common efficiency measures currently being implemented.

Water/Sewer

The water and sewer department's pumping stations, wells, and booster stations generated 12% of the city's greenhouse gas emissions. There are a total of 32 water and

sewer locations in the city that are using energy, but three pumping stations in the city accounted for the majority of the energy usage. Freshet Road, Deer Street, and Rye Street each generated about 22% of the total water and sewer sector's emissions. It is important to note that this sector does not include the waste water and drinking water treatment facilities.

Municipal Emissions Reduction Measures

As the City of Portsmouth continues in its ongoing effort to become more sustainable, it will be taking certain measures to reduce its air emissions. The following are some of the municipal measures implemented after the baseline inventory year of 2006 and some potential suggested measures. Along with a description of the measure is the annual equivalent CO_2 reduction in tons, the percentage of the municipal emissions that it would reduce, and the financial savings. Using the CACP software, proposals for reducing emissions can be quantified and presented as they are in this report. Having a concrete estimate of the reductions from a measure aids in the decision making process about where the largest improvements can be made.

Municipal Measures Already in Place

Opening of LEED certified Public Library:

In January of 2007 a new 39,000 square foot, Leadership in Energy and Environmental Design (LEED) certified public library was opened at 175 Parrot Ave. This new library is an example of the potential for energy efficiency in the municipal buildings in the city of Portsmouth. Since the new library has opened, it has demonstrated that to heat one square foot of building space it requires only one fourth of the natural gas the old library required. Even with the addition of 40 new computers, the electricity usage per square foot in the building is 39% less. The public library should serve as an example for both future municipal and private building projects. Public awareness of the building's benefits can help spur momentum for private builders to do the same. The potential energy savings and corresponding CO_2 emissions reductions associated with LEED building design can already be seen from this analysis.

Annual Equivalent CO_2 Reduction: 88 tons (0.57%)

Savings: According to the preliminary energy analysis for LEED Credit EA 1 prepared by Andelmann and Lelek Engineering, Inc: $23,600/year

Use of B-20 Diesel Fuel in Public Works Vehicle Fleet:

In August 2007 the city's public works department will started phasing in the use of B-20 blended diesel fuel in its diesel-powered vehicles. B-20 is a blended fuel comprised of 20% biodiesel and 80% ULSD diesel fuel. Biodiesel is a cleaner-burning renewable fuel derived from vegetable oils. The many benefits of biodiesel include;

- Lower unburned hydrocarbon, particulate, and SO_x emissions
- No modifications to the existing diesel engine are necessary
- Can be blended with petroleum based fuels

- It can be domestically produced, reducing dependence upon unstable foreign suppliers
- It is renewable

As confidence in the fuel increases, integration into the entire diesel vehicle fleet will hopefully take place. Making it visible to the public that the municipal vehicle fleet is using biodiesel can spark interest and confidence in the fuel's integrity as a viable alternative to petroleum based fuels. A public works plow truck with the words "Powered by biodiesel" written on the side could be an effective means for community awareness.

Annual Equivalent CO_2 Reduction: 97 tons (0.6%)

Savings: Implementing the use of biodiesel will not have any direct economic savings. A capital cost of $5000 is estimated. As of July 24, 2007 the pre-tax price the city will pay for B-20 biodiesel blend and diesel are $2.3705/gal and $2.2749/gal respectively. If there was no reduction in the amount of fuel used, the additional cost would be $9300/year. The cost of this program could potentially be offset through the use of the Clean School Bus USA funding that is available through the EPA's Regional Diesel Collaborative program.

Potential Suggested Municipal Measures:

Cleaning up the School Bus Fleet:

Using biodiesel in Portsmouth's school bus fleet has potential for significant GHG emissions reductions. Portsmouth's school buses are owned and operated by a private contractor, but the services they provide to city residents consume approximately 26,000 gallons of diesel fuel per year. Lowering emissions from school buses has the dual benefit of lowering the overall carbon footprint of the city, and reducing the amount of concentrated diesel exhaust soot. The emissions could be lowered even further by retrofitting the buses with improved particulate removal technology. The EPA has funding available for cleaning up school bus fleets through its "Clean School Bus USA" program. The potential for the measure to be put in action rests largely with the ability to negotiate with the contractor.

Annual Equivalent CO_2 Reduction: From using B-20 biodiesel: 55 tons (0.4%)

Savings: This measure would not yield any direct financial savings. The benefits would be purely emissions and health related. The cost of this program could potentially be offset through the use of the Clean School Bus USA funding that is available through the EPA's Regional Diesel Collaborative program.

Community Analysis

The community analysis is not as in depth as the government analysis due to the larger size, and complexity of gathering data for an entire city. The community analysis breaks the data into five categories: residential, commercial, industrial, transportation and waste. The transportation sector is all of the traffic in the city. The waste sector emissions are from the decomposition of the city's solid waste. The residential, commercial, and industrial sectors correspond with each sector as defined by the utility and fuel suppliers that provided data. Due to the reluctance of some utility providers to release sector-specific data there was some estimation involved to generate the data in this analysis. These estimations coupled with the vast number of variables involved in the city's energy consumption patterns make it difficult to quantify current usage and determine what progress is being made on the community level. The various assumptions and methods that were used to generate the community wide data are explained in Appendix B. The total 2006 equivalent CO_2 emissions for the city were approximately 678,000 tons. The breakdown of these emissions by sector can be seen in figure 5.

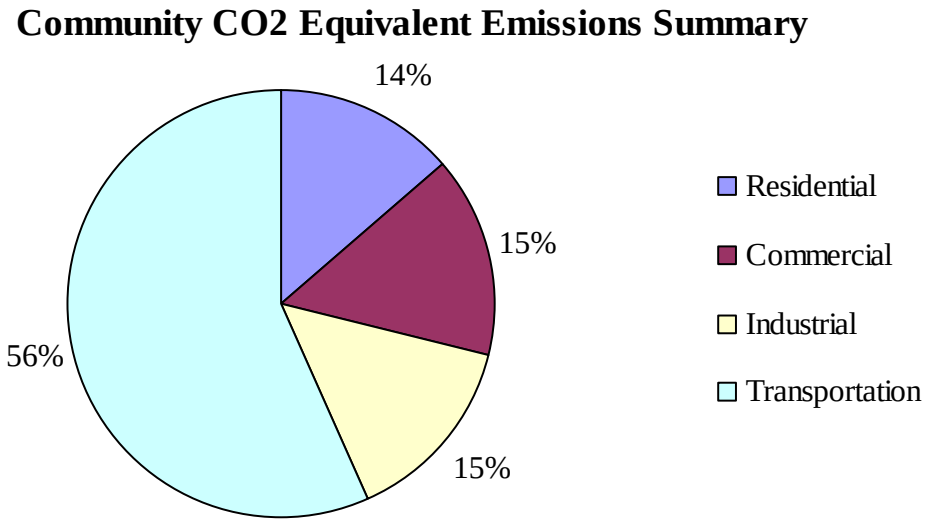

Figure 5 – Percentage of the total community CO_2 equivalent emissions that each sector contributes. The waste emissions contribution is not shown because it is less than 1%. For more detailed information about the waste sector see Appendix B.

Community Measures

The ability to reduce the community's greenhouse gas emissions is limited by the willingness of community members. Education about the critical nature of global warming and the importance of citizens role taking action should be the first steps towards making change in the community. It seems safe to say at this point that most residents are aware of global warming, but not aware of how easy it is to alter their lifestyles in simple ways to reduce their impact. In addition to educating people about how to reduce environmental impacts, education about the positive economic aspects of greener living should also be considered. Broader knowledge of these ideas can be accelerated by community programs

such as Portsmouth Listens, where individuals can hear about how other individuals are making changes. As awareness about the importance of reducing greenhouse gas emissions becomes more widespread, there will likely be more community support for measures such as green building requirements and vehicle mileage standards.