2018 GREENHOUSE GAS INVENTORY

SUSTAINABILITY ACTION PLAN GOAL 1.1.A

OCTOBER 2019

CITY OF BLOOMINGTON
ECONOMIC & SUSTAINABLE DEVELOPMENT DEPARTMENT

CITY OF BLOOMINGTON
ECONOMIC AND SUSTAINABLE DEVELOPMENT

LETTER FROM THE MAYOR

Climate change represents an existential threat, to our planet and our community. The Intergovernmental Panel on Climate Change stresses that the urgency of climate change requires a significant global response. A temperature increase of 1.5 degrees Celsius (2.7 degrees Fahrenheit) above pre-industrial levels will initiate and accelerate a series of cataclysmic effects including species loss, heat waves, rising sea levels, flooding, and increases in ocean acidity. We are already experiencing the impacts here in Bloomington.

Which is why it is so important for our community to accurately measure greenhouse gas emissions and to implement plans to minimize those emissions as quickly as possible. With this urgency in mind, the City of Bloomington completed its first Sustainability Action Plan, which was adopted by City Council in October 2018. The 5-year plan lists specific actions City government and the community can take to shift our trajectory toward greater sustainability, including limiting our greenhouse gas emissions.

One of the first actions recommended by the plan is to develop a greenhouse gas inventory in alignment with the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) standard. Now, Bloomington has applied this standard in developing our 2018 Greenhouse Gas Inventory and we can now accurately evaluate our progress in reducing emissions over time. We are collaborating with hundreds of other cities to build common information about contributions to climate change and with this inventory are able to compare among ourselves.

This challenge is momentous, and it will take our entire community to respond, together. This report helps create information necessary to inform that process. I look forward to continuing our community dialog to ensure we do our part to address the global climate emergency.

John Hamilton
October 15, 2019

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INTRODUCTION

What threat does climate change pose?

The impacts of climate change are already threatening ecosystems across the globe and here in Bloomington. These effects will become increasingly disruptive to natural systems and society over the coming years. Emissions of greenhouse gases from fossil fuel combustion, land-use change, deforestation, and agriculture are driving increases in global average temperatures with devastating effects on air quality, ecosystem health, local food systems, energy and public health. Climate change is undeniably an emergency.

The stakes are high, both globally and locally, and the effects of a changing climate are impacting Bloomington and the world today with increasing severity. A temperature increase of 1.5 degrees Celsius (2.7 degrees Fahrenheit) will initiate and accelerate a series of cataclysmic effects including species loss, heat waves, sea level rise, flooding, and increases in ocean acidity. In the state of Indiana, we are expected to have an increased number of hot days, more frequent rain events, increased flooding, and wetter winters as a result of climate change.

Climate change will disproportionately affect individuals who are already vulnerable and least able to respond to and adapt to climate hazards such as flooding and severe heat. The livelihood of vulnerable individuals will be further stressed by increasing housing and food insecurity from a changing climate.

The most recent report from the Intergovernmental Panel on Climate Change (IPCC) outlined the contributing factors to climate change and the options of how to respond to, effectively mitigate, and adapt to the impact of a changing climate.

Through strategic planning, mitigation, and adaptation, cities can play an important role in reducing communities' collective emissions. The 2018 IPCC Summary for Policymakers recommends mitigation and adaptation actions for cities, including communicating climate change impacts, as well as encouraging cross-sectoral coordination and incremental and transformative changes to land, energy, industry, buildings, and transportation systems.

More information about climate change and its impacts can be found in the climate section of this report, as well as:

- IPCC Special Report on Global Warming of 1.5°C
- NASA's Global Climate Change- Vital Signs of the Planet page
- Purdue University's Climate Impacts Assessment
- Indiana University's Environmental Resilience Institute reports and toolkits

What can cities do to respond to climate change?

Cities contribute the majority of greenhouse gas emissions (GHGs) and progress on global climate change will be impossible without improving sustainability and reducing emissions at the city scale. Reducing energy consumption, using alternative mobility options, improving the design of cities, and how buildings are heated and cooled are all essential to reducing emissions per capita and therefore, the total greenhouse gas emissions that cities produce.

Local governments help manage aspects of how materials and energy flow throughout a city- if materials, waste, water, and energy use in a community are managed well, a city becomes more sustainable and greenhouse gas emissions are reduced. As the level of government that is closest to the public, local governments also play an important role in initiating public engagement, advocacy, education, and strategic planning around sustainability.

The complex task of measuring and reporting greenhouse gas emissions is an important strategic planning action that local governments can undertake to establish a basis for future greenhouse gas emissions comparisons and to determine whether actions are having an impact on yearly emissions produced.

How is the City of Bloomington responding to climate change?

The City of Bloomington is addressing climate change and its impact through a concerted effort which includes strategic policy making, research, reporting, and ongoing emissions mitigation and climate adaptation activities across multiple sectors (see a full list on page 17).

Climate mitigation- ongoing sustainability initiatives

The 2018 Sustainability Action Plan is the guiding framework for Bloomington's sustainability efforts. The plan was developed over an eight month period by the community to set a guiding vision of how the City would address the Bloomington's most critical sustainability priorities for the next five years. In 2018, the City of Bloomington completed and published this plan, which was formally adopted by City Council on October 31, 2018. The 5-year Sustainability Action Plan (SAP) is the first formal sustainability planning effort for the City of Bloomington. The SAP is already strengthening existing sustainability efforts, helping identify and communicate goals that are both actionable and measurable, and establishing a mechanism for annual progress reports. The first progress update on implementation of the SAP was published February 2019 with an annual update to be released in January 2020.

Strategic planning- Sustainability Action Plan & Climate Change

The SAP is divided into eight areas of focus: climate change and adaptation, energy and the built environment, transportation, local food and agriculture, waste, water, ecosystem health and City operations. While greenhouse gas emissions can be tied to many of the areas of focus, the climate change and adaptation chapter addresses the need to accurately account for and reduce greenhouse gas emissions.

Having an inventory of Bloomington's emissions allows for credible, accurate reporting improving the City's understanding of activities in the community are contributing to what emissions, informing climate action planning, and allowing the City to monitor progress towards emissions mitigation consistently over time.

Beyond identifying an emissions reduction goal, the Climate Change and Adaptation chapter identified some actions that the City could take specifically tied to climate mitigation and adaptation. The City is working to engage with local businesses as part of an effort to reduce GHG emissions over the next four years through outreach, education, and advisory services.

Beginning in late 2019, the City of Bloomington will also be collaborating with the IU Environmental Resilience Institute and a consultant to complete a Climate Vulnerability Assessment and Action Plan that will provide a detailed review of the anticipated climate related risks to people, infrastructure, and natural resources in Bloomington and Monroe County through detailed modelling and strategy for community adaptation. Throughout the Sustainability Action Plan, there are actions in each section that will directly contribute to emissions reduction, while also improving the resiliency and sustainability of the community as a whole.

Emissions benchmarking

The City of Bloomington joined the Global Covenant of Mayors which Bloomington joined in 2019, which requires reporting community-wide greenhouse gas emissions. Additionally, the action of accurately measuring the community and local government's greenhouse gas emissions is part of the Sustainability Action Plan goal of further reducing greenhouse gas emissions by 11 percent.

Action 1.1.a. of the Sustainability Action Plan, "establish a consistent methodology for measuring and reporting community GHG emissions" is now complete with the publication of this report.

Action 1.1.a. is also in accordance with recommendations from other policies, notably Goal 3.1 from the Bloomington Comprehensive Plan to reduce community-wide fossil fuel consumption and recommendations from the STAR Communities (now LEED for Cities and Communities). For more information see Sustainability Action Plan: Chapter 1 Climate Change and Adaptation page 3, City of Bloomington Comprehensive Plan, page 48 and in STAR Community Rating System Version 2.0 (October 2016), page 16.

Integration of this action during the Sustainability Action Plan planning process was based on community feedback that it was important to establish a direct and consistent way to estimate the total amount of community greenhouse gas emissions, as well as use metrics to help the community see the accomplishments and direction that the City is taking with respect to sustainability and climate action. The City has also committed to communicate the impacts of climate change and to make it translatable to residents so that residents understand their impact and the importance of climate action.

The City will be educating, researching, reporting, mitigating emissions, and providing adaptation strategies in response to critical sustainability and climate needs. For instance, a full greenhouse gas inventory will be conducted using the Global Protocol (GPC) every two years, progress on ongoing sustainability and climate initiatives will be communicated to the community through progress reports and an upcoming sustainability dashboard. Also, a Climate Vulnerability Assessment will be conducted to evaluate climate hazards and emissions reduction goals will continue to be adjusted according to inventory results and progress towards the U.S. Climate Agreement nationally determined reduction targets.

Climate Policy

Developing a 2018 Greenhouse Gas Inventory was undertaken to measure our community's emissions contributions to global climate change. This is consistent with a history of sustainability initiatives in Bloomington dating back to the 1970s (see Appendix). The City of Bloomington under Mayor Kruzan first committed in 2006 to a reduction of greenhouse gas emissions by 7% from 1990 levels by 2012 in accordance with the Kyoto Protocol, as one of 1,060 signatories to the Mayors Climate Protection Agreement.

In the subsequent decade, the threat and necessity of addressing climate change and the role of cities became increasingly clear. 2015 marked a watershed moment in international climate change policy with the passage of the Paris Climate Agreement, a global agreement and framework for undertaking climate change mitigation, adaptation, and financing efforts with a regular reporting requirement to track implementation efforts and progress towards reduction.

In support of the goals of the Paris Agreement in 2017, Mayor Hamilton, on behalf of the Bloomington community, expressed the City's commitment to meeting the Paris Agreement's greenhouse gas reduction goals as a signatory to the Mayors National Climate Action Agenda.

This commitment through the Mayors National Climate Action Agenda requires Bloomington to reduce its greenhouse emissions by 26 to 28 percent below 2005 levels by 2025. The 11 percent community-wide emissions reduction goal of the Sustainability Action Plan was set utilizing the best data and modelling available at the time to project community emission reductions that had already occurred between 2005 and 2018.

This additional reduction of 11 percent by 2023 was an estimate of what was necessary locally to exceed and meet this required 26% emissions reduction goal of the Paris Agreement by 2025 and the City's commitment to the US Mayors National Climate Action Agenda. The 26% reduction goal set by the Paris Agreement was the nationally determined commitment of the U.S. to reduce emissions to keep the global temperature increase to below two degrees Celsius (3.6 degrees Fahrenheit), with a goal of limiting warming to 1.5 degrees Celsius (2.7 degrees Fahrenheit).

Though Bloomington started making emissions reductions commitments in 2006, a consistent, globally accepted method for cities to calculate and report greenhouse gases emissions at a community scale was not adopted by the Global Covenant of Mayors until 2014. In 2014, the World Resources Institute (WRI), C40 Cities Climate Leadership Group (C40) and ICLEI - Local Governments for Sustainability (ICLEI) launched the first widely endorsed standard for cities to measure and report their greenhouse gas (GHG) emissions, the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC). Before then, the methods and data sources that cities used to inventory their emissions made it impossible to aggregate data at the local, national and international scales.

The Global Protocol is the standard that the City of Bloomington has used to conduct its 2018 Inventory. This inventory was completed in conjunction with support from IU's Environmental Resilience Institute and ICLEI-Local Government for Sustainability, a non-profit that provides support and technical assistance to local governments to accurately account for their greenhouse gas emissions.

Is the community meeting Bloomington's emissions reduction goals?

The City of Bloomington's current Sustainability Action Plan target of 11 percent emissions reduction by 2023 from the 2016 estimate will be evaluated given the results of this 2018 Greenhouse Gas Inventory. Evaluating the City's emissions reduction commitments and determining an appropriate emissions reduction goal will be the next step now that the City has determined what sectors have the most significant impact on the community's production of emissions. Updating the emissions reduction target over time allows the City to reevaluate how it is performing over time relative to the 2017 Mayoral commitment to the Paris Agreement.

The immediate next step will be to get support for the creation of an accurate historical 2005 GHG emissions baseline so that emissions trends can be accurately tracked by utilizing the same methodology. Forecasting past emissions is a complex process and will require additional support, but determining 2005 emissions will be critical to evaluating emissions trends over time and communicating progress towards the community's goals. As goals are evaluated and adjusted based on this inventory, the emissions reduction goals that Bloomington sets will integrate the most recent climate change data and projections.

In this context, the City of Bloomington is pleased to present the 2018 Greenhouse Gas Inventory to the community. The administration looks forward to working together with elected officials, the business community and residents in the City, County and region to set and achieve goals to minimize greenhouse gas emissions from all sources and to prepare for the effects of climate change.

Key: Sectors and topics mentioned in this report are color coded according to the 8 sectors in the 2018 Sustainability Action Plan (below)

Climate Change & Adaptation

Energy & the Built Environment

Transportation

Local Food & Agriculture

Waste

Water

Ecosystem Health

City Operations

ABOUT THE INVENTORY

What is a Greenhouse Gas Inventory?

Greenhouse gas (GHG) inventories estimate the total amount of greenhouse gas emissions produced by given sources over a period of time. Every two years, the City of Bloomington will collect data to measure the local government and community's emissions of carbon dioxide and other greenhouse gases that contribute to climate change.

A greenhouse gas inventory accounts for total emissions produced in a year by collecting data about activities that generate emissions and calculating the quantity of pollution released to the atmosphere as a result of that activity. This activity data is collected across various community sectors, such as stationary energy and transportation, that directly contribute to the release of GHG emissions through the burning of fossil fuels. Cities throughout the United States are conducting inventories to identify the sources and activities responsible for generating greenhouse gases, to understand emission trends, to set emissions reduction goals and to inform the public about progress towards those goals.

"Bloomington will minimize the generation of GHG emissions from all sources, toward an end goal of carbon neutrality, and will prepare for climate change."

-2018 Bloomington Sustainability Action Plan Climate Change & Adaptation Vision

How Does Conducting a Greenhouse Gas Inventory Help Bloomington Meet Its Climate Goals?

Completing an inventory helps the City and community understand how to focus greenhouse gas reduction initiatives, establish and track progress towards our emissions reduction goals, and provides data to support our actions to make government managed infrastructure, operations and investments more sustainable. To affect change in the community around emissions reduction, it is also important to understand the greenhouse gas emissions of Bloomington as a whole through the Community-wide Greenhouse Gas (GHG) Inventory.

Bloomington is working to minimize the generation of GHG emissions from all sources with the goal of further reducing community greenhouse gas emissions in alignment with the Paris Climate Commitment.

This inventory will help us establish a baseline of where we are today so that we can plan for where we are going. Our climate mitigation and adaptation efforts will be informed by these inventory results, which collected data from utility providers, state agencies, and city government officials.

How does this GHG Inventory Compare to Past Bloomington GHG Inventories?

Community-wide inventories were completed in 2005 and 2015 and a local government inventory was completed in 2015. However, the methodologies used in the past and the procedures for compiling data did not consistently follow the Global Protocol for GHG inventories and they were not audited for quality control and assurance by a third party.

It should be noted that it would be difficult and erroneous to make conclusive comparisons between the three GHG inventories since they did not follow the exact same protocol and calculation methods.

For more information, see page 25 "What does the data tell us?" and the Appendix.

What process did we follow to measure 2018 emissions?

The 2018 Community-wide and Local Government Inventories were completed following the GPC standard and reporting using the ClearPath tool, an online software platform developed by ICLEI for completing greenhouse gas inventories used by hundreds of local governments across the United States.

This ensures that Bloomington has followed the national and global protocol for providing an accurate and transparent accounting of local emissions that contribute to climate change.

Fourteen Indiana cities, including Bloomington, Carmel, Columbus, Delaware County/ Muncie, Evansville, Fishers, Fort Wayne, Gary, Greencastle, Goshen, Michigan City, Oldenburg, Richmond and West Lafayette all received training, technology, and technical assistance in 2019 by IU Environmental Resilience Institute and ICLEI to ensure consistent and complete greenhouse gas reporting.

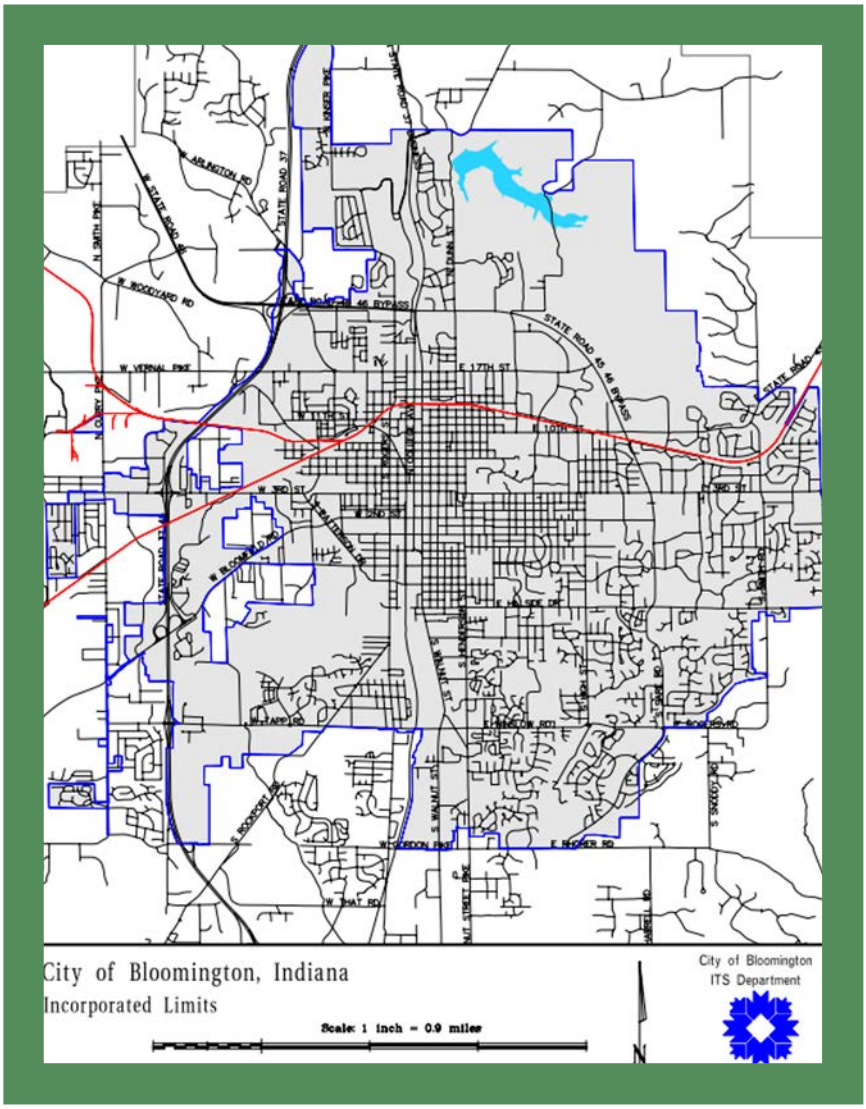
The next Greenhouse Gas Emissions Inventory to be completed in 2021 will utilize the same methodology to ensure consistency of measurement over time.

What is the scope of this study of Bloomington's emissions?

This study accounts for estimated emissions generated within the city limits of Bloomington, IN by Bloomington's 85,000 residents in 2018. (see map on below)

About half of the City's population is comprised of students attending Indiana University's Bloomington campus. The corporate boundary of the City is just over 23 square miles and has a population density of approximately 3,600 people per square mile.

Future partnership with County government to expand the scope of this study to include Monroe County could be one focus of future efforts.



City of Bloomington, Incorporated City Limits

How did we decide which emissions to include in our community-wide and local government inventories?

Bloomington followed the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC), which represents an estimate of the impact of all emissions generating activities attributable to Bloomington. Following this protocol for counting Bloomington's emissions means our quantification method is consistent with how other cities measure their emissions in a manner that is robust, transparent, and globally accepted.

The protocol measures the contributions from the seven GHGs as part of the Kyoto Protocol:

- carbon dioxide
- methane
- nitrous oxide
- hydrofluorocarbons
- perfluorocarbons
- sulfur hexafluoride
- nitrogen trifluoride

Following ICLEI's recommendations we measured carbon dioxide, methane, nitrous oxide, and we recognize that the other four contribute to emissions, but were unable to access verifiable data sources on a local scale.

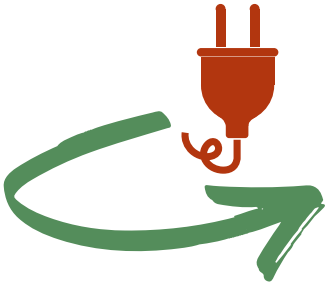
The seven greenhouse gas emission sources measured for the community-wide inventory are:

- stationary energy
- transportation
- waste
- industrial processes and product use (IPPU),
- agriculture
- forestry
- other land use (AFOLU), and other emissions outside the geographic boundaries
- Process & fugitive emissions, upstream impacts

For the local government protocol, Bloomington followed the Local Government Protocol developed by ICLEI and received guidance through the emissions calculation methodology and reporting guidance applicable to U.S. cities.

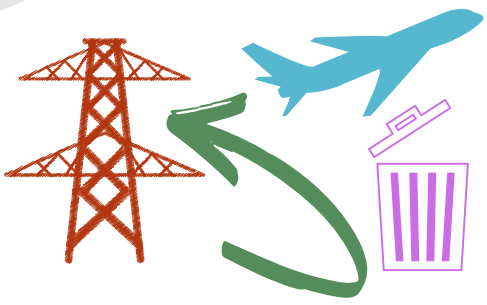
The City followed ICLEI's recommendations and measured carbon dioxide, methane, nitrous oxide and included the following sectors: buildings and facilities, streetlights and traffic signals, water delivery services, vehicle fleet, transit fleet, solid waste, wastewater and fugitive emissions.

Carbon dioxide
Methane - Nitrous oxide



Stationary energy- grid supplied (Scope 2)

Emissions from sources within the city boundary- transportation, waste, stationary energy- fuel combustion, industrial (Scope 1)



Emissions occurring outside city due to activities within city limits- transportation, transmission, waste & wastewater, other indirect (Scope 3)

WHAT IS DRIVING CLIMATE CHANGE?

Drivers of Climate Change

The Earth is covered by a “blanket” of gases, called the atmosphere, that prevent the Sun's heat from escaping back into space. The atmosphere regulates the Earth’s temperature by absorbing solar radiation and re-radiating that energy back to the Earth’s surface. This process makes life on Earth possible by heating the Earth during the day and cooling it at night.

The atmosphere is composed of nitrogen, oxygen, argon, carbon dioxide, and trace gases. Over the past two hundred years, human activities have driven the emissions of increasing amounts of greenhouse gases, predominantly through the burning of fossil fuels, such as oil, coal, and natural gas for transportation, electricity generation, and other activities.

Collectively, these human generated greenhouse gases have enhanced and intensified the natural greenhouse effect, causing global average temperatures to rise at an increasing rate. This change in average global surface temperature has led to a global crisis that is having a significant impact on Earth’s ecosystems—creating an existential threat to Earth’s ability to support life.

Climate change is both a global and local issue, Bloomington can work locally towards reducing GHG emissions by curtailing our community’s fossil fuel dependence through energy mix diversification, large-scale energy efficiency improvements, and improvements to our local food and transportation systems.

CLIMATE CHANGE: KEY MILESTONES

Key Milestones: Climate Change Policy

1988- **Intergovernmental Panel on Climate Change** is formed to provide policymakers with regular scientific assessments

1992- The UN Framework Convention on Climate Change (UNFCCC) was adopted

1997- Kyoto Protocol adopted- the world's first greenhouse gas emissions reduction treaty.

2015- COP 21 - Historical Paris Agreement adopted 195 nations agreed to combat climate change and increase investment towards a low-carbon, resilient and sustainable future

Climate Change: Additional Resources

Impacts to Bloomington/ Monroe County:
IU Environmental Resilience Institute- Hoosier Resilience Index (Nov 2019)

Impacts to the State of Indiana:
Climate Impacts Assessment, IndianaClimate.org, Purdue Climate Research Center

Impacts to the US:
US Fourth National Climate Assessment, Chapter 21: Midwest

Impacts to the World:
IPCC, 2018: Summary for Policymakers
National Climate Assessment (2018)

WHAT CAN WE EXPECT FROM A CHANGING CLIMATE IN THE MIDWEST?

CITY OF BLOOMINGTON
ECONOMIC AND SUSTAINABLE DEVELOPMENT

LOCAL & REGIONAL CLIMATE CHANGE IMPACTS

Local Climate Change impacts

There will be significant climate impacts not only globally, but also here in Bloomington and Monroe County. Based on climate modeling, the Midwest should anticipate

- increased precipitation,
- flood risks,
- increased intensity and frequency of extreme hot days and heat waves;
- increased insect pest and invasive species presence;
- increased vector-borne disease and increased air-borne illness.

Many of the impacts detailed below are interconnected, and thus climate impacts in one sector often result in impacts in related sectors.

The IU Environmental Resilience Institute Toolkit (ERIT) and Purdue University's Climate Change Research Center provide informative resources detailing the specific challenges that Midwestern communities and Bloomington face.

By 2050, Monroe County can expect:

- 50 days of over 95 degrees (historical: 2 days)
- An average hottest day of the year of 107 degrees (historical: 97 degrees)
- An average coldest day of the year of 1 degree (historical: -5 degrees)
- An increase in spring rainfall of 16 percent above historical averages

(ERIT, 2019)

Other projected regional and state climate impacts, regarding temperature and precipitation, air quality, ecosystem health, energy, food and agriculture, public health, transportation & infrastructure, water management, and waste management, are discussed in the next section.

Temperature & Precipitation

Over the past century, Indiana's statewide annual average temperature has risen by 1.2˚F (0.7˚C)—approximately 0.1˚F (0.07˚C) per decade. While fluctuations in daily weather temperatures are common and this may appear to be an insignificant change, when it comes to climate, even a small change can lead to serious impacts.

The Indiana Climate Change Impacts Assessment projects that the average hottest day of the year in 2050 will be 107˚F in contrast to a past average temperature of 97˚F. Moreover, the average coldest day in the winter was -5˚F while projections for 2050 depict the average coldest day to be 1˚F. Historically, Indiana gained 0.32 inches of precipitation per decade from 1895 to 1959; post 1960, the state's rate of precipitation change has increased to 1.33 additional inches per decade.

Spring rainfall is expected to increase by 16% in 2050. It is also anticipated that Indiana will experience wetter winters and springs as the frequency and intensity of extreme precipitation events increases. Warm-season temperatures are projected to increase more in the Midwest than any other region of the United States—leaving specific economic and environmental sectors susceptible to climate change.

Air Quality

Climate change will impact indoor and outdoor air quality. The indoor air quality of buildings and structures will be vulnerable to the growth of fungi and mold. Extreme weather events can also break down the barriers between outdoor and indoor spaces—leaving them susceptible to poorer air quality and triggering negative health effects for people exposed to these spaces. With regards to outdoor air quality, climate change may increase the occurrence of ground-level ozone and particulate matter as temperatures rise.

Bloomington SAP Goal 1.2: Create a community climate adaptation plan.

Effects of climate change on temperature, precipitation and air quality will be part of the Climate Vulnerability Assessment conducted in 2020 by the Department of Economic and Sustainable Development.

Ecosystem Health

As a result of climate stressors, forests will also experience increased tree mortality and reduced forest productivity. With higher temperatures, invasive species and disease will become more prevalent.

The economic and ecological benefits communities receive from these forests are at stake as well. Biodiversity and ecosystems are at risk in the Midwest as changes in land use, temperature, precipitation patterns, humidity, and moisture stress lead to reduced biodiversity in many of the region's prairies, estuaries, wetlands, forests, and freshwater systems.

Bloomington SAP Goal 7.1
Conserve greenspace and enhance 100 acres of habitat

Local Food & Agriculture

Agriculture will be affected as temperatures surge, resulting in a longer frost-free season, and increased rainfall intensity—all leading to reduced crop quality and yield. One crop in particular that could be vulnerable is corn in the southern half of the Midwest.

Crops will also be more vulnerable to pests and changes in soil moisture. Moreover, food transportation systems, such as roads, railways, and aviation, will be susceptible to extreme weather events.

Bloomington SAP Goal 4.3.b
Create economic opportunities for farmers and gardeners

Energy

Climate change will affect the generation, transmission, distribution, and consumption of energy. In the future, higher temperatures will increase energy usage (for heating and cooling buildings). Extreme weather events could also cause stress to existing energy infrastructure and increased power disruptions.

Bloomington SAP Goal 7.1
Reduce building energy use in the Bloomington community 20 %

Public Health

Human health will be affected by numerous climate stressors, which include increases in the frequency and intensity of poor air quality days, extreme high temperature events, and heavy rainfalls; extended pollen seasons; and modifying the distribution of disease-carrying pests and insects.

Bloomington SAP Goal 1.2.b
Educate citizens and businesses about climate change effects

Transportation & Infrastructure

Transportation will be affected by heavy precipitation events that result in road closures, transportation infrastructure erosion, and increased traffic safety risks.

Bloomington SAP Goal 3.5
Increase bicycle infrastructure

Waste Management

Flooding will augment the complexity of managing hazardous waste, and the waste management personnel's ability to protect resources from contamination sites during extreme weather events will decline.

Bloomington SAP Goal 5.1.h
Explore the opportunity for a Materials Recovery Facility

Water Management

Climate change will impact water quality, conservation, and access. Water quality will decrease as algal blooms become more prevalent and water quality operations struggle to respond to extreme drought and storms. Stormwater systems are susceptible to overflow during extreme rain events leading to higher flood risk and pollution control issues as raw sewage enters nearby water bodies.

Bloomington SAP Goal 6.4
Increase the number of green infrastructure features

Determining which climate change impacts will occur locally is complex and requires advanced modeling. The City of Bloomington is planning to enhance its understanding of local vulnerabilities by using models to assess the city's climate-change risk at a neighborhood level.

This will improve the City's understanding of the spatial and demographic impact of climate impacts and ensure that adaptation, resilience, and resistance planning will be supported by locally relevant data. These efforts will support the city's continuing and expanding climate-change mitigation efforts.

2018 Sustainability Action Plan
bloomington.in.gov/sustainability/action-plan

CLIMATE CHANGE: BLOOMINGTON INITIATIVES

The City of Bloomington has led, supported, or managed a variety of sustainability and climate initiatives over the last decade to improve environmental performance across sectors with significant climate impacts. Through the implementation of the 2018 Sustainability Action Plan and expansion of past and current initiatives, Bloomington will continue a coordinated response to the climate crisis by employing a variety of tactics.

The City will mitigate emissions through a combination of infrastructure investments, strategic planning, public education, policy change, and advocacy across all departments and continue to engage the community as active partners in reducing emissions.

Some examples of recent City and community climate initiatives that have resulted in emission reductions include, but are not limited to:

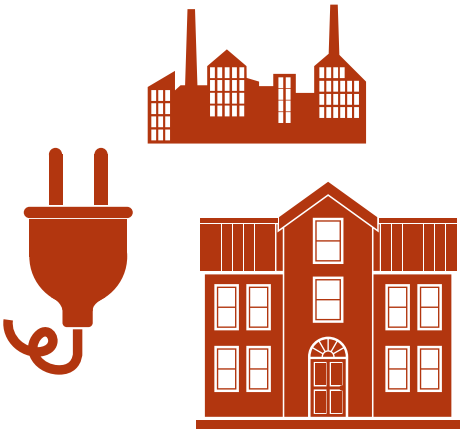
- **Advocacy:** Membership in climate leadership organizations and initiatives such as the Global Covenant of Mayors (GCoM), Climate Mayors, We Are Still In, and Mayors for Solar Energy
- **Infrastructure Investments:**
  - **$15 million**- Installation of on-site solar panels across 32 City-owned buildings and facility sites
  - **$10 million**- Bicentennial Bond investments in trees, side paths, and trails
  - **$9 million**- CBU smart meters
  - **$26 million**- Switchyard Park (57.2 acres of parkland)
- **Strategic Planning:** Five-year Sustainability Action Plan with planned actions across sectors that contribute to emissions, including Built Environment, Transportation, Energy, Local Food, Waste, and Green Infrastructure (Water/ Ecosystem Health), 2019 Bloomington Urban Forestry Plan
- **Public Education:** Solarize Bloomington, Year of Food events Monroe County Energy Challenge
- **Policy Change**: Expansion of City composting program, Sanitation waste modernization, City LEED Certification for new construction and operations/ maintenance, Unified Development Ordinance Sustainable Development incentives
- **Climate/ Sustainability Reporting:** Carbon Disclosure Project, LEED for Cities and Communities, Greenhouse Gas Emissions Inventories, Climate Vulnerability Assessment and Action Plan (upcoming), SAP Progress Reports

FINDINGS IN BRIEF

CITY OF BLOOMINGTON
ECONOMIC AND SUSTAINABLE DEVELOPMENT

MAJOR SECTORS EXPLAINED

STATIONARY ENERGY

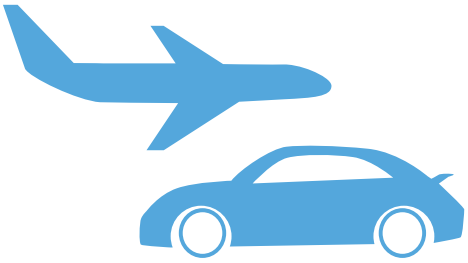


Stationary energy represents one of the largest contributors to Bloomington's greenhouse gas emissions.

Includes:

- Combustion of fuel in residential, government, commercial and industrial buildings
- Combustion of fuel in power plants to provide grid-supplied energy
- Fugitive emissions, or emissions of gases and vapors, from extracting, energy loss from transmission and distribution, transforming, and transporting fossil fuels

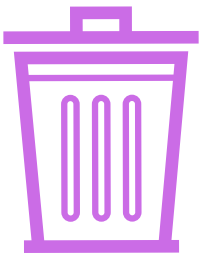
Data Sources: Duke, Vectren, IU CHP (2018 Data)



TRANSPORTATION

Transportation sector Includes all journeys by road, air, water, and rail. GHG emissions are produced by combusting fuel or indirectly by grid supplied electricity.

Data sources: INDOT (2018), EPA Moves, Monroe County Airport (2018)

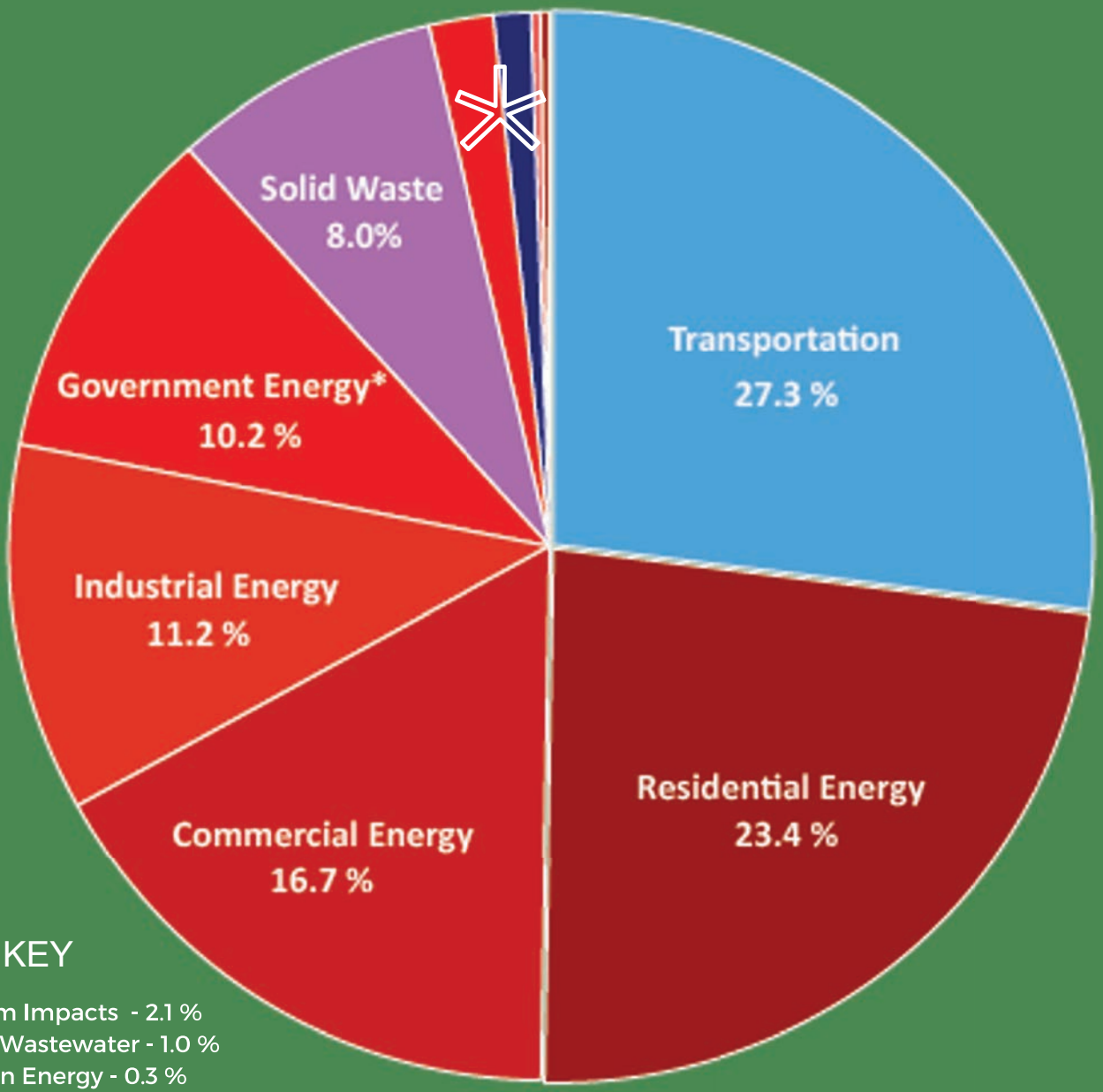


WASTE

Waste disposal and treatment produces greenhouse gases through decomposition.

Data sources: IDEM Land Quality (2018)

COMMUNITY-WIDE GHG INVENTORY PIE CHART

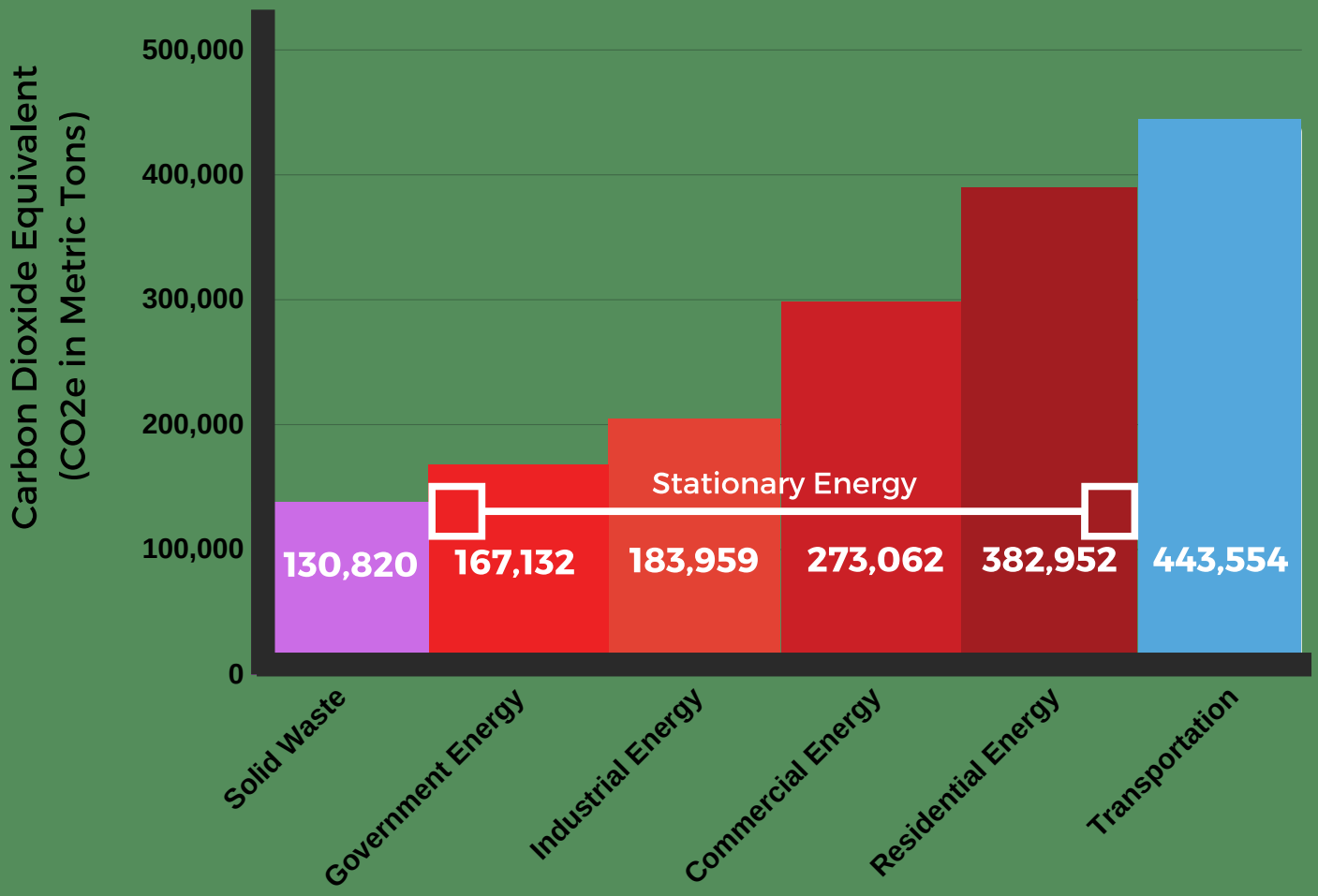


* - KEY

Upstream Impacts - 2.1 %
Water & Wastewater - 1.0 %
Unknown Energy - 0.3 %
Fugitive Emissions - 0.2 %

*Government Energy includes both CoB operations and Monroe County operations

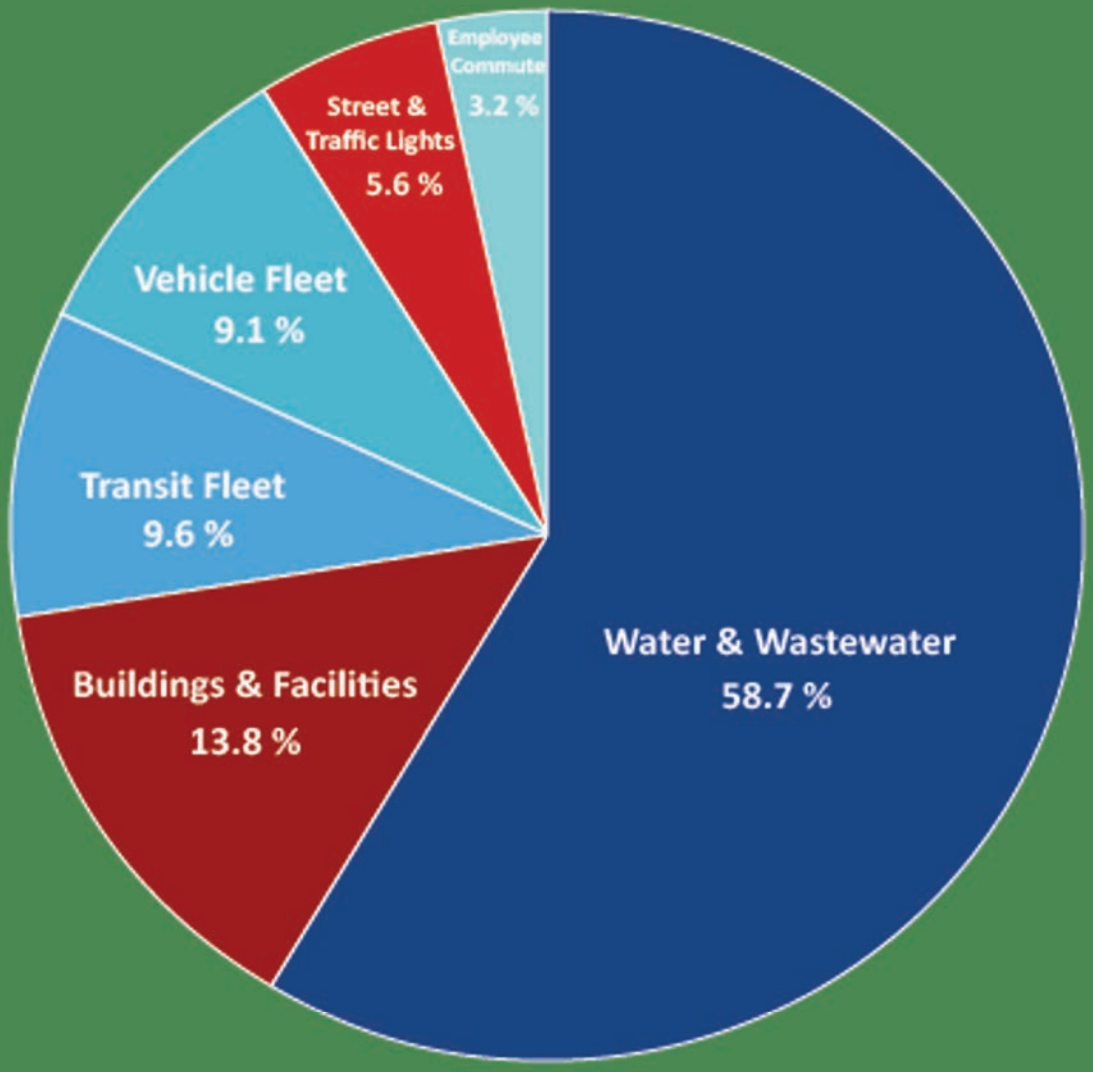
2018 Bloomington Community-wide GHG Emissions (top six sectors by emissions produced)

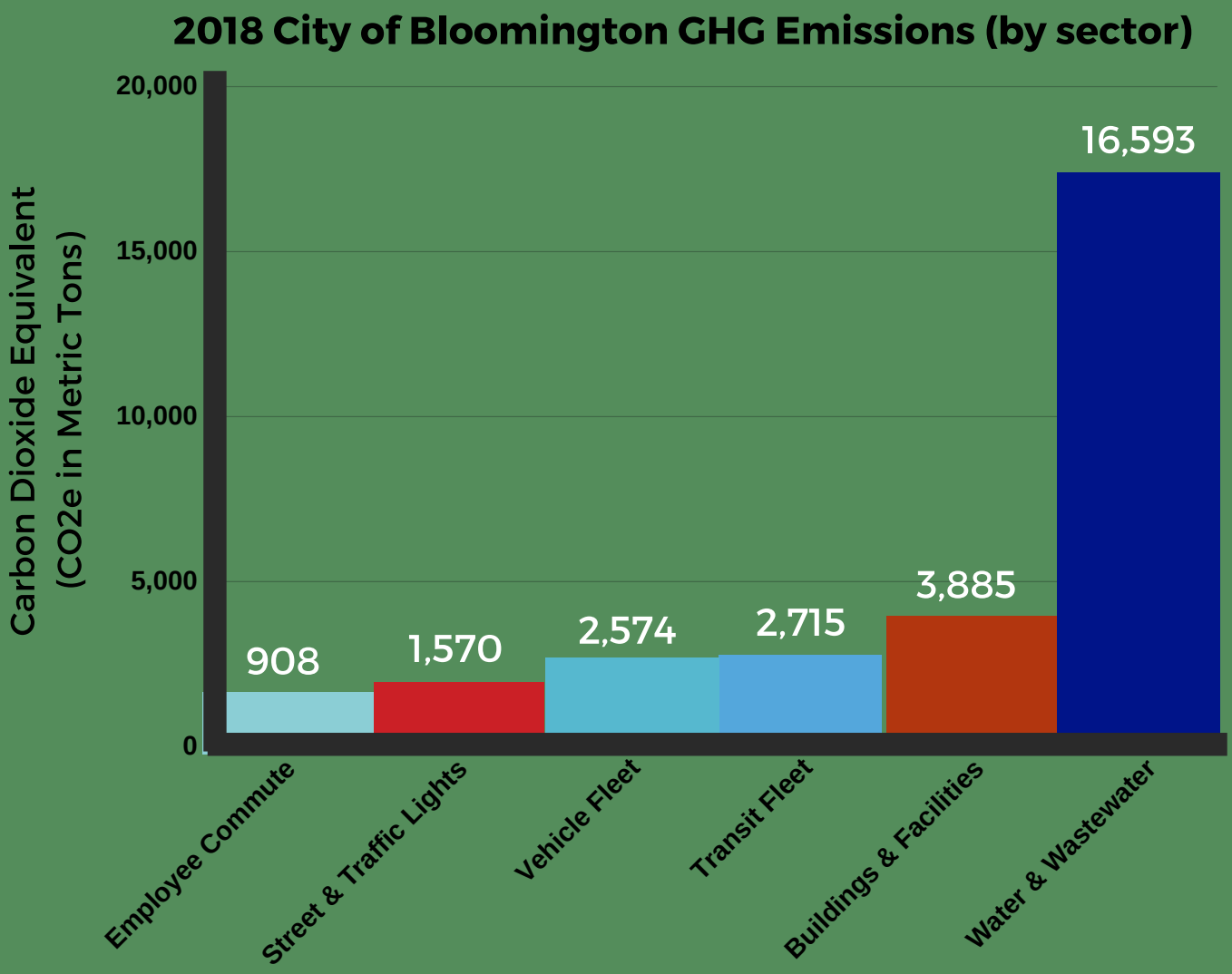


FINDINGS IN BRIEF - COMMUNITY

- **In 2018, the total community-wide emissions for the City of Bloomington: 1,639,657 total CO2e (MT), 19.3 per capita**
- Total CO2e Emissions from Stationary Energy sector: 1,012,815 CO2e (MT)
- Total CO2e Emissions from Transportation & Mobile Sources: 443,554 CO2e (MT)
- Total CO2e Emissions from the Waste sector (Waste & Composting): 130,820 CO2e (MT)
- Total CO2e Emissions from the Water Supply & Wastewater sector: 15,610 CO2e (MT)
- Total CO2e from Fugitive Natural Gas is 3,206 (MT)
- Total Electricity Loss from electricity delivered to Bloomington's residential, commercial, and industrial entities contributed 33,652 CO2e (MT)

LOCAL GOVERNMENT OPERATIONS GHG INVENTORY PIE CHART





FINDINGS IN BRIEF - LOCAL GOVT

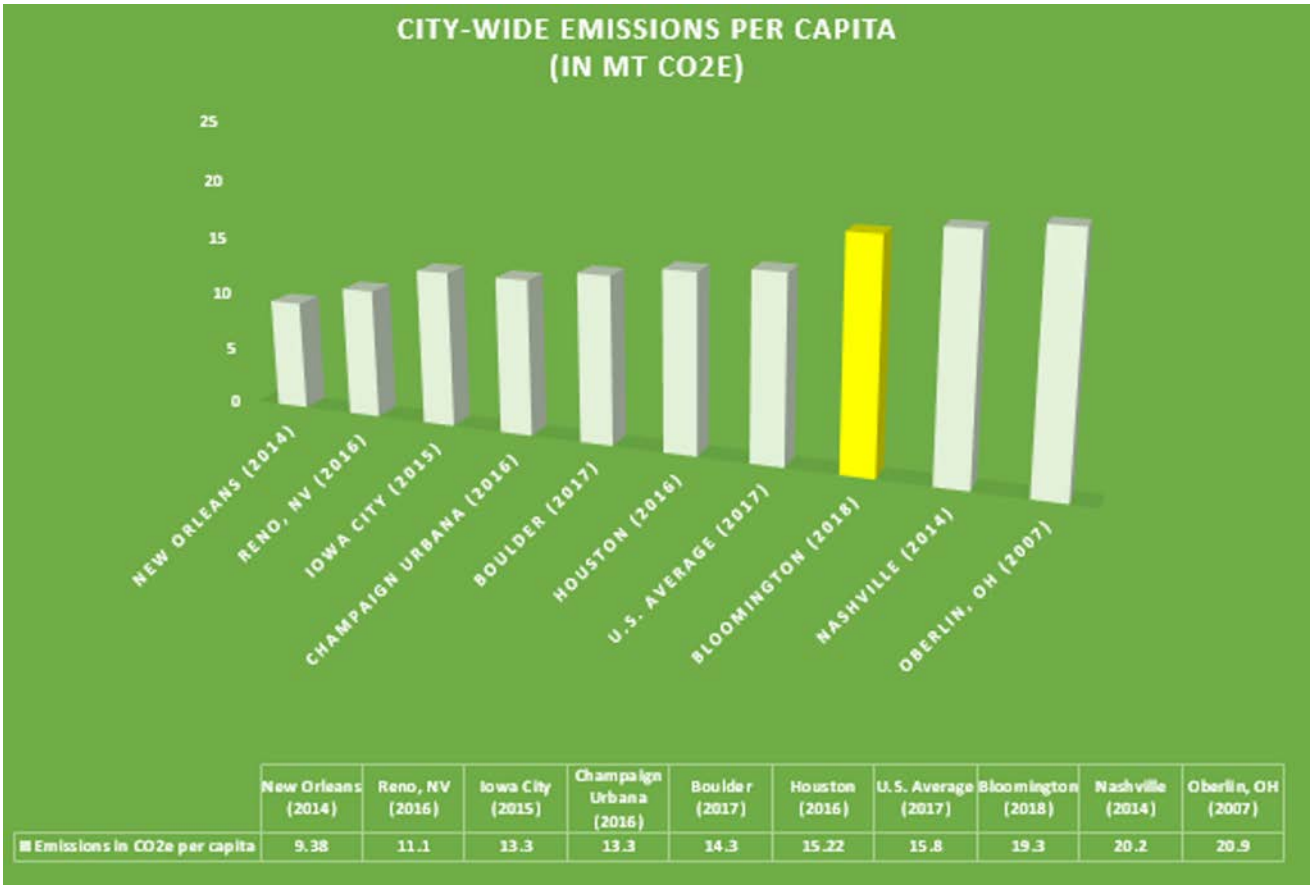
- **In 2018, the City's local government operations emissions: 28,245 total CO2e (MT)**
- Total CO2e Emissions from Water & Wastewater: 16,593 CO2e (MT)
- Total CO2e Emissions from Buildings & Facilities: 3,885 CO2e (MT)
- Total CO2e Emissions from Transit Fleet: 2,715 CO2e (MT)
- Total CO2e Emissions from Vehicle Fleet: 2,574 CO2e (MT)
- Total CO2e Emissions from Street & Traffic Lights: 1,570 CO2e (MT)
- Total CO2e Emissions from Employee Commute: 908 CO2e (MT)

20,000

WHAT STORY DOES THE DATA TELL?

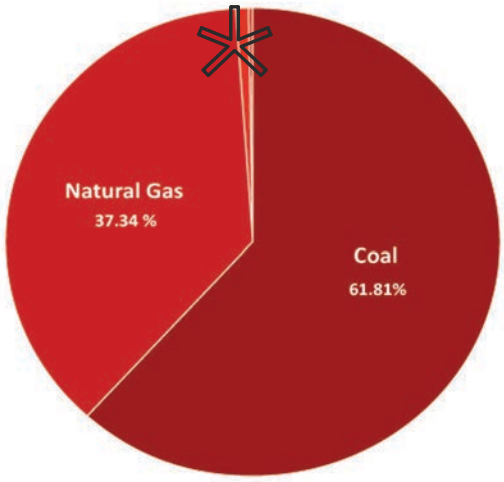
How do Bloomington's 2018 emissions compare to other cities on a per capita basis?

In 2018, Bloomington emitted 19.3 metric tons of CO2e per resident. Note that many factors contribute to a city's per capita emissions production and comparisons have limitations. A city's energy mix, population, development patterns, density, and geographic size all affect per capita emissions. Emission targets are sometimes framed in terms of emissions per capita as another way to communicate how carbon intensity varies across locations. Local context matters as to why per capita emissions are higher or lower. All cities listed below utilized the Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC). Noted is the year that each city reported its greenhouse gas emissions.



	New Orleans (2014)	Reno, NV (2016)	Iowa City (2015)	Champaign Urbana (2016)	Boulder (2017)	Houston (2016)	U.S. Average (2017)	Bloomington (2018)	Nashville (2014)	Oberlin, OH (2007)
Emissions in CO2e per capita	9.38	11.1	13.3	13.3	14.3	15.22	15.8	19.3	20.2	20.9

Duke Energy Mix:
2018 Statewide



Hydro - 0.59 %
Wind & Solar - 0.26 %

Source: 2019 Duke Energy Correspondence

Per capita energy-related carbon dioxide emissions by Indiana resident (2016): 27.4 metric tons of CO2 emissions per person/ year

(source: eia.gov, chart below)

How do Indiana's emissions compare to other states on a per capita basis?

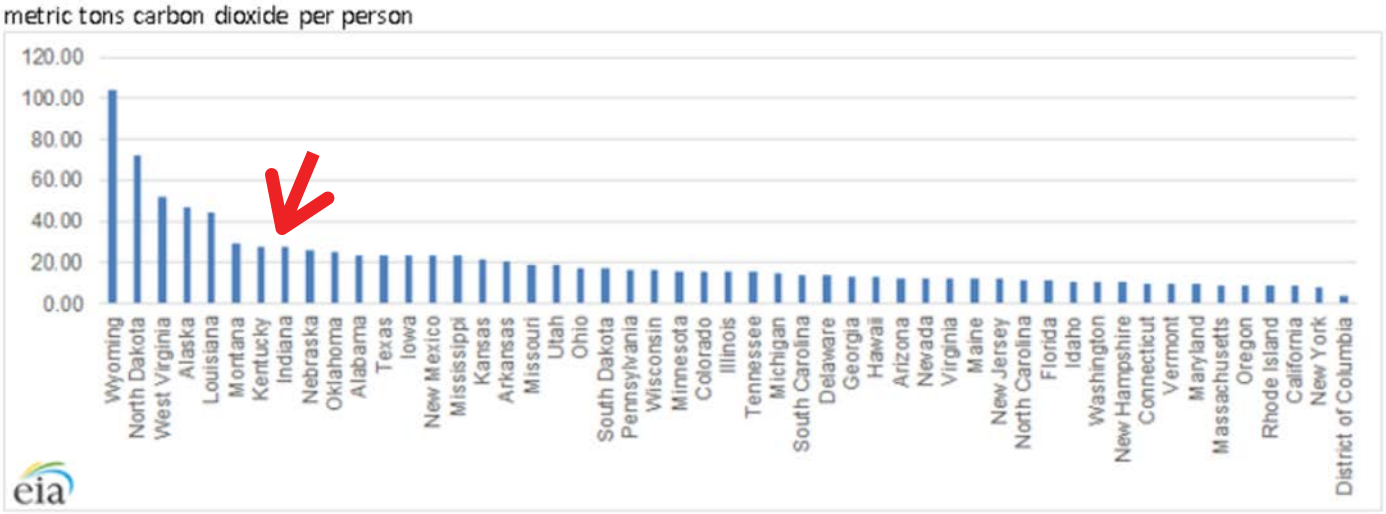
Many factors contribute to variation in the amount of emissions per capita at the state level, including climate, the state's economy, population density, energy sources, building standards, and state emissions reduction policies.

However, Indiana is the ninth-most energy-intensive state per capita in the country. According to a report from the 2018 Indiana Climate Change Impacts Assessment, "nearly three-quarters of Indiana's electricity comes from coal, and 5 percent is generated by renewable sources, though the wind energy sector is growing and coal use is declining.

This energy mix makes the Hoosier State the eighth-largest emitter of climate changing gases, at 18.3 million metric tons of carbon dioxide (CO2) emitted per year."

Source; Climate Change and Indiana's Energy Sector: A Report from the Indiana Climate Change Impacts Assessment., Purdue University, 2018

Figure 2. Per capita energy-related carbon dioxide emissions by state, 2016



Source: EIA, State Energy Data System and EIA calculations made for this analysis.

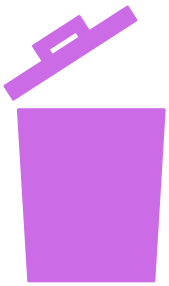
What are the trends in each major activity category per capita in Bloomington between 2011 and 2018?

7.3% decrease per capita in stationary electricity consumed between 2011-2018

(Duke Energy, 2011-2018, includes government sector)

11.5% increase in the number of miles traveled per person/ yr on City streets

(INDOT Historical VMT: City Streets, 2011-2018)



3.9% increase in tons of municipal waste landfilled per person/ yr

(IDEM Land Quality Data: Complete Solid Waste Quarterly Report Database, 2011-2018)

Activity data is a quantitative measure of a level of activity that results in GHG emissions taking place during a given period of time

***Note that this data is for illustrative purposes and does not reflect the magnitude of associated CO2e emissions produced by each activity**

How were past Bloomington GHG Inventories conducted and by whom?

2018: (high confidence) Completed by Department of Economic and Sustainable Development with assistance from IU ERI, ICLEI using the GPC (protocol) for reporting to the Global Covenant of Mayors.

2016: (medium confidence) Completed by Economic and Sustainable Development Department - methodology largely similar, but utilizing the GPC without the reporting software. Therefore, were differences in methodology, what data was included for some sectors. what was measured Inventory was not audited.

2005: (low confidence) completed by Bloomington Commission on Sustainability with 2004 data prior to the GPC. Took raw data about activity in the major source categories, mainly from the Bloomington Environmental Quality Indicator (BEQI) report .

Comparison of past methodologies and data sources*

The 2018 Community-wide Inventory is the most comprehensive yet and covers more sectors than the past inventories. For instance, water and wastewater associated emissions were not included in the last effort to inventory emissions.

The 2018 inventory is the only one that has followed the Global Protocol completely. In the past, the City did not have consistent access to the reporting platform to audit calculations and assumptions.

Comparison of 2016 and 2018 Inventories

Sector	CO2e 2018 (MT)	CO2e 2016 (MT)* Differences in Methodology (see Appendix)
Transportation and Mobile Sources	**443,554**	**116,790*** (pg. 1) Note: this 2016 transportation emissions total does not include all roads in Bloomington City limits, I-69/ 37 effects, MC airport or off-road GHGs
Total Stationary Energy (R+I+C+G+U for natural gas and electricity)	**1,012,815**	**1,190,332*** reported value (incorrect e-grid values, does not count gov. or unknown natural gas) Note: if add natural gas total, electricity, and IU CHP values (Table 3) total is 1,211,232 and subtract leakage (Table 14 value)
Residential Energy	**382,952**	**384,014*** (Table 3 residential natural gas + Table 8 residential electricity)
Commercial Energy	**273,062**	**287,048*** (Table 3 commercial natural gas + Table 8 commercial electricity)
Industrial Energy	**183,959**	**110,695*** (Table 3 industrial natural gas + Table 8 industrial electricity)
Government Energy* (includes CoB and County)	**167,132**	Electricity use only 189,339* Did not measure government natural gas
Unknown Energy	**5,710**	Electricity use only 7,994* Did not measure unknown natural gas
Upstream Impacts of Activities (associated with electricity)	**33,652**	Not measured
Process & Fugitive Emissions (associated with natural gas)	**3,206**	**46,627*** Note: natural gas calculation is inaccurate due to assumptions made- divided national amount of leakage and scaled to Bloomington
Solid Waste	**130,820**	**47,214*** Note: if adjusted to 2018 methodology would be 132,400- 2016 utilized estimate of the expected reduction due to the collection system
Water and Wastewater	**15,610**	Not measured
Total	**1,639,657 MT**	**1,375,237 MT*** **limited comparison due to methodology/ sectors included**

Before 2014, there was no universally accepted methodology for calculating emissions. Previous methodologies have been superseded by the Global Protocol so the past inventories lacked the same consistent and transparent way to measure and report emissions.

*Each inventory reflects then current technology and data-collection practices at the time. As the practice has evolved over time, the three GHG inventories are not able to be exactly compared with each other.

WHAT'S NEXT?

From a community-wide perspective, the top three GHG contributing sectors are Transportation, Residential Energy Use, and Commercial Energy Use. To reduce our community's GHG emissions, future programs and policies will address emissions specific to the aforementioned sectors while building on existing and planned city initiatives. We recommend the implementation and improvement of the following GHG reduction strategies in our community in addition to the climate strategies outlined on the following page.

Transportation

- **Multi-modal Transportation**- Increase mode share for Cycling, Walking, & Public Transit (Comprehensive Plan 6.4.2)
- **Transit Oriented Development**- Enhanced Compact Development to reduce single occupancy vehicle use (SAP 3.1.e)
- **Bicycle & Pedestrian Mobility**- Improved Bike Infrastructure (bike paths & lanes, bicycle-specific crossing signals, improved road maintenance, signal triggering technology for bicycles, showering facilities) (Comprehensive Plan 6.3.1)

Residential Energy Use

- **Renewable Energy Generation**- Facilitate residential solar development by overcoming upfront cost barriers of installation. (SAP 1.1.c)
- **Renewable Energy Generation**- Power Purchase Agreements
- **Energy Conservation and Efficiency**- Residential Energy Efficiency Education (Comprehensive Plan 3.1.1)
- **Energy Conservation and Efficiency**- Low-income weatherization programs seal cracks around windows and doors, add insulation, and sometimes replace inefficient appliances, reducing energy-use-related GHG emissions and lowering utility bills.

Commercial Energy Use

- **Renewable Energy Generation**- Facilitate commercial solar development by overcoming upfront cost barriers of installation. (SAP 1.1.c)
- **Renewable Energy Generation**- Power Purchase Agreements
- **Energy Conservation and Efficiency**- Commercial Energy Efficiency Education/Green Building Initiatives
- **Sustainable Building Practices**- Building Retro-Commissioning - Energy used to heat, cool, and ventilate contributes to the majority of energy used in buildings. Improving the efficiency of the equipment used for these tasks reduces emissions and saves on climatization costs (Comprehensive Plan 3.7.1)

From a local government operations perspective, the top four GHG contributing sectors are the Water Supply and Wastewater System, Buildings and Facilities, along with the Transit and Vehicle Fleets. To reduce our community's GHG emissions, future programs and policies should address emissions specific to the aforementioned sectors. We recommend the implementation and improvement of the following GHG reduction strategies in our community:

Water and Wastewater

- **Water Conservation**- Installation of City of Bloomington Utilities Smart Water Meters (complete by 2020)
- **Water Conservation**- Develop quarterly reporting system for water use in all City facilities (SAP 8.5.b)
- **Efficiency**- Improve wastewater treatment plant efficiency (SAP 8.2.d.)

Buildings & Facilities

- **Renewable Energy Generation**- Increased Municipal Solar Photovoltaic- Identify locations for future renewable energy installations at City-owned properties (SAP 8.1.c)
- **Energy Efficiency and Conservation**- Establish a consistent methodology and process for monthly reporting of individual building energy usage and cost data (SAP 8.2.a)
- **Energy Conservation and Efficiency**- Provide program for facility retrofits

Public Transit Vehicles

- **Renewable Energy Generation**- Alternative Fuel Vehicles- increase number of alternative fuel/ electric buses (SAP 8.4.a)

Vehicle Fleet

- **Alternative Fuel Vehicles**- identify near-term opportunities for fuel-efficient and lower-emission vehicle replacements (SAP 8.3.b)

How will the City utilize the results from the Greenhouse Gas Inventory?
Results from the Greenhouse Gas Inventory will be utilized in the following ways:

- **2018 Sustainability Action Plan**- providing support for ongoing Sustainability Action Plan initiatives in the next 5 years
- **Climate Vulnerability & Action Plan Strategy Development**- ongoing work to meet our climate adaptation and mitigation goals, will include actions within renewable energy, building performance, incentivizing multi-modal and low-carbon transportation, and improving local food systems
- **Climate Community Engagement**- continue community engagement with a focus on outreach and education to citizens and the private sector
- **Tracking and Reporting**- creation of a sustainability dashboard and continued updates through Sustainability Action Plan Progress Reports
- **Networking with Cities**- identify best practices of what other cities are doing to reduce emissions through membership in the Urban Sustainability Directors Network
- **City Operations**- implement actions within city operations that reduces our impact in water delivery and treatment, wastewater facilities, improving efficiency in city buildings, and reducing vehicle fuel use

WHAT'S NEXT?

A STRONG STRATEGY FOR EMISSIONS REDUCTION RELIES ON A ROBUST INVENTORY

1. **Calculate 2018 Impact Using Global Protocol** ✓
   Public Presentation of Report
2. **Review Climate Commitments: Goal Setting**
   Develop 2005 baseline based on forecasting
   Mayors National Climate Action Agenda
   Global Covenant for Mayors (GCoM)
   Sustainability Action Plan- Climate Change and Adaptation
3. **Reduce Emissions**
   Ongoing Sustainability Action Plan Initiatives
4. **Reassess Emissions Reduction Data**
   2020 Greenhouse Gas Inventory (conducted in 2021)
5. **Report Progress**
   Carbon Disclosure Project (yearly)
   Sustainability Action Plan Progress Report (yearly)
   Sustainability Dashboard (upcoming)

Climate Mitigation- apply for Resilience Cohort Environmental Resilience Institute to evaluate and prioritize actions to reduce emissions

Climate Adaptation- Climate Vulnerabilty Assessment (2020) to provide a detailed review of the anticipated climate-related risks to people, infrastructure, and natural resources in Bloomington and Monroe County

WHAT YOU CAN DO

What can we do as citizens to reduce our collective impact on the climate?

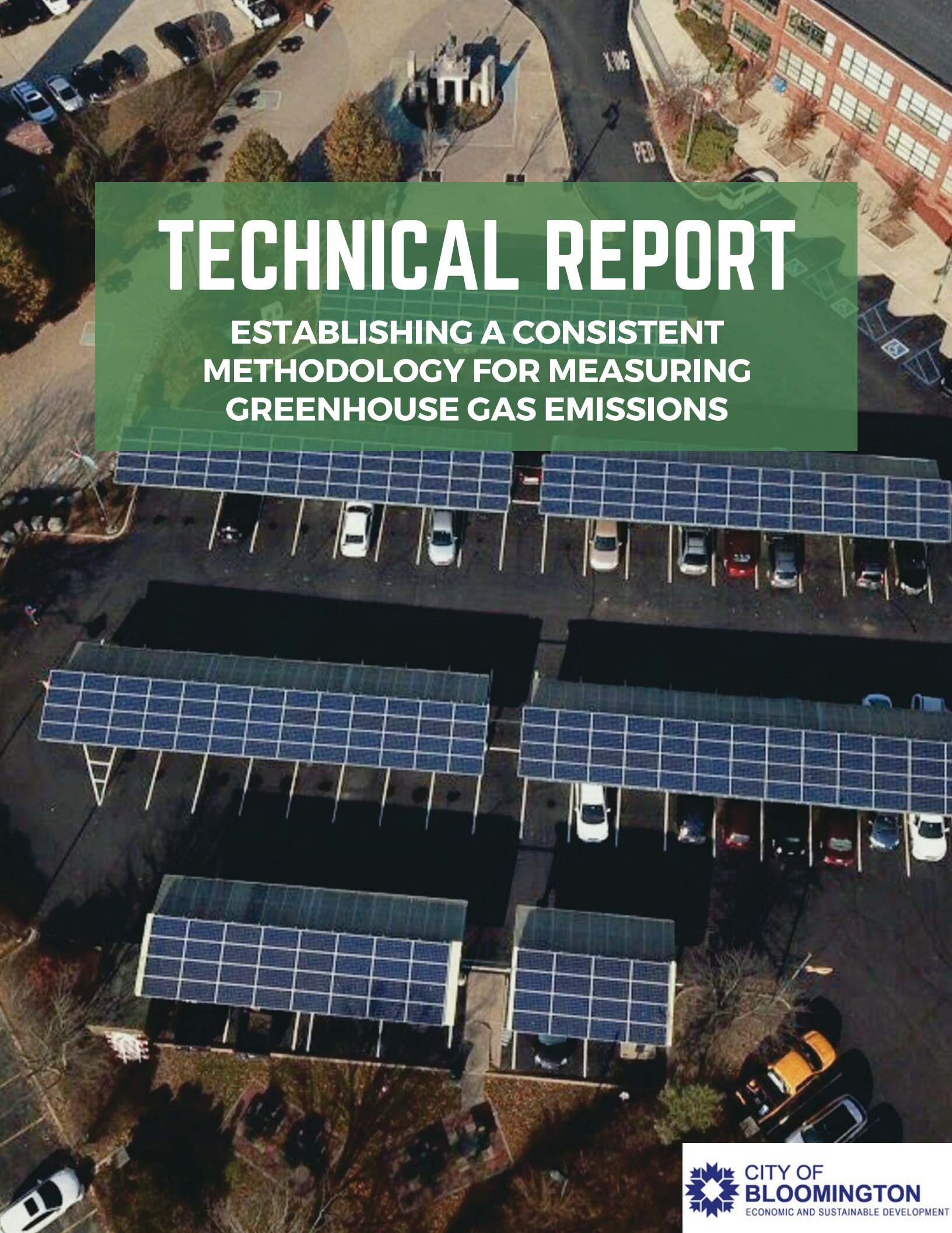
- Consider your role in our community's energy, transportation, local food, waste and water systems. Your actions now will ensure that we can manage environmental, social, and economic resources both now and in the future. Be thoughtful about purchases- consider how something came to be and what will happen when you are done using it.

- Reduce the emissions you create first, then offset. Your primary individual contributions to climate change come from the energy you use, the ways that you get around, the building you live in, and the food you consume. Reduce the electricity use, then pursue purchasing renewables or purchase green power offsets. Take public transportation or alternative modes of transportation, carpool, or low-carbon vehicles. Retrofit or weatherize (aka) the home you live in and eat food that was produced close to where you live.

- Engage with a community organization. Bloomington has a variety of grassroots and non-profit organizations that you can join and volunteer for in a topic that you are passionate about.

- Attend a city commission meeting. City of Bloomington has a Commission on Sustainability, an Environmental Commission, a Tree Commission and a Bicycle & Pedestrian Safety Commission. Monroe County also has an Environmental Commission.

- Support sustainability initiatives at other institutions. Sustain IU, IU Environmental Resilience Institute, IU Integrated Program for the Environment, Monroe County Solid Waste District, Monroe County Public Library, and Center for Sustainable Living among other organizations have ongoing educational programming for the public.



TECHNICAL REPORT

ESTABLISHING A CONSISTENT METHODOLOGY FOR MEASURING GREENHOUSE GAS EMISSIONS

CITY OF BLOOMINGTON
ECONOMIC AND SUSTAINABLE DEVELOPMENT

TECHNICAL REPORT

GHG Accounting Protocol & Details - ClearPath

The 2018 Community-wide and Local Government Operations GHG inventories were completed using ICLEI's ClearPath software, an online software platform, which supports data entry that aligns with the Global Protocol for Community-Scale Greenhouse Gas Emissions GHG Inventories. ICLEI personnel also provide 3rd party verification services for GHG inventory data entry and Bloomington's ClearPath data was verified by ICLEI to ensure a complete, transparent, and accurate accounting of Bloomington's greenhouse gas impacts.

The Community Protocol, developed by ICLEI and other organizations, was released in October 2012, and represents an authoritative 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.

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On July 11th 2019, Mayor John Hamilton committed to joining the Global Covenant of Mayors (GCoM). Commitment to GCoM requires that by four years after the commitment date, cities complete a greenhouse gas inventory utilizing a methodology that follows the GPC. To take steps to meet our GCoM climate commitment, Bloomington chose the GPC as the protocol for the Community-wide GHG inventory. This GHG inventory was conducted to measure the greenhouse gases associated with activities occurring between January 1st, 2018 and December 31st, 2018 and the geographic scope is Bloomington's city boundary.

GHG CONTRIBUTING SECTORS AND SCOPES

Research was conducted for the following sectors within Bloomington's city boundary: Stationary Energy, Transportation, Waste, Industrial Processes and Product Use (IPPU), Agriculture, Forestry, and Land Use (AFOLU), Process and Fugitive Emissions, and Upstream Impacts.

The Stationary Energy sector accounts for emissions from energy use in residential, commercial, and industrial properties.

The Transportation sector is comprised of emissions from single occupancy vehicles, transit fleets, aviation, and off-road vehicles.

Waste accounts for emissions generated by landfilled waste as well as bio-waste and green waste associated with composting.

IPPU is comprised of industrial units that contribute more than 25,000 CO2e metric tons (MT) through product use and processes. The only entity included in Bloomington's city boundary is the IU Central Heating Plant (IU CHP). It should be noted that the IU CHP emissions are organized under the Stationary Energy sector.

AFOLU emissions were not accounted for because Bloomington does not have agricultural land use that would contribute to emissions substantially.

Lastly, Process and Fugitive emissions are included through fugitive emissions from natural gas distribution.

Upstream Impact emissions are accounted for in electric power transmission and distribution losses.

These sectors were further broken down by scope. The GPC provides a three scope method for understanding GHG emissions accounting.

- Scope 1 pertains to all emissions that come from activity that occurs within the city's geographic boundary. For example, emissions from a vehicle driving within the city boundary.

- Scope 2 includes emissions generated from grid-supplied electricity, heat, or steam purchased by those acting within the city's geographic boundary, such as electricity provided by Duke Energy.

- Scope 3 contains emissions that are generated outside of the city's geographic boundary, but are caused by activities occurring within the city boundary. A student traveling by plane from an airport outside of the city's geographic boundary to a destination far away would be an example of scope 3 emissions.

QUANTIFICATION METHOD

To estimate GHG emissions from the various sectors in Bloomington, a calculation-based methodology was used. This method involves acquiring activity data from a GHG source and emission factors for the Midwestern region from the Environmental Protection Agency's eGrid report in order to calculate the total amount of CO2e (MT) produced by a specific source.

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 (in kWh), and annual vehicle miles traveled (VMT).

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 CO2/kWh of electricity).

To calculate emissions for each sector, the activity data was entered manually into the ClearPath system, along with the most recent 2016 eGrid emission factors, and then the software's calculations follow the Global Protocol Methodology to provide CO2e (MT) estimates.

Simplified equation example:
Activity Data (kWh) x Emission Factor (lbs CO2/kWh) = Emissions (lbs CO2)

COMMUNITY-WIDE INVENTORY - STATIONARY ENERGY

The purpose of the community-wide inventory is to estimate the total amount of greenhouse gas emissions produced by the City of Bloomington. The following sections provide information on data collection and calculation methods for each sector that contributes to GHG emissions across the Bloomington community.

Stationary Energy

The Stationary Energy sector emissions are generated from fuel combustion, grid-supplied electricity, as well as fugitive emissions released from generating, delivering, and consuming energy such as heat and electricity. Stationary energy systems that fall within scope 1 include the Indiana University Central Heating Plant and Vectren's natural gas for heating. Scope 2 accounts for emissions produced by all Duke Energy grid-supplied electricity, and scope 3 focuses on natural gas fugitive emissions as well as electric power transmission and distribution losses. The Environmental Protection Agency's 2016 eGrid emissions rates for subregion RFC West were used for CO2e stationary energy calculations.

Scope 1 - Non-Utility Fuel Combustion within the City Boundary

The two entities that are categorized as non-utility fuel combustion include Indiana University's Central Heating Plant (IU CHP) and Vectren's natural gas. IU CHP is located on campus within the city's boundary and it provides heat to the campus community. The three types of fossil fuels used by IU CHP are natural gas, coal, and #1 distillate low-sulfur fuel oil. Over the past few years, IU CHP has made a significant shift from coal to natural gas at the plant. Total emissions from this entity amounted to 85,252 carbon dioxide equivalent (CO2e) in metric tons (MT).

Vectren supplies residential, commercial, and industrial buildings in Bloomington with natural gas for heating systems. Vectren provided aggregated data for the following zip codes: 47401, 47402, 47403, 47404, 47405, 47406, 47407, and 47408; these zip codes account for the entire geographic area of Bloomington and they also capture natural gas use for most of Monroe County. To resolve the issue of zip codes branching out beyond the city limits and into the county, population scaling, using the 2018 Bloomington and Monroe County populations from the U.S. Census, was used to scale down the natural gas estimate.

This calculation provides a more representative value for natural gas use within Bloomington's city limits. The total quantities of natural gas supplied to residential, commercial, and industrial buildings were 11,991,450, 6,446,408, and 44,287 therms, respectively.

Bloomington's total emissions from natural gas use amounted to 98,299 CO2e (MT).

Fugitive Emissions from Natural Gas DistributionVectren's natural gas supply contributes to emissions beyond the energy used at the point of consumption (i.e., heating for households and businesses). Throughout the distribution process, fugitive emissions from natural gas—primarily methane—are released and these must be accounted for in scope 3 because they are not included in the natural gas use totals that Vectren supplied. With an assumed Leakage Rate of 0.3%, Natural Gas Energy Density of 1,028 btu/scf, Natural Gas Density of 0.8 kg per meter cubed, a Natural Gas composition percentage of CH4 at 94%, a Natural Gas percentage composition of CO2 at 1%, and the total quantity of natural gas used in Bloomington being 18,482,145 therms, the estimated CO2e from fugitive natural gas is 3,206 CO2e (MT).

Scope 2 - Grid Supplied Electricity

The primary electricity provider in Bloomington is Duke Energy.

The utility company provided data for residential, commercial, industrial, government, and unknown electricity use. Data analysts acquired the data through a system query searching for entities designated as "City of Bloomington." One issue with this query is that not all locations designated as the City of Bloomington in their system lie within Bloomington's city boundary. This is problematic because electricity use in the greater Monroe County area is included, and so the data overestimates Bloomington's electricity use. Population scaling could not be used to remedy the overestimation issue because it was not possible to determine the true population the electricity data represents.

Overall, the data are not a perfect representation of electricity use isolated to Bloomington's geographic boundary and population.

The total quantity of electricity used by the residential sector—the largest electricity user—is 562,270,593 kilo-watt hours (kWh). In terms of GHGs, this totals to 382,952 CO2e (MT). The second largest energy sector, commercial, used 420,638,053 kWh—equivalent to 273,062 CO2e (MT). Bloomington's industrial entities used 173,471,915 kWh of electricity in 2018—equivalent to 183,959 CO2e (MT). The government and unknown sectors used 294,425,924 and 10,058,642 kWh, respectively. Together, these sectors contribute 172,842 CO2e (MT). The government sector includes City of Bloomington local government operations and Monroe County government operations.

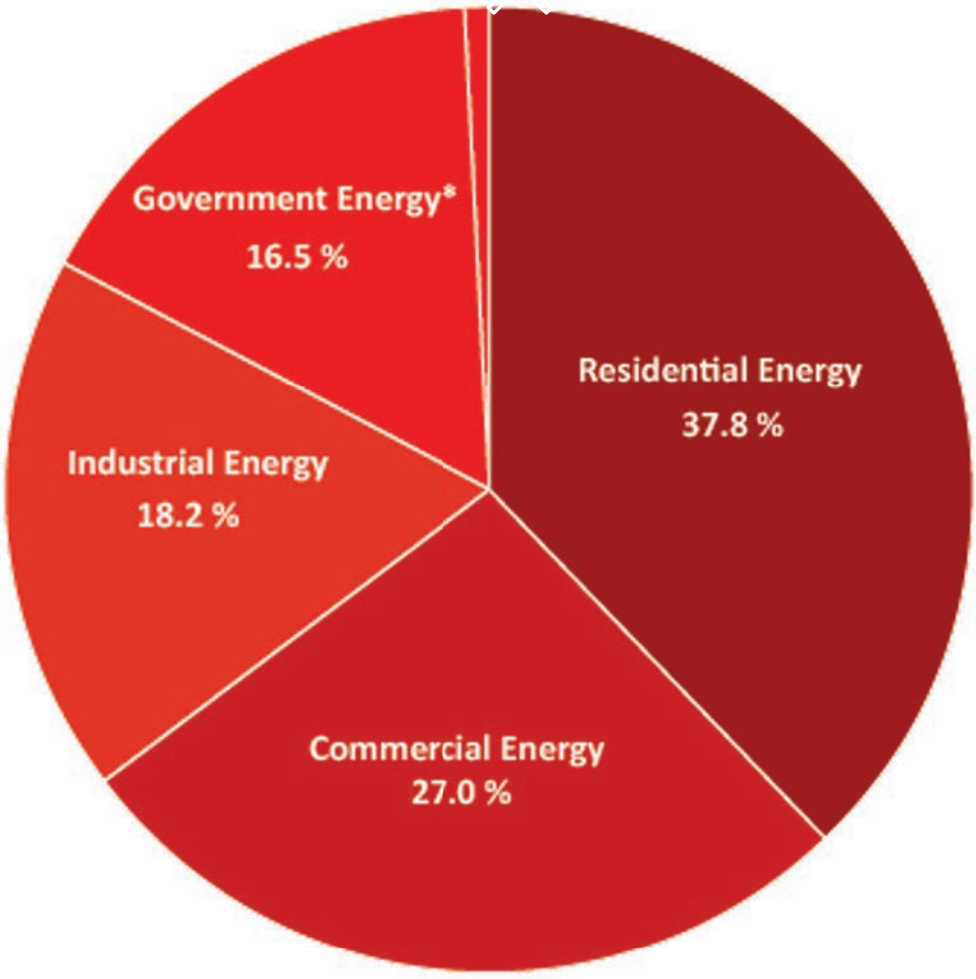
Scope 3 - Reported in Other Scope 3 Upstream Impacts

Scope 3 Stationary Energy accounts for GHG emissions from electricity loss through transmission and distribution. More detailed information can be found in the Other Scope 3 section.

Stationary Energy Community-wide Estimates

Total CO2e Emissions from Residential Energy sector: 382,952 CO2e (MT).
Total CO2e Emissions from Commercial Energy sector: 273,062 CO2e (MT).
Total CO2e Emissions from Industrial Energy sector: 183,959 CO2e (MT).
Total CO2e Emissions from Government Energy and Unknown Energy sectors: 172,842 CO2e (MT).

Total CO2e Community-wide Emissions from Stationary Energy sector: 1,012,815 CO2e (MT).



COMMUNITY-WIDE INVENTORY - TRANSPORTATION

Transportation

The Transportation sector seeks to account for all GHG emissions from automobiles, trains, aviation, boats and ships, and public transit systems that are either reliant on fuel or grid-supplied electricity. Transportation mechanisms in Bloomington that fall within scope 1 emissions include on-road transportation, off-road transportation, public transit, railways, and water-borne navigation. In Bloomington, scope 2 emissions are not applicable because the city lacks substantial use of electric vehicles that rely on grid-supplied electricity. Scope 3 emissions account for emissions produced outside of the city boundary as a result of populations and activity in Bloomington. Emissions factors from the National Default Vehicle Fuel Efficiency & Emissions Factors dataset were used to calculate CO2e from transportation.

Scope 1 - Transportation Emissions Occurring Within the City Boundary

On-Road Transportation

On-road transportation data refers to Vehicle Miles Traveled (VMT) by vehicles traveling within and between city limits. City-level on-road transportation data was acquired from the Indiana Department of Transportation (INDOT) Traffic Statistics Department. Note that this includes all types of roads categorized by IDEM under "Bloomington"in 2018 and includes roads that were reclassified from rural to Bloomington after the completion of the I-69 project

The data includes daily VMT estimates for passenger (non-commercial) and freight (commercial) vehicles for Bloomington in 2018. INDOT collects these estimates using two traffic monitoring systems, a Statewide Traffic Monitoring Systems and a Statewide Coverage Count Program that uses continuous count stations and portable traffic counters, respectively; the data are warehoused in a Traffic Count Database System (TCDS). The 2018 daily VMT for commercial vehicles is 178,613 VMT while non-commercial vehicles is 2,225,046 VMT. The total annual CO2e associated with 2018 on-road transportation is 383,977 MT. It is assumed that these estimates adequately account for the fact that transboundary vehicle movement occurs within the city boundary where some trips start within the boundary but end outside the boundary, start outside the boundary and end within the boundary, and cross through the boundary without stopping.

Off-Road Transportation

Off-road transportation data refers to vehicles used for off-road purposes, such as forklifts, snowmobiles, agriculture tractors. ICLEI provided 2017 CO2e data for Monroe County using the Environmental Protection Agency's MOVES software. Population scaling was used to estimate the amount of CO2e emissions due to Bloomington's activity. The total off-road transportation CO2e is 50,202 MT.

Public Transit

The public transit system in Bloomington includes Bloomington Transit and the Indiana University bus fleet for on campus transportation. The Bloomington Transit General Manager provided data on fuel type and quantity, VMT, and the number of passenger boardings. In 2018, Bloomington Transit used 275,288 gallons of diesel and 33,335 gallons of gasoline. IU's bus fleet data was collected from the IU Campus Bus Director who provided information on fuel type and quantity, VMT, and passenger boardings. In 2018, the IU Bus Fleet used approximately 100,000 gallons of diesel. In 2018, Bloomington Transit produced 3,104 CO2e (MT) and IU's bus fleet contributed 1,021 CO2e (MT). Bloomington public transit systems produced 4,125 CO2e (MT).

Railways

While there is a railroad track that runs through Bloomington, primarily carrying freight, emissions from this transportation type were not accounted for in the 2018 inventory. This is because the railway does not stop or start within the boundary. Since Bloomington activity does not drive the emissions from this source, it is not appropriate to include these emissions in the final CO2e MT estimate for transportation and mobile sources.

Water-Borne Navigation

Bloomington does not have large water bodies that are used for water-borne navigation within the city boundary. It should be noted that recreational boating activity occurs outside of Bloomington's city boundary on Monroe Lake. Approximating emissions from this location that are specifically caused by Bloomington's population would be difficult and was not included in this report.

Scope 2 - Emissions from Grid-Supplied Electricity Used in the City for Transportation

Scope 2 emissions are not applicable because grid-supplied electricity use for electric vehicles is not prevalent in Bloomington.

Scope 3 - Transportation Emissions from Transboundary Journeys Occurring Outside the City Boundary

Aviation

While the City of Bloomington does not have an airport within the city boundary, Bloomington's activity does contribute to aviation emissions that occur outside the city boundary. More specifically, Bloomington residents use the Indianapolis International and Monroe County airports for air travel.

Data was acquired for the Monroe County airport's flights using data provided by the Monroe County Airport's Director of Aviation and the AirportIQ 5010 database. The Director of Aviation provided fuel type and quantity data while the AirportIQ database supplied information on 2014 local and itinerant flights. In 2018, Monroe County Airport used 581,149 gallons of fuel—of which 525,416 gallons were jet fuel and 55,733 gallons were aviation gasoline. It was estimated that the proportion of aviation fuel use attributable to Bloomington activity contributed 5,302 CO2e (MT).

Data for flights from the Indianapolis International Airport were not acquired due to communication and time constraints. In the future, Indianapolis International Airport passenger surveys and fuel use data would support CO2e calculations associated with air travel from this airport.

Transportation Estimates

Total CO2e Emissions from On-Road Transportation Sources: 383,977 CO2e (MT).

Total CO2e Emissions from Off-Road Transportation Sources: 50,202 CO2e (MT).

Total CO2e Emissions from Public Transit Sources: 4,125 CO2e (MT).

Total CO2e Emissions from Aviation Sources: 5,302 CO2e (MT).

Total CO2e Community-wide Emissions from Transportation & Mobile Sources: 443,554 CO2e (MT).

COMMUNITY-WIDE INVENTORY - SOLID WASTE & WATER

Greenhouse gas emissions from waste generation are from the large amounts of methane generate at landfill sites. Bloomington does not have a landfill site located within the city boundary, and so emissions for this sector are categorized under scope 3. Wastewater treatment and water supply GHG emissions come from the electricity used to power the treatment and supply plants, tank operations, and booster and lift stations. Emissions related to water are from multiple booster and lift stations, the Blucher Poole and Dillman Wastewater Treatment plants, and the Monroe Intake Tower and Plant, all three of which are located outside the city boundary.

Scope 1 - Waste Emissions from Waste Treated Within the City Boundary

This section is not applicable in Bloomington because waste generated by the Bloomington population is not treated within the city boundary.

Scope 2 - Grid-Supplied Electricity for Wastewater Treatment & Water Supply

Electricity use for Wastewater Treatment and Water Supply plants operated by the City of Bloomington Utilities (CBU) could be included in this inventory's stationary energy sector.

However, this inventory calculated emissions for water supply & wastewater separately to obtain a more detailed understanding of emissions from this sector. Population scaling was used for CO2e estimates because CBU services a small population on the outskirts of the city boundary. The total amount of electricity used was 24,428,531 kWh—resulting in 15,610 CO2e (MT).

Scope 3 - Waste Emissions from Waste Generated Outside the City Boundary

Waste

Bloomington has a complex waste disposal system because there are numerous actors and pathways in the waste system. The City's Sanitation department collects waste from single-family residences while Republic Services, along with other private haulers, collects waste from various locations in Bloomington. There are many other companies landfilling Bloomington's waste that need to be considered when gathering this data.

The main complication with compiling waste generation data is that landfill waste from Bloomington travels through a complex route system by a variety of waste collectors. It is common for waste collectors to collect waste within Bloomington's city boundary and then collect waste outside the city boundary on the same route before reaching the landfill. This makes it difficult to determine exactly how much of the waste disposed at a landfill is attributable to Bloomington.

To resolve this issue, the Indiana Department of Environmental Management (IDEM) Office of Land Quality's county-level data was used to estimate emissions from Bloomington's landfilled waste. By using IDEM's Complete Solid Waste Quarterly Report Database's 2018 report, we estimated the total tonnage of waste received based on Monroe County's listing as the origin county. Population scaling was used to scale down the county-level estimate. The 2018 derived waste estimate for the City of Bloomington was 141,081 tons—resulting in 130,812 CO2e (MT).

Composting

The two types of composting that exist in Bloomington are the composting of green waste and bio-waste. Green waste is composed of plant waste such as grass and yard trimmings while bio-waste is defined as separated organic household waste, Residential food waste. In Bloomington, green waste is collected by the City's Sanitation and Landscaping departments.

The City Sanitation department collects yard trimmings from households. In 2018, the Sanitation department collected 83 tons of green waste. The Landscaping department composts plant materials and composted 30 tons of green waste. Decomposition of these materials results in GHG emissions that is included in the total CO2e estimate for the waste sector. This green waste compost amounted to approximately 8 CO2e (MT).

Green Camino, a local composting company, collects bio-waste compost from residential homes and businesses throughout Bloomington. In 2018, Green Camino collected approximately 15 tons of compost across Bloomington. This amounted to 0.61072 CO2e (MT) from bio-waste composting. Bio-waste composting is designated under scope 3 because the service's farm, where the composting is processed, is located outside the city boundary.

Solid Waste & Water Estimates

Total CO2e Emissions from the Waste sector (Waste & Composting): 130,820 CO2e (MT).

Total CO2e Emissions from the Water Supply & Wastewater sector: 15,610 CO2e (MT).

COMMUNITY-WIDE INVENTORY- IPPU

The IPPU sector accounts for emissions that result from non-energy related industrial activities and product uses. This includes, emissions from cement, lime, and glass production, as well as chemical and metal industry emissions. ICLEI recommended using the EPA Flight tool to establish industrial actors within the city boundary. The only industrial unit in Bloomington listed in EPA Flight is the IU CHP and these emissions are already accounted for in the Stationary Energy sector scope 1.

Scope 1 - Emissions from Industrial Processes and Product Uses Occurring Within the City Boundary

This section does not apply to Bloomington because the only entity large enough, IU CHP, is already accounted for in Stationary Energy scope 1. This unit was identified using the EPA Flight database that tracks GHG emissions from industrial units contributing more than 25,000 CO2e (MT).

Scope 2 - Not Applicable

All emissions from the use of grid-supplied electricity in industrial or manufacturing facilities within the city boundary are reported under scope 2 in Stationary Energy. There are also no large, GHG-emitting manufacturing or construction industries operating within Bloomington's city limits listed in EPA Flight.

Scope 3 - Other Out-of-Boundary Emissions

Other IPPU entities that exist outside of the city boundary and release emissions from processes and product use due to Bloomington activity were not identified for the 2018 inventory.

Agriculture, Forestry, and Land Use (AFOLU)

Accounting for AFOLU emissions for City of Bloomington is unnecessary because Bloomington does not have a significant amount of agricultural activity, forest removal, or timber harvesting practices that occur within the city boundary.

COMMUNITY-WIDE INVENTORY OTHER SCOPE 3

Other scope 3 emissions include emissions produced outside the city boundary, along with emissions that are not accounted for in the Stationary Energy use totals because some electricity supplied is lost in route to the final destination.

Upstream Impacts & Activities Electric Power Transmission And Distribution Losses

Similar to fugitive emissions from natural gas, electricity is lost during the transmission and distribution process. Because Duke Energy's electricity consumption data for residential, commercial, and industrial entities does not include kilo-watt hours of electricity lost, these losses are accounted for in scope 3 Upstream Impacts and Activities. To estimate electricity loss during power transmission and distribution (T&D), data from the U.S. Energy Information Administration's (EIA) Indiana State Profile on Average Electricity Loss were used for calculations.

EIA provides total annual T&D losses in each State Electricity Profile, which is used to apply a grid loss factor to the total amount of electricity delivered and used at the point of consumption. The grid loss factor for Indiana is 0.051268. Electricity loss from electricity delivered to residential units contributed 16,362 CO2e (MT). Electricity loss from electricity delivered to commercial units contributed 12,242 CO2e (MT). Electricity loss from electricity delivered to industrial units contributed 5,048 CO2e (MT). Total electricity loss from electricity delivered to Bloomington's residential, commercial, and industrial entities contributed 33,652 CO2e (MT).

LOCAL GOVERNMENT (CITY) OPERATIONS INVENTORY

The purpose of the local government operations inventory is to estimate the total amount of GHG emissions produced by City operations in Bloomington. The goal is to collect emissions data for sectors where the local government can effect change. This will allow the local government to determine which sectors contribute most and establish where GHG reductions should be targeted. The following sections provide information on data collection and calculation methods for each local government sector.

Buildings & Facilities

The City's buildings and facilities use electricity and natural gas for daily operations. The 2018 electricity use for City-owned and operated properties was broken down into the following categories: City Hall Showers Building, Parks & Recreation, Public Works, Police Department, and Fire Department. Duke Energy provided electricity use data for all City-owned electricity accounts. The City's 2018 natural gas use, provided by Vectren, was aggregated into one estimate for all City-owned and operated buildings and facilities.

The total amount of electricity used at the City Hall Showers Building in 2018 was 826,578 kWh—contributing 469 CO2e (MT).

Parks & Recreation used a total of 1,754,864 kWh—resulting in 996 CO2e (MT).

Public Works used a total of 845,867 kWh—contributing 480 CO2e (MT).

The Police Department's facilities used a total of 810,759 kWh—resulting in 460 CO2e (MT). Lastly, the Fire Department's facilities used a total of 309,419 kWh—contributing 176 CO2e (MT).

The 2018 aggregate electricity use across all of the aforementioned city-owned and operated buildings and facilities is 4,547,487 kWh, resulting in 2,581 CO2e (MT). The 2018 aggregate natural gas use across all City-owned and operated buildings and facilities is 245,129 therms, resulting in 1,304 CO2e (MT). The total amount of CO2e from City of Bloomington Buildings and Facilities is 3,885 CO2e (MT).

Street Lights & Traffic Signals

A portion of Bloomington's street lights and traffic signals are operated by the City. There are many more street lights throughout Bloomington; however, most street lights' energy use is connected to individual property meters in Bloomington. Typically, a property owner for a commercial business is fiscally responsible for electricity use from street lights located outside their business.

All traffic lights within the city boundary are operated by the local government's Public Works department. The 2018 estimated amount of electricity used by city-operated street lights and traffic signals is 2,765,524 kWh. In 2018, the total emissions contributed by City operated street lights and traffic signals is 1,570 CO2e (MT).

Vehicle Fleet

The City of Bloomington's vehicle fleet is comprised of Police Department, Fire Department, Facilities, and day-use vehicles owned by the City. The City used three different types of fuel for fleet operations: biodiesel (B20 & B5), unleaded gasoline, and diesel for off-road vehicles. The total amount of biodiesel used in 2018 was 144,601 gallons—contributing 1,236 CO2e (MT). The total amount of diesel used in 2018 was 1,347 gallons—contributing 14 CO2e (MT). The total amount of unleaded gasoline used in 2018 was 150,853 gallons—contributing 1,325 CO2e (MT). Overall, the City's vehicle fleet contributed 2,575 CO2e (MT).

Transit Fleet

The main public transit system in the City of Bloomington is Bloomington Transit (BT), which is owned by the Bloomington Public Transportation Corporation, a municipal corporation. The Bloomington Transit General Manager provided data on fuel type and quantity, VMT, and the number of passenger boardings. In 2018, Bloomington Transit produced 2,716 CO2e (MT). More details on fuel use data can be found in the Community-wide inventory public transit section.

Employee Commute

Employee Commute to Work
In 2018, the Economic and Sustainable Development Department sent an Employee Commute Survey to all city employees and this survey received approximately 200 responses. This data was used to estimate the 2018 annual VMT by city employees. City employees produced an estimated 901 CO2e (MT) commuting to and from work.

Employee Air Travel

The City's Controller's Office collects data on all work related flights made by employees. The burning of jet fuel and aviation gasoline from these flights contributes to GHG emissions. The total amount of aviation passenger miles traveled was calculated using flight destination information to determine the distance in flight miles. The underlying assumption for this calculation was that all flights were direct out of the Indianapolis International Airport. The estimated total passenger miles traveled by city employees was 42,875 in 2018. These flights contributed approximately 7 CO2e (MT) that year.The total amount of GHG emissions associated with employee commuting is 908 CO2e (MT).

Electric Power Production

The City of Bloomington does not participate in any non-renewable power production at the municipal level. All grid-supplied electricity within the city boundary is provided by Duke Energy. However, the City has 31 on-site solar installations across multiple facilities and buildings that generate electricity. In 2018, solar panels at City facilities generated over 1.9 million kWh of electricity.

Solid Waste Facilities

Data to accurately capture the amount of solid waste generated by local government operations was not available due to measurement obstacles. However, data was available for emissions from composting in local government operations. Approximately 113 tons of green waste compost contributed 8 CO_2e (MT) while 15 tons of bio-waste compost from departments contributed 0.6 CO_2e (MT).

Water & Wastewater Treatment Facilities

The City of Bloomington Utilities (CBU), a municipal water and wastewater utility, contributes the largest amount of GHG emissions in local government operations. Wastewater and water supply systems rely on electricity to operate plants, tanks, and lift and booster stations. Emissions for this sector come from the Blucher Poole and Dillman Wastewater Treatment plants, the Monroe Intake Tower and Plant, as well as multiple booster and lift stations. Population scaling was not used for the local government operations inventory because the goal was to capture the total emissions associated with all wastewater and water supply plant operations—regardless of population served inside and outside the city boundary. Total CO_2e Emissions from the CBU's Water Supply & Wastewater Treatment system is 16,594 (MT).

Process & Fugitive Emissions

The report attempted to collect data on hydrofluorocarbon & refrigerant emissions associated with City of Bloomington air conditioning in HVAC systems, but data collection was not possible at the time.

MORE INFORMATION & ACKNOWLEDGEMENTS

For more information, please contact the City of Bloomington's Department of Economic and Sustainable Development at 812-349-3418 or via email at sustain@bloomington.in.gov.

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GLOSSARY

Terms

CO_2 **Carbon Dioxide-**

the most common greenhouse gas released by human activity. Carbon dioxide is emitted whenever coal, oil, natural gas, and other fossil fuels are burned. Carbon dioxide is also released through human activities such as deforestation, land use changes, and other activities.

CO_2e **Carbon Dioxide Equivalent-**

a term used to compare the global warming potential of various greenhouse gases. For instance, releasing 1 kg of methane causes 25 times more warming than 1 kg of carbon dioxide (methane has a global warming potential of 25) so the carbon dioxide equivalent (CO_2e) of 1 kg of methane is 25 kg CO_2e. This provides a common unit of comparison across different greenhouse gases.

EIA **Energy Information Administration-**

a federal government agency that collects, analyzes, and disseminates independent and impartial energy information to promote sound policy making, efficient markets, and public understanding of energy and its interaction with the economy and the environment.

ESD **Economic and Sustainable Development Department-**

a department of the City of Bloomington that works to cultivate a resilient community built on shared prosperity, economic opportunity, environmental stewardship, and a thriving arts and culture ecosystem.

FOSSIL FUELS **Fossil Fuels-**

a group of non-renewable energy sources, including oil, coal, and natural gas, formed from the remains of ancient organisms. Fossil fuels contain mainly carbon that when burned, forms carbon dioxide, a greenhouse gas.

GCOM **Global Covenant of Mayors-**

GCoM is the largest global alliance for city climate leadership, built upon the commitment of over 10,000 cities and local governments. The alliance's mission is to mobilize and support climate and energy action in communities across the world. Bloomington joined in 2019.

GPC

Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories -

a robust, transparent and globally-accepted framework that cities and local governments can use to consistently identify, calculate and report on city greenhouse gas emissions.

GREEN-HOUSE EFFECT

Greenhouse Effect-

a process that occurs when the Sun's energy reaches the Earth's atmosphere. At that point, some of that energy is reflected directly back into space and the rest is trapped by greenhouse gases in the atmosphere to warm the Earth's surface. Increasing amounts of greenhouse gases in the atmosphere trap excess energy as heat, which is absorbed by land, the ocean, and the atmosphere, creating a warming effect globally.

GHG

Greenhouse Gas-

gases that trap heat in the atmosphere (i.e., carbon dioxide, methane, nitrous oxide, and fluorinated gases). The contribution to climate change depends on the abundance of the gas, how long the gas remains, and the strength of the impact on the atmosphere (see global warming potential).

GWP

Global Warming Potential-

GWP is a unit of measurement that allows for comparisons of the global warming impacts of different gases—how long the gas remains in the atmosphere on average and how strongly the gas absorbs energy. Specifically, it is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO_2). The larger the GWP, the more that a given gas warms the Earth compared to CO_2 over that time period. The time period usually used for GWPs is 100 years.

ICLEI

ICLEI Local Governments for Sustainability-

a membership organization for local governments to pursue reductions in carbon pollution and improvements in advancing sustainable urban development. ICLEI's members and team of experts work together through peer exchange, partnerships and capacity building to create systemic change for urban sustainability.

IDEM

Indiana Department of Environmental Management-

state-level environmental agency that implements federal and state regulations to protect human health and the environment. Staff members inspect and monitor regulated entities, provide compliance and technical assistance, monitor and assess air, land, and water quality; use enforcement actions as necessary to ensure compliance, and respond to incidents involving spills to soil or waters of the state.

INDOT — **Indiana Department of Transportation** -

state-level transportation agency responsible for constructing and maintaining interstate highways, U.S. routes and state roads in Indiana, including adjacent overpasses, ramps and traffic control devices, including signs and traffic signals, on these roadways.

IU — **Indiana University (Bloomington)**-

a public research institution founded in 1820, Indiana University Bloomington is the flagship and largest campus of the Indiana University system with over 40,000 students.

IU CHP — **IU Central Heating Plant**-

Indiana University Bloomington's Central Heating Plant uses natural gas, coal, and distillate fuel oil to provide the Bloomington campus with heat.

IU ERI — **IU Environmental Resilience Institute**-

a research institute funded through Indiana University's Prepared for Environmental Change Grand Challenge Initiative. The Institute develops forecasts, strategies, and communication resources to enhance the resilience of Indiana, the Midwest, and beyond to environmental change.

KWH — **Kilowatt Hour**-

a measure of electrical energy equivalent to a power consumption of 1,00 watts for one hour.

MITI-GATION — **Mitigation**-

actions taken to limit the magnitude or rate of long-term global warming and its related effects. Climate change mitigation generally involves reductions in human emissions of greenhouse gases.

MT — **Metric Tons**-

a unit of weight equal to 1,000 kilograms (2,205 lbs)

SAP — **Sustainability Action Plan**-

In 2018, the City of Bloomington developed a five-year strategic plan for Bloomington's sustainability initiatives that identifies both short- and long-term goals and actions in City operations and within the broader community. The plan includes an evaluation and reporting mechanism for a comprehensive, community sustainability program that references environmental, economic, and equity elements

VMT — **Vehicle Miles Traveled**-

measures the amount of travel for all vehicles in a geographic region over a given period of time, typically a one-year period. it is calculated as the sum of the number of miles traveled by each vehicle class over that time span.

SUSTAINABILITY TIMELINE

1970s

1970
- First Earth Day Celebration

1971
- Environmental Commission (EC) formed

1974
- Bloomington Farmers' Market begins

1980s

1984
- Bloomington recognized as Indiana's first Tree City USA by the National Arbor Day Foundation
- Bloomington Community Garden Development

1989
- Bloomington Bicycle and Pedestrian Safety Commission formed

1990s

1991
- First Growth Policies Plan published

1992
- Rio Earth Summit Tree Commission formed

1997
- Kyoto Protocol passed

2000s

2001
- First Bloomington Environmental Quality Indicators (BEQI) report published

2003
- Environmental Commission published "Towards a Comprehensive Greenspace Plan,"

2005
- US Mayors Climate Protection Agreement published
- Bloomington Commission on Sustainability (BCOS) formed
- Miller Showers Park recognized by the Indiana Urban Forest Council- Outstanding Project Award
- Ordinance 08-18 passes establishing the Department of Economic and Sustainable Development

2006
- Mayor Kruzan signed the Climate Protection Agreement
- Environmental Commission - "A Framework for Developing a Greenhouse Gas Reduction"
- Environmental Commission publishes Bloomington Environmental Quality Indicators report
- City of Bloomington Green Team formed to identify improvements for municipal operations

2009
- City Council passed Ordinance 09-04 for all City buildings to be designed utilizing LEED standards
- Peak Oil Task Force published "Redefining Prosperity: Energy Descent and Community Resilience"
- Environmental Commission published "Baseline Greenspace Inventory & Assessment: Monroe County, Indiana 1998/1999"

2010-2015

2010

- Bloomington Transit rated as an Outstanding Public Transportation System
- Hoosier to Hoosier Sale starts at Memorial Stadium

2012

- The first "Local Government Operations Energy Use and Inventory" is published by City
- City Hall earns first LEED Existing Building Operations and Maintenance Certification

2014

- EC published "Greenspace Trends Report 2007 – 2011"
- Bloomington named a Gold Bicycle Friendly Community by the League of American Bicyclists
- Downtown Transit Center built to LEED Silver standard

2015

- Bloomington Local Government Operations Energy Use and Emissions Inventory
- Monroe County Energy Challenge begins to provide energy assessments and weatherization, as well as education about energy efficiency to the community

2016- 2018

2016

- Bloomington named Bird Town Indiana by the Indiana Audubon Society
- Bloomington Parks and Recreation Master Plan released
- Bloomington Community-wide Greenhouse Gas Emissions Inventory is published

2017

- Mayor Hamilton commits to delivering on the promise of the Paris Agreement as a signatory to the Mayors Climate Protection Agenda
- Solarize Bloomington initiative begins and City puts solar on City Hall and the Police Station
- City of Bloomington commits to 5 mW of solar by signing guaranteed energy savings contract with Energy Systems Group to install over 15,000 ground mount and rooftop solar panels in more than 30 city managed facilities
- City of Bloomington Sanitation initiates its Waste Modernization initiative and switches to single-stream recycling for City customers

2018

- Bloomington City Council passes the Sustainability Action Plan
- Bloomington Parks and Recreation is awarded the National Gold Medal Award Winner for Excellence in Park and Recreation Management
- Bloomington Comprehensive Plan passed City Hall is certified LEED Gold for operations and maintenance
- Bloomington reports to Carbon Disclosure Project for the first time EPA's Brownfields Grant Program Award and Inventory Development begins in Bloomington
- New Tree Planting - City planted over 400 new trees in public right-of-way and park locations. Contractors and private developers planted another 82 trees, and three memorial tree plantings were performed at Bryan Park
- Bloomington's Bicentennial Bond Transportation Infrastructure Improvements
- Green Camino Composting Services begin in city facilities Bloomington Transit Route Optimization Study begins

2019

- Sustainability Action Plan Progress Report Issued
- City of Bloomington hires a Local Food Coordinator as part of the Indiana Farm Connect Program to increase local food purchasing
- City of Bloomington recognized by the EPA as a Green Power Partner
- City of Bloomington Utilities begins installation of smart water meters atresidences and businesses across the city
- Bloomington Public Transportation Corporation receives grant from for the transit agency's second battery-electric bus
- Bloomington Youth for Environmental Sustainability (Y.E.S.) Society passes resolution outlines ways to mitigate the effects of climate change
- City of Bloomington Utilities Stormwater Green Infrastructure Projects and Residential Grant Program
- Bloomington sends delegation to the Climate Leadership Summit in Goshen
- Mayor Hamilton joins the Global Covenant of Mayors and Solar Mayors
- Bloomington part of inaugural LEED for Cities and Communities reporting through U.S. Green Building Council
- City of Bloomington receives the Governor's Greening the Government award
- Bloomington Urban Forestry report update issued by Parks and Recreation
- Bloomington initiates Climate Vulnerability Assessment and Action Plan
- Friends of Lake Monroe was awarded $119,525 from the State of Indiana with matching funds coming from Monroe County Stormwater Board, City of Bloomington and Sassafras AUDUBON Society to hire a watershed coordinator
- Switchyard Park opens with 57.2 acres of parkland, 600+ trees, 100,000 sq. ft. of native plants and 2,000 reforestation seedlings and buildings designed to LEED Silver standards

What are the trends in each major activity category? (For illustrative purposes)

Historical Activity Data (for general trends only)

Category	2011 Data	Per capita 2011 pop= 81,505	2018 Data	Per capita 2018 pop= 84,981	% Change 2011-2018
Stationary Energy (Commercial, Industrial, Government, Residential grid supplied electricity) Data source: Duke	1,535,757,833 total kWh of electricity consumed by the community in one year (including gov. utilities)	18,842.5 kWh/ person/ yr	1,483,496,972 total kWh of electricity consumed by the community (including government utilities)	17,456.8 kWh/ person/yr	3.4% decrease in total kWh of electricity consumed by the community 7.25% decrease per capita in electricity consumed per capita
Transportation (total miles travelled on City of Bloomington Streets daily) Data source: Travel by County VMT, INDOT	754,000 miles travelled daily on City Streets 271,925,000 miles travelled yearly on City streets	9.25 miles/ person/ day 3,336.3 miles/ person/ yr	866,000 miles travelled daily on City Streets 316,090,000 miles travelled yearly on City streets	10.2 miles/ person/ day 3,719.5 miles/ person/ year	14.9% increase in the total number of miles travelled by vehicles on City Streets 11.5% increase in the total number of miles travelled per person in a year on City Streets
Waste (tons of municipal waste landfilled) Data source: Waste Received, Solid Waste Quarterly Report Database, scaled by population	130,239 tons of municipal waste landfilled in one year	1.6 tons of waste/ person/ yr	141,215 tons of municipal waste landfilled in one year	1.7 tons of waste/ person/ yr	8.5% increase in tons of total municipal waste landfilled in one year 3.9% increase in tons of municipal waste landfilled per person per year

What are the differences in methodology and data sources between GHG reports?

Sector	CO2e 2018 (MT)	2018 Data Sources	2016 Method, Sources	2005 Method
Transportation & Mobile Sources	443,554	INDOT VMT (City Specific) Traffic statistics Aviation- Monroe County Airport Off Road- EPA Moves	Key Difference- Transportation and Mobile Sources emissions not comparable due to lack of inclusion of aviation, off road, other VMT methodology differences INDOT VMT 2016 Traffic Data	x
Energy	**1,012,815**		Key difference- Uses 2014 eGrid electricity related emissions factor values for 2016 data (eGrid 2016 EF values are smaller)- this caused an overestimate in total emissions	x
Residential Energy	382,952	Duke, Vectren	Duke, Vectren	x
Commercial Energy	273,062	Duke, Vectren	Duke, Vectren	x
Industrial Energy	183,959	Duke, Vectren, IU CHP	Duke, Vectren, IU CHP	x
Government Energy*	167,132	Duke	Duke, Vectren	x
Unknown Energy	5,710	Duke	Duke	x
Solid Waste	**130,820**	IDEM Land Quality (County waste total scaled by 0.56 to estimate City impact based on 2018 Kessler report)	IDEM Land Quality (scaled to City), assumptions about methane capture	x
Upstream Impacts of Activities	33,652	Duke/ Energy Information Administration	Not measured	x
Water & Wastewater	15,610	City of Bloomington Utilities/ Duke/ IU	Not measured	x
Process & Fugitive Emissions	3,206	Vectren, ICLEI	Measured, but different calculations and assumptions about leakage rate	x