

# Aurora Energy and Emissions Profile

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## Aurora, Illinois

The City of Aurora is located predominantly in southeastern Kane and southwestern DuPage Counties, but its recent growth has stretched into small portions of Will and Kendall Counties as well. The city covers 39.4 square miles and its land use includes both older and new residential housing stock, and several major commercial areas including a regional shopping center and several commercial corridors.

## Understanding Energy Consumption

### *Natural Gas*

Natural gas is consumed primarily for the purpose of space heating, but includes other uses like hot water heaters, clothes dryers and cooking appliances, too. In the CMAP region, the residential consumers outweigh commercial and industrial (C&I) in consumption with 56% of the region's natural gas consumption attributed to the residential sector. Natural gas is measured in therms. Residential natural gas consumption has been decreasing slightly over time as homes become more efficient.

### *Electricity*

Electricity consumption occurs primarily by air conditioning, utilization of lights, and all electrically powered appliances, with refrigerators being one of the most consumptive. Both commercial and residential consumption is on the rise nationwide. "In the residential sector, a proliferation of consumer electronics and information technology equipment has driven much of the growth. In the commercial sector, telecommunications and network equipment and new advances in medical imaging have contributed to recent growth in miscellaneous electricity use."<sup>1</sup> In the CMAP region, the C&I sector accounts for about 2/3 of all electricity consumption. Electricity is measured in kilowatt hours.

### *The connection between energy and emissions*

Most of the world's energy comes from the burning of fossil fuels that include coal, petroleum, and natural gas. Fossil fuels are made up of hydrogen and carbon, and when they are burned, the carbon combines with oxygen and creates carbon dioxide, one of the greenhouse gases. Other major energy sources include nuclear power and renewable energy from wind, solar, biomass or hydroelectric. Most energy sources are used for specific purposes. For example coal, nuclear, wind and biomass are used for making electricity, while petroleum is used primarily for transportation (with only small amounts used for electricity generation). Finally natural gas is used in two ways, as an end use fuel for heating homes and business and in industrial process, but also as a fuel source for the generation of electricity.

But all energy is not created equal, so to speak. The actual amount of carbon dioxide produced for any given unit of energy depends on the carbon content of the fuel and "the combustion of coal adds a significant amount of carbon dioxide to the atmosphere per unit of heat energy, more than does the combustion of other fossil fuels."<sup>2</sup> Coal emits nearly two times

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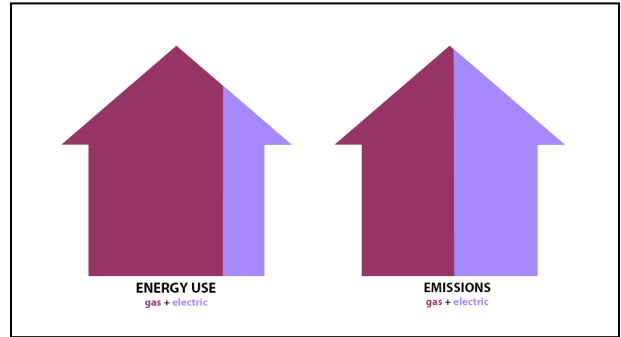
<sup>1</sup> Energy Information Administration: "Miscellaneous Electricity Services in the Buildings Sector", AEO2007 <http://www.eia.doe.gov/oiaf/aeo/otheranalysis/mesbs.html>

<sup>2</sup> Energy Information Administration: "Greenhouse Gases, Climate Change, and Energy," May 2008

the carbon dioxide per unit of energy when compared to natural gas, while crude oil combustion falls between the two. In the Midwest, our electricity is roughly half from coal, half from nuclear with some natural gas used for peak power generation. In contrast, the northeast United States has significant natural gas base load generation and very little coal, while the northwest has significant hydro-electric generation.<sup>3</sup> In short, because of the mix of regional generation sources electricity consumption in the Midwest has a higher rate of emissions compared to petroleum (transportation sector) or natural gas than it might in other areas of the country.

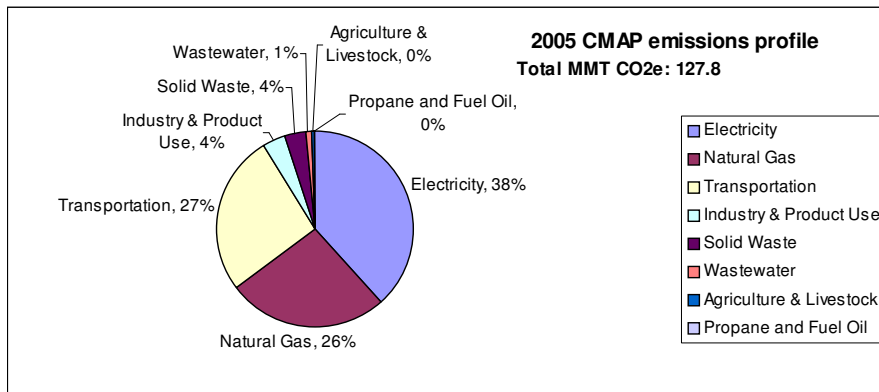
Figure 1.

Figure 1 shows the comparison of a household's energy consumption in kbtu (allowing therms and kilowatt hours to be compared with the same unit of energy). While nearly 75% of household energy consumption can be attributed to natural gas usage and the remainder, electricity, almost half of household emissions are due to electricity consumption.



*The importance of understanding energy consumption*

According to The Chicago Regional Greenhouse Gas Emissions Inventory, energy consumption in buildings makes up about 64% of total greenhouse gas emissions. Another 27% can be attributed to transportation. This translates into over 90% of our region's total emissions being due to energy consumption. (Figure 2.) These emissions are rising steadily, like elsewhere in the nation and worldwide, and will continue to do so if we persist with business as usual. The harmful effects of global warming are already being seen in parts of the world and will become more evident in places closer to home if we do nothing. If we seek to reduce our emissions with mitigation strategies, however, understanding our energy consumption patterns becomes imperative, since the consumption of energy is a major component of our region's emissions profile. Figure 2.



More information about our region's energy use and emissions can be found in CMAP's Regional Energy Snapshot and Regional Greenhouse Gas Inventory.

<sup>3</sup> The Changing Structure of the Electric Power Industry 2000: An Update, Chapter Three. [http://www.eia.doe.gov/cneaf/electricity/chg\\_stru\\_update/chapter3.html](http://www.eia.doe.gov/cneaf/electricity/chg_stru_update/chapter3.html)

## Energy Consumption in Aurora

### Natural Gas

#### Total Consumption

In 2005, the amount of natural gas consumed in Aurora was 80 million therms (80,480,548). (Table 1.) To put this in perspective, Aurora's consumption accounts for about 9.2% of the total consumption in Kane and DuPage Counties, counties in which Aurora's 2005 population of 170,490 is heavily based.<sup>4</sup> Aurora's consumption accounts for about 1.4% of the entire 7-county region's electricity consumption.

#### Natural Gas by sector

Fifty-five percent (55%) of Aurora's natural gas consumption occurred in the residential sector (Figure 3), which is comparable to both the region and DuPage County. Aurora's average consumption per household is 808 therms. (Table 2.) This number is simply an average and varies depending on factors including building size, age of the building and building envelope efficiencies, the efficiency of the furnace/boiler and water heater.

Aurora is lower than the average household consumption in the region, as well as Kane and DuPage Counties. This is likely due to newer housing stock in the city, which is generally more efficient. 41% of the city's existing housing stock was built within the last 20 years.<sup>5</sup>

Table 1.

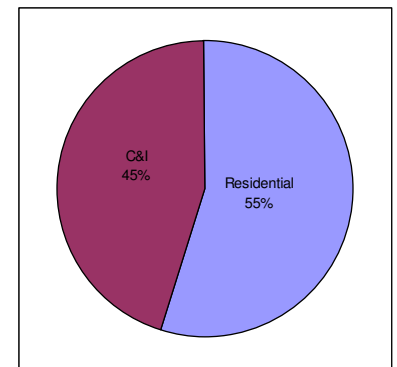
Natural Gas Consumption (in therms)	Residential	%	C & I	%	Total
Region	3,122,788,779	57	2,328,905,728	43	5,451,694,507
Kane	141,615,345	46	167,417,662	54	309,033,007
DuPage	296,676,156	53	258,328,544	47	555,004,700
<b>Aurora</b>	<b>43,946,810</b>	<b>55</b>	<b>36,533,738</b>	<b>45</b>	<b>80,480,548</b>

Note: Aurora is situated within four counties, but the majority of the city lies between Kane and DuPage Counties.

Table 2.

Residential natural gas consumption	43,946,810 therms			
Number of households, 2005 ACS	54,416			
<b>Average therms consumption, per HH</b>	<b>Aurora:</b>	<b>Region:</b>	<b>Kane:</b>	<b>DuPage:</b>
	<b>808</b>	<b>1044</b>	<b>913</b>	<b>898</b>

Figure 3.



### Electricity

#### Total Consumption

In 2005, the amount of electricity consumed in Aurora was 1.4 billion kWh (1,416,848,430). (Table 3.) To put this in perspective, Aurora's consumption accounts for about 10% of the total consumption in Kane and DuPage Counties. Aurora's consumption accounts for about 2% of the entire 7-county region's electricity consumption.

#### Electricity by sector

Sixty-two percent (62%) of Aurora's electricity consumption occurred in the commercial and industrial sector (Figure 4), which is comparable to both the region and Kane County. Aurora's

<sup>4</sup> U.S. Census Bureau, 2005 American Community Survey. Additionally, Aurora's population makes up 12.2% of the population in Kane and DuPage Counties.

<sup>5</sup> U.S. Census Bureau, 2007 American Community Survey.

average consumption per household is 9,856 kWh. (Table 4.) This number is simply an average and varies depending on factors including square footage, the presence of air conditioning, and the efficiency of lighting, appliances and systems. However, Aurora’s average is higher than the region and both Kane and DuPage Counties.

Table 3.

Electricity Consumption (in kWh)	Residential	%	C & I	%	Total
Region	25,178,375,288	34	48,465,369,055	66	73,643,744,343
Kane	1,207,007,675	34	2,294,455,940	66	3,501,463,615
DuPage	3,009,397,425	30	6,865,868,510	70	9,875,265,935
<b>Aurora</b>	<b>536,345,985</b>	<b>38</b>	<b>880,502,445</b>	<b>62</b>	<b>1,416,848,430</b>

Note: Aurora is situated within four counties, but the majority of the city lies between Kane and DuPage Counties.

Figure 4.

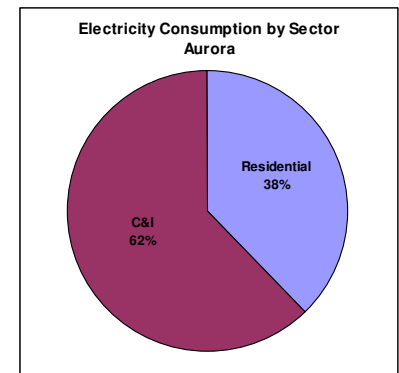


Table 4.

Residential electricity consumption	536,345,985 kWh			
Number of households, 2005 ACS	54,416			
<b>Average kWh consumption per HH</b>	<b>Aurora:</b>	<b>Region:</b>	<b>Kane:</b>	<b>DuPage:</b>
	<b>9,856</b>	<b>8420</b>	<b>7783</b>	<b>9104</b>

## Transportation

In addition to evaluating energy use in buildings, it is important to also consider another major user and emission source – transportation. This was done by evaluating the Vehicle Miles Traveled (VMT) for households in Aurora.

### Vehicle Miles Traveled

VMT was tabulated from travel statistics provided by the Illinois Department of Transportation (IDOT). Next, a scale factor was used to determine VMT attributed to all households. In 2005, the number of VMT in Aurora was 1.08 billion miles, with 929 million attributed to households. We can divide total HH VMT by number of households and arrive at an average number of 17,079 VMT per household in Aurora. (Table 5.) This is higher than the regional average, and just slightly lower than the average in both Kane and DuPage Counties.

It should be noted that VMT per household is simply an average and varies depending on many things, including land use mix, walkable community, and access to amenities and public transportation. These variations are influenced by many different demographic factors including income, household size, and workers per household. For example, large households with higher incomes may own multiple cars, and drive them more, which is reflected in higher VMT relative to the average. Households situated close to reliable public transit or major employment centers may experience decreased annual VMT, because they do not have to depend on their cars as much.

Table 5.

VMT	Total On-Road VMT	Total HH VMT	Number of HH	VMT per HH
Region	60,527,014,013	43,994,702,713	2,989,996	14,714
Kane	3,520,486,524	2,802,927,201	155,090	18,073
DuPage	8,675,394,497	5,665,198,683	330,540	17,139
<b>Aurora</b>	<b>1,075,400,980</b>	<b>929,404,540</b>	<b>54,416</b>	<b>17,079</b>

## Aurora 2000 and 2005 Community Greenhouse Gas Inventory

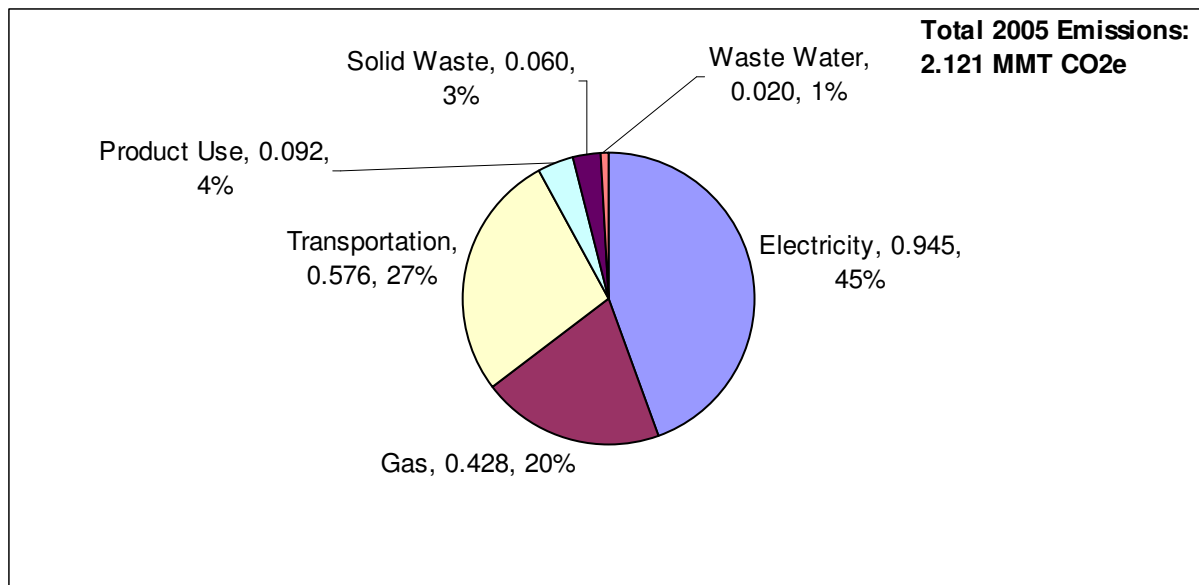
The first step in addressing Aurora’s contribution to global warming is understanding the scope, scale and source of the existing emissions. An inventory of energy use in the community serves as the basis for conducting a community greenhouse gas inventory. This greenhouse gas emissions inventory was developed by calculating emissions for the previously reported data on transportation and energy use, and adding the emissions estimates for waste, waste water, product use, and industrial processes.

The 2005 greenhouse gas emissions for Aurora were 2.121 MMT CO<sub>2</sub>e. This represents a 22.8 percent increase over 2000 emissions of 1.727 MMT CO<sub>2</sub>e.

Table 6.

Year	Electricity	Gas	Transportation	Product Use	Solid Waste	Waste Water	Total (MMT CO <sub>2</sub> e)
2000	0.675	0.404	0.516	0.059	0.055	0.017	1.727
2005	0.945	0.428	0.576	0.092	0.060	0.020	2.121

Figure 5.



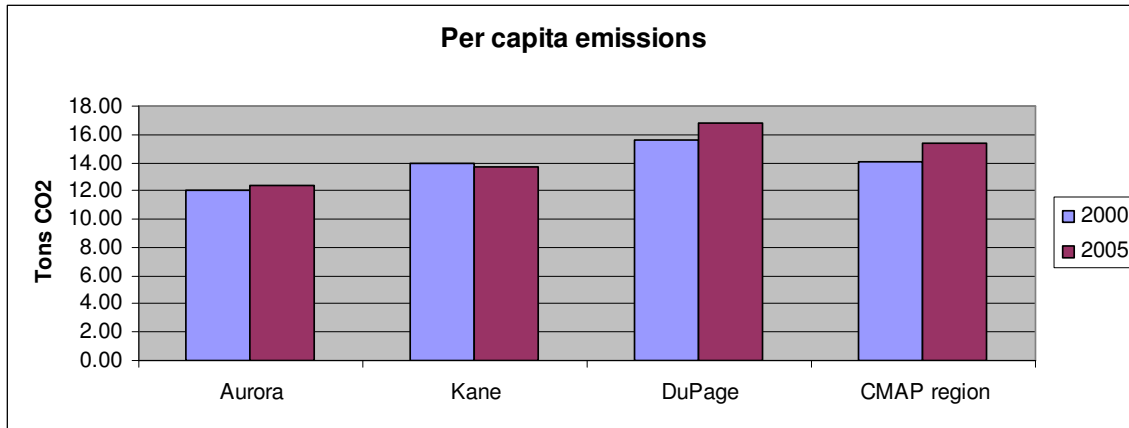
Aurora’s per capita emissions in 2005 were 12.42 tons CO<sub>2</sub>e in 2005, which is lower than both Kane County’s per capita rate of 13.73 tons and DuPage County’s per capita rate of 16.85 tons of CO<sub>2</sub>e, as well as the region’s rate of 15.40.

Table 7. Per Capita Emissions (Tons)

Year	Aurora	Kane	DuPage	CMAA region
2000	12.08	13.91	15.58	14.09
2005	12.42	13.73	16.85	15.40



Figure 6. Annual Per Capita Emissions



### Developing Mitigation Strategies

The greatest opportunity to reduce greenhouse gas emissions is to develop mitigation strategies targeting the highest emitting sectors, energy used in buildings and transportation. Further investigation should focus on evaluating potential mitigation strategies, measuring their reduction potential, and developing an action plan. For best results, it is recommended that the performance be continuously measured over time.

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### Emissions Calculations

The regional greenhouse gas emissions footprint was calculated for the years 2000 and 2005 using United Nations Intergovernmental Panel on Climate Change (IPCC) methods and local data sources in combination with modeling of national data to local demographics. All data presented are measured in metric tons (tons) or million metric tons (MMT) CO<sub>2</sub>e, to enable comparison internationally.

Emissions were calculated for the six major categories of greenhouse gases regulated under the Kyoto Protocol: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>). Emissions were converted into CO<sub>2</sub>e using global warming potentials from the IPCC Third Annual Assessment Report. Activity data were translated into emissions using standard emissions factors and global warming potentials.

**Non transportation energy** emissions in this report primarily represent natural gas and electricity used in buildings, but also include uses such as street lighting. Emissions were calculated using account level data from local utility companies. The CO<sub>2</sub> emissions factors associated with the local North American Electric Reliability Council region from the U.S. EPA's Emissions & Generation Resource Integrated Database (eGRID) were used to calculate indirect electricity emissions.

**Non aviation transportation** emissions include onroad vehicles, such as cars, trucks, and motorcycles and were calculated using odometer data from the Illinois EPA for the locality and IDOT county VMT values.

**Waste and Wastewater** Regional and county emissions for solid waste are calculated using reported numbers from the Illinois EPA. Wastewater emissions are calculated using greenhouse gas emissions calculations conducted by MWRD and prorating based on population.

**Product Use** In the absence of local data, the emissions of this sector are estimated as a proportion of national emissions as reported by the US EPA.

**Agriculture and Aviation** No significant uses occurred in these sectors within the boundaries of the city, however residential and business consumption of agricultural products, air travel, and air delivery contributed to greenhouse gas emissions from these sectors in other part of the region.

## Strategies for Reducing Consumption

Having established the connection between energy consumption and greenhouse gas emissions, reducing the region’s energy consumption becomes the main element of any regional response to climate change. While emissions reductions from any source will help address global warming, electricity, natural gas and transportation are the main sources of the region’s emissions, and thus, where we should target most of our strategies.

The strategy matrices below outline those that pertain to energy in buildings and energy behavior and habits, which were developed for the larger Regional Energy Snapshot, and transportation strategies already defined within the three GO TO 2040 planning scenarios.

Energy strategies (Table 8) may or may not be applicable to every municipality. Three suitability factors are listed below, but each municipality will likely need to consider the financial, legal and political feasibility of these as well. Please refer to the Regional Energy Snapshot for a full description along with potential regional energy savings and emissions reductions for each strategy.

Table 8.

Strategy Areas	Areas with significant older building stock	Areas with significant new construction (residential)	Areas with significant new construction (commercial)
<b>Energy in Buildings</b>			
Residential Retrofits	X		
Commercial Retrofits	X		
Industrial Retrofits	X		
Green Building – Renovation	X		
Green Building – New Construction, Residential		X	
Green Building – New Construction, Commercial			X
Energy Code		X	X
Household Renewable Energy	X	X	
<b>Behavior Change</b>			
Behavior Change - Residential	X	X	X
Behavior Change - Commercial	X	X	X
Appliance Trade-in	X	X	

Transportation strategies (Table 9) are not looked at under the same lens of suitability factors, but by potential for municipal action versus action that requires a larger, more coordinated regional, state or national approach. Please refer to CMAP’s Go To 2040 Planning Scenarios for a full description of each strategy.

Table 9.

Strategy	Primarily achievable through local action	Primarily achievable through regional / other coordinated action
Land use changes that support infill development (such as TOD, brownfield remediation, or others)	X	
Infrastructure investments to support transit	X	X
Bicycle and pedestrian improvements	X	
Transit operational improvements		X
Transportation demand management	X	
Car-sharing		X
Parking policy changes including shared parking or reducing parking requirements	X	
Congestion pricing or variable parking pricing		X
Intelligent Transportation Systems (ITS) adoption	X	X
Alternative fuel conversion and use of advanced vehicle technology		X
Interregional transportation (such as high-speed rail)		X