

To:	City of Cedar Rapids		
From:	Lauren Casey/HDR Dave Dechant/HDR	Project:	Energy Management Plan
CC:			
Date:	June 24, 2010	Job No:	City – 615189-01 HDR - 0112623

Re: Technical Memorandum 6.5 – Current Citywide Energy Use

This technical memorandum (TM) characterizes baseline energy use citywide. It is organized as follows:

- Objective
- Summary
- Dates of Baseline Data
- Overall Energy Use
- Electricity
- Natural Gas
- Steam
- Vehicle Fuel
- Greenhouse Gas Emissions
- Implications

Objective

Provide decision makers with a “base case” describing current energy use patterns in the City of Cedar Rapids. Future efforts to increase efficiency, to reduce energy use or to shift to alternative fuels can then be compared and evaluated against this base case.

The baseline energy profile also provides a framework for goal setting, both short and long term. The baseline is a data set from which to estimate future business-as-usual growth, and a yardstick against which to measure the success of strategies and policies adopted by the City to address citywide sources.

Summary

This memo describes citywide baseline energy use for the City of Cedar Rapids, for fiscal years 2008 and 2009. Fiscal year begins July 1 and ends June 30 of the following year. Citywide energy use includes all sectors (industrial, commercial, residential, municipal, and others). The baseline was developed by working closely with members of the City Energy Management Team and local utility representatives to review annual utility and fuel use data, and to consolidate that data across consistent years for analysis.

Total citywide energy use in FY08 was 36.7 Trillion BTUs (52% natural gas, 26% electricity, and 22% vehicle fuel inclusive of both gasoline and diesel fuel types). In comparison, municipal energy use constituted 1.8% of citywide use.¹

The majority of citywide energy use is in buildings and facilities (78%). Within buildings and facilities (and excluding transportation), the largest citywide total energy-using sectors were industrial (54%), commercial (23%), and residential (21%).

Although complete historical records of all energy use were not available, some trends were still discernible in energy use over time. Energy use in buildings and facilities was observed to increase by 3% from 2007 to 2008 (electricity decreased by 2%, and natural gas increased by 4%). Over the last 20 years, electricity sales in Cedar Rapids have grown by an average of 2.3% per year.² However, electricity use in the City of Cedar Rapids has stabilized since around the year 2000. No data was available to show similar 20 -year historical trends in citywide natural gas or transportation fuel consumption.

Dates of Baseline Data

The energy baseline above describes the energy use in the year prior to the 2008 flood. FY08 would typically be used for the baseline, as the most recent year for which data was available; however FY08 data cannot be considered a complete representation of typical energy use because of the impacts of the severe flooding that occurred in 2008. Because of the flood, both FY08 and FY09 will be considered important benchmark years. Post-flood activity represents the current reality of energy consumption in the City and energy use patterns in the foreseeable future while efforts to rebuild damaged buildings are undertaken. However, pre-flood activity may more accurately represent 'normal' energy use in the City and provide a more accurate picture of which buildings are occupied, and which are being used at a level consistent with the actual demands of the City's population and economic activity.

To date, complete data for fiscal year 2008 and 2009 was not available for all activities. Electricity records were available describing fiscal years 2008 and 2009. Natural gas records were available describing calendar years 2008 and 2009; one year of calendar year data was assumed to be similar to one fiscal year of data when aggregating natural gas use into total energy use estimates. Historic information and estimates based on available data are included as placeholders wherever possible.

Overall Energy Use

Residential, commercial, industrial, municipal, and transportation activities within the City limits of Cedar Rapids collectively consumed an estimated 36.7 trillion BTUs of energy in FY08. Approximately 78% of this energy is used in facilities and the remaining 22% is used in vehicles.

Total energy use by fuel type is broken down for FY08 in Figure 1.

¹ Refer to TM 6-4 for total and breakdown of municipal energy usage.

² Alliant Energy, 2009. "CR growth in sales and customers.xls"

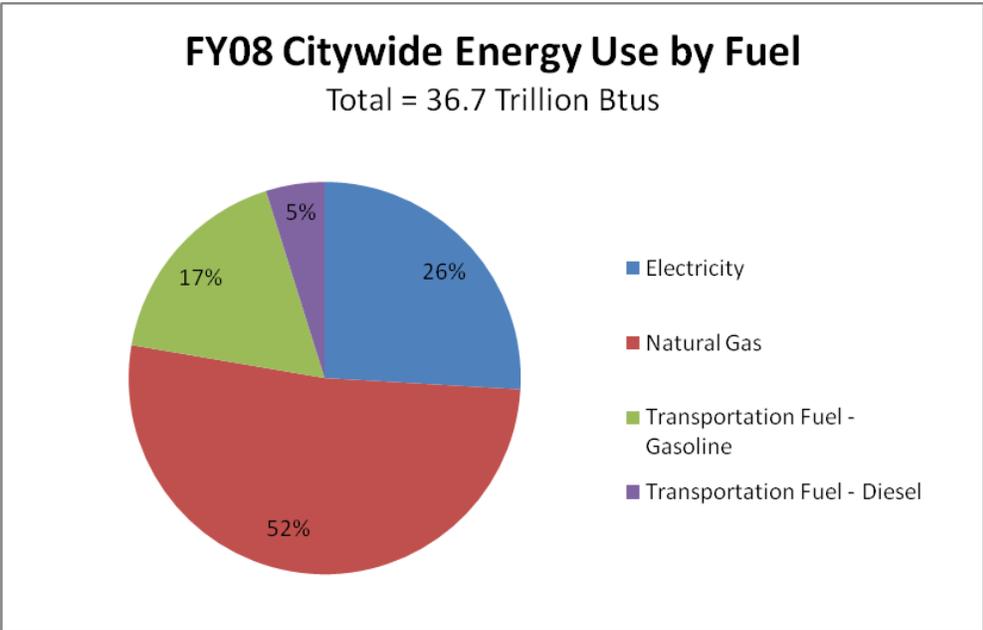


Figure 1 – Citywide Energy Use in FY08

The following sections of this memo provide an overview of each major type of energy consumed in the City.

Electricity

Alliant Energy is the electric utility serving the entire community of Cedar Rapids. Alliant representatives are on the City’s Energy Management Team to provide the utility perspective. These representatives supplied the following city-wide data.

In FY08, the year preceding the floods, all electricity accounts in Cedar Rapids used approximately 2.78 billion kWh of electricity.

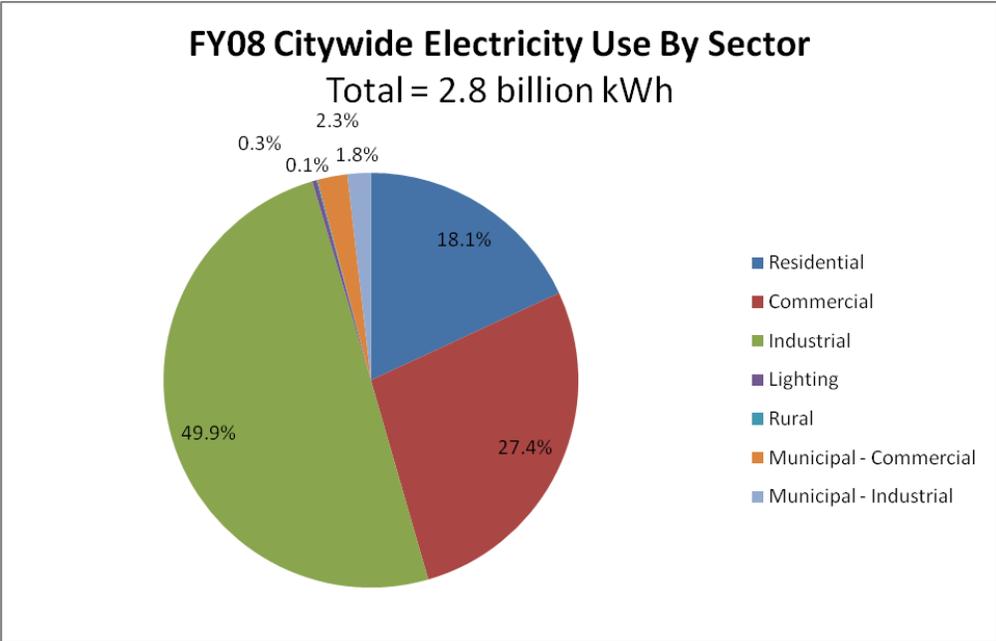


Figure 2 – Citywide electricity use FY08

Of total electricity use in FY08, half (50%) was by industrial accounts. The remainder was used by commercial (28%), residential (18%), and municipal (~4%). Less than 1% was used for lighting and rural accounts.

In the following year, after the flood, total electricity use in the City decreased to 2.71 billion kWh. The distribution of total electricity use was essentially unchanged.

Over the last 20 years, electricity sales in Cedar Rapids have grown by an annual average of 2.3% per year.³ However, electricity use in the City of Cedar Rapids has stabilized since around the year 2000.

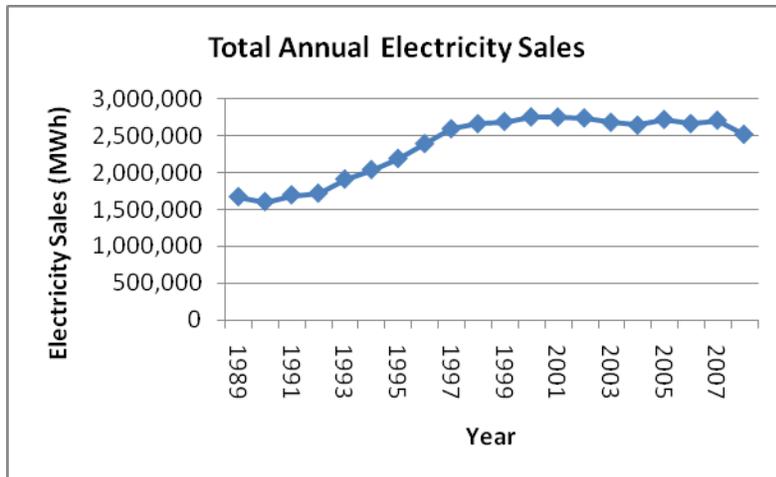


Figure 3 – Historic electricity use in Cedar Rapids

The breakdown of historic growth by sector is as follows:

- Residential: 1.65% per year
- Commercial: 2.91% per year
- Industrial: 2.40% per year
- Municipal lighting: -1.39% per year
- Utility company use: -0.14% per year

Natural Gas

MidAmerican Energy provides natural gas to the entire community. A representative from MidAmerican is serving on the City's Energy Management Team to provide input from the utility's perspective and access to citywide data. Because natural gas data was available by calendar years and not fiscal years, data for both 2007 and 2008 is shown below. 2008 figures were used to estimate total FY08 energy use.

In calendar year 2007, approximately 161 million therms of natural gas were consumed in Cedar Rapids. Of this, over half (61%) was by industrial accounts. The remainder was used by residential (23%), commercial (14%), municipal accounts (2%), and MidAmerican itself (<1%).

³ Alliant Energy, 2009. "CR growth in sales and customers.xls"

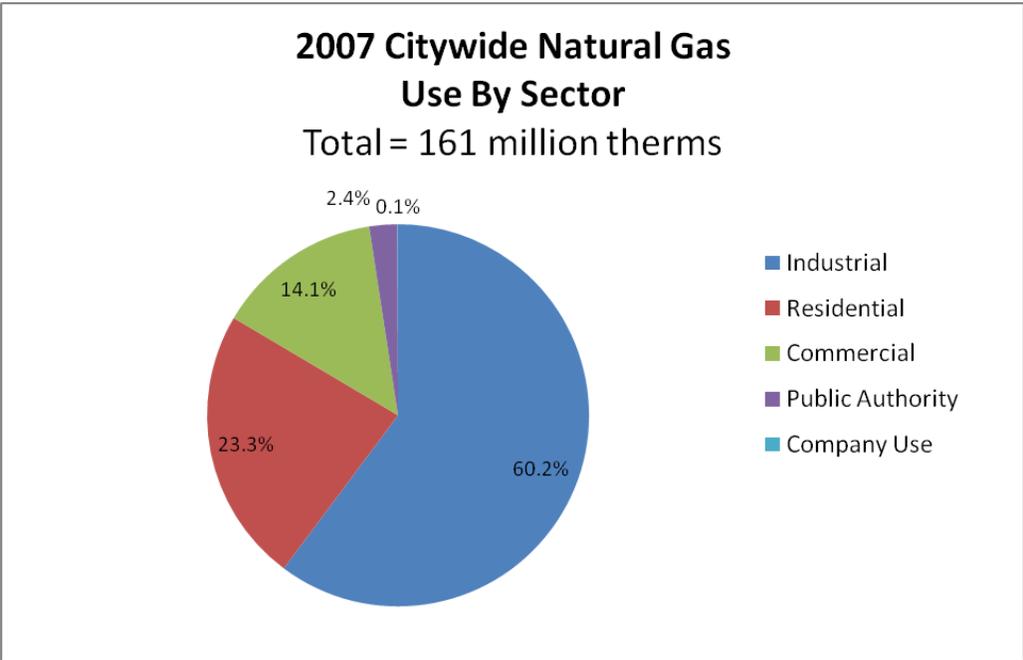


Figure 4 – Citywide natural gas use in calendar year 2007

In calendar year 2008, natural gas use increased to approximately 190 million therms. Natural gas use in all sectors grew by approximately 19%, but experienced the most significant growth in the commercial sector in which natural gas consumption grew by about 70%. Industrial accounts still contributed the majority of natural gas use.

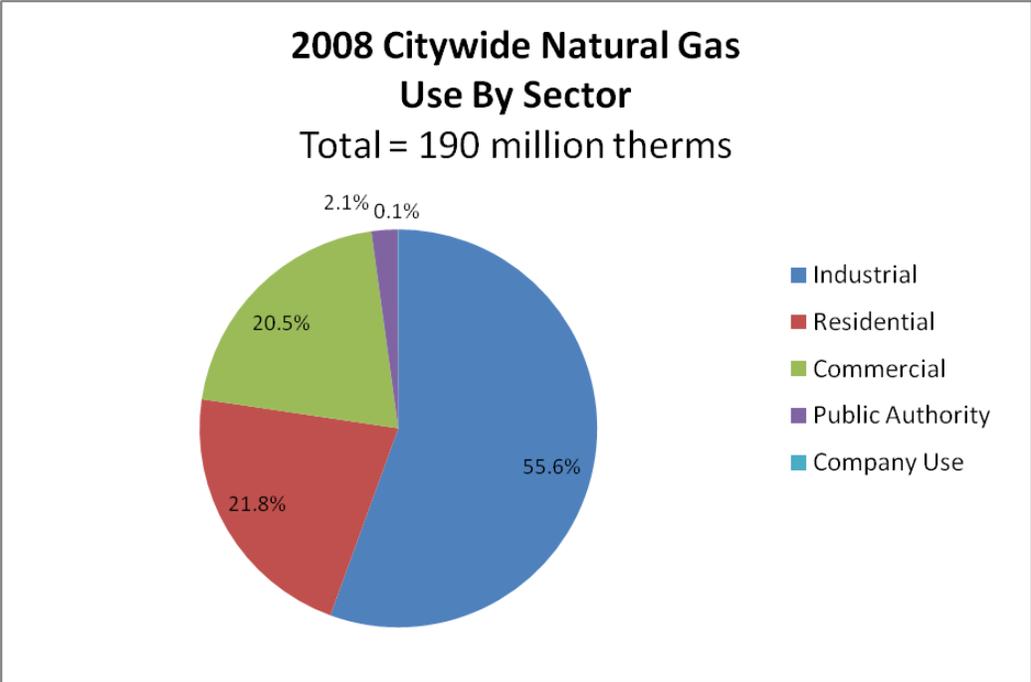


Figure 5 – Citywide natural gas use in calendar year 2008

Much of the growth in natural gas use in 2008 relative to 2007 is likely to be the result of several abnormally long, very cold periods experienced in the City in January and February, and again in December.⁴

Vehicle Fuel

Citywide vehicle fuel use was estimated based on the most recent Iowa Department of Transportation statistics for Linn County, Iowa. In 2007, an estimated 4,713,024 miles were traveled each day by vehicles in the County. Based on a population of 177,786 (from the 2005 census), the per capita daily vehicle miles traveled (VMT) was 26.5 miles. With 128,056 residents in Cedar Rapids, it is estimated that the City itself is responsible for 1,238,621,660 VMT annually. Translating VMT into fuel use requires knowledge of both the fleet average fuel economy, and of the type of vehicles driven. For this initial baseline assessment the following assumptions regarding each were used:

- Average vehicle fuel economy = 19.3 miles per gallon (mpg)⁵
- Fuel breakdown:
 - Gasoline – 80%
 - Diesel – 20%

Using these assumptions, an estimated 51.3 million gallons of gasoline and 12.8 million gallons of diesel fuel are consumed annually in the City of Cedar Rapids. This represents approximately 8.1 trillion BTUs of energy use by vehicles. Because this estimate is based on total VMT countywide, no estimate of the breakdown by sector has been made at this time.

This data does not include commercial vehicle energy use, non-highway equipment energy use, or commercial travel (via bus, rail, or air). The City chose to focus on end uses that were easiest to influence. Additional transportation sources may be quantified at a later date if the City opts to conduct a more comprehensive citywide greenhouse gas inventory. Vehicle fuel reduction programs may be coordinated with the U.S. Department of Energy's Clean Cities program, and may involve activities such as the following:

- Replace petroleum with nonpetroleum-based alternative fuels and blends
- Reduce petroleum consumption by promoting smarter driving practices and vehicle technologies
- Eliminate petroleum use by encouraging the use of mass transit, trip elimination measures, and other congestion mitigation approaches.

⁴ Iowa Department of Agriculture and Land Stewardship.

<http://www.agriculture.state.ia.us/climatology/weatherSummaries/2009/pas2009.pdf>

⁵ Manufacturing Year 2004 CAFE standard for new vehicles in the United States. This was the lowest CAFE standards have been since 1980 and therefore represents a conservative estimate of the fuel economy of passenger vehicles on the road in Cedar Rapids in 2007-2008.

Greenhouse Gas Emissions

A baseline estimate for greenhouse gas (GHG) emissions was prepared based on the energy data collected for municipal operations and citywide. The estimates are based exclusively on the energy data collected, and do not include additional sources of emissions present in Cedar Rapids including wastewater treatment, solid waste, industrial processes, commercial vehicle use, air travel, and others. Emissions estimates were produced using The Climate Registry's General Reporting Protocol version 1.1. Only carbon dioxide emissions were estimated; these estimates do not include other greenhouse gases. Other GHGs such as methane and nitrous oxide, while more potent than CO₂, make up less than 15% of the emissions produced in the United States on a carbon dioxide equivalent scale.⁶ Carbon dioxide is by far the biggest contributor to global warming in Cedar Rapids, and many of the opportunities to reduce CO₂ will also reduce other GHGs.

Citywide GHG emissions were estimated to be 3.7 million MTCO₂ in FY2008.

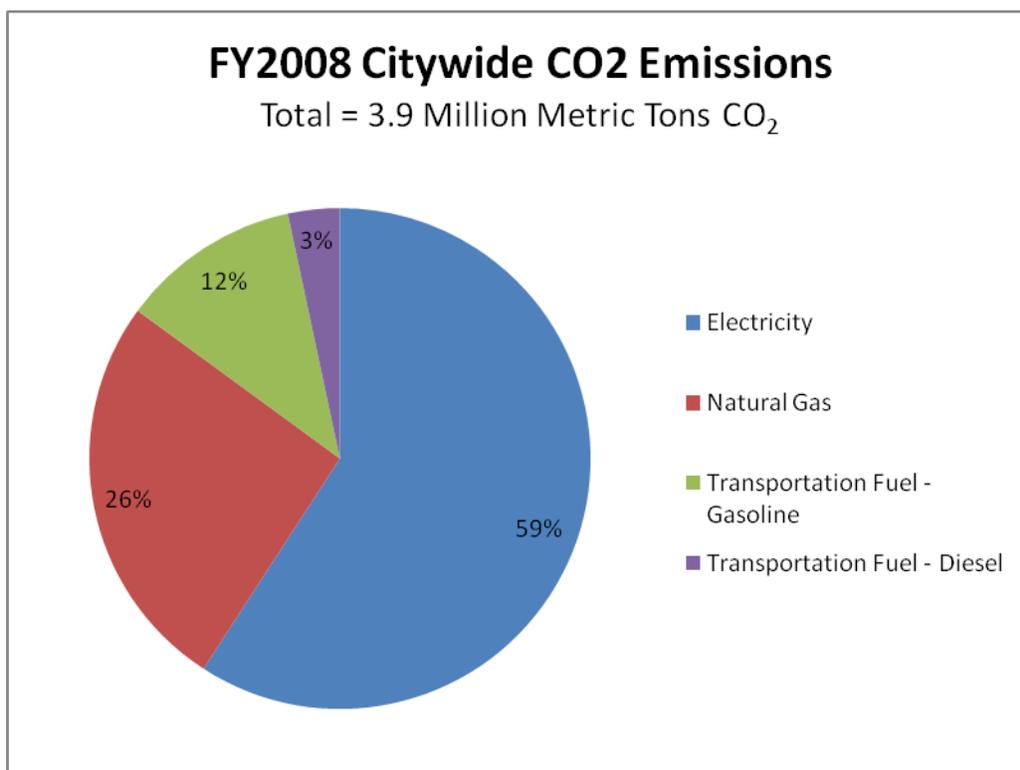


Figure 6 – City-wide GHG emissions in 2007

The citywide total represents approximately 3% of Iowa state emissions, which means that Cedar Rapids contributes a significant amount towards statewide emissions.⁷ This is especially true since the City estimate currently does not include all sources or other (not CO₂) GHGs.

⁶ U.S. EPA, 2009. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007.

<http://epa.gov/climatechange/emissions/downloads09/GHG2007-ES-508.pdf>

⁷ Center for Climate Strategies, 2008. DRAFT Iowa Greenhouse Gas Inventory and Reference Case Projections 1990-2025. 2005 emissions were inventoried to be 121 million metric tons of CO₂e.

Implications of Baseline Energy Use

The baseline energy profiles for the entire City of Cedar Rapids provide important insights for establishing energy management goals and reduction strategies.

This baseline data can be used to guide future energy management in the following way:

- Sector comparison data can be used to focus and prioritize reduction efforts (for example focus on the largest contributing sectors).
- If combined with other data such as economic activity, number of housing starts, population, this data can be used to track progress using metrics such as BTU use per capita, BTU per \$ of Industrial output, etc.

The baseline data shows that municipal energy use accounts for only a tiny fraction of community wide energy use. In total, municipal operations account for only 1.8% of total energy use in Cedar Rapids. Should the City choose to set municipal only reduction targets and to develop policies that affect only municipal operations, it will only marginally reduce the environmental footprint of the Cedar Rapids community. On the other hand, should the City choose to address community-wide energy use, by the development of a range of targets or policies (voluntary or mandatory), that impact the residential and commercial / industrial sectors, as well as the municipal sector, then it may have a significant impact on energy use in the entire area.

Municipal energy use decreased by approximately 30% in the year following the flooding. This substantial drop in use presents a unique challenge for energy management and goal-setting. If goals are set with respect to energy use before the flood, they may not be stringent enough because new buildings, by meeting current energy code, are automatically going to be more efficient than some of the older buildings and building energy systems lost in the floods. If energy goals are set with respect to energy use after the flood, they may be too stringent because the City has been operating at lower energy use levels than if it were occupying and operating the facilities needed for normal, full-scale operations. In order to address this challenge, it will be important to compare future trends to both the pre-flood and post-flood baselines.

The baseline data shows that over half the community's energy use is by industrial accounts. . While the Cedar Rapids Energy Management Plan may not focus on policies and programs to reduce industrial process energy use specifically, the City may highlight existing programs such as the Industrial Assessment Center at Iowa State University or the D.O.E's Save Energy Now initiative. Some example strategies for managing industrial energy use are provided by the U.S. DOE⁸. Collaboration with large industrial energy users, with the local utilities, and with other existing programs will be critical throughout the policy making process to address the biggest end-use sector in Cedar Rapids.

⁸ <http://www1.eere.energy.gov/industry/>