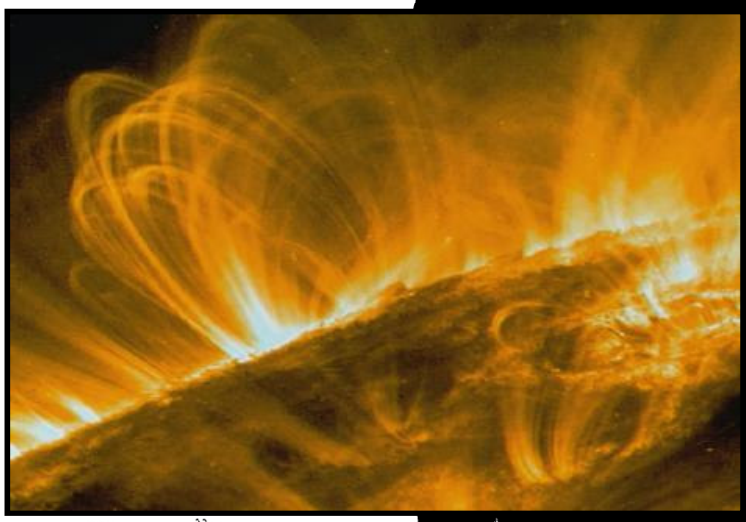
Introduction to Energy

REIC ALTERNATIVE ENERGY PROGRAM

Dossin

- Energy- What is It?
- Alternative Vs. Renewable Energy
- Energy- Two Main Forms
- Conservation of Energy
- Energy Efficiency
- Measuring Energy
- Using Energy



RESOURCES

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Energy

What is it?

Energy does things for us. It moves cars along the road and boats on the water. It bakes cookies in the oven and keeps icrecream frozen in the freezer. It plays our favorite i-tunes and powers our Nintendo Wii. Energy helps our bodies grow and our minds think. Energy is a changing, doing, moving, working thing.

Energy is defined as the ability to produce change or do work, and that work can be divided into several main tasks we easily recognize:

. Energy produces light.
. Energy produces heat.
. Energy produces motion.
. Energy produces sound.
. Energy produces growth.
. Energy powers technology

Energy

Energy is used in many ways around us, but what is the source? It comes from many sources which can be organized into three groups.

Renewable Energy Resources

Resources that can be replaced when needed. For example, wood, it can harvested and regenerated in a relatively short period of time

Nonrenewable Energy Resources

Resources that cannot be replaced once used. For example fossil fuels such as coal because it takes hundreds of thousands of years to produce

Inexhaustible Energy Resources

Resources that will never run out… at least for the next several million years. The sun and wind would be examples of this resource.

Alternative Vs. Renewable Energy

People tend to use these terms interchangeably so what is the difference?

Alternative Energy refers to any source of usable energy intended to replace typical fuel sources (such as fossil fuels). *

Renewable Energy, on the other hand, is energy generated from natural resources—such as sunlight, wind, rain, tides and geothermal heat—which can be naturally replenished.




** Typically, alternative energy fuels sources excludes nuclear energy because even though it doesn't burn fossil fuels, it creates nuclear waste… but we are still going to explore it later in the class.*

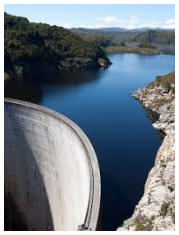
Two Main Forms of Energy

There are many forms of energy, but they all fall into two categories– potential or kinetic.

POTENTIAL ENERGY

Potential Energy is energy waiting to happen.

A gallon of gas sitting in a gas can is only potential energy until it is put in a burned *(then it becomes a tremendous amount of mechanical power!)*



The water sitting behind a dam is only potential energy until the intake valves are opened (*then the water spins the turbine which would then turn into kinetic energy)*

KINETIC ENERGY

Kinetic Energy is energy in motion. The water passing through and spinning a turbine or wind spinning a wind turbine.

Two Main Forms of Energy

There are many forms of energy, but they all fall into two categories– potential or kinetic.

POTENTIAL ENERGY

Potential Energy is stored energy and the energy of position, or gravitational energy. There are several forms of potential energy, including:

Chemical Energy

Stored Mechanical Energy

Nuclear Energy

Gravitational Energy

KINETIC ENERGY

Kinetic Energy is motion—the motion of waves, electrons, atoms, molecules, substances, and objects.

Electrical Energy

Radiant Energy

Thermal Energy

Motion Energy

Sound Energy

Stored energy and the energy of position (gravitational).

Potential Energy

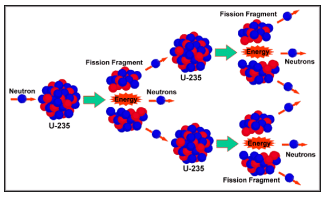
Chemical Energy

Energy stored in the bonds of atoms and molecules. Biomass, petroleum, natural gas, propane and coal are examples.

Stored Mechanical Energy

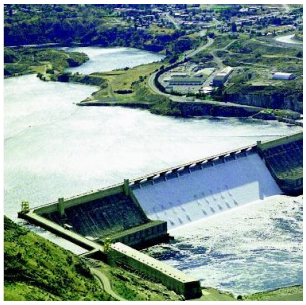
Energy stored in objects by the application of force. Compressed springs and stretched rubber bands are examples.

Nuclear Energy



Energy stored in the nucleus of an atom – the energy that holds the nucleus together. The nucleus of a uranium atom is an example.

Gravitational Energy



Energy of place or position. Water in a reservoir behind a hydropower dam is an example.

Motion: the motion of waves, electrons, atoms, molecules and substances.

Kinetic Energy

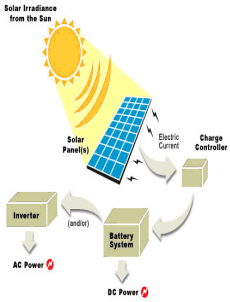
Electrical Energy

Energy from the movement of electrons. Lightning and electricity are examples.

Motion Energy

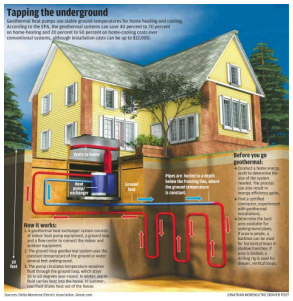
The movement of a substance from one placed to another. Wind and hydropower are examples.

Radiant Energy



Electromagnetic energy that travels in transverse waves. Solar energy is an example.

Thermal Energy



The internal energy in substances – the vibration or movement of atoms and molecules in substances. Geothermal is an example.

Sound Energy

The movement of energy through substances in longitudinal waves.

Conservation of Energy

Conservation of Energy

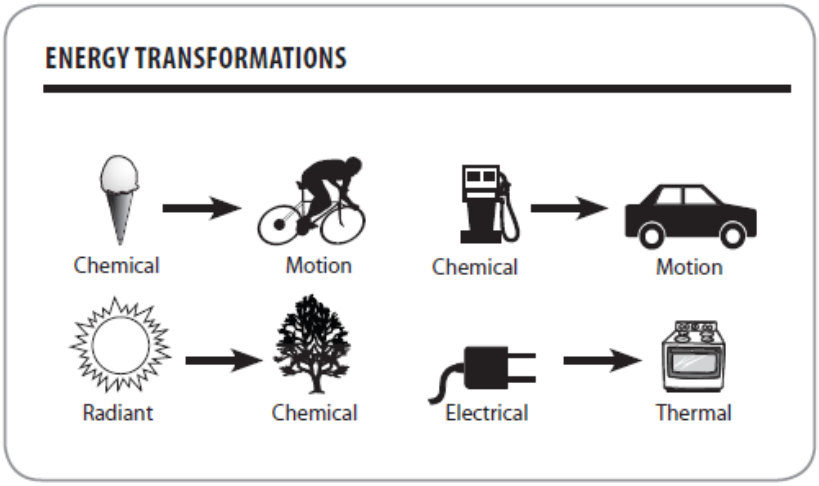
Your parents probably have told you to conserve energy by saying something like, “Turn off the lights!”.

But to scientists, conservation of energy means something quite different. The **law of conservation of energy says energy is neither created nor destroyed.**

When we use energy, we do not use it up -- **we just change its form**. That’s really what we mean when we say we are using energy. We change one form of energy into another. A car engine burns gasoline, converting the chemical energy in the gasoline into mechanical energy that makes the car move. Old-fashioned windmills changed the kinetic energy of the wind into mechanical energy to grind grain. Solar cells change radiant energy into electrical energy

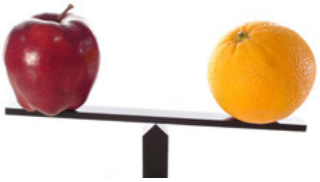
***Energy can change form, but the total quantity of energy in the universe remains the same. The only exception to this law is when a small amount of matter is converted into energy during nuclear fusion and fission.*

Conservation of Energy



The law of conservation of energy says energy is neither created nor destroyed. When we use energy, we do not use it up -- **we just change its form**.

Measuring Energy



"You can't compare apples and oranges," the old saying goes. That holds true for energy sources. We buy gasoline in gallons, wood in cords, and natural gas in cubic feet. How can we compare them? With British thermal units (Btu's), the most basic unit of heat energy. The energy contained in gasoline, wood, or other energy sources can be measured by the amount of heat in Btu's it can produce.

BTU RATING

Measuring Energy

One Btu is the amount of thermal energy needed to raise the temperature of one pound of water one degree Fahrenheit. A single Btu is quite small. A wooden kitchen match, if allowed to burn completely, would give off about one Btu of energy.

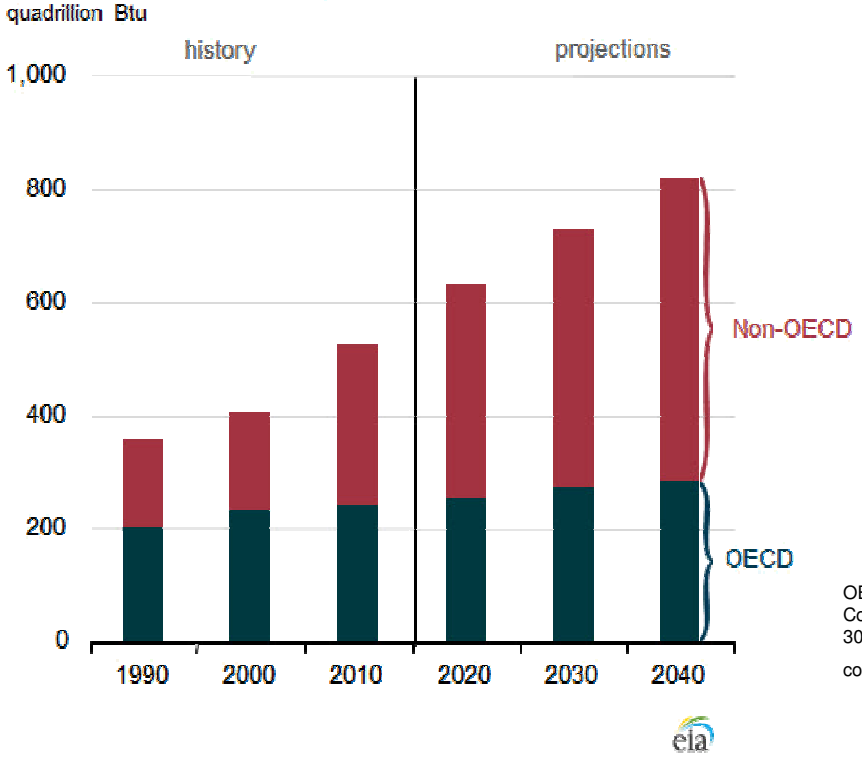
1 match = 1 Btu of energy.

1 oz of gasoline = 1,000 Btu of energy.

Every day the average American uses about 896,000 Btu's.
(Equal to about 7 gallons of gas a day)

Measuring Energy

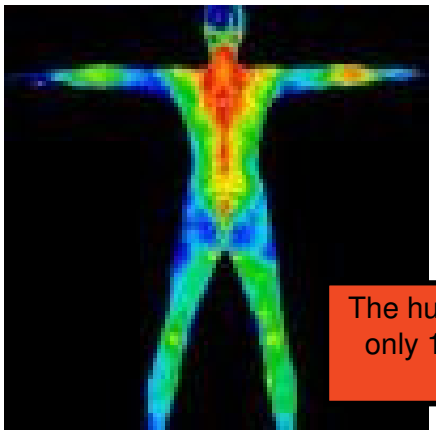
Figure 1. World energy consumption, 1990-2040



OECD stands for Organization for Economic Co-operation and Development. It consist of 30 countries that are high-income, and considered developed.

Energy Efficiency

Energy efficiency is how much useful energy you can get out of a system. In theory, a 100 percent energy-efficient machine would change all of the energy put in it into useful work. Converting one form of energy into another form always involves a loss of usable energy, usually in the form of heat



Automobile gas engines are only about 30% efficient.

The human body overall efficiency is only 15%-20% for converting food into useful energy.

An incandescent light bulb converts only 10% of the electrical energy into light and the rest (90%) is converted into thermal energy (heat). That's why a light bulb is so hot to the touch.

Energy efficiency is how much useful energy you can get out of a system

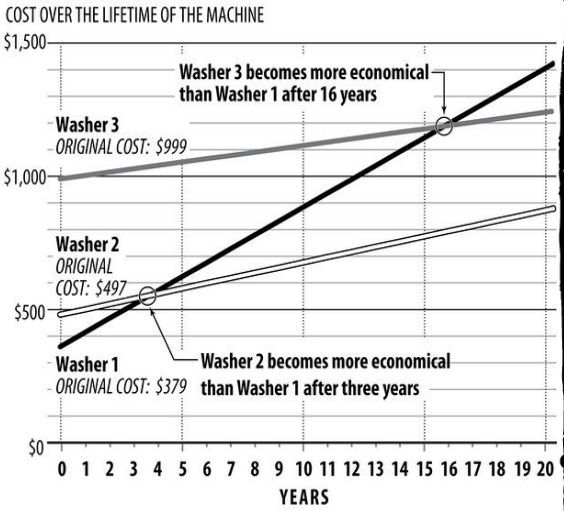
Energy Efficiency

Washing Machine Payback Period

Spending a little bit more money on an energy efficient appliance could save you several hundred dollars over the lifetime of the product. The payback period could be shorter than you think!

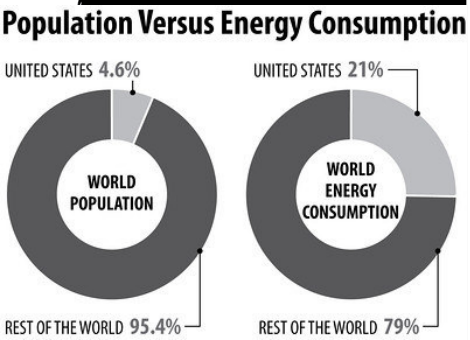
	WASHER 1	WASHER 2	WASHER 3
Original Cost	$379	$497	$999
Estimated Anual Electricity Use	427 kWh	160 kWh	102 kWh
Price of Electricty (per kWh)	$0.12	$0.12	$0.12
Operating Cost per Year	$51.24	$19.20	$12.24

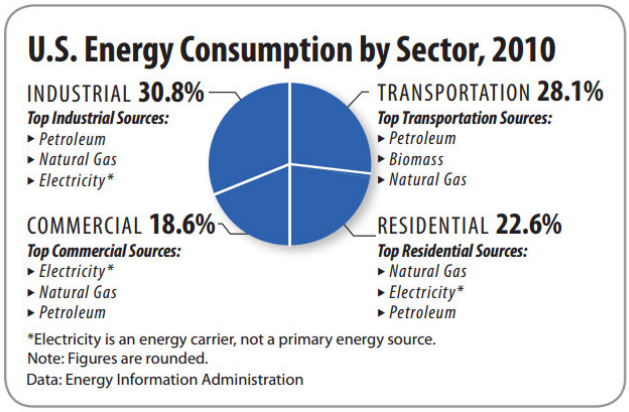
Data: NEED Analysis of washing machine EnergyGuide labels



Using Energy

Every day, the average American uses about as much energy as is stored in seven gallons of gasoline. That's every person, every day. Over a course of one year, the sum of this energy is equal to about 2,500 gallons of oil per person**. <u>This use of energy is called energy consumption.</u>**



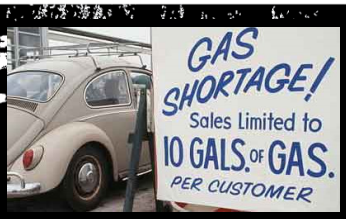


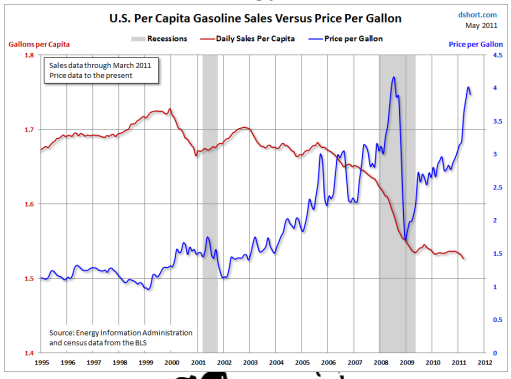
The U.S. Department of Energy uses three categories to classify energy **users—residential /commercial, industrial,** and **transportation.** These categories are called the **sectors of the economy**

Energy Use and Price

Americans tend to use less energy when energy prices are high and we have the statistics to prove it. However, most reductions in energy consumption in recent years are the result of improved technologies in industry, vehicles, and appliances. Without these energy conservation and efficiency technologies, we would be using much more energy today.

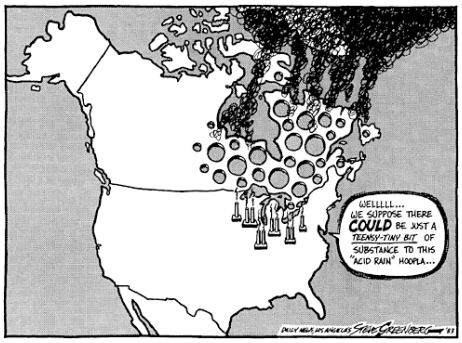
Energy efficiency technologies have made a huge impact on overall consumption since the energy crisis of 1973.

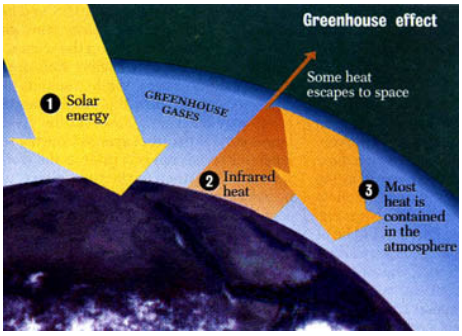




Energy and the Environment

The consumption of fossil fuels leads to environmental problems such as acid rain and the greenhouse effect. **Acid rain** occurs when by-products of combustion, such as carbon dioxide (CO2), nitrous oxides (Nox) and sulfur oxides (Sox) condense in the atmosphere, only to come back down to earth with rain. Canada has been at frequent odds with the US from acid rain that is created in the US but drifts over to Canada.





The Greenhouse effect is said to occur because of gases produced by the burning of fossil fuels as well. The layer of greenhouse gases surrounding our planet isn't allowing the heat from the sun to escape the earth's atmosphere as easily as it once did. Many say this is contributing to the phenomenon known as **global warming**. The effects of global warming is not widely understood, but it could cause melting of icecaps, alter shorelines, and change weather patterns, which could alter agricultural productivity.