Greenhouse Gas (GHG) Mitigation

Existing Conditions

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City of Cedar Rapids Greenhouse Gas Mitigation Existing Conditions

Existing conditions help a community understand where they are right now so that they can determine where they would like to go and how to get there. The existing conditions section includes demographic information, as well as information about greenhouse gas emissions and other trends associated with buildings, transportation, waste, and renewable energy resources. Existing planning and policy context and documents are also highlighted. The data provided through the existing conditions help create a snapshot — or baseline — that can be used to track progress over time.

Data for the existing conditions comes from a variety of sources, including utility data from MidAmerican and Alliant Energy, the Iowa Department of Natural Resources (DNR), the Iowa Department of Transportation (DOT), the U.S. Department of Energy Low-Income Energy Affordability Data (LEAD) tool, and the U.S. Census Bureau, among other sources for more specific data points.

For the purposes of this document, the existing conditions element of the plan is broken into two sections: mitigation and resilience. This section will cover the existing conditions for the City's mitigation work, including the greenhouse gas inventory, and energy consumption from various sectors including building energy use, transportation, waste, as well as relevant programs, policies, and plans. The next section includes existing conditions associated with community resilience in Cedar Rapids.

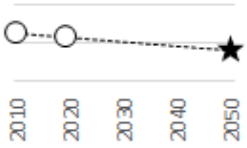
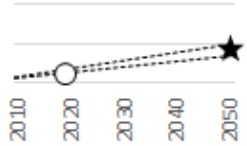
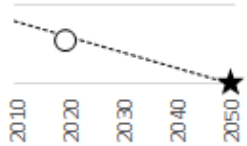
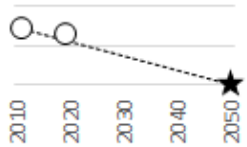
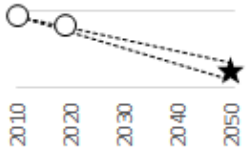
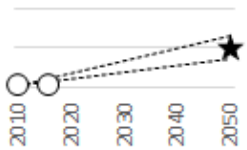
Existing Conditions: Mitigation

Climate mitigation refers to strategies and actions that are aimed at reducing greenhouse gas emissions to limit the city's impact on climate change. In its climate resolution, the city has established goals to reduce greenhouse gas emissions 45% by 2030 from 2010 levels, and achieve net zero carbon emissions by 2050. Further, the resolution commits the city to increase renewables to supply 70-100% of electricity by 2050 and to eliminate the use of coal for electricity generation by 2050. Table 1 includes each of the goals outlined in the city resolution, as well as the baseline data, current data, and a snapshot of progress to date.

As indicated in the table, Cedar Rapids is already making progress in each of these categories. However, there is a lot of work to be done to remain on track. In order to achieve these targets, there needs to be a clear understanding of the current energy use and associated emissions, as well as the opportunities to accelerate clean energy.

In addition to the goals included in the table, the resolution also outlines climate justice targets to achieve, ensuring that equitable implementation of the community's assertive climate policies are done with most vulnerable community members centered in and shaping solutions. The city is also directed to utilize carbon dioxide removal methods that will allow net zero emissions to be achieved by 2050 and to reduce black carbon emissions by 35% from 2010 levels by the same year. Although not a perfect measure of black carbon, Linn County has an ambient PM2.5 monitoring station in Cedar Rapids. In 2010 the average annual PM2.5 air quality level was 11.1 micrograms/m3. By 2019, the ambient average annual PM2.5 air level was 7.9 micrograms/m3, equal to a 28.8% reduction over 2010 levels.

Table 1. Outlines the objectives identified in the February 2020 City of Cedar Rapids Climate Resolution

Objective	Baseline (2010)	Current (2019)	Progress toward Goals
Reduce carbon emissions by **45%** from 2010 levels by 2030 and achieve **net zero** carbon emissions by 2050	6.73 million metric tons CO2e	5.60 million metric tons CO2e (**17%** reduction)[1]	
Reduce methane emissions by **35%** from 2010 levels by 2050	1,592 metric tons	1,476 metric tons (**7%** reduction [2]	
Increase renewables to supply **70-100%** of electricity by 2050	Utility: Alliant reported that for 2005 they had **5%** of total capacity from renewables.	Utility: **18%** of electricity provided to Alliant's customers came from renewables [3]	
Decrease coal-generated electricity to **0%** by 2050	Utility: Alliant reported for 2005 that **44%** of their capacity was coal.	Utility: **27%** of Alliant's electricity production came from coal.[4]	
Decrease coal-generated electricity to **0%** by 2050	On-Site: In 2011, 28.5 million MMBtu of coal was burned for industrial processes within Cedar Rapids	On-Site: 25.6 million MMBtu of coal was burned for industrial processes within Cedar Rapids[5]	
Decrease industry carbon emissions by **65-90%** from 2010 levels by 2050	4.64 million metric tons CO2e	4.05 million metric tons CO2e (**13%** reduction [6]	
Increase the transportation sector's share of low-emission final energy to **35-65%** by 2050	1.1% of on-road cars, and 0% of on-road trucks (.8% of total vehicles) were hybrid, electric, or hydrogen in 2010.	1.6% of on-road cars, and 0% of trucks (**1.2%** of total vehicles) were hybrid, electric, or hydrogen in 2016, the most recent year available[7]	

This section includes the information from the 2010 and 2019 greenhouse gas inventories conducted by the city as well as additional energy use information for buildings and transportation. Finally, it is also important to be familiar with existing programs, policies, and plans related to energy and transportation in order to build upon those foundations. This section includes a summary table of such initiatives that are relevant to the development and implementation of this plan.

GHG inventory

What is a Greenhouse Gas (GHG) Emissions Inventory?
A greenhouse gas (GHG) emissions inventory tracks GHGs associated with a community. The scope and granularity of a GHG inventory vary depending on a community's needs, characteristics, and data availability. The *U.S. Community Protocol* (USCP), developed by ICLEI Local Governments for Sustainability USA, serves as a national standard to define which emissions sources and activities should be included in a community-wide inventory and provides methodologies to account for these emissions. This protocol reflects the sources and activities that local governments are best able to influence, including emissions that occur within the community's geographic boundaries (also known as Scope 1 emissions) as well as emissions occurring outside the community (also known as Scope 2 and Scope 3 emissions). The USCP accounts for the six internationally recognized GHGs that directly impact the climate (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexaflouride). While these gases have different levels of heat-trapping potential, they are assessed using the common metric of carbon dioxide equivalents (CO_2e).

The USCP identifies five Basic Emissions Generating Activities that must be included in community-wide inventories:

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

It also encourages communities to calculate emissions from other sources and activities that may inform community action. In addition to the required categories, Cedar Rapids' GHG inventories also account for:

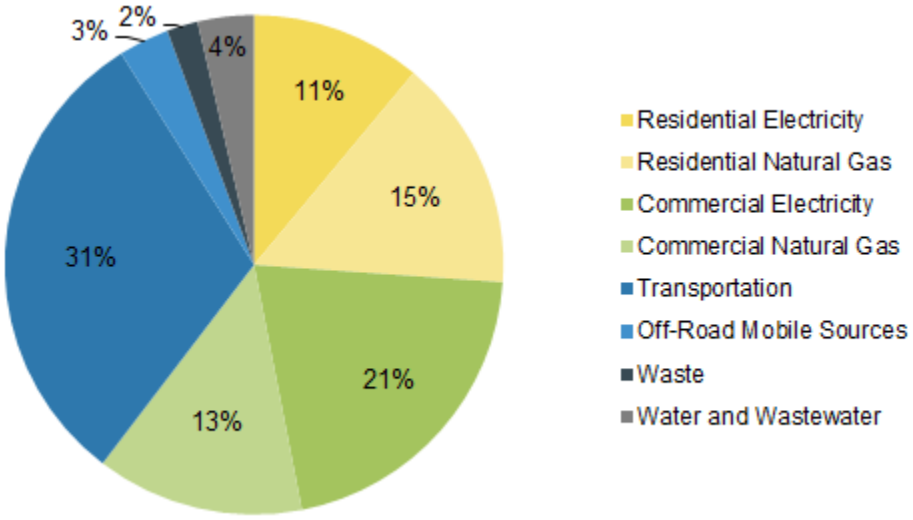
- Use of fuel in industrial stationary combustion equipment
- Process emissions from treating wastewater generated in the community
- Off-road surface vehicles and other mobile equipment operating within the community boundary

Since the scope of Cedar Rapids' inventories may vary from other communities, the total reported emissions may not be directly comparable. However, consistent scopes and methodologies were used to conduct inventories for Cedar Rapids for the years 2010 and 2019. Those inventories provide a baseline for tracking progress toward the City's goals and inform the priorities and strategies included in the implementation plan.

Cedar Rapids GHG Inventory

In 2019, the community of Cedar Rapids emitted 5.60 million metric tons of CO2e. Over 70% of these emissions are associated with industrial processes that take place within the city. Of the remaining emissions, 60% came from energy used in residential and commercial buildings, 34% came from vehicle travel and mobile equipment, and the remaining 6% from waste disposal and water and wastewater treatment and distribution (see Figure 1 for additional detail).

Figure 1. 2019 Non-Industrial GHG Breakdown



Community-wide emissions have decreased by 17% since 2010, which recorded 6.72 million metric tons of CO2e. This shows significant progress toward the City's goal of a 45% reduction from 2010 levels by 2030. Non-industrial emissions have decreased by 26% since 2010, as shown in Figure 2.

Figure 2. Non-industrial GHG emissions for 2010 and 2019

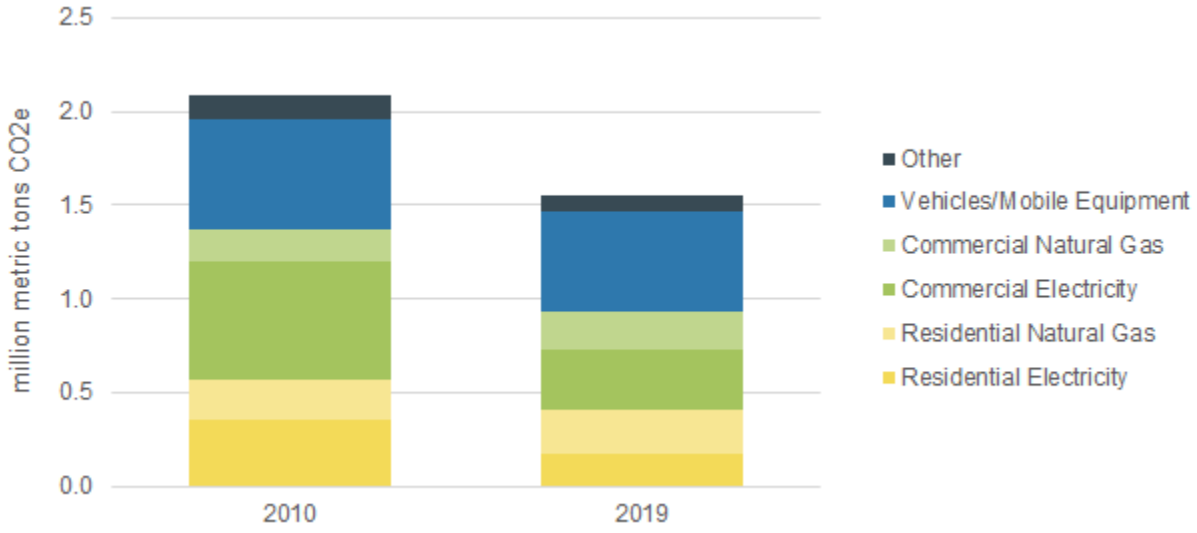
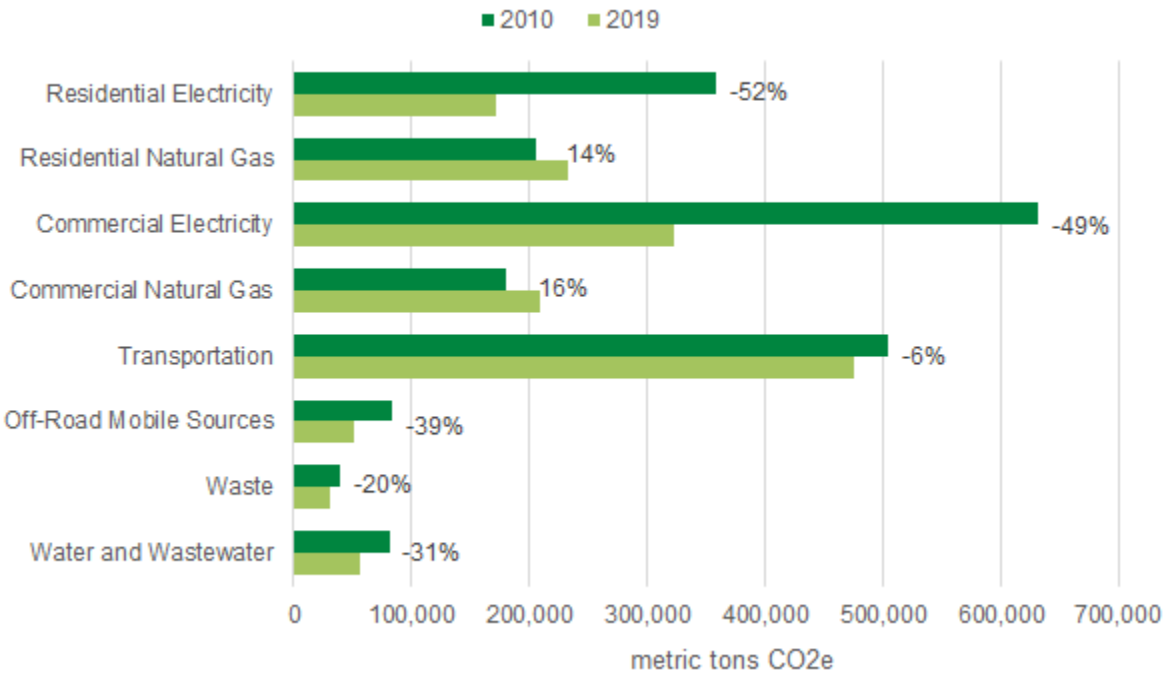


Figure 3. Non-industrial GHG trends from 2010 to 2019



Emissions by Sector

Emissions from building energy use
Buildings generate emissions through energy consumption; the extent of emissions is determined by the amount and source of energy used in the building. The two most common energy types for buildings are electricity and natural gas:

- **Electricity** is commonly used to power lighting, appliances, and air conditioning. Electricity usage and emissions data was provided by the city's electric utility provider, Alliant Energy. Electricity accounted for about a third of the community's non-industrial emissions in 2019, which saw a 50% decrease from 2010 levels. Indeed, the primary driver for the reduction in community-wide emissions is Alliant's ongoing transition to clean electricity sources. Alliant has steadily increased investment in renewable energy and efficient electricity generation systems across their footprint since 2008. The utility has deployed wind and solar farms, upgraded coal facilities to natural gas, and constructed combined-cycle natural gas generation facilities. These changes have caused emissions per MWh of electricity to drop by 52% from 2010 to 2019. Alliant has formally adopted a goal to eliminate coal from its power mix by 2040 and achieve net-zero electricity emissions by 2050.

- **Natural gas** is commonly used for space heating, water heating, and cooking appliances, as well as for some types of commercial equipment. The city's natural gas utility provider, MidAmerican Energy, provided usage data for Cedar Rapids. Emissions from natural gas accounted for 29% of the community's non-industrial emissions in 2019. Emissions from non-industrial natural gas use increased 15% from 2010 to 2019, reflecting an increase in both population and cold weather.

Emissions from building energy use can also be broken into sectors:

- **Residential buildings** were responsible for 26% of non-industrial emissions in Cedar Rapids in 2019, with over half of these emissions coming from natural gas. Residential emissions decreased 28% from 2010 to 2019 due to reductions in electricity emissions.

- **Commercial buildings** accounted for 34% of 2019 non-industrial emissions, with over half of these emissions still coming from electricity despite the steep decrease in electricity emissions from 2010. Commercial emissions decreased 35% from 2010 to 2019.

Emissions from industrial buildings and processes

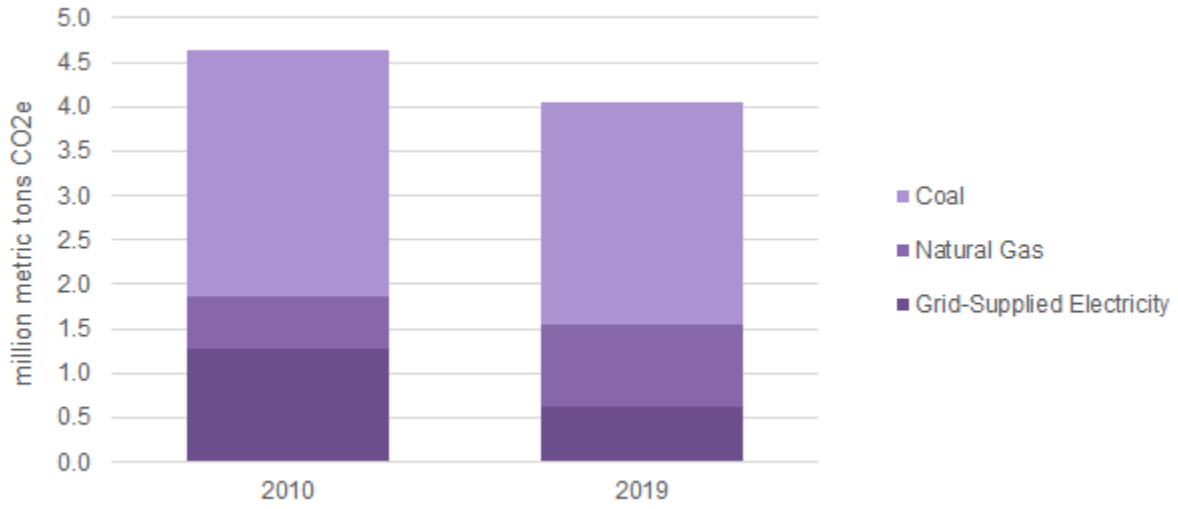
Energy used to power industrial buildings and processes is a significant source of emissions within Cedar Rapids. The primary industrial energy sources used in the community are electricity, natural gas, and coal. A small amount of distillate fuel oil, propane, agricultural byproducts, and biogas is also used. These sources are excluded from the inventories as they are considered too minor to make a difference. Overall, industrial emissions decreased by 13% from 2010 to 2019, as shown in Figure 4:

- **Industrial electricity** data was provided by Alliant Energy and accounted for 15% of industrial emissions in 2019. Similarly to the other sectors, emissions from grid-supplied electricity decreased by 52% from 2010 to 2019.

- **Industrial natural gas** data was provided by MidAmerican Energy and accounted for 23% of industrial emissions in 2019. Emissions from natural gas increased by 60% from 2010 to 2019, reflecting a transition from coal to natural gas across this time frame. This shift resulted in lower emissions overall, as natural gas is a cleaner energy source than coal.

- **Industrial coal** data is publicly available through the U.S. Environmental Protection Agency's Facility Level Information on Greenhouse Gases Tool (FLIGHT). Coal comprised 62% of industrial emissions in 2019 and decreased by 10% from 2010 as equipment was transitioned to natural gas.

Figure 4. Industrial GHG emissions for 2010 and 2019



Emissions from transportation and other mobile sources

Cedar Rapids' inventories include emissions from both on-road and non-road mobile sources. Vehicles and mobile equipment using liquid fuels emit GHGs from their tailpipes while in use. The extent of these emissions is dependent on the amount of use (e.g. miles driven), fuel efficiency (e.g. gallons per mile), and fuel type (e.g. gasoline).

- **On-road transportation** emissions include emissions from vehicle miles traveled within Cedar Rapids, regardless of where each trip started or ended. City-specific vehicle travel data is publicly available from the Iowa Department of Transportation. Emissions were estimated using national averages provided by ICLEI for: vehicle type/fuel breakdown (e.g. gasoline passenger car, diesel heavy truck), vehicle fuel economy, and emissions factors by fuel type. On-road emissions accounted for 31% of the community's non-industrial emissions in 2019. These emissions decreased by 6% from 2010, representing a modest increase in fuel economy across this time period.

- **Non-road mobile** emissions are generated from fuel use in mobile industrial, agricultural, commercial, and construction equipment, ranging from forklifts to lawn mowers. Emissions estimates for non-road mobile emissions are publicly available at the county scale from the U.S. Environmental Protection Agency's National Emissions Inventory (NEI) Data. Emissions were assigned to Cedar Rapids based on the city's proportion of Linn County's population. Non-road mobile emissions accounted for 3% of the community's non-industrial emissions in 2019, and decreased by 39% since 2010.

Emissions from solid waste generation and disposal
Emissions from the community's solid waste management are determined based on the quantity of waste generated within the community, the composition of this waste (e.g. organics, plastics), and the method of disposal (e.g. landfill, recycling, composting). The City of Cedar Rapids Solid Waste & Recycling Division hauls landfill waste, recycling, and organics from homes and apartments with 4 or fewer units; commercial and industrial waste is managed separately. Most solid waste in Cedar Rapids is hauled to the Cedar Rapids/Linn County Solid Waste Agency for landfill disposal. Annual quantities of solid waste landfilled are tracked at the county scale. Citywide waste was estimated for Cedar Rapids based on the city's proportion of Linn County's population. Statewide landfill waste composition data is publicly available from the 2017 Iowa Waste Characterization Study, and landfill characteristics, such as methane capture, was provided by Iowa Department of Natural Resources. Emissions from solid waste management accounted for 2% of the community's non-industrial emissions. Waste emissions decreased 20% from 2010 to 2019. This is due to a significant amount of flood debris being landfilled in 2010. Non-flood waste increased by 8% from 2010 to 2019, and the emissions per ton landfilled stayed constant.

Emissions from water and wastewater treatment and distribution
In addition to the GHGs emitted due to the energy used to treat and distribute water and wastewater, wastewater can produce methane and nitrous oxide as it breaks down. Emissions from these sources are dependent upon the quantity of water processed and the treatment process. Data was provided by the Cedar Rapids Water Pollution Control Division. Site-based water and wastewater treatment is excluded, such as wells, septic systems, and wastewater treated at industrial facilities. Water and wastewater emissions comprised 4% of the community's non-industrial total in 2019. These emissions decreased by 31% since 2010, due primarily to cleaner electricity being used in the treatment facilities.

Energy Use: Buildings

Energy use in buildings includes the natural gas and electricity consumption in the residential, commercial, and industrial sectors. This information is important to understand both in consideration of energy's relationship to greenhouse gas emissions as well as determining a baseline for opportunities to improve energy efficiency and fuel switching. This information was collected from the electric utility, Alliant Energy, and the natural gas provider, Mid American Energy Company, and includes aggregate energy use and number of customers across sectors.

A primary energy demand for buildings, especially in Iowa and the Midwest, is space conditioning, i.e., heating and cooling. There is also consumption associated with other everyday activities, like using appliances in residential buildings, or using professional equipment in commercial buildings. The primary energy sources for buildings are electricity and natural gas. Some buildings use other fuels like propane, though it's a small contribution to total energy use and emissions and not included here.

Energy use for space conditioning in buildings is dependent on how hot or cold it is in a given year. Temperature variation across years can be understood in terms of cooling degree days (CDD) and heating degree days (HDD), which represent the extent to which the average daily temperatures are higher or lower than 65 degrees fahrenheit. Warmer or cooler seasons, can help to explain a decline or increase in natural gas and electricity consumption from one year to another. Table 2 summarizes the CDD and HDD for 2010 and 2019.

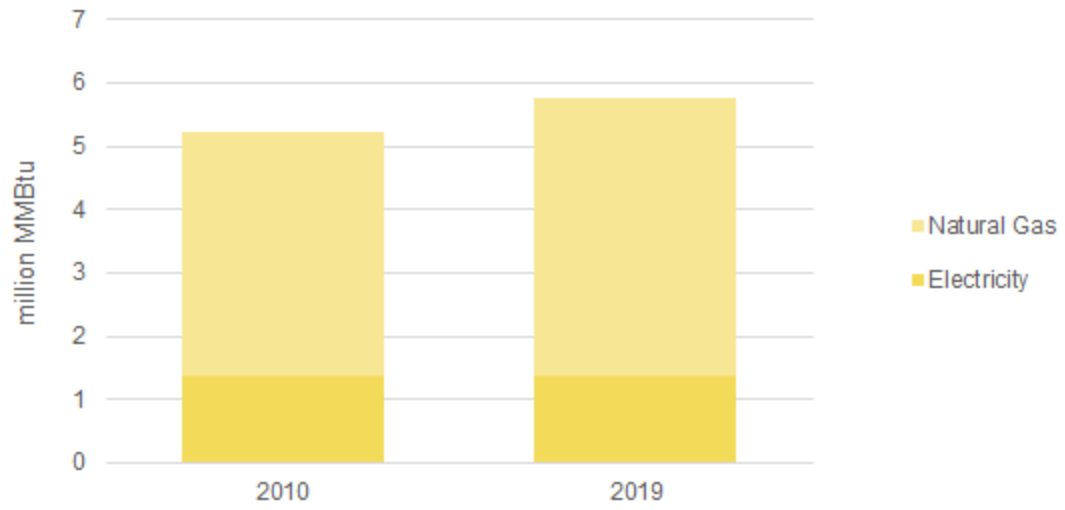
Table 2. Cooling Degree Days (CDD) and Heating Degree Days (HDD) in Cedar Rapids (2010 & 2019)

Measure	2010	2019	% Change
Cooling Degree Days (CDD)	890	770	-13%
Heating Degree Days (HDD)	6,930	7,317	6%

Residential Building Energy Use

In 2019, residential buildings accounted for 47% of total building energy use, not including the industrial sector, as shown in Figure 5. Approximately 76% of residential energy use was consumption of natural gas, with the remaining coming from electricity. This suggests that space heating is likely the primary driver of energy consumption for residences. Natural gas use is largely driven by weather, colder weather will increase heating needs and therefore natural gas use.

Figure 5. Residential energy consumption for 2010 and 2019



Per household energy consumption in residential buildings declined for electricity consumption but increased for natural gas consumption from 2010 to 2019 (see Table 3). Annual per household electricity consumption decreased from 7,031.7 kWh per person to 6,806.9 kWh per person. Annual natural gas consumption increased from approximately 670.3 therms per person to 736.0 therms per household. The difference in weather in 2019 (with a milder summer and colder winter than 2010) likely contributed to these differences.

Table 3. Residential Energy Consumption 2010 - 2019

Activity	Unit	2010	2019	% Change
Total Residential Electricity	kWh	404,230,631	405,670,755	0%
Per Household Residential Electricity	kWh / household	7,031.7	6,806.9	-3.2%
Total Residential Natural Gas	therms	38,533,213	43,864,095	14%
Per Household Residential Natural Gas	Therms / household	670.3	736.0	9.8%

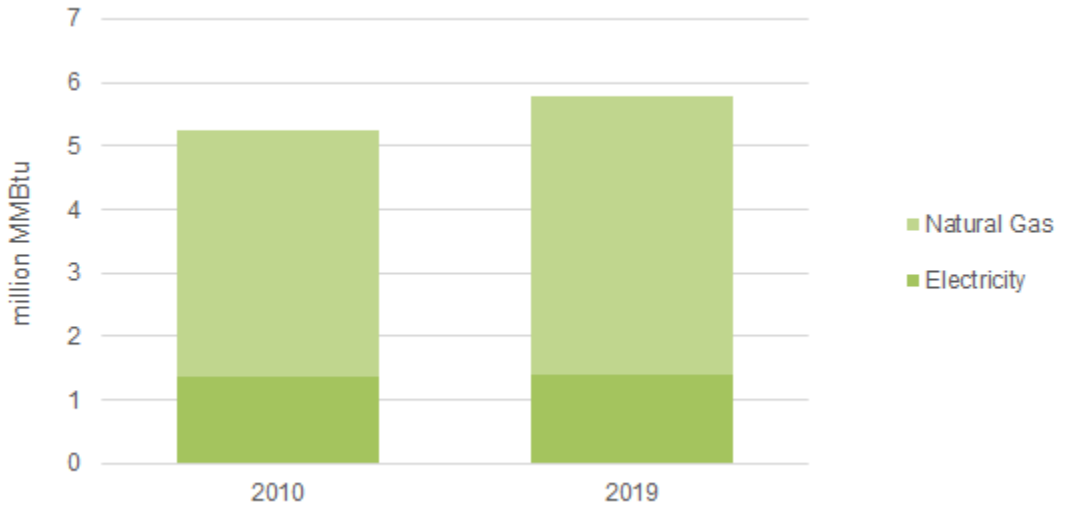
Commercial Buildings

Commercial buildings include small, medium, and large businesses that do not have industrial processing. This can be restaurants, retail shops, grocery stores, and large institutions, as well as multi-family housing and public buildings. In 2019, the energy consumption in commercial buildings accounted for 53% of total residential and commercial building energy consumption. Between 2010 and 2019, commercial buildings saw an increase in energy consumption for both electricity and natural gas. Electricity consumption increased by 7% and natural gas consumption increased by 16%, for a total 10% increase in commercial energy use. Table 4 and Figure 6 show the breakdown of energy consumption across commercial buildings for the two years.

Table 4. Commercial Energy Consumption 2010 - 2019

Activity	Unit	2010	2019	% Change
Commercial Electricity	kWh	711,383,594	763,493,606	7%
Commercial Natural Gas	therms	33,959,820	39,264,045	16%

Figure 6. Commercial energy consumption for 2010 and 2019



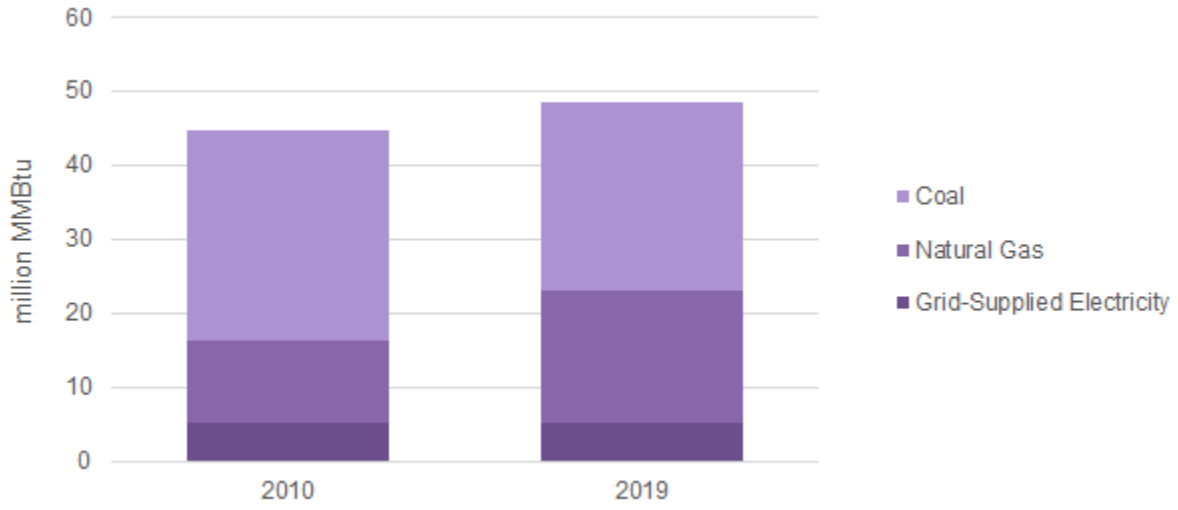
Industrial Buildings

Industrial buildings include any manufacturing or processing facilities in Cedar Rapids. This can be anything from the City's water treatment plant to food processing facilities. Industrial buildings accounted for 80% of total building energy consumption. From 2010 to 2019, electricity consumption remained relatively constant (increased by 2%), while natural gas consumption increased by 60% and coal decreased by 10% (see Table 5). As shown in Figure 7, total energy use increased by 9%.

Table 5. Industrial Energy Consumption 2010 - 2019

Activity	Unit	2010	2019	% Change
Industrial Electricity	kWh	1,506,874,523	1,532,372,711	2%
Industrial Natural Gas	therms	111,382,107	178,147,588	60%
Industrial Coal	MMBtu	28,483,067	25,559,100	-10%

Figure 7. Industrial energy consumption for 2010 and 2019



Household Energy Burden

Energy burden refers to the cost a household contributes to paying energy bills relative to total income. The average energy burden in the U.S. is 3% using median household income. An energy burden greater than 6% is considered a high energy burden, and a severe energy burden refers to paying more than 10% of income on energy. Energy burden can be influenced by a variety of factors like housing tenure, income, building type, and efficiency. Often, households with lower incomes pay disproportionately higher energy bills because the upfront costs to improve efficiency (building envelope, appliances, windows, etc.), are financially unattainable.

In Cedar Rapids, the average energy burden is 2%. However, when looking more closely at various situational factors, energy burden can range from 13%-20% for many households.

Estimates from the U.S. Community Survey (a component of the U.S. Census) found that approximately 15.6% of Cedar Rapids community residents, or just over 20,000 individuals, were living below the poverty level in 2019. An estimated 11% of community residents received public assistance (or food stamps) in that same year.

In Cedar Rapids, the distribution of residents living at less than 100% of the poverty level was also inconsistent across racial dimensions. Many factors can contribute to income status, but estimates show that communities of color are disproportionately represented in lower income brackets. It is also evident that income directly correlates to energy burden. 2019 census estimates found that Black / African-American, bi-racial, or Cedar Rapids residents of a race not listed on the census experienced income below poverty level at much greater frequency than other residents (see Figure 8).

Figure 8. Distribution of Cedar Rapids residents living at less than 100% of the poverty level by Race for 2019

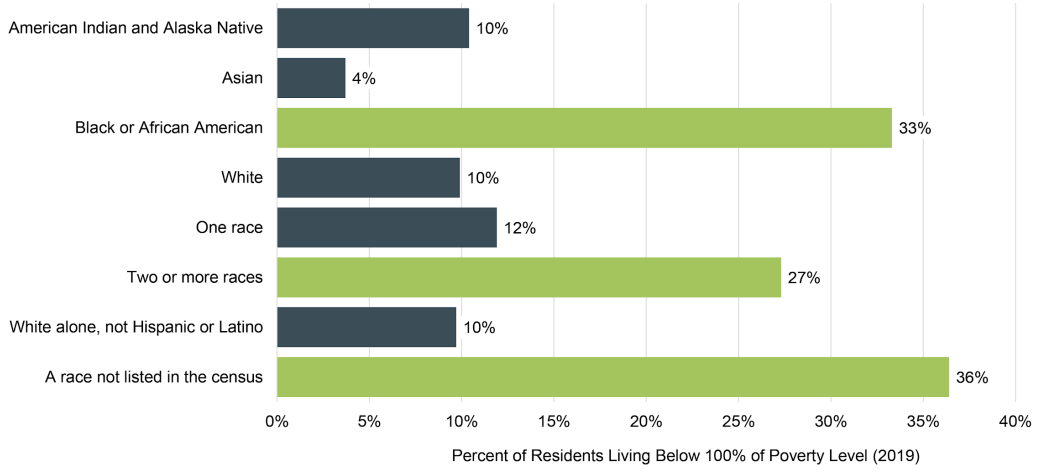
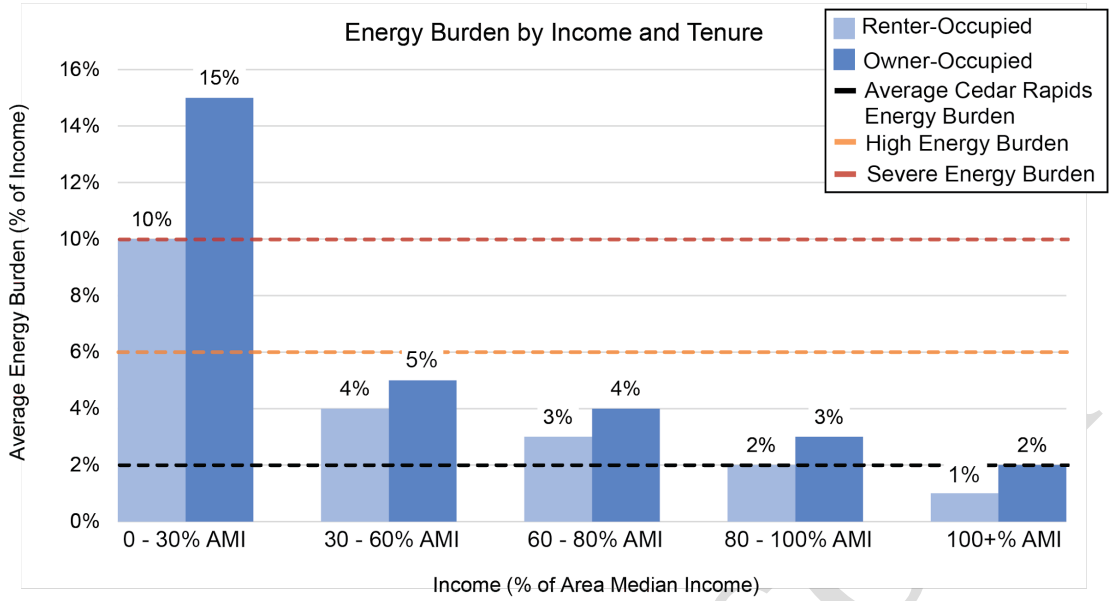


Figure 9 shows the average energy burden for Cedar Rapids residents by both tenure (whether they own or rent where they live) and their income level (as a percent of the area median income or AMI). The figure shows that residents living with income levels less than 30% AMI experience the greatest energy burden (10-15% of income). Energy cost is also an important consideration of energy burden, and varies by income and tenure in Cedar Rapids. In Cedar Rapids, the majority of household annual energy costs are to pay for electricity, regardless of income or tenure. Average annual energy cost increases with income and owner-occupied households pay more on average than renter-occupied households.

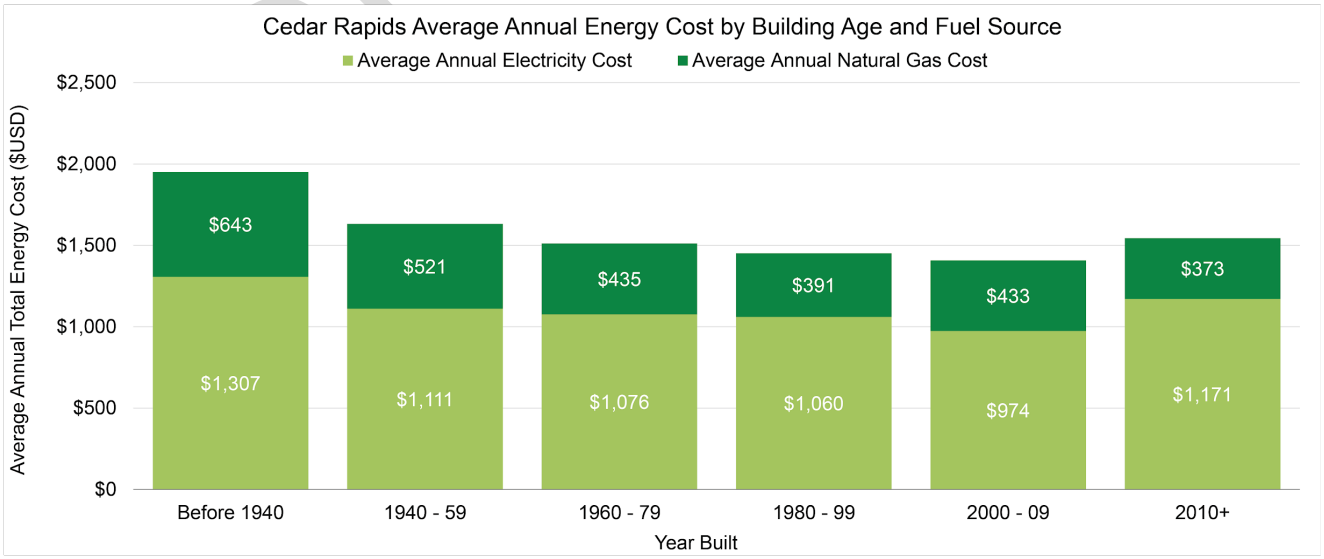
Figure 9. Cedar Rapids Average Energy Burden by Tenure and Income



Data Source: Department of Energy Low-Income Energy Affordability Data (LEAD) Tool which utilizes U.S. Census household-level microdata from 2018

The age of building may also contribute to total energy cost and burden. Most single-family homes built prior to 1978 were not constructed in consideration of energy efficiency. Although these homes may be retrofitted to improve performance, those that have not are likely to be inherently less efficient than buildings constructed with more advanced building energy standards. In Cedar Rapids, average energy burden is highest in buildings constructed before 1960 (6% as compared to 4-5%). Figure 10 shows the average energy cost for Cedar Rapid residents based on the age of the building. Electricity costs residents more on average than natural gas for all buildings, regardless of year built.

Figure 10. Average annual energy cost by building age and fuel source



Data Source: Department of Energy Low-Income Energy Affordability Data (LEAD) Tool which utilizes U.S. Census household-level microdata from 2018

Energy Use: Transportation and Mobility

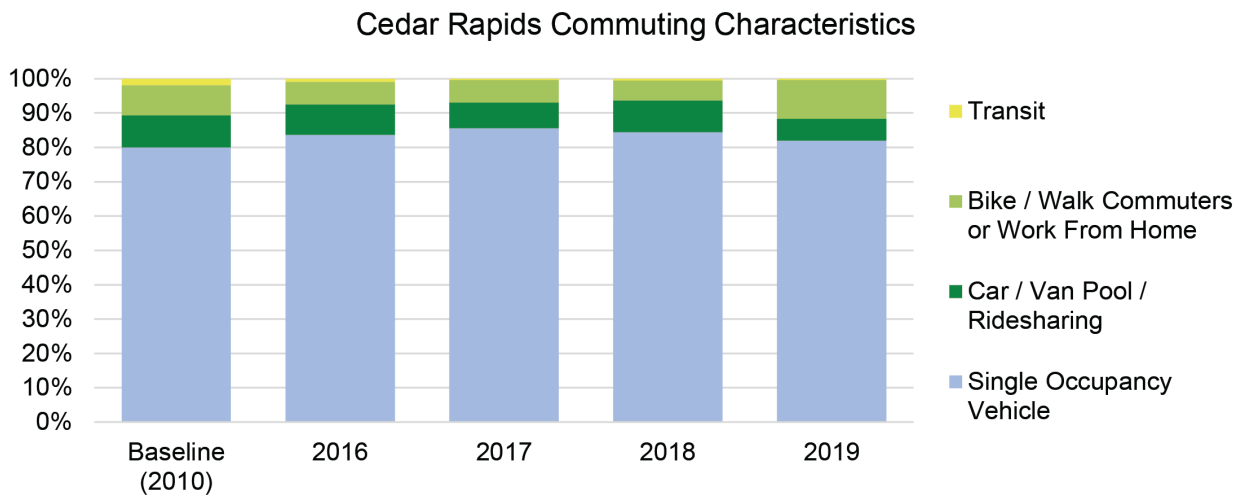
Energy use for transportation includes the fuel that is used to power internal combustion energy vehicles. This includes passenger vehicles as well as heavy-duty vehicles like semi-trucks. Common fuel sources for these vehicles are primarily gasoline and diesel. Combusting these fuels result in both greenhouse gas emissions that impact climate change as well as air pollutants that negatively impact people's health, especially those living near heavily trafficked areas such as interstates and other arterial roads.

This section looks at the composition of the vehicles on the road and the primary commuting options of residents. Reducing transportation emissions requires a combination of reducing energy consumed by vehicles, reducing the use of combustion fuels, and reducing the amount of driving that occurs within the community.

Transportation Characteristics

The most common form of transportation in Cedar Rapids is single-occupancy vehicles. U.S Census Data tracks commuting characteristics through the American Community Survey conducted each year. While this is not always the most accurate measure of a community's travel behavior, it serves as a good proxy to gain insight into how people move around the community. Since 2010, personal vehicles have been the primary mode of commuting for more than 80% of the residents in Cedar Rapids. During this time, it appears that transit ridership has seen a decline while biking, walking, and working from home have seen an increase, representing 10.6% of residents (see Figure 11).

Figure 11. shows the breakdown of community members who use various modes of transportation going to and from work



Current On-road Vehicle Characteristics

As mentioned, single occupancy vehicles are the primary mode of transportation in Cedar Rapids. Vehicles in Cedar Rapids generally include cars, light duty trucks (SUVs, pick-ups, etc.), and heavy duty trucks. Most residents drive cars and light trucks, while heavy duty vehicles are used for deliveries, sanitation, road work, etc. Of the cars and light-duty trucks, most run on gasoline or diesel. These fossil fuels both contribute to climate change and have negative health impacts on residents, especially among those who live close to main arterials.

There are several strategies to reduce emissions and improve quality of life in the transportation sector. Fuel economy can be improved, cleaner fuels can be used to run vehicles, and vehicles can be driven less. In 2010, the average fuel economy for cars and trucks was 21 mile per gallon (MPG). This

increased to 23 MPG in 2016 due to strong fuel standards. The current federal standards for internal combustion vehicles is not increasing at a rate fast enough to achieve the city's goals. It is increasingly clear that combustion vehicles will need to be phased out while low- and no-emissions vehicles are phased in.

There are several alternatives to gasoline and diesel. Flex fuels include ethanol/gasoline blends that can be used in most vehicles that take gasoline. Currently, most ethanol is processed using corn. While there are some carbon benefits to using corn ethanol over gasoline, there are other feedstocks that have the potential to achieve net carbon negative, through soil sequestration and less energy intensive processing. Other commercially available options include hybrid models and full electric vehicles. Currently, there is very little penetration of these vehicles in Cedar Rapids. However, major manufacturers have announced plans to move toward production of only electric vehicles in the coming decade, which will accelerate the adoption rate of these vehicles.

Figure 12. Communitywide Vehicle Fleet Composition in Cedar Rapids (2006 to 2016)

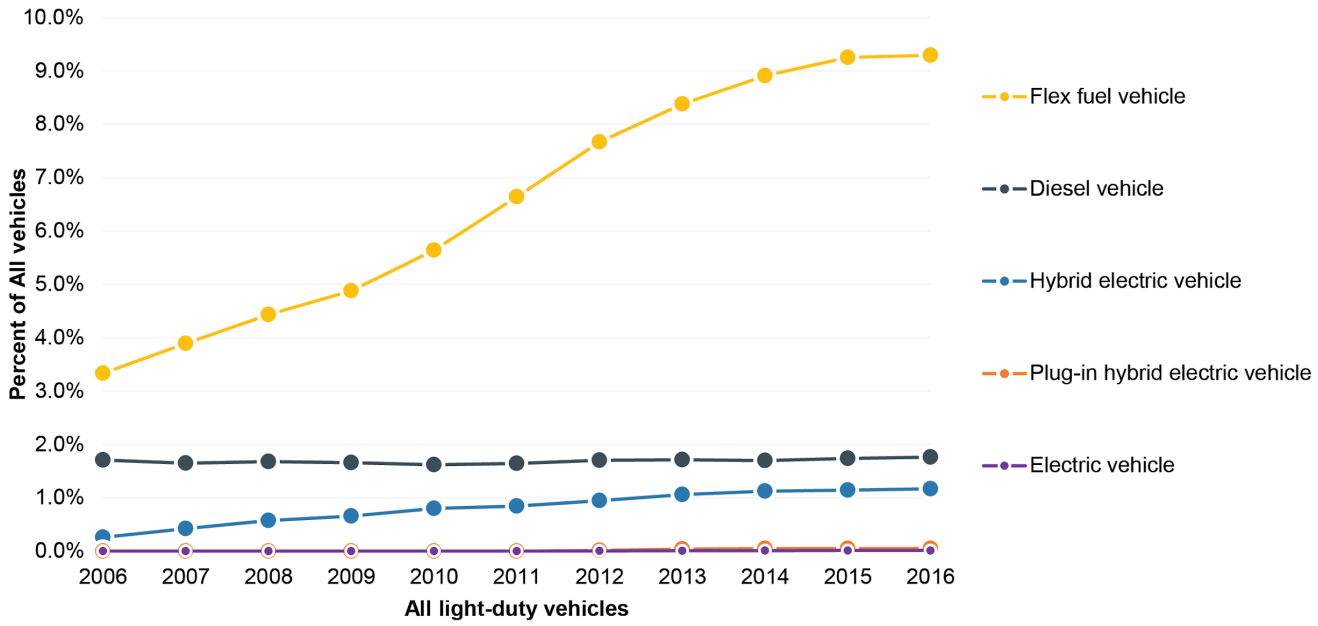
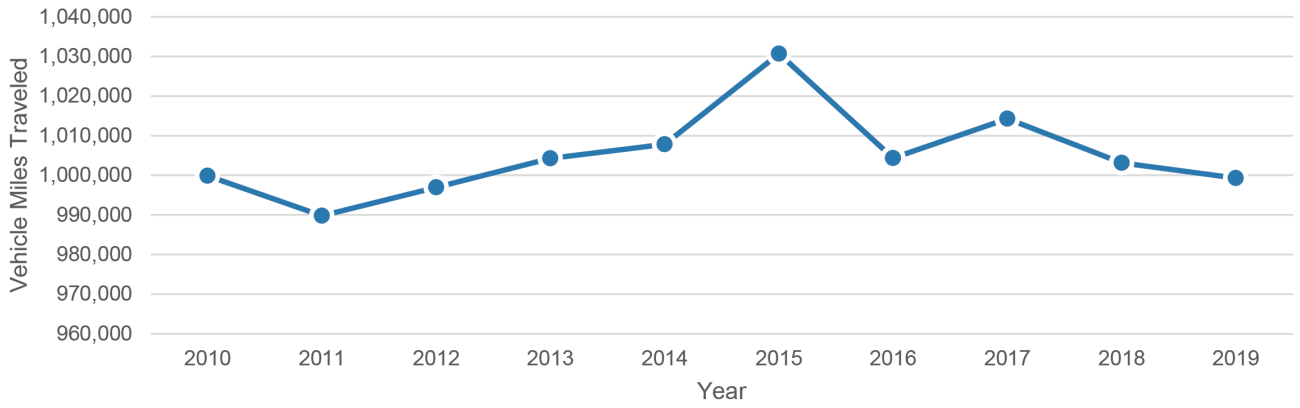


Figure 12 shows the percent of registered vehicles in Cedar Rapids that use fuels alternative to natural gas. Flex fuel (likely an ethanol blend) is the most common alternative fuel used and has seen significant growth over the ten-year period. Hybrid electric vehicles, like the Toyota Prius, have also increased and accounted for 1.2% of all vehicles in 2016. Electric vehicles and plug-in hybrid electric vehicles make up less than 1% of all vehicles.

Finally, another important strategy to reduce emissions from vehicles is to drive less. Between 2010 and 2015, Cedar Rapids saw a slight increase in vehicle miles traveled (VMT) within the community of about 30,000 VMT. Since 2015, VMT has seen a slight downward trend, as seen in Figure 13. Strategies to reduce driving include increasing transit ridership, improving walkability, constructing quality bike infrastructure, and developing more dense land with mixed uses.

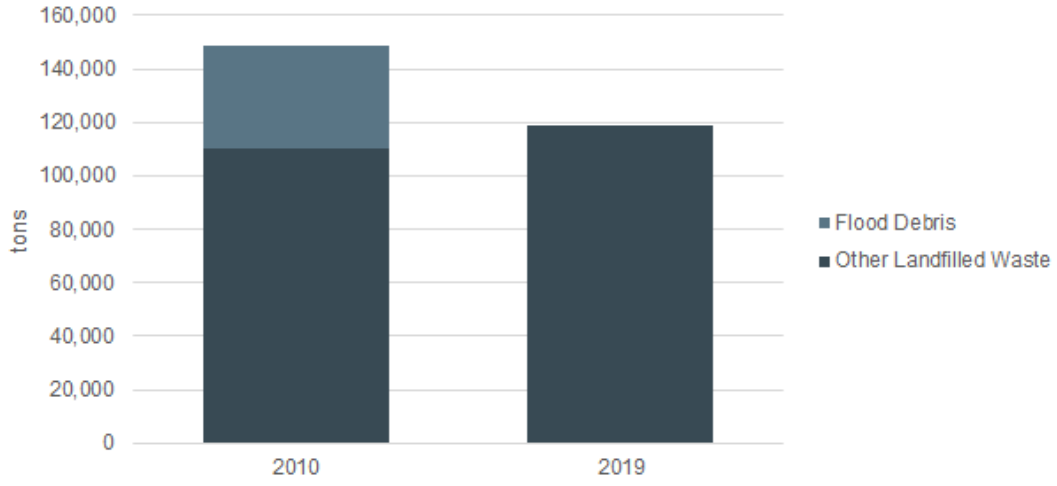
Figure 13. Vehicle Miles Traveled (VMT) in Cedar Rapids from 2010 to 2019



Waste

Solid waste is important from both the standpoint of processing post-consumer waste and in consideration of the global impact from the production of goods and food. Emissions that are generated in the production of goods are not captured in the city report and result in an underestimation of waste's contribution to climate change. Waste that is processed and landfilled must have adequate space for the coming decades. Significant waste reduction through a decrease in consumption, increased reuse and recycling can both reduce greenhouse gas emissions and extend the life of the landfill. As noted, Cedar Rapids, without considering flood debris, saw an increase in the amount of waste landfilled from 2010 to 2019, shown in Figure 14.

Figure 14. Landfilled waste from Cedar Rapids in 2010 and 2019



Clean Energy Resources

Renewable energy sources like wind and solar, as well as others like hydro and geothermal, provide abundant, carbon-free resources to many communities. In recent years, the cost of wind and solar technologies has dramatically declined, making it cost competitive to all other types of energy. In Cedar Rapids, there is tremendous opportunity to harness the natural power from the sun. Wind, which is already prevalent across the state of Iowa, is also readily accessible to the City, both through the utility as part of the City's electric generation mix, as well as for smaller generation resources.

Figure 14. Solar Resource for the City of Cedar Rapids, Zoom in of the Downtown Area Building Rooftops

Solar resource is commonly measured in solar insolation or how intensely the sun shines on any given point. Most often solar arrays installed in cities to capture solar energy - which are smaller energy systems than other solar arrays, like utility-scale - are located on building rooftops. Figure 14 highlights the solar resource across the building rooftops within the City. Many aspects contribute to building rooftop suitability for solar, including the slope of the building (e.g., very large, flat commercial and industrial building rooftops make excellent locations for solar systems), as well as other considerations like roof color, building age, and existing roof infrastructure. Considerate of these factors, many areas stand out as having very high solar resource potential per Figure 14, especially the community's downtown and large commercial corridors.

Data Source: University of Northern Iowa provided Solar insolation data in 2018 based on 2015 LiDAR data; the planometric building footprints were generated by Cedar Rapids GIS based on 2017 data

Based on solar insolation data from the University of Northern Iowa, the estimated solar resource capacity for all of Cedar Rapids (which includes all land area and buildings, but excludes water features) is conservatively around 2,199 megawatts (MW). It's also important to note that this solar data was captured in 2015, pre-derecho, and does not reflect the resulting loss in tree canopy associated with the derecho event; trees are often one of the primary barriers to solar, so the loss of canopy could have created more opportunity for solar.

Despite this, the building rooftops alone host an estimated 181 MW capacity, while the ten buildings with the highest solar capacity measure 9.4 MW of capacity in total. Parking lots may also provide opportunities for solar system installations through the use of advancing technologies like solar carports. The aggregate solar capacity for all parking lots in Cedar Rapids (as of 2017) was an estimated 144.5 MW, and the ten parking lots with the highest potential solar capacity could host an estimated 10.2 MW in total.

Table 6. Summary of Solar Resource Potential

Geography	Total Potential Solar Capacity (MW)	Total Potential Solar Generation (MWh)	Percent of Non-Industrial Electricity Consumption

Building Rooftops	181	234,770	20%
Top 10 Building Rooftops	9.5	12,261	1%
Parking Lots	144.5	187,700	16%
Top 10 Parking Lots	10.2	13,320	1%

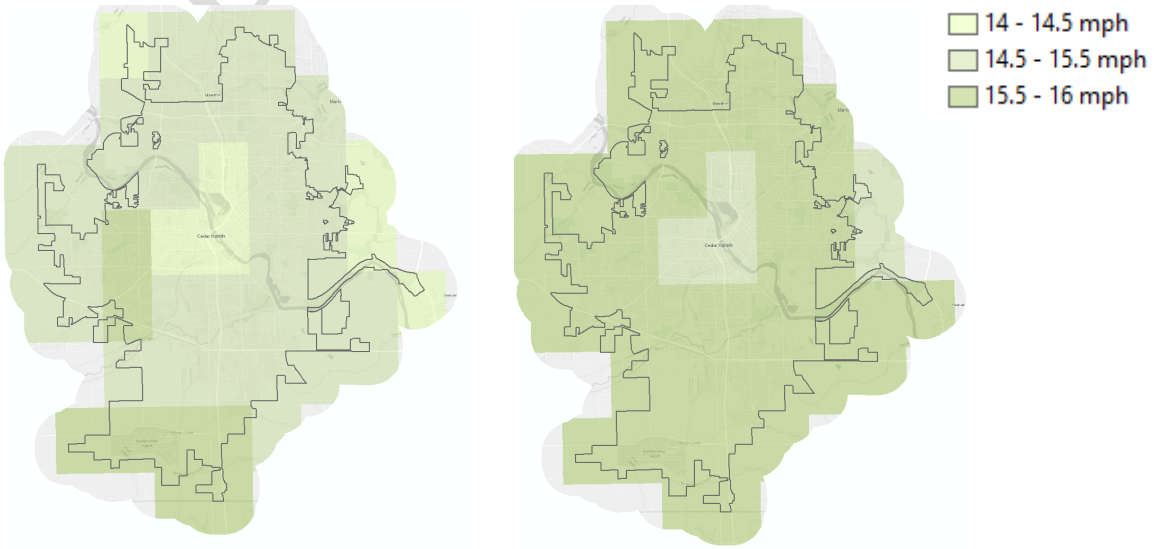
**Estimates assume a conservative 15% panel efficiency. Electricity consumption includes residential and commercial electricity usage from 2019 Alliant data. Parking lot and building data came from the 2017 planometric shapefile created by the City of Cedar Rapids GIS Staff.*

For context, in 2019, Cedar Rapids used 584,582 MWh of electricity in residential and commercial buildings. If Cedar Rapids maximized the potential solar energy capacity of building rooftops alone through installation of solar arrays throughout the City, this new solar energy would generate one-fifth (20%) of the City's total residential and commercial electricity use (see Table 6). If it also maximized opportunity to install solar on existing parking lots, the new solar energy would generate an additional 16% of the City's electricity use from residential and commercial buildings.

Wind Energy

Figure 15 provides insight into the land-based wind speeds within the City of Cedar Rapids at various heights. As a rule of thumb, the higher you go from the ground, the greater the wind speeds (to a point). The maps in Figure 15 show modeled average wind speeds at 80- and 100- meters, although wind turbine technology in recent years allows communities to access even greater heights of 200- or 300-meters. The data behind these maps originates with the National Renewable Energy Laboratory (NREL) and are presented at a spatial resolution of 2.5 kilometers that is interpolated to a finer scale. For wind speeds to translate to good, financially viable wind generation, an average mile per hour wind speed of 12-13 is generally considered the minimum. All areas of Cedar Rapids and adjacent areas have wind speeds that surpass this minimum, while the southern edge of the City has the greatest wind speeds at 80-meters.

Figure 15. Wind Resource for the City of Cedar Rapids at 80- and 100-meters



Current Plans, Policies, and Programs

Cedar Rapids has been a proactive regional leader on climate and sustainability for the last decade, and a suite of existing plans and policies are already in place to support more advanced climate action throughout the City. In 2012, the Cedar Rapids City Council adopted *Guiding Principles of Sustainability for the City of Cedar Rapids,* which resulted in the creation of the iGreenCR program. The iGreenCR program deploys ongoing initiatives and partnerships that have already positioned the CIty of Cedar Rapids to become a national model for environmental excellence.

The City has experienced firsthand the impacts of climate change notably through the extreme weather event in 2014, as well as the more recent Derecho in 2018. In an effort to both acknowledge the strength and resilience showcased in rebuild efforts after these events, as well as to ensure that the City is more prepared for future events, Cedar Rapids has adopted a visionary path forward through their EnvisionCR 2015 Comprehensive Plan (EnvisionCR). EnvisionCR was recently updated in February of 2021.

In addition to the City's EnvisionCR Comprehensive Plan and 2020 Climate Resolution, an expansive body of existing, supporting plans also outline milestones and opportunities for the City to pursue bold climate action while leveraging work already underway. Table X highlights the existing library of plans and their relevance for the Community Climate Action Plan (CCAP).

Table 7. Existing Plans that Support / Integrate with the CCAP

***(inventory of plans currently underway that will populate table: https://docs.google.com/spreadsheets/d/1xuAi24eHRJHDCoRxsn6f2q23q864ilZRxlRTaMBjzN0/edit#gid=504228329)**

***Full table in Appendix document: https://docs.google.com/document/d/1GFVh_eWpnzJ5txKOQz4DhgX_-srwgFqjLKxvcNaSS18/edit**

Name	Highlights	Key Policies	Date Adopted
Plans			
EnvisionCR Comprehensive Plan	The City's dynamic comprehensive plan articulates the community's vision for 2040, as well as initiatives and ongoing work to support the achievement of that vision, including implementation.	Detailed above.	Last updated February 2021
iGreenCR Action Plan	Guidelines for City Operations sustainability goals and activities across three key dimensions - the triple bottom line - of environmental, economic, and social outcomes across four key areas of work: resources, nature, development, and community.	Each chapter of the plan articulates the goals for the iGreenCR Action Plan that can be scaled to communitywide, each of which directly aligns with goals outlined by the Climate Resolution, and actions in this Community Climate Action Plan. Many of the initiatives detailed in the Implementation chapter of the Plan already include community-wide outcomes that can be leveraged and expanded through the CCAP.	Adopted 2020
Pedestrian Master Plan	Identifies the opportunity for Cedar Rapids to become one of America's great walking cities, articulating a suite of solutions modeled by communities across the country that can serve as examples for the City of Cedar Rapids. The ideals of the plan build on Cedar Rapid's existing trail network and expansion of accessible transportation options for all community members. The Plan also establishes a baseline for existing compliance with Americans with Disabilities Act (ADA) accessibility levels through the community.	"The Plan outlines a series of goals to achieve a vision of' ``by 2040, walking in Cedar Rapids will be a safe, convenient, accessible, and enjoyable activity for people of all ages and abilities." • Goal 1: Develop a connection pedestrian network that links popular destinations year-round. • Goal 2: Create a comprehensive approach that fosters a culture of walking. • Goal 3: Measure progress toward achieving the Plan's vision. Strategies are divided into the ""Five Es"" of Education, Encouragement, Evaluation, Enforcement, and Engineering and Planning. The Plan identifies both infrastructure and non-infrastructure strategies, and includes examples like expansion of the existing sidewalk network, as well as updates to existing city code and ordinance language to, for example, amend the minimum sidewalk width as well as standards for ADA compliance. "	December 2019

Cedar Rapids Energy Management Plan	Sets energy efficiency and conservation goals for municipal operations	By 2020: ● 26% reduction from FY08 in facility energy use ● Establish a sustainable revolving fund for municipal energy projects ● 10% of municipal energy provided by onsite renewable energy systems ● Leverage existing training and education programs to train 100% of city staff in energy management ● Improve Residential Energy Efficiency: 5% reduction in sector energy use from FY08 ● Improve Non-Process Energy Efficiency in Commercial and Industrial Facilities: 5% reduction in sector energy use from FY08 ● 30 increase in the fuel economy of the municipal fleet ● 5% reduction in citywide vehicle fuel use	Adopted 2008
Local Neighborhood Action Plans	As part of the EnvisionCR Comprehensive Plan, the City identified development of local action plans as a goal in the StrengthCR chapter, including Neighborhood Action Plans, Area Action Plans, and Corridor Action Plans (as well as identification of priority Study Areas). Local Action Plans provide unique insights into the geographic, demographic, and social diversity of each area within Cedar Rapids. EnvisionCR articulates exactly what local action plans should include, such as existing conditions assessment, opportunities for infill and redevelopment, as well as specific goals and policy initiatives for the area.	Action Plans Currently Underway: ● 6th St SW Corridor Action Plan; ● Czech Village / NewBo Action Plan; Completed Plans: ● College District Area Action Plan; ● Northwest Neighborhood Action Plan; ● Mount Vernon Rd Action Plan;	Ongoing
Policy			
City of Cedar Rapids Ordinance No. 32.04.04: Alternative Energy Systems	This section regulates the use of alternative energy systems including solar, wind, ground source heat pumps.	The purposes of these provisions relating to alternative energy systems are to: 1. Promote the use of wind, solar, ground source heat pumps and other alternative energy systems; 2. Provide opportunities for homeowners to save fuel costs; 3. Ensure that site elements do not excessively shade potential solar system locations; 4. Preserve access to wind for small wind energy systems; 5. Establish standards to encourage the use of ground source heat pumps; and 6. Ensure that alternative energy system are safe	Effective June 2020

City of Cedar Rapids Climate Resolution (No. 3076-2-20)	Climate resolution adopted by City Council in February 2020 that articulates seven goals for emissions and energy consumption reduction. Also explicitly specifies climate justice targets necessary to achieve the goals of the resolution.	• Reduce carbon emissions by 45% from 2010 levels by 2030 and achieve net zero carbon emissions by 2050; • Reduce methane and black carbon emissions by 35% from 2010 levels by 2050; • Increase renewables to supply 70-100% of electricity by 2050; • Decrease coal-generated electricity to 0% by 2050; • Decrease industry carbon emissions by 65-90% from 2010 levels by 2050; • Increase the transportation sector's share of low-emission final energy to 35-65% by 2050; • Utilize carbon dioxide removal methods that allow the city to achieve net zero carbon emissions by 2050.	Adopted February 2020
ReZone Cedar Rapids: Zoning Code Update	A comprehensive initiative to update the City's zoning code to reflect the goals, strategies, and initiatives outlined in the City's 2014 comprehensive plan update, EnvisionCR.	ReZone Cedar Rapids functions under three key principles, in align with the EnvisionCR plan: • MODERNIZE: The new zoning code will enhance the experience of users by incorporating a user's guide and more graphics and user-friendly tables. • SIMPLIFY: The City is exploring how the zoning code could improve the review and approval process for development proposals. The goal is to simplify the process for quality development. • FLEXIBILITY: The new code will address the diversity of Iowa's second largest city by embracing its uniqueness and providing options that accommodate the city's urban, suburban, and commercial areas. The effort recognizes the dynamic nature of EnvisionCR and seeks to personify the living document through regular updates to the City's zoning code.	Adopted December 18, 2018 - Ongoing
Iowa Smart Planning Act	Sets guiding values for comprehensive plans, which include explicit mention of climate-related goals	Broad Guiding Values For Comprehensive Plans 1. Collaboration 2. Efficiency, Transparency and Consistency **3. Clean, Renewable and Efficient Energy** 4. Occupational Diversity 5. Revitalization 6. Housing Diversity 7. Community Character **8. Natural Resources & Agricultural Protection** **9. Sustainable Design** **10. Transportation Diversity**	2010
Program			
Bike Share System	Cedar Rapids deployed the bike share program - VeoRide - in summer 2020 with a fleet of electric-assist bikes and electric scooters. The effort contributes to alternative mobility options for Cedar Rapids community members.	"The program currently maintains 150 electric-assist bikes and 70 electric scooters with 90 designated green parking stations across five districts in the City: • Downtown • New Bohemia • Czech Village • Kingston Village • MedQuarter"	June 2020 - Ongoing

Cedar Rapids STAR Results Report	Summary Report that details the certification results for the City in the STAR program. Cedar Rapids achieved 4-STAR Community designation in July 2018. Cedar Rapids scored high in "Innovation and Process" and "Jobs and Economy." However, Cedar Rapids scored lowest in the "Climate and Energy" goal area, identifying opportunities for growth.	The program evaluates and recognizes progress towards sustainability across eight goal areas with unique dimensions of recognition for each goal: 1) built environment, **2) climate & energy**, 3) education, arts, and community, 4) economy and jobs, **5) equity and empowerment,** 6) health and safety, **7) natural systems**, and **8) innovation and process.** The assessment details next steps for improving progress across all goal areas.	July 2018
City of Cedar Rapids Greenway Project	The Cedar Rapids Greenways project included three sections of greenway totaling 130 acres. The City is committed to transforming the neighborhoods hardest hit by the flood into greenways where a healthier community can grow. The project was initiated as a rebuilding and resiliency initiative in the aftermath of the 2008 flood.	Three overarching goals drive the project: 1. commitment to economic development 2. contribution to community health 3. evolving the face of the riverfront through celebration of the positive aspects of living in Cedar Rapids	2018
Connect CR	ConnectCR is a revitalization effort in urban Cedar Lake. The project is constructing a pedestrian and trail bridge over the Cedar River near the NewBo and Czech Village neighborhoods. The bridge will be built where a historic railroad bridge was wiped out during a 2008 flood event.	• ConnectCR sets ambitious goals for intentional connection. It focuses on: *connecting Cedar Lake to downtown, connecting neighborhoods and the city with the Smokestack Bridge, and connecting the Cedar Valley Nature Trail to the cross-country American Discovery Trail and the Great American Rail-Trail.	In Progress

Endnotes

1. Cedar Rapids Greenhouse Gas Inventory. Includes all CO2e attributable to the community.
2. Cedar Rapids Greenhouse Gas Inventory. Includes all methane attributable to the community.
3. Alliant Energy, “Environmental, Social, and Governance Performance” (July 2020). Note that generation capacity and electricity sales are not directly comparable. However, Alliant’s breakdown of electricity sales by energy source is not available for 2005, so capacity is used as a proxy. The on-site electricity generation occurring at industrial facilities within Cedar Rapids is not currently accounted for within this metric. https://poweringwhatsnext.alliantenergy.com/crr/governance-and-performance/
4. Alliant Energy, “Environmental, Social, and Governance Performance” (July 2020). Note that generation capacity and electricity sales are not directly comparable. However, Alliant’s breakdown of electricity sales by energy source is not available for 2005, so capacity is used as a proxy. https://poweringwhatsnext.alliantenergy.com/crr/governance-and-performance/
5. Coal is burned on-site by several industries in Cedar Rapids. As a proxy for coal-generated electricity in these facilities (which is unknown), this tracks total coal burned. Emissions data was translated into MMBTU using an emissions factor of 0.0978 metric tons CO2e/MMBtu, based on data for subbituminous coal from Tables B.1 B.3 and B.4 ICLEI U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.1, July 2013. Source for coal emissions: U.S. Environmental Protection Agency, Facility Level Information on Greenhouse Gases Tool (FLIGHT): https://ghgdata.epa.gov/ghgp/
6. Cedar Rapids Greenhouse Gas Inventory. Includes all CO2e attributable to industrial energy use within the community.

Vehicle registrations in Cedar Rapids from National Renewable Energy Laboratory, “Light Duty Vehicle Inventory by City and County,” https://openei.org/doe-opendata/dataset/city-and-county-vehicle-inventories

Participation in energy programs

waiting on data request from Alliant

Table X. Summary of Cedar Rapids Participation in Alliant's Energy Programs

	2010		2019	
Program	Participants	Impact	Participants	Impact
Second Nature				
Green Power Purchase				