

SURVEY OF RENEWABLE ENERGY SOURCES USED IN INDIA

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Abstract: Renewable energy is energy that is collected from renewable resources, which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat.[3] Renewable energy often provides energy in four important areas: electricity generation, air and water heating/cooling, transportation, and rural (off-grid) energy services. At the national level, at least 30 nations around the world already have renewable energy contributing more than 20 percent of energy supply. National renewable energy markets are projected to continue to grow strongly in the coming decade and beyond. Some places and at least two countries, Iceland and Norway, generate all their electricity using renewable energy already, and many other countries have the set a goal to reach 100% renewable energy in the future.

Keywords: Renewable Energy Sources (RES), Distributed Generation (DG), MNRE, Sustainable Development, SHP, OTEC

I. INTRODUCTION

India is the fourth largest energy consumer in the world after the United States, China, and Russia. Rapid urbanization and improving standards of living for millions of Indian households, the demand is likely to grow significantly [1]. India is one of the countries with large production of energy from renewable sources. As of 31 March 2020, 35.86% of India's installed electricity generation capacity is from renewable sources, generating 21.22% of total utility electricity in the country. In the Paris Agreement India has committed to an Intended Nationally Determined Contributions target of achieving 40% of its total electricity generation from non-fossil fuel sources by 2030. The country is aiming for even more ambitious target of 57% of the total electricity capacity from renewable 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. Government of India has also set a target for installation of Rooftop Solar Projects(RTP) of 40 GW by 2022 including installation on rooftop of houses.

II. WHY RENEWABLE ENERGY IN INDIA?

India has a strong manufacturing base in wind power with 20 manufactures of 53 different wind turbine models of international quality up to 3 MW in size with exports to Europe, the United States and other countries. Wind or Solar

PV paired with four-hour battery storage systems is already cost-competitive, without subsidy, as a source of dispatchable generation compared with new coal and new gas plants in India.

India is running one of the largest and most ambitious renewable capacity expansion programs in the world. In 2019 at UN climate summit, India announced that it will be more than doubling its renewable energy target from 175GW by 2022 to 450GW of renewable energy by the same year. Newer renewable electricity sources are projected to grow massively by nearer term 2022 targets, including a more than doubling of India's large wind power capacity and an almost 15 fold increase in solar power from April 2016 levels. These targets would place India among the world leaders in renewable energy use and place India at the centre of its "Sunshine Countries" International Solar Alliance project promoting the growth and development of solar power internationally to over 120 countries. Energy plays a vital role in the economic development of all countries. India ranks second position in terms of population that accounts to 18% of world's overall population. The increase in standard of living and population in India makes India to rank fourth place in consumption of energy in the globe. As fossil fuels are depleting and creating more pollution causing global warming, and also since energy demand is increasing day by day, energy production from renewable energy resources becomes the best solution in present condition as renewable energy resources are not exhaustible, clean, and green energy.

III. DIFFERENT RENEWABLE ENERGY SOURCES (RES)

1. Solar energy
2. Wind energy
3. Hydro energy
4. Tidal energy
5. Geothermal energy
6. Biomass energy

How these types of renewable energy work

1) Solar energy

Sunlight is one of our planet's most abundant and freely available energy resources. The amount of solar energy that reaches the earth's surface in one hour is more than the planet's total energy requirements for a whole year. Although it sounds like a perfect renewable energy source, the amount of solar energy we can use varies according to the time of day and the season of the year as well as geographical location. In the UK, solar energy is an

increasingly popular way to supplement your energy usage. Find out if it's right for you below by reading our guide to solar power.

2) Wind energy

Wind is a plentiful source of clean energy. Wind farms are an increasingly familiar sight in the UK with wind power making an ever-increasing contribution to the National Grid. To harness electricity from wind energy, turbines are used to drive generators which then feed electricity into the National Grid. Although domestic or 'off-grid' generation systems are available, not every property is suitable for a domestic wind turbine. Find out more about wind energy on our wind power page

3) Hydro energy

As a renewable energy resource, hydro power is one of the most commercially developed. By building a dam or barrier, a large reservoir can be used to create a controlled flow of water that will drive a turbine, generating electricity. This energy source can often be more reliable than solar or wind power (especially if it's tidal rather than river) and also allows electricity to be stored for use when demand reaches a peak. Like wind energy, in certain situations hydro can be more viable as a commercial energy source (dependant on type and compared to other sources of energy) but depending very much on the type of property, it can be used for domestic, 'off-grid' generation. Find out more by visiting our hydro power page.

4) Tidal energy

This is another form of hydro energy that uses twice-daily tidal currents to drive turbine generators. Although tidal flow unlike some other hydro energy sources isn't constant, it is highly predictable and can therefore compensate for the periods when the tide current is low. Find out more by visiting our marine energy page.

5) Geothermal energy

By harnessing the natural heat below the earth's surface, geothermal energy can be used to heat homes directly or to generate electricity. Although it harnesses a power directly below our feet, geothermal energy is of negligible importance in the UK compared to countries such as Iceland, where geothermal heat is much more freely available.

6) Biomass Energy

This is the conversion of solid fuel made from plant materials into electricity. Although fundamentally, biomass involves burning organic materials to produce electricity, this is not burning wood, and nowadays this is a much cleaner, more energy-efficient process. By converting agricultural, industrial and domestic waste into solid, liquid and gas fuel, biomass generates power at a much lower economical and environmental cost.

IV. COST OF RENEWABLE ENERGY

In 2016, global renewable energy capacity grew by a record amount while its cost fell considerably. This improvement

was largely due to a drop in the cost of both solar and wind energy. 161 GW of renewable energy capacity was installed worldwide in 2016 - a 10% rise on the preceding year and a new record as reported by REN21, a global renewable energy policy network covering 155 nations and 96% of the world's population. New solar installation provided the biggest boost - half of all new capacity. Wind power accounted for a further third with hydropower accounting for 15%. New solar capacity exceeded all other electricity producing technology for the first time ever. Although traditional fossil fuels such as oil and gas still provide 80% of global electricity output, renewables are rising fast. Christina Figures, the former UN climate chief said "The economic case for renewables as the backbone of our global energy system is increasingly clear and proven. Offering greater bang-for-buck, renewables are quite simply the cheapest way to generate energy in an ever-growing number of countries.

Renewable Energy Sources Challenges

Several challenges come into the picture for implementation of renewable energy technologies like:

Providing power on demand

The number one challenge for renewable energy is the fact that, in most cases, it's not always on. You get power when it's sunny or windy and when it's not, you don't. That kind of intermittent generation wouldn't be a problem if we had a cost-effective, reliable way to store power – but we don't, yet. "Our biggest challenge is storage," explained Michael "Mick" Dalrymple '98, director of sustainability practices at Arizona State University. "If we could store electricity we could solve this thing."

Deciding how big to build

It's as much a challenge for renewable energy producers as it was for Goldilocks: How much is just right? As Dalrymple put it, "Because we really can't store electricity, we don't want to build too big [and not use the energy that's produced] but also don't want to undersize because renewable energy generation is hard to build." To mitigate the risk, ASU has 89 distributed solar installations that range in size from relatively small rooftop installations to the 40 MW solar plant run by APS and shared with PayPal

An increasingly unreliable power grid

Getting electricity from where it is generated to where it is consumed requires a power transmission and distribution system: the grid. Where rooftop solar – when combined with battery storage – has the potential to allow homeowners to "disconnect" from the grid, for scale applications of renewable energy, the grid will be as necessary as it is today. "If you want power to be available all the time you have to believe in the grid," explained James Baker '11, a real-time trader with The Energy Authority.

Making the economics work

Energy economics is notoriously complicated – even more so when renewable energy comes into the mix. "There's a lot of

market volatility in renewable energy,” explained Baker. “There’s volatility in generation and volatility in loads – wind and sun are unpredictable – such that prices can spike 10x within a day.” That kind of price volatility can make it really hard for utilities to manage their infrastructure plans.

It’s complicated

One of biggest challenges with renewable energy is complexity. It’s like playing 15-dimension chess.

Government Initiatives

The Government of India (GOI) initiatives for promotion of renewable energy sources (RES) includes [6]:

- a) Exemption of industrial clearance for setting up of Renewable energy industry .
- b) Exemption of clearance from Central Electricity Authority for power generation projects of up to Rs1,000 million.
- c) Five-year tax holiday for renewable energy power generation projects.
- d) Soft loan made available through IREDA for renewable energy equipment manufacturing.
- e) Facilities for promotion of export-oriented units for renewable energy industry.
- f) Financial support extended to renewable energy industries for taking up R&D projects in association with technology institutions.
- g) Power project import allowed.
- h) Allowance to private sector companies to set up enterprises to operate as license or generating companies.
- i) Customs duty concession for renewable energy parts/equipment, including for machinery required for renovation and modernization of power plants.
- j) Excise duty on a number of capital goods and instruments in the renewable energy sector has been reduced/ exempted.
- k) Different types of plans like Jawaharlal Nehru National Solar Mission (JNNSM), Rural Electrification Program (REP), National Solar Mission, Central financial assistance (CFA) scheme etc are being taken under planning commission.

V. CONCLUSIONS

In the past century, research and literature have concluded that CO₂ concentration increased by 28% following the industrial revolution. The global average temperature has increased by 0.3°C to 0.6°C, and the sea level rose 10 to 15 cm in the past 100 years. Scientists predict that if greenhouse gas emissions continue and no effective protection policies for the environment are put into place, the global temperature will increase by 1°C to 3.5°C, and the sea level will increase by 15 to 95 cm. Rise in temperature of 4°C would decrease the food grain production some 28% and 68% for rice and wheat, respectively. This will make many countries uninhabitable by 2100.

In this situation, renewable energy is the most elegant choice to make for meeting our energy demand, ensuring sustainable development and help human race to continue, at least not make an end from energy crisis. Though renewable energy industry is now capital intensive, its increasing use will surely decrease its cost. Per dollar investment in renewable

energy will ensure sustainable development for future, whereas per dollar investment in traditional energy will push human race at the verge of extinction. India has plenty of renewable energy potential to bridge the gap between demand and supply .so, India must put continuous effort in harnessing various form of RES with newer technologies for a cleaner, greener and safer place for generation.

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