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Energy Efficiency Fact Sheet

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Energy-Efficient Buildings

Using whole building design to reduce energy consumption in homes and offices

Key Facts

- Virtually every part of a building's structure—from its placement and design to the appliances it contains—affects its energy consumption. Climate-responsive architecture and whole building design consider the building's surroundings and local climate in order to construct energy-efficient buildings.
- The heating, cooling, and hot water costs in an energy-efficient home are 30 to 40 percent lower than in conventional new homes. The US Environmental Protection Agency (EPA) certifies buildings as Energy Star compliant if they are 30 percent more efficient than required by the national Model Energy Code from 1993, or 15 percent more efficient than the state's energy code, whichever is more rigorous.
- Over 2,300 home builders have joined the EPA's Energy Star Buildings program and have built at least one Energy Star certified building. Energy-efficient buildings have been built in all 50 states.

Energy Efficient Design Features:

- *Building placement:* A building's location and surroundings play a key role in regulating its temperature and lighting. Trees, landscaping, and hills can provide shade and block wind, for example. In cooler climates, designing buildings with an east-west orientation to increase the number of south-facing windows minimizes energy use, by maximizing passive solar heating.
- *Building shell:* Tight building design, including energy-efficient windows, well-sealed doors, and additional insulation of walls, basement slabs, and foundations can reduce heat loss by 25 to 50 percent. Highly insulated buildings may require ventilation, and heat recovery ventilators can provide airflow with minimal energy use.
- *Cool roofs:* Dark roofs become up to 70°F hotter than the most reflective white surfaces, and they transmit some of this additional heat inside the building. Studies by the US EPA in Sacramento, CA and by the Florida Solar Energy Center in Florida found that lightly colored roofs use 40 percent less energy for cooling than buildings with darker roofs. White roof systems save more energy in sunnier climates, and a study by the Lawrence Berkeley National Laboratory found cool roof systems have net energy savings in colder climates as far north as Chicago, Illinois.
- *Heating and cooling:* Advanced heating and cooling systems can reduce energy consumption and improve the comfort of the building's inhabitants. For example, programmable thermostats automatically raise or lower temperatures at night or during the day when no one is present. Zone heating and cooling systems allow the temperature of specific rooms or different floors to be controlled independently. Air-source and geothermal heat pumps can provide both heating and cooling efficiently. Evaporative cooling in dry areas and desiccant cooling in more humid areas are also generally more efficient than conventional cooling systems. Integrated space and water heating systems are often energy efficient in larger buildings.

- *Lighting:* Several methods reduce the need for artificial lighting: proper placement of windows and skylights and use of architectural features that reflect light into a building, such as light shelves. When lighting is required, compact fluorescent light bulbs use two-thirds less energy and last 6 to 10 times longer than incandescent light bulbs. While early fluorescent lights produced stark white light, newer fluorescent lights produce more natural light, and they are cost effective, despite their higher initial cost. Task lighting, lighting sensors, and dimmers also reduce the power needed for lighting. Increased use of natural and task lighting have been shown to increase productivity in schools and offices.
- *Home and office appliances:* Modern energy-efficient appliances use significantly less energy than older appliances. The EPA designates energy-efficient appliances, including refrigerators, freezers, ovens, stoves, dishwashers, and clothes washers and dryers with its Energy Star label. Current Energy Star qualified refrigerators, for example, use 40 percent less energy than conventional models did in 2001. Modern power management systems also reduce energy usage by idle appliances by turning them off or putting them into a low-energy mode after a certain time.

Costs and Benefits

- Many design factors that save energy are virtually free; others quickly pay for themselves in energy savings.
- Home financing that recognizes energy efficiency is available. It enables homeowners to assume greater monthly mortgage payments, recognizing that they will pay less for their utility bills.
- The EPA estimates that if Americans changed the 5 most commonly used lights in their homes from incandescent to compact fluorescent bulbs, each household would save over \$60 a year in energy costs and collectively keep one trillion pounds of greenhouse gases out of the air.
- By using programmable thermostats (which cost between \$50 and \$100), the EPA estimates the average homeowner could save \$100 per year on energy costs. Replacing a clothes washer from before 1994 with an Energy Star clothes washer would save the average household \$110 a year in energy costs.

Issues

- New appliances and improved landscaping can easily be added to all buildings. Constructing new buildings with energy-efficient insulation and heating and cooling systems is easier and less costly than retrofitting existing buildings, however.
- Few energy codes are set at the federal level, and the diversity of state and local energy codes complicates energy-efficient construction. Builders must also remain informed of the many programs and incentives on national, state, and local levels that encourage energy efficiency in schools, federal buildings, and affordable housing developments, as well as the many high-efficiency technologies, appliances, and building designs that are available.
- The poor are more likely to live in homes with less insulation and older appliances. They would benefit most from lower utility bills, but often do not have the resources for energy-efficiency upgrades. They can receive assistance from state and federal weatherization programs.

For More Information

American Council for an Energy Efficient Economy <http://www.aceee.org/Consumer/consumer.htm>
 Energy and Environmental Building Association <http://www.eeba.org/resources/consumer/index.htm>
 DOE Office of Energy Efficiency and Renewable Energy <http://www.eere.energy.gov/EE/buildings.html>
 EPA Energy Star Buildings <http://www.energystar.gov/>

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