8.41A LAWS OF ENERGY

Law of Conservation of Energy, also known as the First Law of Thermodynamics, says that energy cannot be created or destroyed, but it can be changed in form.

This does not apply to nuclear reactions because they convert mass into energy, but the total amount of matter and energy remains constant.

So why do we need to worry about shortages of resources?

The answer comes from the Second Law of Thermodynamics. It says that when energy is changed from one form to another some of the useful energy is always degraded to lower quality energy.

It takes energy to produce energy. Net energy yield is the amount of usable energy remaining after the production cost is subtracted.

The higher the ratio between input cost and output cost, the greater the net energy yield.

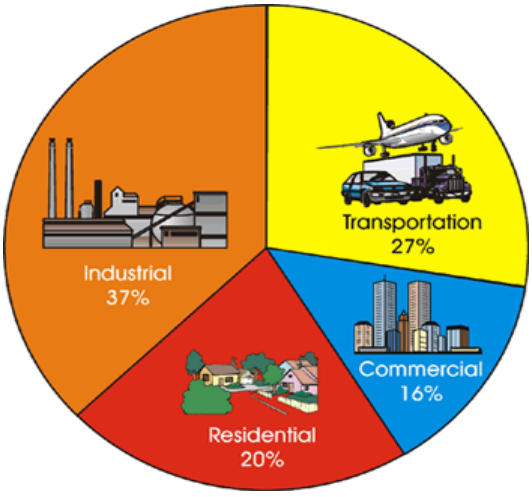
For example, if it cost $8 to produce one unit of energy, but that yields $10 worth of high quality energy, the net energy yield is a ratio of 10/8 = 1.2 net yield.

8.41B

Efficiency is the percentage of total energy input that does the useful work.

Energy-efficient lighting and appliances may cost more to purchase but will save more money in lower energy costs.

The most inefficient and expensive way to heat is with electricity, and yet that is the most common way in the U.S.



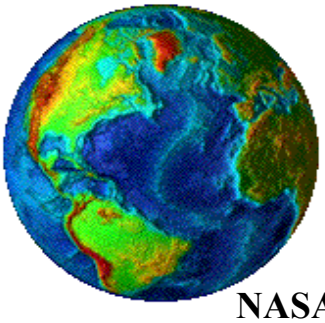
This is how energy usage is broken down by categories.

- **37% Industrial**
- **27% Transportation**
- **20% Residential**
- **16% Commercial**

There are two basic principles of sustainability that apply to energy:

1. Use renewable energy

2. Recycle nutrients and other resources efficiently and return the resources in good conditions so they can be reused.



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The idea is not to convert a renewable resource, such as water, into such a polluted state that it becomes useless.

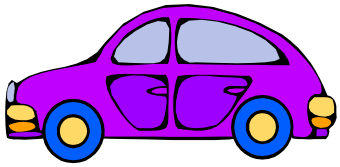
8.41C Other Ways to save energy (and money)

1. Cogeneration uses two useful forms of energy from the same fuel source.

2. Negawatt revolution - reduce the demand on utilities by giving customers rebates for buying efficient lights and appliances.

3. Provide low interest loans to industry and individuals for repairing and upgrading equipment.

4. The most important way to save energy is to increase the fuel efficiency of motor vehicles.



5. Super-insulated buildings, such as straw-bale houses, save energy and money.

6. Look for energy efficient ways to heat houses and water, plug heat and AC leaks, and use thermal pane windows.