

CHAPTER – I

SURVEY OF LITERATURE ON

RENEWABLE ENERGY

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1.1 INTRODUCTION

We know the necessity of energy in human life. Man has needed and used energy at an increasing rate to sustain the life. In previous days man required energy in the primary form such as wood, for cooking or to warm himself. As time goes man demands more energy.

Man gets 65% energy from oil and coal. The energy is used continuously. Hence there is big problem of energy in the coming years. In India oil will come to an end after few years. We will import oil from other country. We can generate electricity from water dams. 35% electricity is obtained from water.

Scientists are trying to produce electricity from atomic energy. 1% to 2% electricity gets from atomic energy, but this is not economical and also there is danger from atomic pollution. It is possible to produce electricity from oil and gas but the work on this is very little. Due to increase in population there is need of energy and it is increasing day by day. So after few years oil and coal will come to an end.

1.2 ENERGY

The word 'energy' has been continuously in the news from 1973. Energy is defined as the rate of work done. The raw material containing energy, is termed as energy source. Intermediate energy is under process and finally usable energy is supplied to the consumers for final use (e.g. electricity). There are three resources of energy are classified as given below.

- Primary energy resources
- Intermediate energy resources
- Secondary energy resources.

- **Primary energy resources :**

The energy, available in the nature in raw form, is called primary energy resources. e.g. coal, petroleum oil, natural gas, fire wood, wind, water, geothermal fluid, ocean waves etc.

Some primary resources are partly recoverable and some are not recoverable e.g. coal at very great depth is non recoverable.

- **Intermediate energy resources :**

The primary resources are generally not suitable for ultimate use. In one or more process they are transformed to intermediate form. Steam and chemicals are intermediate forms of energy.

- **Secondary energy resources (Usable energy) :**

Energy which is supplied to the user for consumption is called as secondary energy sources. e.g. electrical energy, liquid petroleum gas in cylinders etc. Secondary energy resources are either commercial or non commercial. e.g. electricity is commercial while solar energy is non commercial.

1.3 CONVENTIONAL ENERGY RESOURCES

Conventional energy resources are used traditionally since long times. These resources are fossil fuels like coal, oil, gases.

i) **Fossil fuel :**

Fossil fuels are available in the form of solid, liquid and gases. e.g. solid fuels are coal including anthracite, and brown coals lignite and peats. Liquid and gaseous fuels including petroleum and its derivatives and natural gas.

ii) **Coal :**

It is a common source of energy. Modern steam boilers burn coal in any of its forms as a primary fuel. Trees and plants falling into water decayed and produced peat bogs. Coal developed vegetable matter which grew in past geological ages.

Under layers of slit gigantic geological upheavals buried these bogs. Some of the bogs gaseous matter are distilled off to form brown coal or lignite due to soil pressure, heat and movement of earth crust.

iii) **Oil :**

In the whole world peoples are getting 40% energy from oil. Our fuel oils are refining petroleum and crude oil. India is not rich in petrolcum reserves.

iv) **Gas :**

At present gas is utilized completely and in the production of oil process large quantities are burnt off because of the non availability of ready market. Because transportation cost of gas is high. The transportation cost for gas is more than oil.

Gaseous fuels can be classified as

- a) Fixed composition gases e.g. acetylene, ethylene, methane etc.
- b) Composite industrial gases e.g. coke oven gas, water gas, producer gas, blast furnace gas etc.

The total energy consumption in the world is given in table 1.1.

Table 1.1

Coal	32.5%
Oil	38.5%
Uranium	0.13%
Hydro	2.0%
Gas	19.0%
Dung	1.2%
Wood	6.6%
Waste	0.3%

1.4 ENERGY CRISIS

World Wide 'Energy Crisis' appears to be imminent as most of the recognised sources of energy for the production of electrical energy are not likely to last for 'ever' given the present trend of rising 'demands' and shortfalls in supplies, particularly in the developing countries such as India. [1]

Conventional energy resources which are traditionally used are called as non renewable energy resources. Because they are generated only once in interior of the earth. Coal, oil and gas are fossil fuels and main constituents are C, H, O.

The energy estimated from fossil fuel is of the order of 300×10^{21} J. Out of this, more than 50% is available for our future. As today the amount of energy required for whole world per year is 0.3×10^{21} J. with this rate of consumption, we will loss fossil fuels in next 50 years. From the following graph Fig. 1.1 we can understand consumption of fossil fuel and planning or option for energy from the time scale of fossil fuel.

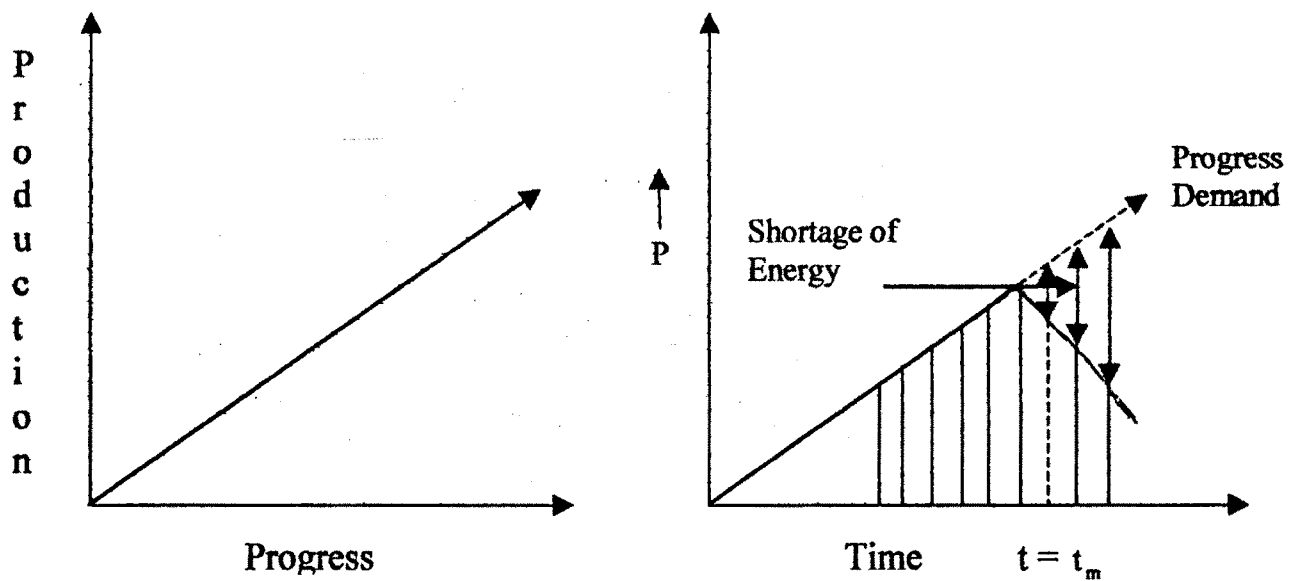


Fig. 1.1 Time Scale of Fossil Fuel

The “time scale of fossil fuel” plot shows that production rate increases with time and reaches a maximum value and again decreases.

Theoretically it is observed that, the rate of production is not constant. The progress of human being is directly proportional to production of energy.

The following are the conditions to overcome shortage of energy.

- 1) Alternative source of energy must be abundant.
- 2) Source of energy must be renewable.
- 3) It must be easily available every where.
- 4) It must be simple in technology and economical
- 5) Ease of maintenance.

1.5 NON-CONVENTIONAL ENERGY

For thermal power plant fossil fuels are used and they will vanish in the next century. Therefore, other systems based on non conventional and renewable sources are being tried by many countries.

- a) Solar energy.
- b) Wind energy.
- c) Energy from biomass and biogas.
- d) Ocean energy.
- e) Geothermal energy.
- f) Hydrogen energy.
- g) Fuel cells.

a) **Solar Energy :**

It is clean, cheap and abundantly available. Solar energy has more potential of the renewable energy and small part of this energy can be used. Energy comes to the earth from the sun which keeps temperature above than in colder space, which causes current in atmosphere and in ocean, causes the water cycle and it results photosynthesis in plants.

We can use Solar energy in following ways.

- 1) Solar water heating.
- 2) Solar distillation on a small scale.
- 3) Solar cookers.
- 4) Solar furnaces.

- 5) Bio-conversion and wind energy.
- 6) Solar drying of agricultural and annual products.

b) Wind Energy :

Wind energy is most attractive solution to get clean, safe and renewable energy sources.

Wind is due to :

- i) Convection currents generated by heating and cooling of the atmosphere. Heating is caused because of absorption of solar energy on the earth's surface and in the atmosphere.
- ii) Due to rotation of the earth around the sun and motion of earth with respect to atmosphere.

Wind energy is defined as "Motion of air molecules on the earth's surface due to uneven heating of atmosphere by solar radiations".

From thousands of years man used energy in different form. The earliest use of wind energy was propulsion of ship. Wind energy can be used for generation of electrical energy.

c) Energy From Biomass and Biogas :

Biogas is a gaseous fuel obtained from biomass by the process of anaerobic digestion.

In India biomass the important alternate source of energy because of agricultural waste and forest resources for production of biomass.

The biogas is produced from wet cow dung or wet live stock (and even human) waste. As the word clearly signifies biomass means organic matter. In simplest form the reaction is the process of photosynthesis.

Biomass resources are divided into three categories.

- i) Biomass in traditional solid mass (wood and agricultural residue). It burn directly and energy is obtained.
- ii) Biomass in nontraditional form (converted into liquid fuels). Biomass is converted into ethanol and methanol to be used as liquid fuels in engines.
- iii) To ferment the biomass anaerobically to obtain a gaseous fuel called biogas.

d) Ocean Thermal Energy Conversion :

A large amount of solar energy is stored in tropical oceans. The surface of the water acts as the collector for solar heat. The upper layer of sea acts as infinite heat storage reservoir. The temperature difference between the warm surface water of tropical ocean and cold water in the depth is used in conversion of electricity and system used for this is called ocean thermal energy conversion system.

The surface water which is at higher temperature could be used to heat some low boiling organic fluid, the vapours of which

is used to run a heat engine. Using pumping, cold water from deeper regions, the exist vapour could be condensed.

e) **Geothermal Energy :**

The energy which lies within the earth is called geothermal energy. The volcanic action takes place in many places which supports to theories that, the earth has a molten core. The steam and hot water comes out of surface of earth. Out of these, steam is used to generate electricity and the hot water is discarded. The dissolved salts and minerals present in a hot water causes damage to the turbine.

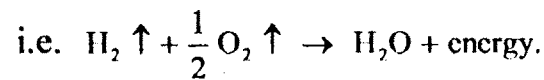
Geothermal energy is expected to use in several countries including India. World's first geothermal power station was established at Lardarello in Italy in 1905.

f) **Hydrogen Energy :**

This energy plays an important role as an alternative source to conventional fuels provided its technical problems of production, storage and transportation can be resolved satisfactorily.

Hydrogen energy can be produced from water which is easily available in nature. It can be used as fuel directly and its burning process is non polluting.

The combination of hydrogen with oxygen results in liberation of energy with water



Hydrogen is not found in its free state because it is chemically active.

On the earth, it present in water, fossil fuels, hydrocarbon, biological materials etc. The primary energy sources like fossil fuel, nuclear fuel and solar energy are used to produce hydrogen. Hydrogen is economical and ideal fuel for transportation purpose because its heating value is 2800 cal/gm.

1.6 WIND ENERGY : IS IT SUSTAINABLE ?

Discussion on environmental impact of wind energy remains incomplete without posing the question – “Is it sustainable ?” “Meeting the needs of the present generation without damaging the prospects of future generation” is called sustainability. Tapping wind power does not deplete future supply and creates no waste.

Wind farm can be decommissioned with no impact on farming or ecology, when its life is over. A wind turbine which has served well, at expiry is likely to be replaced by a new wind turbine, making wind to be both sustainable and renewable source of energy [2].

1.7 NATIONAL AND INTERNATIONAL STATUS OF WIND POWER:

Although it has been exploited for thousands of years, the re-emergence of wind energy for electric power generation in the grid connected mode is recent origin. Modern wind turbines are highly sophisticated machines built on aerodynamic principles, incorporating advanced materials and electronics. Today wind power is a truly global phenomenon.

The world's total wind turbine capacity has crossed 3600 MW with over 25,000 wind turbines in operation world wide producing about six billion kWh annually.

Several European nations, especially Denmark, the Netherlands, Germany, United Kingdom and Spain have committed wind energy programmes.

Wind is one of the most effective renewable technologies and the resource is widely distributed around the world. India has taken up a fairly ambitious programme, faced as we are with growing shortage of power and energy [3].

1.8 PURPOSE OF DISSERTATION

In view of the above literature, explaining different available conventional and non-conventional energy resources, we decided to work, the problem on 'Studies on Microlevel Wind Energy : A Case Study.'

Wind is renewable, diffused and non polluting source of energy. Wind energy has potential applications, such as for electricity generation, water pumping, grinding grains, to drive turbines and so on.

Shivaji University has 1000 acres land out of which some part is densely occupied by buildings while the rest is covered with plantations. We have collected wind energy data at Shivaji University Campus for three years and work out the necessary calculation. It has been observed that the average wind speed at this place is of the order of 10 km/hr. which is sufficient to run aerogenerator of capacity 3 kw, therefore at the boundary of Shivaji University, we have installed a aerogenerator of 3 kw capacity. We have planned to study aerogenerator and work out the efficiency of aerogenerator and to study microlevel wind energy pattern. The wind direction studies were carried out observing and noting the direction of blades and the conclusions are drawn accordingly.

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