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Eco-Friendly Techniques for Power Generation for Better Future: A Review Paper

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Abstract

The energy demand across globe is increasing quickly as a result of rising population and scientific progress. Thus, it is important to guarantee that renewable energy generation is efficient, cost-effective and always lasting, in future, as energy demand ascends. Solar power is a capable free source of energy for handling long-term energy crises, among other renewable energies. The high demand for energy is a constantly growing energy industry around the world, with the main source of energy, fossil fuel, minimal and other sources costly. It has become an instrument for developed countries' economic status and for sustaining the wealthy citizen's life, as it is low cost, after vigorous study to speed up its progress. The solar industry will certainly be an ideal choice for the energy demand for future as it is greater to other sources of renewable energy in terms of cost efficiency, availability, capacities, efficiency, and accessibility. This paper addresses the essential of the solar industry, with their basic ideas, the energy situation in the world, research findings on upgrading the industry of solar, their possible uses and obstacles to solving the energy crisis in the future.

Keywords: Electricity; Energy; Renewable energy; Solar power; Solar energy

Introduction

India is the world's third-largest energy producer and consumer. Till 31 March 2020, the national electricity grid in India is 370.106 GW powered. 35.86% of the overall installed capacity in India is comprised of renewable unit, which also comprise major plants of hydroelectricity. During the economic year 2018-19, the gross power produced by values in India was 1372 TWh and India produced a total of 1547 TWh of electricity (user and non-user). In 2018-19, gross energy consumption was 1.181 kWh per person. In 2015-2016, the world's highest (17.89%) electricity consumption in agriculture was recorded. The potential of India is excessive but the distribution system is insufficient. The Government of India (GOI) initiated a "Power for All" initiative in 2016 to fix this. The programme was implemented in December 2018 to provide all households, factories and commercial establishments with the required infrastructure to ensure continuous supply of electricity. Funding was provided by cooperation between the Indian government and the component states. Fossil energy, especially coal, is dominant in the Indian energy sector, which generated some 3/4 of the nation's electricity in the fiscal year 2018-19. The government is struggling to boost renewable power investment. National Energy Plan 2018 of the Government says that the nation does not require additional renewable energy generating stations in the public subdivision till 2027, when the company commissions a 50,025 MW power generation using coal under production and an extra 275,000 MW of renewable energy in utilities sector after the withdrawal of almost 48,000 MW shows in Table 1 and Figure 1 [1].

Renewable energies are sources of energy that cannot be depleted or replenished within the lifetime of a human being. Wind, solar, geothermal, biomass and hydroelectric power are the most common examples. This is the opposite of non-renewable energy sources like fossil fuels shown in Figure 2. The main benefit of renewable energy is that renewable energy will never be exhausted, will be sustainable forever. Renewable energy consumption and storage facilities need reduced maintenance; with natural fuel reduce the operating costs. More significantly, they contain little to no pollution, such as carbon dioxide or other chemicals, or have fewer environmental effects. Renewable energies can deliver many projects because they are still emerging and will support regional regions economically as well as have economic advantages.

Environmental advantages, economic advantages and alternative ways can be easily recognized but we must also know their inconveniences. One significant disadvantage to renewable energy is that the volumes of electricity generated by conventional generators are difficult to generate. Often renewable energy depends on wind, sunlight, temperature and so on, natural conditions. Examples: the turbine has a need for wind to transform blades, and the hydro generators have rain to replenish dams to provide flowing water. These variables are contradictory and unpredictable. It also has a high capital cost because it is an emerging technology [2].

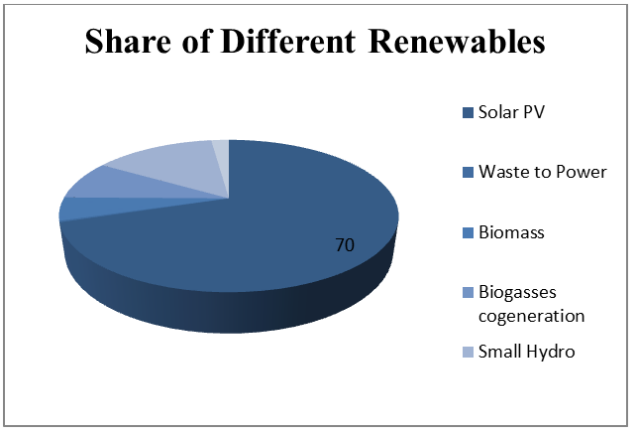

Figure 1: Illustrates the renewables in the renewable energy mix in the Indian electricity grid.

Sources of Renewable	Potential Available (in MegaWatt)	Capacity Allotted (in MegaWatt)	Capacity Commissioned (in MegaWatt)
Breeze	13983	13071.72	2676.935
Small hydro	3000	2956	785.21
Cogeneration	2000	1677	1176
Biomass and wastewater	1135	395.48	113.03
Solar	10000	1100	84
Others			246.77
Total	30118	19200.41	5082

Table 1: The below table shows the progress of the energy in renewable in India.

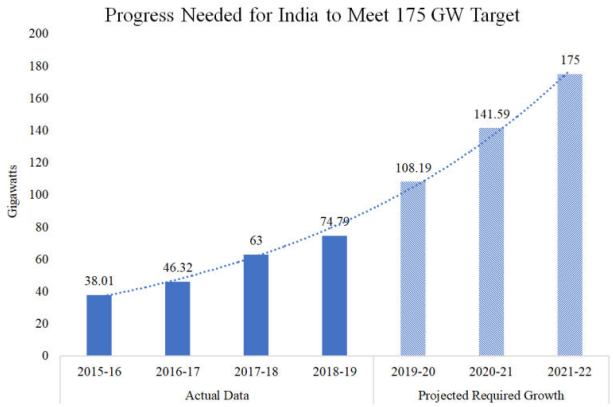

Figure 2: Illustrates the total installed power capacity and renewable installed capacity from 2015 to 2022.

India has a huge amount of solar power. Solar emissions are estimated to be about 5,000 trillion kWh per year, with a typical solar output of 0.25 kWh/M^2 of utilized land with existing business facilities. The installed capacity was 4878 MW as of 31 December 2015. By 2017, India plans to install another 10000 MW by 2022. Due to the national initiative, the Gujarats government introduced the solar energy plan in 2009 and recommends establishing a lot of big solar greens in the declining northern part of the state of Patan, starting with the charanka solar park. The solar energy policy has become an essential component of its growth. Solar park construction would simplify the timeframe for the development of projects by allowing government agencies to undertake acquisition of land and permits and to provide a dedicated shared infrastructure in order to establish solar plants mainly in the private sector.

This would make it easier to accelerate private sector installation and reduce costs by solving the problems facing independent projects. Power reduction, site preparation and leveling, power removal, water availability, road accesses, safety, and services include a common infrastructure for the solar park. Figure 3 shows a solar park in India. The Gujarat Electricity Regulatory Commission has also proposed an input tariff on conventional solar energy that will be extended to solar power plants in the solar park alongside the central government initiative. The responsible agency for the 500 MW solar parks is Gujarat Power Corporation Limited, which leases lands to developers for the production of solar power. Gujarat Energy Transmission Limited will progress transmitting withdrawal from established connection opinions to the solar designer. The Asian Development Bank is partly supporting this project. In over three years, the grid has supported more than 16,000 solar home systems across 2,000 bank branches, in particular in South India's rural areas [3].

When life-cycle charcoal mining, consumption water for when submerging areas of the water reservoir are covered, solar power stations require almost 2.4 hectares (6 acres) of land per MW, which is equivalent to charcoal power stations when life-cycle charcoal mining, consumption water for when submerging areas of the water reservoir are covered. In India's 1% territory, it is possible to construct 1.33 million MW of solar power plants (32,000 square km). There are vast stretches of land ideal for solar power in any part of India that are more than 8% unproductive and vegetation-free. A wasteland (32,000 square kilometers) with a land productivity/yield of 1.5 million Rs. per acre (6 Rs/Khwh), equivalent to many industrial zones and also extra to the strongest dynamic wetted farmland, can produce 2000 billion kWh (two times the total output in 2013-14) of electrical power when installed in solar power plants.

Figure 3: Illustrates solar park in India. As of 2019, India had deployed 87 GW of renewables and these numbers should be seen with the aim of reaching 450 GW of renewables by 2030. (A large part of it is solar).

Literature Review

Canal solar power project in kadi, Gujarat

The purchase of terrestrial is a task for the Indian solar farm project. Many states are discovering ways to report land accessibility with revolution, for instance, by discovering ways of using solar power across large irrigation canals, by reaping solar energy while reducing water loss from solar vaporization. Gujarat developed the solar energy channel first, followed by a 19,000 km network of Narmada channels across the country to produce electricity using solar panels. It was India's first such project [4].

With about 300 bright and sunny days a year (or 5 EWh/year), India's solar energy effect in its own land area is expected to be about 5,000 trillion kilowatt-hours (kWh) per year. In a year, available solar energy generates more energy than all of India's fossil fuel reserves combined. The average day-to-day capacity of India's solar power plant is 0.25 kWh/m^2 of land used for the production, equating with the available commercially tested technologies to about 1500–2000 peak (rated) hour working times a month. On 16 May 2011, the Indian clean development mechanism included India's first 5 MW installed solar power project [5]. The project is situated in the Tamil Nadu village of Sivangai, in the district of Sivaganga. In January 2015, the Indian government announced a significant expansion of its solar ambitions, which now include a US$100 billion investment and 100 GW of solar power by 2022. The solar power plant project is shown in Table 2.

Name of Plant	DC Peak Power (MW)	Notes
NTPC solar plants	110	During the year 2015-16
UT Delhi, Delhi	1	Commissioned in January 2015. Mounted by Novus Green Energy Systems
infosys, Hyderabad	7.2	Commissioned in December 2015. Expected pwer generation 13 milliion KWh\year at Ts 2.8 per KWh
Don Bosco, Kurla, Omega Natural Poloarity (ONC) Mumbai, maharashtra	0.1	Commissioned December 2014
Ushodaya project-smart track solar systems, midjil, Telangana	10	Commissioned December 2013
Charanka solar park-Charanka Village, Patan district, Gujarat	221	Commissioned Aprial 2012
Welspun Solar MP project 151 MW Neemuch solar plant-Neemuch, Madya Pradesh	151	Commissioned February 2014
Sakri solar plants-Maharashtra	125	Commissioned March 2013
Green Energy Development Corporation Ltd (GEDCOL)-Odisha	50	Commissioned 2014
Tata power solar systems Ltd (TPS)-50 MW NTPC-Rajgarh. Madya Pradesh	50	Commissioned March 2014
Welspun Energy 50 Mw Rajasthan Solar Project-Phalodhi, Rajasthan	50	Commissioned March 2013
Green Energy Development Corporation Ltd (GEDCOL)	48	Commissioned 2014
Bittra Solar Power Plant (Adani Power)-Bitta, Kutch District, Gujarat	40	Commissioned January 2012
Dhirubhai Ambani Solar Park, Polhran, Rajasthan	40	Commissioned in April 2012
Welspun 34 MW, Bathinda, Punjab	34	Commissioned in august 2015
Moser Baer-Patan Gujarat	0	Commissioned October 2011
Mithapur Dolar Power Plant (Tata Power)-Mithapur, Gujarat	25	Commissioned 25 January 2012
Green energy Development Corporation Ltd (GEDCOL)-Odisha	20	Commissioned 2014
Kadodiya Solar Park By Vivaan Solar-Odisha	15	Commissioned 2014
Sunark Solar-Odisha	10	Commissioned 2011

NTPC Limited-Odisha	10	Commissioned 2014
Rajaratnam Energy Holdings-Bolarngir Solar Power Project-odisha	10	Commissioned 2011
Azure power-Sabarkantha, Khadoda Village, Gujarat	10	Commissioned June 2011
Green Infra Solar Energy limited Rajkot, Gujarat	10	Commissioned November 2011
Waa solar power Plant (Madhav Power) Surendranagar, Gujarat	10	Commissioned December 2011
tata Patapur-Odisha	9	Commissioned 2012
Azure Power-Rajasthan photovoltaic plant, Rajasthan	35	Commission February 2013
Other Plants	100	From 2001-2015(Minor)

Table 2: Illustrates the projects of solar power plant in India which are either installed or ongoing.

Results and Discussion

Application of solar energy

Electrification in Rural Area: One of the biggest obstacles for rural India's growth is a lack of electricity infrastructure. Indian grid systems are significantly underdeveloped, with large parts of its population still out of the grid. By 2004 about 80,000 villages of the nation had not been electrified yet. The 10th national five-year plan aimed at electrifying 5,000 of those villages (2002-2007). India now has 1.2 million solar lighting systems installed in homes and 3.2 million solar bulbs in use. India has also become Asia's leading market for off-grid solar products. The currently planned projects include 3000 Orissa villages that have been illuminated by solar energy by 2014 [6].

Solar lamps and lighting

Lamps, home lights, and small systems up to 210 Wp are all eligible for a 30 to 40% subsidy under the current ministry of renewable energy. By 2022, 20 million solar standard lamps are expected. By 2012, a total of 4,600,000 solar and 861,654 home solar lamps had been installed. This usually substitute kerosene, and a limited credit may be used to buy kerosene amount for a few months.

Uses in agriculture

Solar water propelling systems powered by photovoltaic panels are recycled for irrigation and potable water. The majority of the pumps are operated by 200 to 3000 watt Wp PV motors, which supply approximately 140,000 liters of water each day from a total head of 10 meters. By the end of September 2006, a total of 7,068 PV pumping systems had been installed, with 7,771 completed by March 2012. Before storage for dry harvest, solar drives are used [7].

Water heater by solar energy

In India, Bangalore has the biggest solar water heater roof deployment. The energy equivalent of these heaters is 200 MW. Bangalore is also the first city in the world to develop an encouragement system by giving residents with roof-topping thermal systems a discount of Rs. 50 on monthly electricity bills. All new frameworks now include these systems. Recently, Pune has also made it compulsory to install solar water heaters in new buildings [8].

Air conditioning and refrigeration using solar energy

Solar panels with thin films provide better output in hot tropical conditions such as India. The lower reduction in solar panel conversion with increasing ambience and no unfinished covering effect enhances the output and fire protection of the thin film panel in India against crystalline silica solar panels.

Stabilization of power grid

Solar plants equipped with battery storage devices wherever the network's energy measurement is done will take electricity from the storage to flow into the net if its frequency is below (50 Hz) and if its frequency is below the parameter, use the network's excess cost-efficiency. Battery storing is already common in India higher than 11 million homes that use charging batteries [9].

Although the solar business is emerging rapidly to encounter global energy claim, there are many obstacles to expansion. This section describes concisely these barricades to the solar market. First, photovoltaic solar expertise is costly as well as requires advanced technology of production and installation. Secondly, solar panels have high performance affected in particular by the sun's strength, cloudiness and wind speed of several environmental factors. Thirdly, rural people worldwide need to be made aware of the potential benefits of solar industry, as their literacy levels are poor. Fourthly, the future impact of other markets and competition are also affecting and preventing the rapid growth of solar energy projects. Fifthly, solar cells generally consist of many chemicals that are environmentally harmful which is difficult for producers and users to disposing them, despite of the lack of any direct effect by Solar Industries on the environment. Sixth, the production of solar power is not always reliable [10].

The incorporation of other energy resources into the network is therefore necessary if reliable delivery is to be achieved. Seventh, a large-scale PV industry is responsible for many indirect effects on the environment. For example, birds as well as insects may be killed by solar collection to improve their performance while flying in concentrated sunlight. Eighth, the collectors have certain toxic fluid

heat exchangers. It is also a difficult task to manage them after use. In addition, the cleaning and cooling turbine generators use large amount of water to make them more effective. This result in water is being wasted with wastewater released which cause water contamination. Ninth, Direct Current (DC), which cannot be applied to house-devices since they are running with Alternating Current (AC) systems, is the energy provided by solar systems. But for better efficiencies which are difficult to manage, it requires complex circuits and storage systems. Although the solar industry has these hurdles, numerous researches are under way to remove the impact of such obstacles on the appropriate limit for increased efficiency of output [11].

Conclusion

Today, photovoltaic technology is used in remote power supplies and can directly or current power electrical appliances powered by the battery. For better control, remote can be set correctly. This is a commonly used technology in the electronic fencing, illumination and pumping of water. Solar power can be used to charge several electronic devices used in areas that do not have plugin power. Many micro devices for smooth operation and automatic systems are now being upgraded to photovoltaic battery charging. An assessment of solar power for future countries that encompasses the photovoltaic technology scenario worldwide, driving forces and trends in growth, highlights of remarkable research on solar collectors, solar energy, design improvements, solar heaters, and sizing, lighting efficiency materials and potential barriers and applications for upgrading the Solar production. In future energy efficiency for solar systems manufacturers, researchers and policy makers, the short description makes a valuable contribution to this sector.

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