City of Goshen

Inventory of Community Greenhouse Gas Emissions 2017

Photo Credit: Bronson Bast

Produced by City of Goshen Parks Department
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See: City of Goshen website for more information

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This GHG Inventory Report was developed using a template provided by ICLEI – Local Governments for Sustainability, USA. This template and its appendices were published in January 2019.

The City of Goshen has a history of cooperating with the environment to improve quality of life, from creating the Millrace for hydropower in the 19th Century, to adopting the moniker “The Maple City” in a tree-planting campaign during the 20th Century, to growing a robust park system in the 21st Century. Every day we learn more about how important the environment is to our health and prosperity. If we want future generations to enjoy a good quality of life, we know that we have to do all we can to protect and increase the value of our water, our air, our forests, our ecosystem, and our climate.

The following report is the result of Goshen’s first Greenhouse Gas Emissions Inventory, conducted during the summer of 2019. With skilled know-how from IU extern, Bronson Bast, and support from the IU Environmental Institute and the Indiana Sustainability Development Program, data about the amounts of energy we consume in Goshen—and the corresponding amounts of emissions—have been collected.

This information about our energy consumption will help all of us – individual households, businesses, schools, corporations, local government—to think about whether we are being responsible consumers. Furthermore, it will help us to see where we can become better stewards of our energy resources, where we can become more efficient, how we can save money, and what steps to take first. Maybe most importantly, this information will help us think about the cost of our waste, in terms of dollars, and in terms of greenhouse gases that are generated by our energy use, and which are causing our climate to change.

This first Greenhouse Gas Emissions Inventory is a snapshot in time: we know what we look like in this moment. From now on, we will be able to look back to this date and compare. Future residents of Goshen will be able to say, “Why didn’t they make better choices? Didn’t they know better?” or “They did a good job. They recognized what was needed and got to work.”

If we want to be uncommonly great, we will need to extend the common good far into the future. This report helps show us how.

Jeremy Stutsman
Mayor, City of Goshen

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Executive Summary

The City of Goshen recognizes that greenhouse gas (GHG) emissions from human activity are catalyzing profound climate change, the consequences of which pose substantial risks to the future health, wellbeing, and prosperity of our community. Furthermore, the City of Goshen has multiple opportunities to benefit by acting quickly to reduce community GHG emissions.

Economic benefits can also be realized by the residents and businesses in the City of Goshen through creating green jobs, improving health of residents, reducing energy costs, improving transportation systems, and continuing to make the City of Goshen an attractive place to live and do business.

The City of Goshen approved a resolution to work towards carbon neutrality in local government operations by 2035. The City of Goshen has begun the climate action planning process, starting with inventorying emissions. This report provides estimates of greenhouse gas emissions resulting from activities in the City of Goshen in 2017.

Key Findings

Community-Wide Emissions

There are a variety of emissions sources and activities included in the community-wide inventory totaling 560,059 Metric Tons of Carbon Dioxide Equivalent ($MTCO_2e$). Carbon Dioxide Equivalent includes all greenhouse gases, but reports their warming potential in terms of carbon dioxide, the most common greenhouse gas. Figure 1 illustrates the emissions sectors and activities. The largest contributor in this set is industrial electricity use contributing 25 percent of emissions. The next largest contributor is commercial electricity use contributing 19 percent of emissions. Actions to reduce emissions in both of these sectors will be a key part of a climate action plan. Transportation, solid waste disposal, and residential electricity and natural gas use were responsible for the remainder of the emissions.

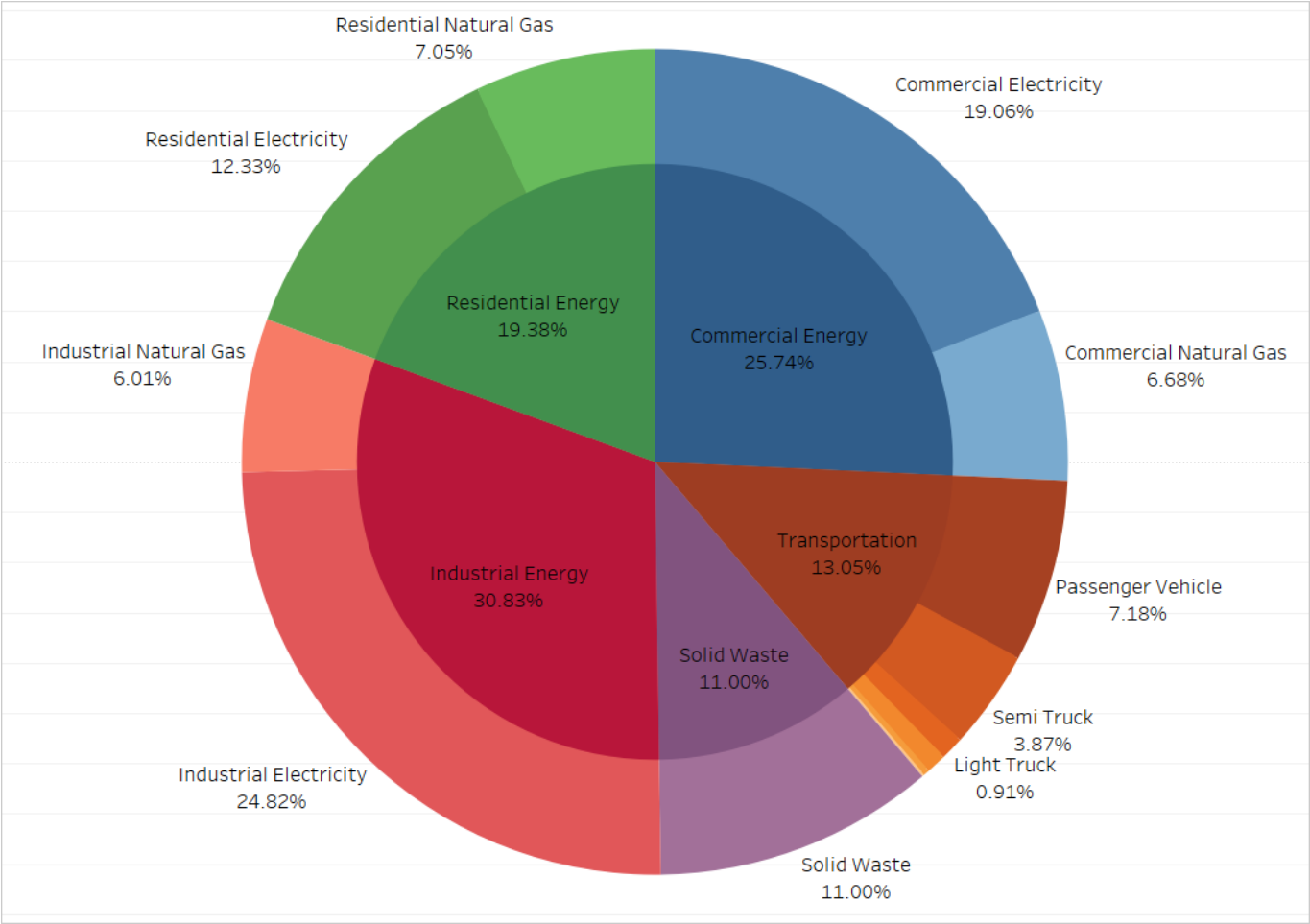


Figure 1: Goshen community greenhouse gas emissions in 2017 totaling 560,059 MTCO$_2$e. Graph excludes wastewater and fugitive emissions for clarity, full data available in Table 2.

Next Steps

The City of Goshen plans to move forward with climate action using this inventory as a baseline. The City will host the Climate Leadership Summit on September 12th, 2019 at Goshen College and will work towards the completion of a climate action plan to identify emissions reduction targets and strategies that will be completed by 2021.

Climate Change Background

Naturally occurring gases dispersed in the atmosphere determine the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect. Overwhelming evidence shows that human activities are increasing the concentration of greenhouse gases and changing the global climate. The most significant contributor is the burning of fossil fuels for transportation, electricity generation and other purposes, which introduces large amounts of carbon dioxide and other greenhouse gases into the atmosphere. Collectively, these gases intensify the natural greenhouse effect, causing global average surface and lower atmospheric temperatures to rise.

Weather records confirm that Indiana is becoming hotter and wetter. The intensity and frequency of flooding and heat waves has already increased in Elkhart County with impacts to our agricultural community, property, and public health. The Indiana Climate Change Impacts Assessment conducted by Purdue University concludes that Elkhart County could expect to see 30 days out of the year with temperatures hotter than 95 degrees Fahrenheit by midcentury compared with just one day historically.

Many communities in the United States have taken responsibility for addressing climate change at the local level. Reducing fossil fuel use in the community can have many benefits in addition to reducing greenhouse gas emissions. More efficient use of energy decreases utility and transportation costs for residents and businesses. Retrofitting homes and businesses to be more efficient creates local jobs. In addition, money not spent on energy is more likely to be spent at local businesses and add to the local economy. Reducing fossil fuel use improves air quality and increasing opportunities for walking and bicycling improves residents' health.

Evidence of Human-Caused Climate Change

The Intergovernmental Panel on Climate Change (IPCC)'s Fifth Assessment Report affirms that "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level."[1] Researchers have made progress in their understanding of how the Earth's climate is changing in space and time through improvements and extensions of numerous datasets and data analyses, broader geographical coverage, better understanding of uncertainties and a wider variety of measurements.[2]

[1] IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K Pachauri, and L.A. Meyer (eds.)]. Geneva, Switzerland, 151 pp

[2] IPCC, 2014: Summary for Policymakers. In: Climate Change 2014: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

These refinements expand upon the findings of previous IPCC Assessments – today, observational evidence from all continents and most oceans shows that "regional changes in temperature have had discernible impacts on physical and biological systems."

The Fifth Assessment asserts that "it is *extremely likely* that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in GHG concentrations and other anthropogenic forcings together. Globally, economic and population growth continued to be the most important drivers of increases in CO2 emissions from fossil fuel combustion. Changes in many extreme weather and climate events have been observed since about 1950. Some of these changes have been linked to human influences, including a decrease in cold temperature extremes, an increase in warm temperature extremes, an increase in extreme high sea levels and an increase in the number of heavy precipitation events in a number of regions". As shown in Figure 2, indicators such as global averaged sea level change and globally averaged combined land and ocean surface temperature anomaly have all increased since the beginning of the 20th century and are continuing to trend upward.

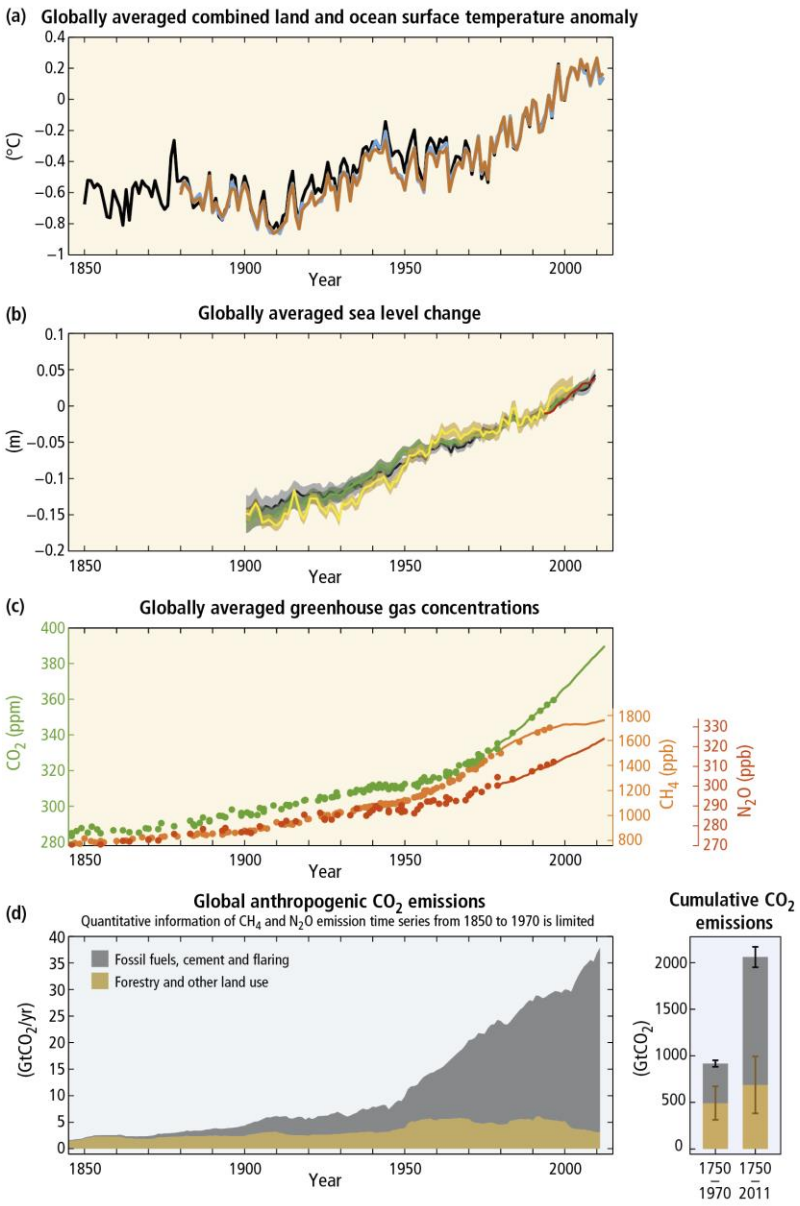


Figure 2: Observations and other indicators of a changing global climate system

In short, the Earth is already responding to climate change drivers introduced by mankind.

Climate Policy Context

Currently there is no expectation of state or federal action to combat climate change in the near term. Local governments in Indiana, however, are taking necessary steps to act on climate. Nine out of the ten largest cities in Indiana have completed a greenhouse gas inventory (Indianapolis, Fort Wayne, Evansville, South Bend, Carmel, Bloomington, Gary, Fishers, and Lafayette).

NIPSCO, Goshen's electricity provider, has also taken steps to decarbonize their electricity generation in alignment with the Paris Accords.

ICLEI Climate Mitigation Program

In response to the problem of climate change, many communities in the United States are taking responsibility for addressing emissions at the local level. Since many of the major sources of greenhouse gas emissions are directly or indirectly controlled through local policies, local governments have a strong role to play in reducing greenhouse gas emissions within their boundaries. Through proactive measures around land use patterns, transportation demand management, energy efficiency, green building, waste diversion, and more, local governments can dramatically reduce emissions in their communities. In addition, local governments are primarily responsible for the provision of emergency services and the mitigation of natural disaster impacts.

Figure 3: ICLEI Climate Mitigation Milestones

ICLEI provides a framework and methodology for local governments to identify and reduce greenhouse gas emissions, organized along Five Milestones, also shown in Figure 3:

1. Conduct an inventory and forecast of local greenhouse gas emissions;
2. Establish a greenhouse gas emissions reduction target;
3. Develop a climate action plan for achieving the emissions reduction target;
4. Implement the climate action plan; and,
5. Monitor and report on progress.

This report represents the completion of ICLEI's Climate Mitigation Milestone One for the community as a whole and provides a foundation for future work to reduce greenhouse gas emissions in Goshen.

Sustainability & Climate Change Mitigation Activities in Goshen

The City of Goshen has already implemented programs that have or will lead to ancillary benefits in the form of energy conservation and greenhouse gas mitigation.

- **Youth Environmental Resolution on Carbon Neutrality by 2035**
- **Solarize Goshen**
- **Reducing energy intensity of local government operations**
- **Recycling and waste reduction programs**
- **Construction of biking/pedestrian paths and corridors**
- **Redesign of Main Street to better accommodate biking and walking**
- **Tree Canopy Goal 45% by 2045**
- **Environmental and climate change education**

Inventory Methodology

Understanding a Greenhouse Gas Emissions Inventory

The first step toward achieving tangible greenhouse gas emission reductions requires identifying baseline emissions levels and sources and activities generating emissions in the community. This report presents emissions from the Goshen community as a whole; emissions from operations of the City of Goshen government are presented in the previously released *"City of Goshen Local Government Operations Emissions Inventory 2017"*. The government operations inventory is a subset of the community inventory; for example, data on commercial energy use by the community includes energy consumed by municipal buildings, and community vehicle-miles-traveled estimates include miles driven by municipal fleet vehicles.

As local governments have continued to join the climate protection movement, the need for a standardized approach to quantify GHG emissions has proven essential. This inventory uses the approach and methods provided by the Global Protocol for Community-Scale Emissions (GPC)[3].

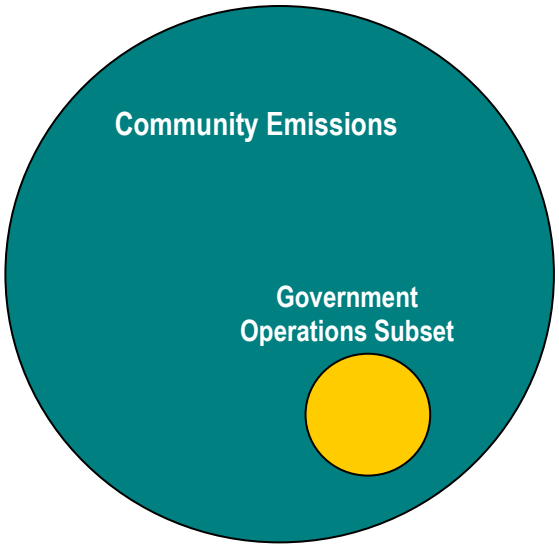


Figure 4: Relationship of community and government operations inventories

Community Emissions Protocol

The GPC is the official protocol specified by the Global Covenant of Mayors and defines what emissions must be reported and how. In addition, this inventory draws on methods from the U.S. Community Protocol[4], which provides more detailed methodology specific to U.S. communities. Inventory calculations were performed using the ClearPath[5] tool.

Quantifying Greenhouse Gas Emissions

Sources and Activities

Communities contribute to greenhouse gas emissions in many ways. Two central categorizations of emissions are used in the community inventory: 1) GHG emissions that are produced by "sources" located within the community boundary, and 2) GHG emissions produced as a consequence of community "activities".

[3] http://www.ghgprotocol.org/city-accounting
[4] http://icleiusa.org/publications/us-community-protocol/
[5] http://icleiusa.org/clearpath/

Source	Activity
Any physical process inside the jurisdictional boundary that releases GHG emissions into the atmosphere	The use of energy, materials, and/or services by members of the community that result in the creation of GHG emissions.

By reporting on both GHG emissions sources and activities, local governments can develop and promote a deeper understanding of GHG emissions associated with their communities. A purely source-based emissions inventory could be summed to estimate total emissions released within the community's jurisdictional boundary. In contrast, a purely activity-based emissions inventory could provide perspective on the efficiency of the community, even when the associated emissions occur outside the jurisdictional boundary.

Base Year

The inventory process requires the selection of a base year with which to compare current emissions. Goshen's community greenhouse gas emissions inventory utilizes 2017 as its base year. This year was selected because it has the most recent data available.

Quantification Methods

Greenhouse gas emissions can be quantified in two ways:

- Measurement-based methodologies refer to the direct measurement of greenhouse gas emissions (from a monitoring system) emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility.
- Calculation-based methodologies calculate emissions using activity data and emission factors. To calculate emissions accordingly, the basic equation below is used: *Activity Data x Emission Factor = Emissions*

All emissions sources in this inventory are quantified using calculation-based methodologies. Activity data refer to the relevant measurement of energy use or other greenhouse gas-generating processes such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles traveled. Please see appendices for a detailed listing of the activity data used in composing this inventory.

Known emission factors are used to convert energy usage or other activity data into associated quantities of emissions. Emissions factors are usually expressed in terms of emissions per unit of activity data (e.g. lbs CO_2/kWh of electricity).

Community Emissions Inventory Results

Community Profile

To put emissions inventory data in context, it is helpful to have some basic information about community such as population and number of households. This information is provided in Table 1.

Table 1: Goshen Community Indicators

Estimated 2017 Population	32,997
Estimated 2017 Households	13,309

Goshen Community Emissions

City of Goshen used guidance from the Global Protocol for Community Scale Greenhouse Gas Emissions Inventories (GPC) in selecting activities to measure for emissions. Considerations were also made concerning the quality of data available and the influence that the City of Goshen has over the emissions. This scope includes all of the five Basic Emissions Generating Activities required by the community protocol (Electricity, Natural Gas, Transportation, Solid Waste, and Wastewater) and fugitive emissions from natural gas. Table 2 and Figure 1 summarize emissions by source and activity.

Table 2: Goshen community greenhouse gas emissions by activity and source in 2017

Source or Activity	Activity Data Quantity and Unit	Emissions Factor	Emissions Factor Source	Emissions ($MTCO_2e$)	Percent of Total
Residential Use of Electricity	86,630,261 kWh	0.0008097 $MTCO_2e$/kWh	NIPSCO	70,141	12.52%
Commercial Use of Electricity	133,877,295 kWh	0.0008097 $MTCO_2e$ /kWh	NIPSCO	108,396	19.35%
Industrial Use of Electricity	174,302,381 kWh	0.0008097 $MTCO_2e$/kWh	NIPSCO	141,126	25.20%
Residential Stationary Combustion (Natural Gas)	753,721 MMBtu	0.05302 $MTCO_2e$/MMBtu	ClearPath	40,079	7.16%

Commercial Stationary Combustion (Natural Gas)	713,953 MMBtu	0.05302 $MTCO_2e$/MMBtu	ClearPath	37,964	6.78%
Industrial Stationary Combustion (Natural Gas)	644,209 MMBtu	0.05302 $MTCO_2e$/MMBtu	ClearPath	34,191	6.10%
On-road Passenger Vehicle Travel	172,527,244 vehicle miles – 572,040 MMBtu	0.07024 $MTCO_2e$/MMBtu	ClearPath Calculator	40,826	7.29%
On-road Light Truck Travel	15,923,574 vehicle miles – 72,644 MMBtu	0.07024 $MTCO_2e$/MMBtu	ClearPath Calculator	5,191	0.93%
On-road Freight Vehicle Travel	13,456,556 vehicle miles – 297,202 MMBtu	0.073934 $MTCO_2e$/MMBtu	ClearPath Calculator	21,994	3.93%
Rail Diesel Use	439,680 gallons	0.01021 $MTCO_2e$/gallon	EPA	4,489	0.80%
Public Transit Diesel Use	35,527 gallons	0.01021 $MTCO_2e$/gallon	EPA	362	0.06%
Aviation Gasoline Use	2,897 gallons	0.0383 $MTCO_2e$/gallon	EPA	111	0.02%
Aviation Kerosene Use	29147 gallons	0.0438 $MTCO_2e$ /gallon	EPA	1,278	0.23%
Nitrification/Denitrification Process Emissions from Wastewater	Estimate based on population served (32,997)	0.0026075 $MTCO_2e$ per capita	ClearPath Calculator	86	0.02%
Process Emissions from Effluent Discharge to Rivers	Estimate based on population served (32,997)	0.0068888 $MTCO_2e$ per capita	ClearPath Calculator	266	0.05%
Generation of Solid Waste	221,823 tons	0.282 $MTCO_2e$ /Ton of waste	ClearPath Calculator; Indiana Waste Assessment	62,555	11.17%
Fugitive Natural Gas Emissions	46.59 MT	23.35 $MTCO_2e$ /MT Natural Gas	NIPSCO	1,088	0.19%
Total Emissions				**560,059**	

The City of Goshen will focus on these emissions sources and activities in developing a climate action plan. The total emissions of 560,059 $MTCO_2e$ will be the baseline for setting an emissions reduction target and measuring future emissions reductions against.

Comparison to Baseline Year

A baseline inventory was also conducted for the year 2012. A comparison of these emissions by sector can be seen in Figure 5. Overall, there was a 2.6 percent increase in emissions from 546,509 $MTCO_2e$ to 560,059 $MTCO_2e$. Emissions due to electricity decreased in general due to a cleaner electricity supply while emissions due to solid waste and natural gas increased due to increased disposal and consumption respectively.

Contribution Analysis

A contribution analysis in Figure 6 was completed that normalized the conditions between 2012 and 2017 by controlling for population and weather. This analysis focused solely on electricity and natural gas use from residential and commercial sectors, on-road transportation from passenger vehicles, light trucks, and freight, as well as solid waste disposal. This analysis was completed using a tool provided by ICLEI that uses a regression analysis to estimate the amount of cooling and heating degree days from local weather records.

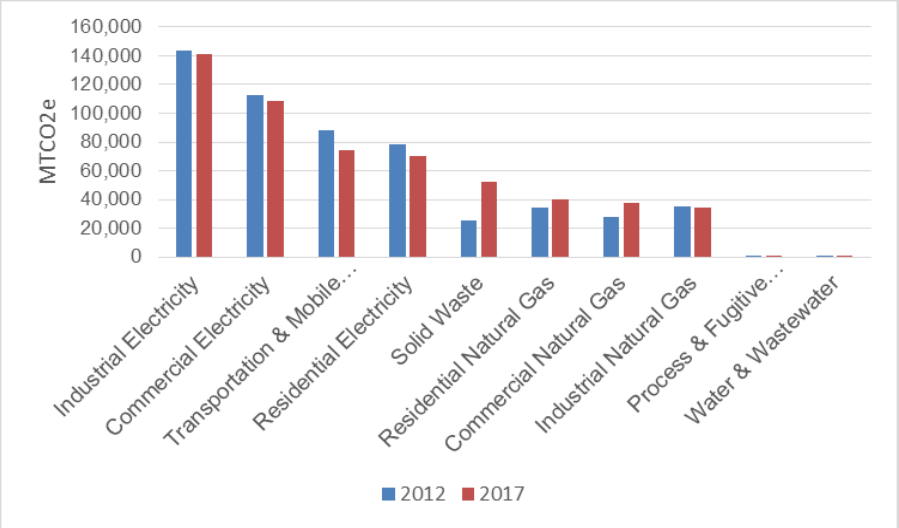
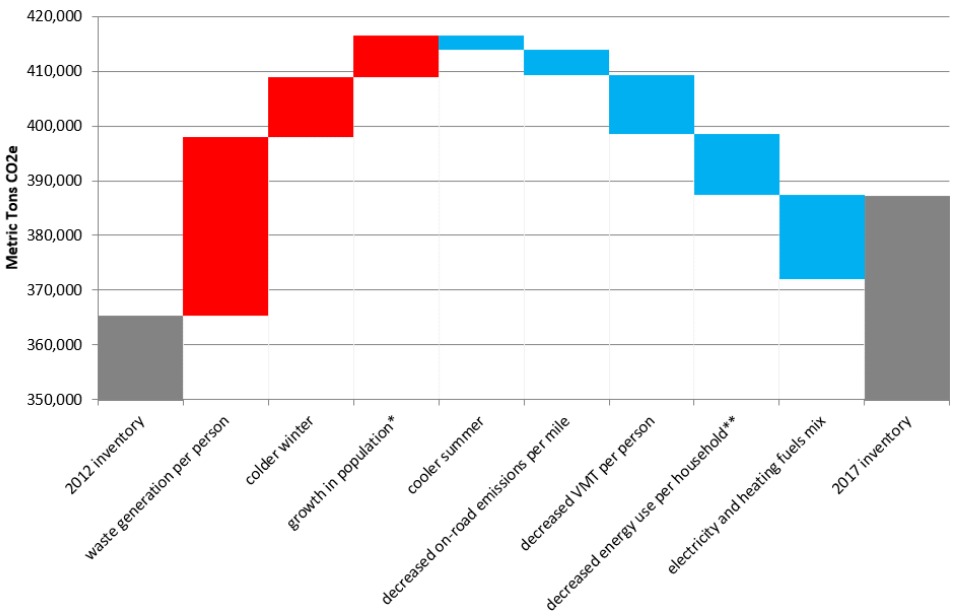


Figure 5: Comparison of emissions by activity between 2012 and 2017.



The analysis shows that emissions due to solid waste generation per person contributed the single largest increase to emissions between 2012 and 2017, followed by a colder winter, which explained the increase in natural gas use. A cleaner electricity supply and a decrease in energy use per household were responsible for the largest decreases.

Figure 6: Analysis of factors driving overall changes in emissions between 2012 and 2017.

Future Projections of Emissions

Future projections of emissions depend heavily on assumptions about energy use and population growth. There is a trend towards increased energy efficiency and lower energy intensity in both buildings and transportation nationally and this trend is also observed in Goshen. It is important, however, to consider the decarbonization of Goshen's electricity supply as it will likely be the single most important factor in the reduction of emissions as 1) purchased electricity contributes over 50 percent of Goshen's current emissions and 2) NIPSCO will reduce the carbon intensity of their electricity generation by 80 percent by 2029 by retiring coal plants and replacing generation with clean energy (Figure 7).

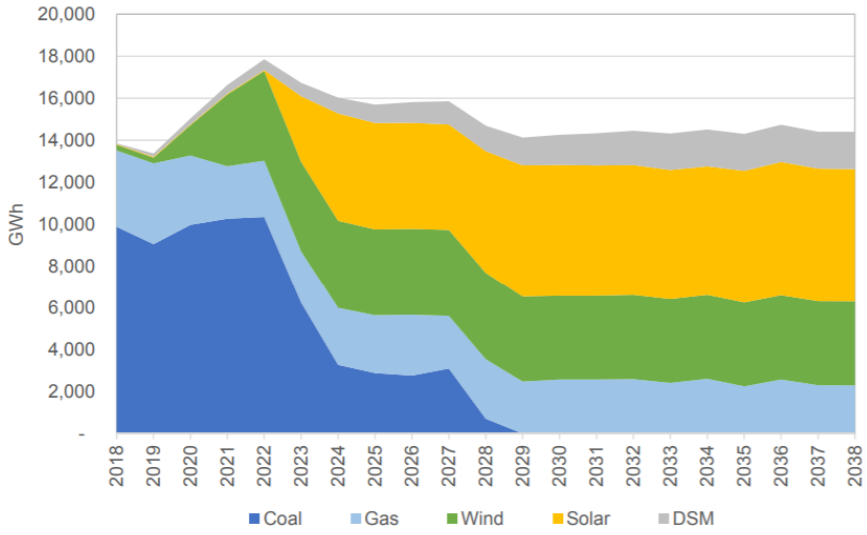


Figure 7: NIPSCO's preferred generation mix as denoted by their Integrated Resource Plan in 2018 showing a retirement of coal plants in 2023 and 2028 and an addition of wind and solar resources alongside demand side management (DSM).

Assuming all else remains constant, the decarbonization of NIPSCO's electricity supply will result in roughly equivalent emissions coming from the transportation, solid waste, residential energy, commercial energy, and industrial energy sectors with natural gas becoming more influential within the energy sectors than electricity use (Figure 8).

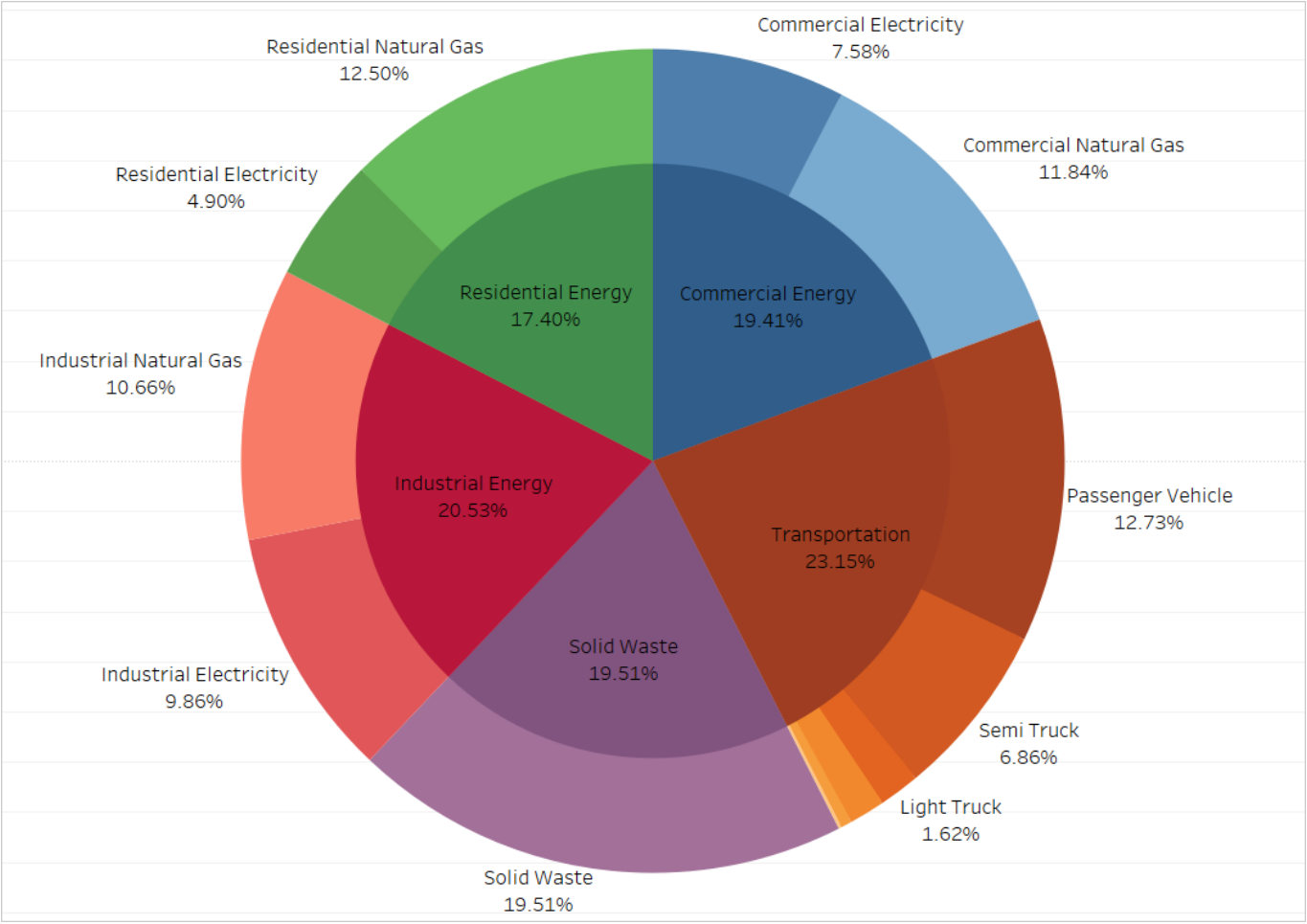


Figure 8: Projected Goshen community greenhouse gas emissions in 2029 totaling 310,665 $MTCO_2e$. Graph excludes wastewater and fugitive emissions for clarity.

Energy

Energy in the form of electricity and natural gas is the largest contributor to emissions in Goshen. Reducing energy use and the carbon intensity of energy use will be a critical step in reducing emissions in Goshen. NIPSCO plans to retire the last of their coal fired power plants in 2029 and to replace this capacity with renewables. This will decrease the carbon intensity of the City of Goshen's electricity supply 61 percent by 2024 and 76 percent by 2029 compared with 2017. Holding all else constant this will reduce the City of Goshen's emissions by 35 percent and 44 percent in 2024 and 2029 respectively.

Data Quality

The quality for the energy data used in this inventory is high as it is directly measured from NIPSCO utility bills. The City of Goshen can be confident that this is an accurate measurement of the total amount of emissions and, more importantly, monitoring for changes in energy use will be accurate.

Trends

In 2017 electricity use was down three percent in the residential sector and was up five and seven percent in the commercial and industrial sectors respectively compared with 2012. In 2017 natural gas use was up 16 percent and 36 percent in the residential and commercial sectors respectively and down three percent in the industrial sector. The increase in natural gas consumption (Table 4) can be attributed to a colder winter and increase in population as identified in the contribution analysis for the residential sector (Figure 6). Data was not available for the commercial building footprint in 2012 and 2017 so this could not be accounted for in the contribution analysis. The carbon intensity measured in pounds of CO2 equivalent per megawatt hour of the electricity supply went down eight percent from 2012 to 2017.

The change in the electricity mix was a major factor in reducing emissions between 2012 and 2017 and the decarbonization of NIPSCO's electricity grid (Figure 7) will continue to play a major role in the reduction of emissions for the City of Goshen. Table 3 demonstrates the profound impact this will have on the emissions from electricity consumption in Goshen.

Table 3: Emissions from electricity use marginally declined in all sectors between 2012 and 2017 despite a rise in consumption in the commercial and industrial sector while emissions are expected to decrease around 80 percent in all sectors by 2029.

Sector and Year	kWh	% Change from 2012	Lbs CO2e/MWh	$MTCO_2e$	% Change from 2012
Residential					
2012	88,979,858		1,940	78,300	
2017	86,630,261	-3%	1,785	70,141	-10%
2024	86,630,261	-3%	700	27,506	-65%
2029	86,630,261	-3%	400	15,718	-80%
Commercial					
2012	127,971,034		1,940	112,611	
2017	133,877,295	5%	1,785	108,396	-4%
2024	133,877,295	5%	700	42,508	-62%
2029	133,877,295	5%	400	24,290	-78%
Industrial					
2012	162,894,271		1,940	143,342	
2017	174,302,381	7%	1,785	141,126	-2%
2024	174,302,381	7%	700	55,344	-61%
2029	174,302,381	7%	400	31,625	-78%
Total					
2012	379,845,163		1,940	334,253	
2017	394,809,937	4%	1,785	319,663	-4%
2024	394,809,937	4%	700	125,358	-62%
2029	394,809,937	4%	400	71,633	-79%

Table 4: Natural gas use increased in the residential and commercial sectors between 2012 and 2017 by 16 percent and 36 percent respectively.

Sector and Year	Therms	% Change	$MTCO_2e$	% Change
Residential				
2012	6,503,230		34,581	
2017	7,537,206	16%	40,079	16%
Commercial				
2012	5,245,699		27,894	
2017	7,139,526	36%	37,964	36%
Industrial				
2012	6,670,719		35,405	
2017	6,442,088	-3%	34,191	-3%
Total				
2012	18,419,648		97,880	
2017	21,118,820	15%	112,234	15%

Transportation

Transportation, primarily in the form of personal vehicle traffic, is the second largest contributor to emissions in Goshen. Reducing emissions in this sector by encouraging multi-modal transportation in the form of transit, biking, and walking as well as facilitating the transition to electric vehicles will be an important step to reducing emissions in Goshen. Electric vehicles can take advantage of a rapidly decarbonizing electric grid. Electric vehicles also do not any tailpipe emissions and therefore can improve local air quality. With the return of control over Main Street to the City of Goshen there is also an opportunity to continue to revitalize downtown by prioritizing transit, biking, and walking.

Data Quality

The quality for the transportation data is relatively low. This is because the data is based on traffic and transportation modeling instead of being a direct measurement. This is the best estimate available and is not necessarily inaccurate, but changes that occur in Goshen will not necessarily be reflected in the model. The models run for 2012 and 2017 are also entirely different models. This was necessary due to data availability and model limitations from MACOG. Differences therefore between 2012 and 2017 could be from these differences in the models. More detailed analysis of transportation in the City of Goshen through corridor studies and transportation demand management planning would need to be done to monitor progress on reducing emissions from the transportation sector.

Trends

Rail, airport, and transit emissions are contributors, but are relatively smaller and show less change. The contribution analysis (Figure 6) shows the overall vehicle miles traveled per person in Goshen has declined. Vehicles also become more efficient between 2012 and 2017, which has helped reduce emissions. Nevertheless, vehicle miles traveled increased in all categories. Passenger vehicles, light trucks, and freight increased by 20 percent, 106 percent, and nine percent respectively according to the model (Table 5). Emissions were down 27 percent and 6 percent for passenger cars and freight respectively and up 86 percent for light trucks. The light truck vehicle class is defined as SUVs, vans, and pick-ups trucks.

Table 5: Models show increases in total vehicle miles traveled but a decrease in emissions due to increase in vehicle efficiency between 2012 and 2017

Vehicle Type and Year	Vehicle Miles Traveled	% Change from 2012	$MTCO_2e$	% Change from 2012
Passenger Car				
2012	172,527,244		55,797	
2017	206,570,772	20%	40,836	-27%
Light Truck				
2012	7,744,573		2,785	
2017	15,923,574	106%	5,193	86%
Freight				
2012	13,156,556		23,390	
2017	14,310,219	9%	21,995	-6%
Total				
2012	193,428,373		81,972	
2017	236,804,565	22%	68,024	-17%

Solid Waste

Solid waste disposed in the Elkhart County Landfill is a relatively smaller portion of Goshen's emissions, but is nevertheless important factor as it is the single largest contributing factor in the increase in emissions from 2012 to 2017. More investigation into this data is necessary to determine the causes for this increase.

Data Quality

The quality for the solid waste data is relatively unknown. It was directly report from the Elkhart County Solid Waste district, but details on their data management and accounting was not provided and the level of detail on the information was simply the number of tons produced by the City of Goshen boundaries in the inventory years.

Trends

Based on the data provided, solid waste generation per person in Goshen rose around 100 percent between 2012 and 2017. This should be investigated and, if possible, more detailed data should be collected on the sources of municipal solid waste from both a sectoral approach looking at residential, commercial, and industrial sources, as well as an effort to characterize the waste stream through a waste characterization study.

Conclusion

This analysis found that the Goshen community as a whole was responsible for emitting 560,059 $MTCO_2e$ in the base year 2017, with emissions from the industrial energy use contributing the most to this total.

Stationary energy use in facilities is the largest contributor to emissions. This will be an important activity to focus efforts on in developing a climate action plan. Transportation and Solid Waste also account for a large part of community emissions and will also be important to address.

As Goshen moves forward with considering emission reduction strategies and works to create a local climate action plan, the City should identify and quantify the emission reduction benefits of climate and sustainability strategies that could be implemented in the future, including energy efficiency, renewable energy, vehicle fuel efficiency, alternative transportation, vehicle trip reduction, land use and transit planning, waste reduction and other strategies. Through these efforts and others, the City of Goshen can achieve additional benefits beyond reducing emissions, including saving money and improving Goshen's economic vitality and its quality of life. City of Goshen staff will continue to update this inventory as additional data become available.

Appendix

Energy

Residential, Commercial, and Industrial Natural Gas Consumption

Activity Data
Activity data was provided directly from NIPSCO. This was in the form of the total number of therms purchased within the boundary of the City of Goshen for the inventory year.
Emissions Factor
Emissions factors for the combustion of natural gas are standardized and included in preloaded factor sets in ClearPath.
Contact
NIPSCO – Stephen Holcomb
Other Notes

Residential, Commercial, and Industrial Electricity Consumption

Activity Data
Activity data was provided directly from utility bills from NIPSCO. This was in the form of the total number of kWh's purchased within the City of Goshen boundaries in the inventory year in spreadsheet form.
Emissions Factor
The emissions factor for electricity varies based on generation sources and was provided by NIPSCO via email.
Contact
NIPSCO – Stephen Holcomb
Other Notes

Transportation

In-Boundary Passenger Vehicle, In-Boundary Light Truck, In-Boundary Freight - Vehicle Miles Traveled

Activity Data
Activity data was provided by MACOG (Michiana Area Council of Governments) in the form of models estimating/predicting vehicle miles traveled (VMT) in the years 2010, 2015, and 2020. A simple interpolation method was used to estimate VMT in 2012 and 2017, the inventory years.
Emissions Factor
The emissions factor was calculated inside of ClearPath using a factor set that uses estimates of miles per gallon based on vehicle class and an emissions factor from the fuel type to estimate emissions.
Contact
MACOG- John Paul Hopman
Other Notes

Interurban Trolley Diesel Use – Red Line

Activity Data
Activity data was obtained from the Federal Transit Administration's National Transit Database in the form of annual fuel use. This was then scaled to in-boundary fuel use with the assistance of input from MACOG that provided the percentage of fuel consumed by the Red Line – the only line that crosses through Goshen – and the portion of the Red Line that is within Goshen.
Emissions Factor
An emissions factor for diesel fuel was used from the Environmental Protection Agency.
Contact
MACOG- Jeremiah Cox
Other Notes

Norfolk Southern Diesel Fuel

Activity Data
Activity data was obtained from Norfolk Southern Sustainability Reports and scaled to the City of Goshen using the percentage of Norfolk Southern's rail that is within the City of Goshen's boundaries. This was done using the measurement tool on Google Earth.
Emissions Factor
An emissions factor for diesel fuel was used from the Environmental Protection Agency.
Contact
N/A
Other Notes

Aviation Kerosene and Gasoline Emissions from Goshen Airport (GSH)

Activity Data
Activity data was obtained directly from the director of the Goshen Airport in the form of fuel records for aviation kerosene and gasoline. There is no control tower at GSH so there is no direct record of incoming or outgoing flights.
Emissions Factor
Emissions factors for aviation kerosene and gasoline fuel was used from the Environmental Protection Agency.
Contact
City of Goshen Airport- Randy Sharkey
Other Notes

Solid Waste

Elkhart County Landfill

Activity Data
Activity data was obtained directly from the director of the Elkhart County Landfill in the form of total tons of waste from within the City of Goshen's boundaries.
Emissions Factor
Emissions factor was calculated using a waste characterization study for the State of Indiana done by Purdue University in combination with the ClearPath calculator.
Contact
Elkhart County Landfill- John Bowers
Other Notes

Wastewater

Process N2O From Effluent Discharge to Rivers and Estuaries and Nitirification/Denitification Process N20 Emissions from Wastewater

Activity Data
Activity data is not available for these emissions as they are not directly measured. An estimate was used instead based on a population parameter.
Emissions Factor
Total emissions were calculated using a population parameter.
Contact
City of Goshen - Jim Kerezman
Other Notes
These emissions were estimated based on a population factor and were calculated inside of ClearPath based on national averages

Process and Fugitive Emissions

Fugitive Emissions from Natural Gas Distribution

Activity Data
Activity data was obtained using NIPSCO utility records for the total amount of therms consumed within the City of Goshen boundaries and leakage rates were provided by NIPSCO.
Emissions Factor
Emissions factors are direct from natural gas and were calculated within ClearPath.
Contact
NIPSCO- Stephen Holcomb
Other Notes