

New Hampshire Energy Facts 2006: Definitions and Technical Notes

- **Gross energy inputs** represents energy at its point of first use. It is all the energy that was put into all activities and processes in the State, including generating electricity for export. Examples: #2 oil burned to heat a house; natural gas burned to generate electricity. The technical term for energy used in these ways is “primary energy”. This term is used by the US Department of Energy’s (DOE) Energy Information Administration (EIA). We use “gross energy use” in New Hampshire Energy Facts for convenience. Gross energy use has more economic and environmental implications than *net* energy use (see below).
- **“Input” vs “Use”** “Input” appears in various places in New Hampshire Energy Facts where “use” might appear to be equally valid. New Hampshire Energy Facts makes a distinction, however, in an effort to separate energy “invested” (primary energy) to make a business or the state’s economy function, as opposed to the actual amount of energy purchased and “used” by the end user. In some instances, such as the purchase of heating oil, the two - “investment” and end use – are the same. The main need for distinction derives from the fact that energy “invested” to generate electricity is not an end use: Some of the energy, such as heat from burning coal, emerges as the Electric Power sector’s “product”, electricity, the end use of which (as “secondary” energy) will occur elsewhere. Unless the distinction is made, the energy in electricity would be counted twice, once as “investment” and again as end-use product.

In the case of heating oil cited above, its “investment” use - to heat a commercial office, for example - is also its end use. There is no “secondary” use here, because the energy in the oil was not converted to any other energy form before being used as heat.

Viewing the State as a whole, the term “input” is valid for a starting point, from which other derivations, analyses and comparisons can be made. In the case of the Electric Power sector, the initial energy is definitely an “input” as opposed to an end “use” of the energy.

- **LFG** is landfill gas, produced by decomposing organic matter in the buried rubbish (Municipal Solid Waste; see below). A given volume of LFG has approximately 50% as much energy as an equal volume of natural gas.
- **“Losses” and Allocation** Most of the energy from burning fuel or splitting atoms at an electricity generation facility becomes heat, not electricity. The “losses” occur:
 - a) at the power plant, and
 - b) in transmitting electricity from the generator over power lines to its point of end use.

US DOE estimates that nationwide this “lost” energy averages 69% of the energy that was put into generation and transmission. Thus, electricity at end use point represents, on average, about 31% of the primary energy that was put into the generation process. The energy “lost” while transmitting electricity over power lines escapes as heat and other forms of radiant energy, and can be heard as “static” on AM radio near high-voltage electricity transmission lines.

EIA allocates these “losses” to the economy sectors in proportion to their metered electricity use. While the logic of this might not be readily apparent, it makes sense in that the “losses” are a necessary consequence of electricity demand, which must be met by generation. Thus, each sector is indirectly responsible for some portion of the generators’ costs to produce the electricity. As with other businesses, the generators pass on their production costs to end users as part of the final “product” purchase cost.

- **MSW** is municipal solid waste. The US Department of Energy (DOE) has determined that the portion of MSW derived from plant and animal remains (“biogenic”), is renewable. DOE’s estimate of renewable energy in MSW for 2005 (latest year available; presumably, EIA estimates this to be a constant ratio in subsequent years) is 56%. Thus, Charts 1 and 2 in NH Energy Snapshot divide the 2.8 TBtu of MSW consumed in 2006 into 1.6 TBtu renewable “Bio MSW” (56% of 2.8 TBtu) and 1.2 TBtu non-biogenic “Non-Bio MSW” and therefore non-renewable (44% of 2.8 TBtu). The non-biogenic portion includes synthetic fabrics, plastics and other materials derived ultimately from petroleum, coal and natural gas.

- **Net energy use** is the amount of energy at end use *in New Hampshire*. Net energy use is less than gross energy inputs because New Hampshire exports some energy as electricity. Net energy use represents the energy necessary to conduct all activities *within the State*, and this amount is the value given by EIA as a state's total energy consumption. This is the amount of energy that would have to be provided if we were interested in meeting only in-State energy demands. It is also the amount of energy that the New Hampshire 25 x '25 Initiative is using to calculate the amount of renewable energy needed to meet the 25% of the State's energy demand 2025; see <http://www.nh.gov/governor/news/2006/082906energy.htm> .

When calculating net energy use, OEP assumes that energy sources such as coal, nuclear and natural gas contribute to electricity consumed in-State and to electricity exported in the same proportion as their total contributions to electricity generation in New Hampshire. For example, if coal contributed 20.2%, nuclear power contributed 44.4%, and natural gas contributed 19.5% of the energy inputs to the State's Electric Power sector in 2006, then OEP assumes these energy sources contributed 20.2%, 44.4% and 19.5% respectively to the electricity consumed in-State, and to the electricity exported from New Hampshire. In reality, more than 44.4% of the exported electricity may have been produced from nuclear energy, for example, given Seabrook Station's proximity to the Boston area's large electricity demand. However, OEP has no way to sort out the flows of electricity from different energy sources within the regional transmission grid. And, the pattern of how much electricity from what sources goes where is dependent on variables such as market conditions as well as on generation facility operational status, for example.

- **Ozone and Ethanol:** **Ozone** is an eye and lung irritant, and contributes to the formation of "smog". Both MtBE and **ethanol** add oxygen to reformulated gasoline (RFG), helping to reduce the amount of ozone emissions from car exhaust. However, MtBE was banned in the State because of groundwater pollution from unintended gasoline releases. Ethanol is both renewable and biodegradable; therefore, it poses a much lower environmental risk than did MtBE. EIA did not estimate ethanol consumption in 2006; however, OEP devised a methodology to approximate the energy contribution of ethanol (2.8TBtu) for 2006. Since 2006, RFG-ethanol has become more widely available in the State, leading to a growing renewable energy contribution by the Transportation sector.
- **TBtu** (Trillion British thermal units) are units of energy. Gallons, tons, cords and cubic feet are units of volume and weight. Because the amounts of energy released from a gallon of gasoline, a gallon of heating oil, a ton of coal, a gallon of propane, a cord of wood or a therm of natural gas are not comparable, it would be difficult to analyze how much energy was provided by what sources. Converting all the fuel volumes and weights to a common energy unit, TBtu, simplifies analysis and facilitates energy planning. For a sense of scale: There are approximately
 - 138,690 Btus per gallon of #2 fuel oil
 - 122,600 Btus per gallon of conventional, regular grade gasoline
 - 3,412,140 Btus per kiloWatt hour (kWh) of electricity.

So, one TBtu is the amount of energy in

- 7,210,325 gallons of #2 fuel oil
- 8,156,600 gallons of conventional, regular grade gasoline
- 293 megaWatt-hours (MWh) of Electricity. 1 MWh = 1,000 kiloWatt-hours = 1 million Watt-hours.

One British thermal Unit (**Btu**) is approximately the heat released by burning one kitchen match.

See also http://tonto.eia.doe.gov/energy_in_brief/comparing_energy_consumption.cfm .