

LAMBERTVILLE CITY'S
GREENHOUSE GAS INVENTORY OF
LOCAL GOVERNMENT
OPERATIONS IN 2014

[Document subtitle]

ABSTRACT

A document outlining greenhouse gas emissions by activity of the City of Lambertville as the first step in creating a Local Climate Action Framework for Lambertville City, NJ.

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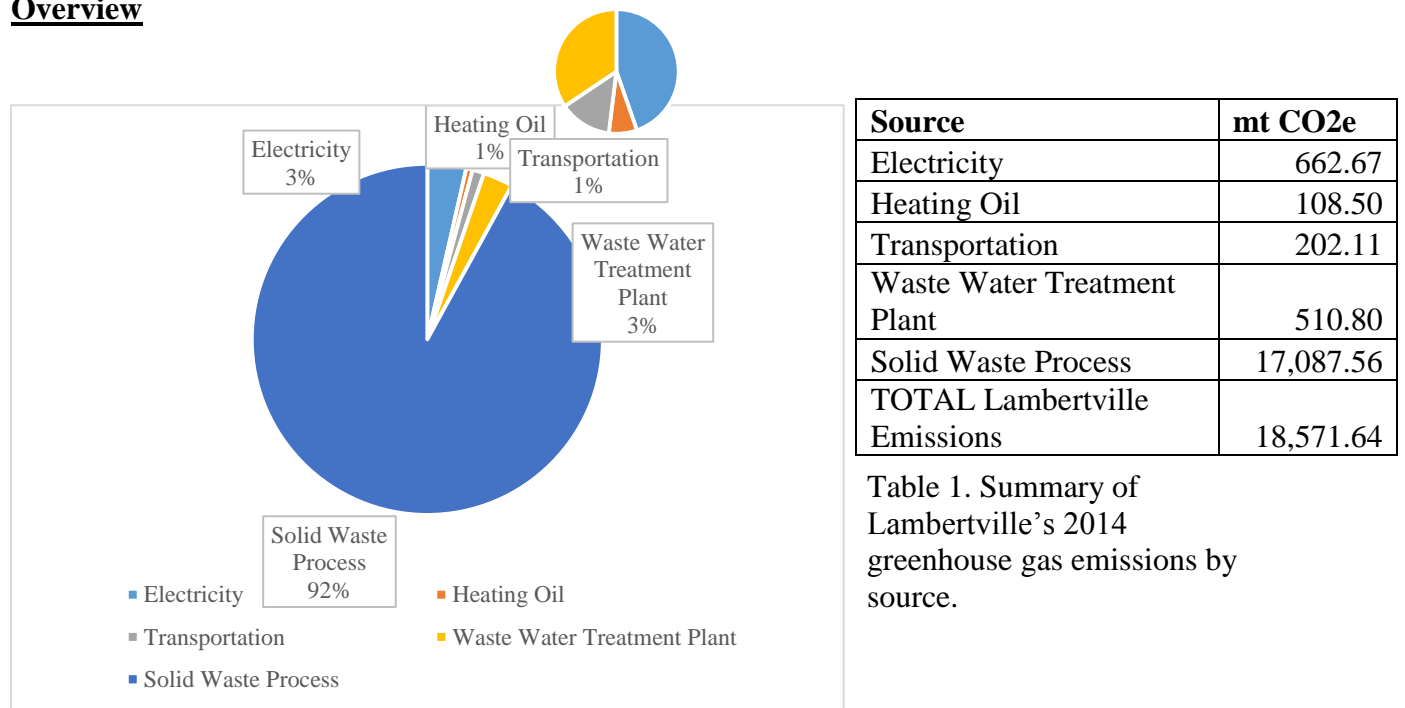
2015 Summer Climate Change Intern

Introduction

Greenhouse gas emissions are a part of the day-to-day operations of local, state, and national governments. Emissions are inevitable and reducing them requires a conscious and deliberate effort. The purpose of this report is not to deny this fact but to investigate where/how Lambertville can conserve its emissions resulting from its day-to-day operations. Lambertville already demonstrates a strong drive to be an environmentally-conscious entity and this report aims to help Lambertville expand this goal to include greenhouse gas emissions-consciousness as part of the EPA’s climate action framework program. This could then be included in our activity as a Sustainable Jersey city.

This report is divided into two sections- the first outlines the greenhouse gas emissions inventory process and results while the second makes suggestions for how the City of Lambertville can reduce these emissions in the coming years.

Overview



Source	mt CO2e
Electricity	662.67
Heating Oil	108.50
Transportation	202.11
Waste Water Treatment Plant	510.80
Solid Waste Process	17,087.56
TOTAL Lambertville Emissions	18,571.64

Table 1. Summary of Lambertville’s 2014 greenhouse gas emissions by source.

Figure 1. Breakdown of greenhouse gas emissions by source in 2014.

The figures above describe the breakdown of the greenhouse gas emissions calculated for this report. Clearly solid waste treatment and removal is responsible for much of Lambertville’s greenhouse gas (GHG) emissions. It should be remembered, however, that even though the Lambertville government is responsible for this process, it is the population of Lambertville which produces much of the solid waste. Thus, while the electricity and fuel amounts represent those resulting from government operations and facilities alone, the solid waste amounts are a product of about 4,000 people. If this inventory were covering the entire Lambertville Community, emissions from solid waste removal would represent a smaller percentage of the overall emissions.

The greatest way to take action with this report is by following up and expanding on the Third Can solid waste removal program which could remove up to 453.5 tons of solid waste

from the trash stream, reducing the overall emissions by up to 29%. Other action items are suggested for further emission reductions in other sectors as well in Part II.

PART I: The City of Lambertville's Greenhouse Gas Emissions of Local Government Operations in 2014

General Methodology

This report outlines the greenhouse gas inventory of the City of Lambertville's administrative/governmental activities including the fuel and electricity consumption of the Police Station at 349 N. Main St., City Hall at 18 York St., the Justice Center at 25 S. Main St., the Quarry St. Garage, and the wastewater treatment facilities. In addition, the emissions from the public works and police vehicles as well as those resulting from street and other outdoor lighting are considered. Lastly, the greenhouse gases emitted as a result of the wastewater treatment and solid waste processes are included in calculations. These areas were chosen as they fall under the city's operational control, and are required by the Local Government Operations Protocol (LGOP) so as to ensure comparability and comprehensiveness between inventories.¹ The base year for much of the calculations in this report is 2014 unless otherwise noted.

There are three greenhouse gases which this report considers- carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Comparing these three gases by weight alone is terribly misleading. Although much more CO₂ is emitted per source, CH₄ and N₂O are far more potent in the atmosphere, meaning they have the ability to push the atmosphere's greenhouse effect more quickly than equal amounts of CO₂. Thus, where CH₄ and N₂O data is available, they are calculated into CO₂ equivalent (CO₂e) amounts which take into account their atmospheric potencies, or Global Warming Potentials (GWP), allowing emissions data to be easily compared. The CO₂e figures used in these calculations came from the Intergovernmental Panel on Climate Change (IPCC)'s Chapter 8- Anthropogenic and Natural Radiative Forcing (2013) and are as follows: each unit of CO₂ emitted has a Global Warming Potential (GWP) of 1, each unit of CH₄ emitted has a GWP of 28, and each unit of N₂O emitted has a GWP of 265.² Also in this report, pounds (lbs) of emissions are converted to metric tons (mt) of emissions by the conversion factor that 1 metric ton= 2205 pounds.

Further advice and guidelines used in the making of this report were taken from the EPA's Climate Action Framework program³ and the U.S Community Protocol by the ICLEI-Local Governments for Sustainability.⁴

Electricity Consumption

- a. Summary/Overview and conclusions

¹ <http://www.theclimaterestory.org/tools-resources/reporting-protocols/local-government-operations-protocol/>

² http://www.climatechange2013.org/images/report/WG1AR5_Chapter08_FINAL.pdf

³ <http://www.epa.gov/statelocalclimate/local/implementation/inventory.html>

⁴ <http://icleiusa.org/publications/us-community-protocol/>

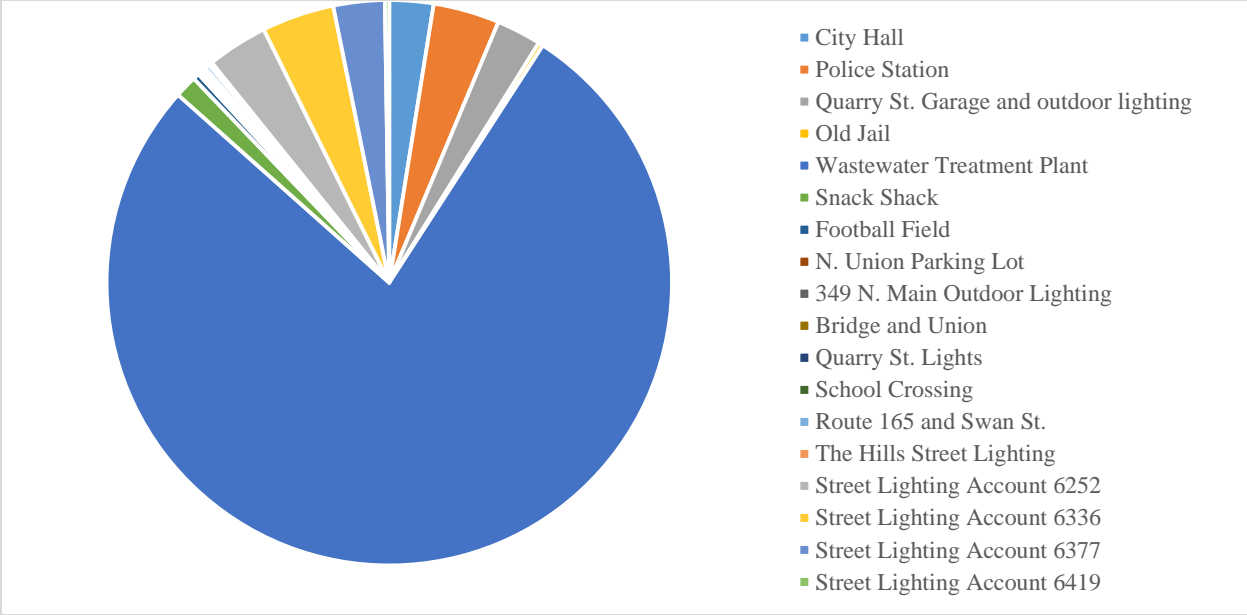


Figure 2. Break down of electricity emissions by facility so that entire circle represents 100% of electricity consumption by the facilities included in this inventory.

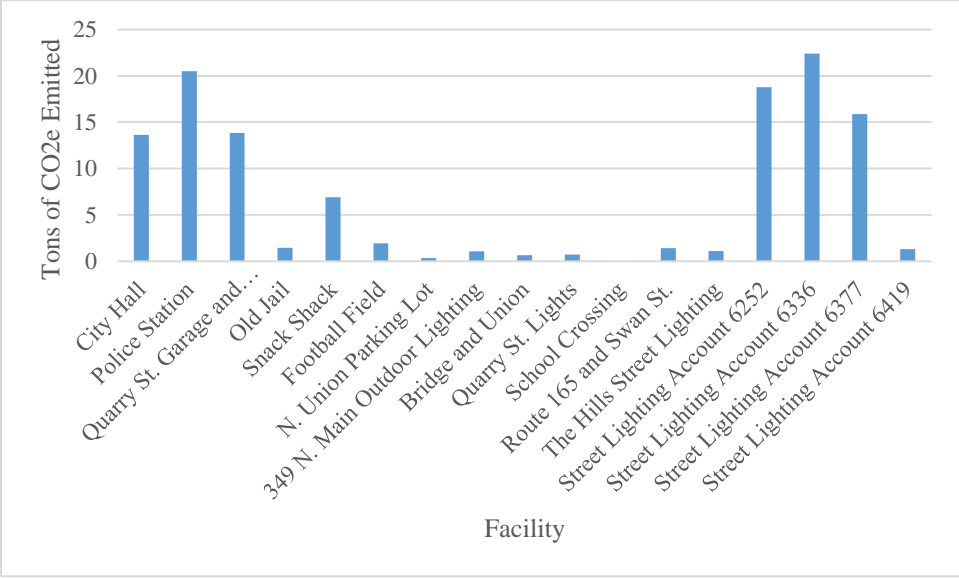


Figure 2. Greenhouse gas emissions by facility excluding the wastewater treatment plant so to better compare other areas of Lambertville’s electricity consumption.

b. Methodologies

The calculations to translate kWh of electricity used to greenhouse gases emitted come from the EPA’s eGrid program calculations for New Jersey and are as follows: 1.00172 pounds of CO₂ are emitted per 1 kWh of electricity, 0.00002707 pounds of CH₄ are emitted per 1 kWh of electricity, and .00001533 pounds of N₂O are emitted per 1 kWh of electricity. Taking into consideration the higher GWPs of both CH₄ and N₂O, the total lbs of CO₂e

emitted per 1 kWh of electricity is 1.007.⁵ The data of electricity consumption (total kWh) is from JCP&L billing. Additional data years are available for further comparison of electrical usage from year to year as well as information on daily averages.

c. Data

Total emissions as a result of electricity consumption in 2014	662.67mt CO2e
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Facility	Metric Tons of CO2e Emitted
City Hall	13.63
Police Station	20.49
Quarry St. Garage and outdoor lighting	13.86
Old Jail	1.47
Wastewater Treatment Plant	418.57
Snack Shack	6.90

Table 2. Total metric tons of CO2e emitted as a result of electricity consumption by facility for base year of 2014.

Outdoor/Street Lighting	Metric Tons CO2e Emitted
Football Field	1.94
N. Union Parking Lot	0.35
349 N. Main Outdoor Lighting	1.07
Bridge and Union	0.65
Quarry St. Lights	0.75
School Crossing	0.05
Route 165 and Swan St.	1.42
The Hills Street Lighting	1.10
Street Lighting Account 6252	18.77
Street Lighting Account 6336	22.40
Street Lighting Account 6377	15.87
Street Lighting Account 6419	1.33

Table 3. Total metric tons of CO2e emitted as a result of electricity consumption by each JCP&L account for base year of 2014.

- d. For more information on single facilities' electricity consumption trends, please see **Appendix A.**

Heating

- a. Summary/Overview and conclusions

Total CO2e emissions from facility heating	108.5mt CO2e
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⁵ <http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html>

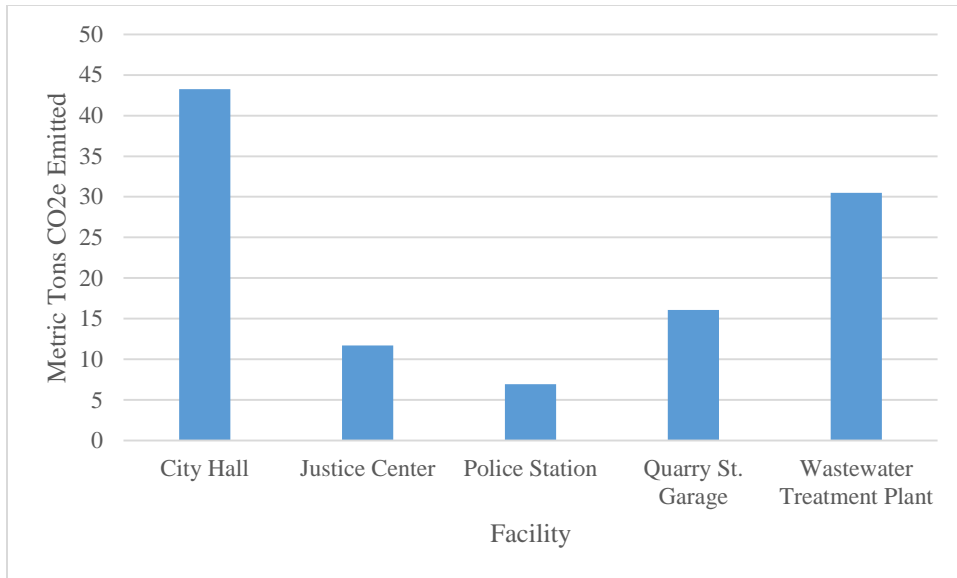


Figure 3. CO2e emissions resulting from heating facilities in 2014.

b. Methodologies

The emissions from natural gas heating in City Hall, the Police Station, and Justice Center and heating oil in the wastewater treatment plant and Quarry St. garage were calculated by taking the amount of energy billed by Elizabethtown Gas (in mBtu or “therms”) and Princeton Fuel Company (in gallons) and multiplying these by the appropriate CO2e emissions factor. The natural gas emissions calculated include only CO2 emissions (keeping in mind the property that 1 unit CO2= 1 unit CO2e) because over 99.9% of emissions from combustion are of CO2, with N2O and CH4 levels negligible according to an EPA publication on Natural Gas Combustion⁶. The units, however, are kept at CO2e in order to make the data comparable to the rest of the data in this inventory. According to the EPA, the emissions factor of CO2/ therm of natural gas burned is 11.7647 lbs of CO2/therm of natural gas. The emission factor for CO2e/gallon of heating oil burned is 22.4lbs of CO2/gallon of heating oil, according to the U.S. Energy Information Administration.⁷

c. Data

Facility	Fuel Type	Emissions (tons CO2e)
City Hall	Natural Gas	95,377.6
Justice Center	Natural Gas	25,808.2
Police Station	Natural Gas	15,306.23
Quarry St. Garage	Heating Oil	35,488.32
Wastewater Treatment Plant	Heating Oil	67,264.96

Table 4. Heating emissions by facility in 2014.

d. For more information

⁶ <http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf>

⁷ http://www.eia.gov/environment/emissions/co2_vol_mass.cfm

Transportation

- a. Summary/Overview and conclusions
- b. Methodologies

The quantities of transportation fuel consumed were taken from Princeton Fuel Oil billing from December 2013-Novembet 2014. The emissions factors for this session also came from EIA and are as follows- 22.04lbs CO₂ are emitted per gallon of diesel burned and 19.4lbs CO₂ are emitted per gallon of gasoline burned.⁸

- c. Data

December 2013-November 2014	Tons CO₂e Emissions
9,264.3 gallons of diesel consumed	93.27
12,370.7 gallons of gasoline consumed	108.84
TOTAL	202.11

Table 5. Emissions resulting from gasoline consumed through driving police cars and public works pickup trucks (gasoline) and solid waste transport trucks (diesel).

- d. For more information

Wastewater Treatment Process

- a. Summary/Overview and conclusions
- b. Methodologies

The Lambertville Municipal Utility Authority serves Lambertville, Stockton, and areas of Bucks County but this report aims to focus on Lambertville' wastewater treatment especially. The billed amount to each locality was added together for a total billed amount and then each locality's billed amount was divided by the overall billed figure to find the population makeup of the WTP customers. Using this method, Lambertville makes up 62% of the population served by the plant, Stockton makes up 4% of the population served by the plant, and Bucks County customers represent 34% of the population served by the plant. Thus, in calculating the emissions as a result of Lambertville's wastewater treatment, 62% of the overall emissions from the plant is included in this greenhouse gas emissions inventory.

Taking into account the wastewater treatment process utilized at this plant, emission factors were taken from the ICLEI Community Protocol for GHG Emissions Inventories. The emissions factors for the waste sent to the incinerator and GROWS landfill were calculated as mixed municipal solid waste. The default emission factor for MSW sent to incinerators is 90.7 kg CO₂/mmBtu. With the waste sent to the landfill, the factor for mixed MSW of 0.06 mtCH₄/ wet short ton waste was used and the equation took into account the fact that the GROWS landfill does collect landfill gasses (LFG).

The electricity usage by the plant is about three times the amount calculated above representing electricity consumed by the city government. This is a result of much of the wastewater treatment process's usage of electricity instead of fossil fuel processes. The

⁸ <http://www.eia.gov/tools/faqs/faq.cfm?id=307&t=10>

emissions resulting from energy consumed at the plant were calculated using the same methodology as described above.

The N₂O fugitive emissions are calculated regularly at the plant and fall well within acceptable amounts. For general N₂O calculations, the population served by the WTP (10,000 people) was found using the percentages outlined above and the known figure that the plant serves 6600 between their Stockton and Lambertville customers. Using the emission factor for WWTPs which use a nitrification/denitrification process, 7g N₂O/person/year, the resulting N₂O emissions from the wastewater treatment process itself is 27.7mt CO₂e/year.

c. Data

Source/Activity (2014 base year)	Data	Resulting Emissions (mtCO₂e)
Fugitive N ₂ O emissions	0.003638494 mt N ₂ O	1.13
Waste sent to Atlantic County Utility Authorities (incinerator)	27 cubic yards/week-load= 1,326,780 lbs/ 601.71 mt waste/year	361.74
Waste sent to GROWS landfill (grit)- EPA ID: PAD000429589	23.35 tons	6.62
N ₂ O emissions	0.07 mt N ₂ O	21.7
Total Emissions		823.87
Emissions Lambertville alone is responsible for	62% of emissions as it represents 62% total population served by plant	510.8

Table 6. Total emissions from the wastewater treatment process in 2014, not including those from heating and electricity for the facility to avoid double-counting of emissions.

d. For more information on our wastewater treatment plant visit www.lmua.org

Municipal Solid Waste Removal and Processes

a. Summary/Overview and conclusions

Although Lambertville’s Municipal Waste System offers a variety of ways to lessen the environmental blow of its waste, trash is still trash. Outside of private accounts which may arrange for their own waste removal (such as the wastewater treatment plant and some foodservice facilities), no landfills are used in the MSW system. Instead, Lambertville Public Works transports city garbage to the Warren County Incinerator aka Covanta Warren Energy Resource Center in Oxford, NJ which as a waste-to-energy plant, generates electricity through trash incineration which is then purchased by JCP&L. This program actually allows for GHG emissions credit for the emissions avoided by producing electricity in other ways, thus lessening the GHG effects of Lambertville’s trash.

Secondly, the amount of waste recycled or composted (1010.58 tons of recycling and 12.79 tons of compost in 2014) lessens the GHG emissions which would have occurred if these materials were disposed as garbage instead. Thus, only the transportation emissions need to be calculated for non-garbage solid waste removal, which are already accounted for through the diesel consumption totals used by Public Works. The quantity of recycled material in 2014 meant that almost 40% of what could have been disposed of in the incinerator wasn't, meaning almost 40% less emissions. This is great!

b. Methodologies

Due to a lack of data from Covanta Warren Energy Resource Center regarding the Waste-to-Energy plant that Lambertville uses, this inventory uses default EPA-calculated CO₂, CH₄, and N₂O factors as provided in the ICLEI Appendix E publication on ...

The values used for calculations were taken from the WARM Version 13 of the EPA publication on municipal solid waste emission calculations and are as follows: the combustion of each short ton of mixed municipal solid waste creates 0.36 metric tons of CO₂ and 0.04 metric tons of N₂O. The avoided utility GHG emissions avoided per short ton of mixed MSW combusted in the Mid-Atlantic region is 0.38 metric tons of CO₂e.⁹

c. Data

Source/Activity	Units	Resulting Emissions (mtCO ₂ e)
Total Municipal Solid Waste to WTE facility	1621.21 short tons= 1460.75mt	
Total Emissions from Combustion		17,703.62
Utility Emissions avoided through energy utilization of combustion of MSW	This is a credit towards the emissions from combustion	-616.06
Net emissions resulting from MSW combustion		17,087.56

Table 7. Total emissions from waste-to-energy combustion process of municipal solid waste in 2014, not including emissions from transportation of waste which is already accounted for in the transportation section above so as to avoid double counting.

d. For more information

⁹ <http://www.epa.gov/epawaste/consERVE/tools/warm/pdfs/Combustion.pdf>

PART II. Reducing the City of Lambertville’s Greenhouse Gas Emissions

Source	mt CO2e	Action	REDUCTIONS (mtCO2e)	ESTIMATED REDUCED EMISSIONS (mtCO2e)
Electricity	662.67	Switch to JCP&L Clean Power Choice Program	180.1	482.57
Heating	108.50	Convert garage and wastewater treatment plant to natural gas	12.63	95.87
Transportation	202.11	Gradually convert to renewable fuel/more efficient vehicals		
Waste Water Treatment Plant	510.80	Emissions credit from switching to WTE plant	156.29	354.51
Solid Waste Process	17,087.56	City-wide adoption of Third Can Program	5,304.95	11,782.61
TOTAL Lambertville Emissions	18,571.64			12,232.99 (34% reduction)

Table 8. Matrix on emissions reduction options.

Solid Waste Removal

As mentioned in the report, although solid waste removal and treatment is the largest producer of greenhouse gases considered in this inventory by far, one must keep in mind that this is concerning all of Lambertville’s waste which goes through the municipal solid waste system- not just those resulting from government activities. Furthermore, the single-stream recycling and waste-to-energy programs the city already participates in significantly reduce greenhouse gas emissions from what they otherwise would be. Thus, there is not too much the city of Lambertville can do to further reduce greenhouse gas emissions in this area. The main area Lambertville can improve on in terms of solid waste removal is expanding the third-can composting program.

As calculated by Lambertville’s environmental commission, if all residents participate in the third-can program up to 453.5 tons of food waste would be removed from the trash stream. A 453.5 tons reduction of garbage, or about 25% less total trash produced, could lead to 5,304.95 less metric tons of CO2e emitted as a result of the solid waste removal process and would reduce Lambertville’s overall emissions by 29%.

Electricity Consumption

KWh consumed	Added Price for switching to the Clean Power Choice Option 1= 98% NJ Wind, 2% NJ Solar (on 15% of	Added Price for switching to the Clean Power Choice Option 3= 99% PJM Wind, 1% NJ Solar
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	usage) Adds 0.825 cents per kWh	Adds 2.7 cents per kWh on all usage
277,193 (does not include wastewater treatment plant which is not part of city's billing)	\$2,286.84 (above JCP&L base-price)	\$7,484.21 (above JCP&L base-price)

There are two main ways that Lambertville can reduce its emissions resulting from electricity consumption. The first is to improve energy efficiency to avoid “phantom energy” and the like so that the electricity consumed is used effectively and efficiently. The recent energy audit contracted by the city is a great first step for this process and has already led to more efficient lighting in all facilities, a new HVAC in the Justice Center, and the new gas heater for City Hall. The next step is to look at each facility’s electrical usage by month for ways to more effectively consume electricity. For example, looking at the snack shack chart in Appendix A we can see that the facility consumes a significant amount of electricity during winter months even though it is not used for sports activities then. What can we do to cut down on this, and other examples, of phantom energy?

The second way the city can reduce its electricity emissions is by switching to a renewable electricity provider from TriEagle energy to the CleanPower Marketer ([Community Energy](#)) which works with JCP&L. This is pretty simple and considerably cheap considering the service and can be completed by simply filling out this [form](#). With options either 1 or 3, 100% of the city’s electricity consumed under the municipalities’ billing would be provided by renewable non-fossil fuel sources, making greenhouse gas emissions from electrical use absolute. Unfortunately, about 2/3 of the government’s electricity consumption comes from the wastewater treatment plant which is not accounted for in the city’s electricity bills. Thus, changing to the clean power choice with JCP&L would only affect 1/3 of energy consumption emissions and 1% of overall emissions unless the wastewater treatment plant were to change to the clean energy provider as well. However, if the wastewater treatment plan were to adopt a similar measure, the electricity emissions could be brought down to 0 mtCO2e and overall emissions would be reduced by 3%.

An alternative clean energy option that Lambertville City could look into is solar energy. This may prove especially cost effective for the wastewater treatment plant which could be looking at up an up to \$25,000 increase in its electric bill should it chose JCP&L’s clean energy program instead. The cost of installing a solar panel system for the plant should be further investigated. According to New Jersey’s Clean Energy Program, the average NJ 1kW capacity of solar provides 1,200 kWh/year to the facility. Thus, with a 573kw capacity system, the wastewater treatment plant’s total electricity emissions would be zero. The cost of solar power is best determined by a solar contractor, but keep in mind that as long as the system provides all of the plant’s electricity needs, the plant could no longer have electric bills. Also as part of New Jersey’s efforts to minimize the costs of solar installations, upon registration the wastewater treatment plant would earn solar renewable energy certificates (SRECs) which is could then trade and sell to offset system costs.

Heating Facilities

Even though heating fuels make up only 1% of Lambertville’s emissions, every ton of CO₂e makes a difference. Additionally, there is an easy way to reduce emissions which City Hall, the Police Station, and Justice Center have already undergone and that is switching from heating oil to natural gas. Natural gas is both more cost effective and emits less greenhouse gases than heating oil. If the Quarry Street Garage and the Wastewater Treatment Plant were to switch from heating oil to natural gas, 4.24 mtCO₂e less would be emitted due to heating the Quarry St Garage and 8.39 mtCO₂e less would be emitted from heating the Wastewater Treatment Plant. Although this seems like a miniscule change in the scheme of things, switching to natural gas is a more cost effective way to heat a facility, with emissions reductions as an added bonus.

Transportation

An immediate switch over to more “green” municipal fleets can be quite expensive and so this report does not suggest this in any way. However, Lambertville should consider a gradual switch to either hybrid or electric vehicles as current vehicles age out of the system. If the city already has to purchase a new vehicle, those vehicles most fuel efficient and green become less of a cost burden and when considering the amount saved on fuel in the long run, could in fact be more cost effective than a standard vehicle.

Wastewater Treatment Plant

The greatest emissions source for the wastewater treatment process is the emissions resulting from the solid waste incineration. One way to offset these emissions is to instead use the Covanta Warren Waste-to-Energy incinerator which Lambertville’s Public Works uses. With the conversion to energy of Public Work’s waste, Lambertville could reduce as much as 156.29 tons of greenhouse gas emissions just through the emissions offsets from the electricity produced through waste combustion.

Taking Action Timeline

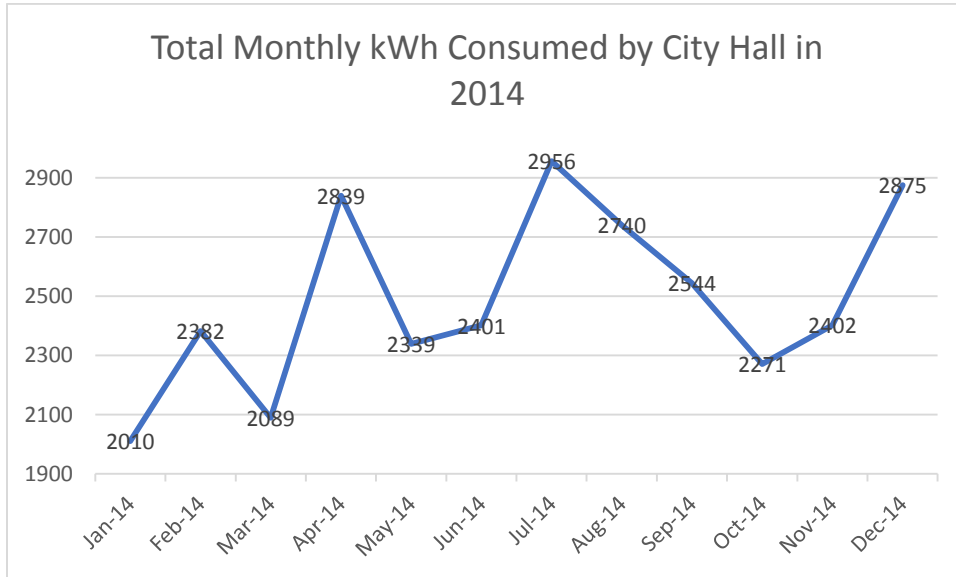
In the next year	Apply for a subsidized (cost-free) energy audit
	Expand Third Can Program
In the next few years	Address phantom energy
	Switch to a waste-to-energy program for the wastewater treatment plan
	Switch to all natural gas (or better) heating methods
	Improve/expand/investigate carbon-offset possibilities and achieving carbon neutrality through actions such as increased tree cover, greenspaces, and protected natural areas.
Gradually Change	“Greener”, more efficient vehicles
	More public, community-wide greenhouse gas emissions inventory and movement
	Follow up on greenhouse gas emissions of city government operations

Table 9. Suggested Timeline for Emission Reductions

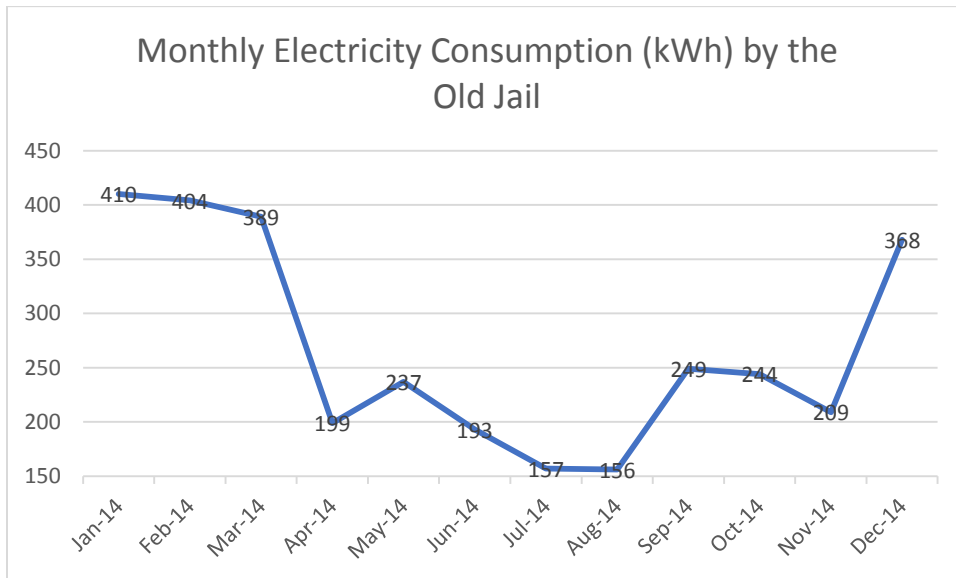
Appendix A- Monthly Charts of Electricity Consumption by facility/account

To monitor the electrical consumption by facility and make appropriate changes to increase energy efficiency.

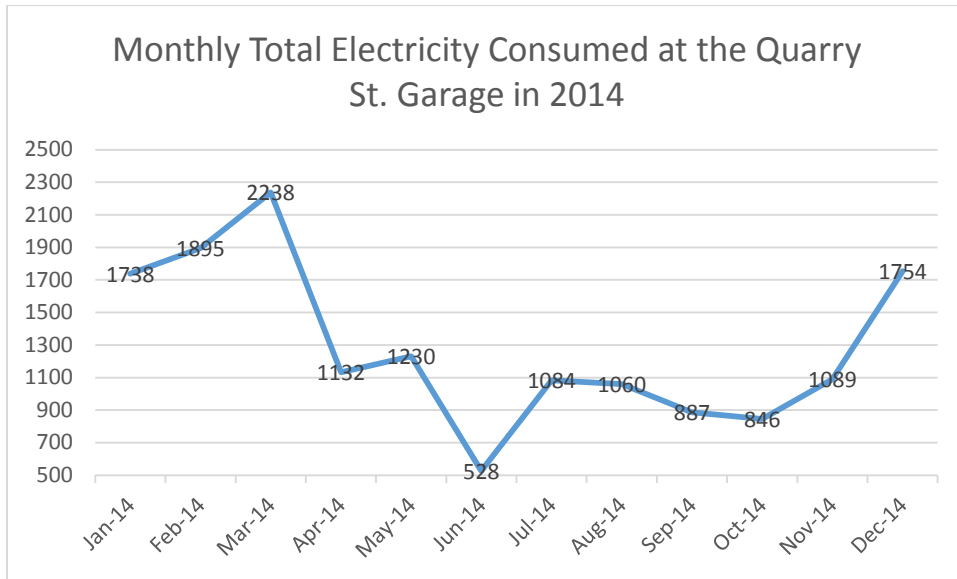
City Hall



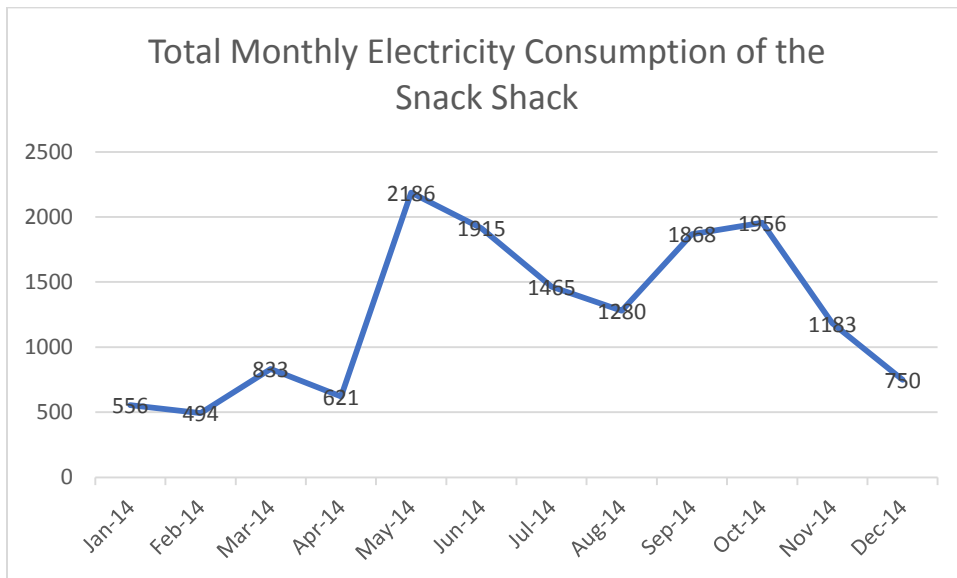
Old Jail



Quarry Street Garage



Snack Shack



Police Station

