Johnson County, Iowa

Community (Countywide) Greenhouse Gas Emissions Inventories: 2010 Baseline and 2020

Produced by
Johnson County Planning, Development and Sustainability Department and
The University of Northern Iowa Center for Energy and Environmental Education
with assistance from ICLEI – Local Governments for Sustainability

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Acknowledgments

The Johnson County (Iowa) Board of Supervisors endorsed the effort to complete these first-ever community (countywide) GHG inventories for Johnson County. This report was co-managed and co-written by Becky Soglin, sustainability coordinator, **Johnson County Planning, Development and Sustainability** (PDS) **Department**, and Cassandra Sonne, previous energy program manager, **University of Northern Iowa Center for Energy and Environmental Education** (UNI CEEE). The projections and activities section was written by Hannah Miller, program officer, **ICLEI.**

The report was reviewed by Josh Busard, PDS director, Johnson County; Kamyar Enshayan, UNI CEEE director; and Ashley Coffin, UNI CEEE assistant director.

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Linn County Rural Electric Cooperative
MidAmerican Energy
University of Iowa Power Plant

City of Iowa City

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The *Iowa City Communitywide Greenhouse Gas Inventory for 2017* and the *Linn County Baseline (2010) Inventory of Community Greenhouse Gas Emissions* were consulted during this inventory process.

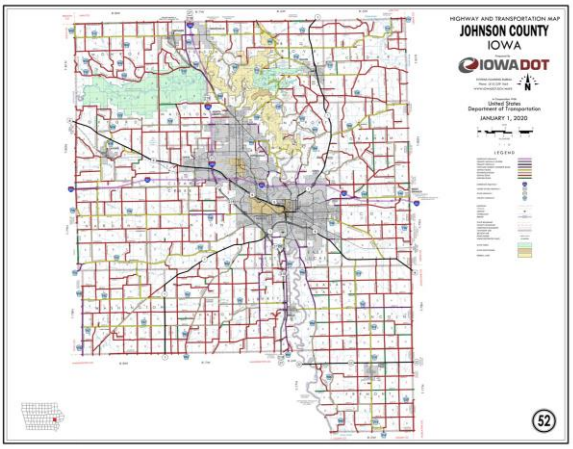
If you have questions or inquiries about these Johnson County inventories, please contact Planning, Development and Sustainability at greenteam@johnsoncountyiowa.gov or 319-356-6083.

TABLE OF CONTENTS

Note: This report uses “County” when referring to the Johnson County government and “county” when referring to the community (i.e. countywide) geographic area where people live, traverse or visit.

Introduction: Inventories and Action

Johnson County, one of the fastest-growing counties in Iowa, has a role in addressing climate change. Conducting a Greenhouse Gas (GHG) inventory is just one important step. These 2010 and 2020 community (i.e. countywide) inventories provide an emissions trajectory for the past decade and a baseline for measuring future emissions. The inventory findings can help the County and its residents, businesses, farms, cities, villages and other interested groups understand sources of emissions, identify ways to reduce GHGs, and strengthen or build collaborations for climate-related education, resilience and action.



Map Source: Iowa DOT, 2020

Why Greenhouse Gases Matter

Some greenhouse gases (GHGs) occur naturally, such as from the decay of plants. However, the burning of fossil fuels and other human-driven impacts have greatly increased GHG emissions since 1900. These emissions warm Earth, and effects on life are mostly negative and often inequitable. The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment comments, “Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.” The IPCC adds that warming beyond the 1.5°C (2.7°F) would cause irreversible damage.

Continental and local projections for Johnson County show increased temperatures and related changes in precipitation, which can negatively affect human health, crops and livestock, sensitive ecosystems, and how well buildings and roads withstand the elements. The IPCC documents that what is occurring is beyond natural climate variability. Already, more frequent extreme weather has led to serious disasters: flood (2008, 2013), high wind (2020) and drought. By assessing local past and recent GHG levels, Johnson County can identify and support informed emissions reduction and related climate responses. Effective efforts should consider equity, resiliency and ingenuity as well as the economy and the environment.

Community (countywide) versus Operational Inventories

Community inventories account for as many GHG emissions as possible related to an entire geographic or geopolitical area, in this case, the area of Johnson County, Iowa. In contrast, *operational*, or municipal, GHG inventories account solely for emissions related to a city or county government’s day-to-day activities. This is the first time Johnson County has completed community GHG inventories; operational inventories were completed for 2009, 2010 and 2017.

Greenhouse Gases (GHGs) and Carbon Dioxide Equivalent (CO2e) Measurement

Emissions counted within this community report include those generated within Johnson County and emissions generated elsewhere but caused by significant activities within the county. GHG emissions in the following **sectors** were measured: **commercial + industrial energy,**

residential energy, transportation, agriculture, stationary fuel, and solid waste. GHG emissions can sometimes be directly measured from the emitting sources; however, for the most part, emissions are calculated based on actual or estimated energy or fuel-related data such as actual kilowatts of electricity used or vehicle miles traveled. The Methodology section provides scientific information on GHGs and data collection. This report uses Carbon Dioxide Equivalent, or CO2e, as its primary unit of measure.

Johnson County Sustainability and Climate Action

The Johnson County Board of Supervisors, elected officials, department heads and staff have worked to address sustainability and climate change. Operationally, many policies and procedures were initiated in 2009, and efforts continue. The Johnson County 2018 Comprehensive Plan and the 2022 Johnson County Economic Development Plan for the Unincorporated Area and Smaller Towns include goals that relate to GHG emissions internally and externally. The Unified Development Ordinance (code) includes, for example, regulations for the safe operation of large-scale wind and solar within the county borders. Examples of County climate change efforts include a resolution about the Paris Climate Agreement, adding solar on County facilities, and hosting public education and engagement. Other focus areas have been energy conservation and efficiencies, adaptation training, bicycle transportation, materials reuse and sustainable construction (www.johnsoncountyiowa.gov/sustainability-milestones).

Many cities, businesses, and organizations as well as residents in Johnson County seek cleaner energy use and undertake sustainability efforts. The Sustainability Working Group of Johnson County brings government entities together for idea exchanges and collaborative work. As this report was being prepared, Congress was introducing the Inflation Reduction Act (IRA), which will provide opportunities and funding to respond effectively to the climate crisis.

ICLEI–Local Governments for Sustainability

ICLEI is a non-governmental organization engaged in sustainability efforts in more than 125 countries. Johnson County used ICLEI's proprietary ClearPath Climate Planner to complete its earlier, operational inventories. This software also provides a communitywide GHG inventory approach that is compliant with the U.S. Community Protocol. This community, or countywide, report also uses ClearPath Climate Planner. A GHG emission inventory is the first step in the ICLEI Five-Milestone Framework for GHG emission reductions (Figure 1). Local governments, including Johnson County, can take additional steps to advance goals, plans and policies to reduce GHGs.

Figure 1: ICLEI Climate Mitigation Milestone, Source: ICLEI

Methodology Overview

Greenhouse Gases and Carbon Dioxide Equivalents

The inventories count and assess emissions of the following greenhouse gases: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The protocol can analyze other GHGs; however, their amounts are considered negligible, so this report does not include them.

Methane (CH_4) and nitrous oxide (N_2O) emissions are converted to **carbon dioxide equivalents (CO_2e) or (CO2e)** using the Global Warming Potentials (GWPs) developed by the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment 100-Year GWP values.

GWPs are used to quantify the effects that different emissions will have on Earth over the next 100 years. Methane has a GWP of 28, or 28 times the heat-capturing ability of carbon dioxide. Nitrous oxide has 265 times the capacity of carbon dioxide. The higher the GWP, the more damage since the heat held in the atmosphere becomes higher. We report GHG emissions in **metric tons CO2e (MT CO2e)** (equivalent to 2,205 U.S. pounds).

Data Sources and Analysis

Greenhouse gas inventories obviously depend on data. However, energy is not always used or tracked in easily accessible ways. We made substantial efforts to gather and analyze data and produce an accurate, informative report; however, there were limitations specific to each particular sector. We summarize these issues below and provide more information in each Results Detail Section.

Greenhouse gas inventories are most useful when used over time, revealing shifts or trends. GHG emissions can sometimes be directly measured from the emitting source but for the most part they are calculated based on actual or estimated activity data using the equation:

Measured or Estimated Activity Data X Emission Factors = Emissions

Sectors: Six **sectors** were the primary categories evaluated**: commercial + industrial energy, residential energy, transportation, agriculture, steam + electrical generation, and solid waste**. Sectors relate to how most of us think about or use energy or resources. The sector data sets are described in the Results Detail section, and additional information is included in the Appendices. The following sectors were excluded due to their small contribution to the overall GHG footprint and/or difficulty in obtaining data: airport, water and wastewater values (representing likely less than 1 or 2% of countywide emissions), quarries and certain agricultural categories. In general, any sector that is likely less than 5% of the inventory emissions is excluded.

The report also considers **activities** and **sources**, and **scopes**. Links are provided to those sections.

Key Findings

This section provides primary findings. The Results Detail section provides analysis more specific to each sector (residential, transportation, etc.).

1. Communitywide GHG emissions decreased by nearly 28% from 2010 to 2020.

In 2010, total GHG emissions tabulated equaled 2,744,051 metric tons (MT) of CO2e compared to 1,980,665 MT CO2e in 2020, representing a 28.5% decrease over the decade (Table 1).

Table 1: Comparison of 2010 and 2020 communitywide GHG emissions

Total GHG Emissions 2010	2,744,051 metric tons of CO2e
Total GHG Emissions 2020	1,980,665 metric tons of CO2e

2. Emissions in all sectors decreased from 2010 to 2020 except for solid waste, which is a relatively small contributor to GHG emissions.

The sectors measured are commercial + industrial energy, residential energy, transportation, agriculture, stationary fuel mix and solid waste (Figure 2 and Table 2). Primary drivers of the overall emissions decrease were increased use of wind energy and decreased use of coal. Energy efficiency equipment changes and behavior likely also had an effect. Other reasons for the decrease may be slight increases in solar energy use, decreases in some commodity and crop production, and increased vehicle fuel efficiency. Effects of the Covid-19 pandemic, which began in March 2020, are not fully understood in terms of temporary or permanent impacts.

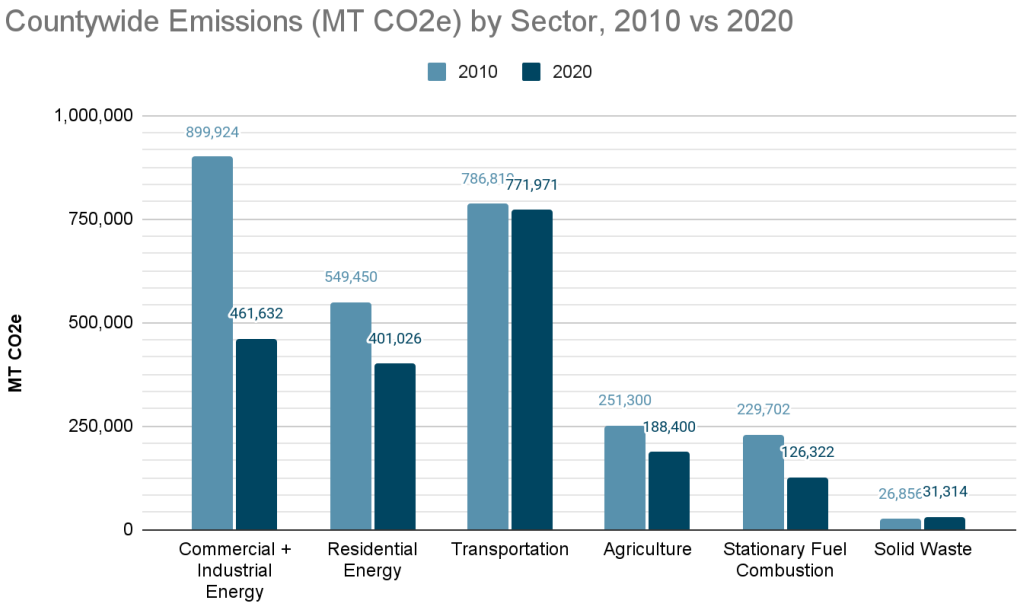


Figure 2: Countywide Emissions (MT CO2e) by Sector, 2010 vs 2020

3. Sectors where GHG emissions decreased from 2010 to 2020 saw 25% or greater reductions, except for transportation which decreased only 1.9%.

Table 2: Overall Emissions By Sector and Percent Change: 2010 versus 2020

Sector	2010 Emissions (MT CO2e)	2020 Emissions (MT CO2e)	Percent Change (+/-)
Commercial + Industrial Energy	899,924	461,632	- 48.7%
Residential Energy	549,450	401,026	- 27.0%
Transportation	786,819	771,971	- 1.9%
Agriculture	251,300	188,400	- 25.0%
Stationary Fuel Combustion (UI Power Plant only)	229,702	126,322	- 45.0%
Solid Waste	26,856	31,314	+ 16.6%
TOTAL OVERALL	**2,744,051**	**1,980,665**	- **27.8%**

4. From 2010 to 2020, despite a 1.9% decrease in actual Transportation-related emissions, Transportation supplanted Commercial and Industrial Energy as the predominant sector of measured emissions.

Commercial and Industrial Energy (blue shading) and **Transportation** (purple shading) (Figures 3 and 4) make up the largest proportions of emissions in both years but reversed their 1-2 order from 2010 to 2020. This change is largely due to energy use for commercial and industrial buildings and processes becoming cleaner, reducing emissions in this sector by nearly 49% (Table 2) and thereby decreasing from 32.8% to 23.3% of the measured emissions from 2010 to 2020 (Figures 3 and 4).

Meanwhile, outright transportation emissions decreased slightly from 2010 to 2020 by almost 2% (Table 2), but as a proportion of overall emissions, this sector increased from 28.7% to 39% in the same time-frame (Figures 3 and 4).

The four other categories experienced less dramatic shifts in proportions of measured emissions from 2010 to 2020 (Figures 3 and 4). **Solid Waste** increased slightly from 1.0% to 1.6%. The proportion of **Stationary Fuel** (for University of Iowa steam and electrical production) decreased from 8.4% to 6.4% as the University switched to cleaner energy production. **Agriculture** as a proportion roughly held steady, increasing from 9.2% to 9.5%, and the **Residential Energy** proportion increased marginally from 20% to 20.2%.

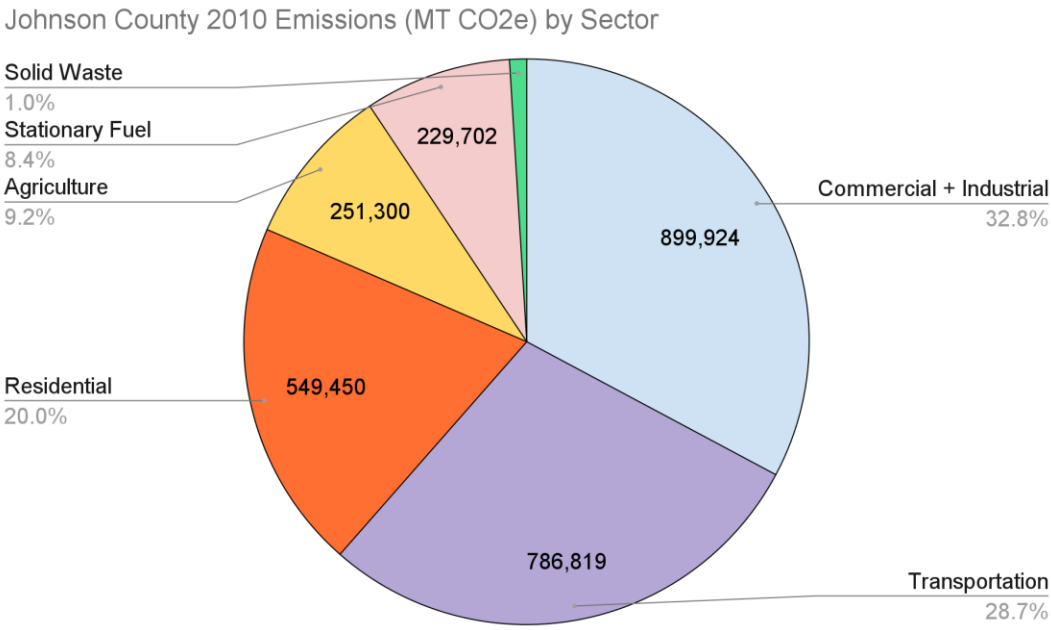


*Figure 3: Johnson County **2010** Countywide Emissions by Sector*

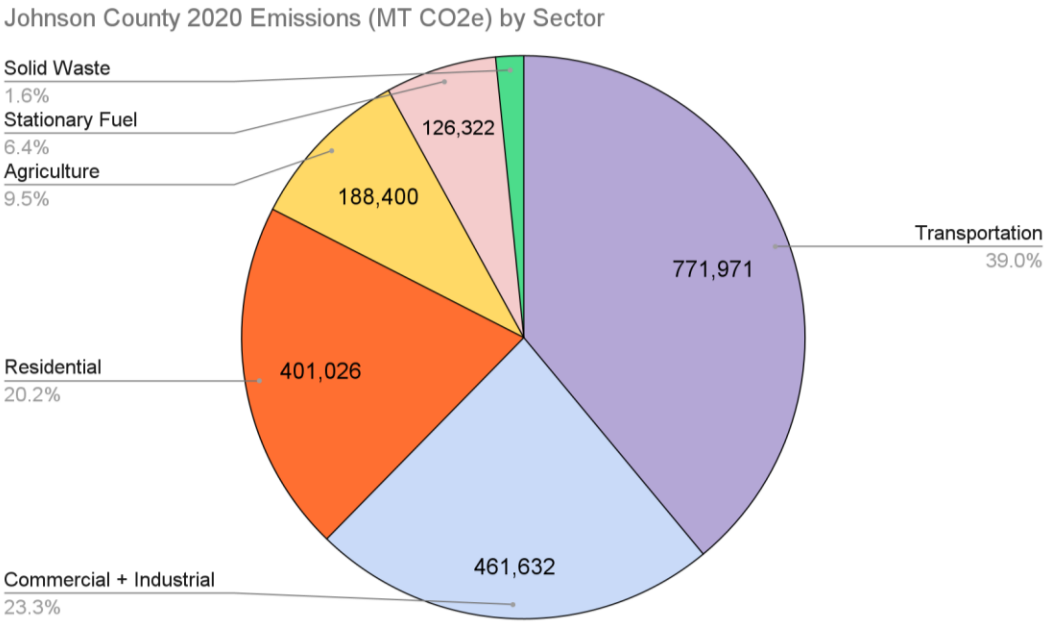
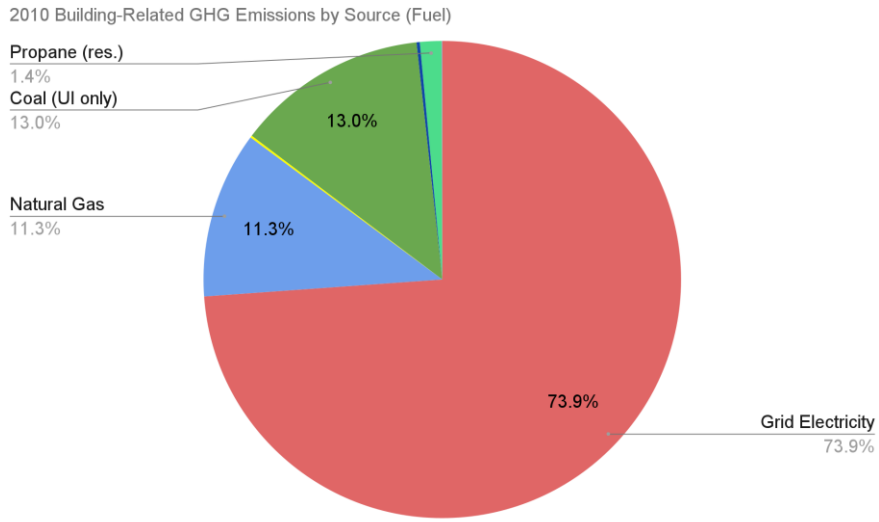


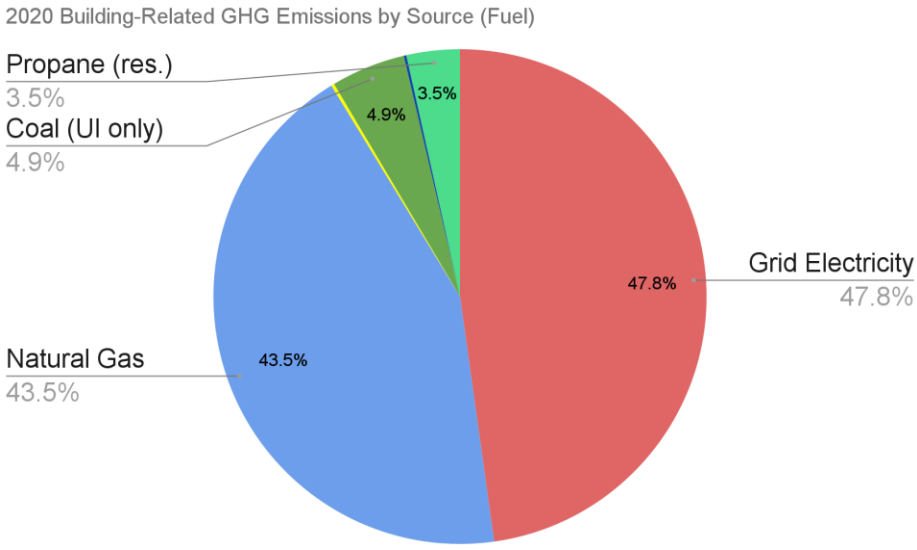
*Figure 4: Johnson County **2020** Countywide Emissions by Sector*

5. For building-related emissions, grid electricity remains the greatest source of GHG emissions. Natural gas GHG emissions increased as an outright value and proportionally became the second-most dominant source for buildings.

Building-related grid electricity GHG emissions decreased as a proportion from nearly 74% to nearly 48%, while those from natural gas increased as a proportion from 11.3% to 43.5% (Figures 5a and b). Natural gas GHG actual emissions increased outright by 13.8% (Table 3). Propane for residential use increased both in actual emissions and as a proportion of building-related emissions from 1.4% to 3.5%. Emission values shown for coal relate only to coal burned *within* the geographic boundaries of Johnson County and represented a lower proportion of building-fuel emissions in 2020 (4.9%) compared to 2010 (13%). (GHG emissions from coal burned at locations outside of Johnson County are not accounted for in these charts.)



Diesel, kerosene/distillates and wood make up the remaining .4%. Grid electricity contains additional coal-based GHGs.



Wood makes up the remaining .2%. Grid electricity contains additional coal-based GHGs.

Figures 5a and b: 2010 and 2020 Building-Related GHG Emissions

Values may not add up to 100% due to rounding.

Table 3: Natural Gas Related GHG Emissions for 2010 and 2020

Use Sources	2010 (metric tons CO2e)	2020 (metric tons CO2e)
Residential Natural Gas	165,604	175,573
Commercial/Industrial Natural Gas	172,764	176,195
UoI Natural Gas	39,326	78,159
TOTALS	**377,694**	**429,927**
PERCENT CHANGE		**+ 13.8%**

6. From a "fair share" point of view and using science-based targets, the County should help facilitate a 56% decrease in countywide GHG emissions by 2030 from 2020 levels.

In addition to considering how to help decrease existing GHG emissions, the County must recognize that future population and related commercial or industrial growth means the likely generation of local additional emissions unless measures are taken. The County also needs to help meet global reduction goals.

Based on estimated population growth and a science-based targets calculator that considers equity, the emissions in the county need to be reduced from 2020 levels by more than half by 2030, which represents **an overall 56% decrease** and a nearly **63% per capita reduction**. Moreover, the Paris Climate Agreement, which the County resolved to honor in 2017 (Appendix D), states that by 2050 the goal should be carbon neutrality.

Population Growth

In keeping with the growth trend since 1990, Johnson County's population is expected to increase by approximately 17% from 152,854 in 2020 to 178,839 in 2030 (Table 4). Based on the expected addition of nearly 26,000 residents, the ICLEI projection software was used to provide science-based reduction targets that Johnson County might want to consider.

Table 4: Population Trend in Johnson County 1990 to 2020

POPULATION TREND	1990	2000	2010	2020	2030 Projection
Johnson County Population	96,119	111,006	130,882	152,854	178,839
Percent Growth per Decade		15.5%	17.9%	16.8%	17%

Sources: U.S. Decennial Censuses for 1990, 2000, 2010, 2020. For the 2030 projection, an assumption of 17% growth is applied to the 2020 U.S. Census value. Note: Projections of Total Population for U.S., Iowa and Its Counties: 2000 to 2040 by Woods and Poole, published in 2009, assumed Johnson County population of 158,456 in 2020 and a population of 184,445 in 2030. Those values were not used due to the availability of the decennial census of 2020.

Science-Based GHG Emission Reduction Targets

The Intergovernmental Panel on Climate Change (IPCC) 2018 report states that to meet the Paris Agreement commitment of keeping warming below 1.5°C, global emissions must be reduced from 2010 levels by 45 to 50% by 2030 and climate neutrality reached by 2050. Equitably reducing global emissions by 50% requires that high-emitting, wealthy nations reduce their emissions by more than 50%. More than ever, it is imperative that countries, regions and local governments set targets that are ambitious enough to slash carbon emissions between now and mid-century.

Science-Based Targets (SBTs) are calculated climate goals, in line with the latest climate science, that represent a community's fair share of the global ambition necessary to meet the Paris Agreement commitment to keep warming below 1.5°C. Community education, involvement, and partnerships will be instrumental in achieving a science-based target.

Johnson County Science-Based GHG Emission Reduction

To support the bold climate action of Johnson county, ICLEI has calculated the County's Science-Based Targets, based on the 2020 measured levels:

- Per-Capita Science-Based Target: 62.8%
- Absolute Science-Based Target: 56.2%

To continue leadership in sustainability, the County will need to help reduce emissions by the percentages stated above.

ICLEI suggests that Johnson County prioritize reducing emissions in the transportation sector through increased electric vehicle (EV) adoption, reduced vehicle miles traveled (VMT) and/or mode-shifting programs such as increased biking, walking and use of public transit. ICLEI also suggests prioritizing reducing emissions in the residential and commercial energy sectors through policies and programs focused on energy efficiency and electrification.

Johnson County can leverage local and regional climate action to meet these goals. Emission reduction is possible through community support, collaboration, and policies and programs. Follow-up action to the 2010 and 2020 inventories are further discussed in Recommendations and Next Steps.

Community Emissions Results Detail

Residential GHGs

Data Sources and Methodology

Johnson County residences are served primarily by five energy providers: two investor-owned utilities, MidAmerican Energy and Alliant Energy, and three rural electric cooperatives (RECs), Eastern Iowa REC, Linn REC, and Farmers Electric Cooperative. All five entities remained providers in the county for residential uses between 2010 and 2020. MidAmerican Energy and Alliant Energy published individual fuel mixes for 2010 and 2020, which were used to calculate the carbon intensity of their emissions. CIPCO values were used for Eastern Iowa and Linn REC carbon intensity fuel mixes, while MROW eGRID numbers were used for Farmers Electric Cooperative. Diesel values were converted to gasoline equivalents due to residential fuel limitations in ClearPath Climate Planner. Propane, wood and distillate fuel values were based on American Community Survey Five-Year estimated housing unit data for 2010 and 2020 and the U.S. Energy Information Administration State of Iowa Heating Fuel data for the same years.

Findings and Analysis

In 2010, residential energy emissions comprised 20% of all assessed countywide GHG emissions; by 2020 the proportion increased slightly to 20.2%. (Figures 3 and 4, p. 9).

- At least six different sources (Figure 6) are used to power or heat residential buildings: grid-electricity, natural gas, propane, wood, fuel oil (distillates) and ultra-low sulfur diesel, which is provided only during periods of high need.
- Emissions from residential grid-based electrical use decreased substantially by nearly 50% from 356,467 to 187,156 metric tons (MT) CO2e (top entry, Figure 6).
- Emissions from residential natural gas use increased 6% from 165,604 to 175,573 MT CO2e. Propane-based emissions increased 63% from 21,256 to 34,604 MT CO2e.

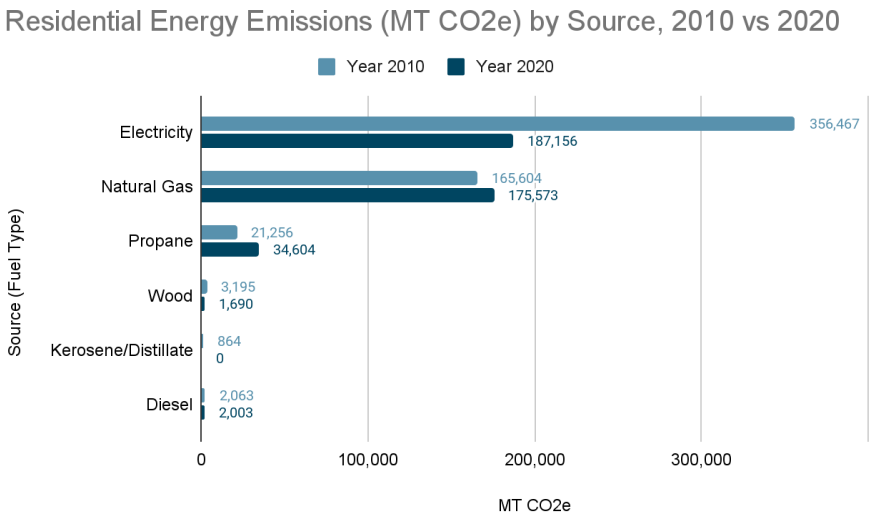


Figure 6: Residential Energy Emissions by Source, 2010 vs 2020

The overall decline in GHG emissions from residential energy use is largely due to the increasing use of renewable energy sources in electricity fuel mixes across all energy providers, including a reduction in coal use.

Across Iowa, wind provided around 16% of the state's electricity in 2010, but by 2020 that percentage had risen to 58%. While solar does not currently contribute as much to the renewable fuel mix, its presence in Iowa, and in Johnson County, is growing. Further, many utilities have set internal goals to provide all renewable energy to customers as quickly as possible, and thus the downward trend in residential electricity use is almost certain to continue.

The increase in residential natural gas usage, and thus GHGs, is likely due to population growth as well as some utilities converting certain types of non-renewable energy electricity sources such as coal to natural gas, which comparatively produces less carbon but is not as clean as renewable energy sources such as wind. The residential natural gas usage increase resulted in an overall increase of 9,969 metric tons of CO2e from 2010 to 2020. However, the *per capita* residential natural gas GHG emissions decreased from 1.265 to 1.146 MT CO2e. This per capita decrease may be attributed to better insulation and/or more efficient equipment.

Propane use increased, due in part to population growth, as housing units using propane increased from 3,215 to 3,887 over the decade studied. In addition, due to the COVID pandemic, people stayed home in 2020 more than typically is the case and likely used more heating fuel. Kesone use stayed steady, with use in approximately 90 housing units in both 2010 and 2020. Wood and other fuels as a primary residential heating fuel increased from an estimated 710 housing units in 2010 to 966 in 2020.

A relatively small amount of diesel is used by Farmers Electric Cooperative during times of high need to generate electricity for homes. This is, in one sense, a stationary type of fuel use (a different sector) and also Scope 1, but it is included in the residential section due to its very small amount of use and proportion. About half of the diesel-based generated electricity is used within Johnson County, and the rest is delivered elsewhere. Diesel emissions decreased by 60 MT CO2e from 2010 to 2020, a 2% decrease within this fuel category.

Commercial + Industrial GHGs

Data Sources and Methodology

As with residential energy, the same utility providers and cooperatives and their fuel mixes and data for 2010 and 2020 were used to calculate emissions for commercial and industrial energy. The commercial and industrial energy sectors were combined together across all sources, as some utilities or cooperatives do not separate out these sectors.

Findings and Analysis

In 2010, commercial and industrial energy emissions comprised 32.8% of all the assessed countywide GHG emissions; by 2030 the proportion decreased to 23.3%. (Figures 3 and 4, p. 9). The commercial and industrial emission totals include emissions related to the University of Iowa grid-based electrical use but does not include emissions related to the institution's use of natural gas and coal use to provide thermal and electric energy use for its operations, including UI Hospitals and Clinics. Those emissions are in the Stationary Fuel sector.

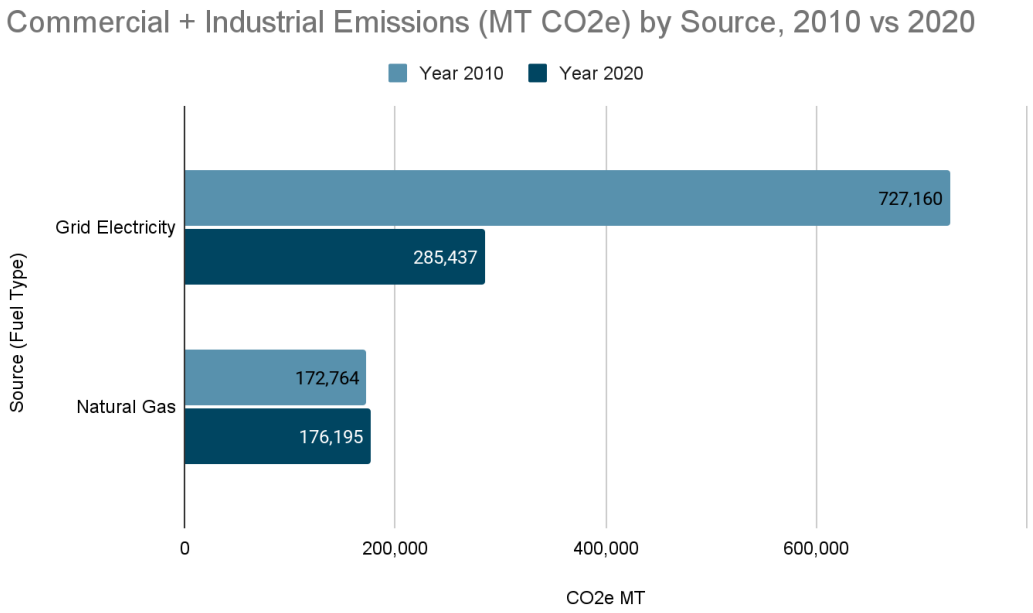


Figure 7: Commercial + Industrial Energy Emissions by Fuel Type, 2010 vs 2020

- GHG emissions from commercial and industrial use of grid-based electricity decreased by more than half (60.7%) from 727,160 to 285,437 MT CO2e (Figure 7).
- Emissions from commercial and industrial natural gas use increased slightly, by about 2%, from 172,764 to 176,195 MT CO2e.
- As is the case with residential uses, GHG emission reductions related to grid-electrical use is due in part to an increased use of renewable energy sources in electricity fuel mixes across all energy providers, including a partial reduction in coal use.

Transportation GHGs

Data Sources and Methodology

Transportation data and factors came from three sources, with adjustments for data availability:

(1) On-road vehicle miles traveled (VMT) for 2010 and 2020, Iowa Department of Transportation

(2) *National Default Fuel Efficiency and Emission Factors CMT by vehicle type (EPA State Inventory Tool)* accessed via ICLEI, which provide (by percentage) the gasoline and diesel vehicles per category: heavy trucks, light trucks, passenger vehicles, and motorcycles for on-road transportation. The oldest available data was from 2016, so this was used as a proxy for 2010 data. As 2019 data was the most recent data available, this was used as a proxy for 2020 data. Per ICLEI staff, the average distribution of vehicle types has not changed significantly over the past decade, making both of these years acceptable proxies.

(3) Off-road transportation emission CO2e values from the *EPA National Emissions Inventories for Iowa* (thus, no separate emission factors are needed). Data from 2011 was used as a proxy for 2010, and the latest available data, from 2017, was used as a proxy for 2020.

Findings and Analysis

Overall, transportation emissions remained nearly the same from 2010 to 2020 (Figure 8). COVID-19, which resulted in many people staying home, may explain the slightly lower transportation emissions in 2020, perhaps offsetting increases one would expect given the population growth since 2016 (as noted, 2016 data was used as the 2010 proxy). In addition, the trend for people to drive larger vehicles could have offset increased fuel efficiency and thus helped keep GHG emissions levels relatively steady.

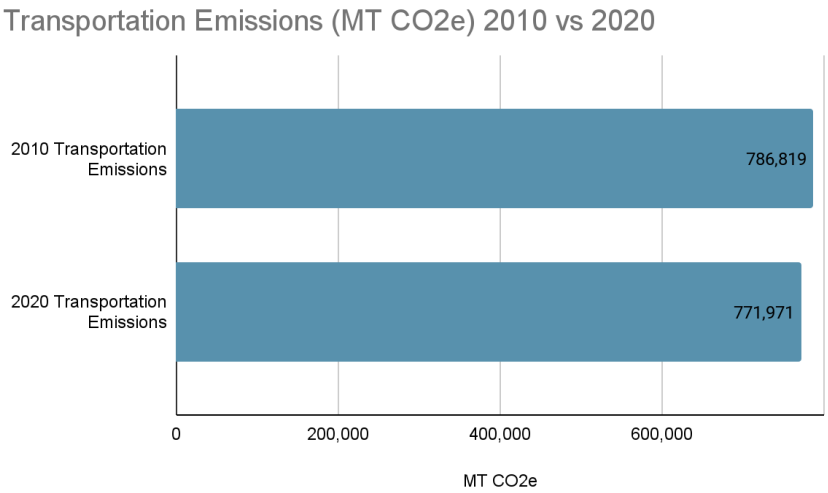


Figure 8: 2010 vs 2020 Transportation Emissions, Johnson County

- On-road gasoline (including ethanol) accounted for nearly 62% of transportation emissions in both years.
- On-road diesel emissions represented 23% of transportation emissions in both years.
- Off-road diesel (including biodiesel) emissions rose from 11.2% to 12.9% of transportation emissions over the decade.
- Off-road gasoline emissions decreased by half, representing 4.1% of all transportation emissions in the earlier year, but only 2.3% in 2020.

2010 Transportation Details

In 2010, on-road gasoline vehicles comprised a majority of emissions, 483,026 metric tons of CO2e (Figure 9) or 61.4% of emissions (Figure 10). On-road diesel vehicles emitted 183,330 MT CO2e, or 23.3% of emissions. Off-road diesel vehicles contributed 88,019 metric tons of CO2e, or 11.2% of emissions, while off-road gasoline vehicles made up the remaining 4.1% of emissions, producing 32,444 MT CO2e. In total, the transportation sector emitted 786,819 MT CO2e, or 28.7%, of total 2010 countywide measured emissions (Figure 3).

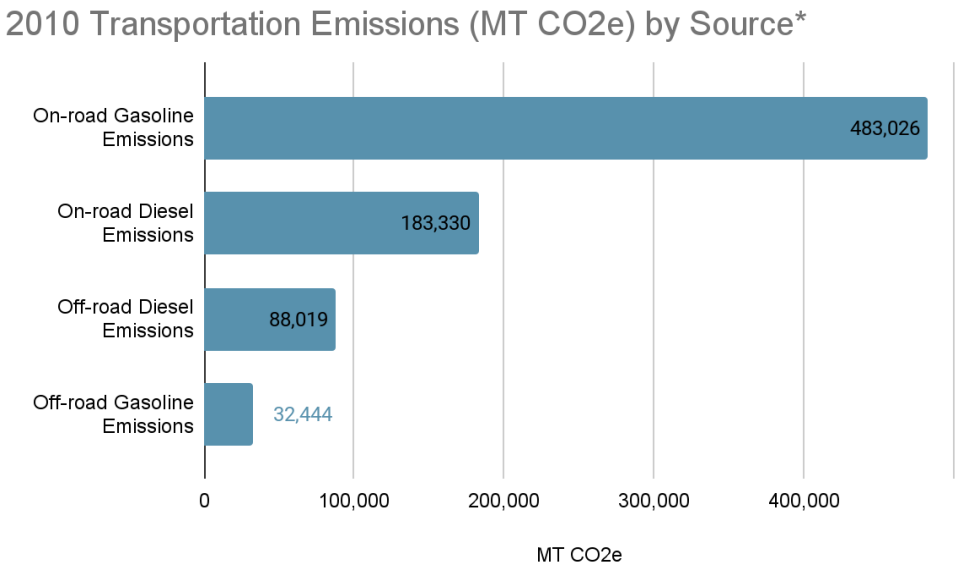


Figure 9: 2010 Transportation Emissions in Metric Tons of CO2e*

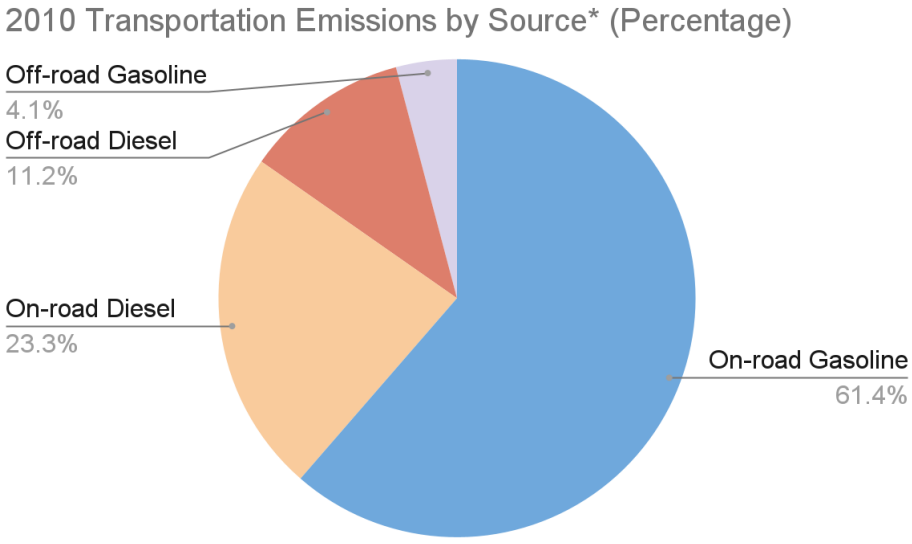


Figure 10: 2010 Transportation Emissions by Percentage

**Gasoline fuel includes ethanol-based fuels, while diesel includes biodiesel fuels.*

2020 Transportation Details

In 2020, on-road gasoline again dominated transportation emissions, emitting 479,576 metric tons of CO2e (Figure 11). This comprised about 62.1% of transportation emissions (Figure 12). On-road diesel transportation emissions contributed 175,450 MT CO2e, or 22.7% of transportation emissions. The remaining 2020 transportation emissions came from off-road diesel emissions at 99,402 MT CO2e or 12.9% of emissions, and on-road gasoline emissions at 17,543 MT CO2e or 2.3% of emissions. In total, the transportation sector emitted 771,971 MT CO2e, or 39.0%, of all 2020 emissions (Figure 4).

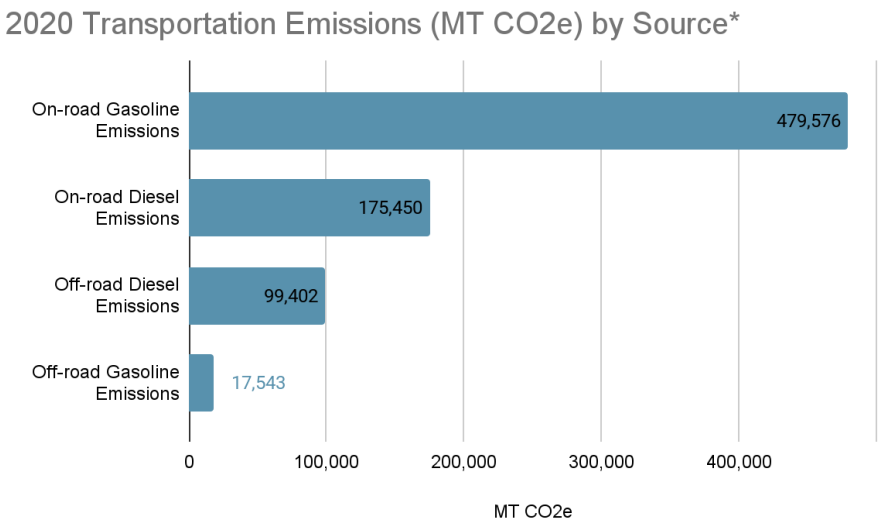


Figure 11: 2020 Transportation Emissions by Source

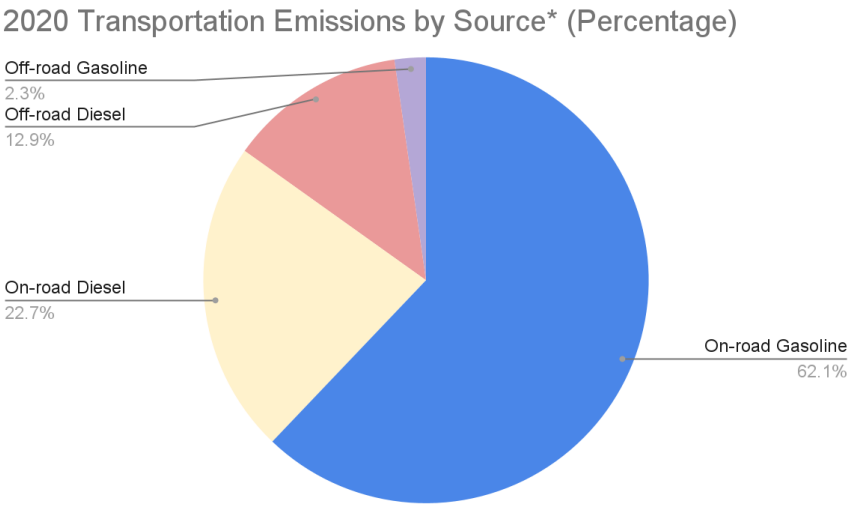


Figure 12: 2020 Transportation by Source

**Gasoline fuel includes ethanol-based fuels, while diesel includes biodiesel fuels.*

UI Stationary Fuel Combustion GHGs

Data Sources

This report tracked only one entity that regularly generates electricity or steam within Johnson County borders for industrial or commercial use. The University of Iowa (UI) uses coal and natural gas to provide thermal and electric energy use for its operations, including UI Hospitals and Clinics. The UI provided from its own records the amounts of coal and natural gas used. Emissions were then calculated using the appropriate ICLEI default emission factors for these fuels. As noted in the residential section, Farmers Electric occasionally uses diesel to generate electricity as a form of back-up power during high need; however, emissions related to that use are included in the residential section. From 2010 to 2020, the UI stationary fuel emissions decreased from 8.4% to 6.4% of overall countywide emissions tracked (Figures 3 and 4).

Findings and Analysis

- From 2010 to 2020, emissions from UI coal use decreased by more than 75% from 190,466 to 48,163 MT CO2e (Figure 13) due to decreased use of the fuel.
- Concurrently emissions from natural gas use nearly doubled from 39,236 to 78,159 MT CO2e (Figure 13). This change resulted from the installation of a new natural gas boiler in 2018.
- Overall, the UI emissions from energy generation became cleaner due to the decreased use of coal. Total emissions were 229,702 MT CO2e in 2010 compared to 126,322 MT CO2e in 2020. Energy efficiencies may have contributed to the decrease as well.

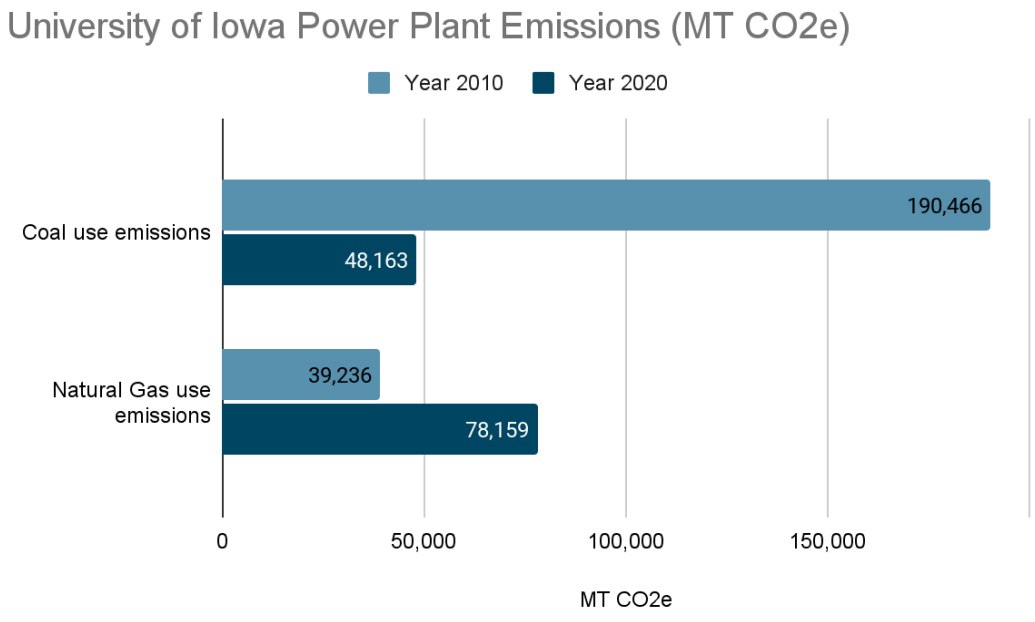


Figure 13: 2020 University of Iowa Power Plant Emissions in Metric Tons of CO2e

Agriculture GHGs

Data Sources and Methodology

Based on county-level data provided by the USDA's National Agricultural Statistics Services for 2010 and 2020, four categories of agricultural emissions were measured for Johnson County: crop residue, enteric fermentation, CH4 manure management, and legume residue.

The 2010 USDA report provided 2007 numbers for livestock, which was used as a proxy for 2010 data, and 2010 data for crops. The 2020 USDA report provided 2017 numbers for hogs and pigs, and alfalfa hay; 2020 values for corn for grain, soybeans and oats; and 2021 data for cattle, which were all used as sources or proxies for 2020 measurements. No accurate data for histosols was available at the county level, leading to its exclusion.

Emissions for all agricultural data were calculated using the Iowa DNR's "Carbon Dioxide, Methane, and Nitrous Oxide from Agriculture Module," which has emission factors built into the function. This evaluation module does not capture every source of potential emissions from agriculture; determination about what to include was based solely on the availability of accurate data. Consequently, emissions from other agricultural emissions such as fertilizer use and liming were not included. However, data access limitations also meant data from practices such as agricultural sinks, which remove rather than produce greenhouse gasses, were not included as part of the evaluation.

Findings and Analysis

- Agricultural emissions decreased by 25% from 251,300 to 188,400 MT CO2e (Figure 14).
- The lower emissions in 2020 can be partially attributed to a decrease in production across several agricultural sectors. While there were small increases in corn production for grain and soybean production, these did not significantly offset the larger decreases in livestock or in oats and alfalfa hay production.

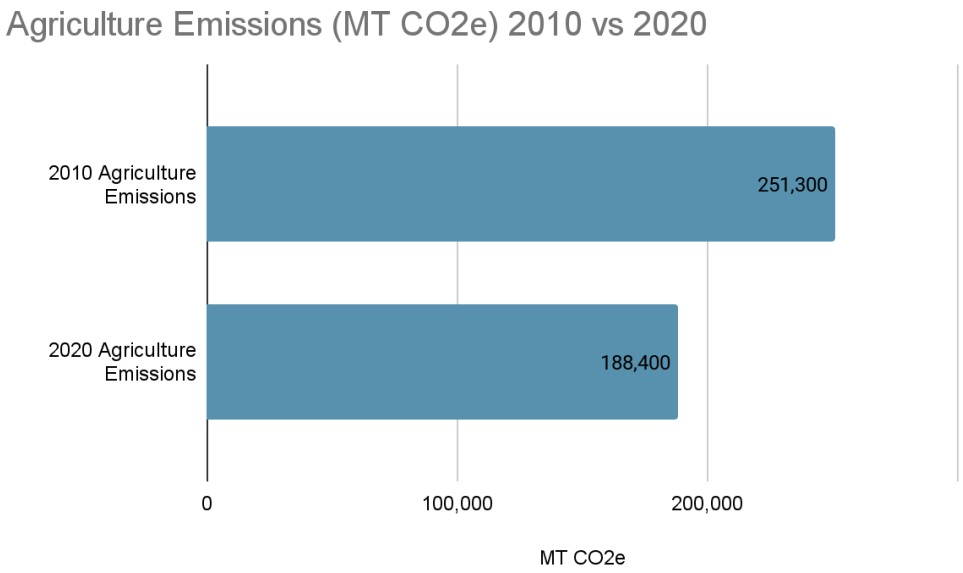


Figure 14: Agricultural Emissions (MT CO2e) 2010 vs 2020

Changes in commodity and crop production

All calves and cattle and hogs decreased from 2007 (2010 proxy) to 2021 (2020 proxy). The count of all cattle and calves decreased from 38,778 head in 2007 to 26,500 in 2021, a 32% decrease. The hog population in Johnson County decreased from 177,012 head in 2007 to 90,685 in 2017, a 49% decrease.

For crops, oats and alfalfa hay production decreased, while the production of soybean as well as corn for grain increased. Specifically, oat production decreased by 27.3%, from 81,400 bushels in 2010 to 59,200 bushels in 2020. Alfalfa hay production decreased from 51,000 tons in 2010 to 38,653 tons in 2017 (last available data set), a 24.2% decrease.

The increase in production for corn for grain was slight at 1.3%, from 16,070,000 bushels in 2010 to 16,288,000 bushels in 2020. The increase in production for soybeans was 10% from 4,206,000 bushels in 2010 to 4,632,000 bushels in 2020.

Solid Waste GHGs

Data Sources and Methodology

GHG inventories can account for solid waste emissions in several different ways. This study opted to use calculated values provided by the City of Iowa City, which operates the landfill, rather than using the ClearPath Climate Planner protocol for this metric. The city-operated landfill provides services for the entirety of the county as well as the cities of Kalona and Riverside in the adjacent county of Washington County. The fact that landfill emissions occur in Johnson County, coupled with data limitations, makes it difficult to separate out emissions attributable to the two cities. As a result, the emissions described here are for all of the solid waste functions at the site. These functions include primarily the landfill solid waste use and its related methane flaring as well as compost and mulch production.

Findings and Analysis

- Overall, solid waste represented 1.0% of all GHG emissions measured within the county in 2010 and 1.6% percent in 2020 (Figures 3 and 4).

- From 2010 to 2020, solid waste emissions increased by 16.6% from 26,856 to 31,314 MT CO2e (Table 5 and Figure 15). The population increase of 16.8% over the decade is the probable explanation for the increased emissions in solid waste.

- There was a very slight decrease of .16% in emissions per capita, which could be simple variation (Table 5).

- From 2010 to 2020, city staff increased and promoted sustainable landfill and recycling activities, including a requirement to recycle cardboard. It is possible these actions offset COVID-19 impacts, which included an increase in the use of disposable products.

- The amount of leaves as well as yard, wood and food waste diverted from being placed into the landfill in 2010 was 7,464 tons and in 2010 was 11,879 tons, a 60% increase. While the diverted wastes still produce GHG emissions (carbon dioxide in the compost process rather than methane in the landfill), keeping them out of the landfill means less land is used to bury waste. In addition, the materials become a local source for mulch and compost, reducing vehicle miles traveled for delivery of such products from elsewhere.

Table 5: Solid Waste Emissions and Changes, 2010 vs. 2020

	2010	**2020**	**Percent Change**
Solid Waste Emissions (Metric Tons CO2e)	26,856	31,314	+ 16.6%
Population (U.S. Decennial Census data)	130,882	152,854	+ 16.8%
Emissions per capita (Metric Tons CO2e)	.2052	.2049	- .16%

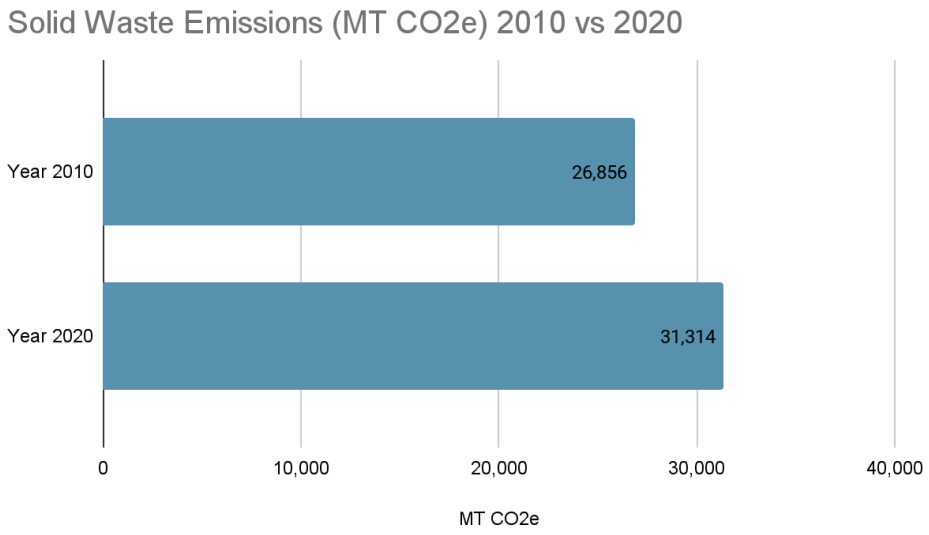


Figure 15: Solid Waste Emissions (MT CO2e) 2010 vs. 2020

Fuel Source Changes

This section explores some of the shifts in use of fuel sources: grid electricity, natural gas, coal (University of Iowa onsite only; not grid-based use), diesel, propane and smaller-use fuels.

Grid Electricity

The overall amount of grid-based electricity used decreased marginally from 1.64 billion kWh to about 1.60 billion kWh, an overall decrease of 2.2% (Figure 16 and Table 6).

As shown in Table 6, a decrease of 6.1% in commercial and industrial grid-electrical use (about 67 million kWh) underlies this change and can likely be attributed to increased energy efficiencies and possibly to the departure or closure of businesses using grid electricity.

Residential grid-based electrical use increased by nearly 6% from 2010 to 2020, due likely to the population increase of 16.8% in that time. Nevertheless, it is possible that energy efficiencies and energy conservation behaviors and strategies helped minimize this increase. The use of onsite solar might have slightly contributed to the overall electrical decrease through metered accounts.

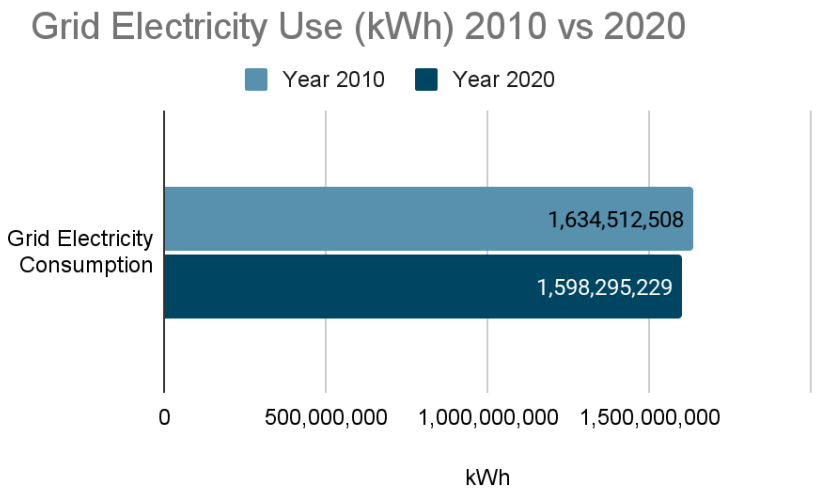


Figure 16: Grid Electricity (kWh) Use: 2010 vs. 2020

Table 6: Grid-based Electrical Use by Sector, 2010 vs. 2020

Use Sectors	2010 (kWh)	2020 (kWh)	Change (kWh) 2010 to 2020	Use Sector Change from 2010 to 2020 (Percent)	Proportion of Total Change from 2010 and 2020
Residential	530,332,414	561,453,388	31,120,973	5.9%	1.9%
Commercial + Industrial	1,104,180,094	1,036,841,841	-67,338,252	-6.1%	-4.1%
TOTAL	1,634,512,508	1,598,295,229	-36,217,279	-2.2%	-2.2%

Natural Gas

Natural gas use increased by nearly 14% from just over 71 million therms in 2010 to nearly 81 million therms in 2020 (Figure 17). The University of Iowa nearly doubled its use of natural gas (Table 7), due to reduced use of coal. This change contributed to just over 74% of the increased natural gas in the county over the decade. Residential use accounted for 19% of the increased gas use, a percentage that closely matches the population increase of nearly 17% for the same period. Natural gas use by the commercial and industrial sector accounted for the remaining 6.6% increase.

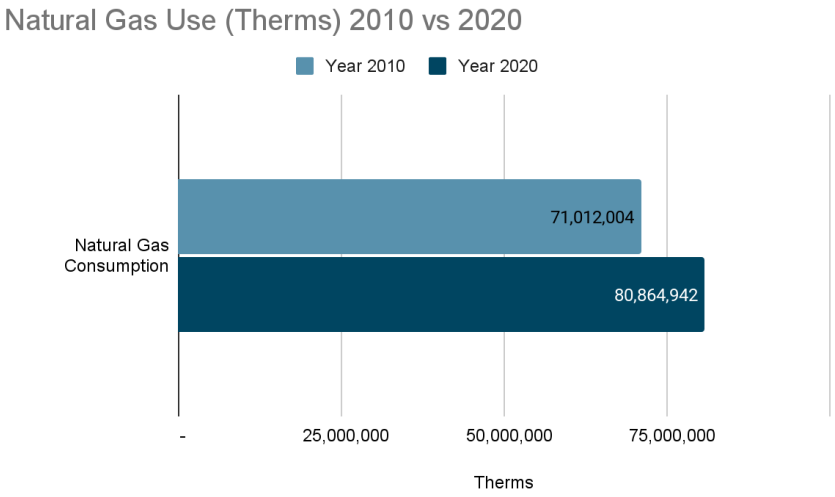


Figure 17: Therms from Natural Gas Use 2010 vs. 2020

Table 7: Natural Gas Use by Sector, 2010 vs. 2020

Use Sectors	2010 (Therms)	2020 (Therms)	Change (Therms) 2010 to 2020	Proportion of Total Increase from 2010 and 2020
Residential	31,136,516	33,010,859	1,874,343	19.0%
Commercial + Industrial	32,482,768	33,127,823	645,055	6.6%
Stationary (UI)	7,392,720	14,726,260	7,333,540	74.4%
TOTAL	71,012,004	80,864,942	9,852,938	100%

Coal and Diesel

As previously noted, the use of coal at the University of Iowa decreased significantly from 2010 to 2020 (Figure 18). Please see the section on Stationary Fuel for more discussion. The use of diesel, mostly by the smaller rural electric cooperatives, remained about the same, in the range of 226,471 to 233,310 metric million British thermal units (MMBTU).

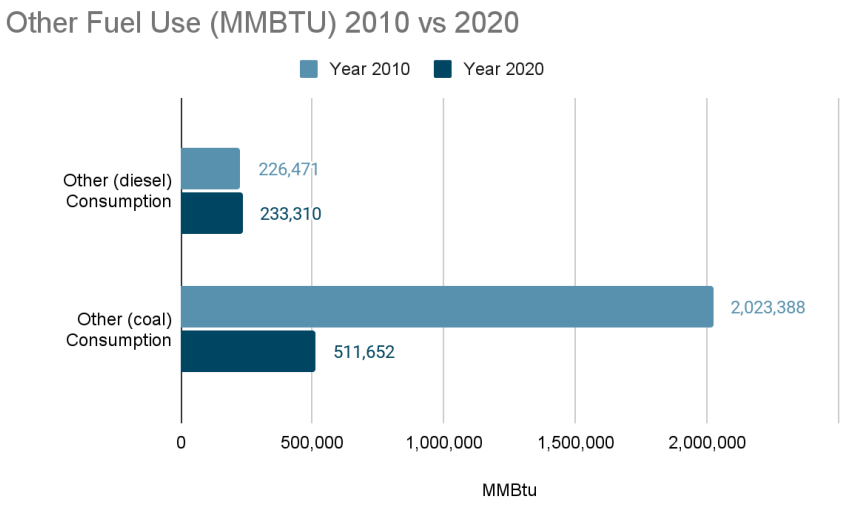


Figure 18: Other Fuel Use 2010 vs. 2020

Propane, Kerosene and Wood

Propane, kerosene/distillates, and wood/other fuels are discussed in the Residential GHGs section.

Activities and Sources

In addition to considering emissions **sectors**, **activities** and **sources** are another way to examine emissions.

Activities within a community include but are not limited to residents and businesses heating homes or buildings, driving cars or transporting goods, and throwing away the trash.

Sources are where activities occur. For instance, to heat a home, electricity or heating fuel needs to be produced, refined, and sent to the home. An example of a source is a local electricity generation facility or natural gas facility.

Within Johnson County, the primary emissions emitting activities come through the usage of private, internal combustion engine vehicles, and the use of electricity and natural gas to heat and power private residences and commercial/industrial businesses (Tables 8 and 9 as well as Figures 19 and 20). While these are the direct activities associated with producing emissions, the actual sources would be the internal combustion engine vehicles burning gasoline or diesel, and the electricity and natural gas facilities providing fuels to the built environment. For Johnson County to move forward with emission reduction planning, activities such as internal-combustion vehicle usage need to be addressed through policy, programs and incentives.

2010 Activity/Source and Sector

Table 8: CO2e Emissions by Activity/Source and Sector for 2010

Scope	Sector	CO2e
Activity	Commercial and Industrial Energy	727,160
Activity	Residential Energy	356,466
Source	Transportation & Mobile Sources	120,462
Source	Solid Waste	26,855
Source	AFOLU	251,300
Source	UI Stationary Fuel	229,702
Source and Activity	Transportation & Mobile Sources	666,356
Source and Activity	Commercial and Industrial Energy	172,764
Source and Activity	Residential Energy	192,983

AFOLU = Agriculture, Forestry and Other Land Use

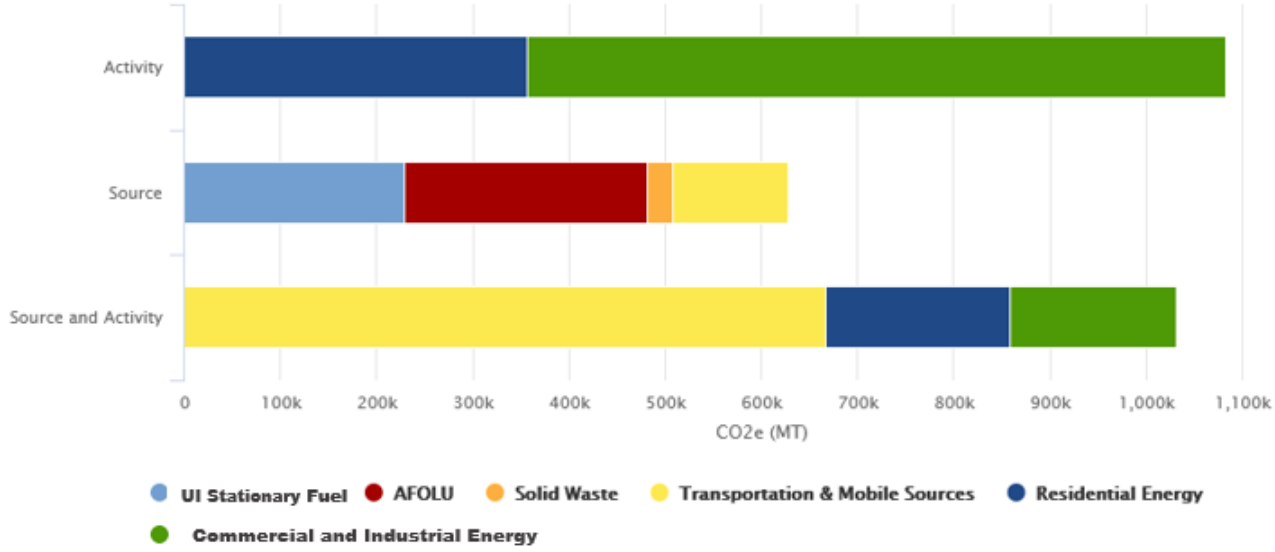


Figure 19: GHG Emissions Activity and Sources for 2010

NOTE: Labels in the original ICLEI-generated table and chart were adjusted in Table 8 and Figure 19 to reflect accurate source and activity custom labels for this inventory.

2020 Activity/Source and Sector

Table 9: CO2e Emissions by Activity/Source and Sector for 2020

Scope	Sector	CO2e
Activity	Commercial and Industrial Energy	285,436
Activity	Residential Energy	187,156
Source	Transportation & Mobile Sources	116,944
Source	Solid Waste	31,314
Source	AFOLU	188,400
Source	UI Stationary Fuel	126,321
Source and Activity	Transportation & Mobile Sources	655,026
Source and Activity	Commercial Energy	176,195
Source and Activity	Commercial and Industrial Energy	213,869

AFOLU = Agriculture, Forestry and Other Land Use

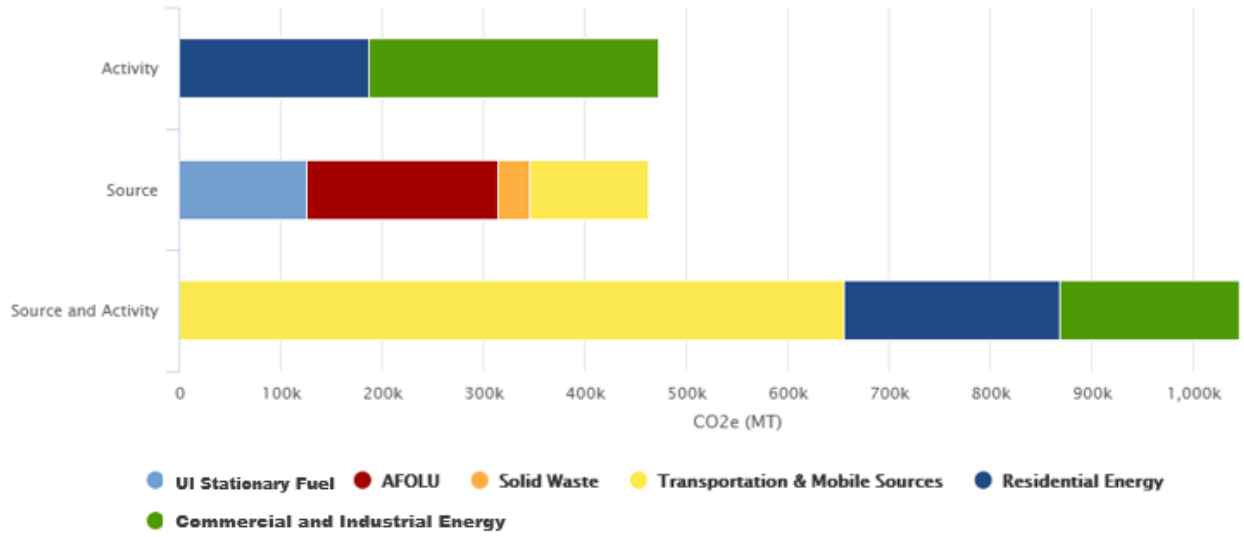


Figure 20: GHG Emissions Activity and Sources for 2020

NOTE: Labels in the original ICLEI-generated table and chart were adjusted in Table 9 and Figure 20 to reflect accurate source and activity custom labels for this inventory.

2010 and 2020 Activity/Source Comparisons

Note: Source and Activity have some redundancy; as a result, “Source” and “Activity” do not add up to the “Source and Activity” in Table 10 and Figure 21 below.

Table 10: CO2e Emissions by Activity/Source Comparison 2010 v 2020

Inventory Comparison By Activity/Source

Comparison of CO2e by activity/source and year over all official inventories

Year	Activity	Source	Source And Activity
2010	1,083,627	628,320	1,032,104
2020	472,593	462,980	1,045,091

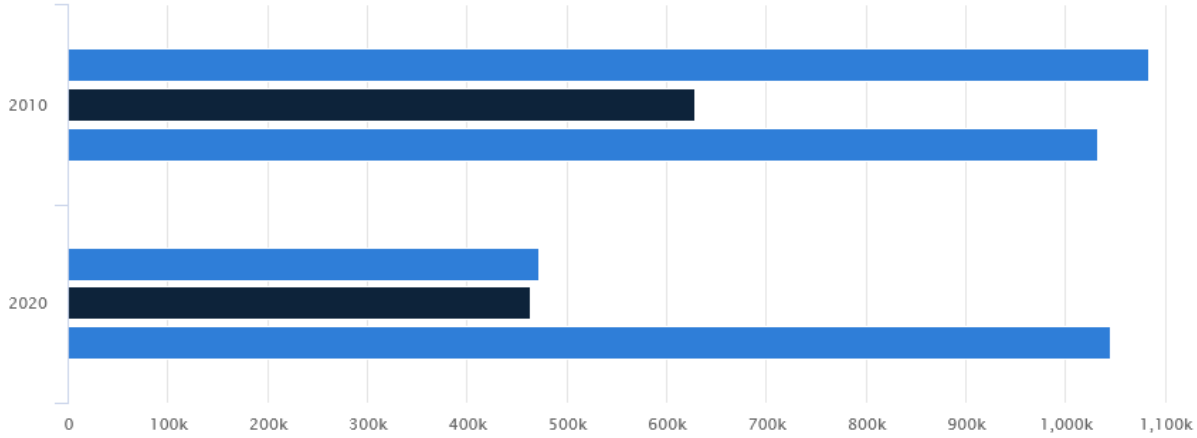


Figure 21: GHG Emissions Activity and Sources Comparison 2010 v. 2020.

Scopes

While communitywide GHG data collection and most analysis focuses on sectors, the **scopes** of the emissions, or how and where the generation of emissions occur, are important, too (Figure 22). While scopes are more typically used for operational inventories, knowing the scopes breakdown can further help identify where to reduce emissions and what means or partnerships might be effective.

Scope 1 includes emissions generated directly from stationary and mobile combustion sources. Examples include the use directly within the county borders of coal or natural gas to generate steam or electricity. There are not many *large* Scope 1 sources, such as the UI Power Plant, in Johnson County. However, every natural gas furnace, boiler, water heater or other natural-gas based equipment in residential households or commercial enterprises can be considered a Scope 1 source, as well, and combined they can become relatively large.

Scope 2 includes emissions that result when an activity that takes place *within* the county causes emissions to be generated elsewhere. This scope covers the emissions incurred when energy is purchased or acquired (e.g. power plant emissions elsewhere in Iowa). The electricity most people use in their home or business involves Scope 2 emissions.

Scope 3 includes emissions that result from activities that occur *outside* the county boundary to meet the needs of community activities. An example would be emissions generated by air travel by an employee or resident. These emissions are often harder to track and are optional in the protocol.

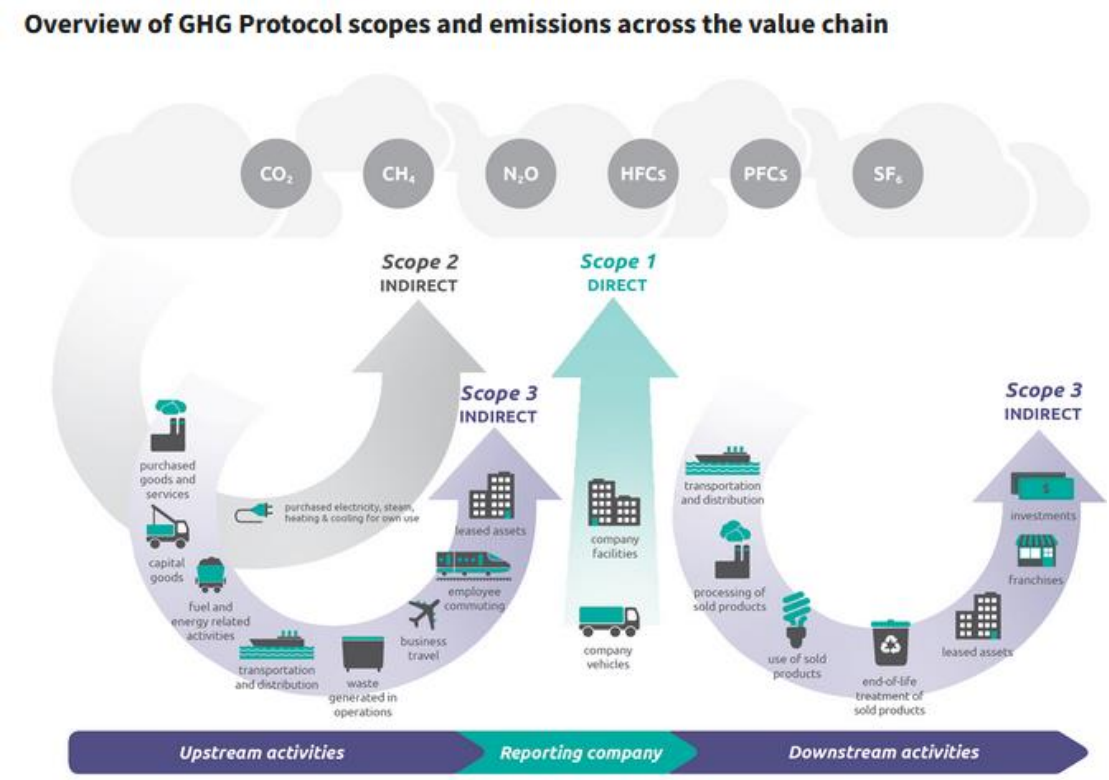


Figure 22: GHG Scopes. Source: WRI

From 2010 to 2020, Scope 1 emissions remained relatively stable, while scope 2 emissions decreased by nearly half from 1,083,627 MT CO2e to 475,593 MT CO2e (Tables 11 and 12). The decrease reflects advances in clean energy delivery to residences and commercial or industrial uses from grid-based electrical plants not located within the county.

2010 CO2e EMissions by Scope

Table 11: MT CO2e Emissions by Scope 2010

Scope	CO2e
Scope 1	1,660,425
Scope 2	1,083,627

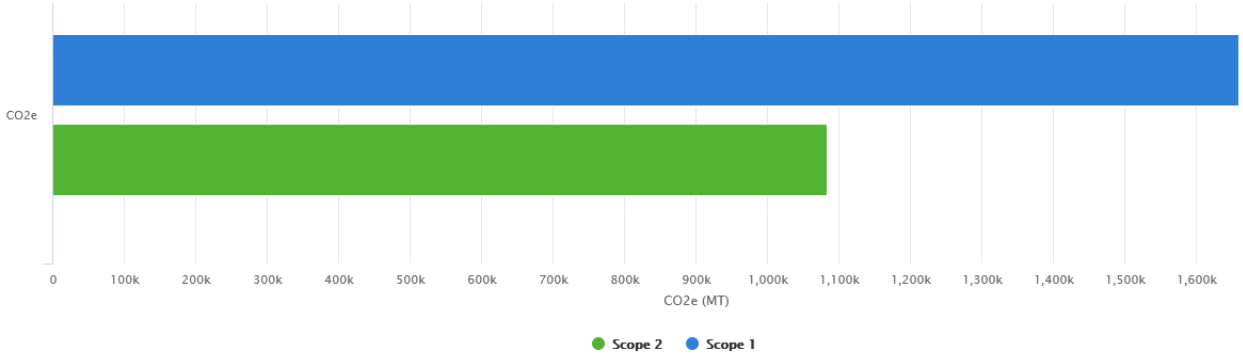


Figure 23: CO2e Emissions by Scope 2010

2020 CO2e Emissions by Scope

Table 12: CO2e Emissions by Scope 2020

Scope	CO2e
Scope 1	1,508,071
Scope 2	472,593

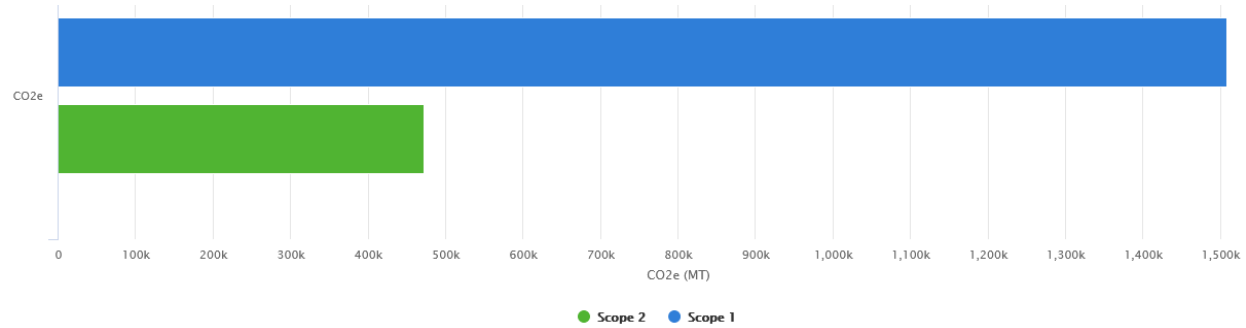


Figure 24: CO2e Emissions by Scope 2020

Recommendations and Next Steps

As is the case with the County's own operations, using *less* energy and *cleaner* energy throughout the entire county can lead to fewer GHG emissions. A challenge to setting and achieving GHG reduction goals is the ever-increasing population of Johnson County. However, the people of Johnson County are resourceful and innovative, and with attention to equity and resilience, approaches can balance the need to reduce GHG emissions while also supporting a strong economy and healthy environment.

Science-Based Target

As noted in the Key Findings, ICLEI has calculated Johnson County's Science-Based Targets for GHG reduction by 2030 to account for our community's fair share of the global ambition necessary to meet the Paris Climate Agreement commitment (Appendix D) to keep warming below 1.5°C.

- Per-Capita Science-Based Target: 62.8%
- Absolute Science-Based Target: 56.2%

Meeting these targets, or ones close to them, while also planning for an expected 17% population growth from 2020 to 2030 will be challenging and require bold leadership, community engagement and commitment. (Details on the population estimates and Science-Based Targets are available on p. 10.)

Recommended Follow-up

The key follow-up steps can be categorized by those that can be acted on immediately or soon, and those that should be set in motion and completed within the next two years.

Stage 1: Now

- Share this report with leadership, partner organizations and the general public.
- Set feasible and equitable countywide GHG emissions goals for both near- and long-term.
- Maintain and cultivate relationships with energy providers, other local governments, advocacy groups, businesses, and residents and consumers to learn about their goals and needs.
- Prioritize and advance energy conservation and efficiencies through education and reminders. Even with technological advances for cleaner and/or renewable energy, reducing energy use wherever and whenever possible in the first place should be a priority. In addition to reducing emissions, efficiency and conservation can provide cost-savings for households, farms and businesses, and quality jobs related to the practices.

Stage 2: Within the next two years

- Create and act on a climate action plan or set of strategic actions that, per ICLEI, uses community engagement and considers, among other factors, equity, the environment and the economy.

- Work with other local governments and organizations to prioritize reductions in transportation (electric vehicle adoption; reduced vehicle miles traveled; increased biking, walking and public transit) and in commercial and residential sectors through energy conservation, efficiencies and electrification.

- Consider leveraging additional greenhouse gas management guidance and program support available from ICLEI and/or other organizations.

- Remeasure emissions at periodic intervals. ICLEI recommends that communitywide inventories be updated every two to three years.

Appendix A: Data Sources and Guidance

Agriculture

- Iowa Department of Natural Resources (Iowa DNR) *2020 Greenhouse Gas Inventory Report* and *2020 GHG Inventory Report Technical Support Document* https://www.iowadnr.gov/environmental-protection/air-quality/greenhouse-gas-emissions

- Iowa DNR Greenhouse Gas Emissions Dashboard https://experience.arcgis.com/experience/f57d1f8a00f1444596d5045ee6dc6798/page/Air-Quality-Bureau/

- USDA National Agricultural Statistics Service (NASS) *2010 Iowa Annual Bulletin* and *2020 Iowa Annual Bulletin.* Both available at https://www.nass.usda.gov/Statistics_by_State/Iowa/Publications/Annual_Statistical_Bulletin/index.php

- USDA NASS 2017 Agricultural Census Profile of Johnson County, Iowa https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Iowa/cp19103.pdf

Residential and Commercial + Industrial Energy Use
Electric Service Boundary Map: https://iub.iowa.gov/regulated-industries/electric/electric-service-area-boundary-map

Fuel Mixes and GHG Intensities for Utility and Rural Electric Cooperatives: see Appendix B

Solid Waste (landfill and other services)
Provided by Iowa City Landfill and City of Iowa City Annual Greenhouse Gas Reporting

Stationary Fuel
Provided by University of Iowa Facilities

Transportation

Iowa Department of Transportation Vehicle Miles Traveled by County and Year Main site: https://iowadot.gov/maps/data/vehicle-miles-traveled
2010: https://iowadot.gov/maps/msp/vmt/countyvmt2010.pdf
2020: https://iowadot.gov/maps/msp/vmt/countyvmt20.pdf

EPA National Emissions Inventories: https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei
These reports are produced approximately every three years. Johnson County 2011 and 2017

Appendix B: Fuel Mixes and GHG Intensities

Alliant Energy 2010 GHG Emissions Intensities

GHG	lbs/MWh	CO2 Conversion	CO_2e lbs/MWh equivalent
Carbon Dioxide	1,363	1	1,363
Methane	1.521	28	43
Nitrous Oxide	1.291	265	342
		Total	**1,748**

Alliant Energy 2020 Fuel Mix and GHG Emissions Intensities

Air emission rates for Alliant Energy's electricty generation in Iowa – by fuel type	Percentage of overall power generated	Pounds of emission per 1,000 kWh generated (a)		
		SO_2	NO_x	CO_2
Generation sources we own	**67.26%**			
Coal	17.36%	2.58	1.18	2,345
Natural gas	28.88%	0.00	0.06	893
Solar	.06%	0.00		
Wind	20.96%	0.00		
Oil	0.00%	0.03	4.73	2,725
Generation sources we purchase	**32.74%**			
Wind	12.86%	N/A		
Hydro	0.11%			
Biomass (b)	0.01%			
Secrond Nature Wind	0.00%			
Nuclear	12.80%			
Solar	0.02%			
Other (c)	6.94%	1.1	0.8	1,098

Note: CIPCO values apply to Eastern Iowa REC and Linn County REC. (Farmers' Electric uses eGrid).

CIPCO 2010 Fuel Mix and GHG Emission Intensities

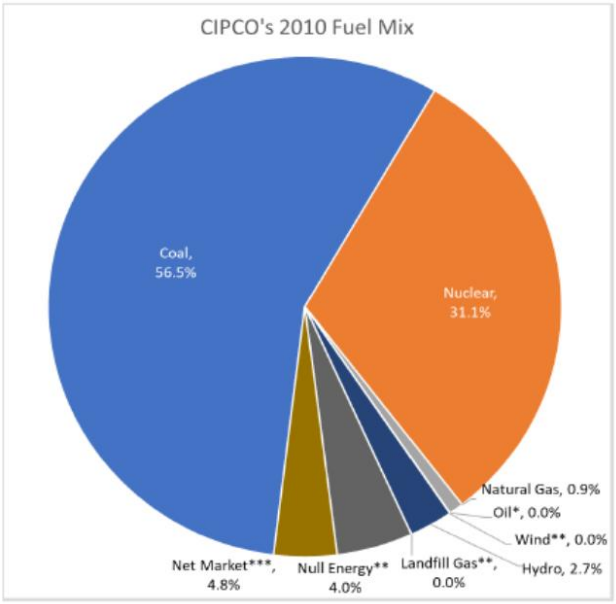
CIPCO's 2010 Fuel Mix Summary

	Supply Fraction %	Sulfur Dioxide lb/MWh	Nitrogen Oxides lb/MWh	Carbon Dioxide lb/MWh
Traditional Resources				
Coal	56.5%	1.89	1.20	1,704
Nuclear	31.1%	0.00	0.00	0
Natural Gas	0.9%	0.00	6.05	1,925
Oil*	0.0%	0.24	6.00	2,028
	88.5%	1.20	0.83	1,108
Alternative Resources				
Wind**	0.0%	0.00	0.00	0
Solar	0.0%	0.00	0.00	0
Hydro	2.7%	0.00	0.00	0
Landfill Gas**	0.0%	0.00	0.00	0
	2.7%	0.00	0.00	0
Other Resources				
Net Market***	4.8%	No Data Available		
Null Energy**	4.0%			
	8.8%			
Total	100%	No Data Available		2,194

*Emission Rates Estimated

**All Null Energy is sourced alternative resources, predominantly wind, in Iowa. CIPCO sells the environmental attributes and can not claim the energy corresponding to RECS that were sold as renewable.

***Net Market is the net interchange of all transactions with the wholesale market. Negative market transactions are energy sales into the wholesale market using CIPCO portfolio average emission rates. Positive market transactions are energy purchases with typical regional emission rates.



CIPCO 2020 Fuel Mix and GHG Emission Intensities

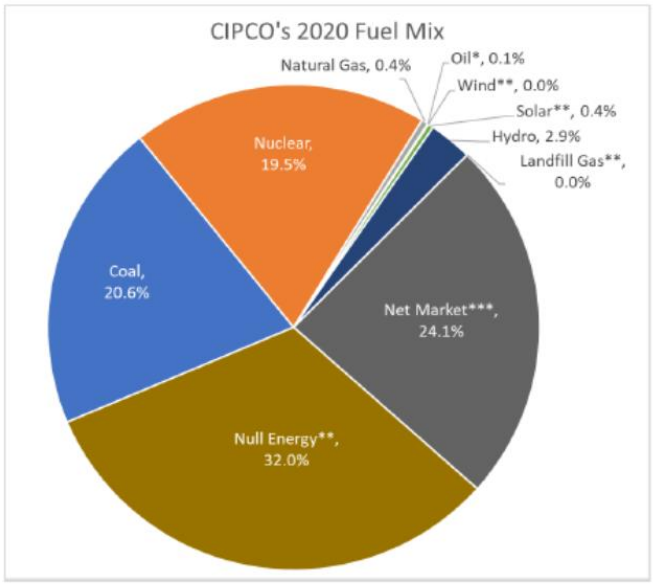
CIPCO's 2020 Fuel Mix Summary

	Supply Fraction %	Sulfur Dioxide lb/MWh	Nitrogen Oxides lb/MWh	Carbon Dioxide lb/MWh
Traditional Resources				
Coal	20.6%	2.59	1.49	2,188
Nuclear	19.5%	0.00	0.00	0
Natural Gas	0.4%	0.00	53.69	10,128
Oil*	0.1%	0.24	6.00	2,028
	40.6%	1.32	1.34	1,224
Alternative Resources				
Wind**	0.0%	0.00	0.00	0
Solar**	0.4%	0.00	0.00	0
Hydro	2.9%	0.00	0.00	0
Landfill Gas**	0.0%	0.00	0.00	0
	3.2%	0.00	0.00	0
Other Resources				
Net Market***	24.1%	1.36	1.46	1,378
Null Energy**	32.0%	1.22	1.25	1,134
	56.2%	1.28	1.34	1,239
Total	100%	1.25	1.30	1,193

*Oil emission rates are estimated

**All Null Energy is sourced alternative resources, predominantly wind, in Iowa. CIPCO does not receive or sells the environmental attributes and can not claim the energy corresponding to RECS that were sold or not received as renewable.

***Net Market is the net interchange of all transactions with the wholesale market. Annual net negative market transactions are energy sales into the wholesale market using CIPCO portfolio average emission rates. Net annual positive market transactions are energy purchases with typical regional emission rates excluding market wind. This is the case for 2020.



MidAmerican Energy Company 2010 Fuel Mix and GHG Emission Intensities

MidAmerican Energy Company
Iowa AEP Annual Fuel Reporting Requirements - Per 199 IAC 15.17(5)
For the year January 1 - December 31, 2010

	Generation Mix Fuel Type	Percent of Mix	SO_2 lb/1000 kWh	NO_x lb/1000 kWh	CO_2 lb/1000 kWh
	Coal	53.6	4.24	1.98	2,190
	Nuclear	13.2	0.00	0.00	0
	Natural Gas	0.1	0.00	0.59	1,074
	Oil	0.0	0.84	17.46	3,537
AEP	Wind[1]	0.0	0.00	0.00	0
	Solar	0.0	0.00	0.00	0
	Hydropower	0.0	0.00	0.00	0
	Biomass	0.0	Unknown	Unknown	Unknown
	Other	0.0	Unknown	Unknown	Unknown
Non-program AEP	Wind	1.7	0.00	0.00	0
	Solar	0.0	0.00	0.00	0
	Hydropower	0.0	0.00	0.00	0
	Biomass	0.4	Unknown	Unknown	Unknown
	Other	0.0	Unknown	Unknown	Unknown
	Null (RECs)[2]	14.0	3.29	1.54	1,703
	Unknown Purchases	17.1			
	Total	**100.0**			

Notes:
1 - The energy from the state fair wind turbine is included the AEP wind turbine category. However, the State Fair wind turbine provided less than 0.1% of the generation mix and therefore does not register in the AEP wind line.
2 - Per the requirements for selling renewable energy certificates (REC), the emission rates for "Null" energy types must be disclosed as equal to the system average emission rates. The emission values shown assume that all available RECs will be sold and are therefore represented as "Null Energy".

MidAmerican Energy Company 2020 Fuel Mix and GHG Emission intensities

Filed with the Iowa Utilities Board on March 31, 2021, IAC-2021-1517

MidAmerican Energy Company
Iowa AEP Annual Fuel Reporting Requirements - Per 199 IAC 15.17(5)
For the year January 1 - December 31, 2020

	Generation Mix Fuel Type	Energy (GWh)	Percent of Mix	SO_2 lb/1000 kWh	NO_x lb/1000 kWh	CO_2 lb/1000 kWh
	Coal	6,518	20.7%	2.42	1.46	2,253
	Nuclear	3,484	11.0%	0.00	0.00	0
	Natural Gas	668	2.1%	0.00	0.14	917
	Oil	0.6	0%	0.52	18.36	1,691
Renewable Advantage Program[1]						
	Wind	0.1	0%	0.00	0.00	0
	Solar	< 0.1	0%	0.00	0.00	0
	Hydropower	0	0%	0.00	0.00	0
	Biomass	0	0%	Unknown	Unknown	Unknown
	Other	0	0%	Unknown	Unknown	Unknown
Alternative Energy						
	Wind	20,371	64.6%	0.00	0.00	0
	Solar	0	0%	0.00	0.00	0
	Biomass	60	0.2%	Unknown	Unknown	Unknown
	Hydropower	7	0%	0.00	0.00	0
	Other	0	0%	Unknown	Unknown	Unknown
	Null[2]	433	1.4%	0.51	0.31	492
	Unknown Purchases	4,263				
	Total[3]	**35,784**	**100%**			
Total Energy used by Iowa Customers		**24,425**				
Renewable Energy used by Iowa Customers		**20,431**	**83.6%**			

Notes: 1 - Includes state fair wind turbine and solar array.
2 - Per the requirements for selling renewable energy credits (RECs), the emission rates for "Null" energy types must be disclosed as equal to the system average emission rates.
3 - At times, Iowa Generation may produce more energy than required by Iowa Customers and is sold in the wholesale electricity market. However, all renewable qualities of the energy (known as Renewable Energy Credits) are retained for Iowa customers, resulting in Iowa customers receiving a greater share of energy usage from renewable resources.
MidAmerican Energy GreenAdvantage program

Appendix C: Sector and Fuel Type Summary Tables for 2010 and 2020

2010

Inventory by Sector and Fuel Type

CO2e by fuel type and sector for the selected inventory year

Sector	Fuel Or Source	Usage	Usage Units	Emissions
Residential Energy	Electricity	530,332,415	kWh	356,467
Residential Energy	Natural Gas	31,136,516	Therms	165,604
Residential Energy	Diesel	233,310	Gallons	2,063
Residential Energy	Distillate Fuel Oil No. 2	11,609	MMBtu	864
Residential Energy	Propane	342,519	MMBtu	21,256
Residential Energy	Wood	320,775	MMBtu	3,195
Residential Energy	Other			-1
Residential Energy Total				549,448
Commercial and Industrial Energy	Electricity	1,104,180,093	kWh	727,160
Commercial and Industrial Energy	Natural Gas	32,482,768	Therms	172,764
C + I Energy Total				899,924
UI Stationary Fuel	Natural Gas	739,272	MMBtu	39,236
UI Stationary Fuel	Other			190,466
UI Stationary Fuel Total				229,702
Transportation & Mobile Sources	Gasoline	1,223,864,664	VMT	483,026
Transportation & Mobile Sources	Diesel	125,628,492	VMT	183,330
Transportation & Mobile Sources	Other			120,463
Transportation & Mobile Sources Total				786,819
Solid Waste	Waste Sent to Landfill	116,954	Tons	26,856
Solid Waste Total				26,856
AFOLU	Other			251,300
AFOLU Total				251,300

NOTES: Labels in the original ICLEI-generated tables are adjusted to reflect accurate fuel / sector labels for this inventory.
Residential Gasoline (original) appears properly here as Diesel
Commercial (original) appears properly here as Commercial + Industrial.
Industrial (original) appears properly here as UI Stationary Fuel

2020

Inventory by Sector and Fuel Type

CO2e by fuel type and sector for the selected inventory year

Sector	Fuel Or Source	Usage	Usage Units	Emissions
Residential Energy	Electricity	561,453,388	kWh	187,157
Residential Energy	Natural Gas	33,010,859	Therms	175,573
Residential Energy	Diesel	226,471	Gallons	2,003
Residential Energy	Wood	169,650	MMBtu	1,690
Residential Energy	Propane	557,598	MMBtu	34,604
Residential Energy	Other			-1
Residential Energy Total				401,026
Commercial and Industrial Energy	Electricity	1,036,841,841	kWh	285,437
Commercial and Industrial Energy	Natural Gas	33,127,823	Therms	176,195
C + I Energy Total				461,632
UI Stationary Fuel	Natural Gas	1,472,626	MMBtu	78,159
UI Stationary Fuel	Other			48,163
UI Stationary Fuel Total				126,322
Transportation & Mobile Sources	Gasoline	1,162,668,558	VMT	479,576
Transportation & Mobile Sources	Diesel	120,616,758	VMT	175,450
Transportation & Mobile Sources	Other			116,945
Transportation & Mobile Sources Total				771,971
Solid Waste	Waste Sent to Landfill	26,856	Tons	31,314
Solid Waste Total				31,314
AFOLU	Other			188,400
AFOLU Total				188,400

NOTES: Labels in the original ICLEI-generated tables are adjusted to reflect accurate fuel / sector labels for this inventory.
Residential Gasoline (original) appears properly here as Diesel
Commercial (original) appears properly here as Commercial + Industrial.
Industrial (original) appears properly here as UI Stationary Fuel

Appendix D: Resolution of Commitment to Honor the Paris Agreement Goals

RESOLUTION OF COMMITMENT
TO HONOR THE PARIS CLIMATE AGREEMENT GOALS

WHEREAS, on June 1, 2017, President Trump withdrew the United States of America from the Paris Climate Agreement; and

WHEREAS, the agreement, signed by 195 nations, aims to keep Earth from warming by more than 1.5 degrees Celsius (2.7 degrees Fahrenheit) above preindustrial levels, and allows each country to set its own greenhouse gas emission reduction targets and adopt strategies to reach them; and

WHEREAS, the agreement recognizes that climate action protects the planet from risks of devastating consequence, and clean energy can benefit our security, prosperity and health; and

WHEREAS, the agreement has the support of the majority of the U.S. populace, and the mayors of dozens of major cities and the governors of 10 states have already pledged to maintain support; and

WHEREAS, local governments, along with cities and businesses, have contributed to greenhouse gas emissions, and Johnson County has for nearly a decade been taking action on climate change to reduce direct and indirect greenhouse gas emissions; and

WHEREAS, Johnson County's efforts have included, among many initiatives, adding nearly 405 kW of renewable solar energy to our operations, reducing paper use, reusing materials when building roads and bridges, adding electric vehicles to and greening our fleet, promoting non-single-driver vehicle travel, and earning recognition for our downtown campus as a League of American Bicyclists Gold Bicycle Friendly Business; and

WHEREAS, Johnson County adopted the Cool Counties Climate Stabilization Declaration in 2007 and has included sustainability in three consecutive strategic plans, showing long-standing commitment to sustainability; and

WHEREAS, local communities can and should lead the way to help ensure that our state and nation as a whole remains a global leader in reducing emissions.

NOW, THEREFORE, be it resolved that we, the Johnson County Board of Supervisors, do hereby commit to honor the Paris Climate Agreement goals. Along with others in our nation, we will continue to lead. We will continue completing energy efficiency, energy conservation and renewable energy projects. We will increase our efforts to cut greenhouse gas emissions, support a clean energy economy, stand for public health and environmental justice, and work with allies near and far to protect Earth from devastating climate risks. The world, our nation, our state and our county cannot wait. We are still in.

On motion by Friese, seconded by Carberry passed and approved the 8th day of June, 2017.

Janelle Rettig, Chairperson
Johnson County Board of Supervisors

Mike Carberry, Vice-Chairperson

Kurt Friese

Lisa Green-Douglass

Rod Sullivan