

SOLAR ENERGY IN INDIA

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Abstract

India, a rapidly growing economy with more than 1 billion people, is facing a huge energy demand. The country stands fifth in the world in the production and consumption of electricity. The electricity production has expanded over the years but we cannot deny the fact that the population of the country is also expanding. The power produced in the country is mostly from coal (53%) and it is predicted that country's coal reserves won't last beyond 2040-50. More than 72% population living in villages and half of the villages remain without electricity. It's high time that our country should concentrate more on energy efficiency, conservation and renewable energy. To meet this surging demand, solar energy is the best form of energy to fulfill the energy needs of India and bridge the energy demand-supply gap.

Keywords-

Alarming, Alternative energy, Solar applications, Renewable Energy

Introduction :-

Energy has always been the key to the Man's greatest goals and to his dreams of a better world. The primary energy comes from non-renewable and fossil sources. These reserves are continuously diminishing with increase in consumption and will not exist for future generation. One of the options is to make more extensive use of the renewable sources like sun, wind, biomass etc. Solar energy is one of the main renewable energy sources. It is abundantly available in India and a free source of energy. Solar energy plays a very important role in providing requirement of electrical power for various utilities. In winter days, storage water heaters/ geysers / immersion water heaters or LPG are generally used by the 80% of medium class families in India, to heat the water.

It is observed that the electricity consumption is increased due to conventional water heating system used by the people (Ganechari et al. 2005)

Indian renewable energy sector is the fourth most attractive renewable energy market in the world¹. India was ranked fourth in wind power, fifth in solar power and fourth in renewable power installed capacity, as of 2020.

Installed renewable power generation capacity has gained pace over the past few years, posting a CAGR of 17.33% between FY16-20. With the increased support of Government and improved economics, the sector has become attractive from investors perspective. As India looks to meet its energy demand on its own, which is expected to reach 15,820 TWh by 2040, renewable energy is set to play an important role. The government is aiming to achieve 227 GW of renewable energy capacity (including 114 GW of solar capacity addition and 67 GW of wind power capacity) by 2022, more than its 175 GW target as per the Paris Agreement. The government plans to establish renewable energy capacity of 523 GW (including 73 GW from Hydro) by 2030.

India's power scenario :-

India's current electricity installed capacity is 135 401.63MW. Currently there is peak power shortage of about 10 % and overall power shortage of 7.5 %. The 11th plan target is to add 100 000 MW by 2012 and MNRE has set up target to add 14500 MW by 2012 from new and renewable energy resources out of which 50 MW would be from solar energy. The Integrated Energy Policy of India envisages electricity generation installed capacity of 800 000 MW by 2030 and a substantial contribution would be from renewable energy. This indicates that India's future energy requirements are going to be very high and solar energy can be one of the efficient and eco-friendly ways to meet the same (Ministry of New and Renewable Energy Sources).

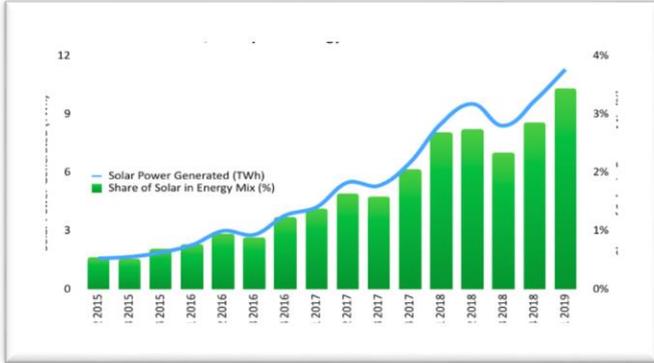
Opportunities for solar thermal power generation in India

Solar thermal power generation can play a significant role in meeting the demand supply gap for electricity. Three types of applications are possible:

- Rural electrification using solar dish collector technology
- Integration of solar thermal power plants with existing industries such as paper, dairy or sugar industry, which has cogeneration units.
- Integration of solar thermal power generation unit with existing coal thermal power plants (Garud, Kalogirou, 2007)

Solar Energy Power in India : Future

In solar energy sector, many large projects have been proposed in India.



Thar Desert has some of India's best solar power projects, estimated to generate 700 to 2,100 GW.

- On March 1st, 2014, the then Chief Minister of Gujarat, Narendra Modi, inaugurated at Diken in Neemuch district of [Madhya Pradesh](#), India's biggest solar power plant.
- The Jawaharlal Nehru National Solar Mission (JNNSM) launched by the Centre is targeting 20,000 MW of solar energy power by 2022MW of solar energy generation.
- In July 2009, a \$19 billion solar power plan was unveiled which projected to produce 20 GW of solar power by 2020.
- About 66 MW is Gujarat's pioneering solar power policy aims at 1,000 installed for various applications in the rural area, amounting to be used in solar lanterns, street lighting systems and solar water pumps, etc.

India is slowly gaining its prominence in the generation of solar power due to the comprehensive and ambitious state and the Centre's solar policies and projects and National Solar Mission. In the latest 2014 budget, Finance Minister Jaitley declared that the Government has proposed an amount of 500 crore rupees to develop some mega solar power plants in Gujarat, [Tamil Nadu](#), Rajasthan, and Ladakh. He also said that solar power-driven agricultural water pumping stations and 1 MW solar parks on canal banks will be developed in the country at an estimated cost of \$74 million and \$18.5 million, respectively. Considering all these facts, we do have a bright picture in front of us as India's potential to be a solar power driven country of the world.

According to the data released by Department for Promotion of Industry and Internal Trade (DPIIT), FDI inflow in the Indian non-conventional energy sector stood at US\$ 10.28 billion between April 2000 and June 2021. More than US\$ 42 billion has been invested in India's renewable energy sector since 2014. New investment in clean energy in the country reached US\$ 11.1 billion in 2018. According to the analytics firm British Business Energy, India ranked 3rd globally in terms of its renewable energy investments and plans in 2020.

Some major investments and developments in the Indian renewable energy sector are as follows. -

- In October 2021, Reliance New Energy Solar Ltd. (RNESSL) announced two acquisitions to build more capabilities.
- Both acquisitions – REC Solar Holdings AS (REC Group), a Norway-based firm, and Sterling & Wilson Solar, based in India – exceeded US\$ 1 billion and are expected to contribute to Reliance's target of achieving the capacity of 100 GW of solar energy at Jamnagar by 2030.
- In June 2021, Tata Power Solar secured a contract worth Rs. 686 crore (US\$ 93.58 million) from the NTPC to build 210 MW projects in Gujarat.
- In May 2021, Virescent Infrastructure, a renewable energy platform, acquired 76% of India's solar asset portfolio of Singapore-based Sindicatum Renewable Energy Company Pte Ltd.
- The NTPC is expected to commission India's largest floating solar power plant in Ramagundam, Telangana by May-June 2022. The expected total installed capacity is 447MW.
- In March 2021, Adani Green Energy announced plan to acquire a 250 MW solar power project in the northern state of Rajasthan (commissioned by Hero Future Energies). The expected deal value stands at ~Rs.10 billion (US\$ 136.20 million).
- The Solar Energy Corporation of India (SECI) implemented large-scale central auctions for solar parks and has awarded contracts for 47 parks with over 25 GW of combined capacity.

Government initiatives

Some initiatives by Government of India to boost India's renewable energy sector are as follows:

- In July 2021, to encourage rooftop solar (RTS) throughout the country, notably in rural regions, the Ministry of New and Renewable Energy plans to undertake Rooftop Solar Programme Phase II, which aims to install RTS capacity of 4,000 MW in the residential sector by 2022 with a provision of subsidy.
- In July 2021, the Ministry of New and Renewable Energy (MNRE) gave the go ahead to NTPC Renewable Energy Ltd., a 100% subsidiary of NTPC, to build a 4,750 MW renewable energy park at the Rann of Kutch in Khavada, Gujarat. This will be India's largest solar park to be developed by the country's leading power producer.
- Under Union Budget 2021-22, the government has provided an additional capital infusion of Rs. 1,000 crore (US\$ 137.04 million) to Solar Energy Corporation of India (SECI) and Rs. 1,500 crore (US\$ 205.57 million) to Indian Renewable Energy Development Agency.

Benefits of solar energy

Following are some benefits of solar energy:

- Using the power of the sun to heat and light our houses is a very clean and environmentally friendly way of generating power.
- Installing solar power in your home will guarantee that you have much lower fuel bills almost instantly.
- These systems can fit into existing buildings and it does not affect land use (Beerbaum 2000).

Applications of solar energy

- Larger solar power plants that collect the heat from the sun, which is subsequently used to produce steam for powering a generator
- Solar energy is harnessed to pump water in remote areas
- Solar cookers
- Solar cars, solar trams, solar buses and even satellite-lites are also seen to operate with the help of solar energy.

- Solar energy can be used to heat residential homes

- Many people use solar energy to heat their water supply and their swimming pools as well

- Recreational vehicles and some boats may also run on solar energy.

- Small gadgets that involve little energy, such as calculators and watches, often use solar energy (Beerbaum, 2000).

Technological trends in the area

The greatest advancement in Photovoltaic research has been nanotechnology (Thin cell solar research).

Very tiny cells are created through silicon and other minerals to collect solar energy. The creation of nano-particles has also helped developers to create solar shingles coated in these cells as well as to develop a spray-on coating that could be sprayed onto another material, such as the roof. This spray-on coating contains the nano-particles that enable other items also to collect solar energy and convert it into electricity. Thin cells make the solar panels smaller ensuring availability to the common consumer because many houses in cities have to conform to specific city codes that may not allow the use of solar panels because they are large, visually unappealing, and also obstruct the view. But by using thin cells, these problems could be sorted out.

Conclusion

Increased use of renewable energy sources for energy generation will not only meet the energy demand but also result in substantial environmental benefits. Solar energy is presently being used on a smaller scale in furnaces for homes and to heat up swimming pools. On a larger scale, solar energy could be used to run cars, power plants, and space ships. Solar energy means a fossil fuel saving, emission free environment, contribution to energy conservation, better economy and modern life style with clean and cheap renewable energy.

Solar energy has a great potential for thermal applications. This chapter presents a brief overview of the developments in types of solar thermal technologies. There are three main types of solar thermal technologies, namely, solar water heating technologies, solar air heating technologies and photovoltaic/thermal hybrid solar technology. Two common types of solar thermal collectors for every one of these solar thermal technologies were presented in this article. The various types of collectors described here include include flat plate, evacuated tube, glazed air collectors, unglazed air collectors, a photovoltaic/thermal hybrid solar liquid collector and a photovoltaic/thermal hybrid solar air collector.

Additionally, typical applications are described in order to show to the reader the extent of their applicability. These include water heating and space heating applications, which comprise thermosyphon solar water heating and solar air heating.

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2- As per data from the Economic Survey;
*According to the Bloomberg New Energy Outlook 2018; 3 - Greenpeace India, Union Budget 2021-22, SPV - Solar Photovoltaic System, MWeq - Megawatt Equivalent
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