

## Exploring Solar Power in India: Capacity, Utilization, and Future Potential

Mr. Jonathan Markley\*<sup>1</sup> & Dr. Stephen Thomas Johnson<sup>2</sup>

\* Ph.D Scholar Department of Business Studies, Joseph School of Business Studies

<sup>2</sup> Assistant Professor, Department of Business Studies, St. John's School of Business Studies, Oxfordshire University, Oxford, UK

### ABSTRACT

Energy is a strategic commodity countries loose the race of economic development due to scarcity of energy and due to not able to consume energy which is available to them in for renewable energy such as wind, solar, hydropower, geothermal and biomass energy. The Indian subcontinent enjoys a huge amount of Sun rays throughout the year yet our citizens has to spend days in heat and nights in darkness .This is due to over dependence upon the Non renewable source of energy such as coal, kerosene etc for cooking and illuminating their houses at night. This paper tries to examine the loopholes of tapping solar energy & its distribution in Uttar Pradesh.

**KEYWORDS:** Solar, Hydro, Geothermal, Biomass & Renewable energy.

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### 1. INTRODUCTION

India is in a state of perennial energy shortage with a demand-supply gap of almost 12% of the total energy demand. This trend is significant in the electricity segment that is heavily dependent on coal and other non-renewable sources of energy. Renewable energy (RE) sources contribute only 7.7% of the total installed power capacity of 167,077 MW in India. Among the RE sources, wind power is the dominating component while solar energy currently contributes to less than 0.1% (on-grid+ off-grid) of the total installed capacity. (Prabhu, Narayanan, & Mathew, 2014).

### 2. MATERIALS AND METHODS

#### Review of Literature

- (Sahoo, 2016)studied the progress of current solar photovoltaic energy in India. It highlights the renewable energy trend in India with major achievements, state wise analysis of solar parks and industrial applications. Finally, it discusses the Indian government policies and initiatives to promote solar energy in India.
- (Pillai & Banerjee, 2009)studied and tried to documented documents the trends in the growth of renewables in India and establishes diffusion model as a basis for setting targets. The diffusion model is fitted tot the past trends for wind, small hydro and solar water heating and is used to establish future targets. The economic viability and green house gas (GHG) saving potential is estimated for each option. Several renewables have high growth rates, for example wind, Photovoltaic (PV) module manufacture and solar water heaters.
- (Kumar, Kumar, Kaushik, Sharma, & Mishra, 2010)studied efforts that have been made to summarize the availability, current status, major achievements and future potentials of renewable energy options in India. This paper also assesses specific policy interventions for overcoming the barriers and enhancing deployment of renewables for the future.
- (Lund, 2007) Studied the perspective of renewable energy (wind, solar, wave and biomass) in the making of strategies for a sustainable development. Such strategies typically involve three major technological changes: energy savings on the demand side, efficiency improvements in the energy production, and replacement of fossil fuels by various sources of renewable energy. Consequently, large-scale renewable energy implementation plans must include strategies for integrating renewable sources in coherent energy systems influenced by energy savings and efficiency measures.
- (Sharma, Tiwari, & Sood, 2012)examined the efforts which have been made to summarize the availability, current status, strategies, perspectives, promotion policies, major achievements and future potential of solar energy options in India.
- (Purohit & Purohit, 2010)studied the technical and economic assessment of concentrating solar power (CSP) technologies in India has been made. To analyze the techno-economic feasibility of CSP technologies in Indian conditions two projects namely PS-10 (based on power tower technology) and ANDASOL-1 (based on parabolic trough collector technology) have been taken as reference cases for this study. These two systems have been simulated at several Indian locations.
- (Ramachandra, Jain, & Krishnadas, 2011)studied the progress made in solar power generation in the country especially with the inception of an ambitious National Solar Mission (NSM) also termed as 'Solar

India'. The organizational aspects of solar power generation with focus on existing policy elements are also addressed so as to probe the actual potential of the identified solar hotspots in meeting the NSM targets and beyond.

### 3. RESULTS AND DISCUSSION

#### Background

As we know that with the industrialization of the economy the need for energy increases and the conventional energy sources are scarce and limited, therefore more emphasis has been given globally for shifting the burden of energy generation from conventional sources such as coal, petrol, diesel etc to renewable energy sources. Solar energy is also such type of resource which is renewable source of energy.

#### Present Situation in Uttar Pradesh

In April 1983 Uttar Pradesh Government created Non- Conventional Energy Development Agency (NEDA) under the department of additional energy sources as an autonomous institution. The institute has been renamed as "Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA)". From the beginning, the agency is also functioning as nodal agency for implementation of various schemes in the state.

Efforts are being made to develop the capacity in renewable energy sources such as solar energy, small-scale hydro electricity and biomass-based electricity production in the state. Various capacity solar power plants are being installed for electricity generation from solar energy. Biomass-based co-generation in the state sugar mills and rice husk based-electricity generation projects are being encouraged. In addition to this, small-scale hydro electric projects are being implemented in collaboration with private entrepreneurs. (UPNEDA, 2019)

*Table 1.1 India's top 10 states by installed solar power capacity*

States	Solar Capacity(MW) 2018	Rank
Karnataka	5,328	1
<b>Telangana</b>	3,501	2
Rajasthan	3,081	3
Andhra Pradesh	2,829	4
Tamil Nadu	2,055	5
Gujrat	1,607	6
Madhya Pradesh	1,526	7
Maharashtra	1,311	8
Uttar Pradesh	875	9
Punjab	845	10

Source:(Abdi, 2019)

The above Table 1.1 shows that Uttar Pradesh ranks at 9 with only 875 MW installed solar power capacity in 2018.This means that in Uttar Pradesh there is a long way ahead for installation of solar power capacity.

*Table 1.2 India's top 10 states by total installed electricity generation capacity*

States	Total electricity generation capacity (MW) 2018	Rank
Maharashtra	43,779	1
Gujrat	31,382	2
Tamil Nadu	30,447	3
Karnataka	27,199	4
Uttar Pradesh	25,061	5
Andhra Pradesh	23,726	6
Madhya Pradesh	21,873	7
Rajasthan	21,833	8
<b>Telangana</b>	15,944	9
Punjab	13,432	10

Source: Self constructed

The above Table 1.2 shows that Uttar Pradesh ranks at 5 with 25,061 MW total installed electricity generation capacity in 2018. This means that in Uttar Pradesh there is a huge scope of Non-Renewable energy generation.

*Table 1.3 Total annual sunshine in Northern India*

<b>Place</b>	<b>State</b>	<b>Hours</b>
Allahabad	Uttar Pradesh	2774
Amritsar	Punjab	2762
Indore	Madhya Pradesh	2884
New Delhi	Delhi	2685

Source (Currentresults, 2019)

The above table 1.3 depicts the average annual sunshine in Northern India during the period of 1961 to 1990 which, on the basis of the above table it is clearly evident that Uttar Pradesh had been experiencing highest annual sunshine with 2774 hrs in a year, which forms a solid foundation that Solar power can be strong source of energy in Uttar Pradesh in form of Renewable energy.

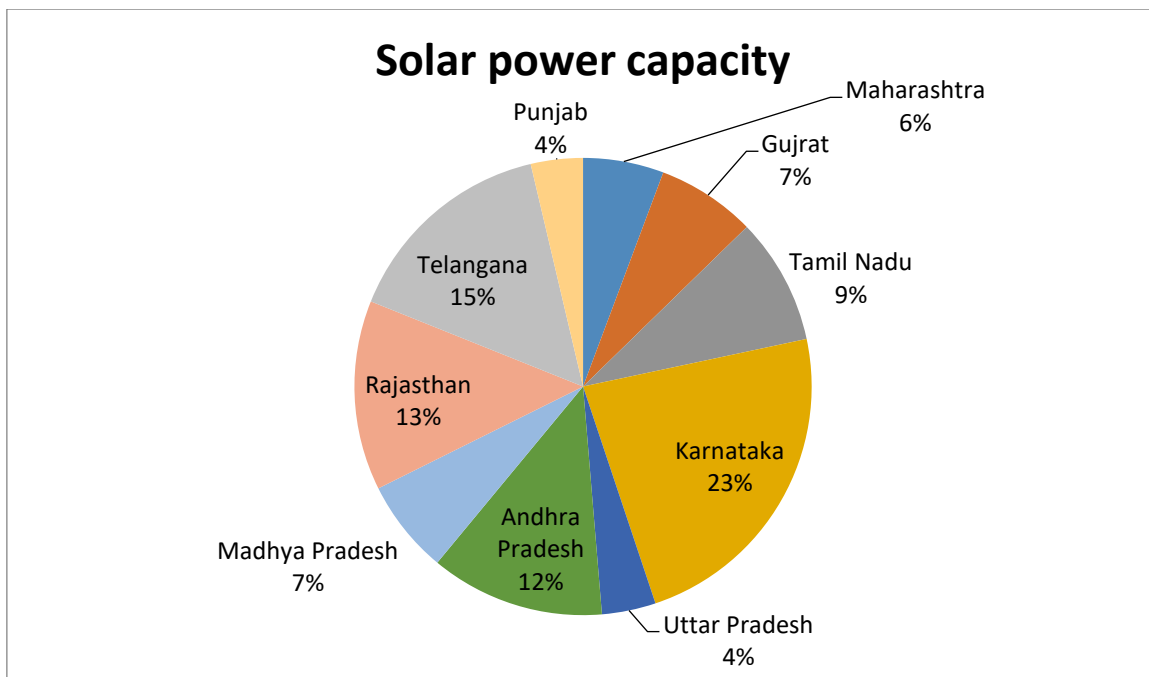


Figure 1.1 Total Installed Electricity Generation Capacity in India in 2018 (Top 10 states)

This shows that there is a Gap between installed electricity generation capacity and generated solar power in the country, which is very much evident in case of Uttar Pradesh which has 25,061MW installed electricity generation capacity but produces only 875 MW which is only 6% of its installed capacity, whereas Telangana which has only 15944 MW 061MW installed electricity generation capacity produces 15%.

Table 1.3 Ranking for Under utilization of installed electricity capacity among Top 10 states for solar power

States	Solar capacity power	Total installed electricity generation capacity	Percentage	Rank
Maharashtra	1,311	43,779	2.99458645	10
Gujarat	1,607	31,382	5.12076987	8
Tamil Nadu	2,055	30,447	6.74943344	6
Karnataka	5,328	27,199	19.5889555	2
Uttar Pradesh	875	25,061	3.49148079	9
Andhra Pradesh	2,829	23,726	11.9236281	4
Madhya Pradesh	1,526	21,873	6.97663786	5
Rajasthan	3,081	21,833	14.1116658	3
Telangana	3,501	15,944	21.9581034	1
Punjab	845	13,432	6.29094699	7
Total Capacity	22958	254676	99.20620815	

Source : Self calculated

The above table shows that there is huge scope of solar power capacity generation in Maharashtra which has highest installed capacity but generates lowest solar power capacity and therefore has been ranked at 10 while Telangana has shown highest solar power capacity with lowest installed electricity generation capacity.

#### 4. CONCLUSION

The mission of installing 175 GW of renewable energy capacity by the year 2022 has been set and 100 GW of solar capacity by 2022 in the country, for achieving this target state government has to work along on same lines with the central government. The study clearly shows that there is under an utilization of

installed electricity generation capacity in India all the stakeholders of the government has to work hard so that dependence on non-renewable sources of energy can be utilized in Uttar Pradesh.

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