
Chicago Green Office Challenge

Energy Cost Reduction Measures (ECRM)

One portion of the Chicago Green Office Challenge is energy conservation. Conserving energy benefits the building owner, the city, and the environment. This handout provides some background information on what is involved in conducting an energy audit and provides an example of how a typical office building in the Midwest consumes energy.

Collect Data

Gather at least one year's worth of energy data

Determine square footage served / Number of occupants / hours of operation / building characteristics / mechanical system characteristics / etc.

Benchmarking

How much energy does your building use annually and how does it compare to other buildings of similar use? Comparing energy usage to other similar buildings provides a good benchmark on how your building is performing.

Energy Use Disaggregation/Modeling

Another very important question is: Where and in what quantities is energy being used throughout your building? How much energy is being consumed by the buildings HVAC (boilers, chillers, and air handlers), lighting, computers, etc. Energy models can help disaggregate total energy consumption figures.

Identifying Conservation Opportunities

Once you know where and in what quantities energy is being consumed, efforts should focus on those areas that demonstrate the greatest potential for energy savings. Common areas that SEDAC looks at are:

- a. Lighting – this is usually the lowest hanging fruit on the tree, particularly in buildings with older lighting systems. Light fixtures, lamps, and controls should all be examined. Occupancy sensors can automatically turn off lights in unoccupied spaces and daylight control sensors can dim lights if sufficient daylight is present.
- b. Mechanical systems - replacement of older systems with high-efficiency equipment can result in significant savings. Modular boilers can replace large older inefficient boiler and new chillers are far more efficient than previous generation chillers.
- c. Recommissioning of mechanical systems – just like an automobile, building mechanical systems occasionally need to be tuned. Well tuned systems usually use the least amount of energy while providing the best comfort conditions. Not only can recommissioning save large amount of money, it can reduce wear on the systems thus extending their functional life.
- d. Building controls – pneumatic controls should be replaced with direct digital controls (DDC). DDC provide better control and oversight of the operation of building mechanical systems. Utilize the power of the energy management control system (EMCS) or Building Automation System (BAS) to schedule equipment and temperature settings. Additionally, if building occupancy fluctuates significantly, demand control ventilation (DCV) should be considered.
- e. Electric motor improvements include replacing older motors with high-efficiency motors and controlling them with variable frequency drives (VFD).
- f. Other conservation opportunities include:

- a. Combined heat and power (CHP) systems. These systems provide electrical power and hot water. Note that your building needs a hot water load for these systems to function efficiently.
- b. Envelope improvements – envelope improvements are usually expensive and have long payback periods. However, energy savings can be significant.
- g. Occupant behavior – do people turn off lights, computers, and other equipment when not needed? Does the janitorial staff turn on only the lights needed in areas where they are working?

Perform Analysis

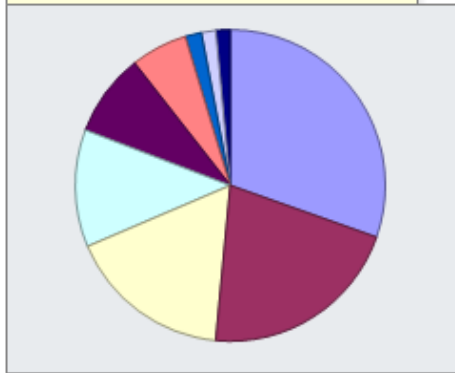
Calculate savings potential for identified energy cost reduction measures (ECRM).
 Estimate cost of ECRM implementation
 Calculate life cycle cost for each ECRM
 Prioritize ECRMs & determine implementation feasibility

ECRM Implementation

Follow up implementation with data collection and analysis to determine success of project

Following are graphs from the Energy Information Administration that illustrate how typical office buildings in the Midwest consume electrical and thermal energy.

Electric Intensity (kWh/sqft) -- Large Office Buildings



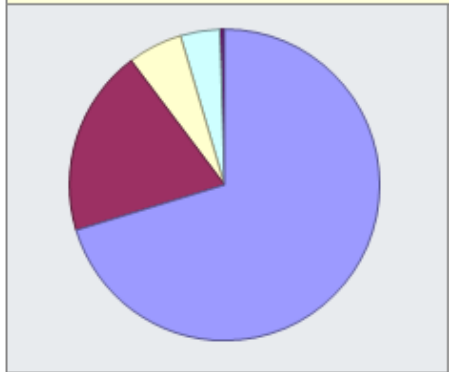
4.89	Lighting	30.40%
3.40	Cooling	21.10%
2.75	Ventilation	17.10%
1.96	Office Equip.	12.20%
1.38	Compressors / Generators	8.60%
0.95	Heating	5.90%
0.27	Cooking	1.70%
0.24	Refrigeration	1.50%
0.24	Water Heating	1.50%

Total Electric Intensity – 16.1 kWh/sqft (annual basis)

Average Electric Consumption per Establishment: 1,449,000 kWh

Average Enclosed Floor space per Establishment: 90,000 sqft

Natural Gas Intensity (kBtu/sqft) -- Large Office Buildings



26.22	Heating	70.30%
7.24	Water Heating	19.40%
2.13	Cooling	5.70%
1.53	Cooking	4.10%
0.19	Compressors / Generators	0.50%

Total Gas Intensity 37.30 kBtu/sqft, (annual basis)

Average Gas Consumption per Establishment: 3,357,000 kBtu

Average Enclosed Floor space per Establishment: 90,000 sqft

