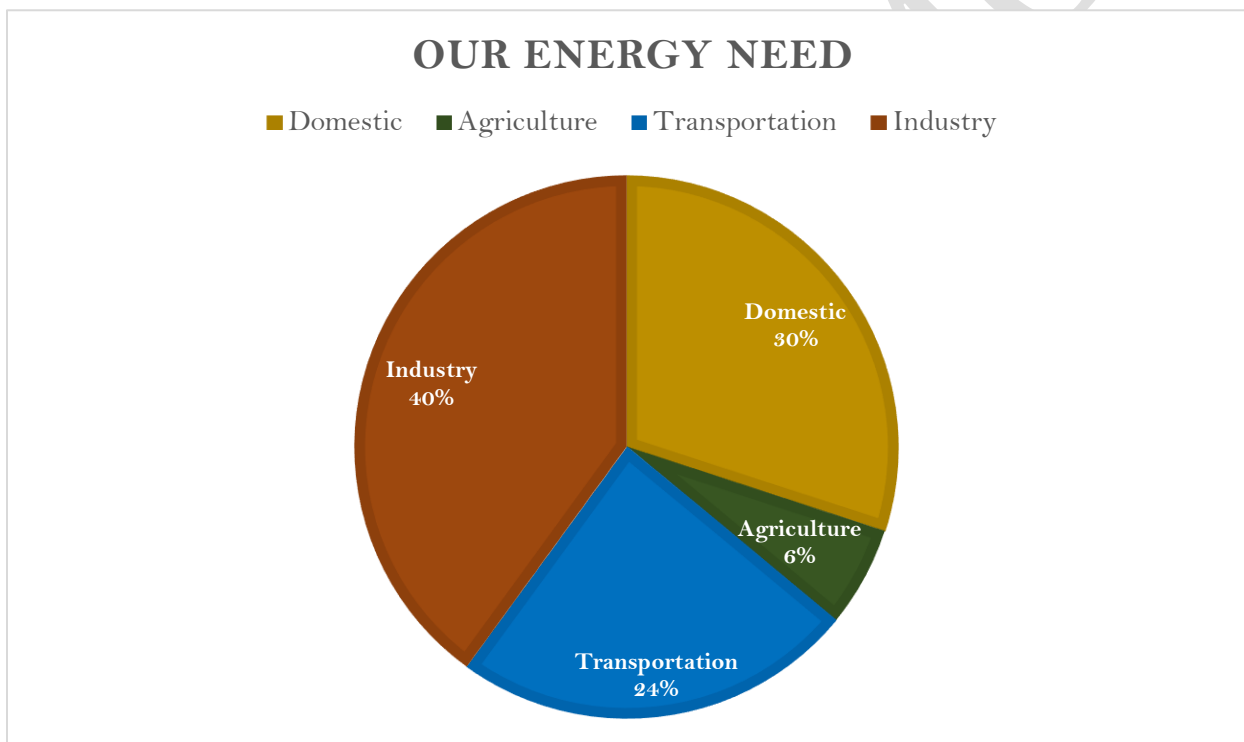


Chapter 2 Natural Resources – Energy Resources

Growing Energy Needs

Energy consumption of a nation is usually considered as an index of its development, because almost all the development activities are directly or indirectly dependent upon energy. Power generation and energy consumption are crucial to economic development as economy of any nation depends upon availability of energy resources. There are wide disparities in per capita energy use of developed and the developing nations. With increased speed of development in the developing nations energy needs are also increasing.



The very original form of energy technology probably was the fire, which produced heat and the early man used it for cooking and heating purposes.

Wind and hydropower have also been used. Invention of steam engines replaced the burning of wood by coal and coal was further replaced by oil.

The oil producing has started twisting arms of the developed as well as developing countries by dictating the prices of oil and other petroleum products.

Energy resources are primarily divided into two categories viz. **renewable and non-renewable sources**.

Energy Scenario

Energy is a key input in the economic growth and there is a close link between the availability of energy and the future growth of a nation. Power generation and energy consumption are crucial to economic development.

In India, energy is consumed in a variety of forms such as fuel wood; animal waste and agricultural residues are the traditional sources of energy. These non-commercial fuels are gradually getting replaced by commercial fuels i.e. coal, petroleum products, natural gas and electricity.

Out of total energy, commercial fuels account for 60% whereas the balance 40% is coming from non-commercial fuels. Of the total commercial energy produced in the form of power or electricity,

69% is from coal (thermal power),

25% is from hydel power,

4% is from diesel and gas,

2% is from nuclear power, and

Less than 1% from non-conventional sources like solar, wind, ocean, biomass, etc.

Petroleum and its products are the other large sources of energy. In a developing country like India, in spite of enhanced energy production, there is still shortage due to increased demand of energy. In spite of the fact that there is a phenomenal increase in power generating capacity, still there is 30% deficit of about 2,000 million units.

Policy makers are in the process of formulating an energy policy with the objectives of ensuring adequate energy supply at a minimum cost, achieving self-sufficiency in energy supplies and protecting environment from adverse impact of utilizing energy resources in an injudicious manner. The main features of this policy are

- Accelerated exploitation of domestic conventional energy resources, viz., oil, coal, hydro and nuclear power;
- Intensification of exploration to achieve indigenous production of oil and gas;
- Efficient management of demand of oil and other forms of energy;
- To formulate efficient methods of energy conservation and management;
- Optimization of utilization of existing capacity in the country
- Development and exploitation of renewable sources of energy to meet energy requirements of rural communities;

- Organization of training for personnel engaged at various levels in the energy sector.
- Government private partnership to exploit natural energy resources

Renewable Resources

The resources that can be replenished through rapid natural cycles are known as renewable resource.

These resources are able to increase their abundance through reproduction and utilization of simple substances.

Examples of renewable resources are plants (crops and forests), and animals who are being replaced from time to time because they have the power of reproducing and maintain life cycles.

Some examples of renewable resources though they do not have life cycle but can be recycled are wood and wood-products, pulp products, natural rubber, fibres (e.g. cotton, jute, animal wool, silk and synthetic fibres) and leather.

In addition to these resources, water and soil are also classified as renewable resources. Solar energy although having a finite life, as a special case, is considered as a renewable resource in as much as solar stocks is inexhaustible on the human scale.

Non-Renewable Resources

The resources that cannot be replenished through natural processes are known as non-renewable resources.

These are available in limited amounts, which cannot be increased. These resources include fossil fuels (petrol, coal etc.), nuclear energy sources (e.g. uranium, thorium, etc.). metals (iron, copper, gold, silver, lead, zinc etc.), minerals and salts (carbonates, phosphates, nitrates etc.).

Once a non-renewable resource is consumed, it is gone forever. Then we have to find a substitute for it or do without it.

Non-renewable resources can further be divided into two categories, viz. Recyclable and non-recyclable

Recyclable resources

These are non-renewable resources, which can be collected after they are used and can be recycled. These are mainly the non-energy mineral resources, which occur in

the earth's crust (e.g. ores of aluminum, copper, mercury etc.) and deposits of fertilizer nutrients (e.g. phosphate rock and potassium and minerals used in their natural state (asbestos, clay, mica etc.)

Non-recyclable resources

These are non-renewable resources, which cannot be recycled in any way. Examples of these are fossil fuels and nuclear energy sources (e.g. uranium, etc) which provide 90 per cent of our energy requirements.

Renewable energy resources must be preferred over the non-renewable resources.

It is inevitable truth that now there is an urgent need of thinking in terms of alternative sources of energy, which are also termed as non-conventional energy sources which include:

Solar energy needs equipment such as solar heat collectors, solar cells, solar cooker, solar water heater, solar furnace and solar power plants.

Wind energy

Hydropower, Tidal energy, ocean thermal energy, geothermal energy, biomass, biogas, biofuels etc.

The non-renewable energy sources include coal, petroleum, natural gas, nuclear energy.

Use of Alternate Energy Sources

There is a need to develop renewable energy sources which are available and could be utilized (solar or wind) or the sources which could be created and utilized (biomass). The main renewable energy sources for India are solar, wind, hydel, waste and bio-mass. Bio-mass are resources which are agriculture related like wood, bagasse, cow dung, seeds, etc.

Hydel energy

India has a total hydro energy potential of about 1.5 lakh MW, of which only about 20 % is installed. Small hydro plant potential is about 15000 MW and most of it is in the northern and eastern hilly regions.

Wind energy

The wind power potential of India is about 45,000 MW out of which capacity of 8748 MW has been installed in India till 2008. India is one of the leading countries in generating the power through wind energy.

Gujarat, AP, Karnataka, MP and Rajasthan are states having more than 5000 MW potential each. These potentials could be improved if the technology of putting turbines in sea is embraced. There are wind farms on sea generating as high as 160 MW of power.

Geothermal energy

Geothermal energy is thermal energy generated and stored in the Earth. Thermal energy is the energy that determines the temperature of matter. Earth's geothermal energy originates from the original formation of the planet (20%) and from radioactive decay of minerals (80%). Geothermal power is cost effective, reliable, sustainable, and environmentally friendly, but has historically been limited to areas near tectonic plate boundaries. Recent technological advances have dramatically expanded the range and size of viable resources, especially for applications such as home heating, opening a potential for widespread exploitation. Geothermal wells release greenhouse gases trapped deep within the earth, but these emissions are much lower per energy unit than those of fossil fuels. As a result, geothermal power has the potential to help mitigate global warming if widely deployed in place of fossil fuels.

Ocean thermal energy conversion (OTEC)

Ocean Thermal Energy Conversion (OTEC) uses the difference between cooler deep and warmer shallow or surface ocean waters to run a heat engine and produce useful work, usually in the form of electricity. A heat engine gives greater efficiency and power when run with a large temperature difference. In the oceans the temperature difference between surface and deep water is greatest in the tropics, although still a modest 20 to 25 °C. It is therefore in the tropics that OTEC offers the greatest possibilities. OTEC has the potential to offer global amounts of energy that are 10 to 100 times greater than other ocean energy options such as wave power

Biomass energy

Biomass is the oldest means of energy used by humans along with solar energy. As soon as the fire was discovered, it was used widely among humans mainly for heat and light. Fire was generated using wood or leaves, which is basically a biomass. The biomass could be used to generate steam or power or used as a fuel. Power is

generated using rice husk in Andhra Pradesh, while several bagasse-based plants are there. India has a potential of 3500 MW from bagasse. Other fast-growing plants could be planned over a huge area, so that it provides biomass for generating power.

Organic waste such as dead plant and animal material, animal dung, and kitchen waste can be converted by the anaerobic digestion or fermentation into a gaseous fuel called biogas. Biogas is a mixture of 65% methane (CH_4) and of 35% CO_2 and may have small amounts of hydrogen sulphide (H_2S), moisture and siloxanes. It is a renewable energy resulting from biomass. Biogas can be used as a fuel in any country for any heating purpose, such as cooking. It can also be used in anaerobic digesters where it is typically used in a gas engine to convert the energy in the gas into electricity and heat. Biogas can be compressed, much like natural gas, and used to power motor vehicles.

Bio-fuels

India has more than 50 million hectares of wasteland, which could be utilized for cultivating fuel plants. Jatropha is one of the options which can be planted on arid lands and be used for production of bio fuels.

Solar energy

India being a tropical country has potential to use solar energy on commercial bases. According to estimates, 35 MW of power could be generated from one sq km. With such potential, solar energy has bright future as energy source for the development of the country. Initial cost is the biggest limitation which has led to the low realization of its potential. For solar energy to become one of the front runners, it will require lot of research, cheap technology and low capital.

Problems Relate to the Use of Energy Resources

Fossil fuel

- Global warming
- Acid rains
- Dangers posed by leaded fuels, Oil spills
- Water pollution caused by poorly managed coal mines
- Air pollution.

Alternate energy resources

- The initial cost of establishment of alternate energy generation is costlier than conventional resources.
- Maintenance of these structures is difficult.
- It requires more space.
- Energy supply is unpredictable during natural calamities.

Conservation of Energy

- Turn off lights and fans when you leave a room.
- Shut off Personal Computers, television sets, set-top boxes, music system etc. when not in use.
- All appliances consume energy on standby mode
- Install automatic switch off devices for area like staircases
- Replace all bulbs with compact fluorescent lamps (CFLs) or even better with light emitting diodes (LEDs)
- Install solar lighting system such as solar water heater, solar cooker, solar lamps etc.
- Buy energy- efficient appliances and check always energy consumption figure and look for BEE star rating
- Follow the principles of ecological architecture.

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