



Overview of the Energy Scenario in India and the World's Renewable Energy Sources

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Abstract—The goal of renewable energy is to provide the power that originates from natural resources such as sunlight, wind, and other sources. Since the use of green energy enhances the environment and reduces global energy consumption, the attention of researchers in this field has been focused on methods of developing green energy resources. Because of using natural resources, the need for microgrid energy systems will be increasing. This paper aims to give an overview of the energy scenario in India and the world renewable energy sources existing in the market today and consider the advantage of using renewable energy resources (RES). This study, afford a brief overview of various RES, their status in India and the World, the socio-economic impact of RES, challenges associated with it, and the future of RES in India in India and the World.

Index Terms: Renewable Energy Sources (RES), photovoltaic (PV), Wind Energy, Power system, Disruption Energy (DE).

I. INTRODUCTION

Society is looking for an alternative way for clean and cheap energy that will get rid of the dependence on costly and polluting energy as oil and gas. The oil and gas cost is high, so the research focuses on how to increase the economies and reduce the pollution of many countries.

Since the renewable energy sources as solar energy system and wind energy system or other energy are able of producing large electricity cleanly and reasonable cost. Renewable energy sources have been considered as a solution to this difficulty due to its abundance and cleanliness, except renewable energy sources are facing many challenges due to its distributed and stochastic nature. The goal of renewable energy is to provide the power that originates from natural resources such as sunlight, and other sources. Since the use of green energy enhances the environment and reduces global energy consumption. The attention of researchers in this field has been focused on methods of developing green energy resources.

Because of using natural resources, the need for microgrid energy systems will be increasing. Moreover, such a system will require small energy storage, small and large loads, and micro-generators, leading to the introduction of a unique category of distributed generation systems known as a microgrid.

Aims to give an overview of the energy scenario in India and the world's renewable energy systems existing in the market today.

II. ENERGY SCENARIO IN THE WORLD

The evolution of Economic growth in the world, together with associated structural changes, has a strong impact on world energy consumption. As countries develop and their living standards, energy demand grows rapidly. For example, in developing countries experiencing fast-paced economic growth, the share of the populace demanding improved housing which requires more energy to construct and maintains often increases.

Across the past 30 years, world economic growth has been led by the developing countries, accompanied by strong growth in energy demand in the region. increase in global energy consumption from 2012 to 2040 occurs among the nations of Asia, a country grouping that includes China and India. Extremely of the world increase in energy demand occurs among the developing nations where strong economic growth and expanding populations lead to an increase in energy use. Developing a nation's demand for energy rises by 71% from 2012 to 2040. In contrast, in the more mature energy-consuming and slower-growing OECD economies, total energy use rises by only 18% from 2012 to 2040 [1].

In total, 41 countries accounted for about 80% of the world's total electricity generation in 2019. is showed in Figure1 [2].

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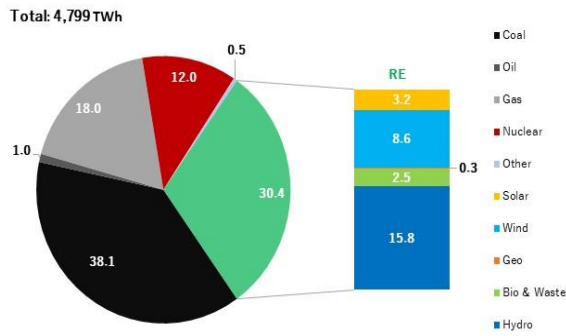


Figure 1. The World's Total Electricity Generation in 2019.

Concerns about energy security, effects of fossil fuel emissions on the environment, and sustained high world oil prices in the long-term support expanded the use of renewable energy sources and nuclear power, as well as natural gas, which is the least carbon-intensive fossil fuel. With government policies and incentives promoting the use of renewable energy sources in many countries, renewable energy is the world's fastest-growing source of energy, at an average rate of 2.6%/year, while nuclear energy use increases by 2.3%/year and natural gas use increase by 1.9% a year.

Electricity consumption by end-users grows faster than their use of other delivered energy, as has been true for the past several decades. Net electricity generation worldwide rises by 1.9%/year on average from 2012 to 2040. Natural gas and renewable energy sources account for increasing shares of total generation, with the natural gas share growing from 22% in 2012 to 28% in 2040 and the renewable share growing from 22% in 2012 to 29% in 2040. Renewable generation (including hydropower) is the fastest-growing source of electric power rising by an average of 2.9%/year, compared with average annual increases for natural gas (2.7%), nuclear power (2.4%), and coal (0.8%).

Hydropower and the wind are the two largest contributors to the increase in world electricity generation from renewable energy sources, together accounting for two-thirds of the total increment from 2012 to 2040. Government policies and incentives throughout the world support the rapid construction of renewable generation facilities[3].

The united states of America's electricity generation from renewable energy sources RES exceeded coal for the first time in April 2019 and the target is coal generation will decline by 13% at the end of this year 2020. Figure 2. shown the U.S renewable energy electric generating capacity additions 2020[4].

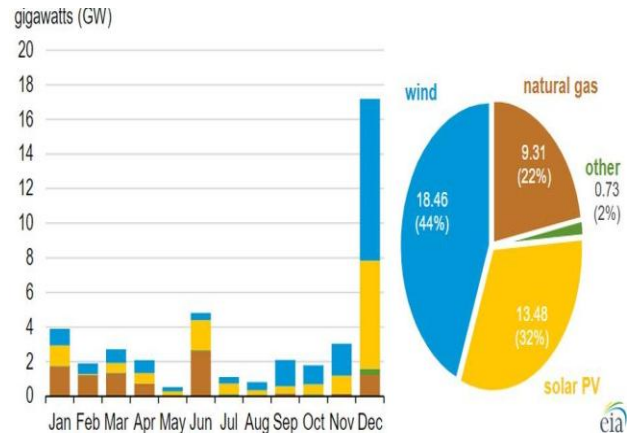


Figure 2. US Electric Generating Capacity Additions 2020.

III. ENERGY SCENARIO IN INDIA

India's rural energy scenario is represented by insufficient energy supply and unreliable supply. India, home to 18% of the world's population, uses only 6% of the world's primary energy. Energy consumption in India has almost doubled since 2000. Energy consumption continues to increase as the world's population increases and the standard of living rises [5].

The need for electricity is increasing despite significantly improved energy efficiency; the greatest demand today and in the future is for more generating electricity [6]. This will increase fuel prices, leading to the world looking for alternative sources of energy. The electricity and utility sector in India has an installed capacity of 305.55 GW effective 30 August 2016 [7].

Renewable power plants established for 28% of total installed power plants. The total electricity generated from the facilities is 1,106 TW per hour and 166 TW hours by captive power plants during the fiscal period 2014-2015 [8]. India became the third-largest world's producer of electricity in the world in 2013, with 4.8% its global share in generating electricity surpassing Japan and Russia [9].

The new and renewable energy ministry of India announced it would build 16 GW of renewable energy this year to reach 175 GW by 2022. No more than 3.9 GW have been installed as of November 2016, according to the progress report by the new and renewable energy ministry [10]. actual conventional generation of 1160.141 BU for the previous year (2016-17). The conventional generation during 2016-17 was 1160.141 BU as compared to 1107.822 BU generated during 2015-16, representing a growth of about 4.72 %. [11].

There is a power deficit year-wise and region wise. The state of Gujarat has the highest surplus power of any Indian state, with about 1.8 GW more power available than its internal demand. It was expecting to find customers, sell excess capacity to meet power demand in other states of India [12], thereby generating revenues for the state. The state of Andhra Pradesh leads in the greatest power deficit with peak power being less by 3.2 GW against demand [13].

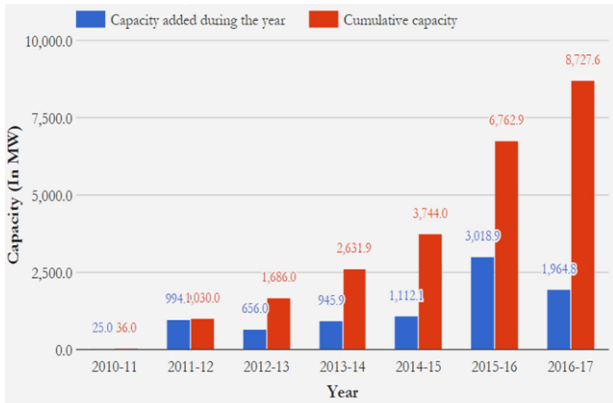


Figure 3. Solar Energy Installations from 2010-2017

Whole installed energy capacity in India Figure 3. Solar energy installations from 2010-2017 were 309 GW on 30 November 2016, and almost 15% of renewable

Energy sources came, according to data from the Office of Energy. From September 2015 till September 2016, 8.5 GW of renewable energy was installed throughout the country in Figure 4. renewable energy was installed in India's capacity. While combined wind, power increased by 15.2%, or 3.7 GW during the year, solar energy increased by about 4.2 GW or 96%.

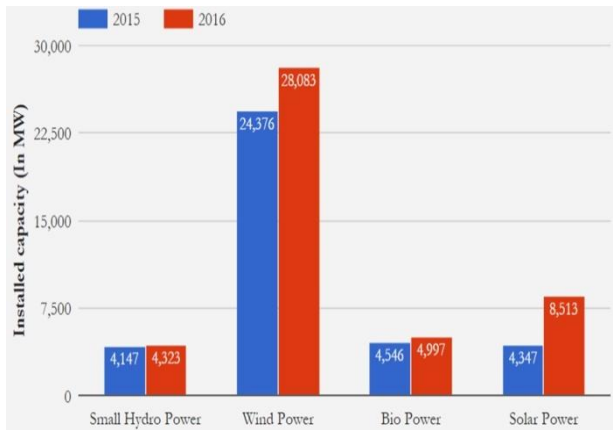


Figure 4. Renewable Energy Installed in India Capacity

Energy Sector in India in this year 2017 Basics and Post-budget insights has some detail about installed capacity by the source of renewable energy shown in Figure 5. India's renewable energy progress [14].

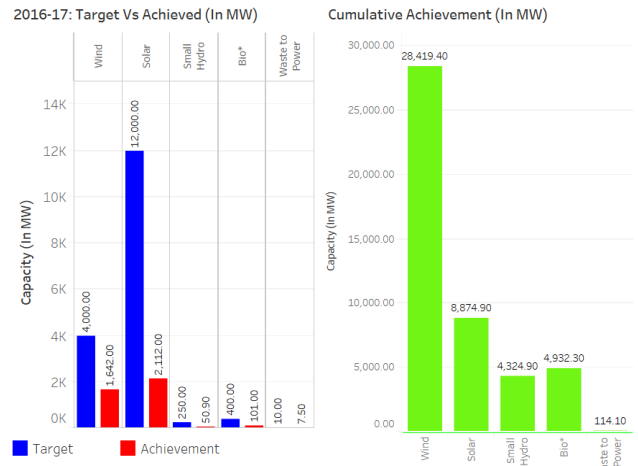


Figure 5. India Renewable Energy Progress

Renewable Energy Sources) include Small Hydro Project, Biomass Gasifier, Biomass Power, Urban & Industrial Waste Power, Solar, and Wind Energy is shown in Figure 6. installed capacity by the source in India.

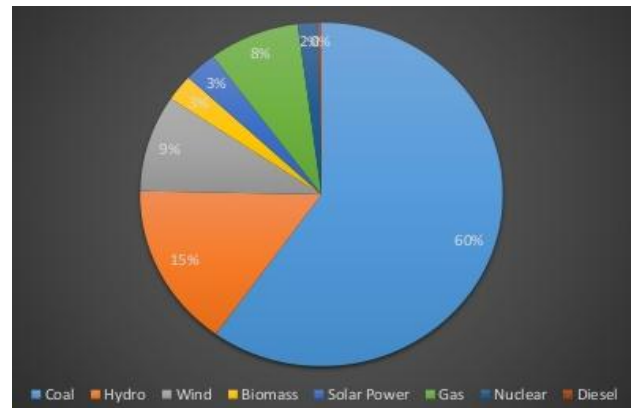


Figure 6. Installed Capacity by the Source in India

The electricity generation target of conventional sources for the year 2017-18 has been fixed as 1229.400 Billion Unit (BU). i.e. growth of around 5.97%.

The overall electrification rate in India is 64.5% while 35.5% of the population still lives without access to electricity. As per the sample of 97,882 households in 2002, electricity was the prime source of lighting for 53% of rural families compared to 36% in 1993 shown in Table 1. Installed capacity in respect of RES 2017 and in Table 2. Generation and growth in conventional in the country during 2009-2010 to 2017-2018.

The generation from renewable energy sources (excluding large hydro) in India reached a record of 127.01 billion units in FY20. The country ranks fourth in the world in terms of total installed wind

power capacity. The government of India is aiming to achieve 225 GW of renewable energy capacity by 2022, much ahead of its target of 175 GW as per the Paris Agreement. Government plans to establish a renewable energy capacity of 500 GW by 2030. Off-grid renewable power capacity has also increased. In 2019, India installed 7.3 GW of solar power across the country, establishing its position as the third-largest solar market

in the world. shown in Figure 7. Electricity generation by source in FY 2019-20[15].

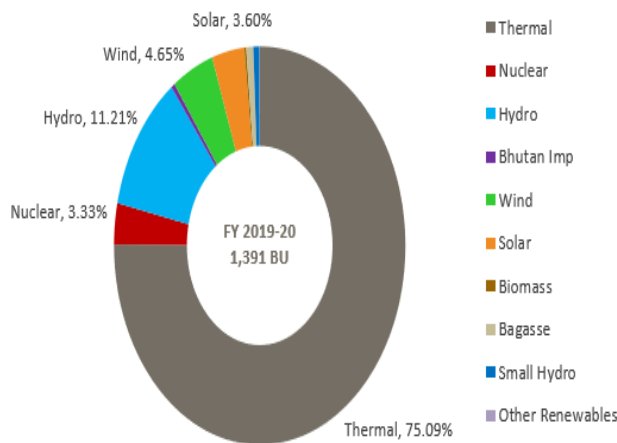


Figure 7. Electricity Generation by Source in FY 2019-20

Table 2. Generation and Growth in Conventional in the Country During 2009-2010 to 2017-2018

Year	Energy Generation	% of growth
2009-2010	771.551	6.6
2010-2011	811.143	5.56
2011-2012	876.887	8.11
2012-2013	912.056	4.01
2013-2014	967.150	6.04
2014-2015	1048.673	8.43
2015-2016	1107.822	5.64
2016-2017	1160.141	4.72
2017-2018	307.663	3.74

Table 1. Installed Capacity in Respect of RES 2017

Fuel	MW	% of Total
Total Thermal	2,20,576	67.0%
Coal	1,94,553	59.1%
Gas	25,185	7.6%
Oil	838	0.3%
Hydro	44,614	13.6%
Nuclear	6,780	2.1%
RES* (MNRE)	57,260	17.4%
Total	329,231	100%

The 17th electric power survey of India report claims:

- A. During the year 2010–11, India's industrial demand reported for 35% of electrical power requirement, domestic household use reported for 28%, agriculture 21%, commercial 9%, public lighting, and other miscellaneous applications reported for the rest.
- B. The electrical energy demand for the year 2016–17 is expected to be 1,392 Tera Watt Hours at least, with a peak electric demand of 218 GW.
- C. The electrical energy demand for the year 2021–22 is expected to be 1,915 Tera Watt Hours at least, with a peak electric demand of 298 GW. If it is assumed that the current average transmission and distribution average losses will remain the same (i.e. 32%), India will need to add about 135 GW of minimum power generation capacity, before 2017, to satisfy the projected demand after losses. It is claimed that India's demand for electricity will cross 300 GW, earlier than most estimates. To explain the expected estimates, the following reasons are considered:
- D. India's manufacturing sector is likely to grow faster. The domestic demand will increase more rapidly as the quality of life for more Indians is improving.
- E. It is planned that 125,000 villages will get connected to India's electricity grid.

Renewable energy technologies are ideally suited to distributed applications, and they have substantial potential to provide a reliable and secure energy supply as an alternative to grid extension or as a supplement to grid-provided power. Over 400 million people in India, including 47.5% of those living in India's rural areas, still had no access to electricity. Because of the remoteness of much of India's electrified population, renewable energy can offer an economically viable means of providing electrical energy access to this group of the population.

IV. OVERVIEW OF RENEWABLE ENERGY

Climate variation and global warming concerns, along with high oil prices, are the peak of oil, and increased government subsidies, are driving up renewable energy development. Renewable energy contributed 19.2% to world energy consumption and 23.7% of electricity generation in 2014 and 2015, respectively. This is energy consumption is divided by 8.9% coming from conventional biomass, 4.2% as (Modern biomass, heat thermal energy, heat energy), 3.9% of hydroelectricity 2.2% is electricity from the wind, solar, geothermal, and biomass [16].

India has great potential for generating energy from renewable sources of energy [17]. The Indian Government is making potential efforts to harness these possibilities. At the end of 2016, installed power from renewable sources is 44,783 MW.

According to various energy reports, India ranks fifth in the world in terms of installed capacity of wind turbine power plants. Total renewable installed they include small hydropower, wind energy, biomass, waste to energy, and solar energy power, etc.[18].

I. CONCLUSION

With the increases in electricity prices in many countries around the world and the continued disruption of the electricity regulator in some countries, especially the developing countries, people are turning to renewable energies such as wind energy and solar power system. They are environmentally friendly and free of charge.

An overview of the energy scenario and power demand trends in India and across the globe is presented. Hybrid power system needs, advantages, and comparison with a single-source system are outlined. Keeping in mind all challenges and the best possible solutions to mitigate them will support in meeting rising electric energy requirements effectively.

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