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INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/13700
DOI URL: <http://dx.doi.org/10.21474/IJAR01/13700>



RESEARCH ARTICLE

DESERT SOLAR POWER INDIA: A SYSTEMATIC STUDY OF POTENTIAL DEVELOPMENT OF SOLAR POWER IN THE INDIAN DESERT

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Manuscript Info

Manuscript History

Received: 31 August 2021

Final Accepted: 30 September 2021

Published: October 2021

Abstract

The deserts of Rajasthan have long been known for their spare beauty and their intense sunshine. Now that sun is being turned into a surge of solar power expansion that may one day power not just Rajasthan but a wide swath of India with clean energy. Rajasthan, with its 300 days a year of sunshine and relatively cheap desert land, has set a goal even more ambitious than India's. In this year's state budget, the newly formed state government announced it hoped to install 25,000 megawatts of solar energy in the state within the next five years, and infrastructure to transmit that power to the national grid. Rajasthan is no newcomer to renewable energy. Since the 1990s, the state has been home to a range of wind energy projects, with about 2,800 megawatts of wind capacity now installed, out of an estimated potential capacity of 5,000 megawatts. Altogether wind power in Rajasthan accounts for about 13 percent of India's wind energy production. But Rajasthan's Great Indian Thar Desert, the test site for India's first underground explosion of a nuclear weapon 15 years ago, may now help make India a solar power as well. The desert set in Rajasthan's largest district Jaisalmer, near the border with Pakistan, it is a place of sand dunes and shrub thickets – but also, increasingly, solar installations that could help change the character of India's energy development. India committed at the U.N. Framework Convention on Climate Change negotiations in Copenhagen in 2009 to reduce its climate-changing emissions, per unit of GDP, by 20 to 25 percent by 2020, compared to 2005 levels. The country is currently the world's seventh largest emitter of global warming pollution and the fifth biggest producer of emissions from burning fossil fuels. Sixty-eight percent of those emissions from fossil fuel use come from creating energy for the world's second most populous country, according to India's energy ministry. Today the country has 2.28 million megawatts of power generating capacity, and about 12.4 percent of that comes from renewable energy. Of the 2,632 megawatts of solar power now installed in India, Rajasthan so far has only 730 megawatts, putting it in second place behind the state of Gujarat, with 916 megawatts, according to India's Ministry of New and Renewable Energy. But Rajasthan, India's largest state and 60 percent covered by sunny desert, is now attracting the world's interest as a solar hotspot. "Around 1 lakh (100,000) square kilometers of barren land is

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available in the northwest arid belt of the state at cheaper rates that could be utilized for large scale solar projects. The government is formulating the policy to harness the enormous solar potential of the region to meet the country's growing energy requirements. Besides large solar installations, the government is studying the possibility of grid-connected rooftop solar photovoltaic units for households. The Solar Energy Corporation of India estimates that 130 million homes could potentially be equipped with the units, creating 25,000 megawatts of generating capacity." said Alok, Rajasthan's Energy Secretary.

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Introduction:-

Solar Energy In The Thar Desert

The deserts of Rajasthan have long been known for their spare beauty and their intense sunshine. Now that sun is being turned into a surge of solar power expansion that may one day power not just Rajasthan but a wide swath of India with clean energy.

Rajasthan, with its 300 days a year of sunshine and relatively cheap desert land, has set a goal even more ambitious than India's. In this year's state budget, the newly formed state government announced it hoped to install 25,000 megawatts of solar energy in the state within the next five years, and infrastructure to transmit that power to the national grid. If the plan succeeds, it would put India ahead of countries like China, the United States and Italy in solar energy production, and have it chasing world leader Germany, which has over 32,000 megawatts of solar capacity, according to a **government statement**.

"The state government is working on plans to develop logistics and attract investors targeting capacity of 25,000 megawatts in Rajasthan," Government of Rajasthan admitted such a scale-up of solar energy was "a mammoth task," but said the project was attracting interest, including recently from two Japanese public sector energy giants, METI and NEDO who had offered to help devise the state's solar plan, as well as from KfW, a German development bank.

Rajasthan is no newcomer to renewable energy. Since the 1990s, the state has been home to a range of wind energy projects, with about 2,800 megawatts of wind capacity now installed, out of an estimated potential capacity of 5,000 megawatts. Altogether wind power in Rajasthan accounts for about 13 percent of India's wind energy production. But Rajasthan's Great Indian Thar Desert, the test site for India's first underground explosion of a nuclear weapon 15 years ago, may now help make India a solar power as well. The desert set in Rajasthan's largest district Jaisalmer, near the border with Pakistan, is a place of sand dunes and shrub thickets – but also, increasingly, solar installations that could help change the character of India's energy development.

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The country is currently the world's seventh largest emitter of global warming pollution and the fifth biggest producer of emissions from burning fossil fuels. Sixty-eight percent of those emissions from fossil fuel use come from creating energy for the world's second most populous country, according to India's energy ministry. Today the country has 2.28 million megawatts of power generating capacity, and about 12.4 percent of that comes from renewable energy, the ministry says. Of the 2,632 megawatts of solar power now installed in India, Rajasthan so far has only 730 megawatts, putting it in second place behind the state of Gujarat, with 916 megawatts, according to India's Ministry of New and Renewable Energy. But Rajasthan, India's largest state and 60 percent covered by sunny desert, is now attracting the world's interest as a solar hotspot.

"Around 1 lakh (100,000) square kilometres of barren land is available in the northwest arid belt of the state at cheaper rates that could be utilised for large scale solar projects. The government is formulating the policy to harness the enormous solar potential of the region to meet the country's growing energy requirements", said Alok, Rajasthan's energy secretary, who has no surname. Besides large solar installations, he said, the government is

studying the possibility of grid-connected rooftop solar photovoltaic units for households. The **Solar Energy Corporation of India** estimates that 130 million homes could potentially be equipped with the units, creating 25,000 megawatts of generating capacity.

Most of the state's planned solar projects are being located in four Rajasthan districts – Barmer, Jaisalmer, Bikaner and Jodhpur – with relatively low population density, little water, limited agriculture and no industrialization, according to **Rajasthan Renewable Energy Corporation**, the agency that has been given sole responsibility for approving projects.

Water And Solar Energy

Solar power is a water-hungry technology, particularly when solar energy is used to heat water and drive turbines to create electricity – and water is scarce in Rajasthan. Almost all the villages in the project areas are dependent on rainwater for what limited agriculture is practised, though some parts of Jodhpur and Jaisalmer districts get irrigation water from the Indira Gandhi Canal.

Many villagers also have tube wells as source of Irrigation water, but high concentrations of salt make the water of limited use for agriculture or drinking. How the solar projects may affect wells or access to canal water remains unclear, though some villages have benefitted from water lines being run from the canal to solar projects, with pipes installed to villages as well, or from solar companies digging reservoirs for neighbouring communities.

Solar Parks

As solar projects are capital intensive, the government aims to set up “solar parks” – much like special economic zones, with a range of tax breaks and other incentives – to make the solar boom more financially attractive for investors. Land purchases may be subsidized, for instance, and customs duties lifted on some technologies.

“Large scale projects like solar parks help reduce the cost of investment by providing common infrastructural facilities, thus reducing the costs of investment and resulting in cheaper solar power.” Investment to generate one megawatt of solar power today in the region costs around 50 million rupees (\$930,000). But generating 1,000 megawatts of power cuts the investment cost per megawatt by almost 60 percent.

A planned solar park at Bhadla, spread over 10,000 hectares, aims to generate 3,000 megawatts of power within next five to 10 years

Sambhar Ultra Mega Green Solar Power Project

India's government has unveiled plans to build an “ultra mega” 4 GW solar power plant in the northwestern state of Rajasthan. According to the government, the plant will be built on a 23,000-acre (9308 ha) site close to Sambhar Lake, about 75 km from Jaipur, the state capital.

“Being the first project of this scale anywhere in the world this project is expected to set a trend for large scale solar power development in the world,” the government said in a statement. The plant's proposed capacity is around three times India's current total solar power production.

The project, called the Sambhar Ultra Mega Green Solar Power Project, is the brainchild of the Ministry of Heavy Industry, which said it expects to complete the 1-GW first phase – 10 times larger than the largest operational Indian solar power plant – by the end of 2016. “The first phase of the project is expected to be implemented through a joint venture company to be formed with equity from BHEL, Solar Energy Corporation of India, Power Grid Corporation, Satluj Jal Vidyut Nigam and Rajasthan Electronics and Instruments Ltd.”. The five companies are state-owned.

The majority of solar projects in India, developed under the auspices of the Jawaharlal Nehru National Solar Mission, are located in Rajasthan. The state is India's largest, with high insolation, a strong grid and state-owned land banks for grid-connected solar projects. India aims to install around 20 GW of grid-connected solar power by 2022. According to reports, the Ministry of New and Renewable Energy (MNRE) has outlined a plan to produce large amounts of solar power in the desert regions of Rajasthan and Gujarat in the next 10 years.

The Prime Minister's office has reportedly authorised an investigation into areas of desert “wasteland” suitable for building 1-GW solar projects. According to MNRE, India's entire electricity demand for 2012 could be met if

“mega” solar projects were built on just 5 percent of the nation’s unused desert land. India is expected to add 2.8 GW of solar capacity in 2014, the result of solar power auctions in 2012 and early 2013. Rajasthan has auctioned 75 MW of PV capacity this year, with projects to be commissioned by 2015. The nation currently has a total of 1761 MW of grid-connected solar capacity.

Potential Capacity Of Thar

The vast Rajasthan Desert is very similar to the Sahara desert in Africa, and has the potential to become the largest solar power plant in India. Due to high levels of available sunlight, CSP plants in Rajasthan could begin satisfying most of India’s energy needs in just a few years. India’s potential benefits from solar power are as numerous as the sands of Rajasthan desert, and include reduced dependence on fossil fuels and a cleaner environment. These benefits can be realized by installing renewable energy technologies, such as CSP, to protect the environment while diversifying energy resources and helping to lower prices.

Solar power can also reduce strain on the electric grid on hot summer afternoons, when air conditioners are running, by generating electricity where it is used. India has optimal conditions to use CSP to harness solar energy from the Rajasthan Desert. However, to take advantage of this innovative technology, potential CSP plant sites must be identified and deployment accelerated. Specifically, India needs to heavily subsidize Solar and Wind Power projects just like Japan, Germany and other European nations are doing. The use of renewable energy has great potential to create more jobs in India especially in the rural areas.

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