City of Goshen

Inventory of Local Government Operations
Greenhouse Gas Emissions 2017

Photo Credit: Bronson Bast

Produced by City of Goshen Parks Department
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With Assistance from ICLEI - Local Governments for Sustainability USA
See: City of Goshen website for more information

Credits and Acknowledgements

City of Goshen

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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.

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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 local government operations GHG emissions.

Financial benefits can also be realized by the City of Goshen through cost savings resulting from reducing energy use and improving data management to identify other cost saving potentials. These initiatives can also benefit residents of Goshen by supporting green jobs, improving health of residents, facilitating green infrastructure, 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

Local Government Operations Emissions

Emissions produced from City of Goshen local government operations totled 11,246 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 electricity use contributing 73 percent of emissions. The next largest contributor is natural gas use contributing nine percent of emissions. Actions to reduce emissions in facilities will be a critical

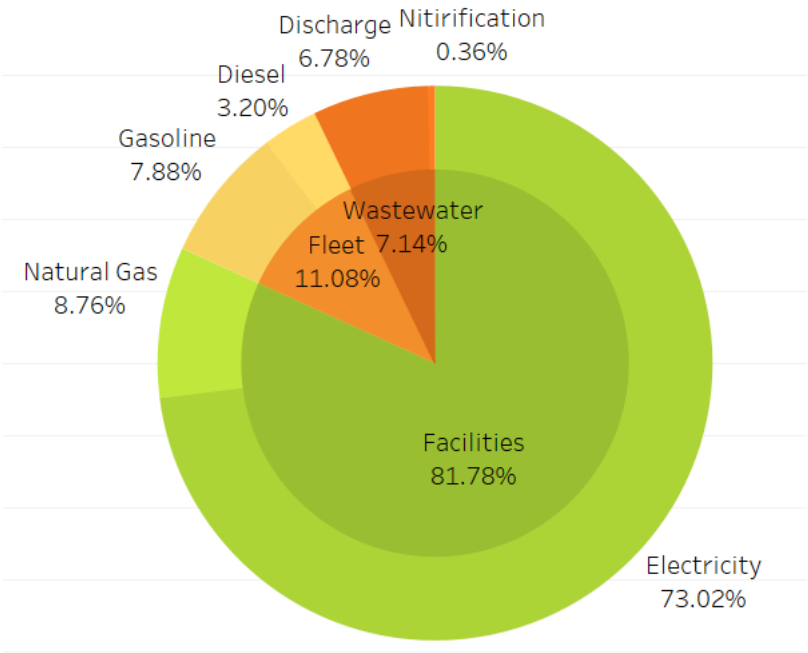

Figure 1: Goshen local government operations greenhouse gas emissions in 2017 totaling 11,246 $MTCO_2e$.

component of the climate action plan. Emissions from the vehicle fleet in the form of gasoline and diesel use and wastewater treatment comprised the remaining emissions. Solid waste information was not available but would be another component of the local government emissions.

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 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 local government operations and provides a foundation for future work to reduce greenhouse gas emissions in Goshen.

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 local government operations. This report presents emissions from the City of Goshen; emissions from operations of the Goshen community are presented in the concurrently released *"City of Goshen Community 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 Local Government Operations Protocol (LGO)[1].

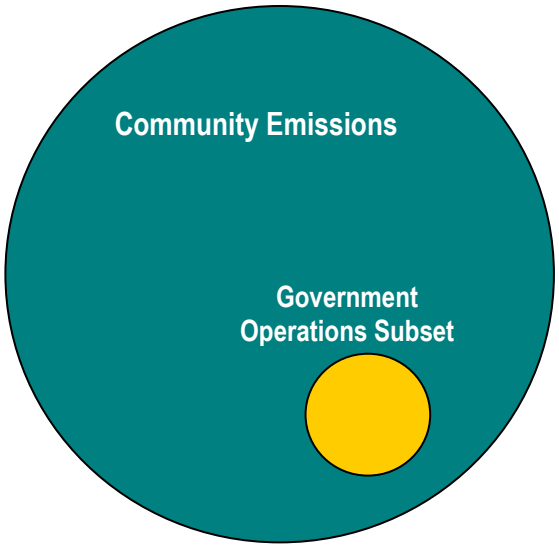

Figure 4: Relationship between community and government operations inventories

Local Government Emissions Protocol

The LGO was developed by the California Air Resources board in 2008 and has become the standard for local government emissions inventories. Inventory calculations were performed using the ClearPath[2] tool.

Quantifying Greenhouse Gas Emissions

Sources and Activities

Local Governments contribute to greenhouse gas emissions in many ways. Two central categorizations of emissions are used in local government operations inventory: 1) GHG emissions that are produced by "sources" directly in operational control of the local government, and 2) GHG emissions produced as a consequence of local government "activities".

[1] https://ww3.arb.ca.gov/cc/protocols/localgov/pubs/lgo_protocol_v1_1_2010-05-03.pdf
[2] https://clearpath.icleiusa.org

Source	Activity
Any physical process under operational control of the local government releases GHG emissions into the atmosphere	The use of energy, materials, and/or services by the local government 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 caused by local government operations. In contrast, a purely activity-based emissions inventory could provide perspective on the efficiency of the local government, even when the associated emissions occur outside the direct operational control of the local government.

Base Year

The inventory process requires the selection of a base year with which to compare current emissions. Goshen's local government 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).

Local Government Operations Emissions Inventory Results

City Goshen Government Operations Emissions

City of Goshen used guidance from the Local Government Operations Protocol (LGO) in selecting activities to measure for emissions that the City of Goshen has operational control over. Considerations were also made concerning the quality of data available. This scope includes four of the five Basic Emissions Generating Activities required by the community protocol (Electricity, Natural Gas, Transportation, and Wastewater). Table 2 and Figure 1 summarize emissions by source and activity. Solid waste data contributions from the local government was not able to be recorded due to a lack of data.

Table 2: Goshen Local Government Greenhouse Gas Emissions by Activity in 2017.

Source or Activity	Activity Data Quantity and Unit	Emissions Factor	Emissions Factor Source	Emissions (Metric Tons CO2e)	Cost of Input
Purchased Electricity	10,142,399 kWh	0.0008097 $MTCO_2e$/kWh	NIPSCO	8,212	$543,000
Combustion of Natural Gas	185,210 therms	0.05302 $MTCO_2e$ /MMBtu	ClearPath	985	$46,000
Fleet Gasoline Use	99,108 gallons	8.78 CO_2e/gallon	EPA	886	$198,000
Fleet Diesel Use	35,251 gallons	10.21 CO_2e/gallon	EPA	360	$79,000
Wastewater Effluent Discharge	Estimate based on population served (32,997)	0.0026075 $MTCO_2e$ per capita	ClearPath	763	N/A
Wastewater Nitrification/Denitrification	Estimate based on population served (32,997)	0.0068888 $MTCO_2e$ per capita	ClearPath	40	N/A
Total				**11,246**	**$866,000**

Future Projections of Emissions

Emissions from the City of Goshen are likely to be influenced in the future by increasing efficiency in vehicles and facilities as more efficient technologies become available, but could also see some increases due to an increase in building footprint.

The carbon intensity of the City of Goshen's electricity supply is the single most important factor in the overall local government operations emissions. This is because 1) purchased electricity contributes 73 percent of the City 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 8).

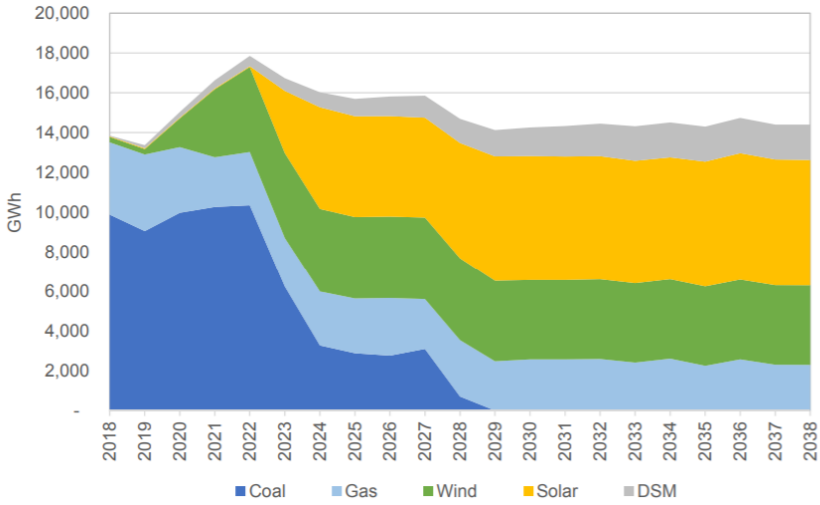

Figure 2: NIPSCO's preferred generation mix as denoted by their Integrated Resource Plan in 2018 showing a retirement of coal plants in 2023 and 2028 and an addition of wind and solar resources alongside demand side management (DSM).

After these coal plants have been retired electricity will still be the largest contribution of emissions for the local government, but will shrink to 38 percent of the total emissions with vehicle fuel becoming 26 percent, natural gas becoming 20 percent and wastewater becoming 17 percent (Figure 8).

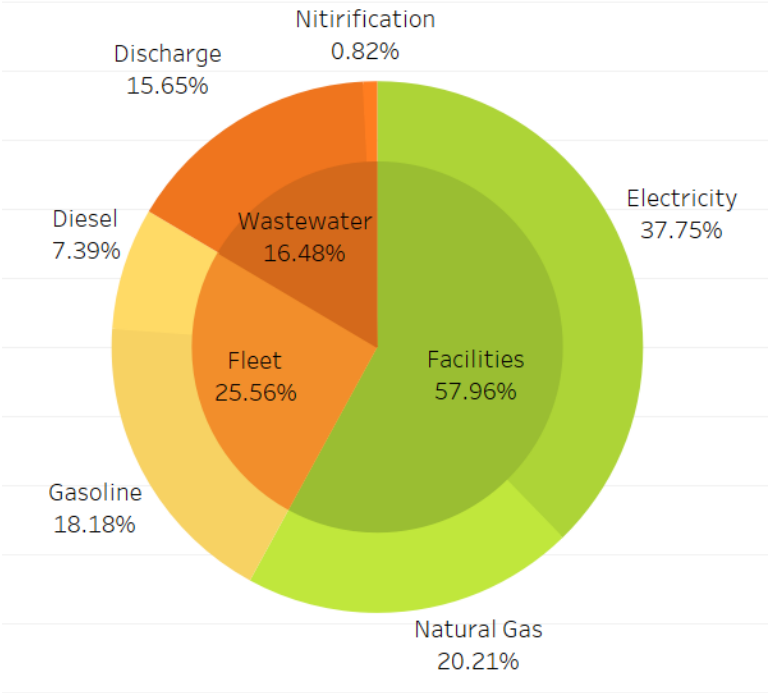

Figure 3: Projected Goshen community greenhouse gas emissions in 2029 totaling 4,874 $MTCO_2e$.

Facilities

Facilities contributed 82 percent of the City of Goshen's emissions in 2017. A large portion of this consumption is in the form of electricity for street lighting. Emissions from electricity will decrease by 80 percent due to NIPSCO's plans to retire coal fired power plants. Holding all other emissions constant the City of Goshen would see a decrease in their emissions from 11,246 $MTCO_2e$ to 6,354 $MTCO_2e$ in 2024 and 4,874 $MTCO_2e$ by 2029. Nevertheless, this sector will continue to dominate the total emissions from the local government operations in 2029 -- contributing 58 percent of total emissions. Natural gas usage will become comparatively much more significant, however, as it will move from contributing only eight percent to 20 percent of total emissions by 2029.

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. The usefulness of this data, however, could be improved by further breaking down which facilities and installations are consuming what amounts of energy. Benchmarking facilities and tracking energy use in street lights and water pumps will be an important next step to identifying opportunities for increasing energy efficiency in local government operations.

Fleet

Fuel use in City of Goshen vehicles contributed 11 percent of overall emissions in 2017. Proportionately this will increase to 26 percent by 2029 as emissions from facilities decrease

Table 2: Total City of Goshen fuel costs by department in 2017.

Department	Fuel Costs	Percentage
Police	$126,034	45.53%
Street	$60,081	21.71%
Fire	$36,835	13.31%
Water/Sewer	$14,003	5.06%
Sewer	$13,189	4.76%
Parks	$11,714	4.23%
Wastewater	$5,410	1.95%
Building	$2,453	0.89%
Engineering	$2,413	0.87%
Cemetery	$1,920	0.69%
City	$1,098	0.40%
Central Garage	$995	0.36%
Water	$623	0.23%
Planning	$27	0.01%
Grand Total	**$276,795**	

Data Quality

The quality for the fuel use data for the vehicle fleet is high as it is directly measured by the Central Garage through annual fuel costs and fuel prices. Monitoring for improvements in this sector should be accurate. As this data is broken down at the asset level, it is currently feasible to identify worst performers in the vehicle fleet for potential replacement. Further improvement of this data could be accomplished by requiring all assets to track mileage. Some assets in the fleet are tracked based on hours. This makes sense for some equipment, but it makes it impossible to compare against like assets.

Wastewater

The City of Goshen uses an aerobic digester to treat wastewater. As such the methane emissions are considered to be biogenic and are not counted towards the inventory. Guidelines in the protocol recommend simply using a population parameter to estimate the nitrogen dioxide (N_2O) emissions. N_2O is a potent greenhouse gas.

Data Quality

As this data is simply based off a population parameter the quality of the estimate is much lower when compared with the other data. It is also a much smaller proportion of the total emissions -- contributing only seven percent of total emissions in 2017.

Conclusion

This analysis found that the Goshen community as a whole was responsible for emitting 11,246 $MTCO_2e$ in the base year 2017. Emissions from the purchased electricity and natural gas contributed 73 and nine percent respectively. As facilities contribute by far the largest amount of emissions from the local government, it will be essential for the City of Goshen to implement better data management systems to identify worst preforming buildings and subsequently look for the most promising opportunities to use energy efficiency upgrades and changes in operations to decrease energy use in buildings. This strategy can also extend to the vehicle fleet to identify and upgrade the least efficient vehicles currently being used by the City.

The City of Goshen intends to use the information contained in this report to lead by example in reducing emissions by identifying the most effective emissions reduction and cost savings strategies through the creation of a climate action plan. This will include a rigorous stakeholder engagement process to include input from the community. This will lead to a more responsible government that more effectively uses taxpayer dollars while also holding itself accountable to global greenhouse gas reduction targets. City of Goshen staff will continue to update this inventory as additional data becomes available.

Appendix

Facilities

Electricity Use

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

Natural Gas Use

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

Fleet

Gasoline and Diesel Use

Activity Data
Activity data was provided by the Central Garage in the form of fuel card records, asset records, and fuel prices. Based on annual fuel costs per asset the total fuel consumption was calculated using fuel prices.
Emissions Factor
The emissions factor for gasoline and diesel was used from the EPA
https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf
Contact
Goshen Central Garage – Jackie Gibbs and Carl Gaines
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