Power to the Plug: An Introduction to Energy, Electricity, Consumption, and Efficiency

Grades: All

Topics: Biomass, Wind Energy, Hydropower, Solar, Geothermal

Owner: The NEED Project

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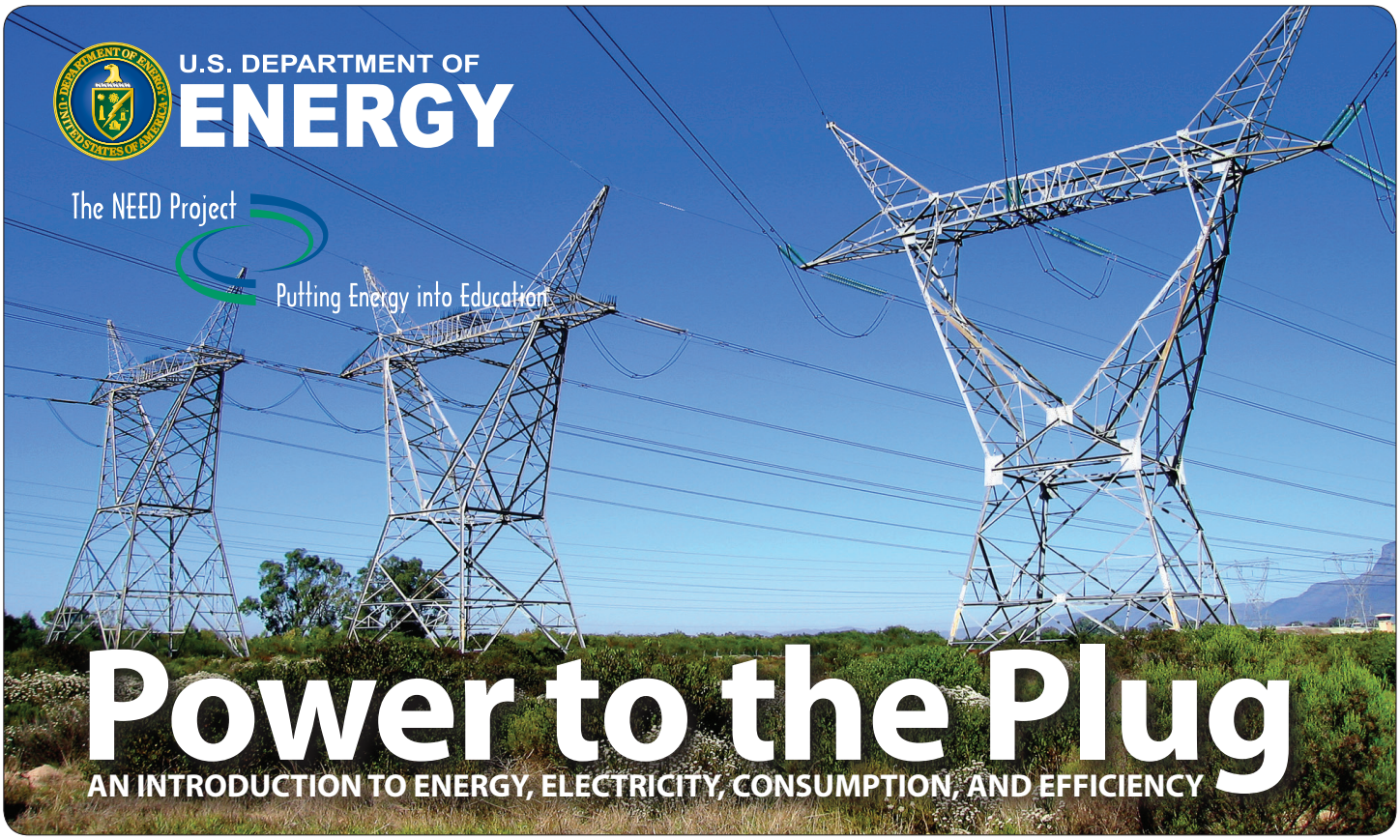


Power to the Plug

AN INTRODUCTION TO ENERGY, ELECTRICITY, CONSUMPTION, AND EFFICIENCY

What is Energy?

Energy makes change; it does things for us. It moves cars along the road and boats over the water. It bakes a cake in the oven and keeps ice frozen in the freezer. It plays our favorite songs on the radio and lights our homes. Energy makes our bodies grow and allows our minds to think. Scientists define energy as the ability to do work.

Sources of Energy

We use many different energy sources to do work for us. They are classified into two groups—renewable and nonrenewable.

In the United States, most of our energy comes from nonrenewable energy sources. Coal, petroleum, natural gas, propane, and uranium are nonrenewable energy sources. They are used to make electricity, heat our homes, move our cars, and manufacture all kinds of products. These energy sources are called nonrenewable because their supplies are limited. Petroleum, for example, was formed millions of years ago from the remains of ancient sea plants and animals. We can't make more crude oil deposits in a short time.

Renewable energy sources include biomass, geothermal energy, hydropower, solar energy, and wind energy. They are called renewable because they are replenished in a short time. Day after day, the sun shines, the wind blows, and the rivers flow. We use renewable energy sources mainly to make electricity.

U.S. ENERGY CONSUMPTION BY SOURCE, 2009

NONRENEWABLE

PETROLEUM 36.5%
Uses: transportation, manufacturing

NATURAL GAS 24.7%
Uses: heating, manufacturing, electricity

COAL 20.9%
Uses: electricity, manufacturing

URANIUM 8.8%
Uses: electricity

PROPANE 0.9%
Uses: heating, manufacturing

RENEWABLE

BIOMASS 4.1%
Uses: heating, electricity, transportation

HYDROPOWER 2.8%
Uses: electricity

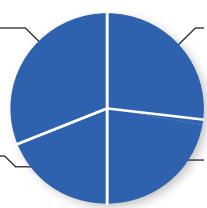
WIND 0.7%
Uses: electricity

GEOTHERMAL 0.4%
Uses: heating, electricity

SOLAR 0.1%
Uses: heating, electricity

Source: Energy Information Administration

U.S. ENERGY CONSUMPTION BY SECTOR AND TOP SOURCES, 2009



INDUSTRIAL 30%
Top Industrial Sources:
- *Petroleum*
- *Natural Gas*
- *Electricity**

TRANSPORTATION 29%
Top Transportation Sources:
- *Petroleum*
- *Biomass*
- *Natural Gas*

COMMERCIAL 19%
Top Commercial Sources:
- *Electricity**
- *Natural Gas*
- *Petroleum*

RESIDENTIAL 22%
Top Residential Sources:
- *Natural Gas*
- *Electricity**
- *Petroleum*

*Electricity is an energy carrier, not a primary energy source

Renewable Energy Sources

Hydropower is used to generate electricity. Today, most hydropower sources make use of falling water through a dam. New technology is utilizing energy from waves and tides.

Wind is created from the uneven heating of Earth's surface. Wind energy is used to generate electricity.

Solar energy comes directly from the sun. Solar energy can be used for heating buildings and water, and to electricity.

Geothermal energy comes from within the earth. Geothermal energy can be used for heating buildings and to generate electricity.

Biomass is any organic matter that can be used as an energy source. Biomass is used for heating, generating electricity, and as a transportation fuel.

What is Electricity?

Electricity is different from energy sources because it is a secondary source of energy. We must use an energy source to produce electricity. In the U.S., coal is the number one energy source used for generating electricity.

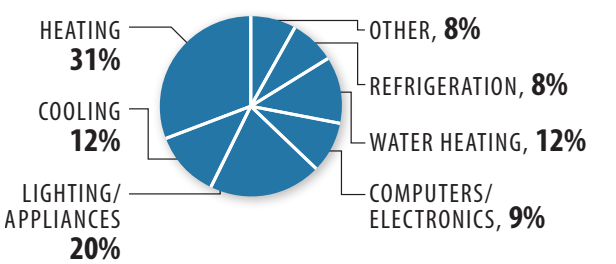
Electricity is called an energy carrier because it is an efficient and safe way to move energy from one place to another, and it can be used for so many tasks. As we use more technology, the demand for electricity grows. Learning how to conserve energy and use it efficiently are important goals for everyone.

Efficiency and Conservation

Energy is more than numbers on a utility bill; it is the foundation of everything we do. All of us use energy every day—for transportation, cooking, heating and cooling rooms, manufacturing, lighting, and entertainment. We rely on energy to make our lives comfortable, productive, and enjoyable.

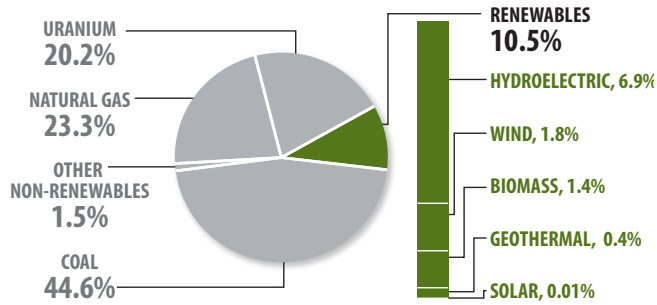
There are many things we can do to use less energy and use it more wisely. These things involve energy conservation and energy efficiency. Energy conservation is any behavior that results in the use of less energy. Energy efficiency is the use of technology that requires less energy to perform the same function. Use the *Home Energy Survey* on the back page to find out how you can use energy more efficiently.

HOME ENERGY USAGE



The typical family spends about $1,900 a year on utility bills. About 66 percent is for electricity; the rest is spent mostly on natural gas and heating fuel oil.

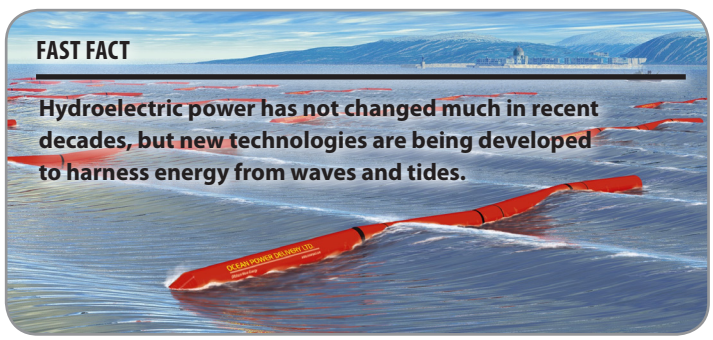
U.S. ELECTRICITY PRODUCTION BY SOURCE, 2009



Water is currently the leading renewable energy source used by electric utilities to generate electric power. Electricity from hydropower makes up 6.9 percent of the U.S. electricity supply.

Note: Figures do not add to 100 due to rounding.
Data: U.S. Energy Information Administration, 2009

FAST FACT

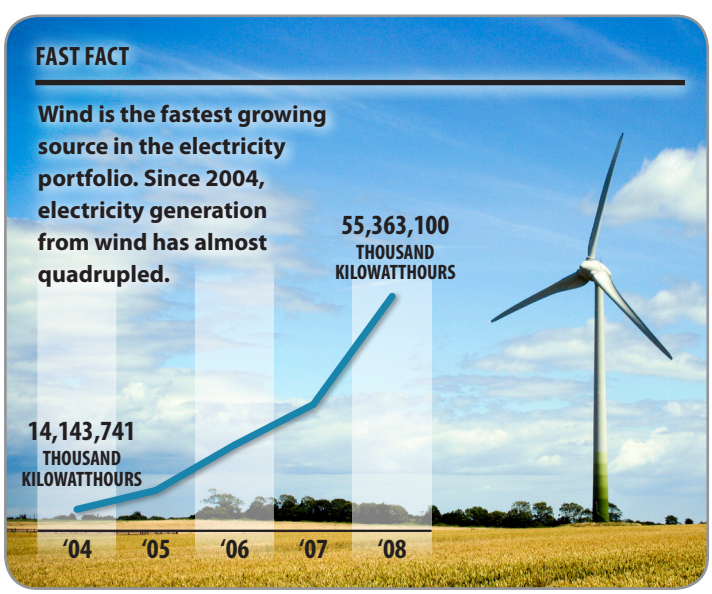


Hydroelectric power has not changed much in recent decades, but new technologies are being developed to harness energy from waves and tides.

FAST FACT

At 25 megawatts, Florida Power and Light's DeSoto Next Generation Solar Energy Center in Florida is the largest solar photovoltaic plant in the country. The electricity produced is enough power to serve about 3,000 homes.

FAST FACT



Wind is the fastest growing source in the electricity portfolio. Since 2004, electricity generation from wind has almost quadrupled.

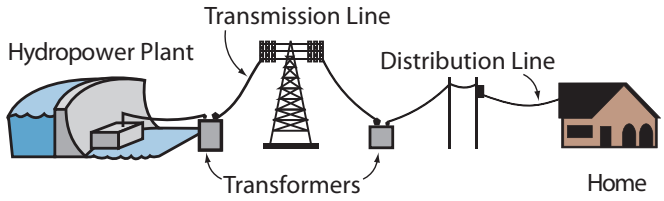
The Electric Grid

To get electricity to consumers, there are more than 300,000 miles of high-voltage electric transmission lines across the U.S. They take the electricity produced at power plants to transformers that step up the voltage to reduce energy loss while it travels along the grid to where it is going to be used. Before coming into your home, another transformer steps down the power down to 120 volts so it can operate your lights, appliances, and other electrical needs. And most remarkably of all, this entire process—from generation at the power plant to the trip along the lines to its availability for use in your home—takes just a fraction of a second!

These transmission lines—whether they are located on poles above ground or buried underground—make up the most visible part of what is called the "electric grid." The grid consists of the power generators, the power lines that transmit electricity to your home, the needed components that make it all work, and the other homes and businesses in your community that use electricity.

The process starts at the power plant that serves your community, and ends with wires running from the lines into your home. Outside your home is a meter with a digital read-out or a series of dials that measure the flow of energy to determine how much electricity you're using. Of course, there are many more parts to this process, ranging from substations and wires for different phases of current to safety devices and redundant lines along the grid to ensure that power is available at all times. You can see why the U.S. National Academy of Engineering has called America's electric grid "the greatest engineering achievement of the 20th century."

ELECTRICITY TRANSMISSION



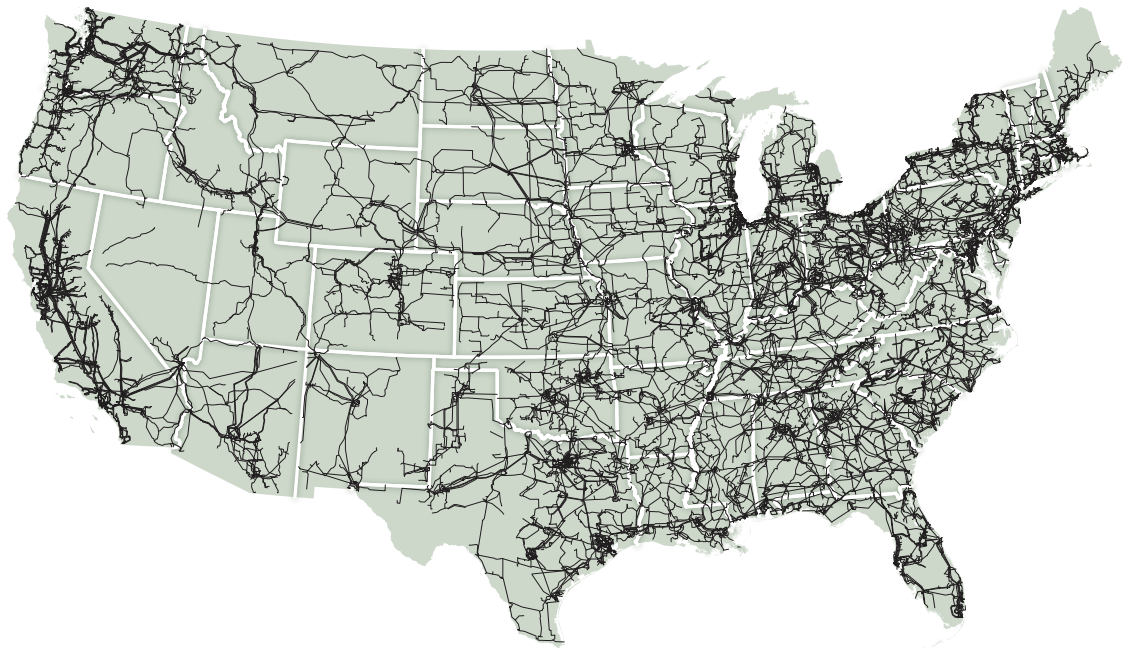
The Smart Grid

The current electric grid is aging and plans are underway to update it and create a "smart grid." The existing electric grid has worked well for many years, but developing a new, more efficient grid will help meet growing electricity demand. Updating the current grid and transmission lines would not only improve current operations, but would also open new markets for electricity generated by renewable energy sources.

The smart grid system will include two-way interaction between the utility company and utilities. During peak demand when power generation is reaching its limit, the utility company can contact consumers to alert them of the need to reduce energy until the demand decreases. The smart grid would alert the power producer to an outage or power interruption long before the homeowner has to call the producer to let them know the power is out.

Developing the smart grid would offer a variety of technologies that will help consumers lower their power usage during peak periods, allow power producers to expand their use of photovoltaics, wind and other renewable energy technologies, provide system back-up to eliminate power outages during peak times, and save money while reducing carbon dioxide emissions.

AMERICA'S ELECTRIC GRID



EFFICIENCY CONSERVATION

Home Energy Survey

Analyze your home energy use. Are their behaviors you can change to conserve energy?

General Home Information

Only 20 percent of homes built before 1980 are well insulated. Sealing windows and doors as well as adding insulation can reduce your energy costs.

1. **When was your home built?**

   _____

2. **What type of home do you live in?**
   a. Single Family
   b. Apartment/Condo

3. **How many windows are on each side of your home?**

   _____

   Are any windows cracked or broken?
   yes no

4. **How many outside doors are there?**

   _____

   Are they insulated?
   yes no

5. **Do windows and doors seal tightly, or do they leak air?**
   yes no

6. **Does your home have insulation in the walls and ceiling?**
   yes no

Lighting

ENERGY STAR qualified lighting provides bright, warm light and uses about 75 percent less energy than standard lighting, produces 75 percent less heat, and last up to 10 times longer.

1. **What kind of lighting is used in your home?**
   a. CFL b. Incandescent c. Other d. Combination
   Outside your home?
   a. CFL b. Incandescent c. Other d. Combination

2. **Can any of the lights be controlled with dimmer switches?**
   yes no

3. **Does your home make use of skylights and/or natural lighting?**
   yes no

4. **How many light bulbs do you have in your home? What kind of light bulbs are they?**

Incandescent	CFL	Other

Home Energy Use

Refrigerators, clothes washers and clothes dryers are the appliances that consume the most energy. Look for an ENERGY STAR label when buying a new appliance. ENERGY STAR labels indicate that the appliance is more efficient than other products.

1. **How many times do you run your dishwasher each week?**

   _____ times

   Is it always full when you start it?
   yes no

2. **Do you have an Energy Saver feature on your dishwasher?**
   yes no
   If so, how often is it used?
   a. 0% b. 25% c. 50% d. 75% e. 100%

3. **How many loads of laundry are washed each week?**

   _____ loads

   Are they all full loads?
   yes no

4. **What is the percentage of laundry loads washed and rinsed in cold water?**
   b. 0% b. 25% c. 50% d. 75% e. 100%

5. **How many times a day:**

is a light left on in an unoccupied room?	
is a TV, radio, computer, or video game left on with no one using it?	
is the water allowed to run while you are brushing teeth or washing dishes?	
is the microwave or toaster oven used to cook instead of the stove or oven?	
is a door or window open when the heat or air conditioning is on?	

6. **How many ENERGY STAR appliances are there in your home?**

   _____

To find out more about how you can save energy at home, visit www.NEED.org and download the *Energy Conservation Contract*.

energy
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