CNTenergy

The Guidebook for the Municipal Energy Profile Project (MEPP)

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Preface

The Municipal Energy Profile Project (MEPP) provided 276 municipalities in the Chicago metropolitan region with an Energy and Emissions Profile that documents annual citywide energy consumption, vehicle miles traveled and greenhouse gas emissions. These profiles have allowed municipalities to move quickly beyond planning and analysis toward energy efficient program design and implementation. Active and engaged municipalities position themselves and the entire region to leverage energy efficiency resources by addressing federal funding priorities.

The collaboration between utilities, non-profits, and municipalities involved in this project has led to more efficient data collection and reporting. This has resulted in the establishment of a framework for future energy and emissions analyses at local and regional levels.

In addition to the Energy and Emissions Profiles, municipalities benefited from three workshops and free technical assistance over the duration of the 16-month project. The Municipal Energy Profile Project (MEPP) Guidebook offers guidance for analyzing the data in each municipality's profile and assessing what the next steps may be for the municipality. This Guidebook is an important tool that can help each municipality make the best possible use of its Energy and Emissions Profile.

The Municipal Energy Profile Project is a project of the Center for Neighborhood Technology and is funded by the Illinois Clean Energy Community Foundation (ICECF) and with support from ComEd, Nicor, Peoples Gas, North Shore Gas, and the Illinois Department of Transportation.

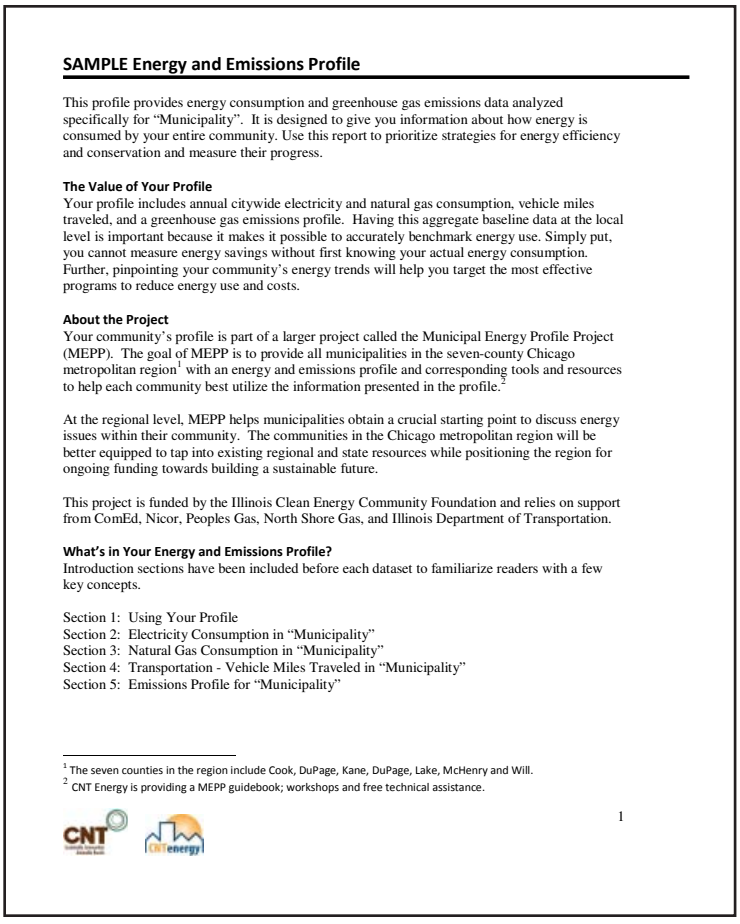
Understanding Your Profile

This section provides an overview of the contents of each Energy and Emissions Profile. It also explains the data contained in each profile and provides guidance on how to interpret the data. Topics discussed in this section include the contents of the Energy and Emissions Profile, reading the data, and baseline metrics.

Contents of the Energy and Emissions Profile

The Energy and Emissions Profile provides energy and greenhouse gas emissions data across the entire community for individual municipalities. The profile then compares the municipality's data to county data for reference. For municipalities that span more than one county, the county that contains the largest area of the municipality was used for comparison purposes. The Energy and Emissions Profile is organized into five sections:

- **Section 1: Using Your Profile**
- **Section 2: Electricity Consumption**
- **Section 3: Natural Gas Consumption**
- **Section 4: Transportation - Vehicle Miles Traveled**
- **Section 5: Emissions Profile**



SAMPLE Energy and Emissions Profile

This profile provides energy consumption and greenhouse gas emissions data analyzed specifically for "Municipality". It is designed to give you information about how energy is consumed by your entire community. Use this report to prioritize strategies for energy efficiency and conservation and measure their progress.

The Value of Your Profile
Your profile includes annual citywide electricity and natural gas consumption, vehicle miles traveled, and a greenhouse gas emissions profile. Having this aggregate baseline data at the local level is important because it makes it possible to accurately benchmark energy use. Simply put, you cannot measure energy savings without first knowing your actual energy consumption. Further, pinpointing your community's energy trends will help you target the most effective programs to reduce energy use and costs.

About the Project
Your community's profile is part of a larger project called the Municipal Energy Profile Project (MEPP). The goal of MEPP is to provide all municipalities in the seven-county Chicago metropolitan region[1] with an energy and emissions profile and corresponding tools and resources to help each community best utilize the information presented in the profile.[2]

At the regional level, MEPP helps municipalities obtain a crucial starting point to discuss energy issues within their community. The communities in the Chicago metropolitan region will be better equipped to tap into existing regional and state resources while positioning the region for ongoing funding towards building a sustainable future.

This project is funded by the Illinois Clean Energy Community Foundation and relies on support from ComEd, Nicor, Peoples Gas, North Shore Gas, and Illinois Department of Transportation.

What's in Your Energy and Emissions Profile?
Introduction sections have been included before each dataset to familiarize readers with a few key concepts.

Section 1: Using Your Profile
Section 2: Electricity Consumption in "Municipality"
Section 3: Natural Gas Consumption in "Municipality"
Section 4: Transportation - Vehicle Miles Traveled in "Municipality"
Section 5: Emissions Profile for "Municipality"

[1] The seven counties in the region include Cook, DuPage, Kane, DuPage, Lake, McHenry and Will.
[2] CNT Energy is providing a MEPP guidebook; workshops and free technical assistance.

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Reading the Data

Sections 2 through 5 of each Energy and Emissions Profile present the data that serve as a baseline for each community's energy usage and emissions. The following information provides tips on how to interpret the data in each profile.

Electricity and Natural Gas Consumption

Section 2 and Section 3 of the Energy and Emissions Profiles contain annual (2007) communitywide electricity (kWh) and natural gas (therms) consumption data, respectively. These sections contain data on total consumption, and average residential consumption and costs per household.

Table 1. Total Electricity Consumption (kWh), 2007

	Municipality	County
Residential	70,684,986	1,341,605,907
C & I	86,922,055	3,609,892,179
Total	157,607,041	4,951,498,086

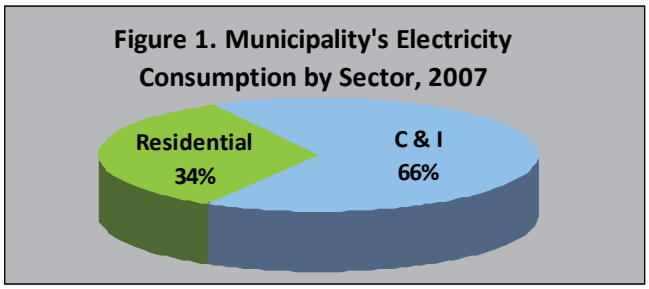
Total Consumption

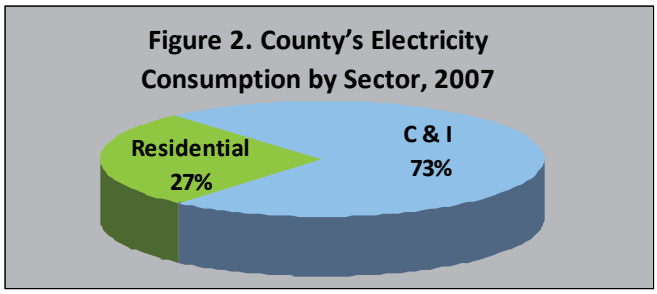
Communitywide and total county consumption of electricity and natural gas are broken down into two building sectors: residential; and commercial and industrial (C&I). These sectors are defined below. (See table 1 and table 3 in the profile.)

1. **Residential:** All residential housing units, including single family, townhouses, and multi-family.
2. **Commercial and Industrial (C&I):** Businesses of all sizes, public buildings, schools, and hospitals.

In addition to tables detailing electricity and natural gas consumption by sector, sections 2 and 3 include pie graphs for the municipality and the county that illustrate what percentage of total consumption each sector consumes (figures 1 through 4 of the profile). Careful consideration of consumption by sector may help guide a municipality in deciding where to focus energy efficiency strategies.

These sample pie graphs show municipal and county-wide electricity consumption by sector.





Average Residential Consumption and Costs

Each Energy and Emissions Profile also provides a snapshot of residential energy trends in the community. This includes information on average energy consumption and costs by household, as defined below. (See table 2 and table 4 in the profile.)

1. **Average consumption:** Average annual electricity and natural gas consumption per household.
2. **Average cost:** Average annual electricity and natural costs per household.

Table 2. Residential Electricity Consumption & Costs, 2007

	Municipality	County
Number of Households	8,142	163,555
Average kWh per Household	8,682	8,203
Average Annual $ per Household	$934	$883

It is important to remember that these averages include all types of residential units and that actual consumption will vary from household to household due to a variety of factors outlined below. Municipalities can compare their community's average household energy consumption to the countywide average. Factors that impact average household consumption in a specific municipality usually can be identified after careful consideration of land uses, building types and other characteristics of the municipality. Municipalities can address household energy consumption by implementing residential retrofit programs, adopting building codes that address energy use and emissions, or permitting on-site renewable energy generation.

Factors that impact household energy consumption	
Electricity	**Natural gas**
square footage	square footage
presence and efficiency of air conditioning	building age
efficiency of lighting	building envelope efficiency
efficiency of appliances and systems	efficiency of the furnace, boiler and water heater
occupant behavior	occupant behavior
	building operations and maintenance

Transportation: Vehicle Miles Traveled (VMT)

Section 4 of the Energy and Emissions Profile analyzes Vehicle Miles Traveled (VMT) data. VMT is the total mileage traveled by all vehicles within the municipality. Energy consumption associated with transportation is very important because transportation accounts for the second largest portion of energy usage after the energy used in buildings. VMT is presented in Table 5 of each profile. Data presented include total on-road VMT and total household VMT.

Total On-Road VMT

On-road VMT is defined as the total miles traveled on the municipality's roads in 2007. This captures trips within municipal boundaries only. This method of analysis essentially puts a bubble over a community and calculates the miles traveled (and emissions) from all transportation within that bubble.

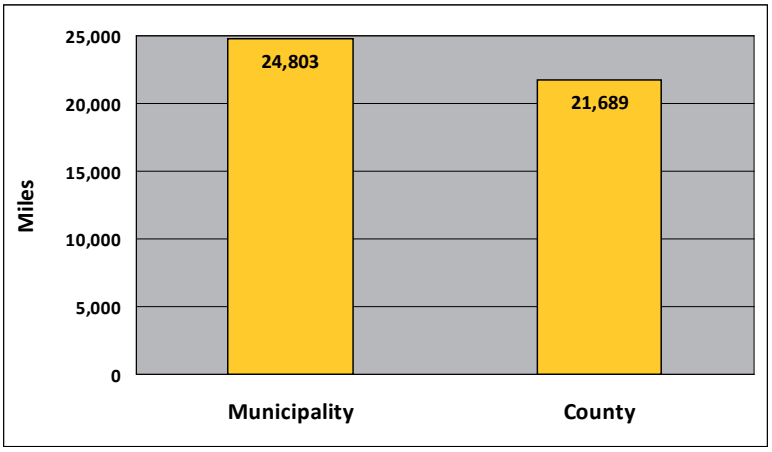
Table 5. Vehicle Miles Traveled (VMT), 2007

	Municipality	County
Total On-Road VMT	201,677,933	3,648,483,852
Household VMT	160,316,793	3,547,369,537

Household VMT

Household VMT is another perspective that looks at the transportation use of households in the community, no matter where they travel to or from. This second perspective directly links data to household activity and may help in promoting VMT and emissions reduction actions by residents. Average household VMT provides another normalized measurement that can be used to compare the average VMT per household with the county average as shown in figure 5.

Figure 5. Average Vehicle Miles Traveled per Household, 2007



As with any energy consumption, there are various factors that affect a municipality's VMT data. Location generally determines the need for car ownership, and demographic factors can affect how many cars a household may need or can afford.

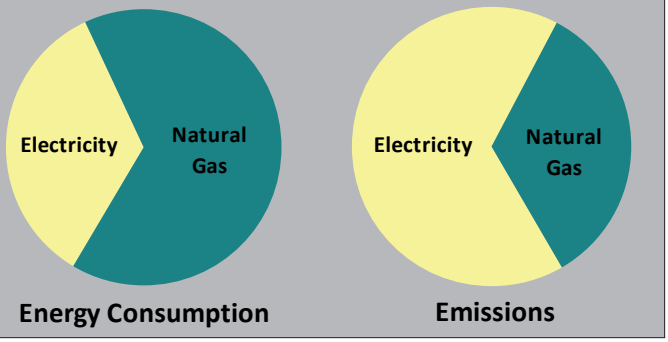
Factors that impact household vehicle miles traveled	
Place-Based Factors	**Demographic Factors**
access to jobs	income
proximity to businesses and amenities	household size
availability/accessibility of public transportation	workers per household
community walkability	

Greenhouse Gas Emissions

The final section of the Energy and Emissions Profile examines annual greenhouse gas emissions for each municipality. The emissions data help municipalities understand which sectors in their communities are the largest contributors to greenhouse gas emissions. This may help determine which sectors to target for energy efficiency strategies.

In reading the profile, it is important to understand the connection between energy and emissions. Coal, which is used to produce electricity, emits nearly twice as much carbon dioxide per unit of energy as natural gas. Figure 6 in each Energy and Emissions Profile depicts this relationship through the Chicago region's 2007 energy consumption and emission data.

Figure 6. Energy Consumption vs. Emission



It is also important to remember that while the burning of fossil fuels contributes to greenhouse gas emissions, nuclear power and renewable energy sources offer significantly lower emissions during energy production.

The Chicago metropolitan region draws electricity from a regional electric grid. The electricity supplied through this regional grid is produced mainly by burning coal (73 percent), and through nuclear power (22 percent).[1] Because fossil fuels, particularly coal, make up such a large percentage of the fuel used to generate electricity in the region, electricity consumption in northern Illinois accounts for a significant portion of greenhouse gas emissions.

For each profile, emissions were calculated for the six major categories of greenhouse gases regulated under the Kyoto Protocol: 1) Carbon dioxide (CO_2); 2) Methane (CH_4); 3) Nitrous oxide (N_2O); 4) Hydrofluorocarbons (HFCs); 5) Perfluorocarbons (PFCs); and 6) Sulfur hexafluoride (SF_6). Emissions were then converted into CO_2e (equivalent carbon dioxide) using global warming potentials from the IPCC (Intergovernmental Panel on Climate Change) Fourth Annual Assessment Report, to allow for comparison.

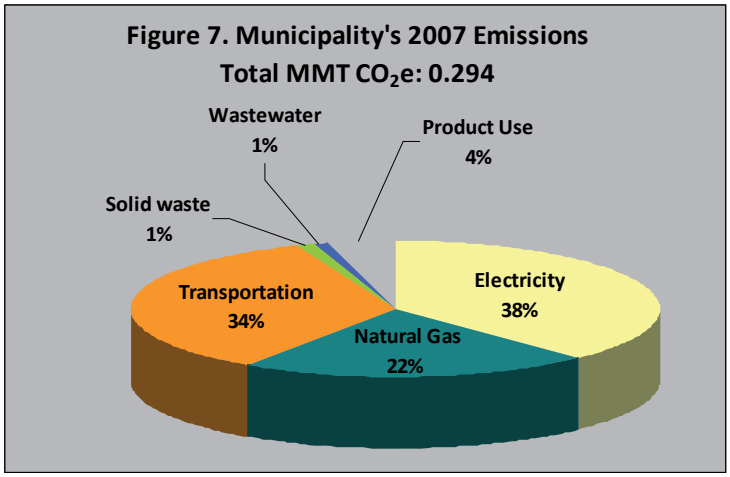
[1] eGRIDweb. U.S. Environmental Protection Agency. 11 February 2011. http://cfpub.epa.gov/egridweb/view.cfm

Emissions by Sector

For each municipality, the greenhouse gas (GHG) emissions profile includes electricity, natural gas, transportation (VMT), solid waste, waste water, and product use, as shown below for a sample municipality. If a municipality has non-energy use emissions from industrial processes, these emissions were not estimated due to lack of data. In general, this is a small source of emissions in the Chicago metropolitan region, but if there is an industry in your community that produces greenhouse gases in its manufacturing process it could have a significant impact on your emissions profile.

Table 6. Municipality's Emissions by Sector, 2007

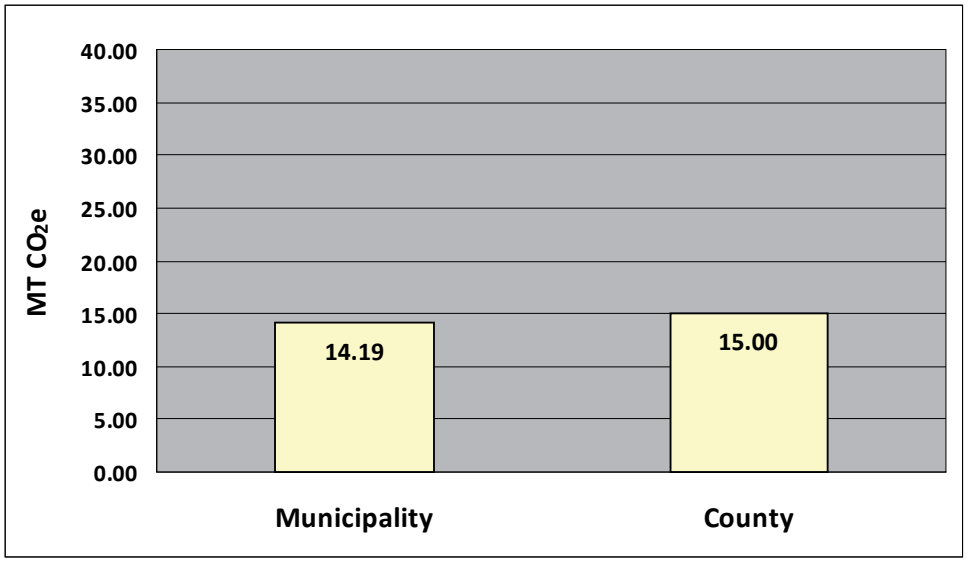
Sector	MMT CO_2e
Electricity	0.111
Natural Gas	0.064
Transportation	0.101
Solid Waste	0.003
Waste Water	0.003
Product Use	0.012
Total	**0.294**



Emissions Per Capita

Next in each Energy and Emissions Profile, per capita emissions were analyzed by dividing total greenhouse gas emissions by the municipality's population, as shown below. This provides normalized data for comparison with other communities regardless of size, and also offers a baseline metric from which to measure progress in the future.

Figure 8. Per Capita Emissions, 2007



Baseline Metrics

The purpose of a baseline measurement is to measure "resulting change that is caused by or linked to some intervention that you have implemented."[2] In essence, a baseline is a snapshot and starting point. The snapshot provides information to assist in identifying the appropriate strategies. The starting point provides a point from which to measure the progress of implemented energy efficiency strategies. This is true at any scale. Baseline metrics can determine how well a retrofit strategy works at reducing energy consumption at the household level to a communitywide level.

Baseline metrics cover: 1) accurate date; 2) data indicators; 3) measuring consumption; 4) calculating past and future consumption; and 5) identifying strategies for your community.

1) Accurate Data

Accurate data provide a more precise picture of your community's energy consumption in contrast to national or regional averages in absence of more specific local data. The data used to create each Energy and Emissions Profile for MEPP were actual 2007 energy consumption utility data at the premise-level. In addition, accurate data provide better calculations of potential for energy and cost savings.

2) Data Indicators

Correct interpretation of data is critical to ensure that data is useful. Data can help identify areas a municipality may want to target. For example, a municipality that has average household energy consumption that is significantly higher than the county average may want to investigate this area and identify potential residential energy saving strategies. Such a municipality might ask whether the higher usage is related to housing type, size, age, or levels of energy efficiency and weatherization.

3) Measuring Consumption

It is important to continue collecting and measuring consumption once baseline metrics are completed; and there are various methods to do so for both buildings and entire communities, as described below. Benchmarking energy consumption allows comparison to past performance. With efficient tracking and ongoing management of goals and corresponding data measurements, opportunities can be identified and pinpointed to improve and adjust programs as they are being implemented in order to achieve better end results.

Communitywide Energy Consumption

For MEPP, each profile includes communitywide energy consumption broken down by sector (residential and C&I). However, there are other methods of defining sectors and analyzing communitywide energy consumption. For example, residential consumption could be broken down into single family and multifamily homes. In addition, consumption of the municipal sector is another area that many municipalities are interested in measuring and monitoring. The following section of this guidebook discusses specific energy efficiency strategies for the municipal sector.

[2] How to Set a Baseline Measure. Washington State Archives. 11 February 2011. http://ow.ly/37QNT

Building Energy Consumption

At a smaller scale, energy consumption can also be measured for an individual building. This data allows for benchmarking and measuring progress toward reducing energy consumption in a specific building after strategies are implemented.

One measure of a building's energy consumption is energy use intensity (EUI), which is measured in kBtu per square foot per year. The EUI of a building can be calculated using annual energy consumption data and facility square footage. This metric normalizes energy usage by building size to enable comparison of how energy is consumed on a square foot basis.

kBtu
kBtu (kilo British thermal unit) is a unit of measure that allows natural gas (therms) and electricity (kWh) consumption to be compared.

Reviewing EUIs of buildings can help identify those with the largest energy consumption per square foot and then target specific buildings for retrofits and energy efficiency measures. The lower the EUI, the less energy is being used per square foot. However, EUIs are relative to the function of the building. Therefore, one should not compare EUIs of buildings with different functions, but rather compare buildings to similar buildings with similar functions. For example, the EUI of a water treatment facility is expected to be high (400 or more kBtu per square foot) given its function. In contrast, an EUI of 150 kBtu per square foot for an office building is high.

Another important aspect of EUI is that it is possible to track the EUI of a specific building from year to year. This helps to measure the success of any implemented energy efficiency measures. Understanding and measuring EUI can be a starting point to flag potential issues, target buildings for more in-depth audits, and then identify and implement strategies for improving energy efficiency.

4) Calculating Past and Future Consumption

There are circumstances when calculating past and future energy consumption can be useful for selecting strategies and setting goals.

Data Back Casting

A "linear backcast" or "regression analysis" utilizes existing consumption numbers to estimate consumption in the past. It's not a perfect method (and presents challenges for high-growth communities) but it is an accepted measurement that provides a starting point from which to move forward.

Data back casting is typically done when a municipality wants to reduce consumption or emissions to a previous level. For example, many communities who have signed the U.S. Conference of Mayors Climate Protection Agreement are interested in back casting. This Agreement, which is discussed in more detail later in this guidebook, involves a commitment to reduce greenhouse gas emissions to 7 percent below 1990 levels by 2012. Therefore, many communities are interested in calculating (back casting) their 1990 emissions.

Data Forecasting

Data forecasting is typically used when future energy consumption or greenhouse gas emissions data is needed to plan for the future and to analyze potential strategies to reduce energy consumption and cost. To calculate energy consumption forecasts for an individual municipality, EIA (Energy Information Administration) growth factors specific to the East North Central region should be used. These growth factors project growth rates of energy consumption by sector and source. EIA growth factors change each time an annual update is released, so it is recommended that municipalities adjust this forecast accordingly.

5) Identifying Strategies for Your Community

The greatest opportunity to reduce energy consumption and greenhouse gas emissions is to develop strategies targeting the highest energy consuming and greenhouse gas emitting sectors and/or buildings. As seen in your Energy and Emissions Profile, this includes energy used in buildings and for transportation. It is important to explore which strategies will achieve high energy and cost savings in order to ensure that investment achieve maximum impacts.

In the following two sections, municipal and communitywide strategies offer ways to reduce greenhouse gas emissions by reducing energy consumption associated with both buildings and transportation. However, there is no single approach that is appropriate for all municipalities. Municipalities in our region vary in size, location, income, housing types and other areas. The unique characteristics of each community will determine what kinds of strategies will be most practical and effective. Municipalities should carefully consider the strategies and ideas put forward in this section and select those that appropriate for their communities. Like individual units of local government, communities across the region are different. Each strategy in this section is described in terms of program highlights, potential savings, characteristics of communities that might prioritize the strategy, and factors that may impact successful implementation.

Municipal Energy Strategies

Once municipal leaders understand how to read the Energy and Emissions Profile, their first instincts may be to address energy consumption in municipal buildings, as it is within the municipality's immediate control. While municipal energy consumption generally accounts for a small portion of a community's total energy consumption, there are important benefits to local government action. In addition to energy and cost savings that can be passed on to taxpayers, there is value in the leadership role. The lessons learned can be passed on to the community as well. The information presented in this section provides information and resources for municipal governments on the topics of municipal operations, municipal policies and ordinances, and establishing a municipal framework for communitywide energy planning.

Municipal Operations

Municipal operations refer to energy consumption that occurs as a result of the day-to-day functions of the municipality, and in particular, 1) municipal buildings, 2) outdoor lighting, 3) municipal water operations, and 4) municipal fleet operations.

1) Municipal buildings

There are numerous benefits to integrating energy efficiency measures into existing municipal buildings. Improving building efficiency can reduce energy costs, save taxpayer dollars, reduce greenhouse gas emissions, and create a healthier and more productive working environment. Well-established strategies already exist. It is only necessary for each municipality to select the methods that best suit them. Energy efficiency strategies can address several aspects of buildings, including building envelope, building systems and equipment, and energy management, operations and behavior changes.

Building Envelope

Building envelope is the separation between the exterior and interior environments of the building. The main performance objectives of building envelope design include structural integrity, and control of moisture, temperature and air pressure. Typical improvements to building envelope address aspects of the structure that determine the building's energy use including; insulation, air leaks, roof, and windows. Two building envelope related recommendations are to conduct energy audits and to implement building envelope improvements, as described below.

- **Energy audits**

  Understanding energy consumption is the first step to increasing energy efficiency. An energy audit is an analysis of the energy consumption in a building including a review of past utility bill data. The building analysis involves a visual and diagnostic inspection of living/work space, all mechanical systems (HVAC, lighting, hot water), and the building envelope. Paired with a review of past energy consumption data, an energy audit report summarizes key issues and recommendations for improvements. Improvements can range from low and no cost strategies to larger investments. Each recommended Energy Conservation Measure (ECM) includes anticipated energy savings and return on investment calculations. The return on investment is the length of time required to recover the cost of the initial investment.

- **Building envelope improvements**

  Based on the findings in an energy audit, municipalities may choose to consider improvements to the building envelope that will result in energy and cost savings. Examples of these improvements include adding insulation, installing energy efficient windows, air sealing and making roof improvements

Building Systems and Equipment

Building systems and equipment are the "living and breathing" systems that make the building functional and operational. They include lighting equipment, heating and cooling units, water heaters and control systems. Just as annual health exams are important to stay healthy, it is important to regularly assess building operations and check for areas where energy efficiency improvements may be needed. These may involve operational changes or equipment replacement.

Routine maintenance ensures that all equipment and systems are able to function at the proper levels. Proper operation ensures all equipment and systems are being run at the proper, most efficient levels. Changing operations through maintenance training and education programs, such as the Midwest Energy Efficiency Alliance's Building Operator Certification program, can result in significant energy and cost savings.[3] Below are suggestions for improving building systems and equipment.

- **Educate building operators about building equipment and systems**
  Many buildings are run inefficiently, resulting in wasted energy consumption. Unfortunately, this is often due to the lack of knowledge about how the building's systems should operate. It is essential that building operators have the proper knowledge about building equipment and systems, and know to call for expert assistance when needed.

- **Conduct routine maintenance**
  Routine maintenance ensures equipment and systems are functioning properly and efficiency. Proper maintenance also ensures a longer life for the equipment.

- **Ensure proper operations**
  Proper operations ensure that all building equipment and systems are being run at their most efficient levels.

- **Replace lighting**
  There are several opportunities to increase lighting efficiency in municipal buildings, including the replacement of fluorescent T12 lamps/magnetic ballasts with T8 or T5 lamps/electronic ballasts; replacement of incandescent light bulbs with compact fluorescent lights (CFLs); and installation of LED signage lighting. Each lighting strategy offers different energy savings and corresponding return on investment.

- **Replace air conditioner filters**
  Replacing air conditioning filters regularly will improve the efficiency of the air conditioner and may prolong the air conditioner's life.

- **Install programmable thermostats**
  A programmable thermostat regulates temperature of a building in both summer and winter; when the building is in use or not. Temperatures can be set back (heating) or set up (cooling) during night or non-occupancy hours. The key is to establish a program that automatically reduces heating and cooling in the building when occupants are not present. Typical settings are:
  - For heating, 70° F when building in use and set back at least 8° F when not in use.
  - For cooling, 78° F when building in use and set up at least 7° F when building not in use.

[3] Building Operator Certification. Midwest Energy Efficiency Alliance. 11 February 2011. http://www.mwalliance.org/programs/building-operator-certification.

- **Install lighting sensors**
  Lighting sensors reduce energy consumption by ensuring that lights are only on when needed, making sure certain lights are not accidentally left on.

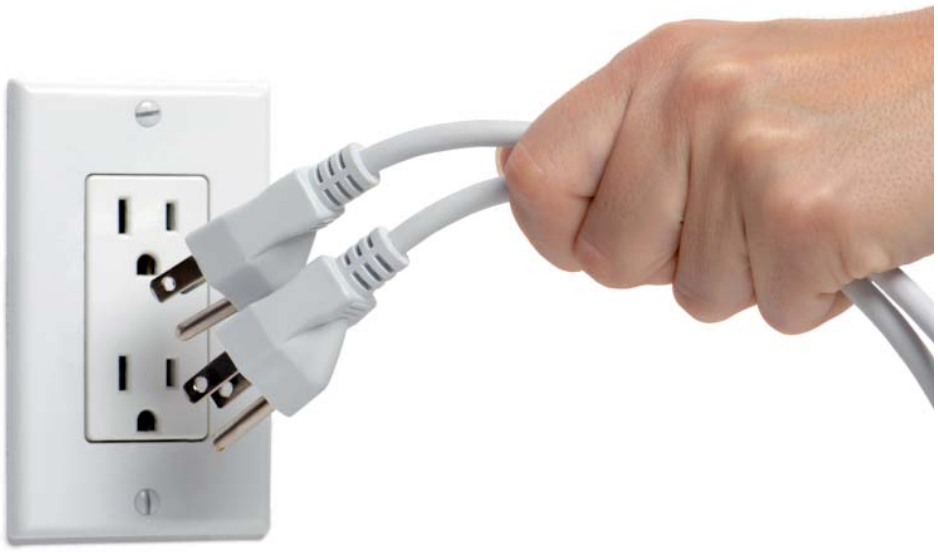
- **Install energy efficient building equipment**
  When replacing building equipment, such as boilers and water heaters, these units should be replaced with energy efficient equipment. This equipment is very expensive and it makes sense financially to replace old or broken equipment with high efficiency equipment.

Energy Management, Operations and Behavior Changes

Energy management refers to behavior and maintenance adjustments that help reduce energy consumption. This includes reducing phantom load, and adjusting heating and cooling temperatures.

- **Reduce phantom load**
  Electric power management controls the building's plug load equipment, which is any equipment that draws electric power from the grid. Any electrical device that is plugged in to the building's electricity system adds to the plug load. Many continue to consume electricity even when turned off or in standby mode. This is referred to as phantom load. Not only do electrical devices consume unnecessary electricity just simply by being plugged in, but standby power is converted into heat; therefore, during warm months, additional energy may be used to remove the extra heat, increasing air conditioning costs. Phantom load can be reduced by unplugging electronics that are not in use or using power strips or other devices to manage standby power.

- **Reduce heating temperatures and increase cooling temperatures**
  Whether a building is heated by electricity or natural gas, adjusting the heating and cooling temperatures by as little as 3° F can make a significant impact on the amount of energy needed to maintain the set temperature of a building.



2) Outdoor Lighting

A significant portion of municipal electricity consumption comes from the operation of outdoor lighting. Streetlights consume electricity daily for an average of ten to twelve hours. Traffic lights remain operational 24 hours a day, seven days a week. Increasing outdoor lighting efficiencies can offer significant savings.

Streetlights

An increasing number of municipalities are achieving significant energy and cost savings by replacing municipal street lighting with more energy efficient lighting, such as induction lighting. Benefits of induction lighting include:

- Potential energy savings of 30 to 60 percent
- Less maintenance with an expected bulb lifetime of 20 years (as opposed to five to seven years)
- Lower maintenance costs
- Excellent return on investment period, with a payback period of three to seven years

Traffic Lights

Traffic lights offer great cost and energy savings potential for municipalities, especially because they are on 24 hours a day. LED (light emitting diode) traffic lights already in place in our region use anywhere from 80 to 90 percent less energy and require considerable less maintenance than older technologies.

3) Municipal Water Operations

Municipal water operations also contribute substantially to municipal energy consumption and costs. Treating wastewater and providing drinking water account for more than one third of a typical municipality's total energy bill, according to recent estimates by the U.S. Environmental Protection Agency (EPA). This is because energy is consumed in all stages of the water use and treatment cycle. The section that follows examines several opportunities to reduce energy consumption and the cost of municipal water operations.

Install energy efficient equipment

Most measures to improve efficiency or conserve energy in treatment plants involve upgrading equipment. An energy audit can identify areas for improving efficiency in maintenance and operations, and can offer recommendations for energy efficient equipment. However, the high cost of new equipment results in lengthy payback periods, so immediate replacements are not economically feasible. Installing more efficient equipment is generally recommended when existing equipment needs to be replaced.

Modify operations and maintenance

Behavioral changes such as operations and maintenance modifications involve little or no cost and have the capacity to significantly impact energy and cost savings. Maintenance of equipment is also important in ensuring longevity.

Reduce water consumption

A community can also reduce energy consumption associated with municipal water operations by reducing water consumption. Development and implementation of a water conservation awareness program for residents has many benefits for a community. Reducing water consumption will result in shorter pump run times, less maintenance, and savings in chlorine to treat drinking water. Some communitywide water conservation programs have been shown to lower water consumption by 10 percent.

4) Municipal Fleet Operations

Many municipalities in the region conduct operations with a fleet of vehicles that vary in size and function. Reduced vehicle miles traveled and lower fuel consumption at the municipal level will result in energy and costs savings and reduced greenhouse gas emissions.

Conduct municipal fleet study to guide fleet operations decisions

Municipalities should examine their fleets to find ways to reduce total mileage and fuel consumption, while saving taxpayers' money at the same time. At a minimum, a fleet study will examine the types of fuels used and the mix of vehicles within the fleet in an effort to maximize efficiencies whenever and wherever possible.

For example, in Eagle County, Colorado, a fleet utilization study examined a monthly account of miles driven, fuel costs, repairs and maintenance. As a result of the study, the county implemented the following cost and fuel-saving strategies: 1) targeted departments with low-use vehicles for sharing of cars; 2) reduced car size whenever possible; 3) implemented a "check out system" for trucks and SUVs that weren't needed on a daily basis; 4) required additional considerations for pickup truck purchases; and 5) implemented an aggressive fleet maintenance program.[4]

Municipalities may want to consider developing similar comprehensive fleet management approaches that institute fleet purchasing requirements that address size requirements and increase usage of hybrid cars and alternative fuels when feasible. Communities should also consider sharing less-used cars among different municipal departments or introducing a car sharing program for departments needing only occasional-use vehicles.

Increase municipal fleet usage of biofuels and more efficient vehicles

There is significant potential to reduce overall fuel consumption and emissions through the use of alternative fuels and through greater fuel efficiency in a municipality's fleet of vehicles. Switching municipal garbage trucks to biofuels and replacing municipal fleet cars with hybrids or more efficient vehicles will provide significant savings.

- **Biodiesel**
  Biodiesel refers to a diesel-equivalent, processed fuel that can be used in unmodified diesel-engine vehicles. It is derived from biological sources such as vegetable oils. Biodiesel is biodegradable and non-toxic, and typically produces about 68 percent less net carbon dioxide emissions than petroleum-based diesel in its full lifecycle.

- **Hybrid Electric Vehicles**
  A hybrid electric vehicle combines a conventional propulsion system with an on-board rechargeable energy storage system to achieve better fuel economy than a conventional vehicle without being hampered in range by a charging unit.

[4] Transportation Case Study: How Eagle County cut fleet costs and fuel consumption. 5 February 2010. Garfield Clean Energy. 11 February 2011. http://garfieldcleanenergy.org/trans-fleets-Eagle.html.

Municipal Policies and Ordinances

In addition to municipal operations, units of local government can affect energy consumption through its ability to frame policies and ordinances in the community. This section examines 1) municipal franchise agreements; 2) municipal building codes; and 3) renewable energy ordinances.

1) Municipal Franchise Agreements

The majority of municipal governments have franchise agreements with utility companies that give the utility the right to operate in the municipality, while allowing the utility to use public land for distribution infrastructure. The EPA Region 5 funded a study examining these agreements across its region and found that franchise agreements "represent a largely unused opportunity for municipalities to promote energy efficiency and renewable energy, and that some franchise agreements even create disincentives for energy efficiency."[5]

If a municipality will be examining and restructuring its municipal franchise agreement soon, it may be helpful to review the study and consider potential topics for discussion with the utility. This is particularly important because most franchise agreements are in place for decades. The study is available at http://www.epa.gov/r5climatechange/franchise-agreement-report.pdf.

2) Building/Energy Codes

The Illinois Energy Conservation Code was signed into law in 2006 and set energy efficiency standards for commercial buildings. In January 2010, the code was amended to include residential buildings. The code requires that the most recent edition of the International Energy Conservation Code (currently 2009 IECC) and the American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE) Standard 90.1 (currently 2007) be followed in all new commercial and residential construction, renovations, alterations, additions and other repairs that require a building permit. Buildings that are not subject to this law include officially designated historic buildings, buildings exempt from a local building code, and buildings that do not use either electricity or fossil fuel for comfort conditioning.

The Illinois Energy Conservation Code is the name of the law that outlines energy building codes in Illinois. It is based on the International Energy Conservation Code (IECC), which is updated every three years by the International Code Council. Every time revisions are made to the IECC, they automatically become a part of the Illinois Energy Conservation Code.

As of early 2011, the Illinois Department of Commerce and Economic Opportunity (DCEO) recognized that many municipalities still may not be at capacity to fully implement the energy codes required for all buildings. As such, the following resources are available to assist Illinois municipalities in establishing and implementing of the Illinois Energy Conservation Code:

- For a limited time the 2009 International Energy Conservation Code can be downloaded free of charge at: www.iccsafe.org/store/pages/doeregistration.aspx?r=FreeIECC.

- Call 1-888-ICC-SAFE (422-7233) or email (dmeyers@iccsafe.org) for technical interpretations of the 2009 IECC as it applies to the State of Illinois.

[5] Utility Franchise Agreements Summary Report. 21 December 2009. U.S. Environmental Protection Agency. 11 February 2011. http://www.epa.gov/r5climatechange/franchise-agreement-report.pdf.

- To assist municipalities DCEO has partnered with the International Code Council to provide 33 seminars in early 2011. Visit www.iccsafe.org/Education/Courses/Pages/IL-DCEO-List.aspx?r=DCEO to find out more.

- The U.S. Department of Energy (DOE) developed compliance software tools for code officials to assist in examining plans for compliance with the International Energy Conservation Code. Residential buildings utilize REScheck and commercial buildings utilize COMcheck. They can be found at www.energycodes.gov/rescheck/download.stm and www.energycodes.gov/comcheck/download.stm.

Green Buildings

Green buildings go beyond the standards of energy and building codes to address energy efficiency at a more comprehensive level. The U.S. Environmental Protection Agency defines green building as "the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort."[6]

Green buildings address the impacts of the built environment outlined in the table below.[6]

Aspects of Built Environment	Consumption	Environmental Effects	Ultimate Effects
Siting Design Construction Operation Maintenance Renovation Deconstruction	Energy Water Materials Natural resources	Waste Air pollution Water pollution Indoor pollution Heat islands Stormwater runoff Noise	Harm to the human health Environmental degradation Loss of resources

Green building programs typically feature a rating system that measures the degree of efficiency achieved through the implementation of a set of prescriptive standards. The U.S. Green Building Council's Leadership in Energy and Environmental Design or LEED is one such program, but many municipalities develop their own programs.

Programs are either mandated through building codes and ordinances, or are voluntary in nature, offering appropriate incentives such as expedited plan reviews or reduced permit fees. One such voluntary program is Chicago's Green Permit Program.[7] Recently, there has been a trend toward mandating green building standards in places that have traditionally led the way in environmental issues, including the entire state of California.[8]

[6] Green Building, Basic Information. U.S. Environmental Protection Agency. 11 February 2011. http://www.epa.gov/greenbuilding/pubs/about.htm.

[7] Green Permit Program. City of Chicago. 11 February 2011. http://www.cityofchicago.org/content/dam/city/depts/bldgs/general/GreenPermit/Green_Permit_Brochure_2010.pdf.

[8] Roosevelt, Margaret. "First in the nation: California adopts mandatory green building code." 14 January 2010. Los Angeles Times. 11 February 2011. http://latimesblogs.latimes.com/greenspace/2010/01/green-building-code-california-usgbc.html

3) Renewable Energy Ordinances

In recent years there has been increasing interest in renewable energy. Renewable energy sources are constantly replenished and will never run out (U.S. EPA). Renewable energy consumption is expected to increase as the costs of oil and natural gas rise and environmental concerns become more widespread.

Currently, more than half of all renewable energy generated in the United States is used to produce electricity. In 2009, only 8 percent of energy used in the United States came from renewable sources. The other major use is the production of heat and steam for industrial processes. Renewable fuels are also used in vehicles, as well as homes.

The table below defines the most common types of renewable energy:

Solar	Solar energy is energy that comes from the sun. Solar energy is used to generate electricity and to heat buildings and water.
Geothermal	Geothermal energy involves capturing heat from within the earth's core via steam or hot water. It is used to heat buildings, provide hot water or generate electricity.
Waste	Waste can be used to generate energy through waste-to-energy combustion or the collection of landfill gases. Waste-to-energy combustion is the most common means of creating energy from waste. It involves burning municipal solid waste at energy facilities. This creates steam and heat, which can be used to generate electricity. Landfill gas is another form of waste energy. This involves collecting the methane gas released when waste decomposes in landfills.
Wind	Wind is air in motion and caused by uneven heating over land and water. Wind energy is used to generate electricity.
Biofuels	Biofuels come from organic materials (plants or animals), or biomass. For example, corn or other plant materials can be used to create ethanol, which is used to fuel vehicles. Biofuels can also be burned to generate electricity or to heat buildings.
Wood	Wood is a biomass (organic material made from plants and animals). When burned, the chemical energy in the wood is released as heat. Wood or wood waste can be burned to provide heat to industries and homes or to generate electricity.
Hydropower	Hydropower is mechanical energy harnessed from flowing water. It is one of the oldest sources of energy and today it is most commonly used to generate electricity.

In Illinois, renewable energy generation is becoming a more viable option. The Illinois Renewable Energy Standard, adopted in 2007, set annual incremental percentage goals for electricity production from renewable sources, culminating in 25 percent renewable sources by 2025. Of that 25 percent, the majority will come from wind energy (75 percent), followed by solar energy (6 percent) and other sources. In order to embrace this trend, a number of local governments are beginning to adopt ordinances that support and regulate renewable energy generation in both individual and large scale systems, and in particular for wind and solar energy.

Establishing a Municipal Framework for Communitywide Energy Planning

Many municipalities are taking a comprehensive approach in addressing energy in their communities by employing a framework that outlines a set of energy goals and strategies that guide actions and decisions over a period of time. This section examines 1) traditional planning tools and 2) policy statements.

1) Traditional Planning Tools in Energy and Climate Issues

Typically, traditional planning and growth management topics have included land use, transportation and housing, among others. However, in recent years, planners have also started to look at energy as a growth management issue. As such, the following examines sustainability plans, climate action plans and energy plans, which all serve to establish energy and sustainability goals that guide municipalities in future decision making.

Sustainability Plans

Across the country many municipalities are developing sustainability plans sometimes called sustainable comprehensive plans. These sustainability plans often follow a format similar to a community's comprehensive plan. A sustainability plan typically addresses energy, climate, food, and health issues that intersect with land use, transportation, housing and other traditional planning issues. Common topics addressed include energy efficiency, renewable energy, waste and recycling, water conservation, green infrastructure and natural resources.

Climate Action Plans

Climate Action Plans (CAP) feature a set of policies and strategies that, when successfully implemented, will reduce fossil fuel consumption and thereby reduce greenhouse gas emissions. The process of developing a climate action plan can identify cost-effective opportunities to reduce greenhouse gas emissions (GHG) that are relevant to the location. Individual characteristics of "economy, resource base, and political structure provide different opportunities for dealing with climate change. However, without targets for emissions reductions, incentives for cleaner technologies, or other clear policies, climate action plans will not achieve real reductions in GHG emissions."[9]

Locally, the Chicago Climate Action Plan (CCAP) serves as an excellent resource for other communities to begin thinking about how they might develop their own climate action plan.[10] With sound research and a well thought out plan at the foundation, the CCAP website provides specific tools and actions for residents and businesses, which inform and engage the public. The plan is available at www.chicagoclimateaction.org.

[9] Pew Center on Global Climate Change. 11 February 2011. http://www.pewclimate.org.

[10] Chicago Climate Action Plan. City of Chicago. 11 February 2011. http://www.chicagoclimateaction.org.

Energy Plans

An energy plan establishes goals and strategies to reduce energy consumption across an entire community. The scale of an energy plan may vary and can include energy in buildings and transportation energy. Examples of energy plans in the Chicago region include a Regional Energy Snapshot, the ComEd Community Energy Challenge and Energy Efficiency and Conservation Strategies (EECS).

- **Regional Energy Snapshot**
  The Chicago Metropolitan Agency for Planning (CMAP) developed an energy analysis of the seven-county region that analyzed regional energy consumption and the potential for energy and cost savings through a variety of strategies. The strategies included in the snapshot include energy efficiency measures, encouraging and adopting widespread behavior change, and efficient growth and development.[11]

- **ComEd Community Energy Challenge**
  In 2009, nine communities developed energy plans to demonstrate their commitment to reduce energy consumption as a requirement of participating in this challenge. Parallel to the strategies outlined in each community's plan, ComEd and the Illinois Department of Commerce and Economic Opportunity targeted existing incentive programs as requested by each community. Participating communities were Aurora, Carol Stream, Elgin, Evanston, Hoffman Estates, Oak Park, Orland Park, Schaumburg and Wilmette.

- **Energy Efficiency and Conservation Strategies**
  Thirty-nine municipalities and six counties in the Chicago metropolitan region developed individual Energy Efficiency and Conservation Strategies (EECS) as a requirement for receiving funding known as the Energy Efficiency and Conservation Block Grant (EECBG). These grants are called "formula" grants because funding amounts are based on size of the place; these municipalities automatically received funding, contingent upon submitting a detailed EECS that outlined specific strategies to reduce energy consumption and greenhouse gas emissions over a three-year period.

EECBG-Funded Municipalities and Counties in the Chicago Metropolitan Region

Municipalities: Addison, Arlington Heights, Aurora, Bartlett, Berwyn, Bolingbrook, Buffalo Grove, Calumet City, Carol Stream, Carpentersville, Chicago, Cicero, Crystal Lake, Des Plaines, Downers Grove, Elgin, Elmhurst, Evanston, Glenview, Hanover Park, Hoffman Estates, Joliet, Lombard, Mount Prospect, Naperville, Oak Lawn, Oak Park, Orland Park, Palatine, Park Ridge, Plainfield, Romeoville, Schaumburg, Skokie, Streamwood, Tinley Park, Waukegan, Wheaton, and Wheeling

Counties: Cook, DuPage, Kane, Lake, McHenry and Will

[11] Regional Energy Snapshot. CMAP GO TO 2040. 11 February 2011. http://www.cmap.illinois.gov/strategy-papers/regional-energy.

2) Policy Statements

The following section examines policy statements or partnerships that acknowledge a municipality's commitment to reducing energy consumption and/or greenhouse gas emissions, including the U.S. Conference of Mayors Climate Protection Agreement, Cool Cities, and the U.S. EPA Green Power Partnership.

U.S. Conference of Mayors Climate Protection Agreement

In 2005, the U.S. Conference of Mayors unanimously endorsed the U.S. Conference of Mayors Climate Protection Agreement, an initiative launched by Seattle Mayor Greg Nickels in which mayors commit to reduce emissions to 7 percent below 1990 levels by 2012. To date, more than 500 mayors have signed the agreement and are now committed to this goal. Key points of the Climate Protection Agreement include:[12]

- Strive to meet or beat the Kyoto Protocol targets through actions ranging from anti-sprawl land-use policies to urban forest restoration projects to public information campaigns
- Urge state and federal government to enact policies and programs to meet or beat the greenhouse gas emission reduction target suggested for the United States in the Kyoto Protocol of 7 percent reduction from 1990 levels by 2012
- Urge Congress to pass bipartisan greenhouse gas reduction legislation, which would establish a national emission trading system

The U.S. Conference of Mayors Climate Protection Center provides mayors with the guidance and assistance they need to lead their cities' efforts to reduce the greenhouse gas emissions that are linked to climate change. Moving beyond advocacy, the Conference established a goal to increase the number of cities involved, and to equip all cities with the knowledge and tools that ultimately will have the greatest impact on the causes of global warming. Tools, resources, and best practices help municipalities develop strategies to reduce energy consumption and emissions.

Cool Cities Campaign, Sierra Club

Sierra Club's Cool Cities Program is a volunteer-led collaboration between community members, organizations, businesses, and local leaders who to commit to reduce their community's carbon footprint and help curb global warming. Since 2005, more than 1,000 city and county leaders have made the commitment to become a "Cool City" or "Cool County."[13] Cool Cities outlines five milestones for participating communities, and provides materials, guides and best practices information that aim to assist municipalities in achieving them.

1. Establish a Cool Cities campaign: Establish a group of local citizens who are committed to reducing global warming emissions.
2. Engage the community: Build support for local action by working with other community groups, generating letters to the mayor, raising the issue in the media, and talking to neighbors.
3. Sign commitment agreement: Sign either the U.S. Mayors' Climate Protection Agreement, Cool Cities/ Counties Agreement or Canadian Partners for Climate Protection.
4. Implement Initial Solution Steps: Turn commitment into initial action, starting with steps to improve the municipality's own operations.
5. Implement Advanced Smart Energy Solutions: Further establish commitment by implementing policies that significantly reduce global warming emissions, lower energy bills, and make the city a cleaner place to live. This includes consideration of things such as green buildings, fuel efficient city fleets, and powering homes with renewable energy.

[12] U.S. Conference of Mayors Climate Protection Agreement. The U.S. Conference of Mayors. 11 February 2011. http://www.usmayors.org/climateprotection/agreement.htm.

[13] Cool Cities. Sierra Club. 11 February 2011. http://www.coolcities.us/about.php?sid=9dca49100bd742830918fcd602b10b84.

U.S. Environmental Protection Agency's Green Power Partnership

The U.S. Environmental Protection Agency (EPA) defines green power as "subset of renewable energy… (with) the highest environmental benefit." Green power includes "electricity produced from solar, wind, geothermal, biogas, biomass, and low-impact small hydroelectric sources."[14] The benefits of green power include reduced emissions and reduced air pollution.

The Green Power Partnership is a voluntary program led by the EPA that brings together like-minded communities and businesses who have committed to buying green power at EPA-established minimum purchase requirements. Participating members are provided with helpful tools and resources, while receiving publicity and recognition.

The City of Aurora, located in the western edge of the region, is the first Green Power Partnership community in the state of Illinois.

The on-site renewable energy strategy outlined in the Communitywide Energy Strategies section in this guidebook provides information on how a consumer can access green power. However, there are other options available in our region, including the purchase of renewable energy certificates (RECs). RECs represent "the property rights to the environmental, social, and other nonpower qualities of renewable energy generation. A REC, and its associated attributes and benefits, can be sold separately from the underlying physical electricity associated with a renewable-based generation source."[15] A home or business owner purchasing RECs may not necessarily use green power, but supports its technology and production elsewhere through purchase of the certificate. RECs offer consumers a way to participate when green power products are unavailable in the local market.

Some utilities may offer "green pricing," which allows consumers to purchase green power at a small premium that covers the costs incurred by the utility to include green power in its generation mix. Several municipal utilities in the Chicago region offer green power options, and because Illinois is a competitive electricity market state, consumers can also access green power through Blue Star Energy, through the purchase of renewable energy certificates or by completely switching service providers. The EPA's Green Power Locator allows consumers to locate green power purchasing options, which is important because the growing market is often changing.

For more information, go to www.epa.gov/greenpower/pubs/gplocator.htm.

[14] Green Power Partnership: Green Power Market. U.S. Environmental Protection Agency. 11 February 2011. http://www.epa.gov/greenpower/gpmarket.

[15] Green Power Partnership: Renewable Energy Certificates. U.S. Environmental Protection Agency. 11 February 2011. http://www.epa.gov/greenpower/gpmarket/rec.htm.

Communitywide Energy Strategies

The strategies outlined in this section are common approaches that many communities nationwide—even worldwide—are implementing to achieve widespread reductions in energy consumption. The following the sections include strategies to reduce energy consumption in buildings and transportation, with a brief summary of how to calculate potential energy and cost savings.

Strategies for Reducing Energy Consumption in Buildings

The strategies examined in this section include: 1) retrofit existing buildings; 2) green building practices in new construction; 3) energy education and behavior change, residential sector; 4) energy efficient window air conditioner replacement; 5) energy efficient refrigerator replacement; and 6) on-site renewable energy systems.

1) Retrofit Existing Buildings

A retrofit is a whole-building approach to reducing energy consumption. It involves examining all systems within a building and making strategic improvements for efficiency. Energy retrofits in existing buildings are critical to any energy strategy because buildings last for many decades. A national evaluation of successful weatherization and retrofit programs shows there is significant opportunity for reducing electricity and natural gas consumption.

Most retrofit programs apply a mix of energy conservation measures (ECMs) and energy efficient technologies. Typical ECMs address building envelope, heating, cooling, hot water, lighting and appliances. The most common technologies include insulation, energy efficient windows, high efficiency boilers and furnaces, programmable thermostats or energy management systems, solar or tankless hot water systems, and compact fluorescent bulbs. It is important to note that typically recommended ECMs involve existing technologies and may also focus on proper equipment operation and maintenance.[16]

Snapshot: Retrofit Existing Buildings	
Savings Estimate per Unit	5% savings on electricity, 25% savings on natural gas
Prioritization	Communities with significant percentage of older building stock
Implementation Factors	Retrofits are expensive. The most effective programs combine technical and financial assistance.

[16] Schweitzer, Martin. "Estimating the National Effects of The U.S. Department of Energy's Weatherization Assistance Program with State-Level Data: A Meta Evaluation Using Studies from 1993 to 2005." Oak Ridge, National Labs. http://www.osti.gov/bridge.

2) Green Building Practices in New Construction

Green buildings offer significant opportunities for energy savings, as well the conservation of water and resource materials in new buildings. Green building programs typically feature a rating system that measures the degree of energy efficiency achieved. Programs can be required through building codes and ordinances, or can be voluntary and offer incentives to those who participate. There are no mandatory green building requirements in the region; however programs in other areas of the country have begun to integrate green building practices into existing building code requirements for all new construction.

Snapshot: Green Building Practices in New Construction	
Savings Estimate per Unit	30% savings on electricity, 30% savings on natural gas
Prioritization	High growth areas (based on population and/or employment projections)
Implementation Factors	Both mandatory and voluntary programs require new codes or ordinances, which may result in political pushback. Education is important, and should focus on explaining benefits and dispelling misperceptions about added costs. Costs are minimal at time of construction.

3) Energy Education and Behavior Change

"Go green" headlines are increasingly splashed across media and advertising today. However, while a 2007 nationwide poll found that more than 80 percent of adults view climate change as an important issue, our actions do not reflect the scale of change needed. Education is critical to a community reducing energy consumption and costs in both the residential and C&I sectors. The disconnect between attitudes and energy consumption is quite common, so a carefully planned education and outreach campaign can result in significant benefits. Proven methods for conducting communitywide energy campaigns can help the entire community reduce energy consumption and cost. Common approaches include the following:

Develop flyers with energy savings tips and share them at common places like municipal buildings, community centers and grocery stores.

Conduct community workshops that cover useful topics such as winter weatherization or keeping cool efficiently in the summertime.

Include energy efficiency as a topic of discussion for elected officials and department heads as part of the municipality's economic (and environmental) agenda.

Partner with schools, including K through 12 schools, universities and community colleges, to develop energy efficiency campaigns.

In addition to providing basic education, a community education strategy should request specific action(s) of stakeholders. The actions in the example below may be small, and the savings of each individually may seem insignificant. However, these changes can be easily embraced by the masses, and collectively, savings can be significant, making this an attractive strategy that could substantially reduce energy consumption at the community scale.

Actions targeted in an education campaign should be tailored to the characteristics of individual municipalities. For the purpose of illustrating this strategy, these simple actions are expected to achieve the energy savings listed below:

1. Turn off unused lights = 131 kWh
   (Assumes three 60-watt light bulbs for 2 hours each, for a total of 6 light bulb hours.)
2. Perform simple air conditioning maintenance = 10 percent of electricity used for cooling
   (Assumes replacement of air conditioner filter. The Energy Information Administration's Residential Energy Consumption Survey reports that 16% of total electricity consumption is used for cooling in the North Central Region.)
3. Reduce heating thermostat settings by 3 degrees = 9 percent of total therms
4. Increase cooling thermostat settings by three degrees = 9 percent of electricity used for cooling
5. Unplug electronic devices that continue to draw energy when not in use = 5 percent of total electricity

Snapshot: Energy Education and Behavior Change in the Residential Sector	
Savings Estimate per Unit	Varies based on actions selected. See example above.
Prioritization	Easy-to-implement behavior changes could be adopted by most households. Municipalities willing and able to conduct education and outreach should consider this strategy.
Implementation Factors	Know your audience. Use appropriate communication methods that will reach those in your community, such as newsletters, e-mail and websites. Consider multilingual materials when needed.

4) Energy Efficient Window Air Conditioner Replacement

Air conditioning and refrigeration are the two largest contributors to electricity consumption in the home. Together, these two appliances make up approximately 30 percent of all residential electricity usage.[17] Window air conditioners are usually replaced when repairs become too costly, or occasionally for new product upgrades. There is a window of opportunity to improve energy efficiency at the time a decision is made to replace a unit. This strategy encourages the following actions:

Increase the pace of replacement by aggressively targeting trade-in and rebate programs for more efficient units, particularly in low-income communities where the cost of replacement may be a barrier.

Educate consumers so that they will be better informed and equipped to make better decisions when purchasing new window air conditioner units.

Properly implemented trade-in programs are highly effective tools to reduce electricity consumption. Requiring a complete trade—swapping out the new unit for the less efficient one—also keeps less efficient units from staying in use. Most new units will achieve energy savings due to increasing federal minimum energy standards, but requiring ENERGY STAR window air conditioners will result in additional energy savings.

Snapshot: Energy Efficient Window Air Conditioner Replacement	
Annual Savings Estimate per Unit	221 kWh
Prioritization	Window air conditioners are more common in older structures, as new buildings almost exclusively use central air conditioning. Communities with a significant percentage of housing stock built before the 1980s should consider this strategy.
Implementation Factors	Rebate programs should offset additional costs incurred by selecting an energy efficient window unit. Trade-in programs that properly dispose of older units are best.

Old window air conditioners are collected for recycling and new efficient units are distributed at an air conditioner trade-in event.

[17] End-Use Consumption of Electricity 2001. U.S. Energy Information Administration. 11 February 2011. http://www.eia.doe.gov/emeu/recs/recs2001/enduse2001/enduse2001.html.

5) Energy Efficient Refrigerator Replacement

Refrigeration is a major source of residential electricity consumption. Regarded as one of the biggest appliance expenditures in the home, residents generally consider replacing a refrigerator only after repairs have become too costly or the unit has become obsolete. This strategy encourages the following actions:

Increase the pace of replacement of older refrigerators by aggressively targeting trade-in and rebate programs for energy efficient refrigerators.

Educate consumers so that they will be better informed and equipped to make better decisions when purchasing new refrigerators.

Encourage the removal of older, second refrigerators that are still in use through programs such as ComEd's appliance recycling program, which offers customers $35 to let the utility pick and recycle a working, old refrigerator or freezer.

The best programs keep less efficient units from remaining in use by requiring trade of old appliances. Old refrigerators commonly stay in use as second refrigerators in basements and garages. This results in increased energy consumption, and consumers are often unaware of the impact. Effective trade-in programs solve this problem. Most new units will achieve energy savings due to increasing federal minimum energy standards, but requiring ENERGY STAR refrigerators will result in additional energy savings.

Snapshot: Energy Efficient Refrigerator Replacement	
Annual Savings Estimate per Unit	306 kWh (based on ENERGY STAR requirements)
Prioritization	Nearly all households have refrigerators, therefore any community could make this strategy a priority.
Implementation Factors	Refrigerators are expensive. Rebates and other financial assistance work best. Trade-in requirements keep secondary units from remaining in use.

6) On-Site Renewable Energy Systems

For more than 100 years, centralized power stations have provided the most efficient method of generating electricity. In recent years, concerns about increasing greenhouse gas emissions have fueled interest in distributed generation (DG) of renewable energy at a household level. Moreover, improved technologies have come to market that make DG a viable option.

Appropriate household systems include wind turbines or photovoltaic (PV) panels that can be installed on roofs or in yards, and gas-fired micro-turbines located in basements. With today's technology, a household system would likely connect to the electric grid to sell excess power back to the utility, or if necessary, to purchase power when home systems do not generate enough electricity. Opportunities for on-site systems in commercial and industrial buildings also include combined heat and power systems that use heat generated from on-site electricity production for other purposes within the building.

Snapshot: On-Site Renewable Energy Systems	
Savings Estimate per Unit	Up to 100% in households; varied in C&I depending on building size and energy needs
Prioritization	Given the mandate for Illinois electric utilities to increase procurement of renewable energy, all communities should consider this strategy. Communities likely to embrace new technologies and those with a high percentage of disposable income are particularly good candidates.
Implementation Factors	On-site systems are very expensive and often require significant financial incentives to initiate. Some incentives are available to consumers at state and federal levels. Integrating an on-site system is slightly less expensive at the time of construction. This strategy achieves very high energy and emissions reductions.

Strategies for Reducing Energy Consumption in Transportation

The strategies examined in this section include: 1) promote car sharing; 2) promote carpooling; 3) utilize existing technology to reduce trips to work; 4) increase transit usage; and 5) increase biking through addition of bike lanes and amenities.

1) Promote Car Sharing

Car sharing refers to membership-based car rental programs for households and businesses that allow participants to access a fleet of cars at an hourly or per mile rate. Access to cars on an as-needed basis allows individuals the freedom of having a car without the hassles of ownership, such as monthly car payments, insurance, and maintenance costs.

Car sharing expands transportation choices for households with limited budgets and for environmentally conscious citizens who seek to reduce their carbon footprint. Benefits for the community at large include reduced congestion, reduced emissions, efficient land use (less space needed for parking), increased mobility options for households and businesses with tight budgets, and an increased connectivity to public transportation.

Snapshot: Promote Car Sharing	
Savings Estimate per Unit	5,500 fewer vehicle miles traveled per year and 219 fewer gallons of crude oil consumed. [18]
Prioritization	Car sharing is ideal in communities with large percentage of income-limited households (e.g. college students, senior citizens, low income households), and environmentally conscious citizens. Municipalities are also incorporating car sharing into fleet operations, especially for departments that don't require constant, everyday use of vehicles.
Implementation Factors	Car sharing programs involve specific insurance and liability issues. Consider reaching out to the two car sharing organizations in the region, Zipcar (national) and I-GO Car Sharing (locally based).

[18] Green Benefits. Zipcar. 11 February 2011. http://www.zipcar.com/is-it/greenbenefits.

2) Promote Carpooling

Carpooling involves at least two commuters sharing rides to and from work, school or other destination points using their personal vehicles. There are two types of carpools. In one, carpoolers share the driving and riding roles, and in another, or one person always drives and the other(s) always ride. However, regardless of how people carpool, costs are usually distributed fairly. Common approaches to carpooling include an online "ride finders" program and highly visible and centralized pickup and drop-off points.

Given the number of employment centers in the Chicago region, municipalities could initiate and publicize carpooling programs that highlight the benefits of carpooling. While the main goal is to reduce the vehicle miles traveled per household and thus reduce fuel consumption, additional benefits include reduced expenses through shared commuting costs and reduced greenhouse gas emissions and air pollution.

Snapshot: Promote Carpooling	
Savings Estimate per Unit	Reduced VMT per year = number of reduced trips x total miles per trip
Prioritization	Communities that are home to large employment centers or have a large percentage of workers traveling to another center should consider developing car pools as a transportation alternative.
Implementation Factors	The success of carpooling programs relies on enhancing the benefits of ride sharing that cannot be captured in daily single occupancy car travel, while implementing safeguards like guaranteed ride-home services, and criminal and driver background checks.

3) Utilize Existing Technology to Reduce Trips to Work

Internet access offers opportunities for telecommuting, webinars, teleconferencing, and e-government solutions. In particular, high-speed internet allows users to share information via email, instant messaging, and file sharing in real time without having to leave home. A reduction in the number of trips to work results in reduced VMT, fuel consumption and greenhouse gas emissions.

Coordinated telecommute programs (sometimes called telework) allow staff to work from home or other approved sites at least one day a week rather than working in the office. This is cited by the U.S Environmental Protection Agency (EPA) as an emissions reduction strategy.[19] Municipalities should consider developing a telecommute program that utilizes these readily available technologies, and expands the use of webinars and teleconferencing in place of face-to-face meetings when possible. Sharing program success and lessons learned with offices and businesses may encourage the adoption of similar practices within the community.

Many municipalities should consider providing online municipal government services, which could help residents eliminate unnecessary trips. A recent study suggests that "more than half of all Americans contact the government in a given year," and that 30 percent of that contact is for simple transactions such as paying a bill.[20] The municipalities should identify all services that could be made available online and implement these online services. Common services include paying parking tickets, renewing car registration, paying state and local taxes, requesting files and documents, and applying for services, permits and licensing forms and other documents.

Snapshot: Utilize Existing Technology to Reduce Trips to Work	
Savings Estimate per Unit	Telecommute: Reduced VMT per year = number of reduced trips x total miles per trip. Tele-conference/webinar: Add VMT avoided per participant to arrive at total VMT avoided per event.
Prioritization	Municipalities could develop a telecommute program among workers now; communities with concentration of offices/headquarters could develop a telecommute office challenge or similar programs.
Implementation Factors	Internet/website security should be investigated when developing large scale telecommute programs. Also, barriers will not permit participation by everyone. Limiting factors could include internet access, language, hearing or sight impairments.

[19] Climate Change - What You Can Do. U.S. Environmental Protection Agency. 11 February 2011. http://www.epa.gov/climatechange/wycd/businesses.html.

[20] Horrigan, John. "How Americans Get in Touch with Government." Pew Internet & American Life Project. May 24, 2004.

4) Increase Transit Usage

Source: www.pacebus.com

In general, our region is well served by an integrated public transit network comprised of Chicago Transit Authority (CTA) buses and train lines, Metra commuter rail and the Pace suburban bus system. Availability and accessibility varies by individual municipality, with some better served than others. The availability of public transit is especially important to those on fixed incomes, including low income households, the elderly, youth/college students, and the disabled.

Proximity of transit is also an important factor for others who find transit to be a reliable and convenient alternative to the hassles of lengthy commuting times, stressful traffic, and bloated parking costs. Municipalities with strong connections to the regional network should promote public transit for travel to work, school and extracurricular destinations and should promote the interconnected extensions available through car sharing, bicycle lanes and pedestrian-friendly destination points.

Snapshot: Increase Transit Usage	
Savings Estimate per Unit	Reduced VMT per year varies based on the number of local trip destinations.
Prioritization	Areas well-served by public transportation, and in particular, CTA, Metra and Pace, should consider promoting increased transit usage among local residents and businesses.
Implementation Factors	In some communities, the success of a campaign to increase transit usage involves removing barriers or stigmas associated with transit. Public transit is most utilized when it is seen as an accessible, safe, convenient and affordable alternative.

5) Increase Biking through Addition of Bike Lanes and Amenities

The U.S. Department of Transportation (DOT) defines multimodal transportation as a long term comprehensive planning issue, stating that "every transportation agency has the responsibility and the opportunity to make a difference to the bicycle-friendliness and walkability of our communities. The design information to accommodate bicyclists and pedestrians is available, as is funding. U.S. DOT is committed to doing all it can to improve conditions for bicycling and walking and to make them safer ways to travel."[21]

Among potential actions, municipalities should consider increasing on-street safety enhancements such as bike lanes; installing secure bicycle racks near public transit, commercial hubs and high traffic areas; developing a "share the road" bicycle safety program; and participating in existing awareness programs such as "Bike to Work Week."

Improving bicycling opportunities and promoting cycling as a viable transportation alternative will compliment other alternative methods of transportation such as transit, car sharing, and walking. Municipalities with particularly strong connections to the regional transit network can tap into the existing CTA, Metra and Pace networks, and utilize the City of Chicago's fast-growing network of bike lanes and amenities that make it safer and easier to travel by bike.

Snapshot: Increase Biking through Addition of Bike Lanes and Amenities	
Savings Estimate per Unit	Reduced VMT per year = number of trips replaced x number of miles per trip
Prioritization	Communities with existing bike plans/routes, and/or strong public transit connections should consider emphasizing biking as an alternative mode of transportation.
Implementation Factors	Safety and liability are often concerns raised by communities. The U.S. DOT provides technical assistance and funding to promote safe multimodal travel.

[21] Design Guidance Accommodating Bicycle and Pedestrian Travel: A Recommended Approach. U.S. Department of Transportation, Federal Highway Administration. 11 February 2011. http://www.fhwa.dot.gov/environment/bikeped/design.htm.

How to Calculate Potential Energy and Cost Savings

An important consideration of whether or not a strategy should be a part of a community's large scale effort to reduce energy consumption is its energy and cost savings potential. Typically, national and regional agencies that estimate energy consumption and savings often do not account for local characteristics of energy consumption patterns. For example, the Energy Information Administration (EIA) reports that average annual household electricity consumption for the upper north central Midwest region is 10,479 kWh. Yet an analysis of consumption data from across the smaller Chicago metropolitan region shows that many communities fall above and below this average. Each Energy and Emissions Profile relies on actual consumption data and provides the most accurate picture of how energy is used in that specific community. This means the profiles allow for more accurate savings estimates. The following section explains how to calculate savings for a sample municipality.

Example

A municipality decides it wants to develop a retrofit program for its residential housing stock, much of which was built prior to the 1950s. The sample municipality estimates that the program will reduce electricity consumption by an average of 5 percent and natural gas consumption by an average of 25 percent.

Step 1: Identify average household consumption and costs (table 2 and table 4).

Table 2. Residential Electricity Consumption & Costs, 2007

	Municipality	County
Number of Households	7,296	163,555
Average kWh per Household	10,101	8,203
Average Annual $ per Household*	$1,087	$883

Table 4. Residential Natural Gas Consumption & Costs, 2007

	Municipality	County
Number of Households	7,296	163,555
Average Therms per Household	1,026	1,008
Average Annual $ per Household*	$911	$895

Step 2: Calculate energy and cost savings per unit.

Multiply average household consumption and cost by anticipated percentage of savings. The example below uses 5 percent savings for electricity and 25 percent for natural gas.

	Annual Electricity Savings		Annual Natural Gas Savings	
	Calculation	**Savings**	**Calculation**	**Savings**
Energy	10,101 kWh x 0.05	505 kWh	1,026 therms x 0.25	256 therms
Cost	$1,087 x 0.05	$54	$911 x 0.25	$227

Step 3: Calculate communitywide savings.

Multiply savings per unit by the anticipated number of units. The example below aims to retrofit 500 homes.

	Annual Electricity Savings		Annual Natural Gas Savings	
	Calculation	**Savings**	**Calculation**	**Savings**
Energy	505 kWh x 500	250,000 kWh	256 therms x 500	128,000 therms
Cost	$54 x 500	$27,000	$227 x 500	$113,500

Information and Resources

As municipalities begin to think about strategies to reduce energy consumption in municipal operations and across the community in households and businesses, there are existing agencies in place that can assist in providing information, tools and in some cases, financial assistance. This section focuses on agencies and programs that are available now for municipalities, residents, and business owners. It should be noted that these opportunities are fluid, and may change as funding and political priorities shift over time; therefore it is important to stay informed about the availability of these resources.

Resources for Municipalities

As public agencies, local governments have access to resources that can assist in reducing energy consumption in municipal buildings, and forging partnerships and strategies that reach across the community.

Illinois Department of Commerce and Economic Opportunity (DCEO)

Under the umbrella of the Illinois Department of Commerce and Economic Opportunity (DCEO), the State of Illinois offers many different funding opportunities in the form of grants and rebate programs. The links below provide information about energy efficiency and renewable energy resources.

Energy Efficiency: Information about incentives and rebates for lighting upgrades, retro-commissioning of buildings and grants for new construction LEED public sector buildings.
www.commerce.state.il.us/dceo/Bureaus/Energy_Recycling/Energy/Energy+Efficiency/

Renewable Energy: Information about solar and wind renewable energy system rebates of up to 50 percent; and a Biogas and Biomass to Energy Grant Program covering up to 50 of costs.
www.commerce.state.il.us/dceo/Bureaus/Energy_Recycling/Energy/Clean+Energy/

Smart Energy Design Assistance Center (SEDAC)

SEDAC is administered by the University of Illinois School of Architecture and provides free technical services (e.g. energy audits) for public facilities to identify energy saving opportunities. Once potential strategies are identified, SEDAC officials can provide additional information on incentives, grants, rebates, tax incentives and other opportunities. http://smartenergy.arch.uiuc.edu/

SEDAC also offers energy saving tips for water treatment facilities online. Download a fact sheet at http://smartenergy.arch.uiuc.edu/pdf/Water%20Treatment%20Plant%20Niche%20Market%20Report.pdf

Illinois Clean Energy Community Foundation (ICECF)

The ICECF was established through a $225 million endowment provided by Commonwealth Edison (ComEd). Projects are funded in three core program areas: energy efficiency, renewable energy resources, and preservation of wildlife/natural areas. Funding recipients are local government agencies or nonprofit organizations that serve Illinois residents. Visit www.illinoiscleanenergy.org for other requirements, funding priorities, deadlines and success stories.

Illinois Green Economy Network (IGEN)

In 2009, Governor Quinn provided state funding for the next phase of the Illinois Green Economy Network (IGEN), which was formerly called the Illinois Community College Sustainability Network. The funding base for the network includes state and federal funding.

IGEN is a growing collaboration between Illinois 48 community colleges. IGEN "brings community colleges together to expand employment opportunities, improve human and environmental health, foster community engagement and accelerate market competitiveness to drive Illinois's emerging green economy." (www.igencc.org) Currently, 12 of the 48 colleges have a Sustainability and Green Economy Center. IGEN's strategy includes expanding these Centers to each college in the Network. These Centers enable the following activities:

- Provide college-wide facilitation and staffing support for campus greening, green workforce development and community outreach activities.
- Support pilot projects in campus greening, green workforce training and community outreach. Use successful pilot projects to foster best practice exchanges across IGEN.
- Provide a partnership platform for business and employer groups to identify and address capacity gaps in the emerging green economy.
- Ensure effective network-wide marketing of all college best practices and green workforce offerings.
- Act as a clearing-house for certification/accreditations, code/regulations, training/education, and job market in their community.
- Support joint campus greening efforts between colleges, driving the green economy by scaling up campus practices.
- Collaborate on grants and fundraising activities as well as developing self-funding models for IGEN activities.

For more information, please visit http://www.igencc.org.

Resources for the Community: Residents and Businesses

As municipalities begin to develop community-scale strategies for reducing energy consumption and greenhouse gas emissions, individual households and businesses can take advantage of existing resources. These resources include energy audit tools, ENERGY STAR ratings and tools, and many utility-based programs designed to meet the needs of different customers in the region.

Energy Audits/Energy Assessments

An energy audit (or energy assessment) is an analysis of energy consumption in a building, including a review of utility bill data. The building analysis involves a visual and diagnostic inspection of living space, all mechanical systems (HVAC, lighting, hot water), and the building envelope. Paired with a review of past energy consumption, an energy audit report summarizes key issues and recommends improvements. Improvements can range from low or no cost strategies to larger investments. Each ECM (Energy Conservation Measure) includes anticipated energy savings and return on investment (the length of time required to recover the cost of the initial investment). There are several ways to obtain an energy audit:

1. **Pay a trained energy professional to conduct an audit.**

2. **Obtain a free energy audit.** Certain businesses in Illinois qualify for free energy audits through the Illinois Smart Energy Design Assistance Center (SEDAC).[22]

3. **Conduct a self-audit employing one or more of the following tools.**

   - **ComEd Energy Star at Home Tool**
     www.comed.com/sites/HomeSavings/Pages/energyanalyzer.aspx

   - **ComEd Energy Analyzer** offers two free services for business consumers.
     - Energy Insights Online offers comprehensive energy consumption analysis tools
       www.comed.com/sites/BusinessSavings/Pages/energyinsights.aspx
     - Whole Building Energy Usage offers energy management tools for owners/managers of multiple buildings: www.comed.com/sites/BusinessSavings/Pages/wholebuilding.aspx

   - **Citizen's Utility Board (CUB):** CUB Energy Saver is a free online energy advisory service that tailors recommendations based on self-reported energy data, and provides personalized energy savings suggestions. www.cubenergysaver.com/

   - **Nicor Energy Depot for Homes:** This Self-audit tool features an energy profile to document past consumption; an energy calculator that calculates annual energy costs for all systems in the home; and a library to address energy concerns: www.energydepot.com/NicorRes/index.asp

[22] Illinois Smart Energy Design Assistance Center. 11 February 2011. http://smartenergy.arch.uiuc.edu.

- **Nicor Residential Overview:** This includes user-friendly tips and tools to help residential consumers better understand their bills, manage natural gas costs, gather energy efficiency tips, and more. www.nicor.com/en_us/residential/

- **Nicor How to Conduct Your Own Energy Audit:** This tool is directed toward commercial and industrial users, but provides useful information for any consumer. The site includes downloadable forms for conducting an audit.
  www.nicor.com/en_us/commercial/planning_needs/build_strategy/energy_audit.htm

- **Nicor Commercial and Industrial Overview:** This resource includes user-friendly tips and tools for businesses. www.nicor.com/en_us/commercial/

ENERGY STAR®

ENERGY STAR® is a joint program of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE) that provides leadership in identifying energy efficient products and practices.[23] It began as a voluntary labeling program to help consumers identify energy efficient products, typically computers, monitors and other office equipment. The ENERGY STAR label has expanded over the years to cover more than 60 product categories, including major appliances, lighting, and home electronics.

In addition to product labeling, ENERGY STAR provides building assessment tools to assist building owners and occupants in achieving greater energy savings. Lastly, entire buildings can earn the ENERGY STAR label. Upon meeting strict guidelines, an ENERGY STAR home can expect energy savings of 20 percent to 30 percent.[24] Commercial buildings meet similar energy performance guidelines.[25]
Learn more at www.energystar.gov.

[23] About ENERGY STAR: ENERGY STAR. U.S Environmental Protection Agency and U.S. Department of Energy. 11. February 2011. http://www.energystar.gov/index.cfm?c=home.index.

[24] Qualified New Homes: ENERGY STAR. U.S Environmental Protection Agency and U.S. Department of Energy. 11. February 2011. http://www.energystar.gov/index.cfm?c=new_homes.hm_index.

[25] Buildings and Plants: ENERGY STAR. U.S Environmental Protection Agency and U.S. Department of Energy. 11. February 2011. http://www.energystar.gov/index.cfm?c=business.bus_index.

Utility-Based Programs

The Illinois Energy Efficiency Portfolio became law in 2007, and requires Illinois utilities to reduce overall electric consumption by 2% by 2015 through the funding and implementation of energy efficiency programs. The law expands to include natural gas utilities in mid-2011. The Illinois Department of Commerce and Economic Opportunity (DCEO) reports that approximately $50 million was devoted to various sectors of utility customers in year one; over $100 million in year two; and more than $150 million in year three.

The Illinois Energy Efficiency Portfolio Standard represents "the largest opportunity Illinois has had for achieving energy efficiency and demand reduction." The collective result of conservation efforts may avoid the need to build additional power plants and expensive infrastructure. Advocates for community-scale energy efficiency programming should continue to work with utilities that have the financial means and legal requirement to develop meaningful opportunities to reduce energy consumption.

Current energy efficient resources available from utilities are listed below.

ComEd Programs and Incentives, Residential [26]

- ENERGY STAR lighting: Instant on-shelf discounts at participating retailers.
- Appliance Recycling: Recycle old, working refrigerators, freezers and air conditioners to receive a $35 rebate.
- Central air conditioner cycling: Receive credits on your bill for allowing the utility to cycle your central air conditioning system unit during high demand periods.
- Central air conditioning efficiency services: Obtain tune-up information or assistance in identifying qualified HVAC services when replacing a central air conditioning system.
- Residential Real-Time Pricing: Tap into cost savings by being billed for the electricity use based on wholesale, hourly market prices.
- All electric home performance tune up: Get a free evaluation of energy consumption.
- Multifamily direct install program: Free installation of efficient showerheads, faucet aerators and up to six compact fluorescent light bulbs for multifamily buildings.

ComEd Programs and Incentives for Business [27]

- Retro-commissioning: Employ an expert to analyze building energy consumption and identify low/no-cost energy saving strategies to achieve optimal energy system performance.
- Lighting: Receive incentives for lighting replacement. Amounts vary based on type of lighting.
- Refrigeration Upgrades: Various incentives may be available. Contact ComEd directly through the account manager.
- HVAC upgrades: Various incentives may be available. Contact ComEd directly through the account manager.
- Electric motors: Incentives up to $7 per horsepower are available for energy efficient motors. Contact the utility directly through the ComEd account manager.
- Sensors and controls: Various incentives for different types of sensors and controls are available.
- Central air conditioning efficiency services: Obtain tune-up information or assistance in identifying qualified HVAC services when replacing a central air conditioning system.
- Multifamily direct install program: Free installation of efficient showerhead, faucet aerators and up to six compact fluorescent light bulbs for multifamily buildings.

[26] Home Savings: Programs and Incentives. ComEd, An Exelon Company. 11 February 2011. https://www.comed.com/sites/HomeSavings/Pages/programsandincentives.aspx.

[27] Business Savings: Programs and Incentives. ComEd, An Exelon Company. 11 February 2011. https://www.comed.com/sites/BusinessSavings/Pages/programsincentives.aspx.

Nicor Residential Programs [28]

- ENERGY STAR equipment replacement rebate: Rebates for Energy Star-rated boilers, furnaces and water heaters. Instant on-shelf discounts at participating retailers.
- Low-to-moderate income program: Home weatherization and furnace upgrades are available to customers with household incomes of 200 to 300 percent of the federal poverty level as identified by Community Action Agencies.
- Existing home retrofit program: Assists homeowners by analyzing energy use, recommending weatherization measures, and facilitating installation. Rebates are received based on the installation of recommended measures.
- Residential multifamily direct install program: In conjunction with the ComEd multifamily direct install program, this program assists owners and residents of multifamily buildings in reducing energy costs through direct installation of energy-saving measurements.

Nicor Business Rebate Programs [29]

- Efficiency rebates: Rebates for high efficiency boilers, furnaces and water heaters, and efficiency maintenance including boiler tune-ups, boiler re-set controls and steam traps.
- Business custom incentive program: Efficiency upgrades not covered in the standard efficiency rebate program may be eligible for financial assistance after installation. An application process is required. www.nicorgasrebates.com/bus-customer/business-custom-incentive-program#Info1

[28] Residential Rebate Information. Nicor Gas, Energy Efficiency Program. 11 February 2011. http://www.nicorgasrebates.com/res-customer/res-cust-rebate-information.

[29] Business Customer Rebate Information. Nicor Gas, Energy Efficiency Program. 11 February 2011. http://www.nicorgasrebates.com/bus-customer/bus-cust-rebate-information.

Methodology

This section provides an abbreviated description of the data and calculations used to develop each Energy and Emissions Profile.

Electricity

All municipalities in the Chicago metropolitan region receive electricity service from ComEd, with the exception of the five municipalities that have Municipal Electric Utilities. Therefore, electricity consumption data for all Municipal Energy and Emission Profiles were aggregated from ComEd 2007 premise level data.

Electricity Consumption

Electricity premise-level data for all utilities was already split between the residential and C&I sectors. The following was completed for each sector to aggregate electricity data.

Total Consumption

1. Identified accounts that are in a ZIP code that resides in a single county.
2. Of the remaining accounts, those that had latitude and longitudinal coordinates were placed on a map; then a spatial join was performed to sum the usage and accounts.
3. The remaining accounts that were not geocoded and fell into ZIP codes that straddle counties. Next, townships of the remaining accounts were analyzed, and a query was done on accounts by mailing city; and townships were identified and placed in the correct county.
4. Then, the final remaining accounts that are split by a county boundary line were aggregated using the fractional area of the municipality in each county.

Average Annual Household Consumption

1. Identified the total kWh consumed by the residential sector
2. Divided by the total number of households as provided by the Census Bureau's American Community Survey, 2006 - 2008.

Average Annual Cost per Household

1. Determined average cost per kWh for ComEd as reported in the Illinois Commerce Commission Utility Sales Statistics for 2007.
2. Multiplied by the average annual kWh consumed per household.

Natural Gas

Municipalities in the Chicago metropolitan region receive natural gas service from Nicor and/or Peoples/North Shore Gas. For Nicor, natural gas consumption data was aggregated from 2007 premise level data. For Peoples/North Shore Gas, it was not possible to acquire 2007 natural gas consumption data within the timeframe of this project. However, analysis determined that the difference in heating degree days between 2005 and 2007 was insignificant for the region; signifying the difference in natural gas consumption would be minimal barring major municipal growth and development during that same time period. For municipalities that obtain natural gas service from People's or North Shore, 2005 data was used.

Natural Gas Consumption

Natural gas premise-level data for all utilities was already split between the residential and C&I sectors. The following was completed for each sector to aggregate natural gas data.

Total Consumption

1. Identified accounts that are in a zip code that resides in a single county.
2. Of the remaining accounts, those that had latitude and longitudinal coordinates were placed on a map; then a spatial join was performed to sum the usage and accounts.
3. The remaining accounts that were not geocoded and fell into zip codes that straddle counties. Next, townships of the remaining accounts were analyzed, and a query was done on accounts by mailing city; and townships were identified and placed in the correct county.
4. Then, the final remaining accounts that are split by a county boundary line were aggregated using the fractional area of the municipality in each county.

Average Annual Household Consumption

1. Identified the total therms consumed by the residential sector
2. Divided by the total number of households as provided by the Census Bureau's American Community Survey, 2006 - 2008.

Average Annual Cost per Household

1. Determined average cost per therm for Nicor and Peoples Gas and North Shore Gas as reported in the Illinois Commerce Commission Utility Sales Statistics for 2007.
2. Multiplied by the average annual therms consumed per household.
3. For those municipalities that receive natural gas service from two utilities, the costs per therm were averaged based on the portion of consumption of natural gas from each utility.

Transportation – Vehicles Miles Traveled (VMT)

Vehicle miles traveled (VMT) and the resulting transportation emissions were calculated using odometer readings from vehicle emissions testing provided by the Illinois EPA, vehicle miles traveled data from the Illinois Department of Transportation, fleet mix data from the Lake Michigan Air Directors Consortium (LADCO), and vehicle efficiency data from the Federal Highway Administration (FHWA). Emissions factors for transportation are taken from the U.S. EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, as well as the State Inventory Tool.

Household VMT

Household VMT are the miles driven by households in each municipality. By using ZIP code-identified odometer readings from emissions tests, annual mileage driven by vehicles was estimated. Because new vehicles are not tested for emissions for the first four years after purchase, a correction factor was applied to account for the absence of these data. The following steps were completed to calculate household VMT for each municipality.

1. VMT per vehicle for each municipality was calculated as the average of any ZIP codes that overlap the municipal boundaries, weighted by the area of overlap.
2. These VMT per vehicle values were multiplied by aggregate auto ownership values for each municipality from the 2006 to 2008 American Community Survey three-year estimates, which yielded the total household VMT for each municipality.

A small number of communities were outside of the non-attainment area[33] in which emissions testing is required. County-averaged VMT per vehicle were used in these cases where municipal level data were unavailable.

On-road VMT

On-road VMT are the miles driven on roads passing through the municipality, including commercial traffic not counted by household VMT. It is this total that is usually counted in greenhouse gas inventories. However, the only available measures of on-road VMT (from the state DOT) were at the county level and not were not broken down for individual municipalities. Therefore, the ratio of on-road to household VMT was calculated at the county level, and then the municipal household VMT were multiplied by that ratio to estimate the municipal on-road VMT.

[30] Chicago-Gary-Lake County, IL-IN PM2.5 Nonattainment Area Map. U.S. Department of Transportation, Federal Highway Administration. 11 February 2011. http://www.fhwa.dot.gov/environment/air_quality/conformity/reference/maps/pm25_1997/ilin_chicago-gary-lakeco.cfm.

Greenhouse Gas Emissions

The municipal greenhouse gas emissions were calculated for 2007 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 (MT) or million metric tons (MMT), to enable comparisons internationally. The profile includes direct emissions for natural gas, transportation, and industrial process and product use. Indirect emissions were calculated for electricity and waste. Despite the fact that most electricity generation and waste handling facilities are located outside of the region, emissions for the electricity consumed and waste generated by its residents were included in the calculation. On-road transportation emissions were calculated using vehicle miles traveled data.

Emissions were calculated for the six major categories of greenhouse gases regulated under the Kyoto Protocol: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Emissions were converted into CO_2e using global warming potentials from the IPCC Fourth Assessment Report. CO_2 formed the majority of the region's greenhouse gas emissions.

Energy-related Emissions

Electricity

Measuring the greenhouse gas emissions associated with electricity is a complex issue because the electricity market is dynamic and changeable. Electricity cannot be easily stored and is constantly traded over the regional grid. As a result, it has become the standard in greenhouse gas accounting to use regional average greenhouse gas emissions factors (greenhouse gases emitted per kWh) as published by the U.S. Environmental Protection Agency's Emissions & Generation Resource Integrated Database (eGRID).

ComEd's environmental disclosure statements show that its electricity supply has proportionally more nuclear power than the region, but at the same time there are coal plants in the area that supply electricity to the local grid but are not part of ComEd's portfolio. Using the regional average electricity emissions factors allows the greenhouse gas calculations to look at electricity consumption the same way the market does. The dynamic market for electricity makes the regional power pool—the grid-connected area over which electricity is likely to be traded—a better description of the electricity used any given area and its environmental impacts. Moreover, the nuclear generation facilities in the region are included in the regional power pool average emissions factors.

The municipalities that received Energy and Emissions Profiles are located in the eGRID RFC West subregion. Electricity usage was converted to emissions using the RFC West emissions factor for 2005, which is the most recent available data reported by eGRID.

Natural Gas

Natural gas emissions were calculated by gathering natural gas consumption data from Peoples Gas, North Shore Gas and Nicor Gas, and applying natural gas emissions factors from the U.S. EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks. The accounting of natural gas emissions is more straightforward than that of electricity, because it is combusted on site, so the consumer of the energy is the same entity as the direct emitter of the greenhouse gases, making the allocation of emissions more clear.

Transportation Emissions

Emissions resulting from VMT were calculated as follows. Using fleet mix estimates from LADCO, VMT were divided into different vehicle classes. Average fuel efficiencies by vehicle class from FHWA were used to convert VMT for each class to gallons of fuel used. Calculation of CO_2 emissions from burning fuel is a straightforward multiplication of an emissions factor from EPA. However, estimating CH_4 and N_2O emissions from fuel use is more complicated, as control technologies for air pollution have evolved over time. The EPA State Inventory Mobile Sources worksheet provides estimates of the on-road mix of vehicles by age and control technology and calculates emissions. CH_4 and N_20 emissions were converted to CO_2-equivalents using the global warming potentials from the IPCC Fourth Assessment Report and the total CO_2-equivalent emissions were reported.

Product Use and Industrial Processes

Many of the emissions in this sector are compounds with high Global Warming Potentials (GWP)—they have relatively large impacts on global warming compared to CO_2 over 100 years, and the CO_2e values shown reflect this. The activity data in this sector are very difficult to find on at the city level, so the emissions of this sector are estimated as a proportion of national emissions as reported by the U.S. EPA.

Product Use

There are a number of products that release greenhouse gases when used. For example, these include the sulfur hexafluoride (SF_6) used as an insulator in electrical equipment and the nitrous oxide (N_2O) used as an anesthetic by dentists. Local data on these emissions were unavailable, so national emissions were prorated by the regional share of the national population using U.S. EPA National Inventory and U.S. Census data to estimate both county and municipal emissions.

Industrial Processes

In addition to any energy-related emissions, certain industrial processes involve the emissions of greenhouse gases, such as those generated in the process of cement or zinc manufacturing. While emissions from industrial processes can be quite significant, it is very difficult to get data to accurately estimate emissions at a municipal level. Therefore, industrial process emissions are not included in the MEPP greenhouse gas emissions estimates. However, if potential sources of industrial emissions have been identified within a municipality, then this information is documented in their municipal reports.

Waste and Wastewater Emissions

Solid Waste

Illinois EPA Landfill capacity reports provide tonnage of waste deposited to landfills for each county in the region. Data provided by the City of Chicago enabled the calculation of the portion of waste composed of degradable organic content and this percentage was used for the entire region. National data was used to estimate the portion of methane emissions that is recovered at the landfill sites, which was deducted from the resulting CH_4 emissions. Solid waste also produces CO_2 as it decomposes, but as the carbon stored in decomposing food, paper, and paper products is biogenic in origin—it was absorbed from the atmosphere by plants in recent history—its release does not contribute to global warming, and there for is not counted in this inventory.

The region has a number of closed landfills within its boundaries. Solid waste takes decades to decompose, so closed landfills continue to generate methane emissions. The IPCC uses a first order decay method to account for current year emissions from historic waste disposal, but data were unavailable at the time of this study to estimate these emissions for the region. This is an area that should continue to be investigated. Municipal emissions were assigned by prorating county emissions by population.

Wastewater

Fugitive methane emissions from water reclamation plants were estimated using a study conducted by the Metropolitan Water Reclamation District (MWRD) using the methods detailed in the 2006 IPCC guidelines. It was assumed that all sewer discharge was delivered to the MWRD plants via a covered sewer collection system. The MWRD estimate of the fugitive methane emissions for the entire district was then scaled by population to represent the water treatment for the entire region.

Water reclamation plants recover methane during the water treatment process. This recovered methane is used on site for heating and/or electricity generation. There is no data available on the amount of methane that is recovered by MWRD annually. This is an area for further research. CO_2 emissions associated with the consumption of the recovered methane were not included in this analysis, as the carbon is biogenic in origin and does not contribute to global climate change. Municipal emissions were assigned by prorating county emissions by population.

Glossary

The following are commonly used energy terms and acronyms.

ARRA (American Recovery and Reinvestment Act) In 2009, the 111th United States Congress enacted ARRA, commonly referred to as the stimulus or simply the Recovery Act. The intent of ARRA was to create jobs and promote investment and consumer spending during the recession.

Compact fluorescent lamp (CFL) A CFL is a gas-discharge lamp that uses electricity to excite mercury vapor. CFLs use less power and have a longer rated life than standard incandescent light bulbs. The cost to purchase a CFL is higher; however, CFLs use 75 percent less energy than incandescent bulbs and last up to 10 times longer.

EECBG (Energy Efficiency and Conservation Block Grant) EECGB was funded through ARRA in 2009. However, it was originally introduced as part of the Energy Independence and Security Act of 2007. The purpose of EECBG is to assist eligible entities in implementing energy efficiency and conservation strategies in order to reduce fossil fuel emissions, reduce total energy use, improve energy efficiency in buildings, transportation, and other appropriate sectors, and create jobs.[31] EECBG funding was allocated through direct formula grants, a competitive grant program, and state funding.

Energy audit (building) An energy audit is the inspection and analysis of a building to evaluate the best ways to improve the energy efficiency of the building. An energy audit may involve evaluation of the building's envelope and efficiency, condition, systems, as well as maintenance and operation.

Energy retrofit (building) Energy retrofits typically follow a building energy audit. A retrofit is an upgrade to a building's infrastructure to improve its performance, comfort, safety, and durability. This may include improving building materials, operating systems and equipment, and installing energy efficient appliances.

ENERGY STAR® The U.S. Environmental Protection Agency (EPA) introduced ENERGY STAR as a voluntary labeling program in 1992. It is designed to identify and promote energy-efficient products and help reduce greenhouse gas emissions. Currently, there are a variety of ENERGY STAR program for homes and businesses. EPA has also extended the label to cover new homes and commercial and industrial buildings.

Greenhouse gas emissions Greenhouse gas emissions refers to the release of gases that trap heat in the Earth's atmosphere. They come from both natural sources and human activities. Common greenhouse gases include carbon dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_20), and Fluorinated Gases.

Green Power This is subset of renewable energy that represents technologies that provide the highest environmental benefit (as defined by EPA). Customers frequently buy green power to avoid the environmental impacts of energy consumption.

[31] The Energy Efficiency and Conservation Block Grant Handout. The United States Conference of Mayors. 11 February 2011. http://www.usmayors.org/climateprotection/documents/eecbghandout.pdf

Btu (British thermal unit) This is a basic measure of thermal (heat) energy. One Btu is the amount of heat energy needed to raise the temperature of one pound of water by one degree F. A Btu is typically used to describe the heat value (energy content) of fuels, and also to describe the power of heating and cooling systems, such as furnaces, stoves, barbecue grills, and air conditioners. However, therms and kWh can be converted into Btu or kBtu (1,000 Btu) in order to allow for comparison among different units of energy.

kWh (kilo Watt hour) This is the unit of measurement for electricity consumption. One kWh is the amount of electricity needed to operate ten 100-Watt light bulbs for one hour.

Light emitting diode (LED) light A light emitting diode (LED) is a semiconductor light source. They are used as indicator lamps in many devices, are increasingly being used for lighting. LEDs are currently more expensive than incandescent lights, but their features make them attractive to certain consumers. They offer lower energy consumption, greater durability, and faster switching, requiring no warm-up period.

Renewable energy Renewable energy is energy that can be naturally replenished. It includes energy from the sun, wind, tides, a geothermal sources. The world currently obtains most of its energy from fossil fuels, which are considered nonrenewable energy sources. This means that the supply of fossil fuels is limited, and that will become more expensive as they become increasingly scarce or difficult to retrive.

Revolving loan fund (RLF) A fund that provides loans, and then as repayments are made, additional funds are made available for new loans to other businesses and people. Therefore, the money revolves from one person or business to another. Typically, the fund is established through a grant or capital that does not need to be repaid.

Smart grid The smart grid refers to an electricity transmission and distribution system that includes advanced digital communications technology. A smart grid makes it possible to respond dynamically to changes in the grid condition. For example, this would allow grid operators to identify and correct outages more quickly. Modernization of the grid will allow for the efficient integration of innovative technologies such as electric vehicles and renewable energy systems.

Sustainability or sustainable development The most common definition of sustainability and sustainable development was presented by the United Nations' Brundtland Commission in 1987: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[32]

Therms The unit of measurement for natural gas consumption.

Vehicle miles traveled (VMT) The total number of miles driven by vehicles within a certain time period and geographic area. VMT is used for planning purposes and is effected by the area's population, age distribution, number of vehicles per household, and land use.

[32] United Nations. 1987. Report of the World Commission on Environment and Development, General Assembly Resolution 42/187, 11 December 1987.