



### ROLE OF RENEWABLE ENERGY SOURCES IN DEVELOPING INDIA

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#### Abstract

In the past few years the research done on electrical energy consumption says that there was a massive reduction in the use of renewable sources of energy which in the result is causing various problems and the use of enhanced electrical energy like thermal and nuclear energy is now limited up to cities and town only. So as per our study we are presenting the use of renewable sources of energy so that the developing areas of India can use the energy as well. As the demand of energy is increasing day by day which needs to be fulfilled in order to increase the economy of India. Enhancing the normal use of renewable energy sources and promoting the basic research and innovation in the technologies to resolve the barriers for development of commercial deployment of solar, wind, hydropower, geothermal and biomass in developing areas in today's need. In this research paper we have shown different types of renewable sources of energy and their amount of energy production then cost reduction, efficiency, applications and application. Our major focus is transport and storage problems are focus of discussion.

**keywords:- Renewable sources of energy Solar ,Wind, Hydropower, Geothermal and Biomass, etc.**

#### 1.INTRODUCTION

All human being needs energy in order to perform various activities in their day to day life. This energy comes from the resources readily available on the earth in the form of Sunlight, Heat, Wind, Water, Biomass and Biofuels.

**1.1 Solar power in India** is a rapidly increasing industry in country. As present year 2017 the India's solar grid had a massive capacity of 16.20 GW. India started its solar-generation capacity from 2,650 MW on 26<sup>th</sup> of May 2014 to 12,289 MW on 31st March 2014. India added 3.01 GW of solar capacity in 2015-2016 time period and 5.525 GW in 2016-2017 time period, the highest of any year, with the decrease in average current price of solar electricity by a margin of 18% below the average price of its thermal counterpart. Indian government has started a initiative in January 2015 which is aimed as a project of 100 GW in order to expand or increase the solar power with an investment of 100 billion dollars which includes a 40GW capacity of rooftop solar by 2022. India is developing off-grid solar power for local energy needs. While starting of solar power in 2014 India has only 1.46% of the total world capacity. . The present research in the solar technology

has helped to achieve this target till now and thus lead to decrease in the use of burning coal and gas combustion which helped in the reduction of the pollution rate in India. Electrification rate in rural areas of India; in 2015 only 55% of all rural populations had access to electricity in which 85% of rural population were depended on solid and liquid fuels for cooking. In order to fulfill the requirements of rural areas needs the utilization of solar operated products are increasingly helping to meet rural needs; by the end of 2015 just under 1 million solar lanterns were purchased in our country, reducing the need for liquid fuels. In the year 2015, 118,700 solar home lighting systems (SHLS) were installed and 46,655 solar street lighting installations were provided under a national program. Total 1.4 million solar cookers were sold in India.

**1.2 Wind power generation in India** has transiently increased in past few years. As the total installed wind power capacity was 32.56 GW in the end of July 2017, which was widely spread across the Southern, Western and Northern areas. And at the end of December 2015, India was ranked fourth largest installed wind power capacity in the world. The compared tariff of wind power reached a lowest record of ₹3.46 per kWh during auctions for wind projects in

February 2017 Subsequently the tariff decreased further in August 2017 in a competitive meeting managed by TANGEDCO (Tamil Nadu Generation and Distribution Corporation) to ₹ 3.42/kWh. The development of wind power in India was started in 1986 with the first wind farms set up in coastal areas of RATNAGIRI, OKHA and TIRUNELVELI with 55 kW Vestas wind turbines. The projects were supported by the Ministry of New and Renewable Energy (MNRE).

**1.3 Hydroelectric power in India** ranks 7th largest producer of hydroelectric power among the world. In year 2015, India's total installed hydroelectric capacity was 44,594 MW, i.e. the 13.5% of its total required power generation capacity in India. In addition to that the smaller hydroelectric power units with a generating capacity of 4,380 MW has been already installed. India's hydroelectric power generation is aimed at 84,000 MW at 60% load factor. In the session 2016-17, the total amount of power generated in India was 122.31 TWh. The installation of hydro-electric power plants at Darjeeling and Shivanasamudram were established in 1898 and 1902 were respectively became the first in Asia and thus India has been playing a vital role in global hydroelectric power development. And India also imports vast amount of hydroelectric power from Bhutan.

**1.4 Biomass energy in India** is renewable energy that can be available from Biomass materials produced from biological sources. Biomass is any organic material are those that are capable of storing sunlight in the form of chemical energy. Sometimes it includes include wood, wood waste, straws, manures, sugarcane, and all other by-products from different waste of agricultural processes. In year 2010, there was 35 GW of power that was installed in the world bioenergy capacity for the power generation, in which 7 GW was generated by the United States of America. In short it is a product to biofuel, which is found from biological sources. In its sense it covers biomass.

**1.5 Geothermal energy** is heat energy that is generated by the Earth. The geothermal energy of the Earth's crust produced from the initial formation of the planet and from radioactive waste of materials. The geothermal gradient, which is the difference in between the core temperature of the planet and temperature of its surface, that runs a continuous liberations in the form of heat from the core to the upper surface of the earth.

## 2. DISCUSSION:-

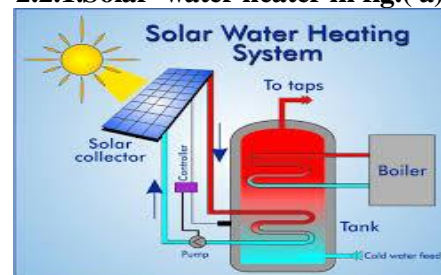
### 2.1 Solar energy

The conversion of light energy into the electrical energy is done by solar cells. These cells contains semiconductor.

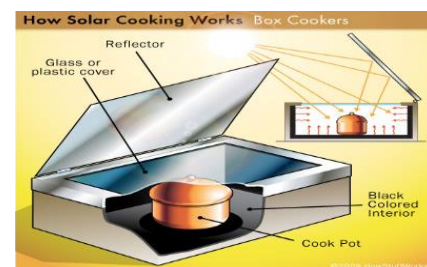
The combination of solar cells are used to power satellites in orbit around the earth as well as to power road light. They are also called as photovoltaic cells. Solar panel differ from the solar cells. Solar panel cannot directly generate electricity and heat up water directly. The cold water from the storage tank is pushed by the pump through the pipes. Heat energy from the sun is utilized for heating of water. Solar panels are placed at the roofs of the buildings as it has abundant amount of solar energy in the form of sunlight. The solar thermal devices used for the this process are solar collector and receiver. The devices like solar water heater. Solar cookers and solar dryers make the use for the this process are solar collector and receiver. The devices like solar water heater. Solar cookers and solar dryers make the use of low grade solar devices mainly for domestic and industrial applications. Fig shows the technique of conversion of solar energy into the electrical energy.

### 2.2.1 Types of solar products:-

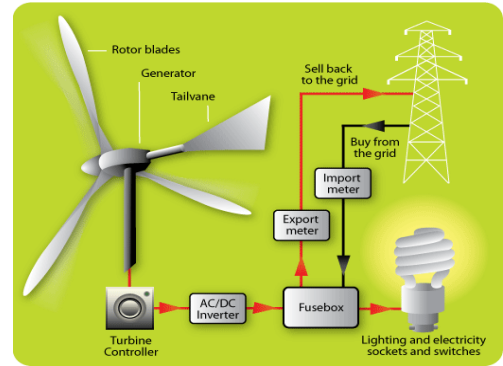
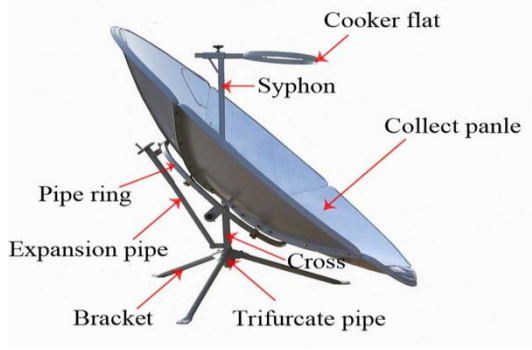
#### 2.2.1. Solar water heater in fig. (a)



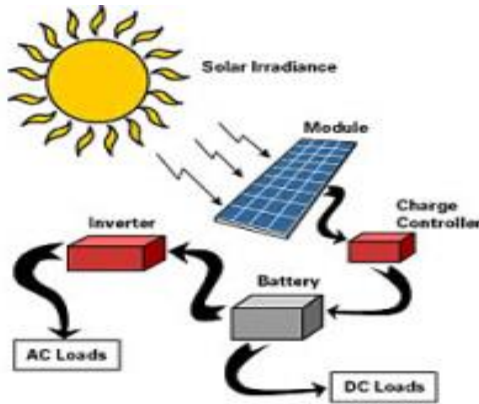
#### 2.2.2. Solar cookers in fig. (b)



#### 2.2.3. Parabolic Concentrating Solar Cooker in fig. (c)



**2.2.4. Solar Electricity Generation Solar Photovoltaic in fig. (d)**



**2.3 Wind Energy Technology:-**

Wind energy is transiently increasing and is now a well recognized form of energy resource worldwide. The kinetic energy of wind is converted into mechanical energy which is then converted into electrical energy. The below **fig. (e)** shows the technique of conversion of wind energy into electric power.

The cheapest source of energy is wind and is utilized to rotate the turbines attached to the mechanism. Constructing the wind mill and maintaining it thus increases the number of jobs and also it's the cost efficient and clean technique to produce electricity. In the areas where there is need of huge energy and also where there is availability of space it can be used. Also it is used in commercial techniques. Now wind power is enhancing and is utilized in a large manner for a better technology.

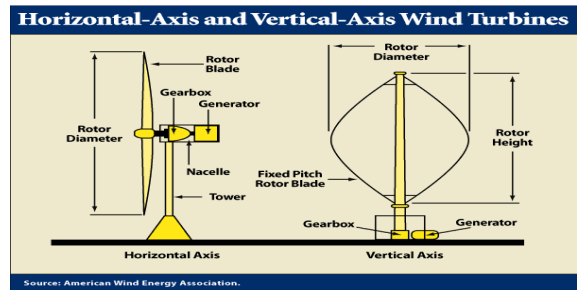
**2.3.1 Parts of wind energy :-**

- 1. Rotorblades
- 2. Generator
- 3. Tailvane
- 4. Turbine Controller
- 5. Inverter

As the important role is played by the generators so in this case the **Wind Electric Generator (WEG)** is used that helps to convert kinetic energy produced by the rotor blades into electric. The various companies that collaborate with the foreign countries like Netherland, Belgium, USA and etc. in order to produce this **WEG's**. In India 225kW-1000KW are being installed. Although the wind farms are not that much popular as it creates noise pollution and can adversely affect the environment as well. It is also possible to construct different size of turbines as per its use. However the technology is still researching on the various topics and techniques to ensure the great efficiency and the less constructional features.

**2.3.2 Types of turbines in fig (f) :-**

- 1. Horizontal Turbines
- 2. Vertical Turbines



**2.3.3 Wind Potential:-**

The continuous working of wind mill requires continuous flow of wind. A wind energy at least requires **15km/hr.** speed in an average. As compared to winter the generator produces lesser power with the same speed of wind shown in fig. (g)

Average wind speed km/h	Suitability
Up to 15	Not good
18	Poor
22	Moderate



**Fig.(g)Guideline of different wind speeds**

As per the potential produced by the states the below chart shows the amount of production of energy by appropriate states shown in fig. (h).

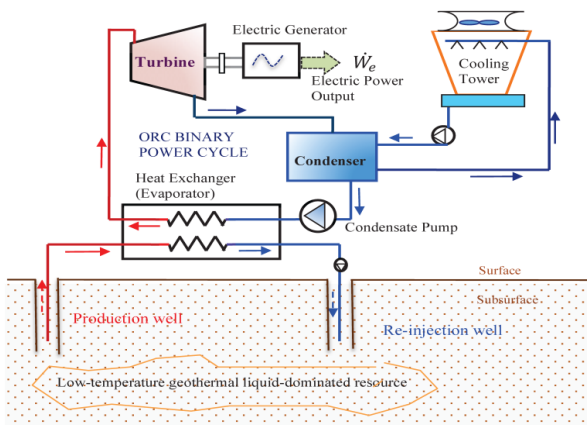
State	Installed Capacity
Andhra Pradesh	213
Gujarat	2641
Karnataka	1852
Kerala	35
Madhya Pradesh	330
Maharashtra	2560
Rajasthan	1830
Tamil Nadu	6613
Others	4
<b>Total</b>	<b>16078</b>

**Fig.(h) Wind power potential of producing electricity in India****2.3.4 Applications:-**

- 1.The power can be utilized by the grid in order to transfer the power to the appropriate areas.
- 2.It can be used to charge the batteries as well.
3. For pumping water.
4. For household purpose.

**2.4 Geothermal energy in India:-**

The technique to convert geothermal energy into electrical energy is now an platform by which the renewable source of energy utilization factor can be increased. The magma present inside the earth crust are melted and thus due to compressions of rock it produces heat which then is utilized to heat the water and rest of the working is same as that of thermal.

**2.4.1 Technique of conversion of geothermal energy into electrical power is shown in fig. (i) below:-****2.4.2 Limitations of producing geothermal energy:-**

- 1.It is very costly.

2. It is a time consuming process thus needs a specific location.

**2.4.3 Advantages:-**

- 1.It doesn't require any type of fuel in order to produce energy.
- 2.Doesn't create any type of hazard to environment.
3. Initial investment is low as compared to thermal.

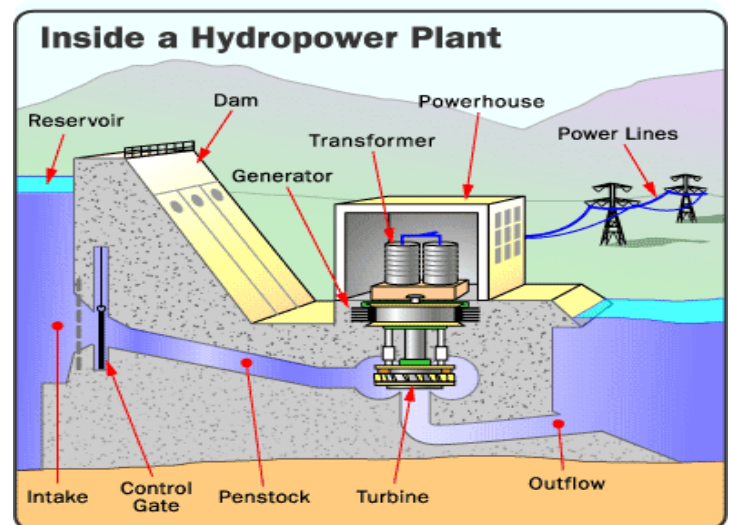
**2.5 Hydropower energy in India:-**

In **hydro power plant** the gravitational force of water is utilized in order to run the turbines that is coupled with a generator so that it can produce electric power. This power plant plays a crucial role to save the fossil fuels that is already in a limited manner, as the power production takes place by the use of renewable source that is water, so it is also a cost free technique without using any fuels.

The great advantage of hydro power is the water which plays the main role to generate electricity in hydro power plant and also its free of cost, it doesn't create any type of pollution in the environment and thus the generated energy is then utilized in a manner that it also helps to reduce the average rate of consumption of electricity in our country.

**2.5.2 Advantages:-**

- 1.The flexibility of this hydropower makes it very successful as it can be controlled as per the requirement from low to high at any instant.
2. It is a deal that can be used as it only requires the initial investment and the value as output is much higher.
3. some of the hydroelectric power plants supply the power to the public sector instead some of the small scale industries also accepted this technique in order to fulfill their requirement, thus it is a beneficiary act for industries also.

**2.5.1 Technique of generating hydropower energy is shown in the fig.(j) below:-**

4. The main advantage of the dams are that they can be used as water controller and supplies water when there is any requirement. Thus it acts as a reservoirs.

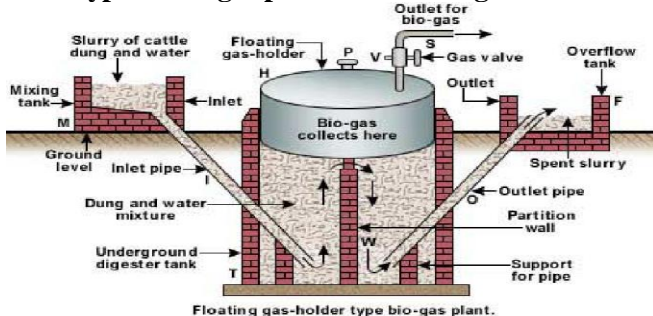
### 2.5.3 Limitations:-

1. Ecosystem damage and loss of land
2. Water loss by evaporation
3. Siltation and flow shortage
4. Methane emissions (from reservoirs)
5. Relocation
6. Failure risks

### 2.6 Biomass fuels in India:-

Biomass energy stands second in the worldwide consumption after fuels like coal, gases, oil. So it's the valuable renewable source of energy that is found on the surface or below surface of earth. It is extracted from the general waste created by different natural or human activities. The byproducts of various industries, agricultural activities, decomposition of waste of forest, waste from household activities, etc. It is such a source of energy that is utilized in a vast manner and also accounts the 35% of the energy consumption in the developing countries for cooking and heating purpose. The different ways by which this energy can be extracted are decomposition and fermentation. The slurry as an output can be used for agricultural uses as natural fertilizer. Hence the use of biofuels in a vast manner can reduce the use of fossil fuels and thus helps to reduce the pollution and saves the environment. Also the gases liberated from is as a byproducts can be beneficial for the environment and the plants and crops

#### 2.6.1 Typical biogas plant shown in fig. :-



### 3. CONCLUSION:-

Fossil fuel's depletion is going to take place one day hence, there is a urgent need to decrease reliance on depleting results of fossil fuels. Renewable energy sources are recognized very important for the energy sector so we should take initiative to generate electricity for our home and farms. Along with this by the use of the renewable energy we can create many employment opportunities starting from the rural areas to more developed areas and thereby improving India for the better future. The strategy for achieving the renewable

energy technologies is totally depend upon all the active participant such as government agencies of NGOs, financial institutions, a young generation of energy entrepreneurs. To confirm that we will have plenty of energy in the next upcoming generation we should reduce our dependency on depleting fossil fuels and go towards the readily available renewable energy sources such as solar, wind, geothermal, wave power and hydropower to provide the clean electricity to herald green energy revolution in India. All energy sources have an impact on environment and leads to the greenhouse effect and global warming, air pollution but the renewable energy sources are ecofriendly, non-polluting, contributing towards the prosperity of the nation.

### 4. ACKNOWLEDGEMENT:-

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