



Al-Farabi Kazakh National University

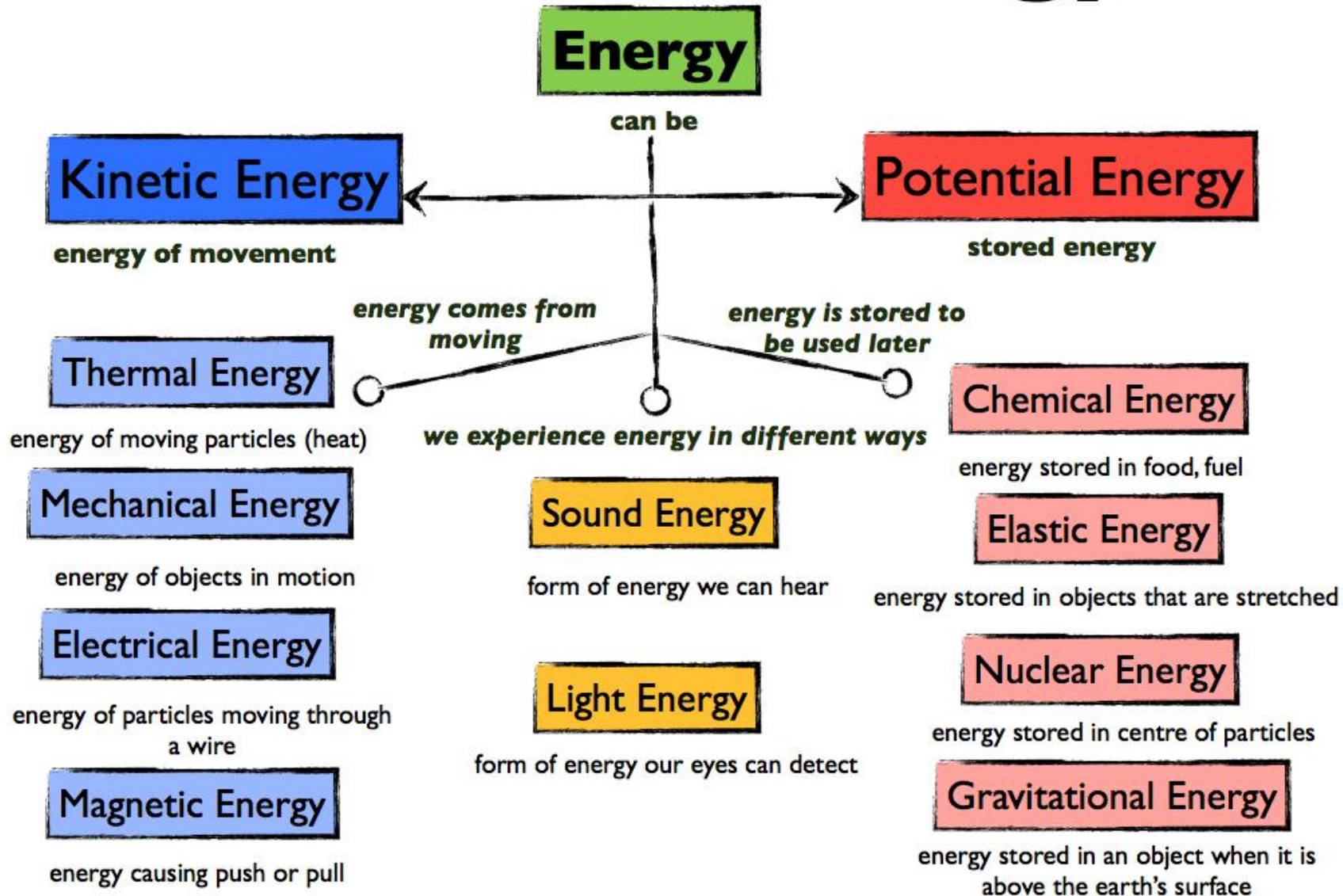


Applied Problems of Mechanics and Energetics

WEEK 1. Introduction

Lecturer: Berdenova B.

Forms of Energy





Thermal (Heat) Energy

- Energy that is associated with the random motion and arrangement of the particles of a material.
- The more the particles are moving, the higher the thermal energy.
- Examples: radiation, stoves, matches


Chemical Energy

- Energy associated with atoms, ions, and molecules and the bonds that they form.
- Chemical energy will change into another type of energy when a chemical reaction occurs.
- Examples: Breathing, photosynthesis, digestion etc

Light Energy

- Is energy associated with the electromagnetic waves.
- Largest source is the sun
- Examples: Plants use it to make food and scientists use it to create lasers

Sound Energy

- Energy that is associated with longitudinal mechanical waves.
 - Travels from the source in the form of waves.
 - Examples: Radio, sirens, alarm clock, ipod, etc.
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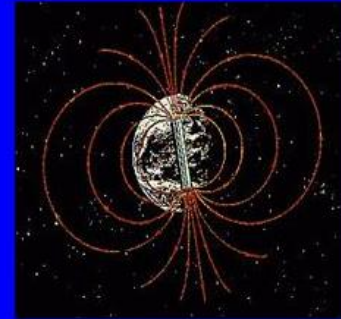
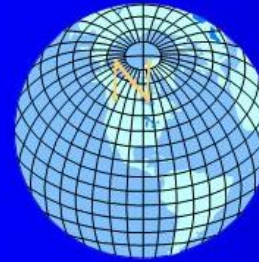
Electrical Energy

- Is associated with current and voltage.
- Examples: Plugging into an outlet, power plants, anything that uses electricity involves electrical energy.

Mechanical Energy

- Is the energy due to the position of something or the movement
- It can be in the form of **potential energy** , **kinetic energy** or a sum of the two put together.
- Examples: walking, running, moving vehicles, moving turbines etc.

What is Magnetic Energy?



- **Magnetic Energy**, once an ancient mystery, is now recognized as the strongest natural force in the universe.
- **Our Earth** is a giant magnet and all life developed under the influence of the earth's magnetic field.
- **Magnetic Energy** permeates everything in our universe, from the vast reaches of outer space to each microscopic cell in our body.

Nuclear energy:

- Changes that occur in the structure of the nuclei of atoms are called nuclear reactions. Energy created in a nuclear reaction is called nuclear energy, or atomic energy.
- Nuclear energy is produced naturally and in man-made operations under human control.

Naturally: Some nuclear energy is produced naturally. For example, the Sun and other stars make heat and light by nuclear reactions.

Man-Made: Nuclear energy can be man-made too. Machines called nuclear reactors, nuclear power plants provide electricity for many cities. Man-made nuclear reactions also occur in the explosion of **atomic and**

Energy transformation

- Energy transformation, also known as energy conversion, is **the process of changing energy from one form to another.**

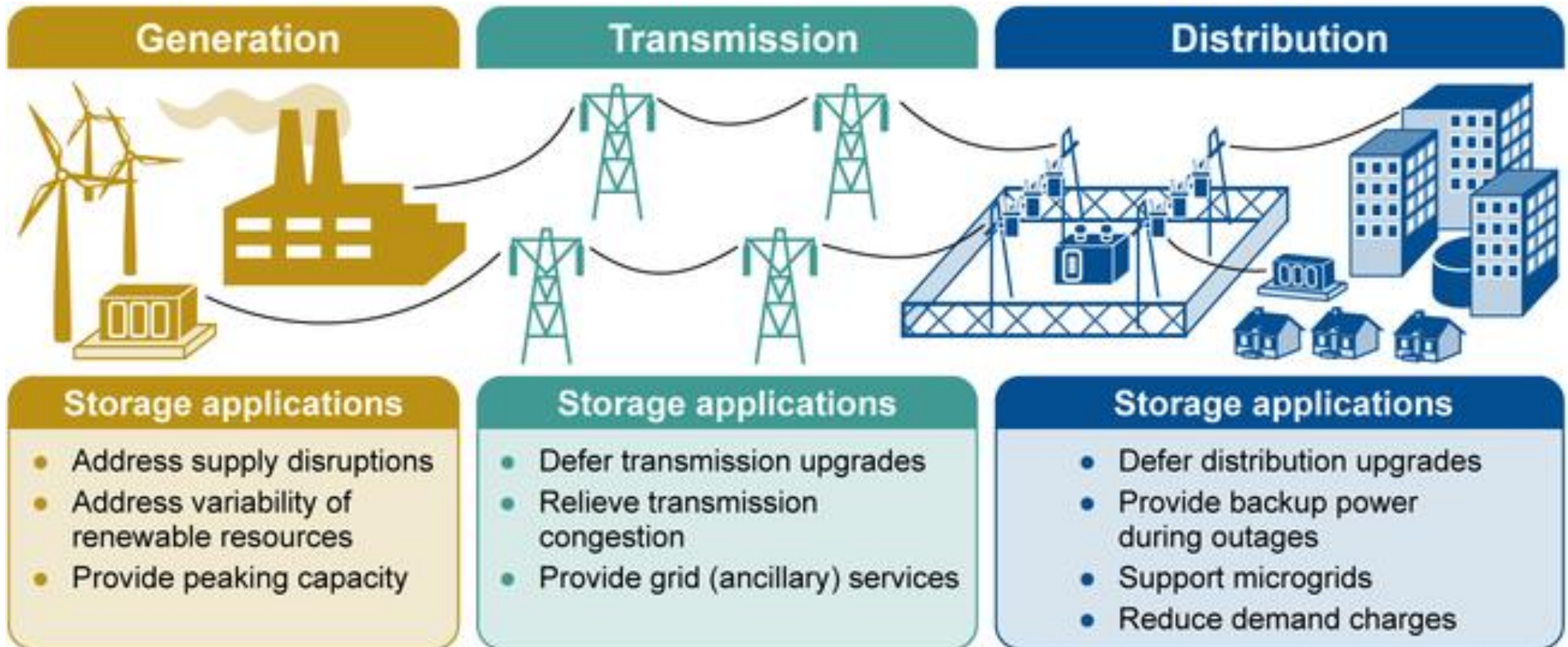
Examples of Transforming Light (Radiant) Energy

- Plants use light (radiant) energy to make chemical energy. [remember Photosynthesis]
- The chemical energy in food is then changed into another kind of chemical energy that your body can use. [remember cellular respiration]
- Your body then uses that energy to give you mechanical energy [kinetic and potential energy]
- Also, the light (radiant) energy converted into chemical energy in say a tree can then be changed into thermal energy when you burn the tree's wood.

Examples of Transforming Chemical Energy

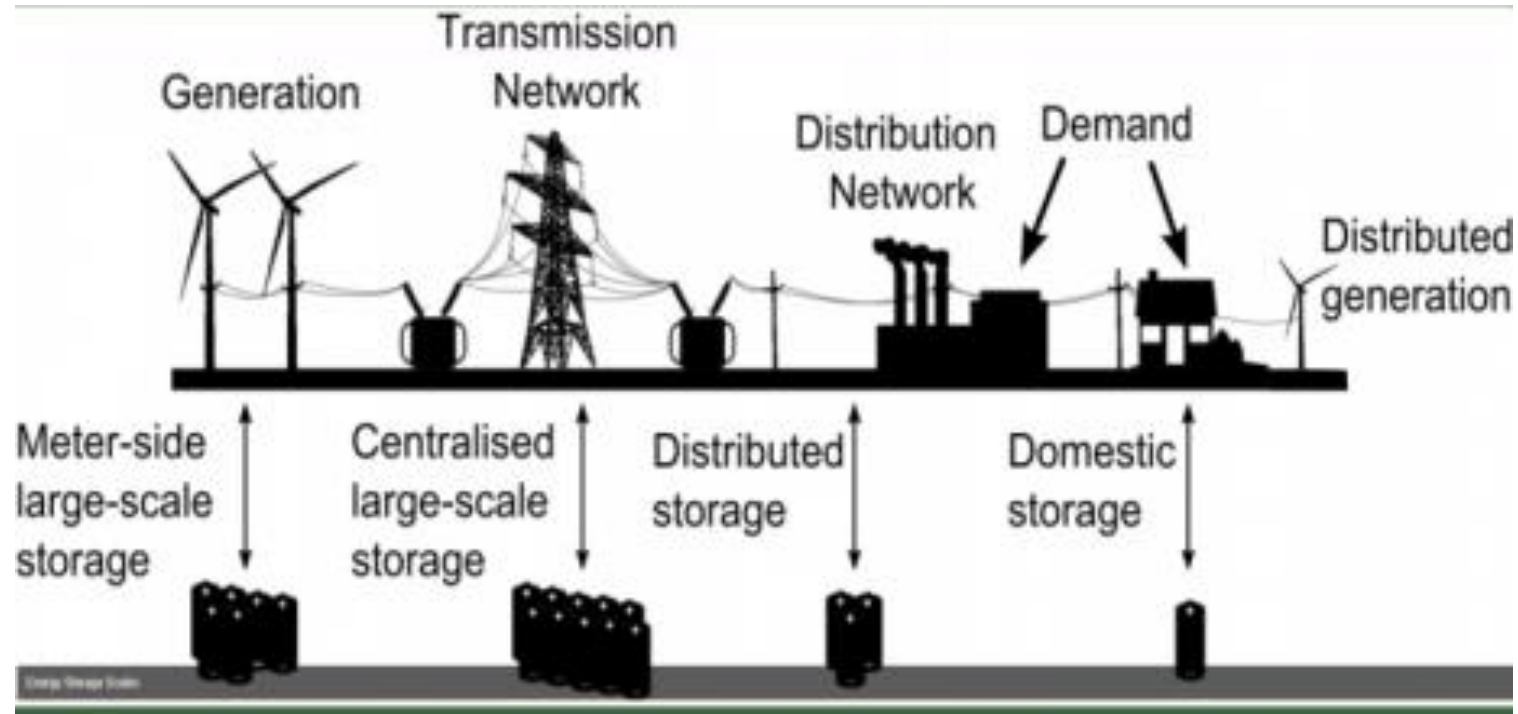
- Inside your body, chemical energy is transformed into mechanical energy (kinetic energy)
- Batteries, wood, matches, fireworks, fossil fuels, etc. are forms of chemical energy that are converted into other forms once used or burned
- The matter contained in living organisms has chemical energy. When organisms die, this chemical energy is broken down and converted to other chemical compounds. In this process, thermal energy is released.

Generation Transmission Consumption



Source: GAO illustration based on studies and documents. | GAO-18-402

Storage on the grid

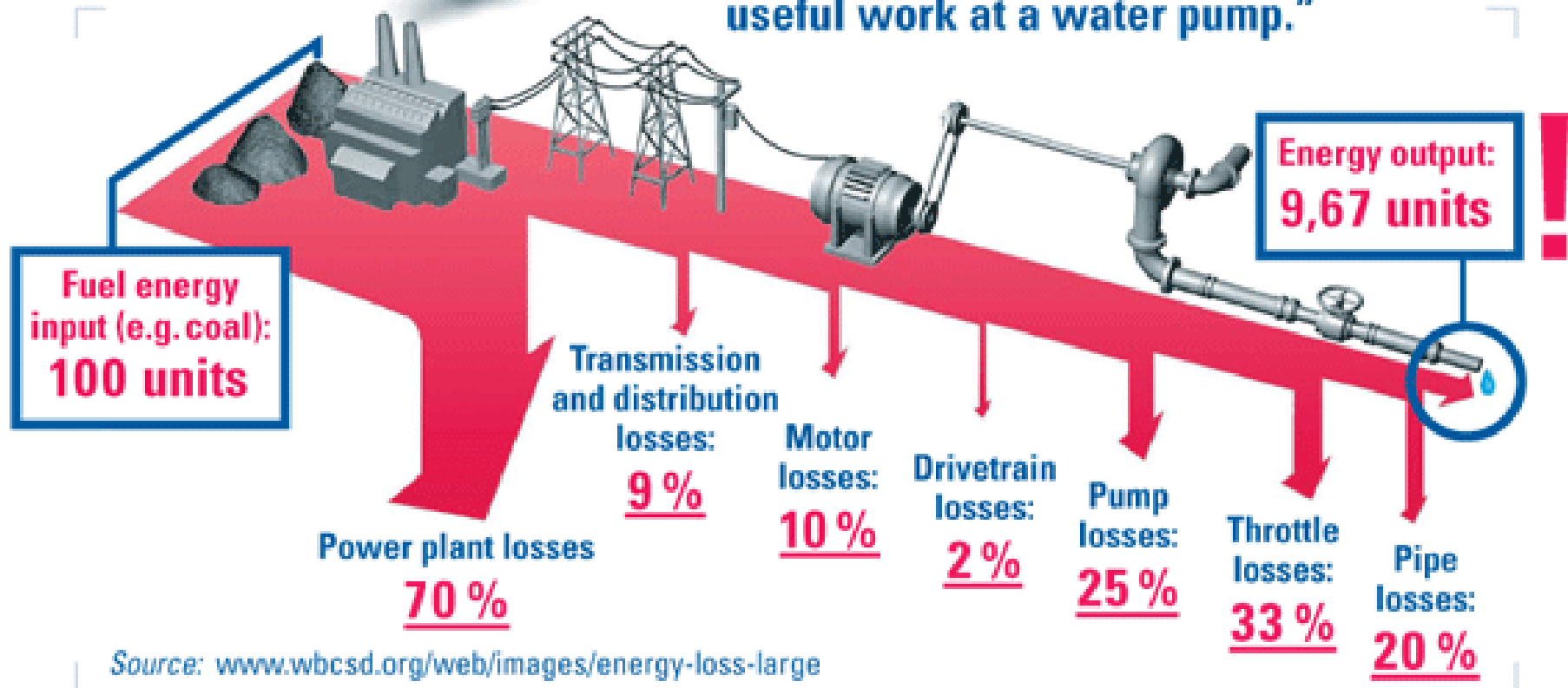


Examples of energy storage units

Energy losses

When energy is transformed from one form to another, or moved from one place to another, or from one system to another there is energy loss. This means that when energy is converted to a different form, some of the input energy is turned into a highly disordered form of energy, like heat.

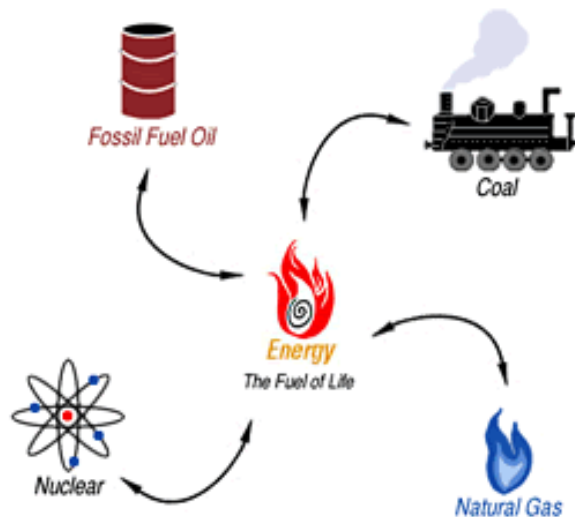
> **Daily Energy Losses** “More than **90 %** of energy extracted from the ground is wasted before it becomes useful work at a water pump.”



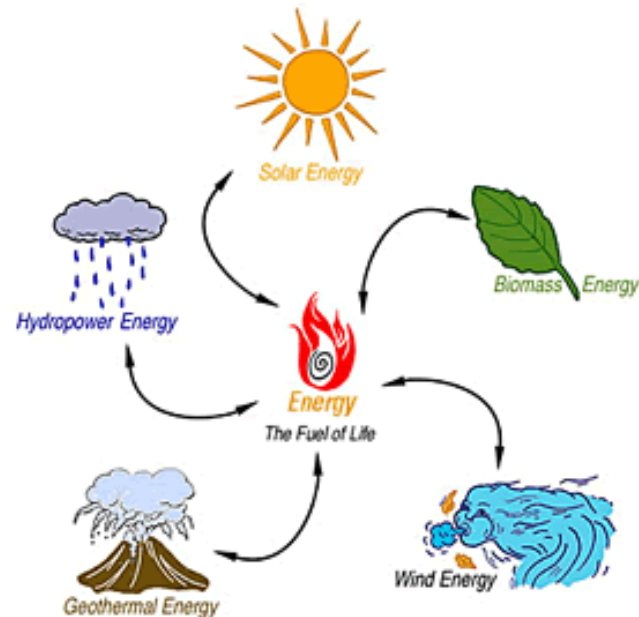
Energy sources

- Renewable energy, often referred to as clean energy, **comes from natural sources or processes that are constantly replenished.**
- A non-renewable resource is a natural resource that cannot be readily replaced by natural means at a pace quick enough to keep up with consumption. An example is carbon-based fossil fuels. The original organic matter, with the aid of heat and pressure, becomes a fuel such as oil or gas

Non-Renewable Energy

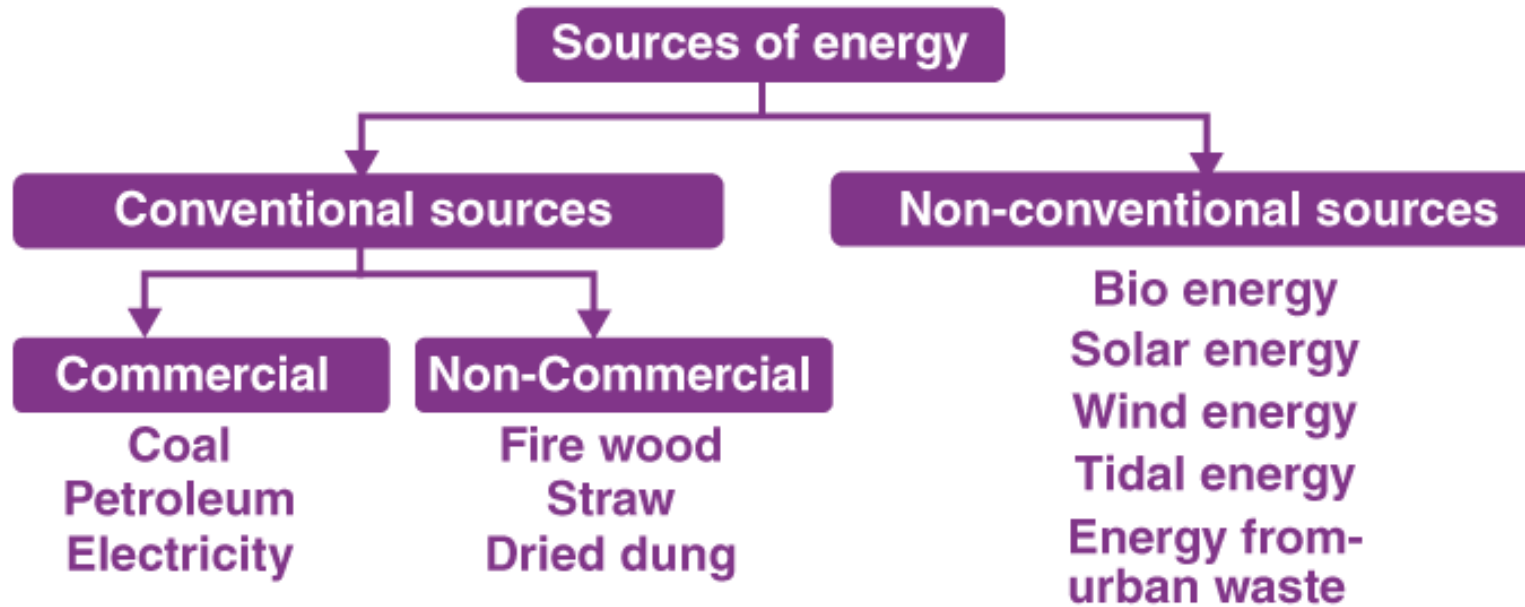


Renewable Energy

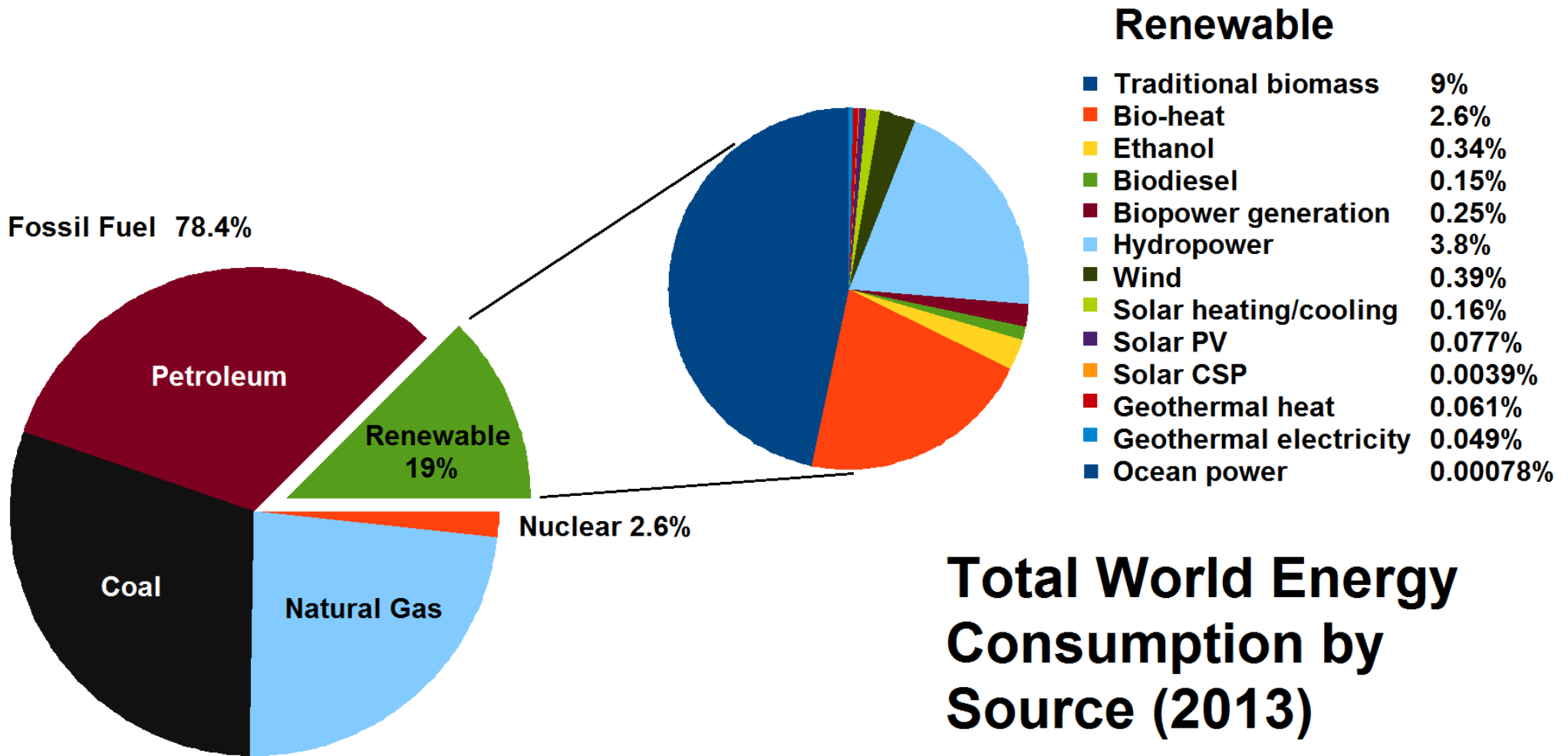


Conventional and unconventional energy sources

Conventional sources of energy are the ones that are commonly used, and generally non-renewable sources of energy, which are being used since a long time. Examples of conventional sources of energy include **oil, natural gas, coal, biomass, and electricity.**



World Energy Consumption 2013



World Energy Consumption over time

