
# City of New Castle, IN

## 2019 Inventory of Communitywide Greenhouse Gas Emissions

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**Produced by the New Castle Climate Action Team**
With Assistance from ICLEI - Local Governments for Sustainability USA

# Credits and Acknowledgements


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This report was prepared by Aaron Dicken, City Council Representative for Sustainability and Krystal Stanich, New Castle-Henry County Public Library from a template provided by ICLEI.

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# Executive Summary

The City of New Castle 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.

With little appetite for green energy, we know that discussions and progress will be slow. But they must be moving forward. We desire, as community partners, to engage in action that is sensitive to our surroundings, especially residential zones, while also working toward solutions to sustain our environment in our hometown for generations to come.

Simple steps that are already in motion include electric vehicle charging stations. Feasible and attainable goals we would like to focus on include solar power for our municipal utilities, electric buses for public transit, further development of our bike-pedestrian plan, a better recycling plan, and tree planting. These projects, while seemingly minor, will be positive first steps.

This report provides estimates of greenhouse gas emissions resulting from activities in the City of New Castle as a whole in 2019.

# Key Findings

Figure 1 shows communitywide emissions by sector. The largest contributor is Industrial Energy with 37.9% of emissions. The next largest contributors are Residential Energy (33.0%) and Commercial Energy (13.6%). Actions to reduce emissions in all of these sectors will be a key part of a climate action plan. Transportation & Mobile Sources and Solid Waste were responsible for the remaining (less than 15.5%) of emissions.

The Inventory Results section of this report provides a detailed profile of emissions sources within the City of New Castle; information that is key to guiding local reduction efforts. These data will also provide a baseline against which the city will be able to compare future performance and demonstrate progress in reducing emissions.

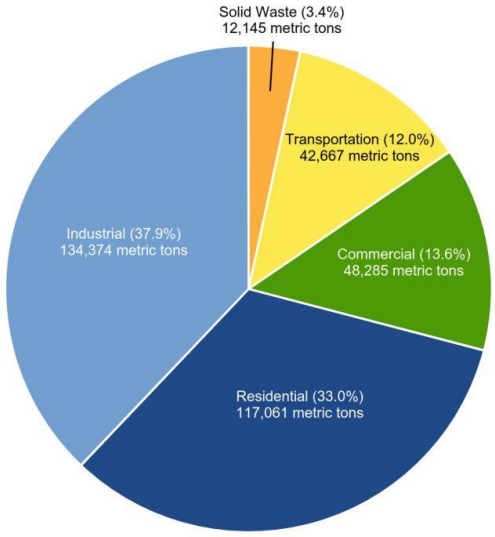



**Figure 1: Communitywide Emissions by Sector**

# Introduction to Climate Change

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. Global climate change influences seasonal patterns and intensifies weather events, threatening the safety, quality of life, and economic prosperity of communities everywhere[1]. Many regions are already experiencing the consequences of global climate change, and the City of New Castle is no exception.

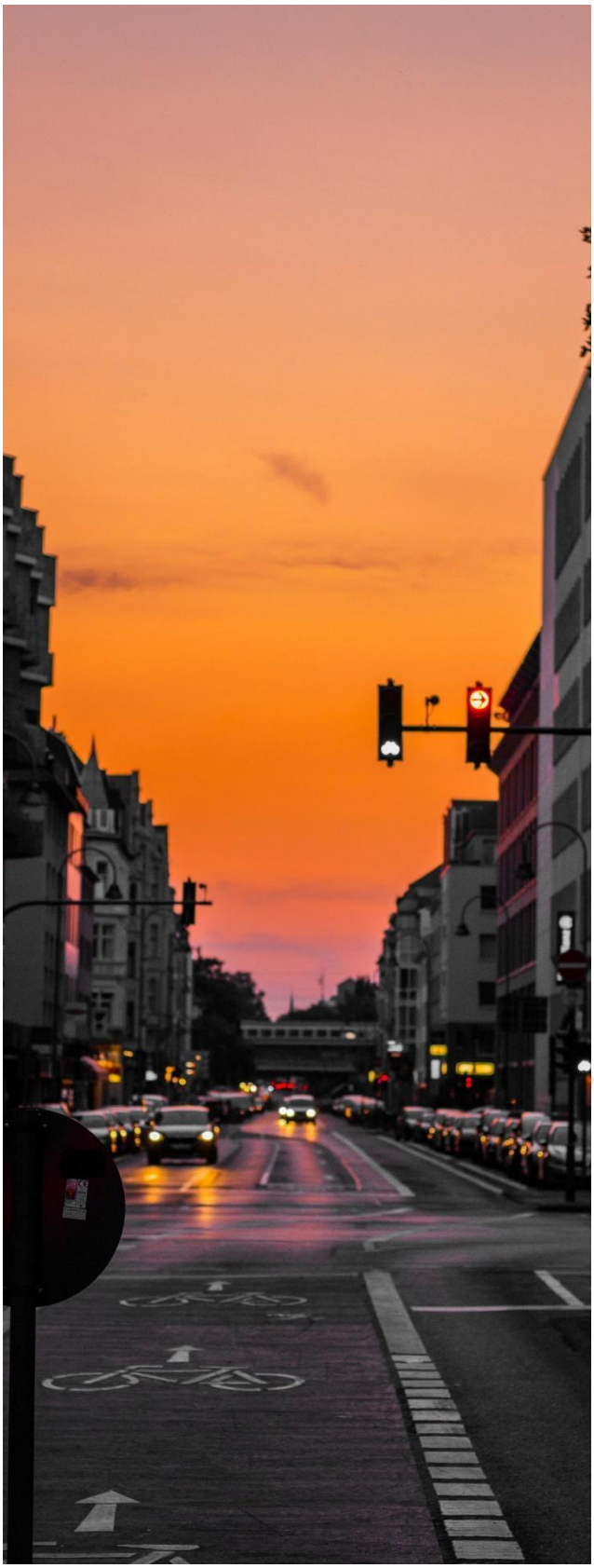
Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate. (high confidence) Warming from anthropogenic emissions from the pre-industrial period to the present will persist for centuries to millennia and will continue to cause further long-term changes in the climate system, such as sea level rise, with associated impacts (high confidence), but these emissions alone are unlikely to cause global warming of 1.5°C (medium confidence). Climate-related risks for natural and human systems are higher for global warming of 1.5°C than at present, but lower than at 2°C (high confidence). These risks depend on the magnitude and rate of warming, geographic location, levels of development and vulnerability, and on the choices and implementation of adaptation and mitigation options (high confidence).[2]

[1] International Panel on Climate Change. 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.)]. IPCC, Geneva, Switzerland, 151 pp. Retrieved from https://www.ipcc.ch/report/ar5/syr/

[2] IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.

According to the National Climate Assessment, the Midwest is probably best known for agricultural production. Trends toward warmer, wetter, and more humid conditions provide challenges for field work, increase disease and pest pressure, and reduce yields to an extent that these challenges can be only partially overcome by technology[3].

Many communities in the United States have started to take 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, when residents save on energy costs, they are more likely to be spend 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.



[3] U.S. Global Change Research Program. 2018. National Climate Assessment – Ch 21:Midwest. Retrieved from https://nca2018.globalchange.gov/chapter/21/

## Greenhouse Gas Inventory as a Step Toward Carbon Neutrality

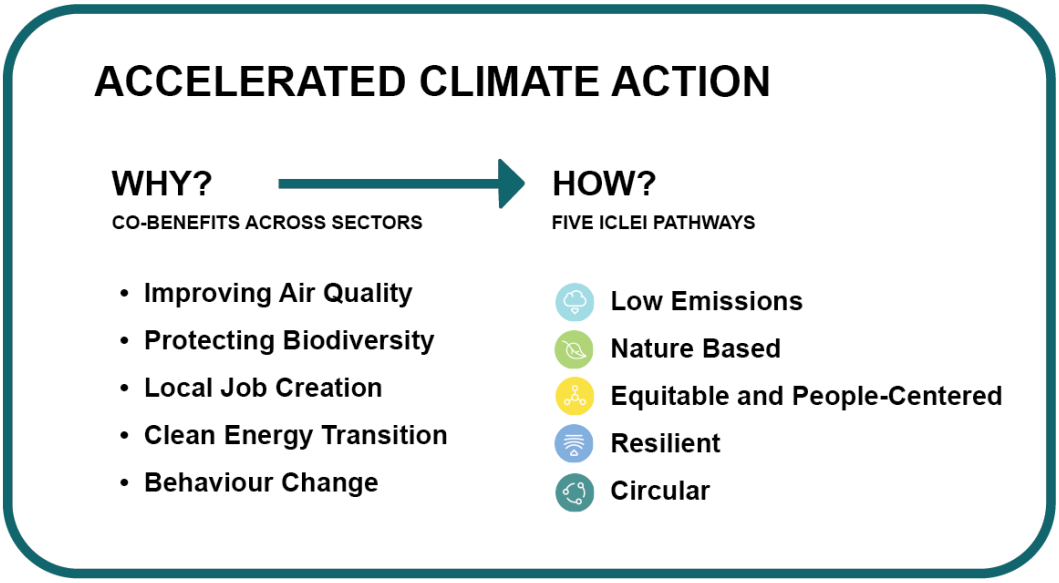
Facing the climate crisis requires the concerted efforts of local governments and their partners, those that are close to the communities directly dealing with the impacts of climate change.

Cities, towns and counties are well placed to define coherent and inclusive plans that address integrated climate action — climate change adaptation, resilience and mitigation. Existing targets and plans need to be reviewed to bring in the necessary level of ambition and outline how to achieve net-zero emissions by 2050 at the latest. Creating a roadmap for climate neutrality requires the City of New Castle to identify priority sectors for action, while considering climate justice, inclusiveness, local job creation and many other impacts that can also deliver on sustainable development.

To complete this inventory, the City of New Castle utilized tools and guidelines from ICLEI - Local Governments for Sustainability (ICLEI), which provides authoritative direction for greenhouse gas emissions accounting and defines climate neutrality as follows:

> The targeted reduction of greenhouse gas (GHG) emissions and GHG avoidance across the community in all sectors to an absolute net-zero emission level at the latest by 2050. In parallel to this, it is critical to adapt to climate change and enhance climate resilience across all sectors, in all systems and processes.

To achieve ambitious emissions reduction, and move toward climate neutrality, the City of New Castle will need to set a clear goal and act rapidly following a holistic and integrated approach. Climate action is an opportunity for our community to experience a wide range of co-benefits, such as creating socio-economic opportunities, reducing poverty and inequality, and improving the health of people and nature.



## ICLEI Climate Mitigation Milestones

In response to the climate emergency, 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, as well as influencing regional emissions through partnerships and advocacy. 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.

ICLEI provides a framework and methodology for local governments to identify and reduce greenhouse gas emissions, organized along Five Milestones, also shown in Figure 2:

1. Conduct an inventory and forecast of local greenhouse gas emissions;
2. Establish a greenhouse gas emissions Science Based Target[4];
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, and provides a foundation for future work to reduce greenhouse gas emissions in the City of New Castle.


**Figure ICLEI Climate Mitigation Milestones**

**Figure 2: ICLEI Climate Mitigation Milestones**

[4] Science-Based Targets are calculated climate goals, in line with the latest climate science, that represent your community's fair share of the ambition necessary to meet the Paris Agreement commitment of keeping warming below 1.5°C. To achieve this goal, the Intergovernmental Panel on Climate Change (IPCC) states that we must reduce global emissions by 50% by 2030 and achieve climate neutrality by 2050. Equitably reducing global emissions by 50% requires that high-emitting, wealthy nations reduce their emissions by more than 50%.

# 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 City of New Castle community as a whole. A government operations inventory is mostly a subset of the community inventory, as shown in Figure 3. For example, most often, 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.


Figure 3: Relationship of Communitywide and Government Operations Inventories

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 U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions (Community Protocol), which is described below.

Three greenhouse gases are included in this inventory: carbon dioxide ($CO_2$), methane ($CH_4$) and nitrous oxide ($N_2O$). Many of the charts in this report represent emissions in "carbon dioxide equivalent" ($CO_2e$) values, calculated using the Global Warming Potentials (GWP) for methane and nitrous oxide from the IPCC 5th Assessment Report:

**Table 1: Global Warming Potential Values (IPCC, 2014)**

| Greenhouse Gas | Global Warming Potential |
|---|---|
| Carbon Dioxide ($CO_2$) | 1 |
| Methane ($CH_4$) | 28 |
| Nitrous Oxide ($N_2O$) | 265 |

## Community Emissions Protocol

Version 1.2 of the U.S. Community Protocol for Accounting and Reporting GHG Emissions[5] was released by ICLEI in 2019, and represents a national standard in guidance to help U.S. local governments develop effective community GHG emissions inventories. It establishes reporting requirements for all community GHG emissions inventories, provides detailed accounting guidance for quantifying GHG emissions associated with a range of emission sources and community activities, and provides a number of optional reporting frameworks to help local governments customize their community GHG emissions inventory reports based on their local goals and capacities.

The community inventory in this report includes emissions from the five Basic Emissions Generating Activities required by the Community Protocol. These activities are:

- Use of electricity by the community
- Use of fuel in residential and commercial stationary combustion equipment
- On-road passenger and freight motor vehicle travel
- Use of energy in potable water and wastewater treatment and distribution
- Generation of solid waste by the community

The community inventory also includes the following activities:

- Wastewater processing

## 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".

| Source |
| --- |
| Any physical process inside the jurisdictional boundary that releases GHG emissions into the atmosphere |
| **Activity** |
| 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

[5] ICLEI. 2012. US Community Protocol for Accounting and Reporting Greenhouse Gas Emissions. Retrieved from http://www.icleiusa.org/tools/ghg-protocol/community-protocol

inventory could provide perspective on the efficiency of the community, even when the associated emissions occur outside the jurisdictional boundary. The division of emissions into sources and activities replaces the scopes framework that is used in government operations inventories, but that does not have a clear definition for application to community inventories.

## Base Year

The inventory process requires the selection of a base year with which to compare current emissions. The City of New Castle's community greenhouse gas emissions inventory utilizes 2019 as its baseline year, because it is the most recent year for which the necessary data are 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*

Most 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). For this inventory, calculations were made using ICLEI's ClearPath tool.

# Community Emissions Inventory Results

The total communitywide emissions for the 2019 inventory are shown in Table 2 and Figure 4.

**Table 2: Communitywide Emissions Inventory**

| Sector | Fuel or source | [Baseline Year] Usage | Usage unit | 2019 Emissions ($MTCO_2e$) |
|---|---|---|---|---|
| Residential energy | Electricity (Duke Energy) | 2019 | metric tons | 82,403 |
| | Electricity (Henry County REMC) | 2019 | metric tons | 6,719 |
| | Natural Gas | 2019 | metric tons | 6,752 |
| | LPG Consumption | 2019 | metric tons | 21,187 |
| | | | **Residential energy total** | **117,061** |
| Commercial energy | Electricity (Duke Energy) | 2019 | metric tons | 28,088 |
| | Electricity (Henry County REMC) | 2019 | metric tons | 7,105 |
| | Natural gas | 2019 | metric tons | 13,092 |
| | | | **Commercial energy total** | **48,285** |
| Industrial energy | Electricity (Duke Energy) | 2019 | metric tons | 71,245 |
| | Natural gas | 2019 | metric tons | 63,129 |
| | | | **Industrial energy total** | **134,374** |
| On-road transportation | Gasoline (passenger vehicles) | 2019 | metric tons | 19,597 |
| | Diesel (passenger vehicles) | 2019 | metric tons | 1,560 |
| | Diesel (freight trucks) | 2019 | metric tons | 3,314 |
| Transit | Gasoline | 2019 | metric tons | 97 |
| Aviation | Jet A (Jet Kerosene) | 2019 | metric tons | 181 |
| | Aviation Gasoline | 2019 | metric tons | 66 |
| Off-Road | Diesel | 2019 | metric tons | 15,817 |
| | Gasoline | 2019 | metric tons | 1,956 |
| Rail | Data Unavailable | 2019 | N/A | Data Unavailable |
| | | | **Transportation total** | **42,588** |
| Solid Waste | Waste Generated | 2019 | metric tons | 12,145 |
| | | | **Solid waste total** | **12,145** |
| | | | **Total community-wide emissions** | **354,453** |

Figure 4 shows the distribution of communitywide emissions by sector. Industrial Energy is the largest contributor, followed by Residential Energy & Commercial Energy.

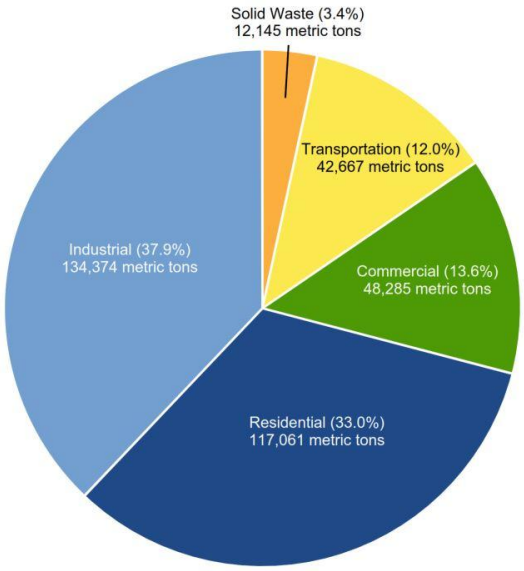



**Figure 4: Communitywide Emissions by Sector**

## Next Steps

The inventory results should be used to focus and prioritize actions to reduce emissions. Based on the inventory results, the following areas have the greatest potential for emissions reduction:

- Municipal Energy (within Commercial Energy)
- Solid Waste
- Transportation & Mobile Sources

Completion of another GHG inventory in two to five years is recommended in order to assess progress resulting from any actions implemented. The detailed methodology section of this report, as well as notes and attached data files in the ClearPath tool provided to the City of New Castle, will be helpful to complete a future inventory consistent with this one.

# Conclusion

This inventory marks the completion of Milestone One of the Five ICLEI Climate Mitigation Milestones. The next steps are to forecast emissions, set an emissions-reduction target, and build upon the existing [Name of Existing Plan or Sustainability Program in the Community] with a more robust climate action plan that identifies specific quantified strategies that can cumulatively meet that target.

The Intergovernmental Panel on Climate Change (IPCC) states that to meet the Paris Agreement commitment of keeping warming below 1.5°C we must reduce global emissions by 50% by 2030 and reach climate neutrality by 2050. Equitably reducing global emissions by 50%

requires that high-emitting, wealthy nations reduce their emissions by more than 50%. More than ever, it is imperative that countries, regions, and local governments set targets that are ambitious enough to slash carbon emissions between now and mid-century.

Science-Based Targets are calculated climate goals, in line with the latest climate science, that represent a community's fair share of the global ambition necessary to meet the Paris Agreement commitment. To achieve a science-based target, community education, involvement, and partnerships will be instrumental. "While we have set a target of 50% for 2030, we recognize that the science is telling us we need ambitious targets that incorporate a fair share consideration of our historic contributions to global GHGs. This understanding means we should identify strategies that get us well beyond 50% reduction by 2030, more likely a 60% reduction."

In addition, the City of New Castle will continue to track key energy use and emissions indicators on an on-going basis. It is recommended that communities update their inventories on a regular basis, especially as plans are implemented to ensure measurement and verification of impacts. Regular inventories also allow for "rolling averages" to provide insight into sustained changes and can help reduce the chance of an anomalous year being incorrectly interpreted. This inventory shows that residential energy, industrial energy, and commercial energy, as well as communitywide transportation patterns will be particularly important to focus on. Through these efforts and others, the City of New Castle can achieve environmental, economic, and social benefits beyond reducing emissions.

# Appendix: Methodology Details

## Energy

The following table shows each activity related to energy consumption, data source, and notes on data gaps.

**Table 3: Energy Data Sources**

| Activity | Data Source | Data Gaps/Assumptions |
|---|---|---|
| **Communitywide** | | |
| Residential, commercial, and industrial electricity consumption | Duke Energy & Henry County REMC | |
| Residential, commercial, and industrial natural gas consumption | U.S. Energy Information Administration | |

If you have multiple emissions factors to represent multiple utilities, add another row and change column Title from "Year" to "Emissions Factor." Then delete this Line.

**Table 4: Emissions Factors for Electricity Consumption**

| Emissions Factor | $CO_2$ (lbs./MWh) | $CH_4$ (lbs./GWh) | $N_2O$ (lbs./GWh) |
|---|---|---|---|
| RFC West eGrid | 1067.679 | 99 | 14 |
| Duke Energy | 1863 | 210 | 30 |
| Henry County REMC | 2049 | 99 | 14 |

## Transportation

**Table 5: Transportation Data Sources**

| Activity | Data Source | Data Gaps/Assumptions |
|---|---|---|
| **Communitywide** | | |
| Vehicle miles travelled | INDOT | Miles multiplied by 340 travel days |

For vehicle transportation, it is necessary to apply average miles per gallon and emissions factors for $CH_4$ and $N_2O$ to each vehicle type. The factors used are shown in Table 6.

**Table 6: MPG and Emissions Factors by Vehicle Type**

| Fuel | Vehicle type | MPG | $CH_4$ g/mile | $N_2O$ g/mile |
|---|---|---|---|---|
| Gasoline | Passenger car | 24.37713 | 0.0183 | 0.0083 |
| Gasoline | Light truck | 17.86788 | 0.0193 | 0.0148 |
| Gasoline | Heavy truck | 5.371652 | 0.0785 | 0.0633 |
| Gasoline | Motorcycle | 24.37713 | 0.0183 | 0.0083 |
| Diesel | Passenger car | 24.37713 | 0.0005 | 0.001 |
| Diesel | Light truck | 17.86788 | 0.001 | 0.0015 |
| Diesel | Heavy truck | 6.392468 | 0.0051 | 0.0048 |

## Wastewater

| Activity | Data Source | Data Gaps/Assumptions |
|---|---|---|
| **Communitywide Operations** | | |
| Energy used in wastewater facilities | Municipal Wastewater Treatment Plant | |

## Potable Water

| Activity | Data Source | Data Gaps/Assumptions |
|---|---|---|
| **Communitywide** | | |
| Energy Usage | Municipal Water Treatment Plant | |
| Gallons of Water Treated | | |

## Solid Waste

| Activity | Data Source | Data Gaps/Assumptions |
|---|---|---|
| **Communitywide** | | |
| Tons of Trash Generated | Hayes Landfill | |

## Inventory Calculations

The 2019 inventory was calculated following the US Community Protocol and ICLEI's ClearPath software. As discussed in Inventory Methodology, the IPCC 5th Assessment was used for global warming potential (GWP) values to convert methane and nitrous oxide to $CO_2$ equivalent units. ClearPath's inventory calculators allow for input of the sector activity (i.e. kWh or VMT) and emission factor to calculate the final $CO_2e$ emissions.