RENEWABLE RESOURCES

Natural resources (also called **land** or **raw materials**) occur naturally within environments that exist relatively undisturbed by mankind, in a natural form. Natural resources are derived from the environment. Many of them are essential for our survival while others are used for satisfying our wants.

Natural resources may be further classified in different ways.
On the basis of **origin**, resources may be divided into:
- **biotic resources** – obtained from the biosphere (forests and their products, animals, birds and their products, fish and other marine organisms; mineral fuels (coal, oil/petroleum) are also included in this category because they were formed from decayed organic matter;
- **abiotic resources** – non-living things (land, water, air, ores).

With respect to **renewability**, natural resources may be divided into:
- **non-renewable resources** – are formed over long geological periods (minerals and fossil fuels). Their rate of formation is extremely slow, so they cannot be replenished once they get depleted. Metallic minerals can be reused by recycling them. But coal, oil/petroleum and natural gas cannot be recycled.
- **renewable resources** – can be replenished or reproduced easily, at a rate comparable or faster than its rate of consumption by humans. Some of them (sunlight, air, wind, tides, hydroelectricity) are continuously available and their quantity is not affected by human consumption. They have also been named perpetual resources. Many renewable resources can be depleted by human use, but may also be replenished. Natural resources such as land, water, soil, plants and animals must be carefully managed, with a particular focus on how management affects the quality of life for both present and future generations.

Renewable resources are seldom perfectly renewable. If their levels are heavily decreased, they may not be able to completely replenish themselves. Urban sprawl, cultivation, irrigation, grazing, deforestation, fishing, hunting, and habitat destruction can all be causes of the destruction of an otherwise renewable resource.

There have been numerous efforts to prevent the mistakes that lead to the depletion of renewable resources. Despite this, destruction of renewable resources often proves to be profitable, and happens as a result. As we have become more environment-oriented in the last decade, we may hope for more reason in renewable resource management.

Kinds of renewable resources

1. Solar energy

Solar energy is the energy derived directly from the sun and it is an extremely clean and renewable form of energy. The sun is the most abundant source of energy on Earth. The main uses of solar energy are: water heating (solar thermal collectors convert the sun's rays into heat), production of electricity (the photovoltaic cell converts sunlight directly into electricity), heating buildings (solar thermal collectors convert the sun's rays into hot air) and desalination of seawater.

Solar panels convert solar energy into DC (district current) electricity which enters an inverter. The inverter turns DC electricity into AC (alternating current) electricity needed by home appliances or lights. When more solar energy is produced than the amount needed, it can be stored in a battery as DC electricity.

One major advantage of solar energy is that it is available to everyone and can be harnessed by individuals everywhere, thus making power distribution across large areas unnecessary.

Photovoltaic cells (www.pdchost.com/.../images/photovoltaic.jpg)

2. Wind

Wind power is the conversion of wind energy into more useful forms. Most modern wind power is generated in the form of electricity by converting the rotation of turbine blades into electrical current by means of an electrical generator. In windmills (a much older technology) wind energy is used to turn mechanical machinery to do physical work, like crushing grain or pumping water.

A wind turbine

A wind farm in Spain

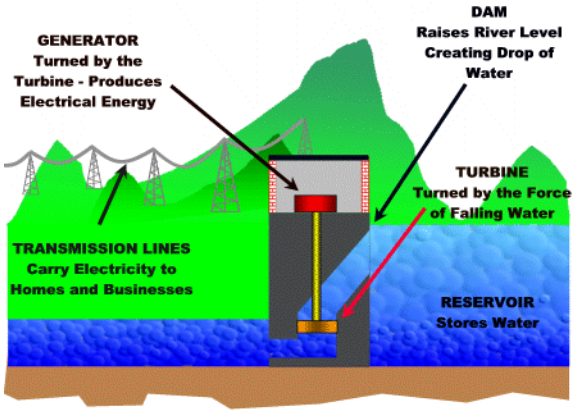
Interest in wind came about because it is a very clean form of energy. The oil shocks of the 1970s furthered interest in wind and other alternative energy sources. Despite research and development cuts, there is considerable wind research and usage today. Many countries have deployed wind technology and use wind equipment to gain energy. Often, power is gained through **wind farms** - large groups of wind turbines.

Wind power is used in large scale wind farms for national electrical grids as well as in small individual turbines for providing electricity to rural residences or grid-isolated locations.
A few people have objected to wind energy, as they work against the greenhouse effect if used to replace the use of fossil-fuel. Nevertheless, some say the wind farms are too noisy and cause traffic congestion nearby. Others complain that windmills kill birds.

3. Hydropower

Hydropower is power derived from the energy of falling water, running water or ocean energy (power of waves), which may be harnessed for useful purposes. It is a very common resource which can be used to generate electricity or to do useful work.

Hydroelectric power plants capture the energy of falling water to generate electricity. A dam usually raises the water level of the river to create falling water and it also makes it possible to control the flow of water. The reservoir that is formed is, in effect, stored energy. The force of falling water pushing against the turbine's blades causes the turbine to spin. The turbine converts the kinetic energy of falling water into mechanical energy. A generator is connected to the turbine, so when the turbine spins it causes the generator to spin also. It converts the mechanical energy from the turbine into electric energy. The amount of electricity a hydropower plant produces depends on two factors: how far the water flows and the amount of water.
Transmission lines conduct electricity from the hydropower plant to homes and business.



The major components of a hydroelectric plant (earthsci.org/.../hydro/hydroplant-animate.gif)

4. Geothermal power

Geothermal power is power extracted from heat stored in the Earth. This geothermal energy originates from the original formation of the planet, from radioactive decay of minerals, and from solar energy absorbed at the surface. A part of direct geothermal heating capacity is installed for district heating, spas, industrial processes, desalination and agricultural applications.

Geothermal power is cost effective, reliable, sustainable, and environmentally friendly. The Earth's geothermal resources are theoretically more than adequate to supply humanity's energy needs, but only a very small fraction may be profitably exploited. Drilling and exploration for deep resources is very expensive.

Geothermal electric plants were traditionally built exclusively on the edges of tectonic plates where high temperature geothermal resources are available near the surface. The improvements in drilling and extraction technology enable building geothermal systems over a much greater geographical range.
The thermal efficiency of geothermal electric plants is low, around 10-23%, because geothermal fluids do not reach the high temperatures of steam. Exhaust heat is wasted, unless it can be used directly and locally, for example in greenhouses, timber mills, fisheries and district heating.
Direct heating is far more efficient than electricity generation as it can use heat resources with lower temperatures. Where natural hot springs are available, the heated water can be piped directly into radiators.

There is a certain environmental risk connected with the use of geothermal heat, namely, hot water from geothermal sources holds dissolved gases and sometimes small amounts of toxic chemicals like mercury, arsenic.

Geothermal power requires no fuel (except for pumps), and is therefore immune to fuel cost fluctuations, but capital costs are significant. Drilling accounts for over half the costs, and exploration of deep resources entails significant risks.

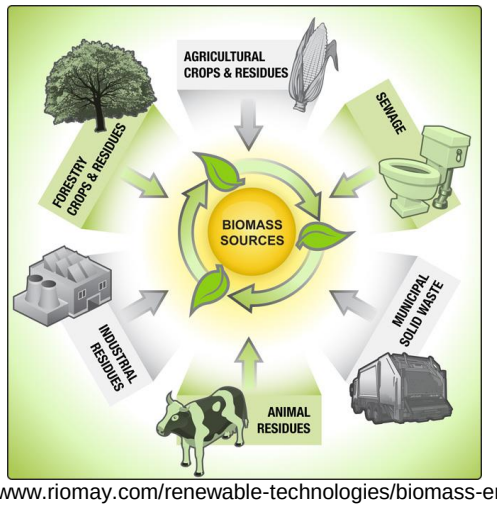
5. Biomass

Biomass is biological material derived from living or recently living organisms. We as humans create a huge amount of by-products including human waste, general waste, animal waste, and much more. Biomass conversion technologies now take advantage of these and by burning by-products, they may release the energy directly, in the form of heat or electricity, or may convert it to another form, such as liquid bio fuel or combustible biogas, instead of

further polluting the atmosphere. Many waste treatment facilities and landfill sites are moving to biomass energy to create power and to make their towns and cities cleaner.

Categories of biomass materials; there are five basic categories of material:

- **Virgin wood**, from forestry or from wood processing
- **Energy crops**: high yield crops grown specifically for energy applications
- **Agricultural residues**: residues from agriculture harvesting or processing
- **Food waste**, from food and drink manufacture, preparation and processing, and post-consumer waste
- **Industrial waste and co-products** from manufacturing and industrial processes



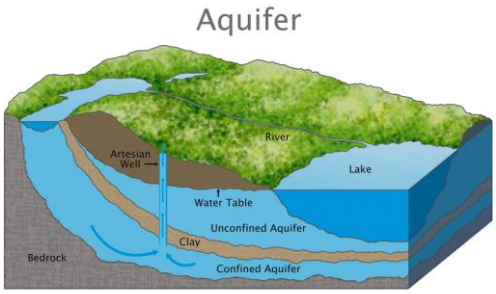
http://www.riomay.com/renewable-technologies/biomass-energy

As there is wide diversity in the characteristics and properties of these different classes of material and their various sub-groups, there is also a wide range of **conversion technologies**, which include both thermal (combustion, gasification, pyrolysis) and chemical conversion technologies (anaerobic digestion, fermentation, composting).

Biomass power plant size is often driven by biomass availability in close proximity as transport costs of the (bulky) fuel play a key factor in the plant's economics.

6. Fresh water

Water can be considered a renewable material in conditions of carefully controlled usage, treatment, and release. If not, it would become a non-renewable resource at that location. For example, groundwater could be removed from an aquifer at a rate greater than the sustainable recharge. Removal of water from the pore spaces may cause permanent compaction that cannot be renewed.



http://education.nationalgeographic.com/education/encyclopedia/aquifer/?ar_a=1

7. Forests

Forests are naturally renewable if removal of the trees is controlled. We are witnessing the process of deforestation (destroying or removing a forest ecosystem) in many areas today. Trees are cut for fuel, for the profit, for acquiring land to plant crops or grow animals. Sometimes deforestation is natural (large fires). Species may become extinct (the loss of their habitat), erosion and flooding can occur as well as desertification and decreased land productivity. The general climate of an area can also change. Many countries have developed programmes aimed at reducing deforestation.

Deforestation for palm oil production in Borneo
(http://kids.mongabay.com/lesson_plans/lisa_algee/deforestation.html)

8. Agricultural products

Sustainable agriculture stands for the use of techniques which allow for minimal and controlled environmental damage. Products from this type of agriculture are renewable and sustainable when processing and logistics related to these products also have sustainable characteristics.

PRACTICE

1. Answer the following questions:

1. What are natural resources?
2. How do we divide them on the basis of origin?
3. How are they divided with respect to renewability?
4. Enumerate some non-renewable resources and explain why they cannot be renewed.
5. Enumerate some renewable resources and explain why they can be renewed.
6. Why can fresh water, forests and agricultural products be considered renewable or non-renewable sources?

2. Explain the following phrases in English.

- photovoltaic cell
- wind farm
- grid-isolated location
- a dam
- hydropower
- thermal efficiency of geothermal el. plants
- biomass
- biomass conversion techniques

Viri:
en.wikipedia.org/wiki/Renewable_resource – facts-about-solar-energy.com/renewable-resources.html
www.investopedia.com › Dictionary
library.thinkquest.org/26026/.../renewable_resources.html
simple.wikipedia.org/wiki/Renewable_resource
en.wikipedia.org/wiki/Natural_resource
www.fermeng.ie/renewable_energy.html
earthsci.org/mineral/energy/hydro/hydro.html
en.wikipedia.org/wiki/Biomass
http://www.biomassenergycentre.org.uk/portal/page?_pageid=76,15049&_dad=portal