Greenhouse Gas Inventory and Energy Audit

Portland, Maine
Summer 2001

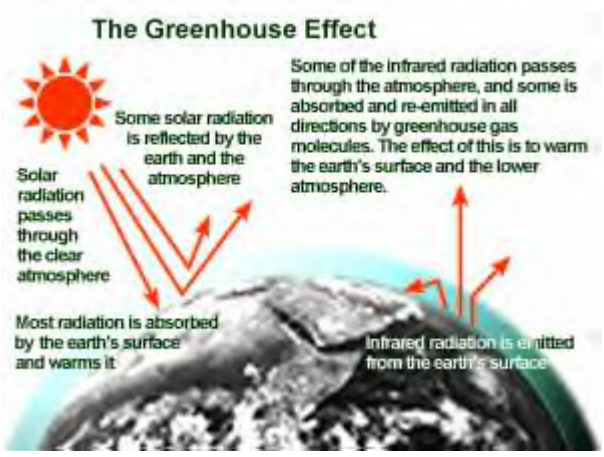
Cities for Climate Protection
International Council of Local Environmental Initiatives

Prepared by Rick Peltier, under the direction of Troy Moon, Public Works Department

Climate Change Overview:

Scientists have been researching the phenomenon of global climate change from the green house effect for decades. There has been growing scientific consensus (although the exact effects are difficult to predict) that increased levels of carbon dioxide and other gases will cause changes in the chemical composition of the earth's atmosphere.

Specifically, energy from the sun heats the earth's surface, while the earth radiates energy from the sun back into space. Atmospheric greenhouse gases naturally present in the atmosphere in small amounts trap some of the outgoing energy, retaining heat somewhat like the glass panels of a greenhouse and heating the earth. The earth normally stays at a constant temperature by shedding heat into space at the same rate it absorbs the energy from the sun. When the system is unmolested, the amount of energy given off from the earth equals the amount of energy absorbed.



However, problems arise when the atmospheric concentration of greenhouse gases increases and upsets the equilibrium of these gases naturally present in the atmosphere. Therefore, the greenhouse effect refers to the increasing warming of the earth because of gases in the atmosphere that trap the sun's energy on earth. In other words, the sun's energy passes through to the earth, but more energy than usual is prevented from escaping back into space. This energy remains trapped on earth and gradually warms the earth beyond its normal temperature.

Scientists generally believe that the consumption of fossil fuels and other human activities are the primary reason for the increased concentration of carbon dioxide in the atmosphere. Energy burned to run cars and trucks, heat homes and businesses, and power factories is responsible for about eighty percent of society's total carbon dioxide emissions. Human industrial activities annually emit the equivalent of 8.3 billion tons of carbon dioxide into the atmosphere. Trees, plants, and oceans reabsorb 60 percent of this carbon. However, the remaining 40 percent increases the atmospheric level of greenhouse gases, magnifying the planet's natural warming mechanism and increasing temperature worldwide—as discussed previously.

Since the mid-1980s, 20.5 billion tons of carbon dioxide or more has been and continues to be pumped into the atmosphere annually. The industrial world, where only one-third of the planet's population lives, produces 80 percent of that amount. This means that the industrial world carries the main responsibility for global warming. This is not surprising, as these countries use most of the fossil fuels. Diagram 2 on the next page illustrates this contention. Clearly, the United States leads all countries in carbon dioxide emissions, both in CO2 emissions per capita and in total CO2 emissions producing.

While increased carbon dioxide emissions appear to be a global problem, its implications can be felt on the local level. The implications associated with excessive carbon dioxide emissions for municipalities in the United States are serious and multifaceted:

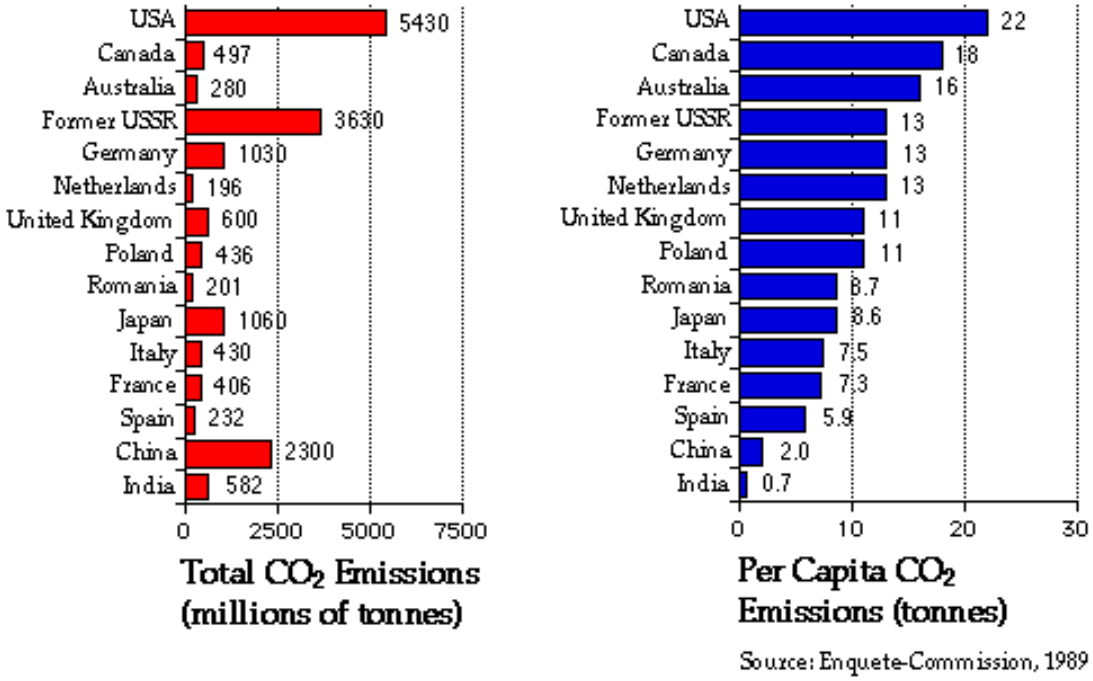
General Impacts of Global Warming

Economic Impacts:

- The imposition of stricter emission standards by the federal government for residents owning automobiles from which the cost of repairs for vehicles that do not meet the new requirements would be high.
- The imposition on area industries by the federal government to install filtering equipment at their manufacturing facilities. This expense means a higher cost of doing business for companies already in

the area, and it could mean some companies would relocate rather than bear the cost. In addition, companies looking to locate in the region would decide to build in attainment areas to avoid the filtering expense. The loss of jobs would have a ripple effect on everyone in the community.

- The loss of federal funding for road repair and construction.



Health Impacts:

- Increases in respiratory diseases such as asthma.
- Increases in infectious diseases such as encephalitis, malaria, and Lyme disease as mosquito and tick populations grow with increases in temperatures.

Environmental Impacts:

- Changes in weather patterns leading to increased flooding and droughts.

Impacts Specific to Portland and Maine

Portland is fairly sensitive to climate change issues. As a community that relies heavily on tourism and fishing, potential climate warming poses several challenges to our way of life in Southern Maine.

Each impact is a general assessment into each sector. This is not a scientific analysis of potential consequences – just items that seem to be obvious concerns when considering climate change.

Infrastructure:
Many of Portland's roadways and transportation corridors (rail beds, airport, etc.) are located just a few feet above extreme high tide levels. Increasing sea level may jeopardize the City's bridges, runways, or rail lines.

Wetlands:
Wetland regions will be inundated with seawater as the level rises. These regions may also be adversely affected by the potential increase in extreme storm events such as hurricanes, N'oreasters, and heat waves.

Water Supply:
Sebago Lake supplies the vast majority of communities in Cumberland County. It is predicted that climate change may bring about significant changes in rainfall amounts (generally, lighter amounts in the summer, more amounts in the winter), which may disrupt the water level. Water availability is something that most Mainers take for granted, but as we continue to examine climate change's impacts, we must consider all consequences to alterations in our water supply.

Public Health:
Climate change is predicted to increase the summer-season heating potential in the region. Mainers are not adept at mitigating heat (such as communities in the Southern United States). Specifically, many residents do not use air conditioning and many may suffer significant heat-related morbidity.

Secondly, vector-borne diseases, or diseases that are transmitted by a third organism (such as West Nile Virus being transmitted by mosquitos) is likely to increase in prevalence. Likewise, water-borne diseases will likely increase with a warmer atmosphere.

Economics:
As a city dependant on fishing and tourism, climate change plays a very detrimental role. Variations in ocean temperatures can cause habitat changes in the ocean ecosystems. This can alter the species type and location in the Gulf of Maine fishing grounds. Anecdotally, there is already a northward migration of lobsters occurring off our coasts.

Likewise, with 50 cruise ship visits a year, changes in climate may alter tourist's impression of the community. Southern Maine is well known for its temperate summer coastal climates, and will likely suffer decreases in tourism if the ambient temperature begins to increase. Although not specific to Portland, the region's primary winter tourism draw, downhill and cross-country skiing, may suffer incredibly bad misfortune as even warmer temperatures make it still more difficult to cover the slopes with snow.

ICLEI and Cities for Climate Protection

The International Council on Local Environmental Initiatives (ICLEI) is an international non-profit working to address global environmental concerns through local sustainability programs. ICLEI began its work 10 years ago to coordinate efforts by communities and to provide technical assistance for local environmental planning. In 1993, ICLEI began the Cities for Climate Change Campaign to assist local governments addressing rising emissions of greenhouse gases. Currently 350 cities, towns, and county governments are members of ICLEI worldwide and 75 municipalities are participating in the CCP Campaign within the United States. It is estimated that these communities represent over 15% of the emissions from this country.

The Cities for Climate Protection Campaign involves a 5-Milestone process to inventory greenhouse gas emissions and develop emission reduction goals and implement programs to reduce local carbon dioxide and methane emissions.

- **Milestone One:** Conduct a baseline emissions inventory for the entire community as well as municipal operations. From this baseline data we projected the emissions growth or decline by the year 2015 assuming no actions are taken to address greenhouse gases. The primary emission sources examined in the Milestone One Inventory are:
  Energy Use - Electricity and heat for residential, commercial, and municipal facilities
  Transportation - Emissions from personal & commercial vehicles, transit vehicles
  Solid Waste - methane and CO_2 contribution of waste disposal operations

- **Milestone Two** - Set an Emission Reduction Target. Many local and international targets have been set at 20% of the base year emissions level, and use their projection year as the goal for obtaining these emission reductions.

- **Milestone Three** - Develop an Action Plan - a collection of initiatives to reach the emission reduction target. These initiatives will include finding efficiency and technological improvements available to the town operations as well as programs to encourage emissions reductions within Portland.

- **Milestone Four** - Implement Actions. Various initiatives may require decisions and efforts by municipal program departments and operators, the City Council, the City Manager's office, local businesses, and community residents.

- **Milestone Five** - Monitor Emissions Reductions. Set annual goals for policy implementation and calculate emission reductions from policies put into place.

At the time of this report, Portland has completed Milestone One. With a comprehensive greenhouse gas inventory and audit, the City can continue this work by setting a feasible reduction goal and developing a suitable Local Action Plan.

There is just one other Maine community that has joined the Cities for Climate Protection Campaign. Augusta has completed their inventory and are currently in the process of developing their local action plan.

Accuracy and Error:

Although every attempt was made to ensure accuracy, it is important to note that this document is an estimate. There is inherent error in the derived formulas, as well as sampling error from examination of data. Whenever possible, data was double checked, and/or a secondary analysis or estimate was conducted. This will be best illustrated by community home heating oil consumption. An estimate was produced using total number of square footage heated by oil multiplied by a gallon per square foot coefficient. A secondary estimate was completed that multiplied average annual consumption for a living area by the number of living areas. Each number was within reasonable proximity, suggesting that the estimation is fairly accurate.

Anyone who has never made a mistake has never tried anything new.
Albert Einstein (1879-1955)

It is in the opinion of the ICLEI intern that this inventory, if anything, may be an under-estimate of energy consumption. Although this variance is inevitable, it is however likely within the boundaries of accuracy. It is suggested that this is an underestimate because error is more likely to occur in not including energy consumption (because it is difficult to verify), rather than overestimate because items are included multiple times (which can be easily verified).

Inventory Methodology

General:
Data for each inventory was collected for a particular time frame. For the Community Inventory (or the inventory for the entire community of Portland, which includes all residences, commerce, industry, government operations, schools, etc.) was conducted for Calendar Year 2000. The Corporate Inventory (or the inventory conducted for energy consumption for strictly municipal operations) examines data for Fiscal Year 2000. The rationale for doing this was ease of data access – corporate data is generally organized by fiscal year.

Projections into the future were also considered. It is expected that there will be an average growth of approximately 14% in the next 15 years. This was projected when appropriate in the data. Corporate analysis is not increased in this manner – it is expected that the municipal operations do not necessarily need to grow (i.e. although there will be more commerce, it is unlikely that the city will have to plow snow on more streets).

There is a small amount technical terminology included in this presentation. However, every attempt was made so that a non-technical reader can understand this. Two helpful definitions are listed below:

BTU – Or British Thermal Unit. A unit of measure for any kind of energy. Most energy sources were converted to BTU, as there are varying energy coefficients between energy sources (i.e. it allows you to compare the energy potential of a kilowatt of electricity with a gallon of gasoline).

eCO2 – Or equivalent CO2, this is a unit of measure for the heat-trapping potential of all greenhouse gases. Not all gases have the same potential for trapping heat. For example, methane is 22 times more potent at hold heat than regular carbon dioxide (a gas commonly found in our atmosphere that is emitted in large amounts in our community).

Community:

All utility data acquired for the community portion of this inventory was collected directly from respective utility companies. In general, community-wide information was extracted from MIS personnel for each organization. Significant contacts are listed below:

Danielle Card, Central Maine Power
Stan Dzuira, Northern Utilities/Bay State Gas

Non-utility data for the community portion of this study was collected, or estimated in several different pathways. Whenever possible, derived or estimated data was double-checked using an alternative method of estimation.

Community Heating Oil:

Because of the natural of distribution of heating oil (non-centralized system), we must estimate average annual community consumption. The methodology for this process can be found below.

Using the 1997 Department of Energy study[1], and fuel usage (and square footage) information for the City of Portland[2], total residential living area square footage heated by oil was multiplied by 0.374 gallons of fuel per square foot of living space. This value of 0.374 gallons was derived from the DOE study, and was offset upwards and additional 29.45% (by virtue that the DOE study represented a national study using average national temperatures – and subsequently "average" heating oil consumption). 29.45% represents the consideration that according to the National Weather Service by Heating Degree Days, Portland, Maine

[1] Residential Energy Consumption Survey, 1997. This report can be found at:
http://www.eia.doe.gov/emeu/recs/recs97/rx97toc.html
[2] Data extracted from Assessor's database by Paul Manson, City of Portland MIS

is 29.45% colder than the national average. Residential data is classified as all of the following land uses: Apartments and Rooms, Commercial Condos, Single, 4, 5-10, 11-20, 21+ family residences, Multi-Use Residential, and Rooming House.

Similarly, commercial and industrial heating oil consumption was estimated using DOE data and information extracted from the Assessors database. The US Department of Energy estimates that commercial and industrial sites use less heating oil per square foot; therefore the formula was modified to reflect that 0.36 gallons per square foot per year are consumed.

Community Propane:
Propane consumption estimation is even more difficult to predict and estimate. However, using market share data, and proprietary information, Suburban Propane[3] of Portland, the largest distributor in the area, was able to give reasonably accurate numbers that reflected the market share and total proprietary consumption. Mr. Matthews was also able to discriminate between residential and commercial/industrial consumption. Per our agreement, the specific company-specific data will not be published, but the data was simply used as a framework for estimation of community-wide consumption.

Community Waste and Recycling:
All community waste and recycling information was provided by the City of Portland[4]. Although it should be included, energy consumption at Portland Water District facilities in Standish (Sebago Lake) we not included, as there is no feasible way to discern proportional energy usage from that particular facility. This data was, however, included in the corporate analysis.

Community Tranportation:
Automotive transportation was provided by the Maine Department of Transportation[5]. Daily Vehicle Miles Traveled was multiplied by 330 days (instead of 365) due to expected decreased traffic on weekends and holidays. This data also includes vehicle data that crosses jurisdictional boundaries on the Maine Turnpike and I-295.

Waterfront transportation information was generated empirically by contacting resources directly at the waterfront. The following resources were contacted:

- United States Coast Guard, Marine Safety Office
- United States Coast Guard, National Vessel Documentation System
- James Carter, Merrill Marine Terminal
- Arthur Fornier, Portland Tugboat Service
- Sean Moody, Chase-Leavitt
- Portland Steamship Authority
- Nick Mavadones, Jr, Casco Bay Island Transit District
- Ben Snow, City of Portland Waterfront and Transportation
- Portland Fish Exchange
- Dimillo's Marina
- Portland Yacht Service
- Jay Fry, Scotia Prince Lines

Exact consumption data was acquired from Casco Bay Island Transit District, Portland Tugboat, and the Scotia Prince. Other data was estimated using the resources listed above. Please refer to the Notes section of the Inventory for specific consumption formulas.

It is important to note that energy consumption by large oil tankers docked at the Merrill Marine Oil Terminal are not included in this inventory, as the terminal is physically located in South Portland.. Also not included in the transportation inventory is jet and plane consumption from Portland International

[3] Suburban Propane. Ken Matthews, (207) 774-0387
[4] Troy Moon, Solid Waste Coordinator - City of Portland, Maine
[5] Ed Beckwith, MDOT – using TIDE model to generate DVMT

Jetport. This was excluded because the nature of this expenditure is purely intercity, and cannot easily be assigned as "Portland Consumption" versus "Destination Consumption".

Corporate:

Energy consumption for municipal operations was gathered, in general, by researching through actual utility/energy records. In most cases, information was verified by the utility itself.

Electricity data was gathered by Central Maine Power[6] since there was too many electric bills to coordinate (over 500 bills). Since the city held an exclusive contract with Union Oil[7] for heating oil delivery, heating oil data was provided by the supplier (rather than the city). This is true for all city accounts, with the exception of heating oil on the islands – this information was provided by the School Department[8], Public Works, and Public Safety (and verified by Peaks Island Fuels).

Community	Population	Community eCO2 Emissions	Per Capita	Year of Inventory
Burlington, VT	39,127	438,931	11.2	1990
Portland, ME	**64,249**	**972,732**	**15.1**	**2000**
Watertown, MA	33,284	695,675	20.9	1999
New Rochelle, NY	72,182	985,112	13.6	2000
Augusta, ME	18,553	349,552	18.8	2000
Austin, TX	470,000	9,633,701	20.7	1998
Santa Cruz, CA	54,575	747.679	13.7	1990
Total for all 2001 CCP Communities	2,032,156	28,056,384	13.8	varies

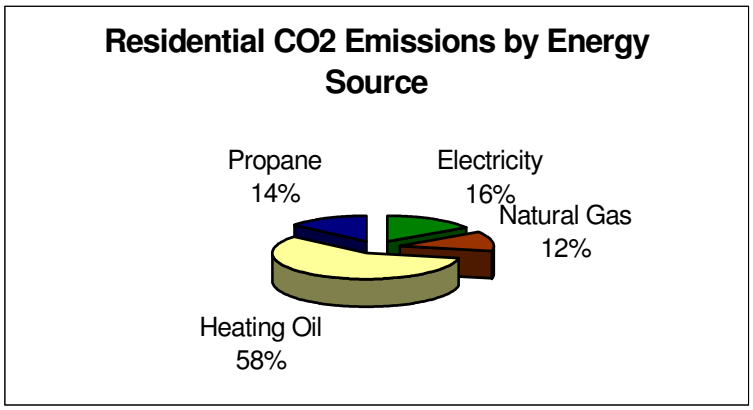
Water and wastewater information was provided by Portland Water District.[9] This data is proportional (per PWD) to the consumption amount for only the City of Portland usage. Streetlight and traffic light data were supplied by Public Works energy accounts and Central Maine Power.

Municipal fleet information was provided by the Department of Public Works. [10] Lastly, the Solid Waste Management Office provided municipal waste data. Recycling data is not available for municipal-only generation.

[6] Danielle Card, CMP – Customer Service MIS Department
[7] Bob Horn, Union Oil Company
[8] Amanda Slaney, Portland School Department
[9] Dick Clark, Portland Water District
[10] Erin Dulac, Fleet Manager – City of Portland Public Works Department

Community – Residential

The City of Portland residential community consumed 79,276,907-kilowatt hours of electricity during calendar year 2000. While this figure seems staggering, it represents just 8.6% of residential energy consumption when each energy type is converted to a standard unit (British Thermal Units – BTU). It is likely that the usage of electricity can be attributed to area lighting and appliance operation, rather than for home heating. Approximately 12% of Greater Portland's homes use electricity as its primary heating source.[11]



The most prominent energy source consumed for the residential sector was light fuel oil (also known as home heating oil). This resource accounted for 58% (per BTU) of all energy sources. Remarkably, the residential sector consumed 13,175,098 gallons of home heating oil. This not only represents approximately 151,610 tons of CO2, but contributes to a vast array of airborne contaminants (such as fine particulate matter, SOx, and carbon monoxide)[12]

Propane and natural gas, contributing 32,071 and 36,217 tons respectively, were secondary sources of energy for the residential community. In Portland, the residential sector consumed 5.4 million gallons of propane, and 505,000 cubic feet of natural gas.

Other sources of energy, such as wood and coal burning, were not examine as they are used in insignificant amounts to account for a large contribution to greenhouse gas emission.

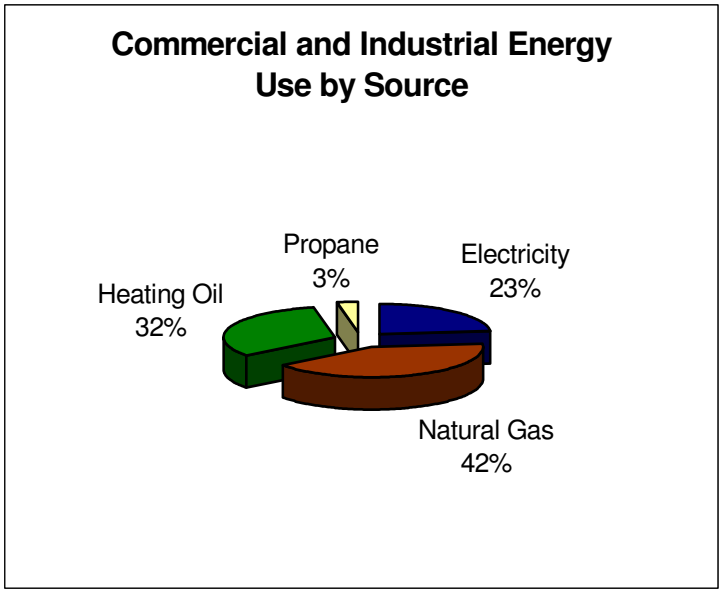
Predictions:
It seems unlikely that the residential community will characteristically change within the next ten to fifteen years with regards to energy consumption. Portland has little room for residential development, and ICLEI considered the majority of growth to occur in the commercial and industrial sectors (as well as transportation).

[11] According to Profile of General Demographic Characteristics: 2000, US Census – American Factfinder
[12] Godish, Thad. Air Quality.

Community – Commercial and Industrial

The Commercial and Industrial Sector, while examined individually in the Cities for Climate Protection Campaign, will be presented together. The Commercial sector is characterized by establishments in business to serve public and private entities, office complexes, and retail storefronts. Industry is defined by facilities used to manufacture, process, or store commercial goods.

The Commercial sector 237,027,150-kilowatt hours of electricity, while the Industrial Sector used just 31,084,026-kilowatt hours. It is difficult to predict in which capacity this resource is consumed (i.e. for heating, manufacturing, or processing). Electricity use by the Commercial and Industrial sector generated emissions of 122,260 and16,033 tons of CO2 respectively.



The Commercial sector consumed 6,520,667 gallons of light fuel oil – presumable for heating sources. The Industrial sector consumed 2,477,730 gallons of light fuel oil. The burning of this fuel produced 75,036 tons of CO2 for the Commercial sector, and 28,512 tons of CO2 for the Industrial sector.

Natural gas statistics, provided by Northern Utilities[13] cannot separate commercial or industrial entities with respect to natural gas consumption. Both sectors consumed a combined total of 1,581,013 Cubic Feet of gas. This represents just over 100,000 tons of CO2 emission.

Propane could not be estimated with enough detail to assign usage to either sector. Therefore, Commercial/Industrial sector propane usage was split evenly, with each consuming 677,419 gallons (equaling an emissions of 4,527 tons of CO2 for each sector).

Predictions:

ICLEI suspects that there will be considerable growth in the Commercial and Industrial sectors in Portland. This growth, estimated at a total of 14.2% by the year 2015, with certainly increase energy demand. This growth value is modifiable, should improved information regarding Commercial and Industrial growth become available.

Currently, the Commercial sector consumes 3,405,729 million BTUs and generates 302,150 tons of CO2. This may increase to 3,889,343 million BTUs, which will produce 205,434 tons of CO2. The Industrial sector consumes 513,798 million BTUs, which accounts for 49,073 tons of CO2. This is predicted to increase to 586,757 million BTUs, generating 37,731 tons of CO2. These predictions are assuming that the energy mix (ratio of oil to electricity to natural gas, etc. will remain the same).

[13] Contact Stan Dziura at Northern Utilities

Transportation – Community

Ground Transportation:

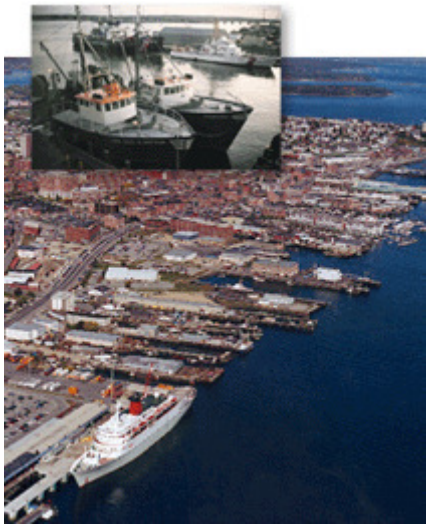
According to the Maine Department of Transportation [14], automotive traffic on the streets and roads in Portland has increased each year. There was a 1.97% increase from 1997 to 1998, 8.14% increase from 1998 to 1999, and a 5.64% increase from 1999 to 2000 (estimated). Last year, there were 539,957,550 vehicle miles traveled within the city of Portland.

Using standard fuel efficiency and automotive mix coefficients[15], this breaks down into the burning of 27,576,529 gallons of gasoline and 2,523,275 gallons of diesel fuel consumption. In addition, approximately 675,000 gallons of propane and 675,000 gallons of compressed natural gas (CNG) were burned for automotive transportation.

Air traffic, in the form of planes and jets at the Portland International Jetport, were not considered in this inventory because the nature of their transportation is inter-city. On the other hand, Jetport service vehicles are included in this inventory, as most of them are registered for street operation (making them a part of the MDOT VMT information)

Overall, our automotive traffic emitted a total of 3,854,162 tons of CO2 the year 2000. Approximately 89.9% of our automotive transportation CO2 emissions were from gasoline-powered vehicles. These vehicle types are also responsible for about 30.6% of all community emissions.

Marine Transportation:

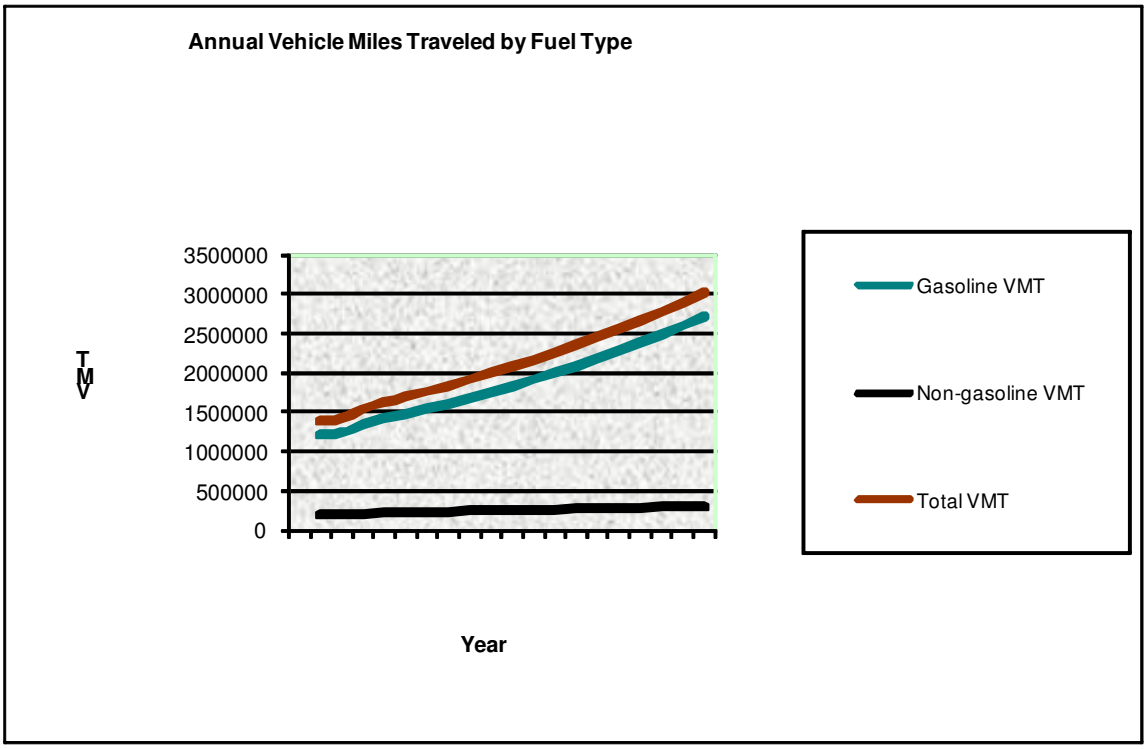


An additional component of this inventory examines the consumption of fuel at the Portland Waterfront. Often overlooked, Portland's waterfront transportation generated 22989 tons of CO2 is 2000, accounting for about 10% of the city's Transportation emissions (or 2.4% of all emissions). In particular, most emissions are associated with diesel combustion by the Casco Bay Island Transit District (208,000 gallons), and our in-port commercial fishing fleet. The commercial fishing fleet is a heavy emitted because their diesel engines run at idle nearly 24 hours a day (for power/ice generation, heating, engine maintenance reasons). These sources account for the burning of a little over two million gallons of diesel fuel consumed each year.

An important addendum to include involves large oil cargo tankers entering the port. Although much of the passage of these vessels is in close proximity to Portland, the oil is discharged at the Merrill Marine Oil Terminal, which is located in South Portland. Therefore, these emissions cannot be technically assigned to this inventory because of jurisdictional boundaries. However, it is important to note that these vessels burned approximately 3.6 million gallons of heavy fuel oil (ISO 380) while idling in port in 2000. This generated roughly 50,000 tons of CO2.[16]

[14] Ed Beckwith, MDOT
[15] Torrie Smith and Associates
[16] James Carter, Merrill Marine Terminal Manager

Transportation Predictions:



Given that annual VMT has been steadily increasing, we will expect to see continued growth in the transportation sector. This is especially apparent as Greater Portland urbanizes, forcing more people to use ground transportation to enter the city for employment, commerce, and travel. As gasoline-powered vehicles tend to be to main source of personal transportation, we can gasoline vehicle usage will increase at 4.5% each year. We will also estimate that diesel, propane, and CNG vehicles will grow at the rate of inflation – at 2% per year. At our target year of 2015, this will result the burning of 53 million gallons of gasoline, 3.4 million gallons of diesel, and 900,000 gallons of CNG and propane. This results in the emission of 625,788 tons of CO2 from automotive combustion.

It is too difficult to predict the future emissions of marine transportation. This is due to the notion that a) the city is undergoing vast waterfront re-development, b) commercial fishing is subject to federal and state fisheries scrutiny, and c) there is no accurate way to predict waterfront activity. Given the current information, it is hoped that the city will use this data to make energy decisions regarding waterfront activity. It is, however, a safe assumption that if left unchecked, waterfront emissions will increase over time.

Community – Waste

The City of Portland generates approximately 11123 tons of Residential solid waste, and approximately 35,000 tons of Commercial/Industrial solid waste. All non-recycled waste is incinerated at Regional Waste Systems in Portland.

Incinerated waste generally does not produce excess CO2. ICLEI's rationale for this is best explained by examining the fate of a piece of wood. Should that piece of wood naturally biodegrade in the woods, it will produce a certain amount of CO2. That same amount of CO2 will be released as it is incinerated. It is important to track waste as a contributor for greenhouse gas if that piece of wood is land filled. In an anaerobic environment (such as one found in a capped landfill), the wood would degrade into methane, a greenhouse gas with 22 times the potency of CO2. However, although the City incinerates its waste, we must account for greenhouse gas contribution from items (such as plastics) that would not ordinarily break down naturally. Using this rationale, and the US Environmental Protection Agency data[17], we can assess the incineration of solid waste with an excess contribution of about 4612 tons of CO2.

It is important to note that 1161 tons of plant debris was composted at the Riverside Recycling Facility. This not only reduces the waste stream, but it provides a marketable commodity for the City to landscapers and construction companies. There is also an environmental benefit associated with composting, which actually serves to have a negative emission for CO2 – approximately 174 tons of CO2 a year are *consumed* by compost heaps.

The recycling program, began in 1999, had dramatically reduced the waste stream (and cost) associated with incineration at Regional Waste Systems. Although recycling cannot be held responsible for dramatically reducing greenhouse gas emissions (because emissions are low to begin with), it is a viable program that continues to reduce costs for the City.

Predictions:
The waste stream for the City of Portland is predicted to remain approximately the same. Incineration is a suitable method for waste disposal, given that appropriate environmental assurances for effluent gases are provided.

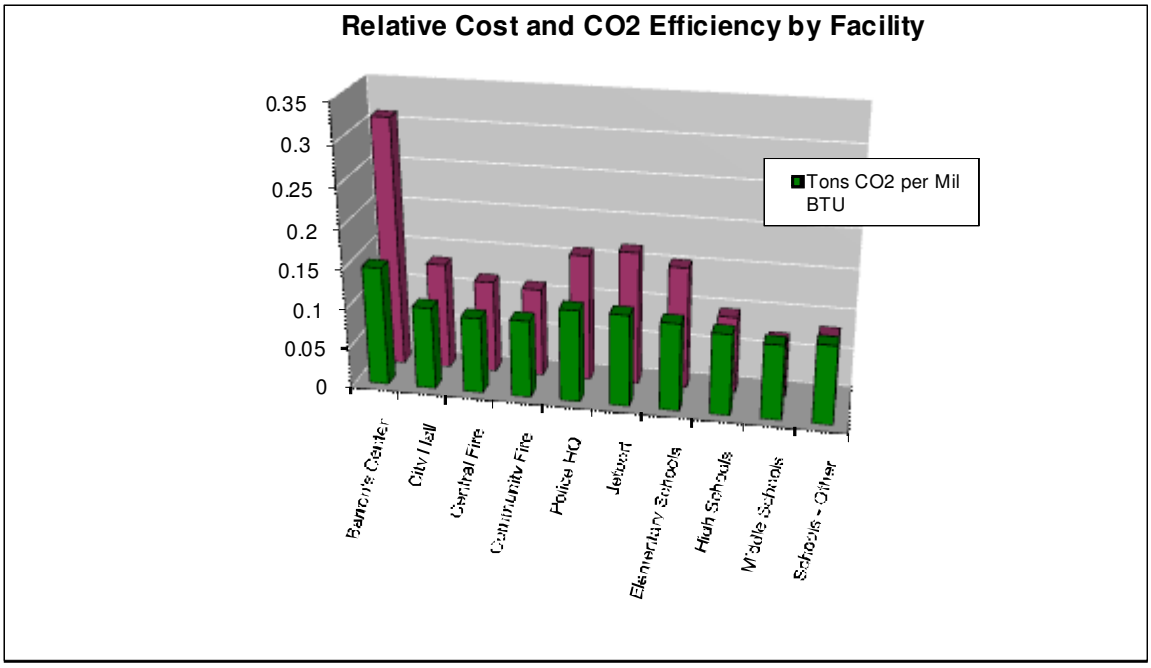
[17] US EPA Document: 530-R-98-013

Corporate – Buildings and Facilities

Like many other communities, the municipal buildings account for a large (58%) portion of operational CO2 emissions. At cost of $2,841,650 in FY2000, the City's buildings consumed 210,083 million BTU of energy. City buildings include maintenance and garages, school buildings, City Hall, Jetport facilities, etc. A comprehensive list is included in the Corporate Greenhouse Gas Detailed Summary output.

Each building group has a varying mix of energy needs. Some facilities use heating oil for space heating, while others use natural gas or electricity. This creates some complication in analyzing and comparing energy consumption and greenhouse gas emissions between facilities.

If facilities are examined on a Per Million BTU scheme, some interesting trends can be elicited. In the graph found below, there are two descriptors that provide information. Cost per Million BTU is the number of dollars spent for each million BTU consumed by the facility (regardless if the BTU is generated from heating oil, electricity, natural gas, etc.). These values were divided by 100 for chart organization reasons. Also, a relative efficiency for CO2 for each unit of energy that is consumed by the facility is included in this chart.



For facilities with a relatively high Cost Per Million BTU (such as Barron's Center or the Jetport), it may be characterized by energy use in an inefficient manner. The level of detail of this analysis cannot be brought to the level of individual buildings or floors, but one may assume that these facilities use spend too much for their energy costs (relative to other municipal facilities). For example, the pricing scheme may be inappropriate, or the facility may be using an inappropriately selected energy source for its proper use (an absurd example might be to use heating oil for your lighting needs).

Also, and with more environmental consequences, one can extract information regarding the amounts of CO2 that is released for each unit of energy that is used (regardless of energy source). Higher values (such as those found in the Barron's Center and the Jetport, suggest that the major sources of energy selected by the facility can be considered "dirty" fuels, rather than using cleaner fuels.

Ideally, one would expect nearly identical numbers for Cost Per BTU. It is fiscally prudent to lower, as much as possible, all Cost Per BTU levels. It is also crucially important, in the City's campaign to protect the environmental, to lower the CO2 Per BTU level as well.

It is very important, however, to take into account the specific energy needs for each facility in question. There is not magic formula for the mix of heating oil to electricity to natural gas to propane. Maintenance garages have different energy requirements than administrative offices. It is only through much closer scrutinies will the City be able to identify further energy inefficiency.

Corporate – Fleet

The City operates, maintains, and procures all of the municipal vehicles in the City. This includes school buses, staff vehicles, fire trucks, garbage haulers, and heavy equipment. There are approximately 468 pieces of equipment that operate on unleaded gasoline and 302 pieces that operate on diesel. This includes vehicles, lawnmowers, street sweepers, heavy equipment, etc. There is a very strong infrastructure in place for the municipal fleet, as all petroleum-powered pieces of mobile equipment are fueled and maintained at the Maintenance facility on Hanover Street.

The City's fleet produced 5,074 tons of CO2 through combustion of unleaded or diesel fuels. Gasoline fuel use cost approximately $211,786 and diesel fuel use cost $177,782. Approximately 53% of CO2 generated from the fleet was produced by gasoline-powered equipment.

209,401 gallons of diesel was burned, while 228,228 gallons of gasoline were burned. It is important to note, however, that Portland Water District vehicles were included into the fleet, even though they are not fueled or maintained by municipal operations. The rationale for this is that water and wastewater service is an inherent and obligatory municipal service. Although not directly controlled by City officials, ICLEI believes it to be appropriate to include this information in the municipal inventory.

Corporate – Streetlights

City-operated streetlights account for approximately 2,025 tons of CO2 emission each year. The City's lights consume 13,396 million BTU of electricity (approximately 3,455,274-kilowatt hours). Streetlights are generally of the mercury-vapor type, and account for approximately 5% of all municipal operations emissions of CO2. In order to have operated these lights, the City paid approximately $1,176,901.

Greenhouse Gas Emissions in Portland

	Year	eCO2 (tons)	eCO2 per capita	Projected change
Community-wide:	2000	972,732	15.1 tons	
forecast:	2015	1,108,994	17.0 tons	14.2%
Gov't operations:	2000	41,640	0.65 tons	
forecast:	2015	41,640	0.65 tons	0%

Corporate – Waste

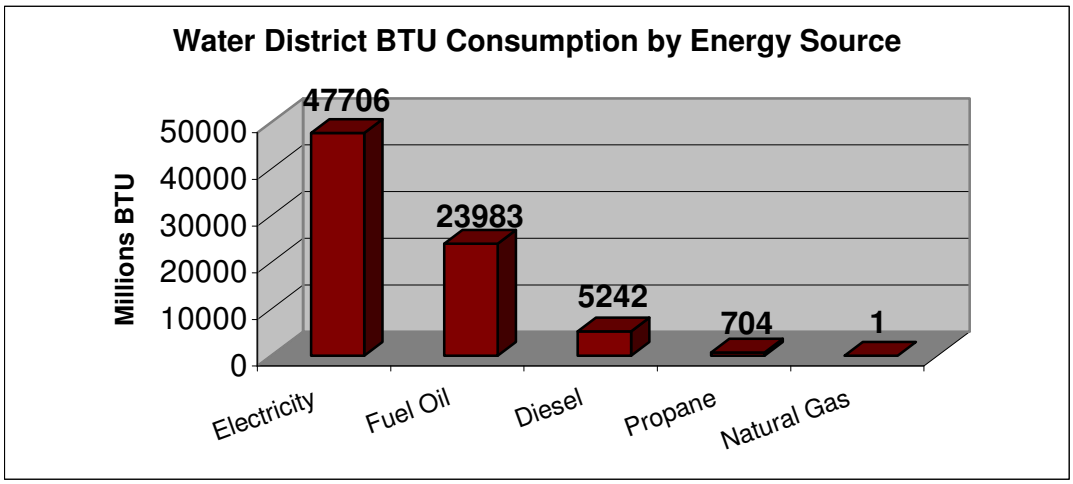
Municipally generated waste totally 1754.91 tons for FY2000. Using US EPA data, this accounted for approximately 175 tons of excess CO2 being emitted as part of the incineration process.

Recycling data for municipal operations is not available, however, an assumption was made that approximately 25% of all yard waste disposed of at the Riverside Recycling Facility was generated by municipal operations (Parks and Recreation, Public Works, etc.). This would account for a negative CO2 emission of approximately 38 tons.

In total (excluding the unknown amount of recycled materials from municipal operations), the City operations generate a total of just 138 tons of CO2 in FY2000.

Corporate – Water and Wastewater

Controlled by the Portland Water District, the Water and Wastewater provisional services draw significant resources from the City of Portland. With an annual proportionally-assessed cost (if the City provided the services itself) of approximately $1.6 million, energy consumption for transport and processing produced 9,698 tons of CO2. In calendar year 2000, it required approximately 77,636 million BTUs of energy to process the City's water and wastewater.



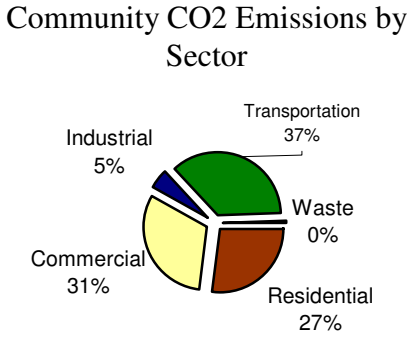
This data does not include energy required for several City-operated sewerage pumping stations that are located throughout the City. These data have been included in Public Works as operating energy requirements.

Measures to Consider

General Overview:

Portland has some unique considerations to encompass as it ventures forward with energy reduction policies. As a city characterized by neighborhoods populated by lobstermen and lawyers, Portland hardly fits into the model of traditional city life. Citizens not only find their employment in the city, but they are proud to call Portland their home.

As a growing region, Portland must incorporate their energy policies into a long-term, comprehensive plan. A plan such as this is imperative, as the city may be highly susceptible to energy supply uncertainty. Unlike many other communities in the US, Portland is located at the end of the energy pipeline – we are not found at any major utility crossroad, and although we are a large port for petroleum products, many of the distribution facilities are located out-of-state.



In considering energy plans, it is in the best interest of the city to incorporate their policies for the reduction of greenhouse gas emissions. This includes selecting, even at an incremental level, less-polluting energy sources. Although unfeasible as a comprehensive alternative, switching to renewable energy sources (even if a partial switch) will play an important role in the city's environmental awareness. More importantly, the city will likely realize significant cost savings through improved energy choices.

The City should, in developing appropriate energy policy, look far into its horizon in implementing environmentally- and fiscally-sound policies. Many communities are satisfied with a 5-year plan. Others choose 10-year plans. ICLEI recommends looking in a 25-30-year timeframe. With this document, it is hoped that a framework for environmental policy can be implemented, leading to the success and prosperity of this wonderful city.

Community-Wide Measures:

Portland, as a municipality with close connections to its citizens, has the opportunity to affect vast amounts of change in the energy culture of the region. Progressively thinking, the community, and the city, can make small incremental changes that will have vast long-term consequences. Some solutions may be the implementation of new programs, while others may be considered extensions of existing programs. Regardless of the type of program, it is important that the community embrace the easy-to-facilitate (or, the proverbial "low-hanging fruit) solutions as a means to achieve environmental change.

Currently, the city has a number of energy-reducing programs implemented at varying degrees of compliance. It is important to accept these programs and improve upon them, as they often are the easiest programs to modify – one will expect more environmental "bang for the buck".

A quick list (found below) summarizes the city's existing measures to lower our community's energy reliance:

Energy Use:

- There are no known programs for residential or commercial/industrial energy use reduction measures.

Transportation:

- Police Foot/Bicycle Patrols (Old Port District)
- Conversion of Traffic Lights from Incandescent to LED
- Continuing Support for The Metro bus service
- Planned Installation of Compressed Natural Gas Fueling Facility

Waste:

- Curbside and "Silver Bullet" recycling
- Blue Bag Garbage Collection

Included below is a list of potential community-wide reduction measures:

Energy Use:

- Home Energy Conservation/Efficiency Program
- Improved Energy Efficiency Building Codes
- Climate Change Outreach and Education
- Block Purchasing or Subsidizing of Green Energy

Transportation:

- Traffic Light Synchronization
- Increased Support for The Metro bus service
- More Support for Car Sharing Programs
- Partnership with Stakeholders for Increased Bike and Pedestrian Lanes
- Transportation-Efficient Development Zoning
- Implement Public and Fleet Alternative Fueling Facilities
- Waterfront Analysis

Waste:

- City-wide Requirement for Community Recycling Standards
- Increase Commercial/Industrial Recycling

Other:

- Increase Public Participation in Energy Reduction Campaign

Home Energy Conservation/Efficiency Program: The city can provide technical expertise (though contractors or local staff) for community members who are interested in launching energy-reducing measures. Ideas to include are working with public utilities to implement increased usage efficiency or public forums for improved design review and outreach.

Improved Energy Efficiency Building Codes: As with many other facets of modification, the city can use zoning requirements to obligate positive energy-reducing building standards. Some changes might include increasing insulative characteristics in buildings, installation of low-power or natural lighting, or setting citywide enforceable energy consumption standards.

Climate Change Outreach and Education: The city can implement public forums to discuss climate change issues and energy efficiency within the community. Community-wide change will best occur if it is developed by the community itself, rather than mandated by City Hall. The City may consider hiring a student intern, or even a professional position, to enact these changes.

Block Purchasing or Subsidizing of Green Energy: A green energy source, or one that has zero emissions (i.e. a hydroelectric dam, or wind power) is not currently available in southern Maine. The market for such services to too widespread, but with an approach in interest by a large community such as Portland will enable the successful development of a green energy source. The city may consider bargaining with organizations such as Interfaith Power and Light[18] for a large "anchor account" to establish viability in this type of power generation.

Transportation:

Traffic Light Synchronization: Traffic lights can be better synchronized to improve traffic flow patterns on major arterioles and thruways. This will reduce vehicle idling time at traffic lights. Average gasoline-powered vehicles burn 1.6oz of gasoline per minute at idle. If 180000 vehicles (of the approximately

[18] Contact Maine Interfaith Power and Light at 725-5342

250,000 vehicles that travel through the city every 24 hours) reduce their idling time by 780 minutes a year (3 minutes per day, 5 days per week, 52 weeks per year), the community will avoid about 1,038,960 gallons of fuel per year burned during idling.[19],[20],[21]. Alternately, the City can enact anti-idling ordinances.

Increased Support for The Metro bus service: The Metro Bus service, shared with the City of Westbrook, provides a centralized support system of public transportation. The City should embrace this service as a means to reducing local traffic congestion and elimination of greenhouse gases (and other pollutants such as SOx, NOx, and particulate matter). Ridership has been increasing[22], and is undergoing the process of conversion to a Compressed Natural Gas bus fleet. There is also a social equity involved in this decision, too. Bus service represents a lifeline to those who cannot afford their own transportation – something very important to the citizens of a community that embraces such immigration and diversity.

More Support for Car Sharing Programs: The City can encourage its citizens and daytime residents (such as commuters) to take advantage of many of the ride-sharing/public transit options available to the city. For more information, you are encouraged to approach the Maine Turnpike Authority for more information.

Partnership with Stakeholders for Increased Bike and Pedestrian Lanes: As a small city, Portland can encourage its residents to use zero-polluting methods of transportation, such as walking and biking, as they enter the downtown regions. This can be facilitated only if the infrastructure for walkways and bike paths are improved. Therefore, it is imperative that the city reaches out to grassroots organizations (such as Portland Trails) to develop such plans.

Transportation-Efficient Development Zoning: Zoning regulations can be modified to reflect the desire to allow development in a way that reduces urban sprawl. Although much of the developable land in Portland has already been developed, the city can encourage responsible growth by requiring development to occur along with public transportation modes

Implement Public and Fleet Alternative Fueling Facilities: Growing from the Department of Energy grant that has been received by the Greater Portland Council of Governments (Clean Cities Coalition of Maine), the City should promote this facility as a good choice for the public. Public-private partnerships should be developed with transportation-dependant organizations (such as Oakhurst Dairy, United States Postal Service, or Hapag-Lloyd Container) to increase usage of this facility. In addition, the City can promote the facility as an option for public use. Increasing usage of this facility not only has environmental benefits (as associated with the use of cleaner fuels), but economy of scale forces will lower the per unit price of such fuels.

Waterfront Analysis: The City of Portland has the opportunity to be a leader in developing environmentally and economically sound energy policy with respect to an established commercial waterfront. To ICLEI's knowledge, there is no precedent for undertaking an energy audit and greenhouse gas inventory for a waterfront, nor has any community established any particular waterfront ordinances. It is unclear what can be done with respect to waterfront energy consumption, therefore it is recommended that future analysis continues.

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[19] Assuming idling gasoline vehicles burn 0.0074 gallons per minute. Refer to www.climatechangesolutions.com/english/individuals/ for more information.
[20] Taylor, Gordon. 1992. Technical Background Document on the Effects of Excessive Idling. Prepared for the Ministry of Transportation of Ontario, Trucksave/Drivesave Programs. October, 42 pp.
[21] Traffic numbers derived from MDOT and Lucie Cote of the City of Portland.
[22] Per conversation with Peter Hefler, Metro Manager

Waste:

City-wide Requirement for Community Recycling Standards: Building on the existing recycling program, the City may choose to mandate recycling in the residential, commercial, or industrial sector. Increasing recycling compliance will reduce the waste stream incinerated by Regional Waste Systems. With residential recycling compliance of ~45%, municipal solid waste has been reduced by about 4000 tons per year[23] (which translates to an approximate savings of 800 tons of CO2 per year).

Increase Commercial/Industrial Recycling: Commercial and industrial recycling programs lag behind their residential counterpart. There is no established City-wide policy regarding recycling compliance – something that should be addressed. Since commercial and industrial accounts generate approximately 35,000 tons of solid waste each year (compared to just 16,000 tons of residential waste), one can expect that there would be significant environmental and economic benefits associated with increasing commercial/industrial recycling compliance.

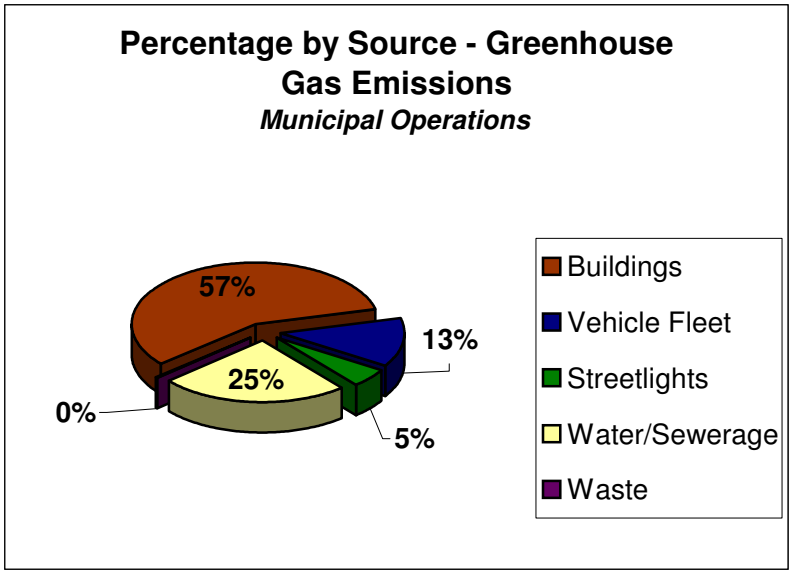
Other:

Increase Public Participation in Energy Reduction Campaign: Through public outreach and press, the City can serve as a role model for energy reduction techniques and support. The public will often follow the lead (or sometimes mandate) of the municipal organization, and the City of Portland is no exception. The City may consider hiring technically qualified personnel to conduct future energy auditing or greenhouse gas inventories. This will serve to connect the city to its constituents, assisting with environmental protection and economic security.

Municipal Operations

Clearly, the City's largest contributor to greenhouse gas emissions is associated with its public buildings. Accounting for over 57% of all greenhouse gas emissions, it seems to be the obvious choice to approach when considering options for employing efficiency measures.

Secondary to consider, the City's water/wastewater systems produce a relatively high amount of eCO2. As mentioned, this includes the use-proportional energy costs associated with processing all of the water for the city's inhabitants.



The vehicle fleet offers many opportunities for change as these items are often replaced on a particular schedule (i.e. trucks are replaced every five years). This poses some possibilities of effecting a change in a short amount of time.

There are, of course, some measures that can be taken that are will not be easy to

[23] According to Troy Moon, Solid Waste Coordinator, City of Portland

quantify. For example, there is a social benefit for the City to take an initiative as a leader in environmental change – this may lead to citizens or businesses following the lead of the city to enact changes of their own.

As with measures to enact in the community, there are possibilities to develop new and innovative programs as well as extending currently existing programs. Each have benefits and disadvantages, and it is encouraged for the City to examine each one thoroughly.

Efficiency Measures Currently in Place:

Buildings:

- Office Lighting Replacement to High-Efficiency Bulbs
- Requirement for Energy-Star Enabled for Computers/Monitors
- Window Replacement Program for City Hall

Vehicle Fleet:

- Anti-Idling Requirements

Streetlights:

- Changeover to LED Traffic Light Bulbs

Waste:

- Office Recycling Initiatives

Water/Sewerage:

- There are no known efficiency measures taking place.

Suggested Policies for Efficiency Measures – Municipal Operations

General Non-Sector:

- Redesign of Energy Purchasing Policies
- Student Support

Buildings Sector:

- Enact Employee Energy Reduction Measures and Standards
- Retrofit Older Buildings with Improved Efficiency Devices
- Replace Older Technology Oil Burners with High-Efficiency Natural Gas Burners
- Strongly Enforce Energy Star Enabled Devices
- Replace Office Devices with Energy Star Products
- Replacement of Exit Signs with LED Exit Signs
- City Purchase of Green Energy
- Installing Building Automation Systems/Central Energy Controller
- Incorporate High-Efficiency Measures into Planned Public Works Building

Vehicle Fleet:

- Downsizing of Vehicle Pool (Number and Size of Vehicles)
- Stronger Enforcement of Anti-Idling Regulations
- Conversion to Biodiesel and CNG
- Discouraging Unnecessary Travel
- Examination of City Vehicle Routes

Waste:

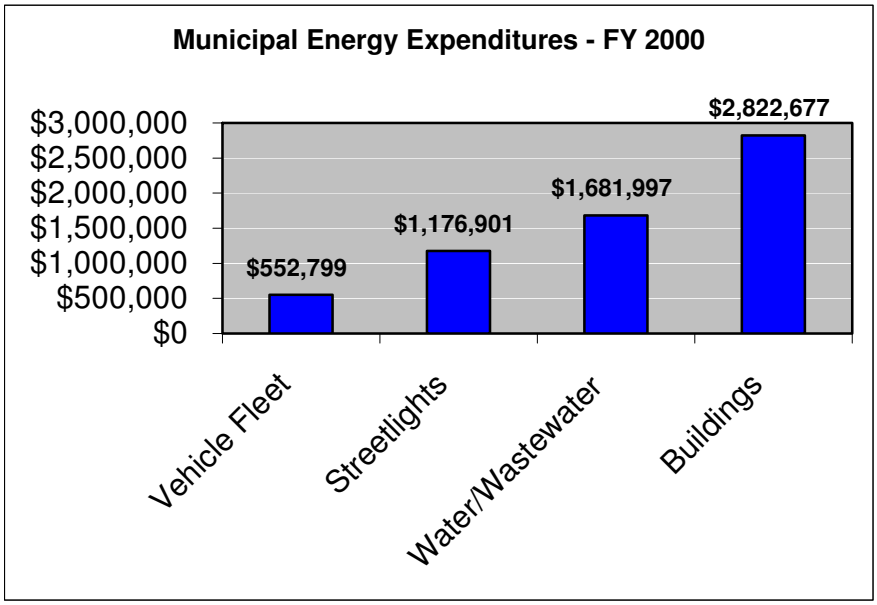
- Broaden Recycling Program for City Employees
- Pay-Per-Throw Program for City Offices

Water/Sewerage:

- Encourage Portland Water District to Purchase Greener Energy
- Conduct Energy Audit for Portland Water District

Traffic/Streetlights:

- Retrofit Mercury Streetlamps to High-Pressure Sodium
- Convert Walk/Don't Walk Signs to LED
- Change Electricity Source of Streetlights to Greener Energy



General Non-Sector:

Redesign of Energy Purchasing Policies: It is clear to ICLEI the there is little coordination of energy purchasing for municipal operations. A collective bargaining agreement with Union Oil (for Heating Oil) was established in FY2000, which did result in a favorable pricing scheme. However, this was the only example found with the intention of energy cost reductions. Often for a particular facility (for example, Community Police Stations), there are several municipal departments that serve to budget and pay for its energy bills. It seems that a more efficient approach to reducing energy costs is to consider on department responsible for a facility, even if the objective of the department does not necessarily reflect the facility's usage. In the example, Public Buildings, Public Safety, and General Funds are grouped together to operate this facility.

In addition, the City can improve its collective bargaining and price tracking with energy providers. Annually, Kerosene prices (used mostly by Portland School Department) ranged from $1.259 per gallon to $1.8601 per gallon. Heating Oil, although offset by island transportation issues, begins from the negotiated price of $0.6842 per gallon on the mainland, and ranged from $0.8425 to $1.6545 per gallon on Peaks Island.

Student Support: Initiatives such as this cannot continue without dedicated support. Given that there are many municipal employees who have a genuine interest in climate change programs such as this, it is unlikely to find funding, or personnel, to continue to grow this project into the bigger picture. It is imperative that the City establish continued support, through student internships or part time student jobs within the government, to carry this work on in developing a local action plan. Student interns are given the opportunity to learn about municipal policy, offer a fresh sense of creativity, and are very inexpensive (and often free).

Buildings:

Enact Widespread Energy Reduction Measures and Standards: Often, the City's employees can be challenged to reduce energy consumption. The City can encourage its employees (through trivial prizes or rewards) for departments that can reduce their energy consumption. This can be done at very little cost to the City, and will develop a sense of departmental community in acting together for a common cause. In addition, the City can ask individual departments to complete a plan for its energy reduction measures. This plan should be enforced by the City Manager.

Retrofit Older Buildings with Improved Efficiency Devices: The City should follow the lead of Portland School Department of retrofitting many of its energy consumption devices. This includes installation of low-energy compact fluorescent bulbs, motion sensors for infrequently used office space/rooms, high-efficiency windows and siding, or re-enforcing insulation in its buildings. Although there is a high up-front capital cost, the long-term energy reductions will cover many of the expenses.

Replace Older Technology Oil Burners with High-Efficiency Natural Gas Burners: As the City grows, it should consider switching from oil-fired heating boilers to natural gas boilers. In the recent past, oil prices have been very labile. Although the City has entered into favorable fixed-price contracts (and given our dependence of foreign sources of oil) the per unit price of oil will likely increase. This provides incentives for switching energy sources to cleaner natural gas. Currently, the market price per BTU (retail) for natural gas is significantly cheaper than heating oil[24]. Additional benefits to natural gas (aside from decrease CO2 production), are lowered emissions of particulate matter, carbon monoxide, and NOx – all of which are detrimental to human health.

Strongly Enforce Energy Star Enabled Devices: Many of our common office devices, such as computers, printers, and monitors, are equipped with Energy Star compatibilities. This enables the device to enter a low-power mode during periods of extended inactivity. Anecdotally speaking, many of the computers in the City have had this feature disabled (often for convenience of the user during the day, as there is a slight pause when the computer must "wake up"). For example, if just 10 computers were enabled (avoiding 18 hours per weekday, and 24 hours per weekend day of unneeded power), each year the city will save approximately 9984 kilowatts, at a cost savings of approximately $900. MIS personnel can be asked to enable this feature of the City's computers, and department managers can be encouraged to enforce the use of this measure.

Replace Office Devices with Energy Star Products: Building on the previous recommendation, the City can preferentially purchase Energy Star office devices as a means to decrease energy consumption. Common devices that are currently available include photocopiers, fax machines, or televisions. As the City replaces these kinds of devices, it should consider these as viable options.

Replacement of Exit Signs with LED Exit Signs: In each public entry to City buildings, municipal and state regulations require illuminated exit signs. Quite often, these are overlooked as measures to consider, even though these devices are illuminated 24 hours a day. A standard exit sign, with two, 20-watt incandescent bulbs, costs approximately $35 per year to operate. LED bulbs cost approximately $2.50 per year, and need replacement every 15 years (rather than every six months for incandescent bulbs).

City Purchase of Green Energy: In an effort to make greener energy course available, the City may consider purchasing electricity from zero-emission sources. This may drive the price of such power down (it is currently at a premium of approximately 20% about green power). This is especially important considering that the Standard Offer by the Maine Public Utilities Commission will soon expire, allowing for market fluctuations in electricity prices to occur.

Installing Building Automation Systems/Central Energy Controller: Efforts have already begun to enact building automation. This is important as a way to control energy usage by centralized coordination of

[24] According to the Energy Information Administration, US Department of Energy

energy consumption. This is a concept embraced by many corporations to ensure that energy is not being inefficiently consumed. The next step in this concept is to employ an energy manager - Westchester County in New York State utilizes an energy manager as a person to enforce energy policy, work with departments to reduce energy, and act on the behalf of the County in negotiations for price contracts with energy providers. A partial solution may be to hire/enact student help from the University of Southern Maine (or other local university). Projects such as this are inexpensive, and serve as a good connection to the community.

Incorporate High-Efficiency Measures into Planned Public Works Building: As the City ventures forth in the design and construction of a new Public Works facility, it should consider all options in making the building environmentally friendly. This may include design changes such as installation of windows and skylights, roof-top photovoltaic cells (which can also be used on non-use periods such as weekends to sell power back to Central Maine Power), or solar water heating/pre-heating systems. The opportunities are endless, and it is recommended to consult professional design staff that has experience in developing highly efficient office buildings and facilities.

Vehicle Fleet:

Downsizing of Vehicle Pool (Number and Size of Vehicles): The City should consider a thorough examination of the usage of its municipal vehicles. There are numerous ways to undertake an analysis of vehicle usage[25], and a reduction in fleet size will save both fuel costs as well as maintenance costs. Also, in acquiring new vehicles, the City should examine with scrutiny the size/payload of the new vehicle to ensure that it is appropriately sized. Quite often, a municipal fleet has "too much bang for the buck." Cost-effective and reliable vehicles are commonly available.

Stronger Enforcement of Anti-Idling Regulations: A standard light duty pickup truck (with a 5.0 liter gasoline engine) burns approximately 1.9 ounces of fuel when idling. Annually, just 10 trucks that idle 30 minutes a day (for five days a week) will needlessly burn approximately 1154 gallons of fuel at a municipal cost of about 1000 dollars. Additional benefits include decreased maintenance costs.

Conversion to Alternate Fuel Sources: The City should consider converting its existing diesel-powered vehicles to Biodiesel, a cleaner burning (and sustainable) source of diesel fuel[26]. This requires no retrofitting or special training, although currently is more expensive than traditional petro-diesel. Natural gas is a true alternative fuel that will be available within two years at the Metro Bus facility. As a Department of Energy grant, the City will be home to a public CNG fueling facility[27]. In conjunction with the Greater Portland Council of Governments, the City should acquire natural gas-powered vehicles. A particularly good option for these types of fuels is within the 72 vehicles of the Police Department. Vehicle performance is identical, and the gasoline-gallon equivalent of natural gas is significantly cheaper. Police vehicles are often very prominent in the community; CNG-powered police cars will serve as a synergistic effect for the City's citizens in promotion of alternative fuels as well as in improved public relations. Although there is an incremental cost associated with CNG vehicles, there are many grants available to assist with these costs[28]

Discouraging Unnecessary Travel: Although often a policy of municipal fleets, personal usage of City vehicles often is abused. The City may consider examining usage of its vehicles for non-municipal reasons. This can include restricting employee daily usage, or discouraging employees from taking their assigned city vehicles home with them after work hours.

Examination of City Vehicle Routes: A close examination may be in order to determine the most efficient use of route-vehicles (such as snowplows and garbage trucks). In theory, garbage trucks annually should

[25] Refer to www.greenfleets.org
[26] Refer to www.worldenergy.net for more information
[27] Refer to the US Department of Energy Clean Cities Program
[28] Please contact Steve Linnell at the Greater Portland Council of Governments at 774-9891.

not drive any more than the distance of all roads in the city (approximately 520 miles – 260 miles times two sides of the street) plus the distance to travel daily between pickup locations and dump locations times 52 weeks per year. This theoretical value is approximately 32000 miles per year. In reality, our garbage trucks travel approximately 100000 miles a year. The City can easily examine its routes for snow and garbage removal, as well as street sweeping, to minimize redundant traveling.

Waste

Broaden Recycling Program for City Employees: The City can require the same compliance of its employees as it does for its citizens. Office recycling programs can be expanded and improved, and City employees can be encouraged to continue recycling. Since existing infrastructure already exists for recycling facilities, this measure will be fairly easy to implement.

Pay-Per-Throw Program for City Offices: Much like the program for the residential community, a Pay-Per-Throw program can be implemented for municipal offices. This will shift the burden of waste generation directly on the departments (rather than payment for waste hauling in the general fund), and may provide an incentive to departmental waste-reduction measures. This will also serve to identify any waste-generation anomalies throughout the City Government.

Water/Wastewater

Encourage Portland Water District to Purchase Greener Energy: A large consumer of electricity, the Portland Water District can be encouraged, along with support from other member communities, to shift to the use of greener energy supplies. Similar to a program implemented in New Rochelle, NY, the local wastewater treatment plant can be equipped with photovoltaic cells to reduce the reliance on grid electricity. Finally, the City may choose to investigate mitigation methods for the capture (and potential use) of exhaust methane from the treatment plant – this is a potent greenhouse gas that has marketable uses for energy generation.

Streetlights

Retrofit Mercury Streetlamps to High-Pressure Sodium: Accounting for approximately half of all electricity consumed by the City of Portland municipal operations, the streetlights should be retrofitted with more efficient High-Pressure Sodium bulbs. Although fairly expensive to purchase, the long-term maintenance and energy savings will pay for the new lighting.

Change Electricity Source of Streetlights to Greener Energy: The City may choose to purchase the streetlights within the city from Central Maine Power and switch energy sources to electricity generated by green sources. The City may consider purchasing its power from hydroelectric or wind-powered generation facilities, or perhaps may consider something even more interesting – purchasing the power generated from its own garbage incineration at Regional Waste Systems. The purchase price of the streetlamps, however, may be prohibitively expensive, but the city should consider negotiations.

Convert Walk/Don't Walk Signs to LED: The City has successfully launched a LED (Light Emitting Diode) replacement campaign for its many traffic lights. These lamps use approximately 1/10 the energy of a standard incandescent bulb, and require 8-10 times less maintenance. The campaign should continue to be funded to replace any remaining incandescent traffic lights, as well as replace all crosswalk bulbs.

Conclusions

The next step for the City of Portland is to set an appropriate reduction goal, and then to draft a Climate Protection Action Plan. The Action Plan is a proposal for how the City can take a leadership role in the community towards reducing energy use and greenhouse gas emissions in Portland. This document will be written with the input of multiple departments within City Hall and community members. Both existing and potential programs to reduce emissions in every sector of the community and town operations are described in this report. Most of these measures have been successfully implemented in other communities across the country.

The municipal operations currently account for just over 4% of the community's total CO_2 emissions. Measure taken to increase energy efficiency within City buildings will have a measurable impact on these emissions and will present a clear cost savings benefit. At the same time, the City can also promote community wide programs to reduce energy consumption and emissions. This includes both improvements to energy use efficiency and changes in energy sources. Technology provides many opportunities to increase electrical, heating, and transportation efficiency. Policies can shift energy sources towards cleaner burning fuels and renewable energy. Finally, encouragement to create some changes in behavior, such as vehicle use, energy conservation, material purchasing and waste disposal, will also be needed to reach the City's emission reduction goal.

Climate change is not something that will occur tomorrow. But, it will occur. A progressively worsening environmental problem, a warming climate will cast forth vast consequences, ranging from economic issues to public health concerns. This is truly a global problem, but as such, it cannot be controlled at the global level. Only though local action, within the individual municipalities and communities, can the City of Portland make an impact on this crucial issue.

ICLEI will continue to offer its support to the city, whether technical or logistical, in its development and plan for this issue. Presented to you is a document that outlines where the City is right now – only you can choose where the City will be in the future.

Respectfully Submitted on August 18th, 2001

Richard E. Peltier, Jr.
International Council of Local Environmental Initiatives
Cities for Climate Protection Intern – Portland, Maine