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ROLE OF RENEWABLE ENERGY SOURCES IN ENVIRONMENT PROTECTION

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***Abstract*:** Renewable technologies are considered as clean sources of energy and optimal use of these resources minimize environmental impacts, produce minimum secondary wastes and are sustainable based on current and future economic and social societal needs. Sun is the source of all energies. The primary forms of solar energy are heat and light. Sunlight and heat are transformed and absorbed by the environment in a multitude of ways. Some of these transformations result in renewable energy flows such as biomass and wind energy. Renewable energy technologies provide an excellent opportunity for mitigation of greenhouse gas emission and reducing global warming through substituting conventional energy sources.

***Keywords*: Greenhouse gases, CO_2 mitigation, Sustainable development, Renewable energy sources.**

1. INTRODUCTION: -

Renewable energy sources (RES) supply 14% of the total world energy demand [1]. RES includes biomass, hydropower, geothermal, solar, wind and marine energies. The renewable are the primary, domestic and clean or inexhaustible energy resources [2, 3]. Large-scale hydropower supplies 20 percent of global elec tricity. Wind power in coastal and other windy regions is promising source of energy [1, 4]. RESs are also called alternative energy sources. The share of RESs is expected to increase very significantly (30–80% in 2100) [4]. Changes towards environmental improvements are becoming more politically acceptable globally, especially in developed countries. Society is slowly moving towards seeking more sustainable production methods, waste minimization, reduced air pollution from vehicles, distributed energy generation, conservation of native forests, and reduction of greenhouse gas emissions [6].Increasing consumption of fossil fuel to meet out current energy demands alarm over the energy crisis has generated a resurgence of interest in promoting renewable alternatives to meet the develop-ing world's growing energy needs [7-8]. Excessive use of fossil fuels has caused global warming by carbon dioxide; therefore, renewable promotion of clean energy is eagerly required [9]. To monitor emission of these greenhouse emissions an agreement was made with the overall pollution prevention targets, the objec-tives of the Kyoto Protocol agreement [10]. In this paper, attempt has been made to find out the scope of renewable energy gadgets to meet out energy needs and mitigation potential of green house gases mainly carbon dioxide. Renewable energy sources give us clean energy. RES which is also called alternative energy sources can become the ultimate solution for the forthcoming power crises. At present RES contributes about 15% o f the total energy generation of the world.RES includes solar, wind geothermal, hydropower, biomass and marine energies. The RES are the primary, domestic and clean or the exhaustable energy resources. The following table 1 shows the renewable energy resources and their usage:

Table 1:
Main energy renewable sources and their usage form

Energy Source	Energy conversion and usage options
Direct Solar	Photovoltaic, Thermal Power generation, Water heaters
Geothermal	Urban heating, Power generation, Hydrothermal, Hot dry rock
Hydropower	Power generation
Modern biomass	Heat and power generation, Pyrolysis, Gasification, Digestion
Solar	Solar home system, Solar dryers, Solar cookers
Tidal	Barrage, Tidal stream
Wind	Power generation, Wind generators, Windmills, Water pumps

2. RENEWABLE ENERGY SOURCES:-

Renewable energy resources will play an important role in the world's future. The energy resources have been split into three categories: fossil fuels, renewable resources and nuclear resources [11]. Renewable energy sources are those resources which can be used to produce energy again and again, e.g. solar energy, wind energy, biomass energy, geothermal energy, etc. and are also often called alternative sources of energy [12].Renewable energy sources that meet domestic energy requirements have the potential to provide energy services with zero or almost zero emissions of both air pollutants and greenhouse gases. Renewable energy system development will make it possible to resolve the presently most crucial tasks like improving energy supply reliability and organic fuel economy; solving problems of local energy and water supply; increasing the standard of living and level of employment of the local population; ensuring sustainable development of the remote regions in the desert and mountain zones; implementation of the obligations of the countries with regard to fulfilling the international agreements relating to environmental protection [13]. Development and implementations of renewable energy project in rural areas can create job opportunities and thus minimizing migration towards urban areas [14]. Harvesting the renewable energy in decentralized manner is one of the options to meet the rural and small scale energy needs in a reliable, affordable and environmentally sustainable way [15-16].

3. CLIMATE CHANGE SCENARIO:-

Climate change is one of the primary concerns for humanity in the 21st century [17]. It may affect health through a range of pathways, for example as a result of increased frequency and intensity of heat waves, reduction in cold related deaths, increased floods and droughts, changes in the distribution of vector-borne diseases and effects on the risk of disasters and malnutrition. The overall balance of effects on health is likely to be negative and populations in low income countries are likely to be particularly vulnerable to the adverse effects. The experience of the 2003 heat wave in Europe showed that high-income countries may also be adversely affected [18]. The potentially most important environmental problem relating to energy is global climate change (global warming or the greenhouse effect). The increasing concentration of greenhouse gases such as CO_2, CH_4, CFCs, halons, N_2O, ozone, and per oxy acetyl nitrate in the atmosphere is acting to trap heat radiated from Earth's surface and is raising the surface temperature of Earth [19].

Table 2
Global renewable energy scenario by 2040 [5].

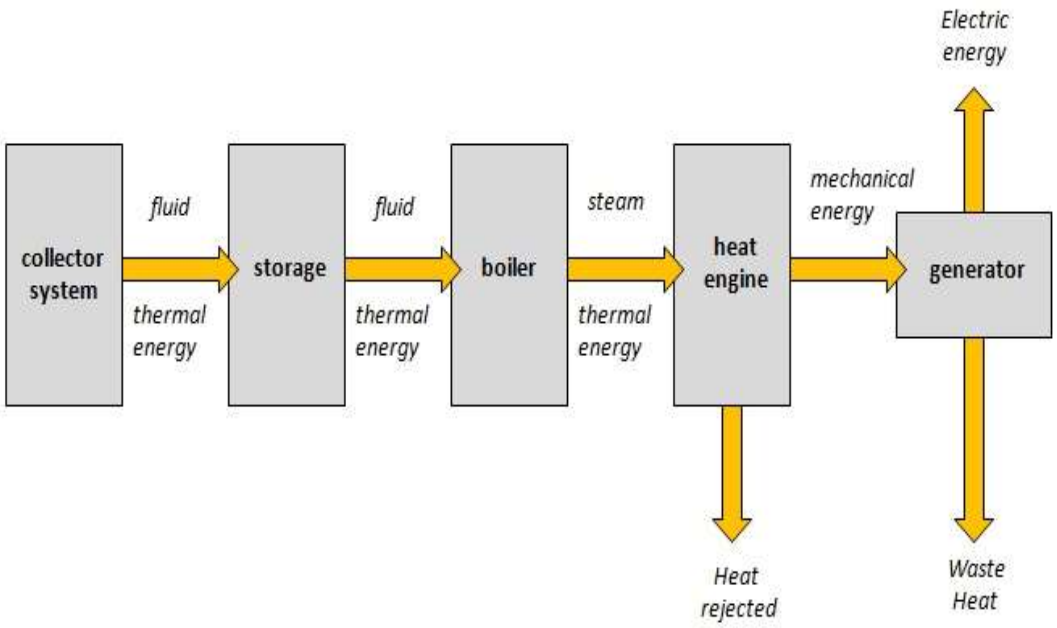
	2001	2010	2020	2030	2040
Total consumption (million tons oil equivalent)	10,038	10,549	11,425	12,352	13,310
Biomass	1080	1313	1791	2483	3271
Large hydro	22.7	266	309	341	358
Geothermal	43.2	86	186	333	493
Small hydro	9.5	19	49	106	189
Wind	4.7	44	266	542	688
Solar thermal	4.1	15	66	244	480
Photovoltaic	0.1	2	24	221	784
Solar thermal electricity	0.1	0.4	3	16	68
Marine (tidal/wave/ocean)	0.05	0.1	0.4	3	20
Total RES	1,365.5	1,745.5	2,964.4	4289	6351
Renewable energy source contribution (%)	13.6	16.6	23.6	34.7	47.7

Industry contributes directly and indirectly (through electricity consumption) about 37% of the global greenhouse gas emissions, of which over 80% is from energy use. Total energy-related emissions, which were 9.9 Gt CO2 in 2004, have grown by 65% since 1971 [20].There is ample scope to minimize emission of greenhouse gases if efficient utilization of renewable energy sources in actual energy meeting route is promoted [21].

4. SOLAR ENERGY:-

As far as renewable energy sources is concerned solar thermal energy is the most abundant one and is available in both direct as well as indirect forms. The Sun emits energy at a rate of 3.8×10^{23} kW, of which, approximately 1.8×10^{14} kW is intercepted by the earth [22]. There is vast scope to utilize available solar energy for thermal applications such as cooking, water heating, crop drying, etc. Solar cooking is the most direct and convenient application of solar energy. Solar energy is a promising option capable of being one of the leading energy sources for cooking [23-25].

Fig. 1



Solar water heater of domestic size, suitable to satisfy most of the hot water needs of a family of four persons, offers significant protection to the environment and should be employed whenever possible in order to achieve a sustainable future [26]. It is esti-mated that a domestic solar water heating system of 100 l per day capacity can mitigate around 1237 kg of CO2 emissions in a year at 50% capacity utilization and in hot and sunny region it is about1410.5 kg [27-28]. Solar energy is a very important energy source because of

its advantages. There are many remote areas in the world where electricity is not available, but solar irradiation is plentiful, thus the utilization of solar energy to produce electricity in these areas is quite possible [29].

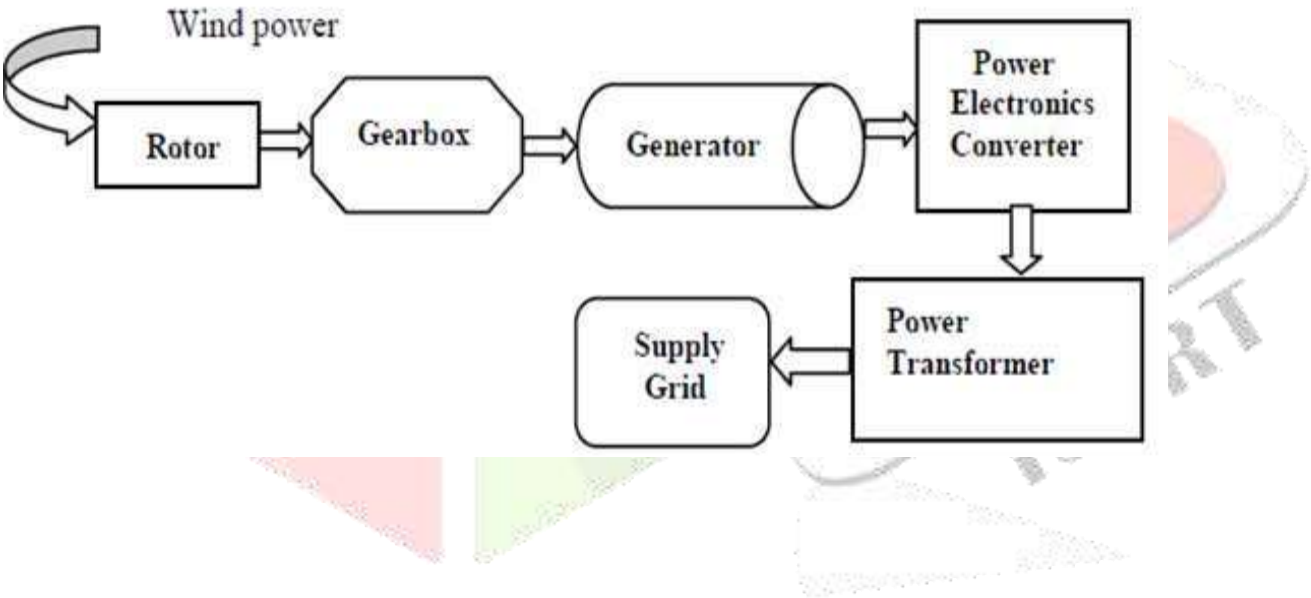
Table 3
Economics and emissions of conventional technologies compared with solar power generation [29].

Electricity generation technology	Carbon emissions (gC/kWh)	Generation costs (US¢/kWh)
Solar thermal and solar PV systems	0	9-40
Pulverized coal–natural gas turbine	100-230	5-7

5. Wind Energy:-

Of the renewable energy technologies applied to electricity gen-eration, wind energy ranks second only to hydroelectric in terms of installed capacity and is experiencing rapid growth. India is one of the most promising countries for wind power development in the world [30]. Wind energy for electricity production today is a mature, com-petitive, and virtually pollution-free technology widely used in many areas of the world [31]. Wind technology converts the energy available in wind to electricity or mechanical power through the use of wind turbines [32].

Fig.2



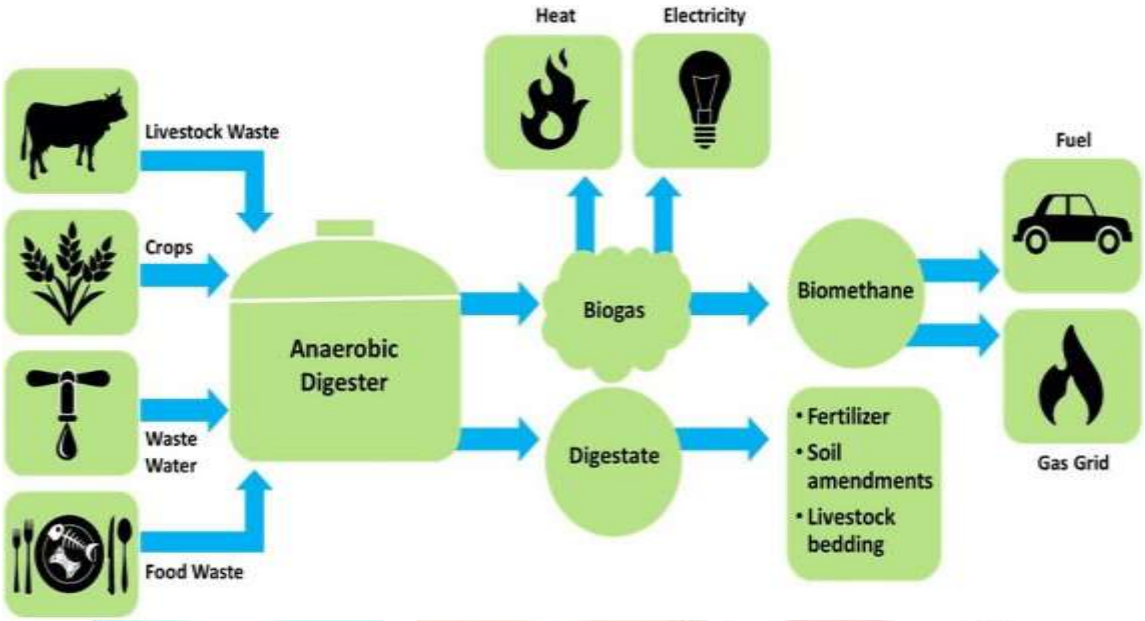
The function of a wind turbine is to con-vert the motion of the wind into rotational energy that can be used to drive a generator, as illustrated in Fig. 2. Wind turbines capture the power from the wind by means of aerodynamically designed blades and convert it into rotating mechanical power. Wind turbine blades use airfoils to develop mechanical power [33].

6. BIOENERGY:-

The production of biogas through anaerobic digestion offers significant advantages over other forms of bio energy production. It has been evaluated as one of the most energy-efficient and environmentally beneficial technology for bio energy production. For the production of biogas it is possible to use several different raw materials and digestion technologies [34]. This variety and the various fields of application for the biogas and digested product result in great differences in the environmental performance among the potential biogas systems. Among the raw materials are organic waste from households and the food industry, dedicated energy crops, and agricultural waste products, such as crop residues and manure [35].Biogas is a mixture of gases that is composed mainly of CH440–70%, CO2 30–60%, and other gases 1–5%. The calorific value of biogas is about 16–20 MJ m−3 [36]. Biodiesel is a clean burning fuel that is renewable and biodegrad-able. Biodiesel is being extracted from Mahua oil [37], rubber seed oil

[38], Pongamia pinnata oil [39], palm oil [40], Jatropha curcas [41-42], duck tallow [43] and castor seed oil [44] and its blends showed performance characteristics close to diesel [45].

Fig.3



7. HYDROGEN AS FUEL:-

Hydrogen has fascinated generations of people for centuries, including visionaries like Jules Verne. Hydrogen is expected to play a key role in the world's energy future by replacing fossil fuels. Hydrogen is gaining increasing attention as an encouraging future energy [46]. Its conversion to heat or power is simple and clean. When burnt with oxygen, hydrogen generates no pollutants, only water, which can return to nature. However, hydrogen, the most common chemical element on the planet, does not exist in nature in its elemental form. It has to be separated from chemical com-pounds, by electrolysis from water or by chemical processes from hydrocarbons or other hydrogen carriers. The electricity for the electrolysis may come eventually from clean renewable sources such as solar radiation, kinetic energy of wind and water, or geothermal heat. Therefore, hydrogen may become an important link between renewable physical energy and chemical energy carriers [47].

Most H_2 is currently produced from nonrenewable sources such as oil, natural gas, and coal [48]. Thermo chemical conversion processes such as pyrolysis and gasification of biomass have considerable potential for producing renewable hydrogen, which is beneficial to exploit biomass resources, to develop a highly efficient clean way for large-scale hydrogen production, and to lessen dependence on insecure fossil energy sources [49]. The main advantages' of biomass to hydrogen are:

1. The use of biomass reduces CO2 emissions, and thus replacing fossil fuels with sustainable biomass fuel is one option that needs consideration in reducing CO2 emissions.

2. The residues conversion increases the value of agricultural out-put.

3. The costs of getting rid of municipal wastes are mounting as land resources are constrained.

Production of hydrogen from renewable biomass has several advantages compared to that of fossil fuels [50]. Producing hydrogen from woody biomass is mainly carried out via two thermo chemical processes: (a) gasification followed by reform-ing of the syngas, and (b) fast pyrolysis followed by reforming of the carbohydrate fraction of the bio-oil [51-52].

Table 4

Conditions of thermal treatment of biomass [53].

Process	Temperature (K)	Heating rate (K/s)	Solid residence time (s)
Pyrolysis	675–875	0.1–1.0	600-2000
Fast pyrolysis	975-1225	250-300	1-3
Gasification	975-1225	300-500	0.5-2.0

8. CONCLUSION:-

A comprehensive literature survey of major renewable energy gadgets for domestic and industrial applications such as solar water heaters, solar cookers, dryers, wind energy, biogas technology, biomass gasifies, improved cook stoves and biodiesel was made. The review gives an overview of the development and scope of CO2 mitigation for clean and sustainable development. The use of solar drying of agricultural produce has good potential for energy conservation in developing nations. Biodiesel from no edible vegetable.

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