Energy and Environment

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Energy is the capacity for doing useful work. It is a primary input in any industrial operation.

Energy is also a major input in sectors such as commerce, transport, telecommunication, different services required in the household and industrial sectors etc.

Increasing industrialization and unsustainable consumption patterns are escalating the environmental problems due to depletion of resources and energy.

The unsustainable use of renewable resources and the generation of toxic materials during industrial operations are creating problems to biodiversity, environment and human health.

Owing the far-reaching changes in the forms of energy and their respective roles in supporting human activities; research and training on various aspects of energy and environment have assumed great significance.

CLASSIFICATION OF ENERGY RESOURSES

A. <u>Primary energy resources :</u> These are mined or otherwise obtained from the environment. Ex :

a. Fossil fuels: Coal, lignite, crude oil, natural gas, etc.

b. Nuclear fuel: Uranium, Thorium, Deuterium, other Nuclei used in fission or fusion reactions.

C. Hydro energy: The energy of water used to run turbines or mill wheels.

d. Geo-thermal: The heat from the underground streams or heat stored in the hot rocks beneath the earth's surface.

e. Solar energy: Electromagnetic radiation from the sun.

f. Wind energy: The energy from air used by wind mills.

G. Tidal energy: The energy associated with the rise and fall of tidal water.

The primary energy resources can be further classified as renewable and non-renewable resources.

Renewable resources are those which are not exhaustible and which can hence provide continuous supply of energy, e.g. wood, tidal energy, wind energy, Geothermal energy etc.

Non-renewable resources are those which are finite and exhaustible e.g. fossil fuels, nuclear\ fuels etc.

CLASSIFICATION OF ENERGY RESOURCH:

B. Secondary energy resources are those which do not occur in nature but are derived from primary energy resources. Ex : Petrol or gasoline, electrical energy from coal burning, hydrogen obtained by electrolysis of water etc.

Conventional or Commercial energy sources:

The commercial sources include:

1. Fossil fuels i.e. solid fuels, liquid and gaseous fuels.

2. Water power or hydroelectric power i.e. the energy stored in water.

3. Nuclear power i.e. energy of nuclear fission.

Non-conventional or non-commercial energy sources:

Non-commercial sources include sun, wind, geothermal, bio-mass, tidal, ocean thermal electric conversion, fuel cells, thermionic, thermoelectric generators etc.

However, the sun is the source for most of our energy resources:

--- Sun light is the source of solar energy.

--- The evaporation of water, causing rain fall is the basis of hydro energy.

--- Photosynthesis because of solar radiation forms the basis for chemical energy in the plants.

---The chemical energy stored in fossil fuels is also due to the solar heat.

- **Table: The percentage use of various sources for the total energy consumption in the world…..**

Coal	32.5%	
Oil	38.3%	
Gas	19.0%	92%
Uranium	0.13%	
Hydro	2.0%	
Wood	6.6%	
Dung	1.2%	8%
waste	0.3%	

❖Coal, oil, gas, uranium and hydro are commonly known as commercial or conventional energy sources.

❖Looking at the percentage distribution, we find that world's energy supply comes mainly from fossil fuels. The heavy dependence on fossil fuels stands out clearly.

❖One of the so most significant aspects of the current energy consumption pattern in many developing countries is that non-commercial sources such as firewood, animal dung and agriculture waste represent a significant 8% of the total energy used in the world.

❖These constitute about 4 times the energy produced by the hydro and 60 times the energy produced by nuclear sources.

❖In some developing countries non-commercial energy sources are a significant fraction of the total resources.

❖This dependence of the developing countries is likely to continue unless replaced by other alternative sources of energy.

Advantages of renewable energy sources

Even though renewable options do not supply a substantial amount of energy to developing countries over the short terms, they do have these advantages :

Renewable energy is an indigenous resource available in considerable quantities to all developing nations.

The use of renewable energy could help to conserve foreign exchange and generate local employment.

It conservations technologies can be designed, manufactured, assembled & installed locally.

Several renewable options are financially and economically competitive for certain application, such as in remote location, where the cost of transmitting electrical power or transporting conventional fuels are high.

Because conversion technology tends to be flexible and modular, it can usually be rapidly deployed & reduced transmission and distribution cost are required for dispersed rural locations.

- **Obstacles to the implementation of renewable energy sources**

Experience with renewable energy project in the developing countries indicates that there are a number of ineffective developments and widespread diffusion of these systems. Among these are:

1. Inadequate documentation and evaluation of past experience and data and lack of clear priorities for future work.

2. Weak and uncoordinated institution and also weak financial and commercial policies.

3. Technical and economic uncertainties

4. Lack of qualified person to design, manufacture, operate and maintain such systems.

5. Inadequate donor coordination with little or no information access on successful and unsuccessful projects.

Prospects of renewable energy sources:

Rapid scientific and technological advantages are expected to expand the economic range of renewable energy applications over the next 8-10 years, making it imperative for international decision makers and planners to keep abreast of these developments

From an operational view point, the correct way to treat renewable energy is as a means to reduce the demand for conventional energy forms. Thus in performing economic and financial analysis there is no real distinction between renewable energy technologies and those designed to improve the efficiency of conventional energy use.

Renewable already supply a major part of the world's energy needs. Biomass, for example accounts for about one seventh off all fuel consumed and supplies over 90% of that used in some third world countries. Hydro generates one quarter of the world's electricity, and more than two thirds of that used over 35 countries and the sun contributes directly to space heating in virtually all buildings through the walls and windows although precise estimates of the size of this contribution are not available. However over the last two decades there has been burgeoning interest in renewable from the more industrialized nations and this has lead to growing capital investment.

- **Renewable energy technologies are in many ways more lucrative than most conventional energy technologies**

1. They can deliver quality energy required for a specific task, thus reducing the need to use premium fuel or electricity to provide low grade forms of energy such as hot water (which can be supplied in many other ways).

2. They can often be build on or close to the site where the energy is required this minimizes transmission cost.

3. They can be produced in large numbers and introduced quickly unlike large power stations. Rapid planning and construction lowers the cost and helps to responded quickly to the changing patterns of demands.

4. The diversity of systems increases flexibility and security of supply. In contrast, over dependence on imported fuels makes a country more vulnerable to political pressure from producer nations and multinationals. They are free from problems like generic faults in power plants, serious breakdowns, industrial actions etc.

5. Although there are physical and environmental risks associated with the construction and operation like any other conversion systems, they are relatively modest compared to fossil fuels or nuclear power, except some events like failure of a large hydro-electric dam, fire in a biomass plants or the explosion of a methane digester.

Waste heat utilization

Waste heat utilization refers to the beneficial use of heat discharged in the steam turbine condenser-cooling water from an electric power generation plant. From about 50 to 60 % of the heat supplied either by combustion of a fossil fuel (coal, fuel, oil or natural gas 0 or by fission of a nuclear fuel in existing steam-electric plants is removed by the cooling water. This heat is dissipated to the environment by---

---Direct discharge of the warm water to the ocean or a river

---By passing through a cooling tower or cooling lake.

Possibilities for utilization:

Various possibilities are being considered for making use of the large amount of heat that is lost in this way and it may be more practical to utilize the heat directly. They are---

1. Combined cycle heat-recovery system.
2. Space heating and cooling.
3. Warm water in agriculture including raising livestock.
4. Warm water in aquaculture.

- **They are described briefly as follows---**

1. Combined cycle heat-recovery system, in which fossil fuels can be utilized more efficiently, with less heat discharged for a given total electric power output.

2. Space heating and cooling:

Warm water can be distributed to homes, stores, and industry, as it in several European countries and to some extent in the United States, for space heating and domestic use.

Cooling could also be achieved with hot water (nearly 100°C) using "Absorption cooling refrigerating system".

However, to be useful for space heating and cooling, the temperature of the water should be (50 to 100°C), where as the average temperature of the steam-turbine condenser discharge water is only about 40°C.

This space heating and cooling may not be appropriate for an existing community because of the high cost of installing the required underground distribution system.

But in developing a new residential and commercial complex, the hot water pipes could be laid at the same time as the service-water lines, it is improbable that such a complex would be built close to a steam electric plant (or vice versa).

But it has been estimated that water at a temperature approaching 100°C could be transmitted in wide pipes for distances up to 65 km without serious heat losses

3. Warm water in agriculture:

a. To heat greenhouses in winter.

b. For protecting fruit trees from frost by spraying.

C. For irrigation.

d. For soil warming to extend the growing seasons of trees and vegetables.

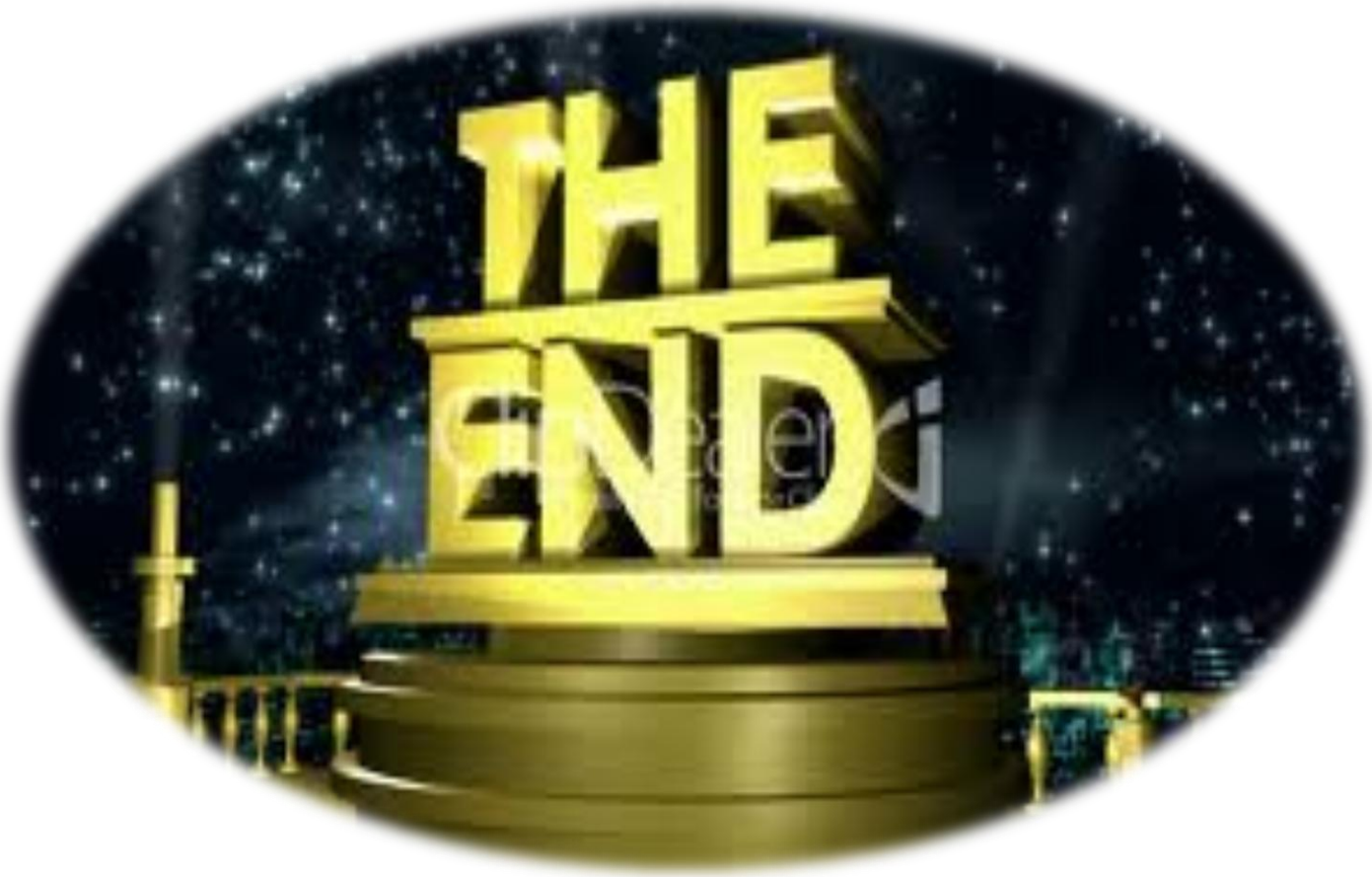
4. Warm water in aquaculture:

Fishing farming could greatly extended by using warm water from power plant discharges.

a. Catfish and tilapia fish from Africa, exhibit optimum growth, relative to nutrients supplied, at a temperature of 32^0C. If this temperature could be maintained throughout at the year, the yield from a given pond could be increased. Lower temperature are required for spawning and egg development, consequently, fingerlings would have to be raised in a hatchery and transferred to the warmer water at the appropriate stage of development.

b. The low-cost nutrients, like various small plants and animal organisms, upon which fish normally feed, could be produced in warm water ponds supplied with various animal and food processing wastes. Their supply is an essential requirement for economic aquaculture.

c. Several marine shellfish (e.g. shrimp, oyster and lobster) also exhibit maximum growth in warm water. Experiment conducted in the united States, the United Kingdom and Japan have shown that shellfish can be cultivated successfully under controlled conditions in sea water warned by condenser discharges.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