

Renewable Energy Sources

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ABSTRACT

A renewable resource is a natural reserve which will restock to replace the bit exhausted by usage and utilization, either through natural duplicate or other confirmed processes in a finite quantity of time in a human time scale.

Some examples of renewable energy sources are solar energy, wind energy, hydropower, geothermal energy and biomass energy. These types of energy sources are different from fossil fuels, such as coal, oil, and natural gas.

India is one of the countries with the largest production of energy from renewable sources. As of 2019, India's total electricity generation mix is 35% from renewable energy, 55% from coal, 2% from nuclear power, and the remaining 8% from small hydro and other sources.

Key words-Renewable resource, solar energy, Biomass and fossil fuels.

Energy is the spinal feature for every country. Status of any country with respect to development criteria is directly proportional to energy production capacity of the country. Energy is being produced since the birth of civilization. Means of energy production got changed with the time span. Due to limited availability of conventional sources of energy and their adverse effects on climate, energy production by non conventional sources is getting quiet attention. India is also paying sufficient attention to produce energy via renewable energy sources.

In the Paris-Agreement, India has devoted to an Intended Nationally Determined Contributions target of achieving 40% of its total electricity generation from renewable energy sources by 2030. The country is aiming for even more ambitious target of 57% of the total electricity capacity from non-fossil energy sources by 2027 in Central Electricity Authority's strategy blueprint. According to 2027 blueprint, India aims to have 275 GW from renewable energy, 72 GW of hydroelectricity, 15 GW of nuclear energy and nearly 100 GW from "other zero emission" sources. In the quarter ending September 2019, India's total renewable electricity capacity (including large hydro) was 130.68 GW. This represents 35.7% of the total installed electricity generation capacity in the country, which is around 366 GW.

As of October 2019, of the 175 GW interim target, 83 GW is already operational, 29 is under installation, 30 GW is under bidding, and remaining 43 GW is under planning. 175 GW interim targets is 100 GW of solar, 60 GW of wind, 10 GW of bio mass and 5 GW of small hydro. As of 2019, 35% total power production comes from renewable energy, 13% or 45.399 GW of the total from all sources comes from large hydro projects, 10% or 36,686.82 GW of the total from all sources from wind power which is fourth-largest in the world, 8% or 9.1 GW of total power from all sources from Biomass power from biomass combustion, biomass gasification and biogases cogeneration.

Types of Renewable Energy

Let's look a little closer at some examples of renewable energy sources----

1-Solar Energy

Direct energy from the sun powers solar energy systems. More solar energy reaches the Earth each minute than is consumed in fossil fuels in an entire year.

Solar energy may be divided into two major categories: solar thermal and solar voltaic. Solar thermal energy relies on heating of a carrier fluid, often water. The warmed liquid may be used directly, as in hot water heating, or used to drive another process, such as electrical generation. Solar voltaic or photovoltaic systems generate energy by capturing electrons excited by photons in sunlight. Photovoltaic (PV) cells use the electromagnetic properties of sunlight to generate electricity.

Despite massive potential, solar power currently has limited market penetration. Even in highly suitable countries such as Australia, solar provides less than 10% of energy demand. Nonetheless, worldwide, more than 140 million m² of solar thermal collectors has been installed—more than 100 GW in energy-generating potential, which is more than total global installed wind capacity. In areas with large amounts of available land, central-receiver solar electrical generation has major potential for expansion. Solar thermal production might supply 5–20% of all energy demand worldwide by mid-century.

Photovoltaic generation has strong potential for supplying a major portion of electricity demand. Photovoltaic's can be mounted on roofs in urban demand centers. Nanotechnology may soon provide photovoltaic paints that will allow electricity generation from any painted surface. It is possible that all residential electricity use could be provided by photovoltaic's within the 21st century.

Hence solar energy or energy from the sun, is harnessed using solar collectors. This collected energy can then be used to provide heat, light, or other forms of electricity.

Pros: Sunlight is free and readily available almost everywhere. Using it does not create any wastes or pollutants.

Cons: The technology needed to collect and use solar energy can be expensive. Sunlight can only be collected during the day when it is sunny.

The total installed capacity of Renewable energy in India is 71 GW as on June 2018, where 23.02 GW power is installed capacity of SPV plants including rooftop systems.

Rajasthan state captures solar radiation of 6-7 kWh/m² /day with approximately 300 sunny days per year (27.0238° N, 74.2179° E).

2-Wind Energy

Wind energy is just what it sounds like energy that we get from the wind. Windmills have been used for hundreds of years to pump water from the ground. Today, we use large, tall wind turbines that use the wind to generate electricity. Many wind turbines are often placed together in wind farms in flat areas with strong winds.

Global installed wind energy capacity is currently more than 60 GW. Global wind capacity increased 12-fold between 1995 and 2005. Virtually all of this wind capacity is in the form of electricity-generating turbines of different sizes.

If current growth in wind capacity continues, global installed capacity could reach more than 1 TW by 2020, at which point global electric energy demand may be 2 or 3 TW. It is likely that mismatches between demand centers and areas with high wind potential will limit future expansion of wind energy. It is possible that wind energy will provide as much as 50% of electrical demand by 2050.

Wind power generation capacity in India has significantly increased in recent years. As of 31 March 2019 the total installed wind power capacity was 36.625 GW, the fourth largest installed wind power capacity in the world. Wind power capacity is mainly spread across the South, West, North and East regions.

4298 MW wind power plant has been installed in Rajasthan.

Pros: Does not produce any waste or pollutants. It takes up little ground space.

cons – Wind Turbines can disturb or kill flying creatures, like birds and bats .wind is not constant and reliable.

3-Biofuels

Biofuels convert energy from the sun to plant materials, which are then processed to produce liquid fuels. Biofuels include ethanol, which may be substituted for gasoline in many recent model automobiles. For this reason, biofuels are especially useful in providing the energy needs of the transportation sector.

Brazil has the most advanced biofuels program in the world, where approximately 40% of gasoline use has been replaced by ethanol from sugarcane and other sources

Biodiesel is a renewable fuel that is produced mainly from vegetable oils and animal fats. Biodiesel is renewable, non-toxic, and biodegradable (98% biodegrades in just a few weeks), contains fewer sulfur compounds compared to the diesel and has a high flash point ($> 130^{\circ}\text{C}$) [1]. The soaring price of edible oil leads to biodiesel production unaffordable and present feedstock sources for fuel production are limited. Food crops like *Jatropha*, rapeseed, and canola are used for biodiesel production but they have great dependency on soil and climatic conditions, high labor and intensive energy requirement. Animal slaughtering for biodiesel production will not be a good option.

Biogas Production in India.

In India, the estimate for the production of biogas is about 20,757 lakh cubic meters in 2014-15. This is equivalent to 6.6 crore domestic LPG cylinders. This is equivalent to 5% of the total LPG consumption in the country today.

In case of our Rajasthan state conditions are quiet adequate in sense of bio gas energy. Rajasthan will be the first State to produce manure from biogas plants at the cow shelters. Biogas plants with the capacity of over 100 cubic meters will be set up shortly at 25 gaushalas in Rajasthan with 50% subsidy on investment costs paid by the state government's Gopalan Department.

4-Hydropower

Hydropower is the generation of electricity by running a turbine with water impounded behind a dam. Hydropower currently comprises slightly more than 20% of the world's electrical generation. Canada draws more than half of its electric power from hydro, whereas in the United States hydro supplies less than 10%. China has the greatest potential for growth in hydro and is pursuing an aggressive strategy of hydro development. Much of the potential for high dams for hydropower has already been realized worldwide. Future expansion is limited by social (displacement of communities) and environmental concerns. There is greater potential for expansion in small- to medium-sized hydropower projects.

India is the 7th largest producer of hydroelectric power in the world. As of 30 April 2017, India's installed utility-scale hydroelectric capacity was 44,594 MW, or 13.5% of its total utility power generation capacity.^[1] Additional smaller hydroelectric power units with a total capacity of 4,380 MW (1.3% of its total utility power generation capacity) have been installed.^{[2][3]} India's hydroelectric power potential is estimated at 148,700 MW at 60% load factor.^[3] In the fiscal year 2016-17, the total hydroelectric power generated in India was 122.31 TWh (excluding small hydro) with an average capacity factor of 33%.

5-Geothermal energy

Geothermal energy uses heat from the Earth's core, in surface manifestations often associated with features such as geysers and hot springs, to boil water and produce electricity in a steam-driven turbine. Total world capacity is currently less than 8 GW, and even assuming a doubling by mid-century, this source will remain minor in global terms. In theory, deeper earth heat can be tapped by deep drilling, which could greatly expand future geothermal potential.

A variant on geothermal production is ocean thermal production, in which the temperature gradient across the surface layers of the ocean is used to boil a highly volatile carrier such as ammonia to drive a turbine. Ocean thermal potential is huge, but it is limited by transportation problems. Energy produced must be transported to land as electricity in huge submarine cables or converted to a liquid carrier.

India has reasonably good potential for geothermal; the potential geothermal provinces can produce 10,600 MW of power (but experts are confident only to the extent of 100 MW). But yet geothermal power projects has not been exploited at all, owing to a variety of reasons, the chief being the availability of plentiful coal at cheap costs. However, with increasing environmental problems with coal based projects, India will need to start depending on clean and eco-friendly energy sources in future; one of which could be geothermal.

6-Tidal energy

Tidal energy uses the energy force of the tides to generate electricity. A dam or barrier perpendicular to Tidal the direction of tidal flow can create enough head to generate electricity. Tidal power is largely untested but may have wider potential for expansion than ocean thermal because it can be sited closer to end demands.

CONCLUSION

Ultimately, the sun powers all major renewable energy technologies except geothermal and tidal power. The sun drives atmospheric processes that result in wind for wind power, plant growth for biofuels and water evaporation that makes hydropower possible. Renewable energy sources are developed worldwide, owing to the high prices of fossil fuel and to limiting greenhouse gas emissions. The depletion of the known petroleum reserves makes the renewable energy sources more attractive ever before.

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