

Appendix A:
Municipal Energy and Emissions Profiles

Algonquin Energy and Emissions Profile

Algonquin, Illinois

The Village of Algonquin is located in northern Kane and southern McHenry Counties. The village covers 10 square miles and its land use is predominantly single family residential homes. About 60% of Algonquin's total housing stock was built within the last 20 years.¹

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 CMAP2 region, the residential consumers outweigh commercial and industrial (C&I) in consumption with 57% 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."³ In the CMAP region, the commercial and industrial sector accounts for about 2/3 of all electricity consumption. Electricity is measured in kilowatt hours (kWh).

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.

However, 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 since "the combustion of coal adds a significant amount of carbon dioxide to the atmosphere per unit of

¹ U.S. Census Bureau, 2007 American Community Survey

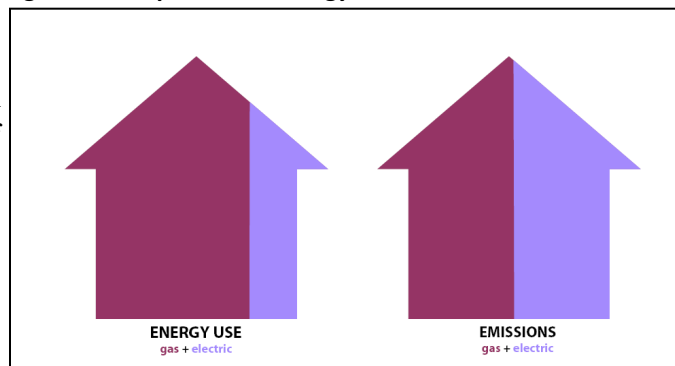
² Cook, DuPage, Kane, Kendall, Lake, McHenry and Will Counties.

³ Energy Information Administration: "Miscellaneous Electricity Services in the Buildings Sector", AEO2007 <http://www.eia.doe.gov/oiaf/aeo/otheranalysis/mesbs.html>

heat energy, more than does the combustion of other fossil fuels.”⁴ Coal emits nearly two times the carbon dioxide per unit of energy when compared to natural gas, while crude oil combustion falls between the two. In Illinois, electricity is largely generated from coal-fired and nuclear plants with some renewables, and some natural gas used for peak power generation. The Chicago region’s electricity comes from the wider electric grid covering parts of the Midwest which has a higher concentration of coal. 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.⁵ In short, because of the mix of regional generation sources, electricity consumption in Illinois 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. Comparison of Energy Use and Emissions

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

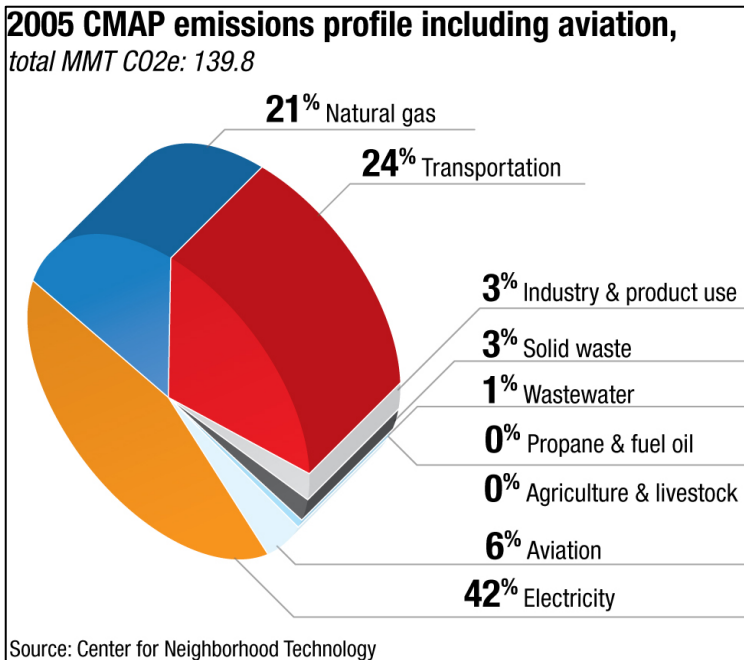
According to The Chicago Regional Greenhouse Gas Emissions Inventory, energy consumption in buildings makes up about 63% of total greenhouse gas emissions. Another 24% can be attributed to transportation. This translates into nearly 90% of our region’s total emissions being due to energy consumption. (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, it becomes imperative to understand our energy consumption patterns, since the consumption of energy is a major component of our region’s emissions profile.

⁴ Energy Information Administration: “Greenhouse Gases, Climate Change, and Energy,” May 2008

⁵ 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

Figure 2. 2005 CMAP Region Emissions Profile



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

Energy Consumption in Algonquin

Natural Gas

Total Consumption

In 2005, the amount of natural gas consumed in Algonquin was 16.2 million therms (16,287,679) (Table 1.) To put this in perspective, Algonquin's consumption accounts for about 3.4% of the total consumption in Kane and McHenry Counties, and about 0.3% of the entire 7-county region's natural gas consumption.

Natural Gas by sector

Eighty percent (80%) of Algonquin's natural gas consumption occurred in the residential sector (Figure 3), which is significantly higher than both the regional average and Algonquin's home counties. This is likely due to the village's high concentration of residential land use.

Algonquin's average consumption per household is 1,339 therms. This amounts to approximately \$1,571 annual natural gas expenses per household.⁶ (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.

⁶ Illinois Commerce Commission Utility Sales Statistics for 2005 were used to calculate average cost and as such, dollar amounts reflect a snapshot in time. As energy prices continue to fluctuate, it may be important to recalculate average cost per household. It should also be noted that there are other rate structures that may significantly influence household average cost, too.

Algonquin’s average is slightly higher than the average household consumption region-wide, and also Kane and McHenry Counties.

Table 1: Algonquin Natural Gas Consumption

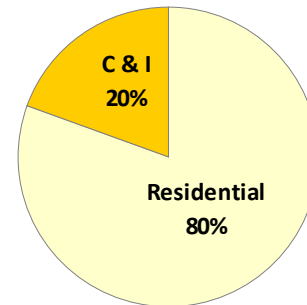
	Residential		Commercial & Industrial		Total
	Therms	% of total	Therms	% of total	Therms
Algonquin	13,105,940	80	3,181,739	20	16,287,679
Kane	141,615,345	48	150,649,744	52	292,265,089
McHenry	100,616,102	58	74,198,436	42	174,814,538
Region	3,122,788,779	57	2,337,611,588	43	5,460,400,368

Table 2: Algonquin Residential Natural Gas Consumption & Costs

Average annual residential natural gas consumption		
	Therms per HH	Annual \$ per HH
Algonquin*	1,339	\$1,571
Kane	913	\$1,071
McHenry	971	\$1,139
Region	1,044	\$1,224

*9,786 HH (2005 – 2007 ACS)

Figure 3. Algonquin Natural Gas Consumption by Sector



Electricity

Total Consumption

In 2005, the amount of electricity consumed in Algonquin was 240 million kWh (240,005,964). (Table 3.) To put this in perspective, Algonquin’s consumption accounts for about 3.1% of the total consumption in Kane and McHenry Counties, and about 0.3% of the entire 7-county region’s electricity consumption.

Electricity by sector

Fifty-one percent (51%) of Algonquin’s electricity consumption occurred in the residential sector (Figure 4). This is much different than the region and its home counties where commercial and industrial is the dominant electricity user, but likely due to Algonquin’s high concentration of residential land use. Algonquin’s average consumption per household is 12,507 kWh. This amounts to approximately \$1,076 annual electricity expenses per household.⁷ (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. While Algonquin’s average is similar to McHenry County, it is quite a bit higher than the average kWh per household in the region and Kane County.

⁷ Illinois Commerce Commission Utility Sales Statistics for 2005 were used to calculate average cost and as such, dollar amounts reflect a snapshot in time. As energy prices continue to fluctuate, it may be important to recalculate average cost per household. It should also be noted that there are other rate structures that may significantly influence household average cost, too.

Table 3: Algonquin Electricity Consumption

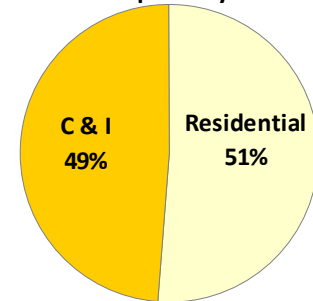
	Residential		Commercial & Industrial		Total
	kWh	% of total	kWh	% of total	kWh
Algonquin	122,391,849	51	117,614,115	49	240,005,964
Kane	1,454,100,543	29	3,482,599,522	71	4,936,700,065
McHenry	1,197,956,940	43	1,585,960,702	57	2,783,917,642
Region	26,296,220,042	31	59,202,016,205	69	85,498,236,248

Table 4: Algonquin Residential Electricity Consumption & Costs

Average annual residential electricity consumption		
	kWh per HH	Annual \$ per HH
Algonquin*	12,507	\$1,076
Kane	9,376	\$806
McHenry	11,560	\$994
Region	8,795	\$756

*9,786 HH (2005 – 2007 ACS)

Figure 4. Algonquin Electricity Consumption by Sector



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 Algonquin.

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 Algonquin was 161 million miles, with 142 million attributed to households. We can divide total HH VMT by number of households and arrive at an average number of 14,593 VMT per household in Algonquin. (Table 5.) This is lower than the regional and county averages.

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. Algonquin VMT: Total and Household Data

	Total On-Road VMT	Total HH VMT	Number of HH	VMT per HH
Algonquin	161,142,069	142,815,119	9,786	14,593
Kane	3,520,486,524	3,663,012,000	155,090	23,619
McHenry	2,146,275,643	2,675,387,500	103,623	25,818
Region	60,527,014,013	55,347,815,873	2,989,996	18,511

Note: The methodology selected by CMAP to calculate household VMT for counties uses a different approach than the methodology for total VMT (as reported by IDOT). Due to this discrepancy, the household VMT numbers are larger than the total VMT for 4 counties (Will, Kane, McHenry, and Kendall). The IDOT numbers measure VMT driven on roads in the counties, whereas the method for determining household VMT measures the miles driven by vehicles registered in that county. Therefore, if the vehicles owned by households in a certain county are driven outside of the county a significant amount, it is possible that household VMT may be larger than total VMT for a county.

Algonquin 2000 and 2005 Community Greenhouse Gas Inventory

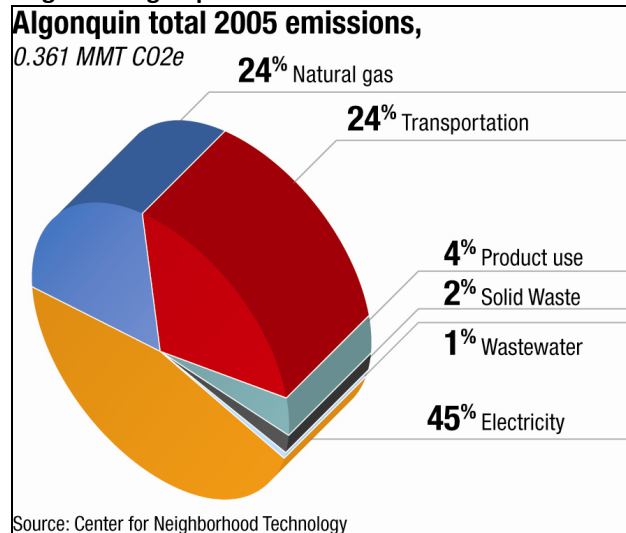
The first step in addressing Algonquin's contribution to global warming is understanding the scope, scale and source of the existing emissions. An inventory of energy use in the community serves as the basis for conducting a community greenhouse gas inventory. This greenhouse gas emissions inventory 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 Algonquin were 0.361 MMT CO₂e. This represents a 32.7 percent increase over 2000 emissions of 0.272 MMT CO₂e.

Table 6. Algonquin Greenhouse Gas Emissions, MMT CO₂e

	MMT CO ₂ e						Total
	Electricity	Natural Gas	Transportation	Product Use	Solid Waste	Waste Water	
2000	0.091	0.081	0.080	0.010	0.008	0.003	0.272
2005	0.160	0.087	0.086	0.016	0.009	0.003	0.361

Figure 5. Algonquin Total 2005 Emissions

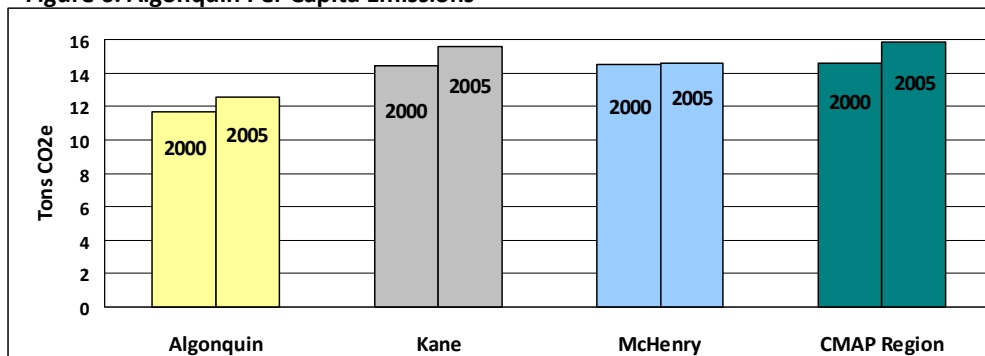


Algonquin's per capita emissions in 2005 were 12.56 tons CO₂e in 2005, which is lower than both Kane County's per capita rate of 15.55 tons and McHenry County's per capita rate of 14.56 tons CO₂e, as well as the region's rate of 15.81.

Table 7. Algonquin Per Capita Emissions

	Tons CO ₂ e			
	Algonquin	Kane	McHenry	Region
2000	11.71	14.40	14.52	14.55
2005	12.56	15.55	14.56	15.81

Figure 6. Algonquin 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.

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) CO₂e, to enable comparison internationally.

Emissions were calculated for the six major categories of greenhouse gases regulated under the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Emissions were converted into CO₂e 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 CO₂ 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. Algonquin Energy Strategies

Strategy Areas	Areas with significant older building stock	Areas with significant new construction (residential)	Areas with significant new construction (commercial)
Energy in Buildings			
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	
Behavior Change			
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. Algonquin Transportation Strategies

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

Aurora Energy and Emissions Profile

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. As of 2008, the city covers 45.9 square miles with a projected population of 182,638. Its land use includes its historic downtown area along the Fox River, 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 CMAP1 region, the residential consumers outweigh commercial and industrial (C&I) in consumption with 57% 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."² In the CMAP region, the commercial and industrial 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.

However, 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 since "the

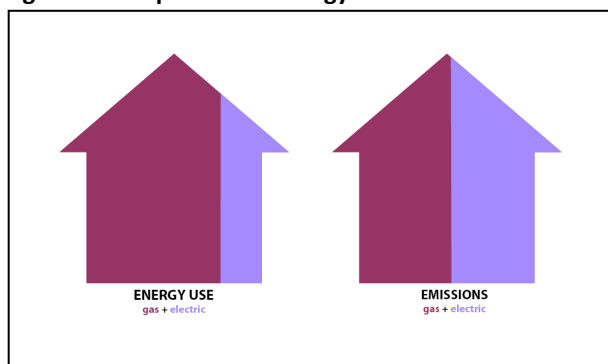
1 Cook, DuPage, Kane, Kendall, Lake, McHenry and Will Counties.

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

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.”³ Coal emits nearly two times the carbon dioxide per unit of energy when compared to natural gas, while crude oil combustion falls between the two. In Illinois, electricity is largely generated from coal-fired and nuclear plants with some renewables, and some natural gas used for peak power generation. The Chicago region’s electricity comes from the wider electric grid covering parts of the Midwest which has a higher concentration of coal. 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.⁴ In short, because of the mix of regional generation sources, electricity consumption in Illinois 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. Comparison of Energy Use and Emissions

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

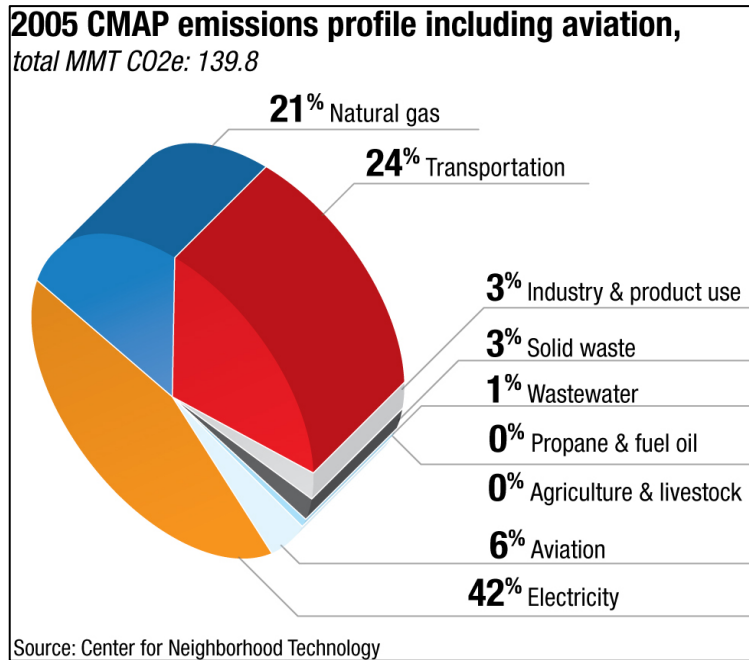
According to The Chicago Regional Greenhouse Gas Emissions Inventory, energy consumption in buildings makes up about 63% of total greenhouse gas emissions. Another 24% can be attributed to transportation. This translates into nearly 90% of our region’s total emissions being due to energy consumption. (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.

³ Energy Information Administration: “Greenhouse Gases, Climate Change, and Energy,” May 2008

⁴ 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

Figure 2. 2005 CMAP Region Emissions Profile



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

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 9.5% of the total consumption in Kane and DuPage Counties, counties in which Aurora’s 2005 population of 170,490 is heavily based.⁵ Aurora’s consumption accounts for about 1.5% 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. This amounts to approximately \$948 annual natural gas expenses per household.⁶ (Table 2.) This number is simply an average and varies

⁵ U.S. Census Bureau, 2005 American Community Survey. Additionally, Aurora’s *population* makes up 12.2% of the population in Kane and DuPage Counties.

⁶ Illinois Commerce Commission Utility Sales Statistics for 2005 were used to calculate average cost and as such, dollar amounts reflect a snapshot in time. As energy prices continue to fluctuate, it may be important to recalculate average cost per household. It should also be noted that there are other rate structures that may significantly influence household average cost, too.

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.⁷

Table 1: Aurora Natural Gas Consumption

	Residential		Commercial and Industrial		Total
	Therms	% of total	Therms	% of total	Therms
Aurora	43,946,810	55	36,533,738	45	80,480,548
Kane	141,615,345	48	150,649,744	52	292,265,089
DuPage	296,676,157	54	255,167,002	46	551,843,159
Region	3,122,788,780	57	2,337,611,588	43	5,460,400,368

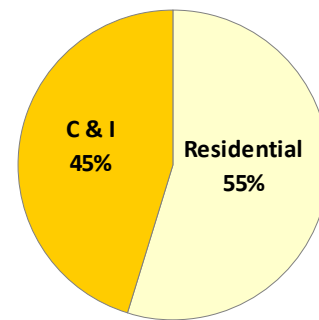
Note: Aurora is situated within four counties, but the majority of the city lies between Kane and DuPage Counties.

Table 2: Aurora Residential Natural Gas Consumption & Costs

Average annual residential natural gas consumption		
	Therms per HH	Annual \$ per HH
Aurora*	808	\$948
Kane	913	\$1,071
DuPage	898	\$1,053
Region	1,044	\$1,224

*54,416 HH (2005 – 2007 ACS)

Figure 3. Aurora Natural Gas Consumption by Sector



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 8.5% of the total consumption in Kane and DuPage Counties. Aurora’s consumption accounts for about 1.7% 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 lower than both the region and Kane County. Aurora’s average consumption per household is 9,856 kWh. This amounts to approximately \$848 annual electricity expenses per household.⁸ (Table 4.) This number is simply an average and varies depending on factors including square footage, the presence of air conditioning, and the

⁷ U.S. Census Bureau, 2007 American Community Survey.

⁸ Illinois Commerce Commission Utility Sales Statistics for 2005 were used to calculate average cost and as such, dollar amounts reflect a snapshot in time. As energy prices continue to fluctuate, it may be important to recalculate average cost per household. It should also be noted that there are other rate structures that may significantly influence household average cost, too.

efficiency of lighting, appliances and systems. However, Aurora’s average is higher than the region and both Kane and DuPage Counties.

Table 3: Aurora Electricity Consumption

	Residential		Commercial & Industrial		Total
	kWh	% of total	kWh	% of total	kWh
Aurora	536,345,985	38	880,502,445	62	1,416,848,430
Kane	1,454,100,543	29	3,482,599,522	71	4,936,700,065
DuPage	3,015,947,372	26	8,626,162,317	74	11,642,109,688
Region	26,296,220,042	31	59,202,016,205	69	85,498,236,248

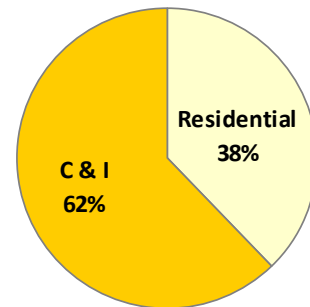
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Table 4: Aurora Residential Electricity Consumption & Costs

Average annual residential electricity consumption		
	kWh per HH	Annual \$ per HH
Aurora*	9,856	\$848
Kane	9,376	\$785
DuPage	9,124	\$994
Region	8,795	\$756

*54,416 HH (2005 – 2007 ACS)

Figure 4. Aurora Electricity Consumption by Sector



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. Aurora VMT: Total and Household Data

	Total On-Road VMT	Total HH VMT	Number of HH	VMT per HH
Aurora	1,075,400,980	929,404,540	54,416	17,079
Kane	3,520,486,524	3,663,012,000	155,090	23,619
DuPage	8,675,394,497	7,283,778,000	330,540	22,036
Region	60,527,014,013	55,347,815,873	2,989,996	18,511

Note: The methodology selected by CMAP to calculate household VMT for counties uses a different approach than the methodology for total VMT (as reported by IDOT). Due to this discrepancy, the household VMT numbers are larger than the total VMT for 4 counties (Will, Kane, McHenry, and Kendall). The IDOT numbers measure VMT driven on roads in the counties, whereas the method for determining household VMT measures the miles driven by vehicles registered in that county. Therefore, if the vehicles owned by households in a certain county are driven outside of the county a significant amount, it is possible that household VMT may be larger than total VMT for a county.

Aurora 2000 and 2005 Community Greenhouse Gas Inventory

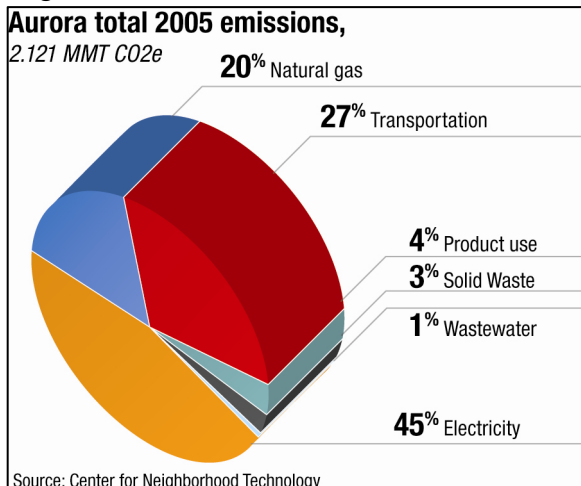
The first step in addressing Aurora’s contribution to global warming is understanding the scope, scale and source of the existing emissions. An inventory of energy use in the community serves as the basis for conducting a community greenhouse gas inventory. This greenhouse gas emissions inventory was 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 CO₂e. This represents a 22.8 percent increase over 2000 emissions of 1.727 MMT CO₂e.

Table 6. Aurora Greenhouse Gas Emissions, MMT CO₂e

	MMT CO ₂ e						Total
	Electricity	Natural Gas	Transportation	Product Use	Solid Waste	Waste Water	
2000	0.675	0.405	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 Total 2005 Emissions

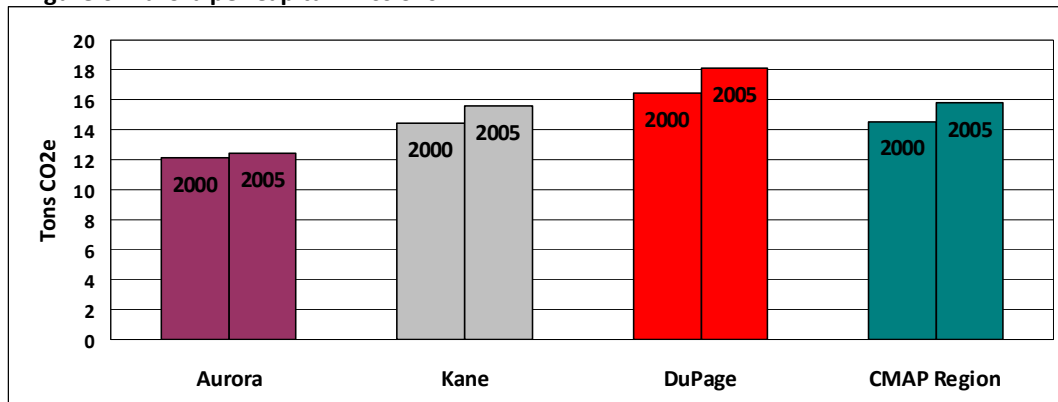


Aurora’s per capita emissions in 2005 were 12.42 tons CO₂e in 2005, which is lower than Kane County’s per capita rate of 15.55 tons and DuPage County’s per capita rate of 18.12 tons of CO₂e, as well as the region’s rate of 15.81.

Table 7. Aurora per Capita Emissions

	Tons CO ₂ e			
	Aurora	Kane	DuPage	CMAP region
2000	12.08	14.40	16.38	14.55
2005	12.42	15.55	18.12	15.81

Figure 6. Aurora 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.

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) CO₂e, to enable comparison internationally.

Emissions were calculated for the six major categories of greenhouse gases regulated under the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Emissions were converted into CO₂e 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 CO₂ 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. Aurora Energy Strategies

Strategy Areas	Areas with significant older building stock	Areas with significant new construction (residential)	Areas with significant new construction (commercial)
Energy in Buildings			
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	
Behavior Change			
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. Aurora Transportation Strategies

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

Blue Island Energy and Emissions Profile

Blue Island, Illinois

The City of Blue Island is located in southern Cook County. The city covers 4.1 square miles and its land uses are predominantly residential, industrial and some small commercial areas downtown. The residential housing stock is well established, with nearly 80% built before 1970, and 40% built before 1940.¹

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 region², the residential consumers outweigh commercial and industrial (C&I) in consumption with 57% 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."³ In the CMAP region, the commercial and industrial 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.

However, 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 since "the combustion of coal adds a significant amount of carbon dioxide to the atmosphere per unit of

¹ U.S. Census Bureau, 2000 Decennial Census.

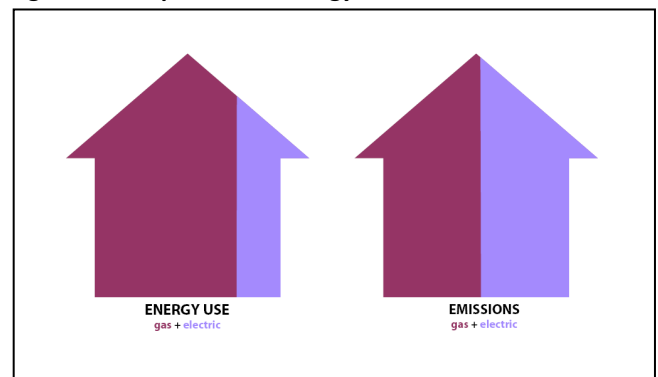
² Cook, DuPage, Kane, Kendall, Lake, McHenry and Will Counties.

³ Energy Information Administration: "Miscellaneous Electricity Services in the Buildings Sector", AEO2007 <http://www.eia.doe.gov/oiaf/aeo/otheranalysis/mesbs.html>

heat energy, more than does the combustion of other fossil fuels.”⁴ Coal emits nearly two times the carbon dioxide per unit of energy when compared to natural gas, while crude oil combustion falls between the two. In Illinois, electricity is largely generated from coal-fired and nuclear plants with some renewables, and some natural gas used for peak power generation. The Chicago region’s electricity comes from the wider electric grid covering parts of the Midwest which has a higher concentration of coal. 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.⁵ In short, because of the mix of regional generation sources, electricity consumption in Illinois 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 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.

Figure 1. Comparison of Energy Use and Emissions



The importance of understanding energy consumption

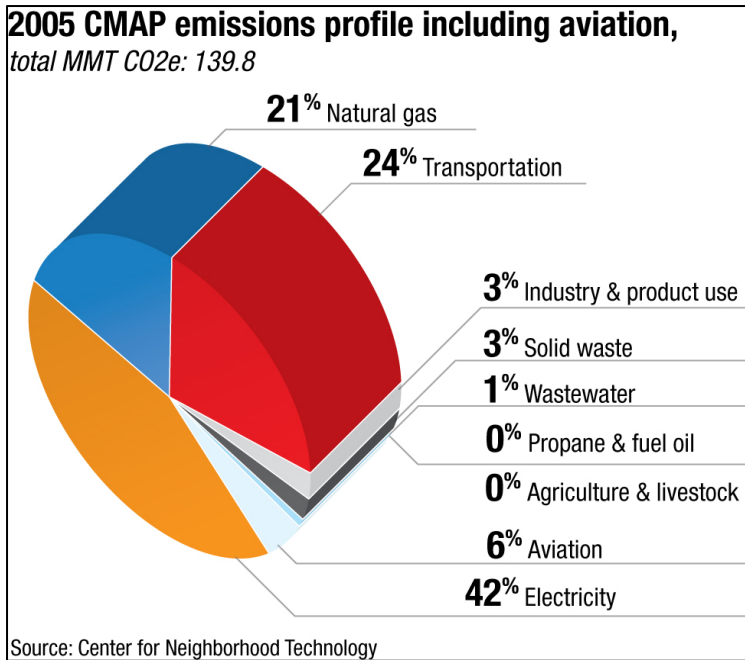
According to The Chicago Regional Greenhouse Gas Emissions Inventory, energy consumption in buildings makes up about 63% of total greenhouse gas emissions. Another 24% can be attributed to transportation. This translates into nearly 90% of our region’s total emissions being due to energy consumption. (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.

⁴ Energy Information Administration: “Greenhouse Gases, Climate Change, and Energy,” May 2008

⁵ 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

Figure 2. 2005 CMAP Region Emissions Profile



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

Energy Consumption in Blue Island

Natural Gas

Total Consumption

In 2005, the amount of natural gas consumed in Blue Island was 22.9 million therms (22,929,895). (Table 1.) To put this in perspective, the city’s consumption accounts for 0.6% of the total consumption in Cook County, and about 0.4% of the entire 7-county region’s electricity consumption.

Natural Gas by sector

Seventy-five percent (75%) of Blue Island’s natural gas consumption occurred in the commercial and industrial sector (Figure 3), which is much greater than the percentage of commercial and industrial consumption in the region or Cook County. This is likely due to heavy presence of industrial buildings in the city. Blue Island’s average consumption per household is 705 therms. This amounts to approximately \$827 annual natural gas expenses per household.⁶ (Table 2.) This number is simply an average and varies depending on factors including building size, age of

⁶ Illinois Commerce Commission Utility Sales Statistics for 2005 were used to calculate average cost and as such, dollar amounts reflect a snapshot in time. As energy prices continue to fluctuate, it may be important to recalculate average cost per household. It should also be noted that there are other rate structures that may significantly influence household average cost, too.

the building and building envelope efficiencies, the efficiency of the furnace/boiler and water heater.

Blue Island’s average is much lower than the average household in the region, or Cook County. This is likely due to the fact that less than half the city’s housing stock is single family residential.⁷ Eighteen percent (18%) of the housing stock is two-family structures, and 31% are higher numbers of multi-unit structures. Non-single family units are almost always smaller than a single family home, and a smaller household requires less gas to heat the space.

Table 1: Blue Island Natural Gas Consumption

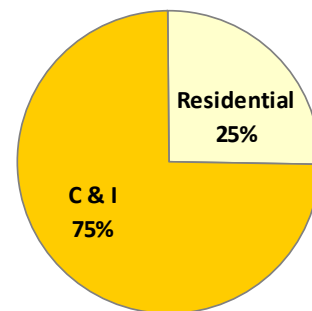
	Residential		Commercial and Industrial		Total
	Therms	% of total	Therms	% of total	Therms
Blue Island	5,767,231	25	17,162,664	75	22,929,895
Cook	2,101,159,795	59	1,464,729,092	41	3,565,888,888
Region	3,122,788,779	57	2,337,611,588	43	5,460,400,368

Table 2: Blue Island Residential Natural Gas Consumption & Costs

Average annual residential natural gas consumption		
	Therms per HH	Annual \$ per HH
Blue Island*	705	\$827
Cook	1,084	\$1,271
Region	1,044	\$1,224

*8,176 HH (2005 – 2007 ACS)

Figure 3. Blue Island Natural Gas Consumption by Sector



Electricity

Total Consumption

In 2005, the amount of electricity consumed in Blue Island was 213 million kWh (213,063,438). (Table 3.) To put this in perspective, the city’s consumption accounts for about 0.4% of the total consumption in Cook County and 0.2% of the entire 7-county region’s electricity consumption.

Electricity by sector

Sixty-nine percent (69%) of Blue Island’s electricity consumption occurred in the commercial and industrial sector (Figure 4), which is comparable to both the region and Cook County. Blue Island’s average consumption per household is 8,206 kWh. This amounts to approximately \$848 annual electricity expenses per household.⁸ (Table 4.) This number is simply an average and varies depending on factors including square footage, the presence of air conditioning, and the

⁷ U.S. Census Bureau, 2007 American Community Survey

⁸ Illinois Commerce Commission Utility Sales Statistics for 2005 were used to calculate average cost and as such, dollar amounts reflect a snapshot in time. As energy prices continue to fluctuate, it may be important to recalculate average cost per household. It should also be noted that there are other rate structures that may significantly influence household average cost, too.

efficiency of lighting, appliances and systems. Blue Island's average is slightly lower than the region and a bit higher than Cook County.

Table 3: Blue Island Electricity Consumption

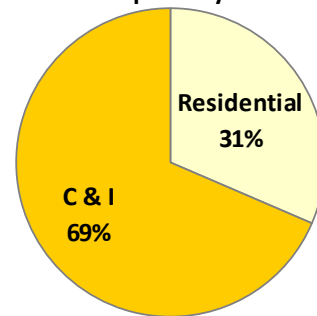
	Residential		Commercial and Industrial		Total
	kWh	% of total	kWh	% of total	kWh
Blue Island	67,091,508	31	145,971,930	69	213,063,438
Cook	15,376,395,958	30	35,623,701,242	70	51,000,097,200
Region	26,296,220,042	31	59,202,016,205	69	85,498,236,248

Table 4: Blue Island Residential Electricity Consumption & Costs

Average annual residential electricity consumption		
	kWh per HH	Annual \$ per HH
Blue Island*	8,206	\$848
Cook	7,935	\$682
Region	8,795	\$756

*8,176 HH (2005 – 2007 ACS)

Figure 4. Blue Island Electricity Consumption by Sector



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 Blue Island.

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 Blue Island was 146 million miles with 107 million miles attributed to households. We can divide total HH VMT by number of households and arrive at an average number of 13,130 VMT per household in Blue Island. (Table 5.) This is lower than the regional average, and about the same as the county average.

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. Blue Island VMT: Total and Household Data

	Total On-Road VMT	Total HH VMT	Number of HH	VMT per HH
Blue Island	146,237,908	107,356,210	8,176	13,130
Cook	34,370,678,312	30,292,202,554	1,937,864	15,632
Region	60,527,014,013	55,347,815,873	2,989,996	18,511

Blue Island 2000 and 2005 Community Greenhouse Gas Inventory

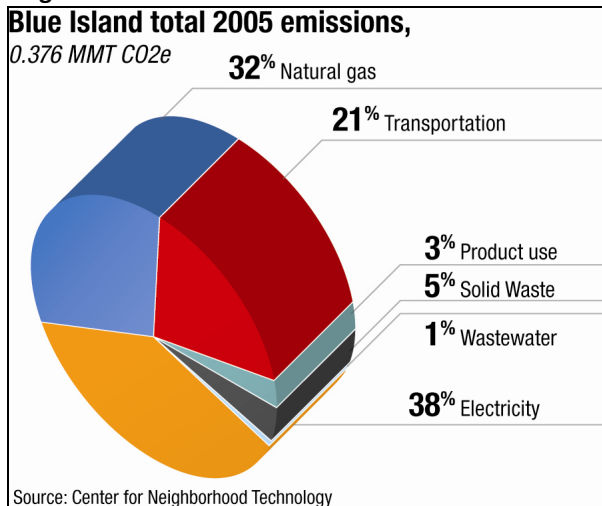
The first step in addressing Blue Island's contribution to global warming is understanding the scope, scale and source of the existing emissions. An inventory of energy use in the community serves as the basis for conducting a community greenhouse gas inventory. This greenhouse gas emissions inventory 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.

Table 6. Blue Island Greenhouse Gas Emissions, MMT CO₂e

	MMT CO ₂ e						Total
	Electricity	Natural Gas	Transportation	Product Use	Solid Waste	Waste Water	
2000	0.116	0.126	0.078	0.010	0.016	0.003	0.349
2005	0.142	0.122	0.078	0.013	0.017	0.003	0.376

The 2005 greenhouse gas emissions for Blue Island were 0.376 MMT CO₂e. This represents an 8% increase over 2000 emissions of 0.349 MMT CO₂e.

Figure 5. Blue Island Total 2005 Emissions

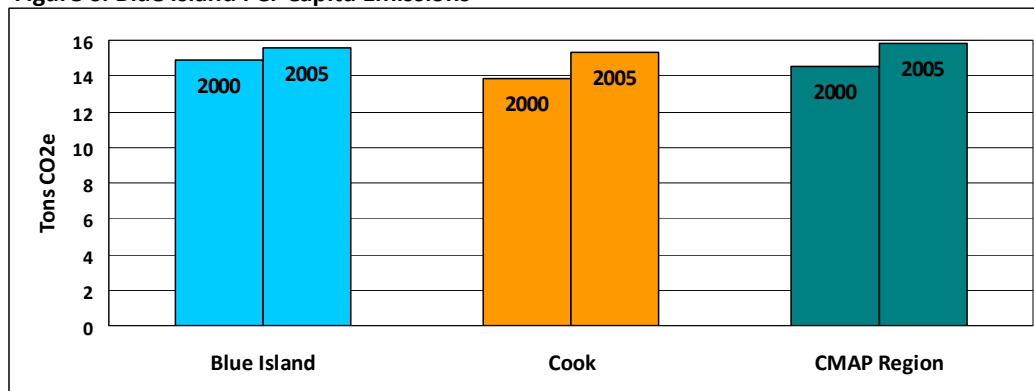


Blue Island's per capita emissions in 2005 were 15.59 tons CO₂e in 2005, which is lower than Cook County's per capita rate of 15.33 tons CO₂e, but higher than the region's rate of 15.81.

Table 7. Blue Island Per Capita Emissions

	Tons CO ₂ e		
	Blue Island	Cook	CMAP Region
2000	14.86	13.89	14.55
2005	15.59	15.33	15.81

Figure 6. Blue Island 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.

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) CO₂e, to enable comparison internationally.

Emissions were calculated for the six major categories of greenhouse gases regulated under the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Emissions were converted into CO₂e 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 CO₂ 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. Blue Island Energy Strategies

Strategy Areas	Areas with significant older building stock	Areas with significant new construction (residential)	Areas with significant new construction (commercial)
Energy in Buildings			
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	
Behavior Change			
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. Blue Island Transportation Strategies

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

Highland Park Energy and Emissions Profile

Highland Park, Illinois

The City of Highland Park is located in southeastern Lake County and covers 12.3 square miles. The city is predominantly residential, with nearly 80% of that sector being single family. About half of all residential structures in Highland Park were built before 1960, but a large building boom between 1960 and 1989 resulted in approximately 36% of today's housing stock being built during this time period.¹

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 region², the residential consumers outweigh commercial and industrial (C&I) in consumption with 57% 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."³ In the CMAP region, the commercial and industrial 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.

¹ U.S. Census Bureau, 2007 American Community Survey

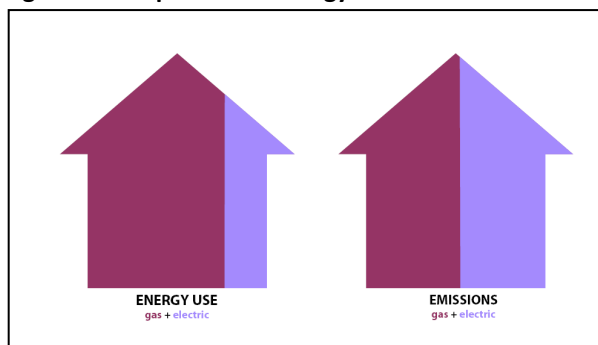
² Cook, DuPage, Kane, Kendall, Lake, McHenry and Will Counties.

³ Energy Information Administration: "Miscellaneous Electricity Services in the Buildings Sector", AEO2007 <http://www.eia.doe.gov/oiaf/aeo/otheranalysis/mesbs.html>

However, 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 since “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.”⁴ Coal emits nearly two times the carbon dioxide per unit of energy when compared to natural gas, while crude oil combustion falls between the two. In Illinois, electricity is largely generated from coal-fired and nuclear plants with some renewables, and some natural gas used for peak power generation. The Chicago region’s electricity comes from the wider electric grid covering parts of the Midwest which has a higher concentration of coal. 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.⁵ In short, because of the mix of regional generation sources, electricity consumption in Illinois 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 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.

Figure 1. Comparison of Energy Use and Emissions



The importance of understanding energy consumption

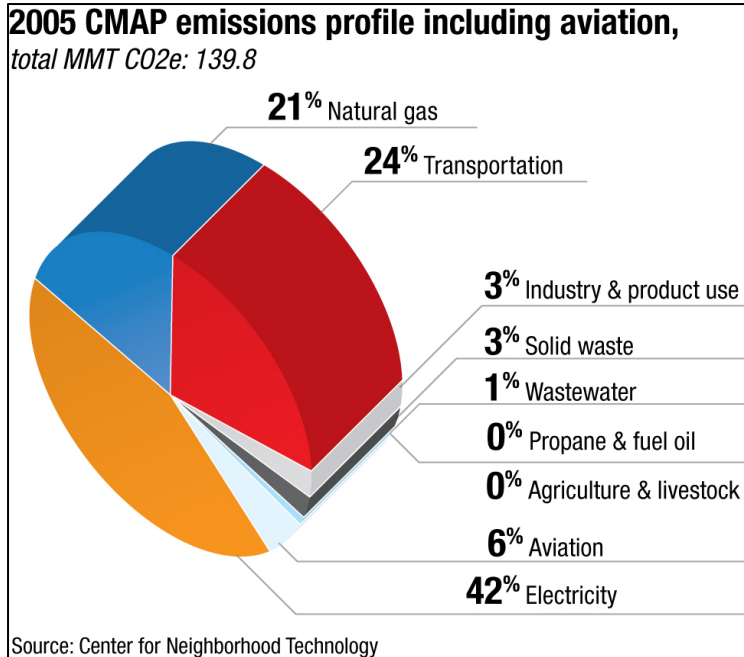
According to The Chicago Regional Greenhouse Gas Emissions Inventory, energy consumption in buildings makes up about 63% of total greenhouse gas emissions. Another 24% can be attributed to transportation. This translates into nearly 90% of our region’s total emissions being due to energy consumption. (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.

⁴ Energy Information Administration: “Greenhouse Gases, Climate Change, and Energy,” May 2008

⁵ 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

Figure 2. 2005 CMAP Region Emissions Profile



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

Energy Consumption in Highland Park

Natural Gas

Total Consumption

In 2005, the amount of natural gas consumed in Highland Park was 27 million therms (27,248,842). (Table 1.) To put this in perspective, the city’s consumption accounts for about 6.4% of the total consumption in Lake County, and about 0.5% of the entire 7-county region’s electricity consumption.

Natural Gas by sector

Seventy-nine percent (79%) of Highland Park’s natural gas consumption occurred in the residential sector (Figure 3), which is much higher than both Lake County and the region. This is likely due to the city’s high concentration of residential land use.

Highland Park’s average consumption per household is 2,052 therms, which is nearly double the region’s average. This amounts to approximately \$2,407 annual natural gas expenses per household.⁶ (Table 2.) It should be noted that while this number is just an average, homes in Highland Park are typically larger than most in the region and even Lake County, and this is

⁶ Illinois Commerce Commission Utility Sales Statistics for 2005 were used to calculate average cost and as such, dollar amounts reflect a snapshot in time. As energy prices continue to fluctuate, it may be important to recalculate average cost per household. It should also be noted that there are other rate structures that may significantly influence household average cost, too.

likely the reason for such a high average per household. In general, consumption will vary by house and depends on factors including building size, age of the building and building envelope efficiencies, the efficiency of the furnace/boiler and water heater.

Table 1: Highland Park Natural Gas Consumption

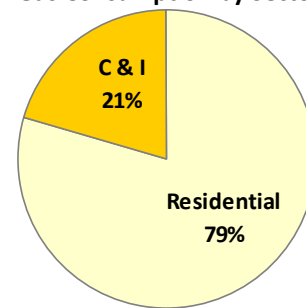
	Residential		Commercial and Industrial		Total
	Therms	% of total	Therms	% of total	Therms
Highland Park	21,631,876	79	5,616,966	21	27,248,842
Lake	273,917,101	64	151,905,611	36	425,822,712
Region	3,122,788,779	57	2,337,611,588	43	5,460,400,368

Table 2: Highland Park Residential Natural Gas Consumption & Costs

Average annual residential natural gas consumption		
	Therms per HH	Annual \$ per HH
Highland Park*	2,052	\$2,407
Lake	1,180	\$1,384
Region	1,044	\$1,224

*10,542HH (2005 – 2007 ACS)

Figure 3. Highland Park Natural Gas Consumption by Sector



Electricity

Total Consumption

In 2005, the amount of electricity consumed in Highland Park was 430 million kWh (430,488,585). (Table 3.) To put this in perspective, the city’s consumption accounts for about 5.7% of the total consumption in Lake County and about 0.5% of the entire 7-county region’s electricity consumption.

Electricity by sector

Fifty-eight percent (58%) of Highland Park’s electricity consumption occurred in the commercial and industrial sector (Figure 4), which is comparable to Lake County and the region. The city’s average consumption per household is 17,280 kWh. This amounts to approximately \$1,486 annual electricity expenses per household.⁷ (Table 4.) Again, 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, Highland Park’s average is approximately double the region’s and significantly higher than Lake County’s average per household. This is likely a result of very large homes present in the city.

⁷ Illinois Commerce Commission Utility Sales Statistics for 2005 were used to calculate average cost and as such, dollar amounts reflect a snapshot in time. As energy prices continue to fluctuate, it may be important to recalculate average cost per household. It should also be noted that there are other rate structures that may significantly influence household average cost, too.

Table 3: Highland Park Electricity Consumption

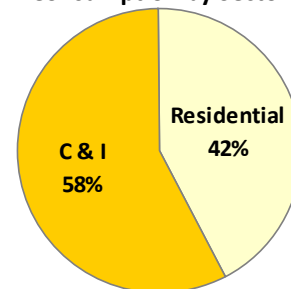
	Residential		Commercial and Industrial		Total
	kWh	% of total	kWh	% of total	kWh
Highland Park	182,160,780	42	248,327,805	58	430,488,585
Lake	2,699,023,830	36	4,874,824,022	64	7,573,847,852
Region	26,296,220,042	31	59,202,016,205	69	85,498,236,248

Table 4: Highland Park Residential Electricity Consumption & Costs

Average annual residential electricity consumption		
	kWh per HH	Annual \$ per HH
Highland Park*	17,280	\$1,486
Lake	11,631	\$1,000
Region	8,795	\$756

*10,542HH (2005 – 2007 ACS)

Figure 4. Highland Park Electricity Consumption by Sector



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 Highland Park.

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 Highland Park was 301 million miles (301,139,878), with 205 million attributed to households. We can divide total VMT by number of households and arrive at an average number of 19,527 VMT per household in the city. (Table 5.) This is higher than both Lake County and the region.

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. Highland Park VMT: Total and Household Data

	Total On-Road VMT	Total HH VMT	Number of HH	VMT per HH
Highland Park	301,139,878	205,863,322	10,542	19,527
Lake	5,828,892,021	5,405,748,000	232,046	23,296
Region	60,527,014,013	55,347,815,873	2,989,996	18,511

Highland Park 2000 and 2005 Community Greenhouse Gas Inventory

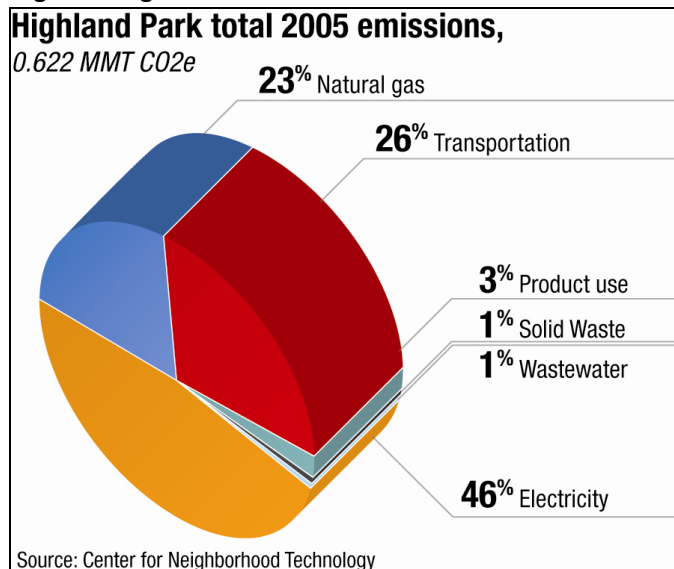
The first step in addressing Highland Park's contribution to global warming is understanding the scope, scale and source of the existing emissions. An inventory of energy use in the community serves as the basis for conducting a community greenhouse gas inventory. This greenhouse gas emissions inventory 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 Highland Park were 0.622 MMT CO₂e. This represents a 7.2 percent increase over 2000 emissions of 0.557.

Table 6. Highland Park Greenhouse Gas Emissions, MMT CO₂e

	MMT CO ₂ e						Total
	Electricity	Natural Gas	Transportation	Product Use	Solid Waste	Waste Water	
2000	0.230	0.159	0.165	0.013	0.010	0.004	0.580
2005	0.287	0.145	0.161	0.016	0.009	0.004	0.622

Figure 5. Highland Park Total 2005 Emissions

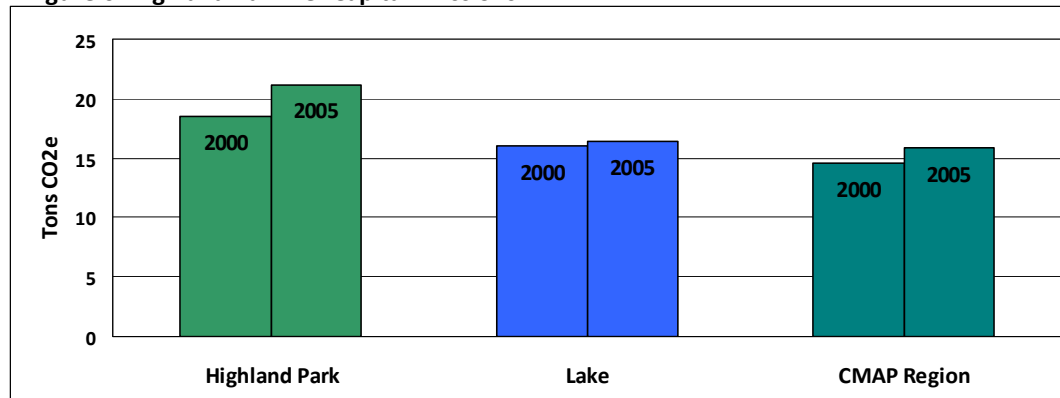


Highland Park's per capita emissions in 2005 were 21.20 tons CO₂e in 2005, which is higher than Lake County's per capita rate of 16.35 tons CO₂e, and the region's rate of 15.81.

Table 7. Highland Park Per Capita Emissions

	Tons CO ₂ e		
	Highland Park	Lake	CMAP Region
2000	18.51	16.01	14.55
2005	21.20	16.35	15.81

Figure 6. Highland Park 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.

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) CO₂e, to enable comparison internationally.

Emissions were calculated for the six major categories of greenhouse gases regulated under the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Emissions were converted into CO₂e 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 CO₂ 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. Highland Park Energy Strategies

Strategy Areas	Areas with significant older building stock	Areas with significant new construction (residential)	Areas with significant new construction (commercial)
Energy in Buildings			
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	
Behavior Change			
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. Highland Park Transportation Strategies

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

Joliet Energy and Emissions Profile

Joliet, Illinois

The City of Joliet is located predominantly in western Will County and a very small portion of eastern Kendall County. The city covers 38.3 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 region¹, 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."² In the CMAP region, the commercial and industrial 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.

However, 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 since "the combustion of coal adds a significant amount of carbon dioxide to the atmosphere per unit of

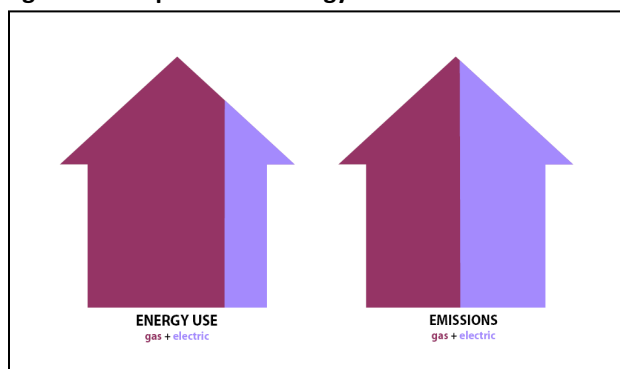
¹ Cook, DuPage, Kane, Kendall, Lake, McHenry and Will Counties.

² Energy Information Administration: "Miscellaneous Electricity Services in the Buildings Sector", AEO2007 <http://www.eia.doe.gov/oiarf/aeo/otheranalysis/mesbs.html>

heat energy, more than does the combustion of other fossil fuels.”³ Coal emits nearly two times the carbon dioxide per unit of energy when compared to natural gas, while crude oil combustion falls between the two. In Illinois, electricity is largely generated from coal-fired and nuclear plants with some renewables, and some natural gas used for peak power generation. The Chicago region’s electricity comes from the wider electric grid covering parts of the Midwest which has a higher concentration of coal. 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.⁴ In short, because of the mix of regional generation sources, electricity consumption in Illinois 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 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.

Figure 1. Comparison of Energy Use and Emissions



The importance of understanding energy consumption

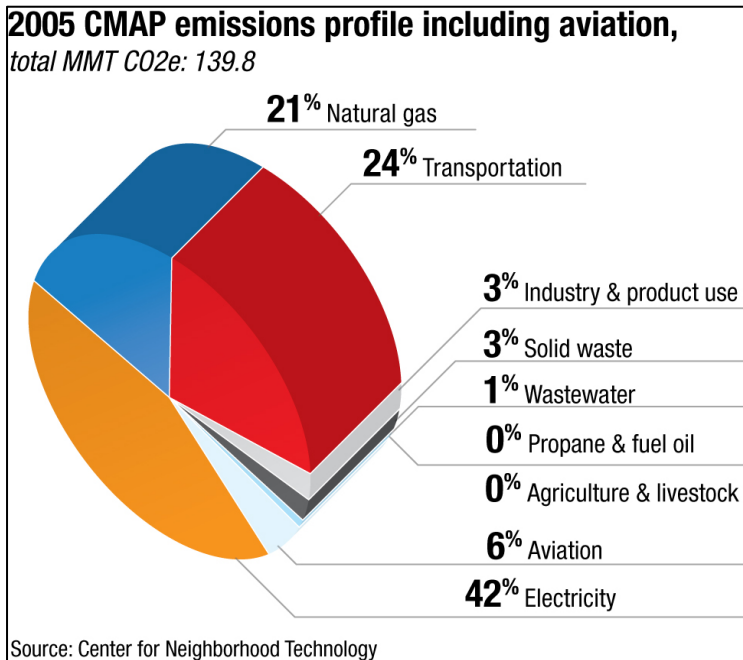
According to The Chicago Regional Greenhouse Gas Emissions Inventory, energy consumption in buildings makes up about 63% of total greenhouse gas emissions. Another 24% can be attributed to transportation. This translates into nearly 90% of our region’s total emissions being due to energy consumption. (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.

³ Energy Information Administration: “Greenhouse Gases, Climate Change, and Energy,” May 2008

⁴ 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

Figure 2. 2005 CMAP Region Emissions Profile



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

Energy Consumption in Joliet

Natural Gas

Total Consumption

In 2005, the amount of natural gas consumed in Joliet was 76.5 million therms (76,599,452). (Table 1.) To put this in perspective, the city's consumption accounts for about 19.1% of the total consumption in Will County, of which much of its population is based.⁵ Joliet's consumption accounts for about 1.4% of the entire 7-county region's electricity consumption.

Natural Gas by sector

Fifty-two percent (52%) of Joliet's natural gas consumption occurred in the commercial and industrial sector (Figure 3), which is comparable to Will County, but not the region, where the residential sector consumes slightly more instead. Joliet's average consumption per household is 872 therms. This amounts to approximately \$1,023 annual natural gas expenses per household.⁶ (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. That being said, the city's average is lower than region's, but nearly identical to the Will County average per household.

⁵ U.S. Census Bureau, 2005 American Community Survey.

⁶ Illinois Commerce Commission Utility Sales Statistics for 2005 were used to calculate average cost and as such, dollar amounts reflect a snapshot in time. As energy prices continue to fluctuate, it may be important to recalculate average cost per household. It should also be noted that there are other rate structures that may significantly influence household average cost, too.

Table 1: Joliet Natural Gas Consumption

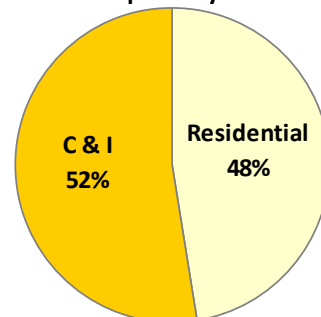
	Residential		Commercial and Industrial		Total
	Therms	% of total	Therms	% of total	Therms
Joliet	36,429,101	48	40,170,351	52	76,599,452
Will	180,399,933	45	221,085,733	55	401,485,665
Region	3,122,788,779	57	2,337,611,588	43	5,460,400,368

Table 2: Joliet Residential Natural Gas Consumption & Costs

Average annual residential natural gas consumption		
	Therms per HH	Annual \$ per HH
Joliet*	872	\$1,023
Will	882	\$1,035
Region	1,044	\$1,224

*41,764 HH (2005 – 2007 ACS)

Figure 3. Joliet Natural Gas Consumption by Sector



Electricity

Total Consumption

In 2005, the amount of electricity consumed in Joliet was 1.2 billion kWh (1,157,483,478). (Table 3.) To put this in perspective, the city’s consumption accounts for 17% of the total consumption in Will County, while its population makes up about 20% of the county’s total population.⁷ Joliet’s consumption accounts for about 1.4% of the entire 7-county region’s electricity consumption.

Electricity by sector

Fifty-seven percent (57%) of Joliet’s electricity consumption occurred in the commercial and industrial sector (Figure 4), which is comparable to Will County and similar to the region’s sector balance. The city’s average consumption per household is 11,962 kWh. This amounts to approximately \$1,029 annual electricity expenses per household.⁸ (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, Joliet’s average is comparable to Will County, but significantly higher than the region. This is likely a reflection of the newer housing stock built in the city; new construction home are likely larger in size and built to include central air conditioning. Over 20% of Joliet’s existing housing stock was built between 2000 and 2004, and an additional 18% from 1990 to 1999, so new residential buildings play a significant role in energy consumption in the city.⁹

⁷ U.S. Census Bureau, 2005 American Community Survey. The 2005 ACS is used for continuity since the energy consumption data is from 2005.

⁸ Illinois Commerce Commission Utility Sales Statistics for 2005 were used to calculate average cost and as such, dollar amounts reflect a snapshot in time. As energy prices continue to fluctuate, it may be important to recalculate average cost per household. It should also be noted that there are other rate structures that may significantly influence household average cost, too.

⁹ U.S. Census Bureau, 2007 American Community Survey.

Table 3: Joliet Electricity Consumption

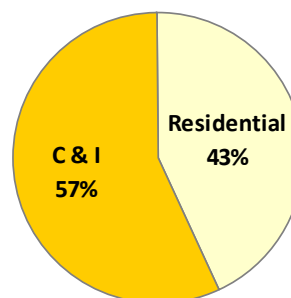
	Residential		Commercial and Industrial		Total
	kWh	% of total	kWh	% of total	kWh
Joliet	499,566,292	43	657,917,185	57	1,157,483,478
Will	2,271,873,428	33	4,566,002,611	67	6,837,876,039
Region	26,296,220,042	31	59,202,016,205	69	85,498,236,248

Table 4: Joliet Residential Electricity Consumption & Costs

Average annual residential electricity consumption		
	kWh per HH	Annual \$ per HH
Joliet*	11,962	\$1,029
Will	11,109	\$955
Region	8,795	\$756

*41,764 HH (2005 – 2007 ACS)

Figure 4. Joliet Electricity Consumption by Sector



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 Joliet.

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 Joliet was 878 million miles (878,162,776) with 644 million attributed to households. We can divide total HH VMT by number of households and arrive at an average number of 14,577 VMT per household in Joliet. (Table 5.) This is almost the same as the regional average, but quite a bit lower than the Will County average.

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. Joliet VMT: Total and Household Data

	Total On-Road VMT	Total HH VMT	Number of HH	VMT per HH
Joliet	878,277,421	644,133,408	44,188	14,577
Will	5,300,575,756	5,336,716,500	204,500	26,096
Region	60,527,014,013	55,347,815,873	2,989,996	18,511

Note: The methodology selected by CMAP to calculate household VMT for counties uses a different approach than the methodology for total VMT (as reported by IDOT). Due to this discrepancy, the household VMT numbers are larger than the total VMT for 4 counties (Will, Kane, McHenry, and Kendall). The IDOT numbers measure VMT driven on roads in the counties, whereas the method for determining household VMT measures the miles driven by vehicles registered in that county. Therefore, if the vehicles owned by households in a certain county are driven outside of the county a significant amount, it is possible that household VMT may be larger than total VMT for a county.

Joliet 2000 and 2005 Community Greenhouse Gas Inventory

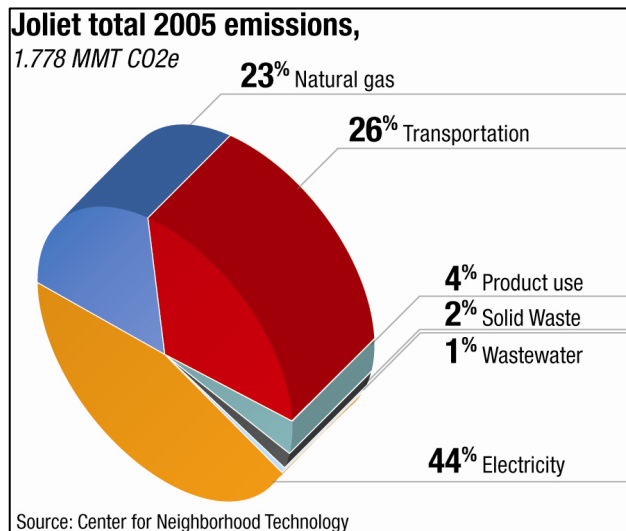
The first step in addressing Joliet’s contribution to global warming is understanding the scope, scale and source of the existing emissions. An inventory of energy use in the community serves as the basis for conducting a community greenhouse gas inventory. This greenhouse gas emissions inventory was 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 Joliet were 1.778 MMT CO₂e. This represents a 19.4 percent increase over 2000 emissions of 1.489 MMT CO₂e.

Table 6. Joliet Greenhouse Gas Emissions, MMT CO₂e

	MMT CO ₂ e						Total
	Electricity	Natural Gas	Transportation	Product Use	Solid Waste	Waste Water	
2000	0.653	0.348	0.391	0.044	0.041	0.013	1.489
2005	0.772	0.408	0.470	0.072	0.040	0.016	1.778

Figure 5. Joliet Total 2005 Emissions

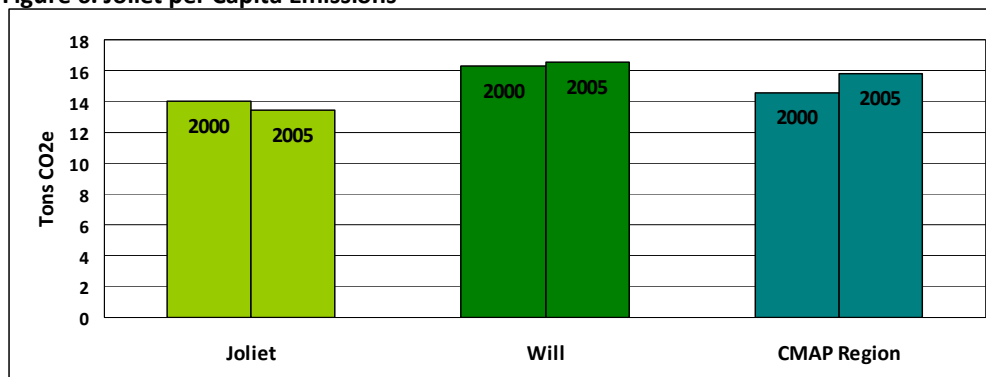


Joliet’s per capita emissions in 2005 were 13.39 tons CO₂e in 2005, which is lower than Will County’s per capita rate of 16.60 tons CO₂e, and the region’s rate of 15.81.

Table 7. Joliet per Capita Emissions

	Tons CO ₂ e		
	Joliet	Will	CMAP Region
2000	14.02	16.25	14.55
2005	13.39	16.60	15.81

Figure 6. Joliet 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 were calculated for the six major categories of greenhouse gases regulated under the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Emissions were converted into CO₂e 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.

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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. Joliet Energy Strategies

Strategy Areas	Areas with significant older building stock	Areas with significant new construction (residential)	Areas with significant new construction (commercial)
Energy in Buildings			
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	
Behavior Change			
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. Joliet Transportation Strategies

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

Schaumburg Energy and Emissions Profile

Schaumburg, Illinois

The Village of Schaumburg is located in northwestern Cook County and covers 19.1 square miles. Its land use includes major commercial retail and office areas, as it is home to the largest commercial center in the state outside of the City of Chicago, with a daytime population approximately twice the size of the village's current population of 74,271. Its residential sector experienced major growth during the 1970s and 1980s, when nearly 67% of today's housing stock was built.¹

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 region², 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."³ In the CMAP region, the commercial and industrial 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.

¹ U.S. Census Bureau, 2007 American Community Survey.

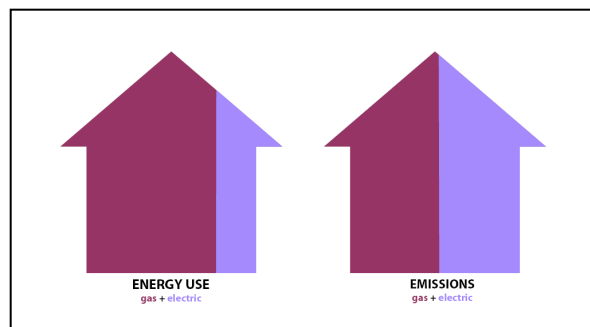
² Cook, DuPage, Kane, Kendall, Lake, McHenry and Will Counties.

³ Energy Information Administration: "Miscellaneous Electricity Services in the Buildings Sector", AEO2007 <http://www.eia.doe.gov/oiarf/aeo/otheranalysis/mesbs.html>

However, 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 since “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.”⁴ Coal emits nearly two times the carbon dioxide per unit of energy when compared to natural gas, while crude oil combustion falls between the two. In Illinois, electricity is largely generated from coal-fired and nuclear plants with some renewables, and some natural gas used for peak power generation. The Chicago region’s electricity comes from the wider electric grid covering parts of the Midwest which has a higher concentration of coal. 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.⁵ In short, because of the mix of regional generation sources, electricity consumption in Illinois 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 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.

Figure 1. Comparison of Energy Use and Emissions



The importance of understanding energy consumption

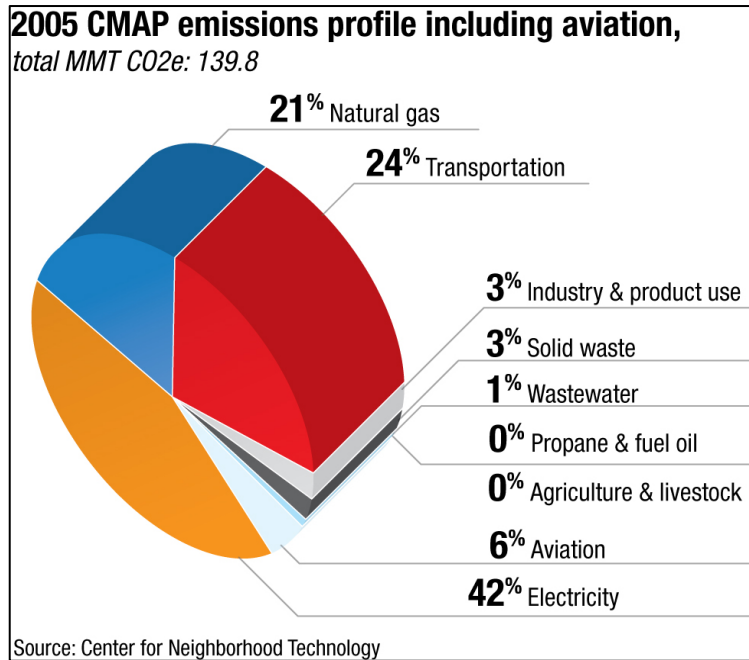
According to The Chicago Regional Greenhouse Gas Emissions Inventory, energy consumption in buildings makes up about 63% of total greenhouse gas emissions. Another 24% can be attributed to transportation. This translates into nearly 90% of our region’s total emissions being due to energy consumption. (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.

⁴ Energy Information Administration: “Greenhouse Gases, Climate Change, and Energy,” May 2008

⁵ 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

Figure 2. 2005 CMAP Region Emissions Profile



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

Energy Consumption in Schaumburg

Natural Gas

Total Consumption

In 2005, the amount of natural gas consumed in Schaumburg was 44 million therms (44,200,395). (Table 1.) To put this in perspective, the village's consumption accounts for about 1.2% of the total consumption in Cook County. Schaumburg's consumption accounts for about 0.8% of the entire 7-county region's natural gas consumption.

Natural Gas by sector

Schaumburg's natural gas consumption by sector is split right down the middle, with fifty percent (50%) each in the residential sector and in commercial and industrial (Figure 3). This is different than the county and the region, which generally see a predominance of the residential sector, but likely explained due to the large number of commercial buildings in comparison to homes.

Schaumburg's average consumption per household is 688 therms. This amounts to approximately \$807 annual natural gas expenses per household.⁶ (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. However, the city's average is significantly lower than Cook County and the region. This is

⁶ Illinois Commerce Commission Utility Sales Statistics for 2005 were used to calculate average cost and as such, dollar amounts reflect a snapshot in time. As energy prices continue to fluctuate, it may be important to recalculate average cost per household. It should also be noted that there are other rate structures that may significantly influence household average cost, too.

likely due to the presence of many multi-family buildings in Schaumburg. Only 35% of the existing housing stock is single family detached, while 46% is located in multiple unit buildings, which generally means smaller square footage and requires less energy to heat. Another 19% is single family attached (i.e. townhomes), which are also often smaller in square footage than single family detached.⁷

Table 1: Schaumburg Natural Gas Consumption

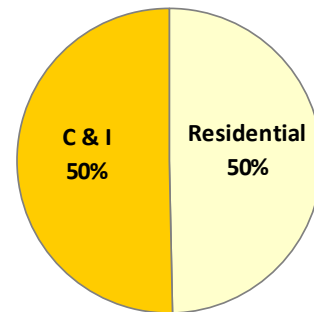
	Residential		Commercial and Industrial		Total
	Therms	% of total	Therms	% of total	Therms
Schaumburg	22,028,133	50	22,172,262	50	44,200,395
Cook	2,101,159,795	59	1,464,729,092	41	3,565,888,888
Region	3,122,788,779	57	2,337,611,588	43	5,460,400,368

Table 2: Schaumburg Residential Natural Gas Consumption & Costs

Average annual residential natural gas consumption		
	Therms per HH	Annual \$ per HH
Schaumburg*	688	\$807
Cook	1,084	\$1,271
Region	1,044	\$1,224

*32,014 HH (2005 – 2007 ACS)

Figure 3. Schaumburg Natural Gas Consumption by Sector



Electricity

Total Consumption

In 2005, the amount of electricity consumed in Schaumburg was 1.2 billion kWh (1,236,578,430). (Table 3.) To put this in perspective, the city’s consumption accounts for about 2.4% of the total consumption in Cook County and about 1.4% of the entire 7-county region’s electricity consumption.

Electricity by sector

Seventy-eight percent (78%) of Schaumburg’s electricity consumption occurred in the commercial and industrial sector (Figure 4), which is higher than both the region and Cook County, but not surprising, given the large commercial sector in comparison to its residential sector. At the household level, Schaumburg’s average consumption is 8,378 kWh. This amounts to approximately \$721 annual electricity expenses per household.⁸ (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, Schaumburg’s average is comparable to the region and only slightly higher than Cook County.

⁷ U.S. Census Bureau, 2007 American Community Survey.

⁸ Illinois Commerce Commission Utility Sales Statistics for 2005 were used to calculate average cost and as such, dollar amounts reflect a snapshot in time. As energy prices continue to fluctuate, it may be important to recalculate average cost per household. It should also be noted that there are other rate structures that may significantly influence household average cost, too.

Table 3: Schaumburg Electricity Consumption

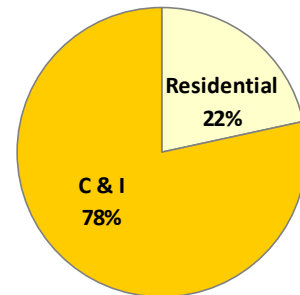
	Residential		Commercial and Industrial		Total
	kWh	% of total	kWh	% of total	kWh
Schaumburg	268,220,026	22	968,358,404	78	1,236,578,430
Cook	15,376,395,958	30	35,623,701,242	70	51,000,097,200
Region	26,296,220,042	31	59,202,016,205	69	85,498,236,248

Table 4: Schaumburg Residential Electricity Consumption & Costs

Average annual residential electricity consumption		
	kWh per HH	Annual \$ per HH
Schaumburg*	8,378	\$721
Cook	7,935	\$682
Region	8,795	\$756

*32,014 HH (2005 – 2007 ACS)

Figure 4. Schaumburg Electricity Consumption by Sector



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 Schaumburg.

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 Schaumburg was 660 million miles (660,532,642,) with 484 million attributed to households. We can divide total HH VMT by number of households and arrive at an average number of 15,319 VMT per household in the city. (Table 5.) This is higher than both the regional average and Cook County.

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. Schaumburg VMT: Total and Household Data

	Total On-Road VMT	Total HH VMT	Number of HH	VMT per HH
Schaumburg	660,532,642	484,531,668	31,630	15,319
Cook	34,370,678,312	30,292,202,554	1,937,864	15,632
Region	60,527,014,013	55,347,815,873	2,989,996	18,511

Schaumburg 2000 and 2005 Community Greenhouse Gas Inventory

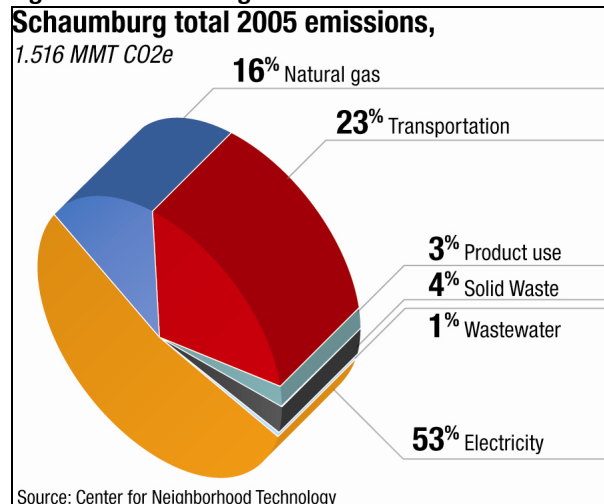
The first step in addressing Schaumburg’s contribution to global warming is understanding the scope, scale and source of the existing emissions. An inventory of energy use in the community serves as the basis for conducting a community greenhouse gas inventory. This greenhouse gas emissions inventory 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 Schaumburg were 1.516 MMT CO₂e. This represents an 11.6 percent increase over 2000 emissions of 1.359 MMT CO₂e.

Table 6. Schaumburg Greenhouse Gas Emissions, MMT CO₂e

	MMT CO ₂ e						Total
	Electricity	Natural Gas	Transportation	Product Use	Solid Waste	Waste Water	
2000	0.668	0.247	0.352	0.031	0.053	0.009	1.359
2005	0.824	0.235	0.354	0.040	0.054	0.009	1.516

Figure 4. Schaumburg Total 2005 Emissions

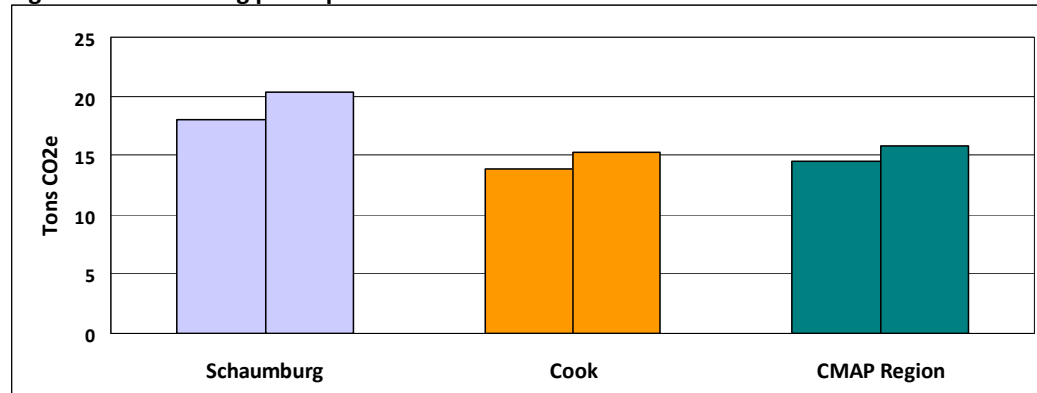


Schaumburg’s per capita emissions in 2005 were 20.37 tons CO₂e in 2005, which is higher than Cook County’s per capita rate of 15.33 tons CO₂e, and the region’s rate of 15.81.

Table 7. Schaumburg per Capita Emissions

	Tons CO ₂ e		
	Schaumburg	Cook	CMAQ region
2000	18.03	13.89	14.55
2005	20.37	15.33	15.81

Figure 5. Schaumburg 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.

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) CO₂e, to enable comparison internationally.

Emissions were calculated for the six major categories of greenhouse gases regulated under the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Emissions were converted into CO₂e 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 CO₂ 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. Schaumburg Energy Strategies

Strategy Areas	Areas with significant older building stock	Areas with significant new construction (residential)	Areas with significant new construction (commercial)
Energy in Buildings			
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	
Behavior Change			
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. Schaumburg Transportation Strategies

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

Appendix B: Methodology

Methodology

Converting to KBTU

The tables below are a summary of the CMAP Region's energy consumption in KBTU (Kilo British Thermal Units). KBTU allows natural gas (therms) and electricity (kWh) consumption to be compared. Below are the conversions factors:

1 therm = 100 KBTU

1 kWh = 3.412 KBTU

	Natural Gas, KBTU		
	Residential	Commercial & Industrial	Total Natural Gas
Cook	210,115,979,525	146,472,909,233	356,588,888,758
DuPage	29,667,615,687	25,516,700,183	55,184,315,870
Kane	14,161,534,534	15,064,974,396	29,226,508,930
Kendall	2,840,434,683	1,987,596,992	4,828,031,675
Lake	27,391,710,117	15,190,561,128	42,582,271,245
McHenry	10,061,610,151	7,419,843,638	17,481,453,789
Will	18,039,993,269	22,108,573,273	40,148,566,542
Region	312,278,877,967	233,761,158,842	546,040,036,808

	Electricity, KBTU		
	Residential	Commercial & Industrial	Total Electricity
Cook	52,466,438,461	121,553,108,674	174,019,547,135
DuPage	10,290,839,128	29,433,686,253	39,724,525,380
Kane	4,961,596,778	11,883,122,288	16,844,719,066
Kendall	958,545,513	1,510,779,519	2,469,325,032
Lake	9,209,451,164	16,633,589,254	25,843,040,418
McHenry	4,087,598,566	5,411,522,296	9,499,120,862
Will	7,751,953,561	15,579,846,905	23,331,800,466
Region	89,726,423,171	202,005,655,188	291,732,078,359

	Total Energy Consumption (Natural Gas & Electricity) KBTU
Cook	530,608,435,892
DuPage	94,908,841,250
Kane	46,071,227,996
Kendall	7,297,356,707
Lake	68,425,311,663
McHenry	26,980,574,651
Will	63,480,367,007
Region	837,772,115,167

Natural Gas, 2005 data

Nicor:

Residential sector consumption:

Natural gas consumption was provided for only Nicor residential accounts with a full 12 months of billing. However, a total count of all residential accounts, including those with less than 12 months of billing was available. To estimate usage for these additional accounts, an average billing period of six months was assumed, and then the same average rate of consumption per account as the 12 month accounts was applied. By this method of estimation, the partial accounts represented 18% of the total residential usage in the Nicor

service area. This amount was added to the total natural gas consumption for Nicor customers.

Next, all natural gas (therms) consumption data was sorted that has a zip code within only one county and the data was then allocated to the appropriate county. Next, it was determined which natural gas consumption data has no zip code and this data was aggregated using municipalities/townships. Then, data that is within municipalities/townships that are split by a county boundary line were aggregated using the fractional area of the municipality in each county. Subsequently, natural gas consumption data that has a point zip code (zip codes that weren't matched to a county) was aggregated by municipality/township, and then the same fractional split method was used to allocate the data. Finally, natural gas consumption data that has a zip code but are across county lines was first aggregated by municipality/township, and then the same fractional split method was used.

Commercial and industrial sector consumption:

All natural gas (therms) consumption data was obtained that has a zip code within only one county and the data was then allocated to the appropriate county. Next, it was determined which natural gas consumption data has no zip code and this data was aggregated using municipalities/townships. Then, data that is within municipalities/townships that are split by a county boundary line were aggregated using the fractional area of the municipality in each county. Subsequently, natural gas consumption data that has a point zip code (zip codes that weren't matched to a county) was aggregated by municipality/township, and then the same fractional split method was used to allocate the data. Finally, natural gas consumption data that has a zip code but are across county lines was first aggregated by municipality/township, and then the same fractional split method was used.

People's Gas:

Methodology for residential sector and commercial and industrial sector was identical for People's Gas. Since People's Gas only serves Cook County in the CMAP region, the account level data was obtained and aggregated.

North Shore:

Methodology for residential sector and commercial and industrial sector was identical for North Shore. All natural gas consumption data was obtained that has a zip code within only one county and the data was then allocated to the appropriate county. Next, it was determined which natural gas consumption data has no zip code and this data was aggregated using municipalities/township.

Transport Gas:

Within the data sources for natural gas, "transport gas" amounts to a small portion of total natural gas consumption. Transport gas is simply gas that passes through the pipelines in the region for sales by third party suppliers. In some cases it is consumed in the region, and in other cases, it is merely passing through to other areas of the state and beyond. Determining how much transport gas is burned and used within the region can only occur with distribution usage data provided by each utility. For the purposes of this report, only transport gas consumed within the region has been included in the analysis.

All utility companies include transport gas used within the region when reporting consumption data; and cannot be differentiated. North Shore is the only utility company that also includes transport gas that passes through the region; however, this can be differentiated and was removed.

Average annual household consumption:

Average annual therms per household were determined by identifying the total therms consumed by the residential sector in the county. Then, the total number of residential therms was divided by the total number of households in that county in 2005 as provided by the Census Bureau's American Community Survey. This determined the average annual household consumption of natural gas.

Annual cost per household:

The regional average cost per therms was determined by averaging North Shore, People's Gas, and Nicor revenue per therm for residential sales (117.303 cents per therm) as reported in the Illinois Commerce Commission Utility Sales Statistics for 2005. Then, 117.303 cents per therm was multiplied by the average annual therms consumed per household in each individual county and in the region. This determined the average annual cost of natural gas consumption per household.

Annual energy cost savings:

Cost savings attributed to specific strategies were determined by finding the average cost per therm for residential sales (117.303 cents per therm) and commercial sales (109.991 cents per therm, calculated by first averaging the small and large customers in Nicor, North Shore and Peoples Gas, and then averaging those three numbers together.) These numbers are reported in the Illinois Commerce Commission Utility Sales Statistics for 2005. Then, the appropriate cents per therm (residential or commercial) was multiplied by the amount of therms saved. This determined the energy cost savings of natural gas for a specific strategy.

Electricity, 2005 data

ComEd:

The first steps in the methodology to determine electricity (kWh) consumption for the residential and commercial & industrial sector were the same.

All electricity consumption data was obtained that has a zip code that is within one county and the data was then allocated to the appropriate county. Next, it was determined electricity consumption data that has no zip code and this data was aggregated using municipalities/township. Then, data that is within municipalities/townships that are split by a county boundary line were aggregated using the fractional area of the municipality in each county. Continue to the residential or commercial and industrial sector for the subsequent steps.

Residential sector consumption:

Subsequently, electricity consumption data that has a point zip code (zip codes that weren't matched to a county) was aggregated by municipality/township, and then the same fractional split method was used to allocate the data. Finally, natural gas consumption data that has a zip code but are across county lines was first aggregated by municipality/township, and then the same fractional split method was used.

Commercial and industrial sector consumption:

Next, very large C&I accounts located in a zip code that crosses county lines were examined for accuracy. We took this important extra step because these large accounts were responsible for 90% of the usage in zip codes that straddled county lines. In order to ensure that these top accounts were placed in the correct county, we geocoded the top 10,000 accounts. Using a Google geocoding spreadsheet, these accounts were mapped, and the usage allocated to the correct county. Remaining accounts were aggregated by municipality/township and again the fractional split method was used.

Average annual household consumption:

Average annual kWh per household was determined by identifying the total kWh consumed by the residential sector in the county. Then, the total number of residential kWh was divided by the total number of households in the county in 2005 as provided by the Census Bureau's American Community Survey. This determined the average annual household consumption of electricity.

Annual cost per household:

The regional average cost per kWh was determined by ComEd revenue per bundled services for residential sales (8.60 cents per kWh) as reported in the Illinois Commerce Commission Utility Sales Statistics for 2005. Then, 8.60 cents per kWh was multiplied by the average annual kWh consumed per household in each individual county and in the region. This determined the average annual cost of electricity consumption per household.

Annual energy cost savings:

Cost savings attributed to specific strategies were determined by finding the ComEd revenue per kWh for residential sales (8.60 cents per kWh) and commercial sales (6.49 cents per kWh, average from small and large customers) as reported in the Illinois Commerce Commission Utility Sales Statistics for 2005. Then, the appropriate cents per kWh (residential or commercial) was multiplied by the amount of kWh saved. This determined the energy cost savings of electricity for a specific strategy.

Transportation

Transportation emissions were developed using vehicle miles traveled data from the Illinois Department of Transportation and Amtrak; fleet mix data from the Lake Michigan Air Directors Consortium (LADCO); vehicle efficiency data from the Federal Highway Administration (FHWA); and fuel sales and usage from the U.S. Department of Energy and the National Transit Database. Emissions factors for transportation are from the U.S. EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks and State Inventory Tool.

Total On-Road Vehicle Miles Traveled (VMT):

Annual vehicle miles traveled (VMT) statistics for each county were taken from Illinois Highway Statistics reports by the Illinois Department of Transportation. The sum of all seven counties amounted to the total on-road VMT for the region.

Household (HH) Vehicles Miles Traveled (VMT):

Estimates of vehicle miles traveled (VMT) attributable to households were provided by CMAP. CMAP estimated median VMT per vehicle for each county by analyzing odometer readings collected by the Illinois Department of Transportation during emissions testing. To estimate total household VMT, the median VMT per vehicle were multiplied by the total autos owned in a given county, as reported in the 2005 American Communities Survey. These data pertain only to household VMT; total county VMT values are reported directly from IDOT.

Overall Strategy Notes and Assumptions

Residential households:

The data provided from utilities was from 2005, so it makes sense to use 2005 as a comparison and starting point for both the energy consumption and energy strategy analysis. Savings are calculated for the year 2040, a point in time that is congruent with the *GO TO 2040* long range planning process.

Number of Households, 2005: American Community Survey (U.S. Census Bureau)

Number of Households, 2040: CMAP projections per scenario

Commercial businesses:

Again, the data provided from utilities was from 2005, so it makes sense to use 2005 as a comparison and starting point for both the energy consumption and energy strategy analysis. However, because there is no regional database that provides the exact number of businesses, we used the number of commercial accounts in 2005 (ComEd) as a proxy (300,267). For analyzing energy strategies in the year 2040, we used an annual growth rate of 0.008 and applied this growth rate through the year 2040 to arrive at the number of businesses in 2040. This number comes from a Chicago building permit review for 2005.

Understanding energy savings:

In this report, all estimated energy and cost savings are a "snapshot in time" in the year 2040, at different levels of implementation. It should be noted that these savings could also be calculated cumulatively, meaning that instead of just capturing the energy savings for that one year in 2040, one would count total energy savings each year, which would increase as more and more homes

are built each year. This cumulative approach would provide the actual estimated energy savings over a period of time.

Specific Strategy Assumptions

Green Building Renovation, Residential:

- Assumes approximately 25,000 rehabbed homes per year, a number arrived when applying the same scale of renovations per existing housing units in a review of Chicago building permit data in 2005.
- Assumes 30% energy savings (natural gas and electricity)

Green Building Renovation, Commercial:

- Assumes an estimated 1.5% of total commercial buildings are renovated each year. Total commercial buildings =
 - Number of commercial accounts
 - 0.0098 annual decrease
(Chicago building permit review scaled to the region; primarily due to shrinking industry)
 - + New construction, per estimated growth rate
- Assumes 30% energy savings (natural gas and electricity)

Appliance Trade-in Programs:

This strategy calculated the energy savings for trade-ins on refrigerators and window air-conditioners.

- Window air conditioners: uses number of housing units built before 1980, because those are likely built without central air conditioning.
- Assumes savings for refrigerator at 500 kWh and window air conditioner at 221 kWh, based on typical program savings documented nationwide.

Residential Retrofits:

This strategy calculated the energy savings for retrofits in *existing* housing units.

- Uses number of existing housing units in 2040 as base
- Existing housing units to retrofit in 2040 =
 - Number of housing units
 - 0.0029 annual decrease
(Chicago building permit review scaled to the region)
 - # of substantial rehabs per year
- Assumes 30% energy savings (natural gas and electricity)

Commercial Building Retrofits:

This strategy calculated the energy savings for retrofits in *existing* buildings.

- Uses number of existing commercial buildings in 2040 as base
- Existing commercial building to retrofit =
 - Number of commercial accounts
 - 0.0098 annual decrease (Chicago building permit review scaled to the region)

- # of substantial rehabs per year
- Assumes 30% energy savings (natural gas and electricity)

Updating Energy Codes:

- Total new homes based on subtracting the 2005 exiting number of households from the CMAP 2040 scenario household projections.
- Assumes 15% to 30% energy savings (natural gas and electricity) across the region. Savings will vary due to types of codes and construction practices already in place in different municipalities.

Green Building Program for Residential New Construction:

This strategy calculated the energy savings for green building new construction in *new* homes.

- Total new homes based on subtracting the 2005 exiting number of households from the CMAP 2040 scenario household projections.
- Assumes 50% energy savings (natural gas and electricity)

Green Building Program for Commercial New Construction:

This strategy calculated the energy savings for green building new construction in *new* businesses.

- Total new businesses based on applied growth rate (0.008)
- Assumes 50% energy savings (natural gas and electricity)

Behavior Change in the Residential Sector:

This strategy calculated the energy savings for behavior change, in any home.

- Assumes the following annual energy savings for specific actions per household, based on research and documented programs:
 - Reduce thermostat by 3°: 9% of therms (94 therms)
 - Increase thermostat by 3°: 9% of a/c kWh (16% of kWh attributed to air conditioning in residential sector¹: 1528 kWh x 0.09 = 126.65 kWh savings)
 - Reduce 6 light bulb hours per day (3 light bulbs for 2 hours), assumes 60-watt: (131.4 kWh)
 - Replacing air conditioner filter: 10% a/c kWh (140.72 kWh)
 - Reducing phantom load: (527.7 kWh)

Behavior Change in the Commercial Sector:

- Assumes the following annual energy savings for specific actions per business, based on research and documented programs:
 - Reduce thermostat by 3°: 9% of therms (699 therms)
 - Increase thermostat by 3°: 9% of a/c kWh (25% of kWh attributed to air conditioning in commercial sector²: 49,202.5 kWh x .09 = 4428.23 kWh)
 - Thermostat during non-working hours

¹ 2001 Residential Energy Consumption Survey (RECS). Energy Information Administration, Official Energy Statistics from the U.S. Government

² 2003 Commercial Buildings Energy Consumption Survey (CBECS). Energy Information Administration, Official Energy Statistics from the U.S. Government

- Total hours in a week 7 days x 24 hours = 168 hours
- Working hours is 5 days x 16 hours = 80 hours
- Average of 88 nonworking hours (52% per week) can have temperature setbacks
- If a 3° setback at 100% of the time equals a 9% savings, then a setback at 52% of the time could be at 52% x 9% to equal 4.7% of a/c kWh saved (49,202.5 kWh x 0.047=2,313 kWh); 4.7% therms saved = 7771 therms x .047 = 365 therms

Household Renewable Energy Generation:

This strategy calculated the energy savings for renewable energy generation, in any home.

- Assumes 100% electricity savings and 25% natural gas savings