



E³A: Understanding Energy

Understanding Energy

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Green Building

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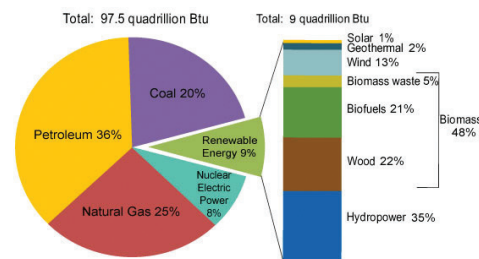
Sources and uses of energy in the United States

Making informed decisions about energy requires an understanding of where energy comes from and how it is used.

Primary energy sources

Primary energy sources are petroleum, coal, natural gas, nuclear fuel and renewable energy. These are used to make secondary sources of energy like electricity. The top three primary energy sources in the United States are petroleum (37 percent), natural gas (25 percent) and coal (21 percent). Primary energy sources are divided into two categories: renewable and nonrenewable.

U.S. Energy Consumption by Energy Source, 2011



Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 10.1 (March 2012), preliminary 2011 data.

Nonrenewable sources

The top four primary energy sources in the United States are nonrenewable — coal, petroleum, natural gas and uranium. Nonrenewable resources are those that are consumed faster than they can be replenished. Fossil fuels — such as coal, oil and natural gas — fall into this category, and all have high percentages of carbon.

All fossil fuels are nonrenewable, but not all nonrenewable energy sources are fossil fuels. Uranium is a nonrenewable resource, but is not a fossil fuel.

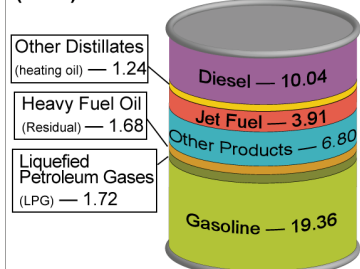
Renewable sources

Renewable energy sources regenerate and can be sustained indefinitely. Sources of renewable energy include biomass, hydropower, geothermal, wind and solar. Use of renewable energy is not new. Wind power has been used for pumping water and grinding grain throughout history. Wood, or biomass, supplied 90 percent of the United States' energy needs more than 150 years ago, but reliance on renewable resources waned as use of other resources expanded. Americans are once again looking for ways to incorporate renewable energy, but it currently represents only 8 percent of our total energy production.

Sources and uses

- Petroleum is the basis for oil products and gasoline production. Petroleum is refined into a variety of products, mostly related to transportation fuels.
- Natural gas is used to heat slightly more than half of the homes in the United States, but 31 percent of the supply is also used to generate electricity. Natural gas is used in industrial manufacture of plastics and agriculture-related products such as nitrogen fertilizers.
- Power plants use 93 percent of the nation's coal production to generate electricity. Power plants burn coal to create steam that powers electrical generators. Roughly half of the electricity supply in the United States comes from coal.

Products Made from a Barrel of Crude Oil (Gallons) (2009)

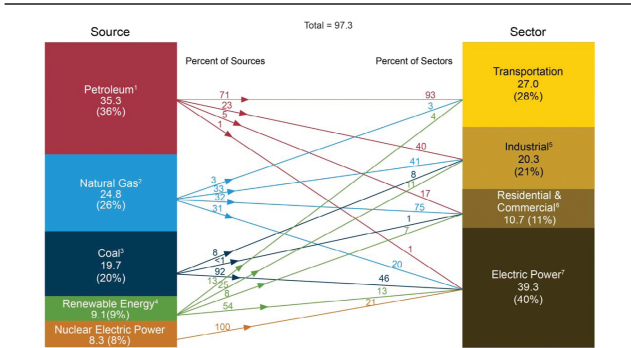


Credit: Department of Energy

- Renewable energy makes up about 9 percent of the U.S. total energy supply. Hydropower is our largest renewable energy resource, representing 31 percent of the supply.
- Nuclear energy provides approximately 21 percent of the U.S. electricity supply. Nuclear energy is created from uranium using nuclear fission.

The graph below shows the primary sources of energy and the primary users of energy in the U.S. Petroleum sources provide 93 percent of our transportation fuels, which means we have few alternative if petroleum prices change or if the supply chain is compromised.

Figure 2.0 Primary Energy Consumption by Source and Sector, 2011 (Quadrillion Btu)



¹ Does not include bitulfields that have been blended with petroleum—bitulfields are included in "Renewable Energy."
² Excludes supplemental gaseous fuels.
³ Includes less than 1 quadrillion Btu of coal coke net imports.
⁴ Conventional hydroelectric power, geothermal, solar photovoltaic, wind, and biomass.
⁵ Includes industrial combined heat and power (CHP) and industrial electricity-only plants.
⁶ Includes commercial combined heat and power (CHP) and commercial electricity-only plants.
⁷ Electricity-only and combined heat and power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes 0.1 quadrillion Btu of electricity net imports not shown under "Source."
⁸ Notes: Primary energy in the form that it is first accounted for in a statistical energy balance, before any transformation to secondary or tertiary forms of energy (for example, coal is used to generate electricity). * Sum of components may not equal total due to independent rounding.
 Sources: U.S. Energy Information Administration, Annual Energy Review 2011, Tables 1.3, 2.1b-2.1f, 10.3, and 10.4

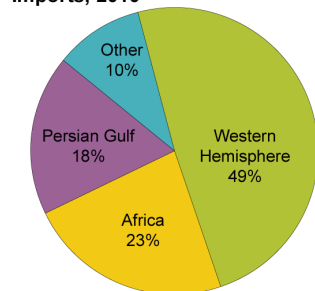
Additionally, only 4 percent of the transportation supply comes from renewable sources. The graph shows that 92 percent of the nation's coal supply goes to produce electricity, but coal accounts for only 46 percent of the total supply for electrical power generation. This graph further shows that most renewable energy goes to electrical power production or industrial applications.

You can find this and other Lawrence Livermore graphs at <https://flowcharts.llnl.gov/>.

About imported sources of energy

Energy independence is a common concern in this day and age. However, there are many misconceptions regarding our dependence on foreign sources of energy. Only 24 percent of total U.S. energy supply was imported in 2009. However, the U.S. imports roughly 60 percent of its petroleum supply on an annual basis.

Sources of U.S. Net Petroleum Imports, 2010



Source: U.S. Energy Information Administration, *Petroleum Supply Monthly* (February 2011), preliminary data.

It may surprise you to learn where our imported petroleum is coming from. In 2010, 49 percent of imported petroleum came from the Western Hemisphere. Canada is our top

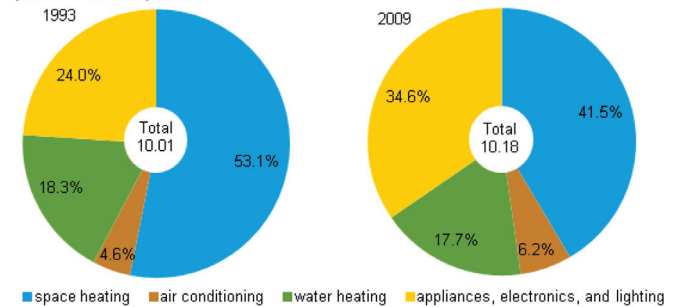
supplier of petroleum, but countries in Central and South America and the Caribbean Islands provide almost half of our total supply. Although Saudi Arabia is the second largest supplier of petroleum to the U.S., the total Persian Gulf region accounts for only 18 percent of the nation's total petroleum imports.

Visit <http://www.eia.gov/state/?sid=MO#tabs-1> to learn more about energy consumption in Missouri.

Energy use in homes

According to the U.S. Energy Information Administration, natural gas is the most common type of energy consumed in U.S. homes at 45 percent, and most of it is used for space heating. Electricity comes in second at 41 percent and is mostly used for lighting and appliances. Visit http://www.eia.gov/consumption/residential/reports/2009/state_briefs/pdf/MO.pdf for more information about household energy use in Missouri.

Energy consumption in homes by end uses quadrillion Btu and percent



Energy use in agriculture

Energy use varies by type of operation, so averages are less meaningful when considering agricultural energy uses. There are several common areas of energy consumption in agriculture, but fuel types used vary by operation. The following are categories of key areas of agricultural energy consumption:

- Tractor and field operations
- Irrigation systems
- Indoor and outdoor lighting
- Farm shop energy use
- Livestock building energy use
- Grain drying
- Livestock watering systems

The home energy consumption of most agricultural operations is also significant.

Why does this information matter to me?

Considering energy sources and uses can help inform any decisions about exploring energy alternatives. For example, if your goal is to reduce dependence on imported energy sources, produce your own or reduce your use of transportation fuels. If your objective is to reduce fossil fuel consumption, consider how you use fossil fuels. Do you consume more gas for transportation or natural gas to

Table 1. Possible sources of alternative energy.

Current energy use	Alternative energy source
Electricity	Wind turbine Photovoltaic panel Micro-hydro system Anaerobic digester
Hot water (Current source may be electric, gas or propane)	Solar thermal system Concentrating solar power using a parabolic trough Geothermal (desuperheater)
Heated air (Current source may be electric, gas, wood or propane)	Solar air collector Transpired solar collector Geothermal (ground-source heat pump) Biomass Passive solar design
Transportation fuel	Biofuel Renewable electricity for electric or hybrid vehicles

heat your home? Understanding your energy consumption habits informs any actions undertaken to reduce your energy consumption.

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