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Prospects and Challenges of Solar Energy in Rural Areas

Neelabh Sharma[1], Dr. Anshul Shrivastava[2]

[1]Research Scholar, Dept. of Commerce & Management, Dr. C. V. Raman University, Bilaspur (C.G)
[2]Assistant Professor, Dept. of Commerce & Management, Dr. C. V. Raman University, Bilaspur (C.G)

Abstract - The battle against pollution and the depletion of natural resources in all its forms, whether in terms of quantity or quality, is the most significant and serious conflict the world is now engaged in. As we speak, this conflict is being waged in every part of the world, and a solution to these problems is urgently needed. The finest and most appropriate solution to all of these significant issues is the use and use of renewable energy. Solar energy is the most practical substitute for electricity, a key component of this conflict that is now a basic human need, in order to address issues with its production and delivery. Understanding and identifying the potential and difficulties of solar energy in India's rural areas is the aim of the current study. Prospects and obstacles are identified by analysing previous studies and the body of literature in the topic. A "solar panel," which is a piece of equipment used to generate electricity from sunlight, is all that is needed to access solar energy, which is the most plentiful and easily accessible energy source on the world. One nation in the globe that is well situated to receive an abundance of high-quality sunshine throughout the year is India. Utilising solar energy is the greatest way for citizens of this nation to combat pollution and protect their natural resources.

***Key Words*:** Solar energy, Rural areas, India, Problems, Prospects, Rooftop

1. INTRODUCTION

In the modern world, every natural resource—fuel, petrol, water, forests, etc.—is depleting at a very rapid pace. The rapid rate of global population growth is a key contributing element to this impact on resource availability and atmospheric conditions. Over the past 10 years, its numbers have significantly expanded, reaching millions. This not only speeds up the consumption of these resources but also has a significant negative impact on the atmosphere in terms of pollution: more plastic is used, people are less aware of recycling and resource reuse, and the controlled use of these resources is also invisible.

The growing human population also results in a significant demand for essentials like food, shelter, and power. Government agencies now find it challenging to provide the fundamental needs of every single person residing in various parts of their nations. New plans are outlined for this, including the building of new food industries, apartment buildings and power plants (Diallo and Moussa, 2020). To further, although the above-mentioned implementations provide for food and household essentials, the creation of new power plants that use natural resources like coal or petroleum as fuel is necessary to meet the increased demand for energy (Kumar, 2014). Because energy is needed by almost every sector of an economy, production cannot be reduced despite the astronomical rate of pollution in the environment, which contributes significantly to global warming. In order to combat this issue, "solar energy" is an alternate resource that may be exploited as a low-investment, tiny emission source of power. It is one of the most prevalent natural resources in our surroundings and can be found almost anywhere there is human life (Nduka, 2021).

'Solar panels' allow us to generate power using sun energy. When they are under direct sunlight, they generate energy. These panels are made up of several solar cells that are composed of a substance called "silicon." When exposed, the light (photons) striking the compounds, especially metals, causes the material's surface to release electrons (Rahut et al., 2017). These electrons then travel and emit more, creating electricity. The 'photo-electric effect' refers to this process, which is the conversion of sunshine into an electron flow (electricity). Globally, solar energy is a fast expanding energy source. Our electricity demands might be immediately met by harnessing the sun's energy (Advisors and Global, 2018). Additionally, once manufactured, solar panels may provide power with almost little pollution or waste. This implies that there is no reliance on the natural resources of the planet, which may be a viable substitute for their use and a way to lessen pollution. Modules have a long lifespan and are highly dependable because they don't have any moving components. The primary advantages of solar panels are their minimal maintenance requirements and relative ease of installation (Nduka, 2021). They also enable you to produce electricity near where it is used. This eliminates the need to provide and distribute power to isolated locations over great distances.

2. REVIEW OF LITERATURE

According to Bhattacharyya and Palit (2014), solar photovoltaic technology has been employed to provide power access on India's islands and isolated, wooded communities. Approximately 12,000 villages and hamlets have been electrified with solar energy as part of the Government of India's Remote Village Electrification Programme. Using solar mini-grids, the Central Indian state of Chhattisgarh has successfully electrified almost 1,400 isolated and wooded villages. The fundamental reasons for this initiative's success have been the robust policy backing as well as an efficient maintenance and supervision system.

According to Raven et al. (2017), quickly emerging nations like India confront a number of social and environmental sustainability issues that are linked to their rapid economic expansion and growing energy use. This is why India's off-grid photovoltaic solar energy project is developing, with a focus on creative business models. Although this has been shown to be rather successful, it has trouble reaching the lowest of the poor.

According to Venkateswaran et al. (2018), 244 million people in India are among the 1.2 billion people worldwide who do not have access to electricity. The majority live in geographically dispersed rural regions in low-income households. For lighting, many homes rely on inefficient paraffin. In addition to the serious health dangers associated with indoor kerosene burning without adequate ventilation, its

byproducts also contribute to climate-altering black carbon emissions and respiratory and skin conditions. For rural communities without or with limited access to power, solar photovoltaic technology provides an instant lighting alternative. Decentralised availability that can reach far-flung locations, ease of control, enough light production, mobility for both indoor and outdoor home lights, and the absence of interior pollution are some benefits of solar photovoltaics.

Dhiman (2019) points out that social relevance is crucial to the adoption of solar photovoltaic household system design in rural areas as it combines social and environmental advantages with financial gains for better livelihoods. Additionally, in a broader sense, socially built design helps a rural community advance by creating microenterprise possibilities and improving rural livelihoods. One of the biggest issues, particularly for the development of India's northeastern provinces, is energy poverty. The region becomes economically behind as a result of this discrepancy. Accordingly, the adoption of small-scale solar PV household systems in rural northeast India marked the emergence of socially built energy solutions as a crucial component of growth and development. This strategy might address current issues such as the lack of participation from local stakeholders and the dearth of job-related opportunities required to promote the adoption of solar PV home systems in rural households. Consequently, rural development can incorporate socially built energy solutions to foster local self-sufficiency. Additionally, this might help spread renewable energy technology and support the socioeconomic growth of the area's rural communities.

Central Question

Can the quickly expanding and developing globe, which depends on power as a need, be met with solar energy as a viable option to generate electricity?

Related Questions

1. Would solar energy be sufficiently advanced or invented to meet every sector's high electricity needs?
2. Can solar power installation costs be kept within the means of rural residents even with a minimum 50% government subsidy?
3. Given that solar energy requires a sizable open space to function, should it be installed in all developed regions as an environmentally benign alternative to electricity grids?

Hypothesis

Solar power has enormous potential to replace power generation through electrical grids and other currently employed methods since India is one of the hottest countries in the world, receives a lot of sunshine, and has zero percent emissions.

Objectives of the study

- In collaboration with local government entities, the semi-private sector, and the private sector, encourage the adoption of decentralised electricity solutions that are economical, sustainable, and the least expensive for areas that are not practical for grid connection or extension.
- Develop and carry out a comprehensive program for the creation and execution of renewable energy projects.
- Utilise solar energy technologies as a means of promoting sustainable growth.

3. METHODOLOGY

The information and data used in the upcoming project were obtained from newsletters and reports that were printed in newspapers as well as online in blogs and journals written by different environmental activists who are actively pushing solar energy as one of the most significant renewable energy sources. We take into account the special characteristics of solar power generation, which include systems that provide energy at the point of consumption, on peak, without the need for ongoing fuel purchases, and with major environmental and security benefits over fossil fuels. Because they enable utilities to avoid the expenses of fuel, plant, reserve capacity, transmission, and distribution in their centralised assets, these features often raise the value of solar power.

4. SOLAR ENERGY ANALYSIS IN RURAL AREAS

India's rural population makes up 37% of the country's GDP and 67% of its overall population. Rural India continues to lag far behind, even if the country's economy as a whole is predicted to develop at the quickest rate among major world economies—more than 7%

The absence of essential infrastructure like power, clean water, and sanitary facilities is the main obstacle to increases in rural production and, consequently, economic growth. The lack of grid-connected power for around 300 million people in rural India encourages the use of antiquated energy sources like kerosene, diesel, wood-fired chulhas, etc., which not only results in significant government subsidies but also poses serious health and environmental risks. Solar energy has a chance to close the enormous infrastructure gap and enhance environmental, social, and economic metrics.

Although solar energy has been around for a while, its scope has been limited by historically high costs that required it to be driven by government subsidies or philanthropic capital. However, with a nearly 70% decrease in capital costs over the last few years, solar energy is now commercially mainstream, drawing in private capital and entrepreneurs (Advisors and Global, 2018). This genuinely makes solar energy the much anticipated remedy for the millions of people without access to electricity.

Government in promoting Solar Energy in rural areas Solar energy has received a lot of support from the central government, which is led by Prime Minister Narendra Modi. The Centre has given special attention to encouraging distributed solar power as part of the government's "Electricity for all by 2019" agenda. To date, it has approved 4,604 distributed solar projects in rural areas, which would power 4,745 villages and hamlets.

- Because solar power is modular, it may be easily used for a variety of rural applications, affecting important aspects of rural life including livelihood, safety, productivity, health benefits, and access to clean water and warmth. For instance, replacing kerosene lamps with solar lights not only offers a superior way to increase rural output, but it also significantly lowers health risks. Rural households can increase their income and productivity with just four to five hours of extra lighting (Bisaga and Parikh, 2018).
- Nearly 3.5 million solar lighting solutions have been installed till date and the demand for these has been substantially growing. Earlier the funding was done by government-backed programs, of late most products are sold on a commercial basis, backed by financing support from cooperative banks and now a number of national and international companies have come into the market, hence the competition has increased, resulted in decrease in the price for solar panels and building solar power plants by huge numbers which makes it more affordable. Private players like Jain Irrigation, Tata Solar, Greenlight Planet, etc, now dominate the market. Simpa Networks is an excellent example of a private enterprise providing commercially viable micro grid solution to the poorest of poor districts– it has provided pay per use solutions to eight districts in UP, thus lighting nearly 15,000 homes (Venkateswaran et al., 2018).
- Solar-powered agricultural pumps are another significant use that might significantly increase Indian farmers' production. For the agricultural industry to profit properly, adequate irrigation infrastructure and other amenities are required. The majority of farmers use grid-connected pumps, but the majority also use diesel and other fossil fuels, which accounts for over 20% of India's installed electricity. The Indian government has started a number of programs to encourage the development of solar pumps and grid-connected solar power plants. The government hopes to achieve 25,750 MW of total solar capacity under this program by 2022.
- In rural India, access to clean water is still a major problem since power is needed for water treatment. In this area, solar energy is finding significant uses. For instance, in Tsiesma, a hamlet close to Kohima, Nagaland recently set up a solar-powered water treatment facility that uses a cutting-edge membrane filtering technology to produce pure drinking water.

It is clear that using solar energy as a substitute energy source might improve rural India's socioeconomic issues, and in the next years, there will undoubtedly be "Sunny Days" in these areas (Balls, 2020).

5. EVIDENCES OF SOLAR ENERGY FROM INDIAN STATES

Solar energy has grown significantly in recent years and is now a major technology for new power generation capacity worldwide. In India, energy is moving away from conventional sources and towards renewable ones, and people are becoming more aware of the need for an energy transition in the near future. According to a research by the International Renewable Energy Agency (IRENA), between 2010 and 2018, the cost of establishing solar photovoltaic plants in India decreased by almost 80%. In addition to Within just six years, the total installed solar capacity increased 600 times from 10 MW in 2010 to 6000 MW in 2016. As of August 31, 2019, the nation's installed capacity for solar energy was 30.709 GW. Solar now accounts for 38% of the renewable energy mix and 30% of the 100 GW target set for 2022 (Diallo and Moussa, 2020).

After China, the United States, and Russia, India is the world's fourth-largest energy user. Furthermore, India is the world's third-largest producer and user of coal, which increases carbon emissions. Power consumption will only increase due to India's expanding economy, thus switching to alternative energy sources is the best strategy to strike a balance between environmental sustainability and economic progress.

Solar energy had long been used in India. Tamil Nadu boasts the world's second-largest solar power facility, whereas Gujarat was the first state to embrace and expand its solar power capabilities. Many states have switched to using solar energy throughout time. India has various areas with vast amounts of land that are suitable for the installation of solar panels and have a significant potential for producing solar electricity. These are the states-

Gujarat- Due to its high solar power potential, availability of undeveloped land, connectivity, transmission and distribution facilities, and utilities, Gujarat was one of the first states in India to adopt solar energy and is now one of the most solar-developed states in the country. The Gujarat state government announced the introduction of a new solar rooftop program in its budget on July 2, 2019. By the end of this year, almost two lakh families would have benefited from this program by switching to solar power (Bhattacharyya and Palit, 2014). National Thermal Power Corporation Limited intended to construct the nation's largest solar park, with a 5 GW capacity, in September 2019.

Rajasthan- With a total photovoltaic capacity of 2289 MW, it is one of the most solar-developed states in India. Since 2012, Dhursar hamlet in Rajasthan's Jaisalmer district has been home to the 40 megawatt Dhirubhai Ambani Solar Park photovoltaic power plant. With an installed capacity of more than 1,500 MW, Jodhpur district leads the state, followed by Bikaner and Jaisalmer. As of October 2019, 29 government colleges in Jaipur have come forward to use solar energy to meet all of their electricity demands. Under the previous administration, solar panels were installed in these universities last year in an effort to lower electricity costs. These universities may now save millions of rupees a year on their power costs, which they previously paid in lakhs. The money saved can then be used to further expand these institutions (Balls, 2020).

Maharashtra- The biggest solar power facility in Maharashtra is the 125-MW Sakri Solar facility. The biggest solar steam system in the world is located at the Shri Saibaba Sansthan Trust. 50,000 meals are prepared daily for pilgrims who visit the shrine using this technology, which saves 100,000 kg of cooking gas annually. It was made to provide steam for cooking even when there is no energy to power the circulating pump.(2019) Sri Saibaba Sansthan Trust. The Osmanabad area of Maharashtra receives a lot of sunshine and is the third-best solar-insolation zone in India. In Osmanabad, a 10 MW solar

power facility was put into service in 2013. Maharashtra has a total electricity capacity of around 500 MW.

Telangana- ranks in second place in India for solar energy producing capacity. With a 3400 MW solar power generating capacity, the state is lagging behind Karnataka, and by 2022, it hopes to reach a 5000 MW capacity. BHEL has been given a work order by the National Theramal Power Corporation in Ramagundam to build a 100 MW floating solar PV plant on its water supply reservoir (Venkateswaran et al., 2018).

Tamil Nadu- Kamuthi's second-largest solar power facility globally. It can cover 10 square kilometres at one spot and has a 648 megawatt capacity. When operating at maximum capacity, it should provide enough electricity to run about 150,000 houses.

Dadra & Nagar Haveli - India's Union Territory has been selected as one of the Union Territories for the government's POWER FOR ALL Program, which intends to supply electricity to the area around-the-clock. By 2022, the government and UT administration hope to have 449MW of solar capacity installed. Compared to the national average of 1010 units, Dadra & Nagra Haveli has the highest per capita power usage in the nation, with 13,769 units as of 2015. The main cause of this significant disparity is the local industries, which account for 97% of Dadra and Nagar Haveli's electricity usage.

Jammu and Kashmir - known as the second-largest state in the nation for solar power generating potential, the Ladakh area is also referred to as the "solar capital" of India since it gets sunlight in its purest form. The solar power plant, which has a 1 MW generation capacity, is located in the Katra train station. Additionally, the government has established a number of regulations to encourage the state's rooftop solar system installation.

Andhra Pradesh- The biggest operating solar park in the world, Kurnool Ultra Mega Solar Park, is located in Panyam Mandal of Kurnool district in Andhra Pradesh. It spans 5,932.32 acres (24.0072 km2) and has a 1,000 MW capacity. The Andhra Pradesh Solar Power Corporation Private Limited (APSPCL) was in charge of carrying out the project. The goals of the New and Renewable Energy Development Corporation of Andhra Pradesh Limited (NEDCAP) are to preserve energy in rural regions and produce power using renewable resources.

Jharkhand- Known for its coal deposits, Jharkhand has one of India's lowest installed capabilities for renewable energy. The Central Electricity Authority reports that the state's total electricity capacity was 2,773.53 MW as of January 2024. Just 332.87 MW of this came from renewable sources, including 191 MW from hydropower. Thermal power made up the remaining 2,440.66 MW. As of January 2024, the Ministry of New and Renewable Energy (MNRE) reports that, excluding big hydro, the entire renewable capacity is made up of 4.05 MW of small hydro power, 14.1 MW of biopower (non-bagasse biomass cogeneration), and 123.72 MW of solar power. Ground-mounted solar (21 MW), rooftop solar (53.19 MW), and off-grid solar (49.53 MW) make up the state's 123.72 MW total solar capacity. The state has no wind power capability. Nonetheless, the state is working to boost adoption and realise its potential for renewable energy. As a result, Jharkhand's renewable energy sector has seen a number of regulation changes, including group and virtual net metering for rooftop solar systems and open access to green energy.

6. SOLAR POWER SCHEMES

With 300 days of sunshine a year, India is endowed with a wealth of solar energy potential. India's geographical surface experiences over 5,000 trillion kWh of energy annually, with the majority getting 4–7 kWh per square metre every day. In order to make effective use of this renewable energy source, the government is working to develop solar programs. A list of some of India's most well-known and prosperous solar projects may be seen below –

Jawaharlal Nehru National Solar Mission

Former Prime Minister Dr. Manmohan Singh announced the Jawaharlal Nehru National Solar Mission in January 2010. By means of long-term strategy, large-scale deployment targets, research and development, and domestic raw material manufacturing, it seeks to lower the cost of solar power generation and build 20,000MW of grid-connected solar power. The JNNSM mission is to improve India's rural economy in addition to providing large-scale grid-connected power. India's rural economy will shift as a result of the rapid adoption of solar-powered water pumps, lighting systems, and other uses. The goal is to grow and position India as a world leader in the solar energy industry.

Rooftop Solar Scheme

Of the 200 MW of projects allotted under the rooftop plan run by SECI (Solar Energy Corporation of India), 45 MW of capacity have been put into service. Furthermore, specific programs have been introduced, such as 73 MW for warehouses and 50 MW for the Central Public Works Department (CPWD). The largest global tender of its kind was issued by SECI, which offered a 30% subsidy to the social sector, private non-profit educational institutions, residential sector, and health facilities. The Ministry of New and Renewable Energy's (MNRE) program to create momentum for reaching the goal of 40GW of rooftop solar power generation by 2022 includes the tender. Likewise, SECI intends to shortly release a 1,000 MW rooftop procurement, which might not come with a subsidy.

Solar Park Development

MNRE has developed a plan to establish many solar parks with a combined capacity of almost 500 MW in several states. The plan calls on the Government of India to provide financial assistance for the establishment of solar parks in order to make it easier to build the infrastructure needed for new solar power projects, including land distribution, transmission, road access, water availability, etc. These solar parks will be created in cooperation with the State Governments in accordance with the policy. We will identify and purchase the land needed to create solar power plants with a cumulative capacity typically close to 500 MW and higher.

Government Solar Energy Subsidy

Under this scheme, the applicant will get capital subsidies and financial support equal to 50 percent, 75 percent, and 90 percent of the solar energy plant's base cost. According to the Government Yojana, if someone gets solar panels placed on their roof, they are qualified for a subsidy. The solar power plant's capacity determines the amount of the subsidy. The

primary goal of the plan is to use solar energy to support the power loom. The proposal would solve the lighting issue, and the facility will employ solar energy to boost output in order to expand the textile industry. People will also be able to lower their electricity costs, and the strain on thermal power plants will lessen as power generation increases.

UDAY Scheme

Ujjwal Discom Assurance or UDAY With the goal of finding long-term solar power solutions to the financial crisis that the power distribution was experiencing at the time, the Government of India introduced Yojna in November 2015 as a revival package for Indian energy distribution businesses. Its objectives include power sector reform, operational enhancement, renewable energy development, lowering power generating costs, energy efficiency, and conservation. The states can choose not to participate in this plan. In order to repay the lenders, the state government will issue sovereign bonds covering up to 75% of the debt, with the remaining 25% being issued as bonds. UDAY anticipates having a long-term solution for the electricity sector's current and any future problems.

PM Surya Ghar: Muft Bijli Yojana

The PM Surya Ghar: Muft Bijli Yojana, the world's largest domestic rooftop solar initiative, is transforming India's energy landscape with a bold vision to supply solar power to one crore households by March 2027. By March 2025, installations under the scheme are expected to exceed 10 lakh, with the numbers doubling to 20 lakh by October 2025, reaching 40 lakh by March 2026, and ultimately achieving the target of one crore by March 2027. Launched by Prime Minister Narendra Modi on 13 February 2024, this groundbreaking initiative aims to provide free electricity to households by facilitating the installation of rooftop solar panels. The scheme offers a subsidy of up to 40 percent to households, making renewable energy more affordable and accessible. In just nine months, 6.3 lakh installations have been completed, resulting in an impressive monthly installation rate of 70,000, ten times higher than the pre-scheme average. With a goal to benefit one crore households, the program is also expected to save the government ₹75,000 crores annually in electricity costs. This transformative initiative empowers millions to adopt clean energy, reinforcing India's commitment to sustainable development and energy innovation

7. CHALLENGES

One of the world's most significant energy sources is soon to be solar energy. By 2050, it is anticipated to provide 16% of total energy needs. By 2022, India alone plans to have 100 GW of solar power. Of this, 40 GW will originate from rooftop solar power systems installed in homes and businesses. However, it doesn't look like an easy road. Every step has challenges:

1) Capital cost

A solar project's needed capital cost is too expensive in relation to the savings it produces. The investment's overall balancing period is seven to ten years, which is a very lengthy time. People thus don't want to divert funds from non-business endeavours and endure this burden for little savings and commercial/industrial firms.

2) Lack of trust for performance

Customers are not prepared to invest in solar power solutions, even if the government offers several advantages, including subsidies and direct and indirect tax benefits. This is due to a dearth of information and serious questions over the functioning of plants in India. Since most of the local businesses are relatively new startups or middlemen for foreign investors in this industry, they have little to no expertise, which contributes to the lack of confidence.

3) Inferior Technology and Quality

Indian brands of solar panels are unable to match their international counterparts in terms of quality and efficiency. This is a result of Indian firms' lack of technological know-how and intellectual property (Advisors and Global, 2018).

4) Atmospheric conditions

The presence of dust in our surroundings is another significant problem. India, a growing nation with a large population, is essentially a dust storm. In actuality, a single particle of sand can have an impact on a solar PV cell or module's performance (Diallo and Moussa, 2020). The capabilities of Indian solar panel manufacturers have been directly impacted by these difficulties.

5) Higher Pricing

In order to get large projects, the international competitors in the Indian solar business, supported by Softbank and Goldman Sachs of Japan, are offering incredibly cheap costs, while Indian firms are still vying for grid parity. Due to a lack of innovation, technical assistance, and growth in this area, locally made panels encounter several difficulties, which raises their cost.

6) Incompatibility and limitations in technology in India

The CUF (elemental composition) of a solar power plant was estimated to be about 20% in the central energy authority's draft national electricity plan, which was published in December 2016. Therefore, around 1,000 square feet of terrace space are required for a 10-KW solar plant that can power three air conditioners and a three-bedroom condominium (Raven et al., 2017). Houses in India don't have standardised roofs like those in Europe and America, therefore it might be difficult to find the necessary shade-free space. As a result, there is insufficient room for solar systems that are financially viable. In addition, the majority of locals are opposed to blocking their rooftops. They construct water tanks, split air conditioners, and dry clothes on the terraces, among other uses.

8. FINDING OF THE STUDY

The following conclusions may be drawn from the research and studies:

a) India, a nation with significant pollution and population problems, has chosen solar energy as the most practical and beneficial way to meet its electrical needs.
b) In India, the promotion and application of solar power has taken into account both developed and rural regions equally.
c) The government has encouraged and supported the transition to solar power for all sectors of the economy, whether they require energy or already have the capacity to generate it.
d) With remarkable figures in solar power development and deployment, India has emerged as a global leader.
e) Thanks to significant government assistance in the form of subsidies and foreign investment in this technology, India is also among the nations that provide solar panel equipment at some of the lowest prices when compared to other nations.

9. CONCLUSION

In India, solar power is one of the industries that is growing the quickest, if not the fastest. It has received worldwide criticism for its progress in almost every area of its economy, yet it has done very well in the development of renewable energy (Diallo and Moussa, 2020). Facts show that as of September 30, 2019, the nation's installed solar capacity amounted to 31.124 GW. Additionally, the capital cost per MW for installing solar power facilities is the lowest in the world. In 2022, the Indian government set a goal of 20 GW of capacity, which was accomplished four years ahead of schedule and acknowledged by the UN. The goal was increased in 2015 to 100 GW of solar capacity by 2022, including 40 GW from rooftop solar, with an expenditure of $100 billion. Nearly 42 solar parks have been created in India to provide land to solar project developers.

The second-largest solar power facility in the world is located at Kamuthi, Tamil Nadu, India. This 648 megawatt solar farm, which spans 10 square kilometres, is located in the southern Indian state of Tamil Nadu. This facility was recognised as the biggest solar power plant in one place in 2016. The project was constructed at a cost of about 679 million USD and consists of 2.5 million separate solar modules. It is anticipated that the Kamuthi solar power plant would generate enough electricity to run about 150,000 houses when it is operating at full capacity.

India has become the world's second most desirable market for renewable energy equipment due to its extensive renewable energy projects.

Solar energy has grown astronomically in emerging nations in recent years. India is now the world's second-largest market for solar power (in terms of solar power installations), surpassing even the United States. In 2015, the nation's grid-connected solar power capacity was 9 GW; now, it stands at about 25 GW. In India, rooftop solar is poised to grow, while large-scale solar projects make up 87% of the country's solar capacity. Nearly 53% of the nation's new energy capacity increases last year came from solar. With the help of the Ministry of New and Renewable Energy and multinational corporations (MNCs) who view India as a potential investment destination for the development of this technology and the production of solar panels, it has the potential to become the largest producer of electricity through solar power, and the current facts and figures demonstrate the rate of growth of development in this sector (Bisaga and Parikh, 2018). It is anticipated that it would surpass all other solar-powered electricity producers in the world by 2022.

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