

Pittsfield, MA

Cities for Climate Protection (CCP)

Greenhouse Gas Inventory

This report will summarize energy consumption in Pittsfield and analyze the carbon footprint of the city. The figures used in the report come from the Clear Air and Climate Protection (CACCP) software from the International Council for Local Environmental Initiatives (ICLEI). The report is separated into two sections: community and municipal.

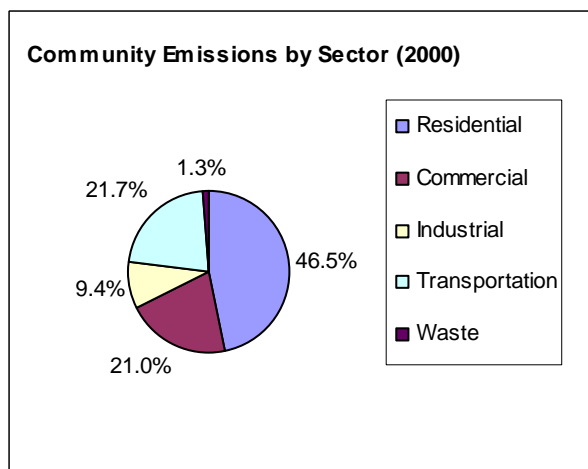
The **community** report measures the greenhouse gas emission of the entire city, including homes, businesses, factories, vehicles, and solid waste. Community-wide data was collected for 2000 and data for 2010, 2012, and 2015 is forecasted using estimated growth factors.

The **municipal** report measures emissions from city operations, including city buildings, city vehicles, streetlights, traffic signals, water/wastewater operations, and city solid waste. Municipal energy use data has been collected for 2005-2008, and data for 2010, 2012, and 2015 is forecasted using estimated growth factors.

After the community and municipal reports have been summarized, both reports will be further broken down by sector. This is where the methods for estimating forecast year emissions will be explained.

Community-Wide Emissions Inventory

In 2000, Pittsfield produced **684,152 tons of greenhouse gas emissions** (measured in equivalent CO₂, or eCO₂). With a population of 45,793, this amounts to **14.9 tons per resident**. The chart below shows the breakdown of emissions by sector:

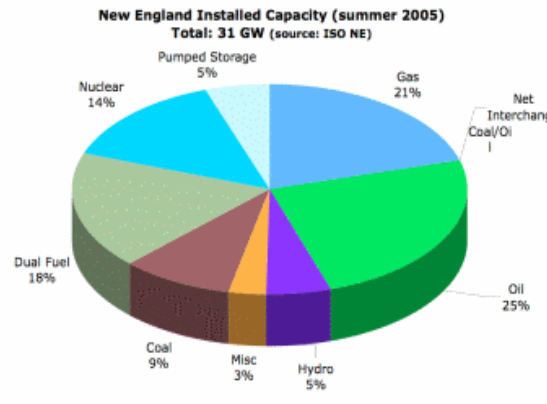
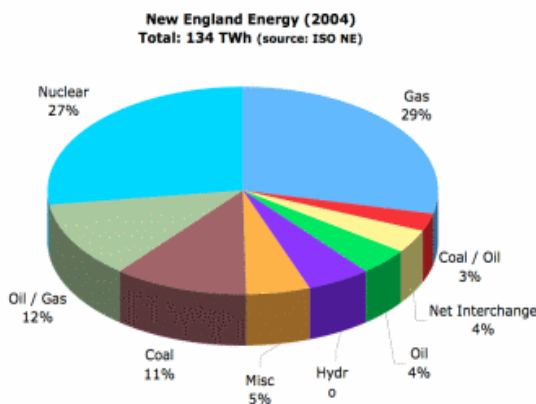
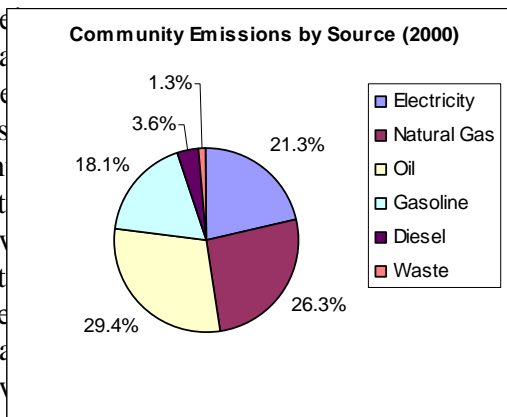


The “Waste” sector measures the greenhouse gas emissions resulting from the incineration of solid waste at eco/Pittsfield, LLC on Merrill Road.

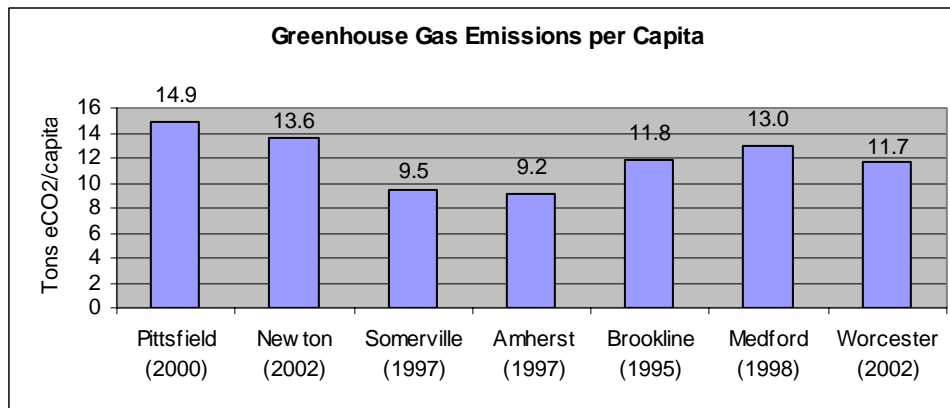
The chart shows that residential energy usage produces the most greenhouse gas emissions compared to other sectors. Commercial, industrial, and transportation also contribute large portions. Waste accounts for only a small portion of the city’s emissions.

The chart below shows the breakdown of community emissions by fuel source:

The four most significant fuel types are electricity, natural gas, fuel oil, and gasoline. Diesel fuel and waste are less significant, but still important contributors to community emissions. The charts below further break down into electricity into its power source, showing the actual energy breakdown for New England in 2004.

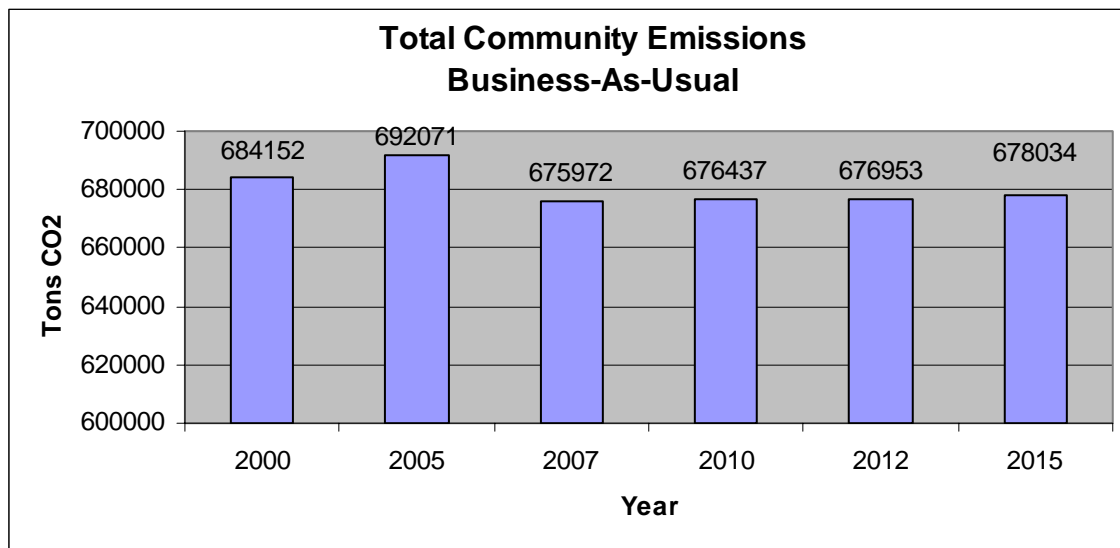


We can compare Pittsfield's per capita emissions to other Massachusetts cities who have conducted emissions inventories:



According to this graph, it is clear that there are many opportunities to increase sustainability and reduce emissions within the city. It is very important that Pittsfield set a rigid reduction target and stick to it. It is also important to increase public awareness of environmental sustainability. Without help from the citizens of Pittsfield, it will be impossible for the city to meet any of its goals.

Below are the projected levels of greenhouse gas emissions for future years.



This is a “business-as-usual” scenario, which assumes that the city takes no steps to reduce its emissions. Notice that emission levels for forecast years are lower than 2000. This is due to Pittsfield’s steady decline in population; it is not due to increased energy efficiency. In fact, per capita emissions levels are significantly higher, increasing from 14.9 in 2000 to 17.3 in 2015 based on 2015 population estimates. However, population is not the only factor in predicting future emission levels. After the municipal emissions inventory, community emissions will be broken down by sector, each with its own separate growth factors.

Targets

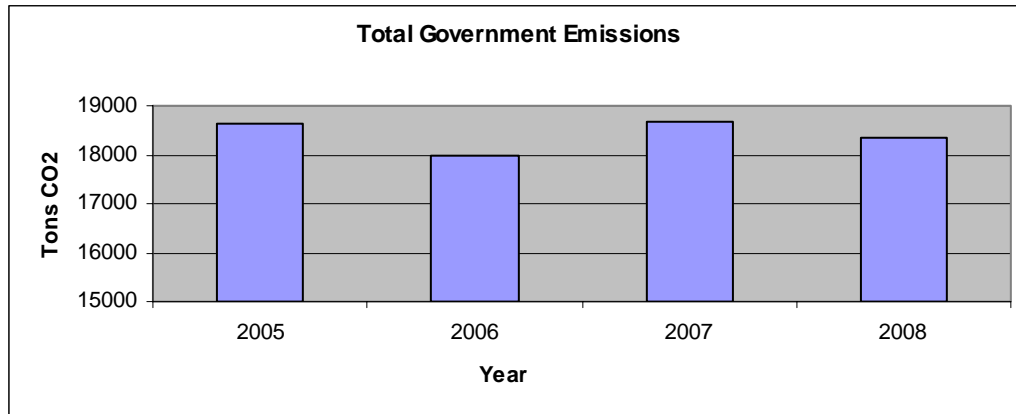
The most important job for the Green Commission in the near future is to choose a target year and a target reduction percent for community emissions. For example, they may decide that Pittsfield must reduce community emissions to 10% below 2000 levels by 2012. It is crucial that this target be ambitious, but reasonable. If the target is too difficult, failing to accomplish the goal will be demoralizing and may limit future sustainability initiatives. If the target is not difficult enough, the city may be content to just meet the target while ignoring other opportunities to further lower emission levels.



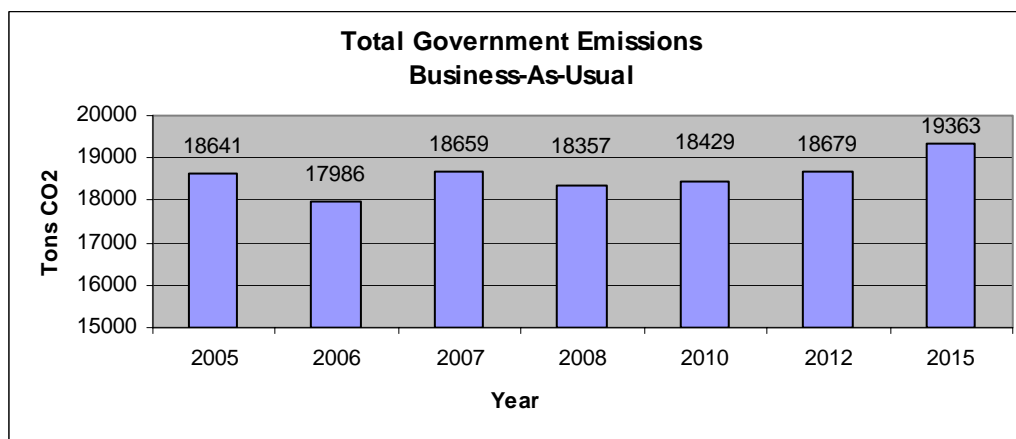
Keep in mind that this target need not be the same for community and municipal emissions. Other communities have decided to set a shorter, more intense reduction target for municipal emissions. This is because it is often more feasible and practical to reduce municipal emissions. Also, municipal reductions are a great way to increase public awareness and set a precedent.

Municipal Emissions Inventory

Municipal emissions were calculated for Pittsfield in 2005, 2006, 2007, and 2008.

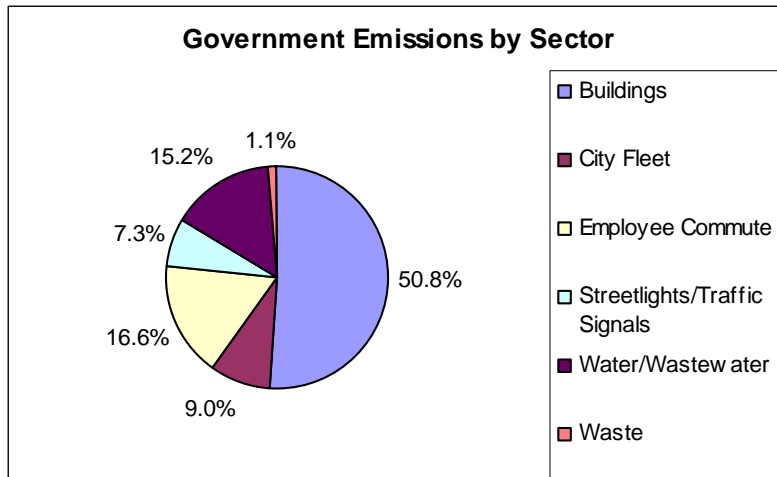


Although municipal emissions are only about 2.7% of the city's total emissions, it is important for the city to set a precedent and set a strong reduction target for the future. Using trends from individual sectors, emissions are expected to rise over the next few years in a "business as usual" scenario:

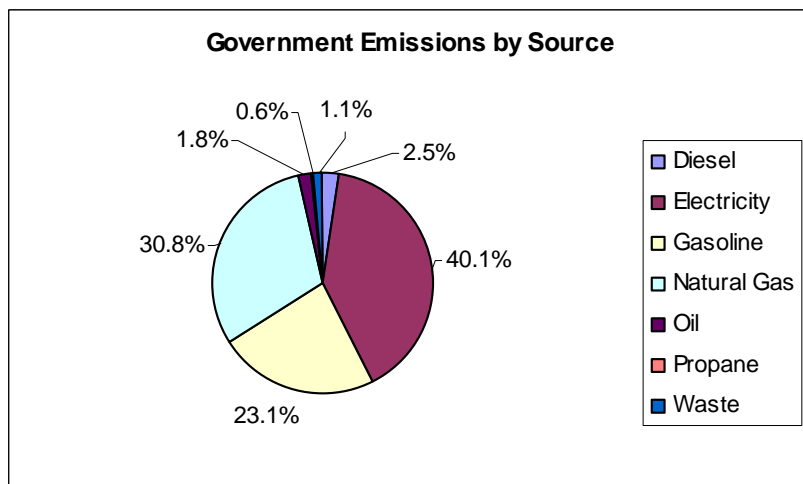


2015 greenhouse gas levels are estimated to be 5.5% greater than 2008 levels. One reason for this increase is the growing number of city employees. Though city population numbers have decreased over the same period, the number of city employees has increased from 2276 to 2319 from 2005 to 2008. The trend of increasing city employees leads to greater fleet usage and greater emissions from employees commuting to work. Emissions per city employee also increase slightly from 8.1 tons to 8.3 tons.

The first chart on the right depicts the breakdown of municipal emissions by sector. “Buildings” includes both school buildings and other municipal buildings, though school buildings make up 84% of all building emissions. School building energy use accounts for 43% of total municipal emissions.



The next chart breaks down municipal emissions by fuel source. Fuel oil plays a much smaller role in municipal emissions than it did in community-wide emissions. This is mostly due to the use of natural gas for heating buildings rather than fuel oil. All school buildings, for example, use natural gas rather than fuel oil for heating. Like the community wide data, electricity and gasoline also make large contributions to greenhouse gas emissions.



Targets

As mentioned above, target reduction levels will also need to be set for municipal emissions. This target does not need to be the same as the community-wide target. Even though municipal emissions represent less than three percent of total community emissions, municipal reductions are often easier and more noticeable than community reductions.

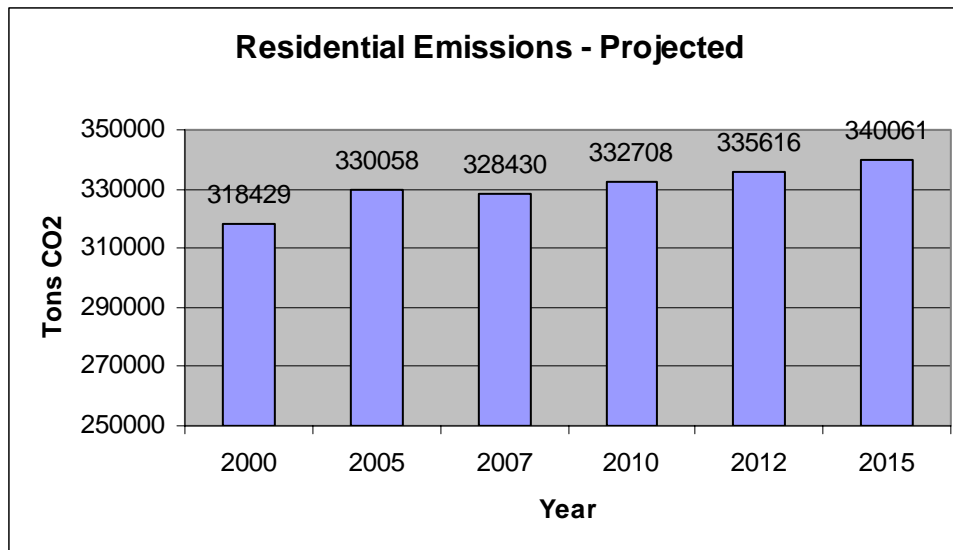


In addition, Pittsfield has also signed up for the EPA New England Community Energy Challenge, pledging to reduce energy intensity per square foot by a total of 10% in all city buildings. So, any target reduction level must take this 10% building reduction into consideration.

Community-Wide Sectors

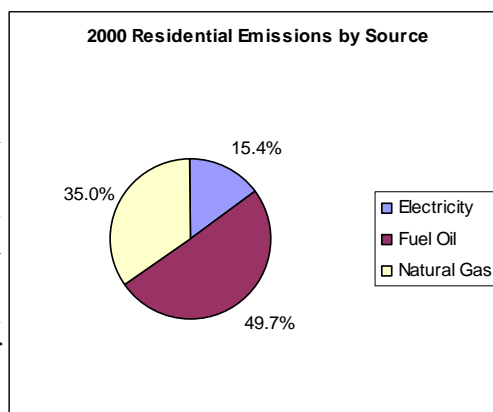
Residential Sector

In 2000, there were a total of 19704 households, an increase of 51 households since 1999. In all, the residential sector produced a total of **318,429 tons eCO₂**. This is 16.2 tons per household per year. Below are the projected emission levels for the residential sector in future years:

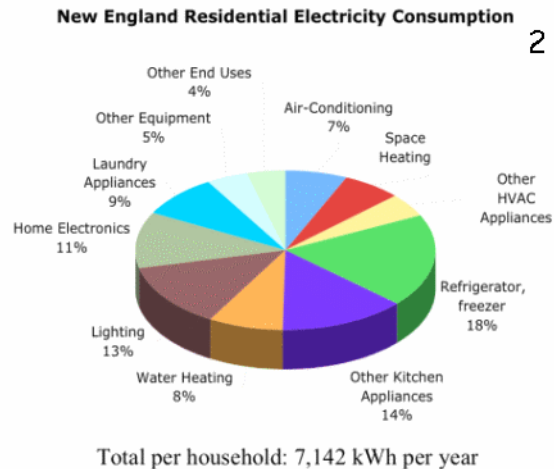
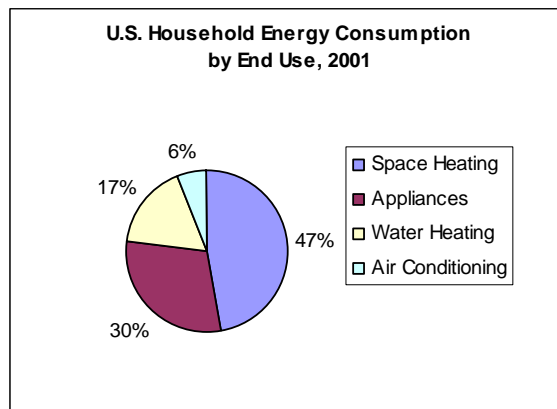


In the CACP software, community emission projections are based on growth (or decline) factors that are inputted by the user. For the residential sector, I used separate growth factors for electricity, natural gas, and oil based on their 2000 through 2007 trends. Even though the population of Pittsfield is in decline, the number of households is actually slightly increasing. Because the number of households is growing, so too is the residential sector energy use.

According to the 2000 census, 45.7% of households in Pittsfield are heated with “fuel oil, kerosene, etc.”, 43.1% are heated with natural gas, and 7.3% are heated with electricity. For this reason, all three fuels are responsible for large portions of residential emissions.



The charts below show average energy use for households in the United States in 2001. The first chart breaks down end use for all sources of energy, the second looks more closely at residential electricity use, in particular.



The best ways to reduce residential energy consumption are to build the home with energy efficiency in mind and to use renewable sources of energy (wind, solar) where possible. As a way to encourage renewable energy use, Tory Hanna suggested that the city consider reducing building permit fees for projects that involve renewable sources of energy.

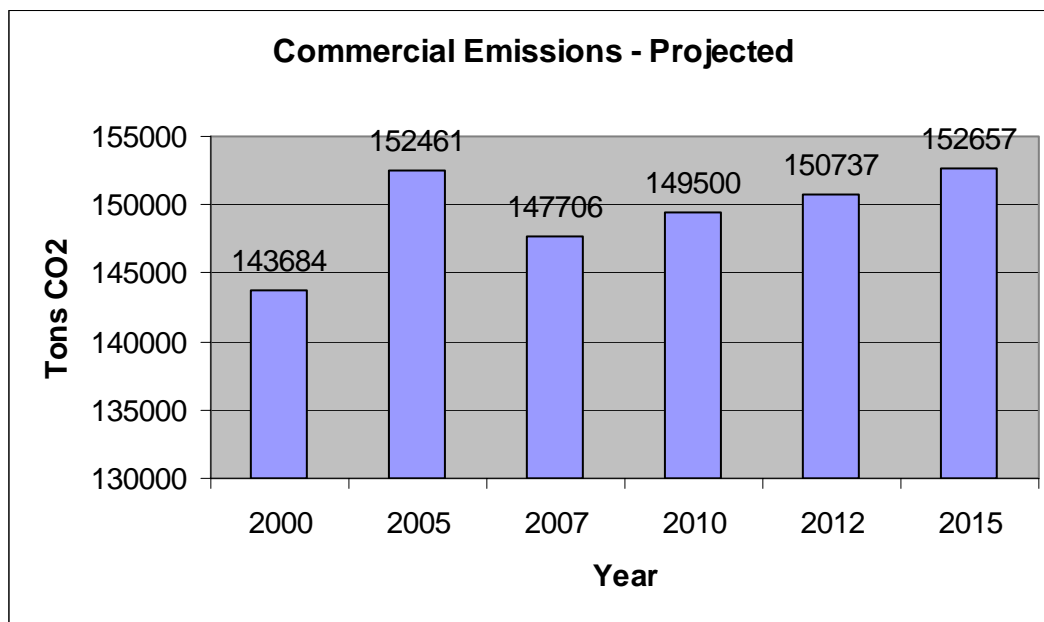
Also, not all energy efficiency measures for homes require energy audits and expensive projects. First, WMECO and Berkshire Gas both provide incentives to upgrade the efficiency of your electrical and gas equipment. These companies will help pay for the installation of energy saving measures that will help both the home and the energy company save money. Another moderate cost idea to implement in your home is to increase insulation. Insulation can keep in heat during the winter and keep it out in the summer, reducing energy costs associated with heating and cooling.

Here are a few small ways to reduce household energy use in quick and affordable ways:

1. Install energy efficient lights (compact fluorescent bulbs). They use a quarter of the energy and last 8-12 times longer than normal incandescent bulbs.
2. Install a programmable thermostat. Adjusting the temperature down a few degrees in the winter and up a few degrees in the summer. Being only slightly uncomfortable can save 6% of heating energy use.
3. Water heater thermostats are often set at 140 degrees when 120 degrees is sufficient.
4. Many electronic devices use electricity even when they are powered off. To avoid this “standby” energy use, use a power strip to turn off the devices or unplug them completely from the wall.
5. Use “energy-saving mode” on appliances, and utilize the “sleep” and “hibernate” features on your computer to save energy while you are away from the computer.
6. Air dry clothes during the summer rather than using the dryer.
7. Use sunlight wisely. In the winter, open shades on sunny days, but be sure to close them again at night to reduce the loss of heat through windows. Close blinds and shades during the summer to reduce the amount of heat coming in.
8. Install low-flow showerheads.
9. Turn off all lights, appliances, and electronics when not in use.

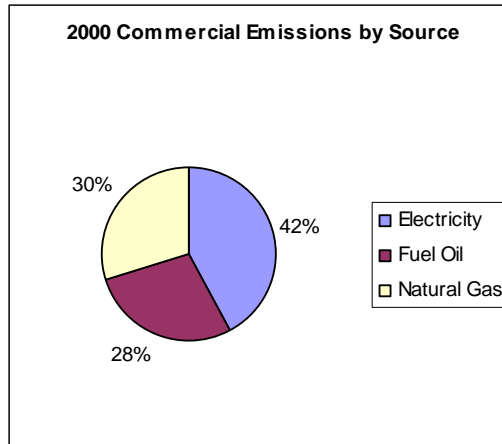
Commercial Sector

There were 1524 commercial and industrial businesses in Pittsfield in 2000, employing a total of 21266 workers. Of this, 17130 are employed in the commercial sector. Commercial businesses produced **143,684 tons of eCO₂**. This is equivalent to 8.4 tons per worker. Below are the projected emission levels for the commercial sector in future years:

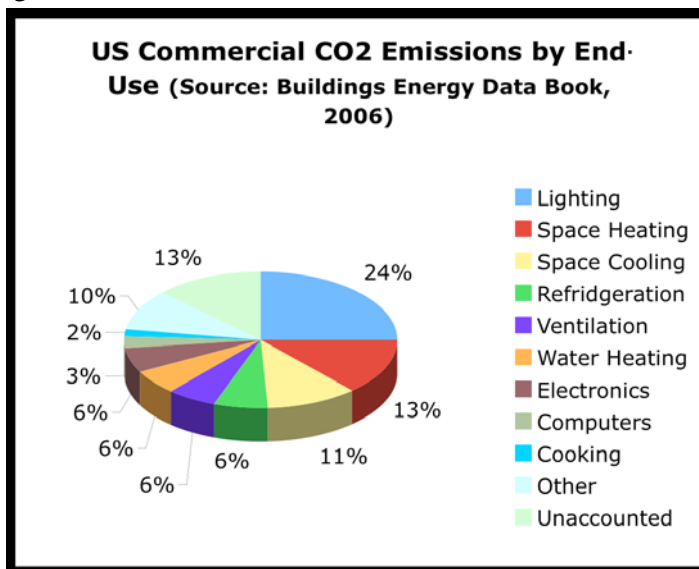


For the commercial sector, the growth factors I used were based on the trends of the energy use for 2000, 2005, and 2007 as well as the trends of the total number of business establishments in Berkshire County. Trends for just the city of Pittsfield were not available. The number of establishments in Berkshire County has been very slowly decreasing, moving from 4383 in 2000 to 4271 in 2005. According to the CACP software, emission levels dropped from 2005 to 2007, but are projected to increase steadily toward 2005 levels by 2015.

Compared with the residential sector, the commercial and industrial sector relies much more on natural gas and electricity, while fuel oil plays a much smaller role.



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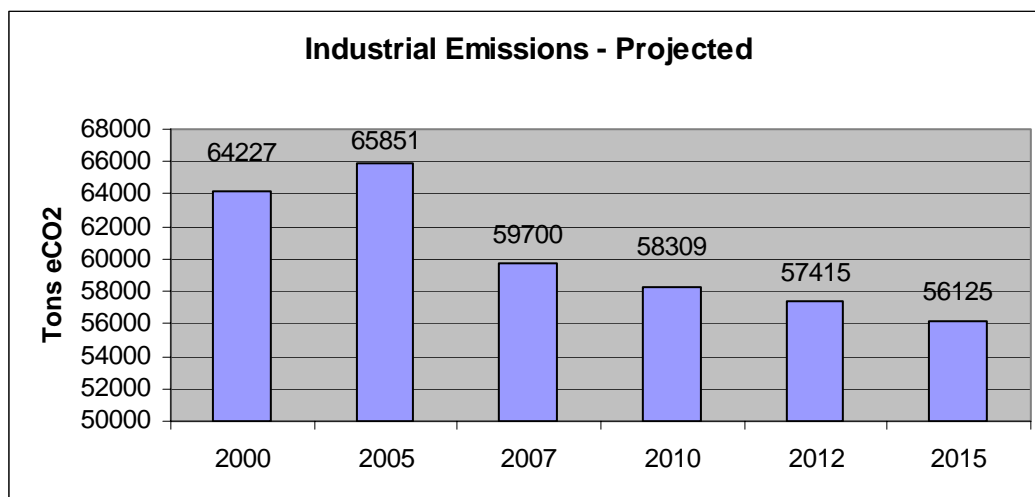
Commercial and industrial emissions bring a new set of end uses. Temperature control accounts for 24% of all emissions, similar to the residential sector. Lighting plays a much bigger role in these businesses, increasing from 13% of residential emissions to 24% of commercial emission.

As with homes, the most energy efficient measures that can be taken are often in the design and construction of the building. Keeping energy efficiency in mind during construction and researching possible ways to incorporate renewable energy into the building will work best for lowering emissions. For offices, there are also some quick, painless tips that will keep your building green and possibly save some money on your energy bill. This is a list of suggestions that I had to reduce the footprint of City Hall, but most of these ideas can be used for any office.

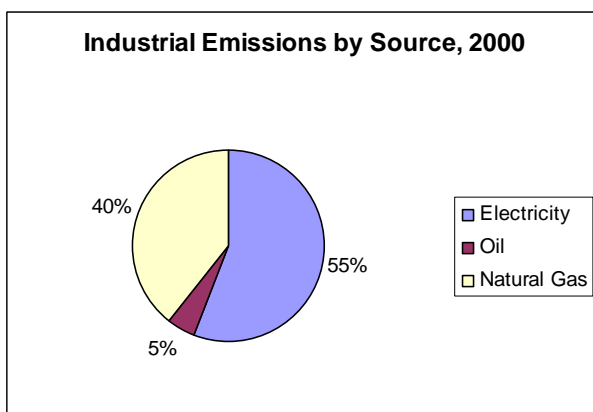
1. Turn off computers at night. (If IT department needs to update computers at night, at least turn them off over the weekends.)
2. Set all computers to sleep or hibernate after a few minutes of inactivity. Screensavers do not save energy, they keep images from being burned onto the monitor screen. Computers with a screen saver on use as much energy as a computer in use.
3. If the AC or heat is on, don't open the windows. Use one or the other.
4. Use compact fluorescent bulbs rather than incandescent bulbs and use motion sensors to turn off lights in unoccupied areas.
5. All office electronics should be Energy Star certified.
6. Use the double-sided or duplex options on copiers.
7. Purchase 100% recycled paper.
8. Use the blank backs of already used paper to send faxes.
9. Use sunlight rather than electricity to light rooms whenever possible.
10. Adjust temperature a few degrees up in the summer and a few degrees down in the winter. Allow/encourage employees to dress seasonably and comfortably.
11. Automate the heat/AC to turn off at night and come on 15 minutes before employees arrive.
12. Use shades in windows to reduce the need for AC.
13. Recycle all empty ink/toner cartridges and outdated electronic equipment.
14. Label recycling containers with what can and cannot be recycled. Place them in convenient spots.
15. Reuse file folders and interoffice envelopes.
16. Contact the company who supplies the office vending machines and have them turn off the light inside it. In almost all cases, the light is unnecessary but is on 24 hours a day.
17. Reduce bottled water use by removing it from the vending machines and offering filtered water stations instead.

Industrial Sector

In 2000, a total of 4,136 workers were employed in fields that are defined under the industrial sector. **The industrial sector produced 64,227 tons of eCO₂ in 2000**, equivalent to 15.5 tons per employee per year. Below are projected emission levels for future years:



Growth factors for industrial energy use are based on energy use trends from 2000, 2005, and 2007. Emissions peaked in 2005, but decreased greatly from 2005 to 2007 and are projected to continue decreasing in the future.



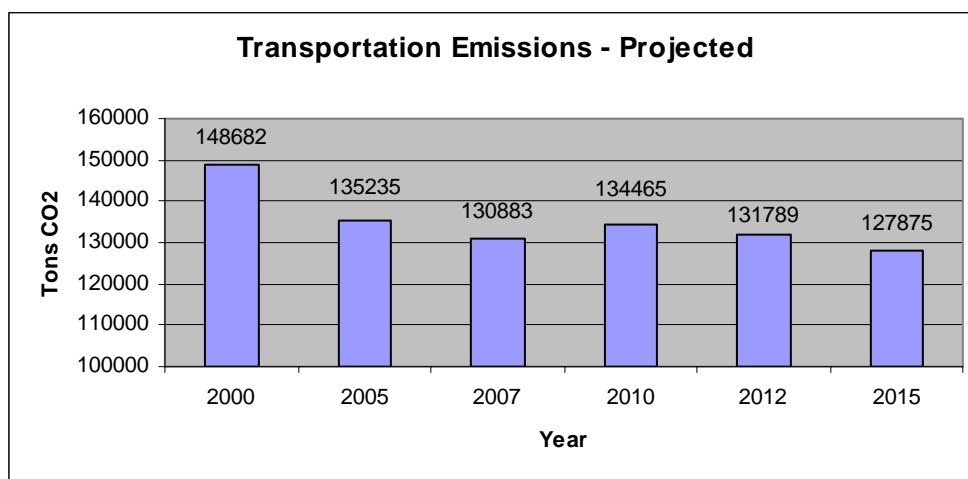
Breakdown by source reveals a much greater reliance on electricity and natural gas, while oil is reduced to a much smaller role compared to the residential and commercial sectors.

Since industrial establishments vary so much from one to another, it is difficult to provide general ideas to help reduce emissions. It is best for each business to observe its emissions and find their own unique ways to reduce them.

Transportation Sector

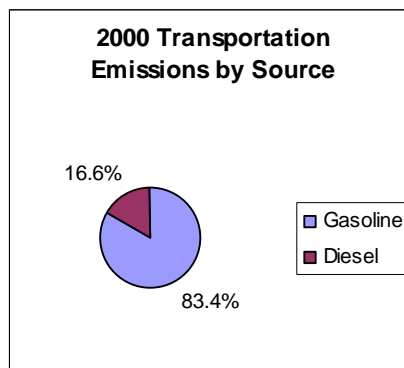
The City of Pittsfield is home to over 223 miles of road. In order to calculate emissions, each road is looked at separately. The length of the road is multiplied by the average daily traffic of the road then multiplied by 330 to account for reduced traffic on weekends and holidays. These numbers are added up for each street and the result is the total annual vehicle miles traveled (VMT). Total VMT for Pittsfield in 2000 was 216,307,859 vehicle miles.

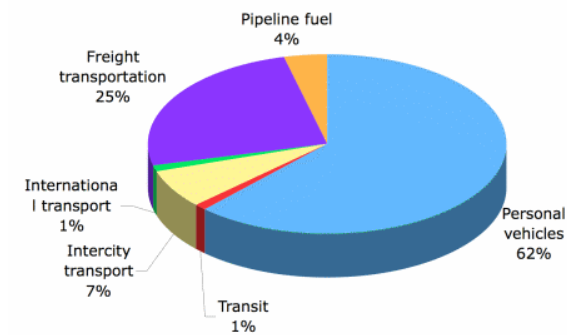
However, every vehicle uses a different amount of fuel to travel the same distance. To calculate the emissions of vehicles in Pittsfield, the CACP software provides a default breakdown of vehicles and their respective fuel economy. This allows us to approximate the annual transportation emissions for 2000, which was **148,682 tons eCO₂**. This is about 3.25 tons per resident.



In order to estimate future emissions, I used a growth factor based on the trends of the entire population. For Pittsfield, the population is slowly declining, so there is actually a negative growth rate. In addition, advances in vehicle technology are making average fuel economy in the United States higher and higher. This also leads to lower emissions and is another reason why transportation emissions in Pittsfield are forecasted to decrease even in a business-as-usual scenario.

The chart to the right depicts the division of emissions between gasoline and diesel fuel. As more advanced technologies like plug-in electric cars, compressed natural gas, and ethanol become more readily available, the use of gasoline and diesel may begin to decline.





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This figure shows the end use of all transportation emissions in New England. It is clear that personal vehicles are by far the largest use of fuel and also the area with the most room for improvement. The three best ways to reduce vehicle emissions are to reduce vehicle use, purchase vehicles with better fuel economy, and purchase vehicles with alternative fuel sources.

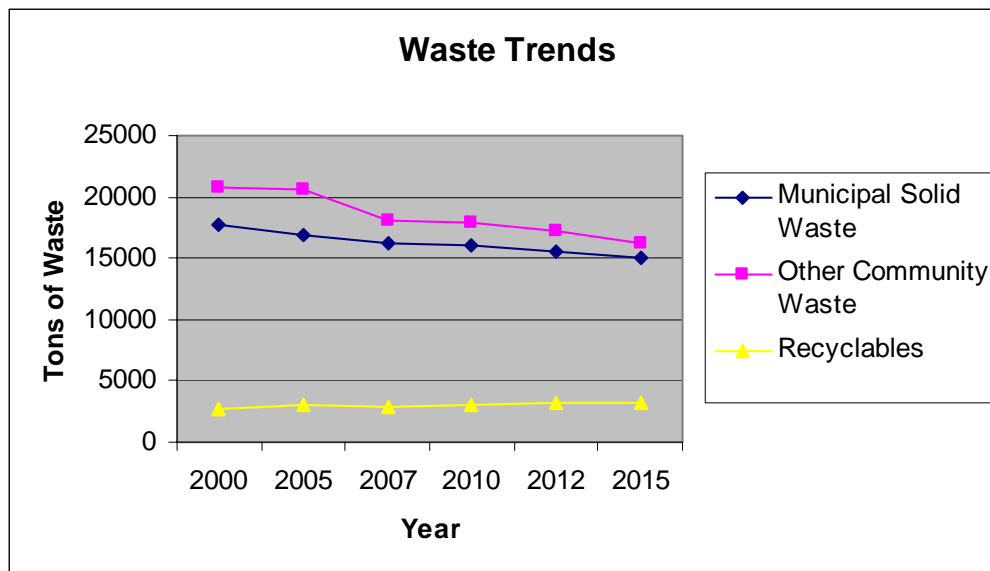
However, not many people know that there are ways to improve your fuel economy (and save money on gas) without buying a new car. Many people are able to get mpg rates well above EPA estimates by incorporating the following techniques:

1. Keep tires well-inflated
2. Replace air filter regularly
3. Drive slower on the highway. Generally, the faster you go, the better your fuel economy. However, there is a certain speed at which fuel economy stops increasing and spikes down. For most cars, this occurs somewhere between 45 and 60 miles per hour. Regardless of what car you are driving, if you are going above 60 miles per hour, you are wasting a significant amount of gas.
4. Avoid jackrabbit starts and stops. Accelerating the car uses a lot of gas. Instead, accelerate more slowly and anticipate stops ahead. If you see that you are about to hit a red light, coast and brake slowly and steadily rather than waiting.
5. Eliminate any unnecessary weight the car is carrying.
6. Fuel economy is reduced when the engine is cold. To offset this, consolidate multiple trips into a single trip. Travel the longest distance first to warm the engine as much as possible.
7. Remove any bike, ski, luggage racks when not in use.
8. If you won't be driving for longer than a few seconds, turn off your car rather than idling it. No, it does not take more fuel to turn the car on. (It is actually illegal to idle longer than five minutes in Massachusetts.)
9. On flat terrain, cruise control can help keep a steady speed and avoid wasting gas on acceleration. On hilly terrain, it is more efficient to hold the speed steady yourself.
10. Wider tires improve handling, but also increase friction and lower fuel economy.

There are many other, more advanced techniques that can increase your fuel economy even further. Drivers who use these techniques call themselves "hypermilers". The bottom line is, you do not need to buy a new car to reduce vehicle emissions. For example, Edmonton, Alberta was able to increase its fleet's average fuel economy by 20% just by coaching employees on fuel efficient driving techniques.

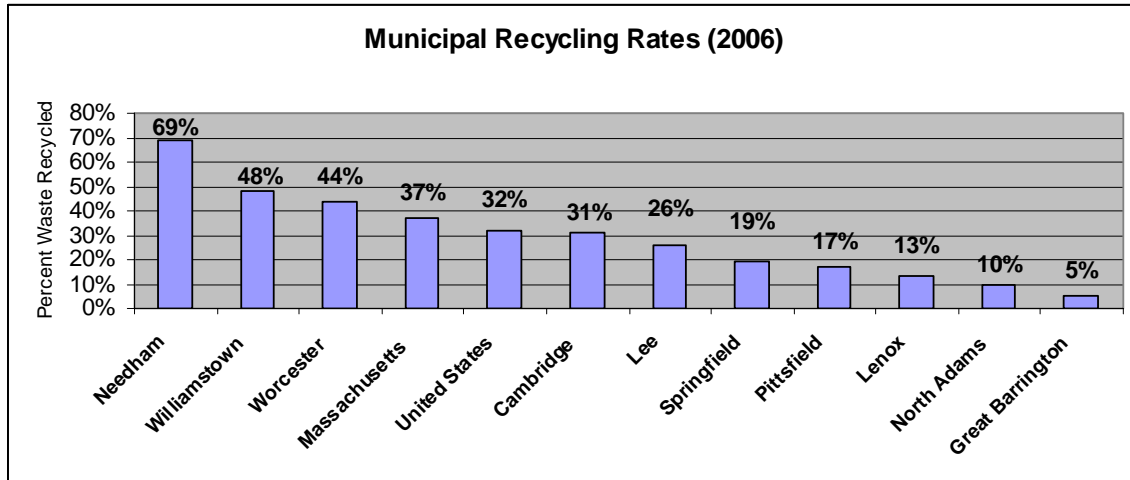
Waste Sector

The city of Pittsfield produced a total of 37,953 tons of waste in 2006. With a population of around 43,500, this amounts to over 1700 pounds of waste per person per year. The combination of hauling and incinerating this amount of waste produced a total of 8,422 tons of eCO₂.



Of the 37,943 tons of waste, only 2,647 tons were recycled. In addition, according to the Massachusetts state website, Pittsfield collected 821 tons of leaf and yard waste which was used as compost. The standard formula for calculating recycling rates is total amount of waste diverted divided by total municipal waste (other community waste is not factored in). **In 2006, Pittsfield's recycling rate was just over 17%.**

The good news is that Pittsfield's total waste is declining over the years, while the amount of recycling has been increasing. The bad news is, in a business-as-usual scenario, Pittsfield recycling rate is still predicted to be no greater than 22% by 2015. Compare Pittsfield's recycling rate to the United States average and the recycling rates of other Massachusetts communities in 2006:



From the chart, we can tell that Pittsfield is around average for other Berkshire County communities, but well below both the Massachusetts and United States average.

Needham, Williamstown, and Worcester, three communities with great recycling rates, use a “pay as you throw” system. Rather than allowing unlimited waste disposal to citizens, they are charged per bag of waste. Most of these communities do not charge for bags of recyclables. This is in an effort to curb the amount of total amount of waste and also to have citizens separate their trash and recyclables more efficiently.

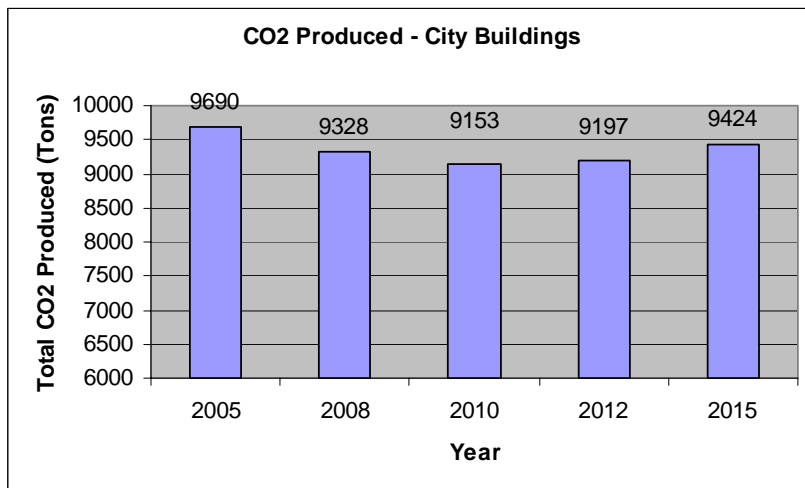
Other ideas for reducing solid waste include:

1. Educating community residents and businesses about proper recycling protocol. Many people do not know which items are recyclable or how to prepare them to be recycled. When in doubt, they go the easy route and throw it in the garbage.
2. Encourage residents to create their own compost bins. There are instructions all over the internet on how to create your own compost bin, complete with worms, which can take your trash and turn it into great fertilizer for gardens.
3. Hold an electronics recycling day.

Government Sectors

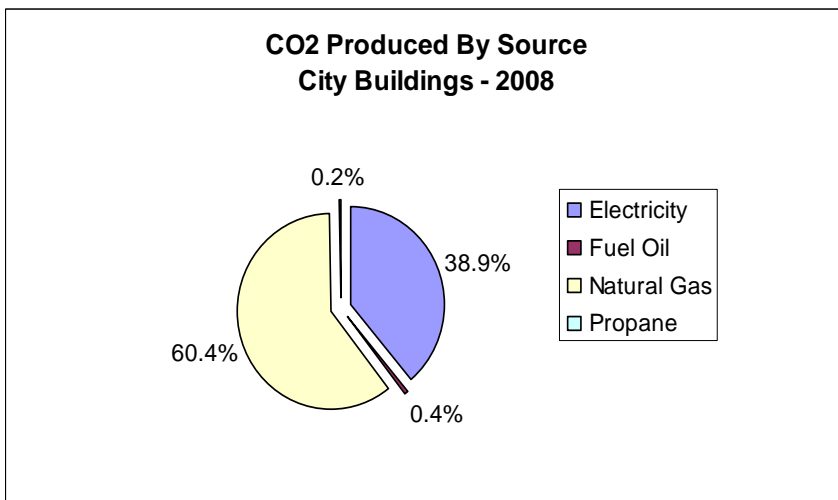
Municipal Buildings

Pittsfield owns a total of 140 buildings. Of the 140, 14 are school buildings and 39 are water/wastewater facilities. Water and wastewater buildings are not included here, they are considered in the water/wastewater sector. City buildings produced a total of **9,328 tons of eCO₂** for fiscal year 2008 and had a combined energy bill of \$2,966,550.



eCO₂ emissions are predicted to stay relatively stable over the next few years, although total energy use is actually declining very slightly. 2015 emission levels are 1% higher than 2008 levels.

The breakdown of emissions by fuel type reveals that natural gas is by far the largest contributor. This is due mostly to the 14 school buildings, which all use natural gas for heating. School buildings account for a whopping 84% of building emissions and 43% of total government emissions. But, as you will see in the next chart, there is plenty of room for improvement in these school buildings.

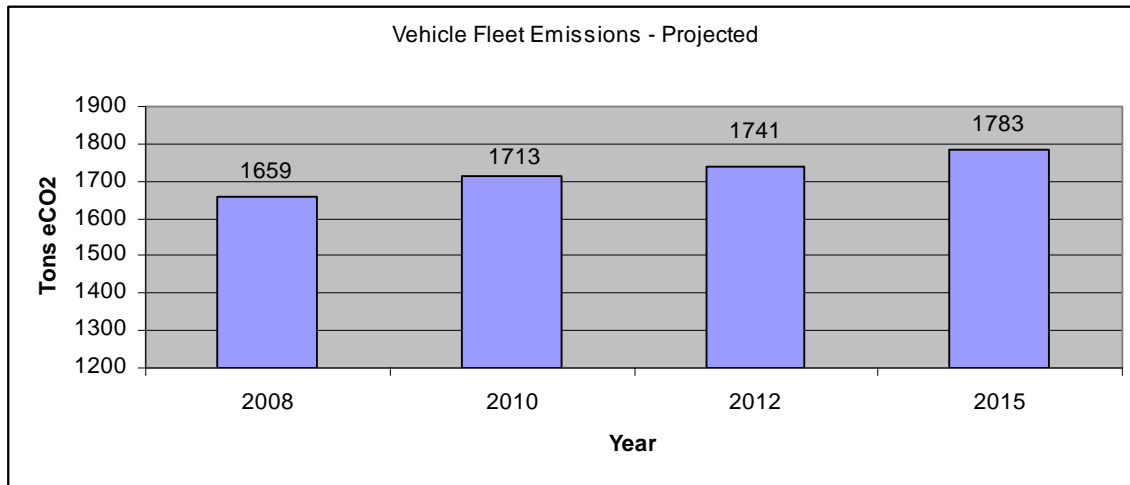


Below is a list of the 29 city buildings which consume the majority of energy. Energy intensity represents the amount of energy used per square foot of the building. A higher number means lower efficiency in the building as a whole. However, just because one building has a higher energy intensity than the other, that does not mean that one is better than the other. Different buildings serve different purposes, some of which are more energy intensive than others. The 1-100 rating is the EPA's Portfolio Manager rating. If a building has a rating above 75, it is eligible to apply for Energy Star recognition. So, a rating of 50 is not failing, it is closer to average. However, as this chart shows, there are many buildings with an extremely low rating. **It is these buildings with low ratings that the city should focus on when considering energy audits or renewable energy projects.** Unfortunately, ratings are not available for every building type.

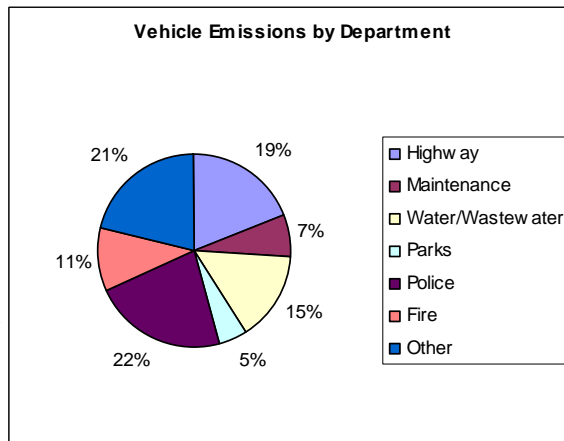
Facility Name	Floor Space (Sq. Ft.)	2008 Energy Intensity (kBtu/Sq. Ft.)	Current Rating (1-100)	Cost per Sq. Ft. (US Dollars (\$))
Allendale Elementary School	48,133	95.9	19	\$2.21
Animal Shelter	2,078	178.4	N/A	\$5.09
Berkshire Artisans	9,952	41.6	N/A	\$2.06
Berkshire Athenaeum	45,938	65.3	N/A	\$3.08
Capeless Elementary School	38,654	103.0	17	\$2.41
City Hall	32,090	82.4	58	\$2.60
Conte Community School	69,518	98.1	25	\$1.97
Crosby Elementary School	69,826	144.8	12	\$2.54
Egremont Elementary School	63,869	104.0	20	\$2.38
Emergency Management	8,214	31.6	N/A	\$0.81
Fire Headquarters	16,589	25.3	N/A	\$1.36
Herberg Middle School	107,640	76.1	63	\$1.81
Hibbard Alternative School	31,519	95.3	13	\$1.96
Holmes Road Fire Station	4,280	131.0	N/A	\$3.96
Maintenance Building	11,358	69.7	75	\$1.41
Maintenance Garage	7,800	17.7	N/A	\$0.90
Mercer Administrative Building	17,653	120.5	30	\$2.77
Morningside Community School	69,654	96.9	24	\$2.02
Pecks Road Fire Station	6,341	21.4	N/A	\$1.02
Pittsfield High School	203,051	89.2	47	\$2.02
Police Headquarters	25,057	152.3	N/A	\$3.44
Reid Middle School	115,036	74.8	62	\$1.83
Somerset Fire Station	6,030	119.6	N/A	\$2.95
Springside House	5,819	196.5	8	\$3.93
Stearns Elementary School	39,343	74.6	40	\$1.87
Taconic High School	189,686	103.7	18	\$2.57
W. Housatonic St. Fire Station	3,283	111.2	N/A	\$2.78
Wahconah Park	12,614	25.6	N/A	\$1.15
Williams Elementary School	53,900	87.7	32	\$1.98

Vehicle Fleet

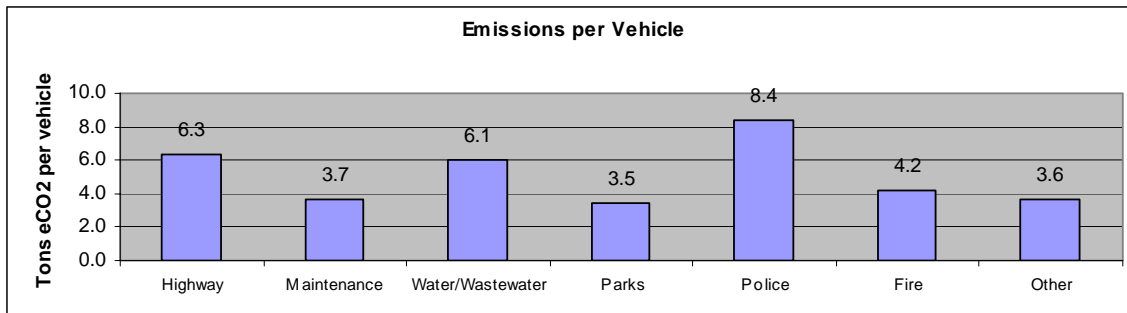
The city’s vehicle fleet is composed of 328 vehicles in 22 different departments. For fiscal year 2008, the fleet used a total of 111,386 gallons of gasoline and 44,126 gallons of diesel fuel. This resulted in a total of **1659 tons of eCO₂** being released.



Projections for vehicle fleet emissions are based on city employee trends. Because the number of city employees is slowly increasing, so too is the amount of fuel needed to do their jobs. For this reason, 2015 vehicle emissions are projected to increase by 7.5% from 2008 levels. The breakdown of vehicle emissions by fuel type and by department are below.



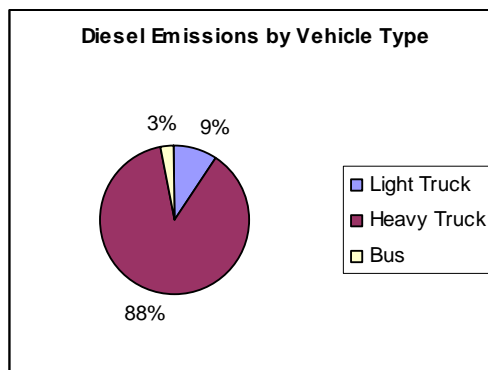
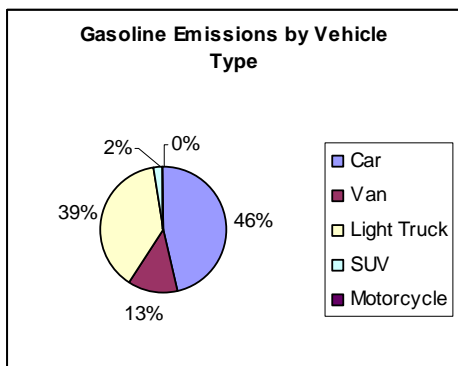
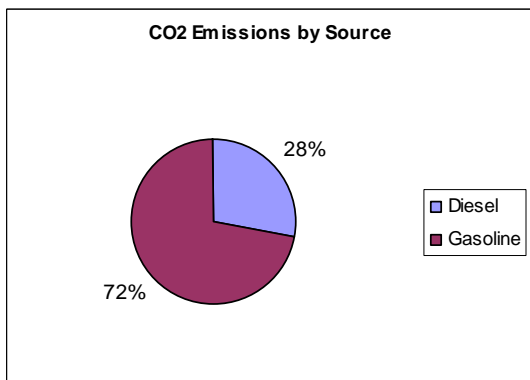
Six of the twenty two departments make up over 70% of total vehicles and 85% of fleet emissions. To compare the different departments even further, below is a bar graph showing average emissions per vehicle in each department.



When analyzing this data, keep in mind that different departments have different types of vehicles. The police department has mostly cars, which get more miles per gallon than, say, the highway department’s diesel street sweepers. In order to reduce the footprint of the fleet, the city should consider:

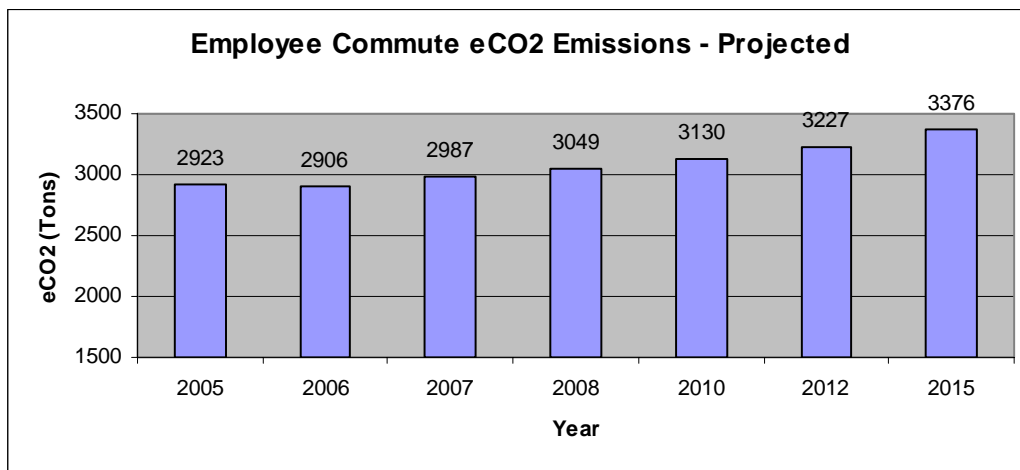
1. Creating a vehicle purchase policy stating that the most fuel efficient vehicle that is sufficient for the tasks its must perform should be purchased.
2. Consider downsizing or eliminating vehicles which are too inefficient for the tasks it performs.
3. Perform scheduled maintenance on all vehicles, keep tires inflated, etc.
4. Educate employees in fuel-efficient driving techniques, which were listed in the community-wide transportation sector.

The three pie charts below break down emissions by fuel type and type of vehicle.



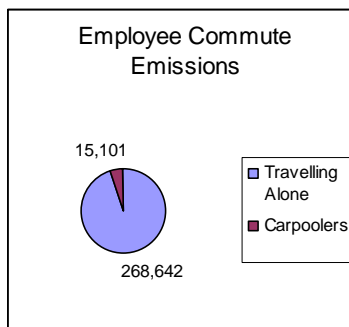
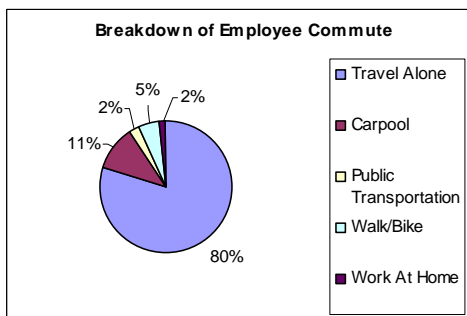
Employee Commute

In fiscal year 2008, the City of Pittsfield employed a total of 2,319 full time employees. According to the 2000 census, average commute time to work for Pittsfield residents is 17.1 minutes. Also from the census, we can find the percent breakdown of how Pittsfield workers commute to work. According to the EPA, the average fuel economy for vehicles in the United States in 2008 is 20.4 miles per gallon. If we assume the average speed when driving to work is 25 miles per hour, we can come up with an estimate of how many gallons of gasoline are used by employees for their commute. In 2008, city employees produced an estimated **3,049 tons of eCO₂**.



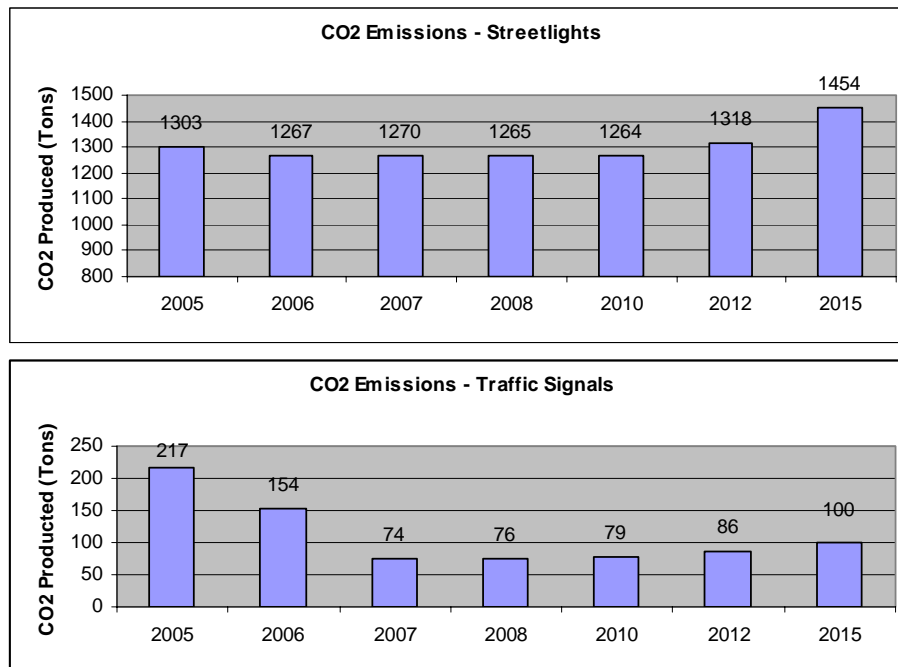
Of course, this is a very rough estimate. It is impossible to figure out the fuel economy of each car, so the U.S. average is used. It is also difficult to estimate the average method of commute and commute time to work, so the Pittsfield average is used. Finally, it is also very difficult to judge average speed on the way to work. Due to some light traffic, traffic lights and stop signs, I felt an average speed of 25 miles per hour was appropriate.

In order to reduce the emissions associated with employee commute, the city should consider making it easier for people to commute in more efficient ways. Placing bike racks outside the building, starting an employee carpool list, or giving incentives such as preferred parking to carpoolers are some possible ideas. The left chart below shows the method of commute for all Pittsfield workers, according to the 2000 census. The right chart shows the amount of emissions that each method produced in 2008.



Streetlights and Traffic Signals

Streetlights and traffic signals are a necessary expense for any local government. In 2008, electricity use of streetlights and traffic signals accounted for **1265 and 76 tons of eCO₂** respectively. It may not seem that there is much you can do to reduce electricity use of these devices, but there are a few solutions. Below are projected emission levels and some possible ways to improve the efficiency of streetlights and traffic signals.



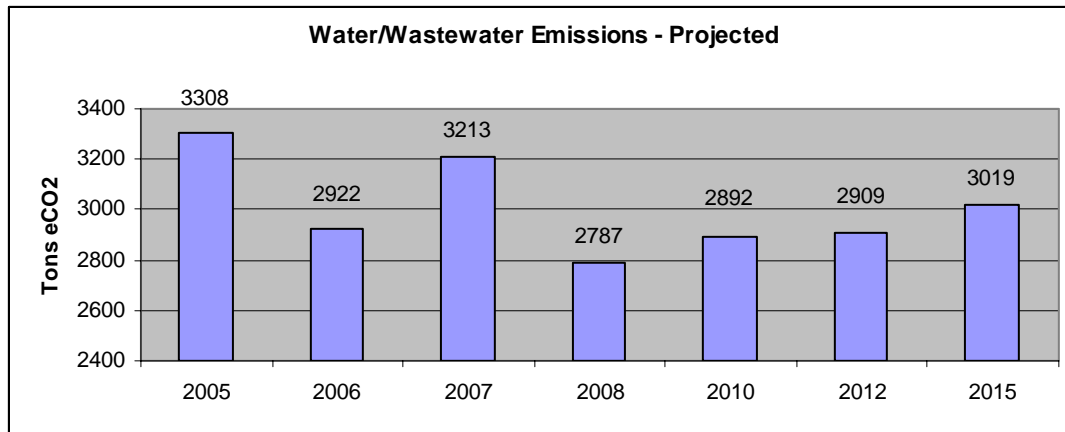
Notice the 66% reduction in traffic signal emissions from 2005 to 2007. This is thanks to the switch from incandescent bulbs to LED bulbs. Without these retrofits, the city would have spent an additional \$95,000 on electricity for its streetlights in 2007 and another \$95,000 in 2008. Emissions from both streetlights and traffic signals are projected to increase slightly from 2008 levels in a business-as-usual scenario. These projections are based on the linear trends of emissions from 2005-2008. For traffic signals, 2005 and 2006 were not included in the projections because of the significant decrease in emissions due to LED lights installed in 2007.

A similar project to the LED streetlights is replacing incandescent streetlight lamps with high pressure sodium lamps, which are much more efficient. I believe Bruce Collingwood is already in the process of making this happen.

One more thing that was mentioned to me is that there are a number of streetlights around the city which are lit twenty four hours per day. Assuming a 1000 watt lamp, if just a single streetlight was turned off from 6AM to 6PM it would save 4380 kWh a year, enough to supply an average home for 6 months. The city should try to avoid wasting electricity like this.

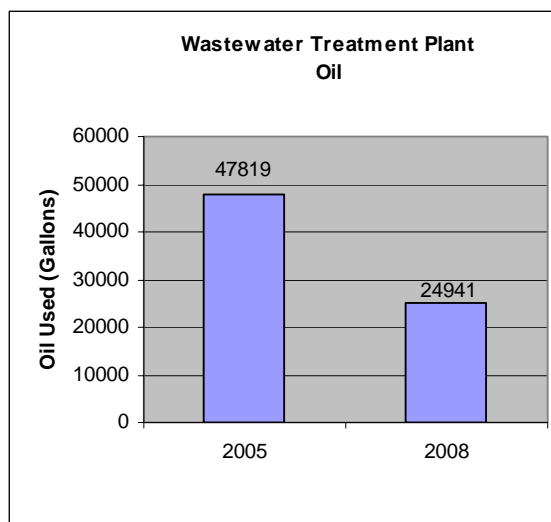
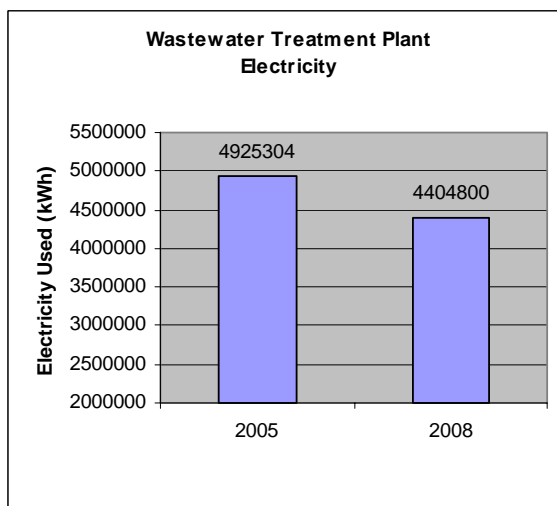
Water/Wastewater

There are a total of 20 water facilities, including treatment plants, flow control stations, pumps, and tanks spread between Pittsfield, Washington, and Hinsdale. The 19 waste water facilities include 12 plant facilities on Holmes Rd. and various lift stations around the city. In fiscal year 2008, the energy to power all of these facilities produced 2787 tons eCO₂ and cost the city just over a million dollars. The wastewater plant produces the majority of emissions, accounting for 69% of water related emissions in 2008.

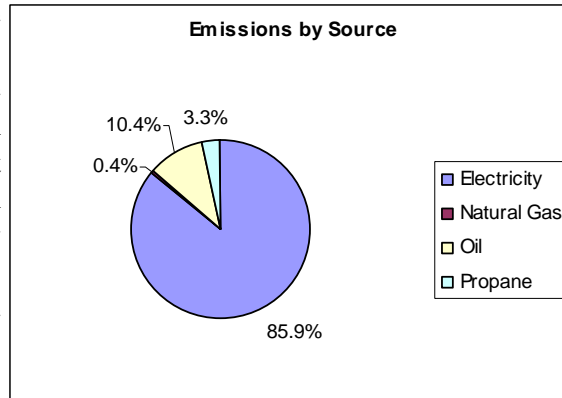


From 2005 to 2008, water/wastewater emissions have been reduced by more than 15%. Energy use is expected to remain fairly steady or possibly decrease in the future, though emissions will rise slightly, as has been the case with many sectors. According to the software, the same amount of energy will produce greater emissions in years to come.

The reduction in emissions from 2005 to 2008 is thanks, in large part, to the efforts that the wastewater plant has taken to conserve energy and save money. Electricity use has declined by 10.6% and oil use has declined 47.8%.



Water and wastewater facilities are highly dependent upon electricity, thus electricity accounts for the majority of emissions. Oil and propane are used to a lesser extent while natural gas plays a limited role. Below are water facility energy use and cost data for FY2008. (Natural gas use is omitted so the chart fits on the page.)

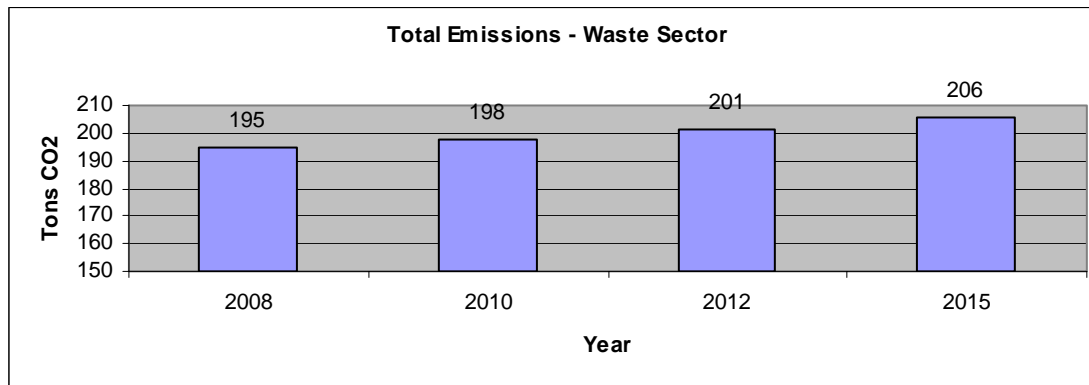


I do not know anything about water facilities, so it is impossible for me to say how to improve their efficiency. However, this chart will help points out the most energy intensive facilities.

	Electricity		Propane		Oil		Total Energy Cost (\$)
	Use (kWh)	Cost (\$)	Use (Gallons)	Cost (\$)	Use (Gallons)	Cost (\$)	
Water							
Ashley Plant	231,168	35,582					35,582
Cleveland Plant	985,344	143,260	3,571	7,421			150,681
West St.	253,327	37,801					38,346
Coltsville	3,000	778	461	1,220			1,998
East New Lenox	14,838	2,516	274	849			3,364
Crane Ave	13,731	2,311					2,311
South Mountain	37,557	6,965					7,284
North St. Pump	91,015	6,965					6,965
Pecks Rd.	102,971	15,993					15,993
East Acres	4,359	958					958
Lebanon Ave	4,879	1,027					1,027
Valentine Rd.	3,011	780					780
Elmer Ave.	4,493	977					977
Ashley Chlorinator	35,656	5,445	541	1,741			7,186
Cleveland Chlorinator	40,378	6,333	8,764	19,137			25,470
Sewer							
Thomas Island Rd.	14,618	2,733					3,407
North St. Waste	32,085	5,222					5,222
Lakeway Dr.	14,091	3,015					4,067
Blythewood Dr.	6,208	1,203	95	322			1,524
1015 South St.	36,270	6,572					6,572
Plumb St.	28,249	4,909					4,909
1045 South St.	46,919	8,311					8,311
Central Berkshire Blvd.	22,142	4,209					4,209
Wastewater							
Wastewater Treatment Plant	4,404,800	617,044			24,941	57,775	617,044
Totals	6,431,109	\$920,908	13,706	\$30,689	24,941	\$57,775	\$1,011,963

Waste

From the 140 buildings owned by the city, a total of 879 tons of waste were collected for FY2008. This amounts to .38 tons, or 760 pounds, of waste per employee. The equivalent greenhouse gas emission for this amount of waste is **195 tons eCO₂**.



Due to the rising number of city employees, this number is projected to increase slightly in the future. Total emissions are estimated to rise 5.6% from 2008 to 2015. Unfortunately, recycling data for city buildings is unavailable, so we cannot calculate the recycling rate for city employees. Regardless of what it is, it is always a good idea to try to reduce waste and increase recycling. Below are a few tips which are relevant to city operations. (These were already listed earlier for ways to improve office buildings)

1. Print and copy all documents double sided.
2. Purchase 100% recycled paper.
3. Use blank backs of used paper to send faxes.
4. Reuse file folders and interoffice envelopes.
5. Recycle all empty ink/toner cartridges and outdated electronics.
6. Announce recycling procedures and encourage employees to recycle.
7. Place recycling containers in convenient spots.
8. Reduce bottled water use by removing it from vending machines and using filtered water stations instead.
9. Discourage use of paper plates, paper cups, and plastic silverware. Encourage the use of coffee mugs, metal utensils, etc which can be washed and reused.

1. From <http://ceic.cambridgeenergyalliance.org/wpcontent/uploads/2007/12/installedcapacity.gif>

2. From http://ceic.cambridgeenergyalliance.org/wpcontent/uploads/2007/12/residential_electricity_end_use.gif

3. From Buildings Energy Data Book, 2006

4. From

http://ceic.cambridgeenergyalliance.org/wpcontent/uploads/2007/12/transportation_energy_end_uses.gif

Inventory Methods – Community Data

Residential Sector

Residential energy use data for 2000 was provided by Nancy Nylen at the Center for Environmental Technology (CET). She was able to provide electricity consumption which was retrieved from Western Massachusetts Electric Company (WMECO) and natural gas data from Berkshire Gas. To estimate oil use, I found the percentage of people who heat their homes using fuel oil and natural gas. This was available through the 2000 census. With that, I used the natural gas numbers to estimate oil usage.

To estimate forecast year emissions, I input an estimated household growth factor (.26%) into the CACP software. I also input a separate growth factor for electricity, which was 1.3% per year. The software is able to give estimates for any future year with this growth factor.

Commercial and Industrial Sectors

Commercial/Industrial use data for 2000 was also provided by Nancy Nylen. To estimate fuel oil use for these sectors, I used this website: http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/fuel_oil_and_kerosene_sales/historical/2000/pdf/table4.pdf I found the state average of residential fuel oil sales versus commercial and industrial fuel oil sales. I then used the residential fuel oil totals that we found earlier to estimate the commercial and industrial sector totals.

To estimate forecast year emissions, I input an estimated business growth factor based on the trends of energy use for 2000, 2005, and 2007. Electricity, for example, was +1.1% per year for commercial and -1.5% per year for industrial. Gas and oil growth factors were based on the growth rate of the number of businesses in Berkshire County. This data was not available for Pittsfield only, so I used Berkshire County.

Transportation Sector

Transportation emissions for 2000 are based on a calculation that ICLEI recommends if you are not able to retrieve data for vehicle miles traveled (VMT) directly. Peter Powers, of the engineering department of the Department of Public Works, was able to supply me with the data that I needed. He gave me a CD which had an excel document on it. Each street in the city is listed, along with its length (in miles) and average daily traffic (ADT). The streets are also classified into three categories of local, arterial, and collector roads. For each category, the length of the road is multiplied by the ADT and then by a conversion factor (330) to get annual data. 330 is used to account for reduced traffic on weekends and holidays. This final VMT number is input into the CACP software. All of this data and calculations can be found in the “Roads and Traffic Data” spreadsheet under I:\Inventory Data folder on this computer.

The software provides a default breakdown of VMT by fuel and vehicle type. To estimate growth factors for transportation emissions, I used the growth rate for the population of Pittsfield. According to census estimates, this is about -1.0% per year.

Waste Sector

A summary of municipal solid waste and recycling for FY2003-FY2007 was provided by Bruce Collingwood of the Department of Public Works. Each year has its own page with tonnage of municipal solid waste, “other” solid waste, and recyclables. These sheets also have hauling and tipping fees. These summary sheets are paper clipped and located in the top drawer of my desk in a manila folder labeled “Inventory Data”.

The software provides a default breakdown of waste by waste type (paper, food, etc.) To estimate growth factors for waste, I graphed the tonnage of waste by year and used a linear trendline to find a growth factor. Then I input this growth factor (-1.5% per year) into the CACP software.

Inventory Methods – Municipal Data

Buildings

Data for energy consumption of municipal buildings was provided by two different people. Sally Douglas, School Department Business Manager, provided electricity and natural gas data for school buildings for FY2005-2008. Ernie Fortini, director of the Maintenance Department, provided electricity, natural gas, and oil data for the other city buildings, excluding water and wastewater buildings.

The spreadsheet “Building Summary Sheet” has yearly totals for all buildings for FY2005-2008 and is located in the I:\Inventory Data folder on this computer. If you are looking for monthly data, you will need to look elsewhere. For schools, monthly data can be found in the Inventory Data manila folder in my desk. The spreadsheets are clipped together and there is a post it note on the front that says FY’05 final. For other buildings, monthly data can be found in the I:\Inventory Data folder. For example, 2005 electricity will be found under 2005 Electricity.xls.

To estimate growth for future years, I graphed the total electricity, natural gas, and oil used for city buildings separately over these four years. For each fuel type, I fit a linear trendline to the data. Then I plugged in future years for the “x” in the trendline equation. Linear trends are not the best way to forecast growth, but the CACP software does not provide any helpful ways to forecast municipal emissions, so I figured this would be the best way.

Fleet

Data for vehicle fleet fuel consumption was provided by Tom Foody, Superintendent of the Highway division of the Department of Public Works. The spreadsheet contains the entire inventory of city vehicles. There is a short identifier of the vehicle, total gallons of fuel used in FY2008, and the total number of miles on the vehicle (NOT the number of miles driven in FY2008). This spreadsheet, along with my breakdown of vehicles into

departments, is located in the I:\Inventory Data folder under “Fuel Report – With Totals.xls”.

I was only able to retrieve one year of fleet information because the tracking software used by the highway department was implemented sometime during FY2007. So, I could not use linear trends for fleet data. Instead, I used linear trends for the number of city employees. I assumed that the number of gallons used per employee would stay the same. Since the number of employees is projected to increase (see the next section on employee commute) the fuel used for the city’s vehicle fleet is also projected to increase.

Employee Commute

Data for employee commute was calculated using city employee numbers as well as census information. Patty Mayhew, Payroll Systems Specialist, provided the total number of city employees for FY2005-FY2008. Using 2000 census information, I found the average commute time to work (19.1 minutes) for Pittsfield workers as well as the method of transportation to work. I also had to make some other assumptions, like an average of 2.5 people per carpool and an average speed of 25 miles per hour on the way to work. All assumptions and calculations can be found in the “Employee Commute Calculations.xls” file in the I:\Inventory Data folder.

I also used linear trends to estimate the number of city employees for future years. Holding everything else constant, this increase in city employees means an increase in emissions due to employee commute. This is why emissions are projected to increase over time.

Streetlights and Traffic Signals

Streetlight and traffic signal data was provided by Sheila Eberth, Sr. Clerk Typist for the Highway Department. Sheila provided electricity bills for FY2005-FY2008 for both streetlights and traffic signals. All data is located in the “Street Lights.xls” and “Traffic Signals.xls” spreadsheets in the I:\Inventory Data folder on this computer. After summing up total consumption for each year, I again used linear trends to predict future energy consumption.

For traffic signals, because of the switch to LED bulbs in 2007, energy use decreased significantly from 2005 to 2007. Because we cannot expect to continue reducing energy use for our traffic signals like this, only 2007 and 2008 were used to predict future energy use.

Water/Wastewater

Water and sewer building energy use was provided by Sally McLaughlin, Sr. Clerk Typist for the Water Division of the Department of Public Works. Sally provided electricity/propane/gas/oil bills for FY2005-FY2008 for all water buildings other than the wastewater plant.

Wastewater plant energy use information was provided by Tom Landry, Wastewater Superintendent, for FY2007 and FY2008. To go further back, I went through the stacks

of purchase orders in the city Accounting department for FY2005 and FY2006. This data can be found in the “Water and Wastewater” spreadsheets in the I:\Inventory Data folder on this computer.

Again, I graphed each energy source separately and used linear trends to predict future energy use.

City Waste

Estimates for the amount of waste produced by city buildings was provided by Paul McMillan and Killian Flynn at Allied Waste. Data was only provided for FY2008.

To try to project future waste tonnage, I again used the linear trends for number of city employees. Keeping the amount of waste per employee the same, total waste increases over the years along with city employees.