

ENE 101 – Introduction to Energy Engineering

WEEK 3

Energy resources can be classified into two groups.

1. Non-renewable Energies:

- **Non-renewable energy resources** will eventually run out – once used they cannot be used again.

Examples: coal, oil, gas, nuclear energy

- **The Energy Solution:** Development of efficient and sustainable energy technologies is necessary for taking the next big step in renewable energy usage.
- **Potential Sources of Energy when Fossil Fuels Run Out:** Nuclear Fusion, and Renewable Energies.

2. Renewable Energies:

- **Renewable energy resources** can be replaced or regenerated and will never run out (at least not for a very long time). These are resources found in nature that are self-generating, does not lead to climate change, and does not involve emission of pollutants.

Examples: hydropower (water), solar, wind, geothermal, and biomass, tidal energy etc.

1. **Geothermal Energy:** It is a renewable energy source because the water is replenished by rainfall and the heat is continuously produced inside the earth. Geothermal energy is generated in the earth's core, about 4,000 miles below the surface. Japan, Iceland, New Zealand are largest users of geothermal. Very little potential in east and mid-west.
2. **Wind Energy:** The terms "wind energy" or "wind power" describe the process by which the wind is used to generate mechanical power or electricity. Wind is called a renewable energy source because the wind will blow as long as the sun shines.

3. **Solar Energy:** Solar energy is the sun's rays (solar radiation) that reach the earth. Solar Energy can be used to heat water and heat spaces. Solar energy can be converted to electricity in two ways: Photovoltaic (PV devices) or "solar cells" and Solar Power Plants.
 - **Photovoltaic** (PV devices) or "solar cells" – change sunlight directly into electricity. PV components are PV cells, Modules, Arrays.
 - **Solar Power Plants** - indirectly generates electricity when the heat from **solar thermal collectors** is used to heat a fluid, which produces steam that is used to power a generator.

4. **Hydropower Energy:** Hydropower (also called hydraulic or water power) is derived from the force of moving water. Since water is much denser than air, its movement generates more energy than wind does. Electricity generated with hydropower is called hydroelectricity. Hydropower supplies some 19% of all electricity in the world. It is generally far cheaper than fossil fuels or nuclear energy.

5. **Biomass Energy:** Biomass is organic material made from plants and animals. Biomass consists of living or recently dead organisms or other biological materials; i.e. carbon. Biomass can be converted to other usable forms of energy like methane gas or transportation fuels like ethanol and biodiesel. Biofuels do not burn as much as fossil fuels. Biofuels are cleaner burning and produce fewer air pollutants than fossil fuels. First generation bio-fuels: bioalcohols, biodiesel, green diesel, vegetable oil, bioethers, biogas, syngas, solid biofuels.

- **Advantages vs. Disadvantages of Renewable Energies**

Types of energy	Advantages	Disadvantages
Sun Energy	Energy source is free: causes no pollution	Expensive: supply of sunlight can be interrupted.
Wind Energy	Energy source is free: causes no pollution	Only practical in areas with strong steady winds
Hydroelectric Energy	Station cheap to operate: causes no pollution	Stations can only be built in certain locations
Geothermal Energy	Energy source is free: causes no pollution	Only practical in a few locations
Biomass Energy	The fuel tends to be cheap; less demand on the Earth's resources	By burning the fuel, it makes greenhouse gases

References:

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2. World Energy Resources Summary, 2016.
(<https://www.worldenergy.org/wp-content/uploads/2016/10/World-Energy-Resources-Full-report-2016.10.03.pdf>)
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