Energy Information Administration
Official Energy Statistics from the U.S. Government

Energy in Brief — What everyone should know about energy

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How can we compare or add up our energy consumption?

To compare or aggregate energy consumption across different energy sources like oil, natural gas, and electricity, we must use a common unit of measure. This is similar to calculating your food energy intake by adding up the calories in whatever you eat.

Energy sources are expressed in different units, but their energy content can be compared using British thermal units (Btu)

Conversion Table of Common Energy Sources to Btu

Energy Source	Physical Units and Btu Equivalents
Gasoline	1 gallon = 124,000 Btu
Diesel Fuel	1 gallon = 139,000 Btu
Heating Oil	1 gallon = 139,000 Btu
Electricity	1 kilowatthour (kWh) = 3,412 Btu (but 10,000 Btu to generate the electricity)
Natural Gas	1 cubic foot (ft3) = 1,028 Btu 1 cubic foot = 0.01 therms

In American households we use several kinds of energy. It's difficult to add up or compare the total energy we use because each energy source comes in a different unit: gasoline is in gallons, electricity is in kilowatthours, and natural gas is in cubic feet. One way to add and compare different energy sources is to convert them all to one common unit of measure based on their energy content.

Did You Know?

The average car in the United States uses 68.7 million Btu per year, which sounds like a big number for just one car. But total energy use for cars and light duty vehicles in 2007 was about 16 quadrillion Btu, which is 16 with 15 zeros added on to it. That was equivalent to about 18% of total U.S. energy consumption in 2007.

The Energy Information Administration uses the British thermal unit (Btu) as its common energy unit.

A Btu is approximately equal to the amount of energy that comes from burning one wooden kitchen match.[1] A Btu isn't an everyday term to most people, but you might see it on your energy bill or in a newspaper article.

Because a Btu is such a small unit of energy, there are tens of thousands of Btu even in one gallon of gasoline. The table at left shows how to convert different energy sources into Btu units.

Btus are to energy as calories are to food.

You probably already have experienced converting from physical units to energy units. When calculating the total "amount" of food you eat, you might look up how many calories are in each item and then add up the calories. You can't add a hamburger and a soft drink without the conversion. So you can see that calories are a common unit for measuring the energy content of food.

Let's say you consume a typical fast-food meal of:

Hamburger	1/4 pound	300 calories
French fries	50 fries	400 calories
Soft drink	16 ounce	200 calories
Total		900 calories

If you ate the items listed, you would have consumed 900 calories. Just as calories are a useful measure to help you compare different food items, Btus are useful for making energy comparisons.

If you want to calculate the total amount of energy you use, the process is similar. You can take the gallons of gasoline, the heating fuel amounts, and the electricity to run your home appliances and convert them all to Btu equivalents, using the conversion rates in the table. Then you can add up the different pieces to get a total amount in common units.

One wrinkle is that electricity is an energy carrier, or secondary fuel source, rather than a primary fuel. There are significant losses in the conversion of primary fuels to electricity.[2] For example, in 2007 the average coal-fired plant used 10,000 Btu of coal to generate one kilowatt hour (=3,412 Btu) of electricity. If your focus is on primary energy use (such as coal, natural gas, or oil), you should start your calculation with the energy used to make electricity instead of the energy in the electricity itself.

Most people are interested in saving energy these days, and you can use Btu equivalents to help you compare the different levels of savings resulting from taking different actions or making lifestyle changes. Which do you think uses more energy in a year: gasoline in the average car or electricity in the average home? It's easy to find the answer if you make some assumptions about what is average and then convert the numbers to Btu. See the answers below.

Total energy used by one average U.S. car per year…

Driven 12,400 miles per year at 22.4 miles per gallon equals 554 gallons of gasoline at 124,000 Btu per gallon

= 68.7 million Btu

Total electricity used by one average U.S. home per year for appliances, lighting, etc.…

Total U.S. residential electricity used is 1,275 billion kWh divided by 111.1 million homes at 3,412 Btu per kWh

= 39.2 million Btu

Total primary energy used to provide the electricity used by one average U.S. home per year…

Total energy input to electricity production is 40.5 quadrillion Btu times the residential share of electricity use of 37% divided by 111.1 million homes

= 134.9 million Btu

It's interesting to see in these comparisons that residential use of energy for electricity appears to be lower than that for an average car when you use the consumption Btu value of 3,412 Btu per kWh for electricity. But if you count all the primary energy used to generate the electricity, average residential use of energy for electricity is actually much higher than it is for a car.

Here's another way to compare energy use. Suppose you hear about a new energy efficiency plan that will save 1,000 trillion Btu per year, which is about 1% of total U.S. annual energy use. A trillion of anything is a big number to visualize. Sometimes it's easier to appreciate how much energy that is by thinking in terms of cars or houses, just like it's easier to think of calories as hamburgers and fries, not the energy units themselves.

You could divide the energy used by one car (68.7 million Btu) into 1,000 trillion Btu to find that the energy savings in the same plan shown above is equal to about 14.6 million cars taken off the roads. These averages give you a way to envision and understand the magnitude of the energy issues and solutions being considering for our energy future.

Learn More

- Energy Conversion Calculators
- Converting Energy Units 101
- Tables to Convert Energy or CO2 to Familiar Equivalents, Arthur H. Rosenfeld and Satish Kumar, Lawrence Berkeley National Laboratory, May 2001
- "Peanut Power" – An Experiment in Energy (California Energy Commission)

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[1]Technically, one Btu is the amount of heat needed to raise the temperature of one pound of water by one degree Fahrenheit.
[2]Some electricity is also lost in moving it along the power lines to customers.