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Solar Energy Potential in India

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Abstract

India is a country that has enormous solar energy potential. The geographical location of the country stands to its benefit for generating solar energy. The current power generation in India is heavily dependent on non renewable resources such as coal and diesel. Solar energy source is the green and environment friendly. Our country is facing a huge gap between demand and supply of the energy. So it is important to tap the solar energy potential of the country to meet the energy needs. The present study analyses the solar energy potential of the country and various policy initiatives taken by the government.

Keywords: Renewable Energy, Non-Renewable Energy, Solar Energy, Energy Conservation, Sustainable Energy, Energy Security.

Introduction

Energy is a basic requirement for economic development. Every sector of the national economy–agriculture, industry, transport, commercial and domestic needs inputs of energy. The economic development plans implemented since independence have necessarily required increasing amounts of energy. As a result, consumption of energy in all forms has been steadily rising all over the country.

The growing consumption of energy has also resulted in the country becoming increasingly dependent on fossil fuels such as coal, oil and gas. Increased use of fossil fuels also causes environmental problems both on local and global scales. In this background, there is urgent need for the country to develop a sustainable path of energy development. Promotion of energy conservation and increased use of solar energy are the twin planks of sustainable energy.

Objectives

The present study has following objectives:

1. To understand the current power generation scenario in India.
2. To assess the solar energy potential in India.
3. To study and analyse the policies and initiatives of the government for the solar energy generation.

Methodology

Availability of information in terms of data is important for any scientific research. In the present study only secondary data have been used. The data pertaining to the power generation, solar power potential and target has been taken from ministry of power and ministry of new and renewable energy. In the present study qualitative method has been used for data analysis.

Power Generation Scenario in India

India, a rapidly growing economy with more than 125 crore people, is facing a massive energy demand. The power produced in the country is mostly from thermal (69.8%) and it is predicted that country's coal reserves won't last beyond 2040-50. The current power generation in India is heavily dependent on non-renewable natural resources such as coal and diesel, whose fast depletion has forced the government and the power generation companies to look into renewable energy sources, especially solar power. Renewable energy source hydro contributes only 15% of the total installed power capacity of 284303 MW in India (table 1). Other Renewable Energy Sources (RES) contribute 13.2 % of total power generation. Among other RES wind power is the dominating component (8.7%) while solar energy currently contributes to only 1.7 % of the total installed capacity.

Table-1
Power Sector at a Glance in India
(as on 31.12.2015)

Sector/ fuel	Production (MW)	% of total production
Thermal	198484	69.8
Hydro	42623	15.0
Nuclear	5780	2.0
Renewable Energy Sources (wind, solar, small hydro power, bio-mass, etc.)	37416	13.2
Total	284303	

Source : ministry of power, govt. of india

Solar Energy Generation and Potential

The total installed solar power generation capacity of the India was 4878.87 MW as on 31.12.2015 .This is only 1.7 percent of the total power installed capacity of 284303 MW. India is a country that has tremendous solar energy potential. The geographical location of the country stands to its benefit for generating solar energy. The solar energy potential in India is immense due to its convenient geographical location near the Equator. India receives nearly 3000 hours of sunshine every year, which is equivalent to 5000 trillion kWh of energy. Almost all parts of India receive 4-7 kWh of solar radiation per sq meters. This is equivalent to 2,300–3,200 sunshine hours per year. States like Rajasthan, Jammu and Kashmir, Madhya Pradesh , Maharashtra , Andhra Pradesh, Karnataka, Telangana, Tamilnadu, Uttar Pradesh, Gujarat, Chhattisgarh and Odisha have great potential for tapping solar energy. India has an estimated Solar Energy potential of 749 GW (table 2 and map).

Government Initiatives to Develop the Solar Energy Generation

There are four government bodies established to promote solar energy in India. The first is the Ministry of New and Renewable Energy (MNRE), which is the nodal ministry for all matters relating to new and renewable energy. The second, Indian Renewable Energy Development Agency (IREDA), is a public limited company established in 1987 to promote, develop and extend financial assistance for renewable energy and energy efficiency/conservation projects. The third Solar Energy Corporation of India (SECI) under the administrative control of MNRE is involved in development, promotion and commercialization of the solar energy technologies. SECI is also involved with development and sale of low cost solar energy equipments. The fourth National Institute of Solar Energy (NISE), an autonomous institution under Ministry of New and Renewable Energy is the apex national R&D institution in the field Solar Energy.

The Government of India has converted 25 year old Solar Energy Centre (SEC) into NISE in 2013 to assist the MNRE in implementing the National Solar Mission and to coordinate research, technology and other related works. The NISE has assumed all technical activities of SEC and has also re-organized itself to undertake roles and responsibilities assigned to it by the Ministry. The institute is involved in demonstration, standardization, interactive research, training and testing solar technologies and systems. It is an effective interface between the Government and institutions, industry & user organizations for development, promotion and widespread utilization of solar energy in the country.

India's National Action Plan on climate change (NAPCC) identifies eight critical missions to promote climate mitigation and adaptation. National Solar Mission, which has the specific goal of increasing the usage of solar thermal technologies in urban areas, industry, and commercial establishments, is one of the core components of this policy. The Jawaharlal Nehru National Solar Mission (JNNSM) was launched in 2010. The Mission has set the target of deploying 20,000 MW of grid connected solar power by 2022 is aimed at reducing the cost of solar power generation in the country through (i) long term policy; (ii) large scale deployment goals; (iii) aggressive R&D; and (iv) domestic production of critical raw materials, components and products.

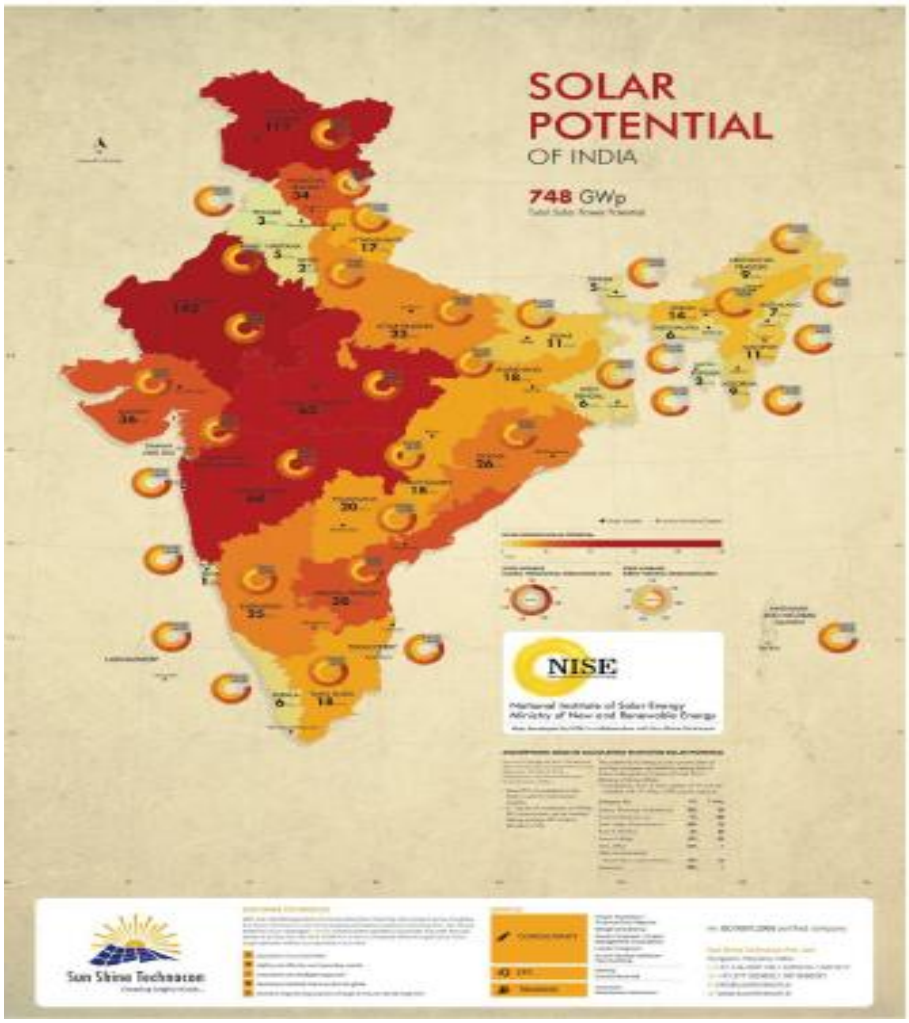
Now on the 17th June 2015 government of India has revised the solar power capacity target under the Jawaharlal Nehru National Solar Mission by five times, reaching 1,00,000 MW by 2022.The government of India has set the tentative target for the states and union territories(table 2) . The target will principally comprise of 40 GW Rooftop and 60 GW through Large and Medium Scale Grid Connected Solar Power Projects. With this ambitious target, India will become one of the largest green energy producers in the world, surpassing several developed countries.

Table-2
State wise Estimated Solar Power Potential and Tentative Break-up of Solar Power Target to be Achieved by the year 2022

State/ UTs	Solar Power Potential (GW)	Target to be achieved by the year 2022 (MW)
Andhra Pradesh	38.44	9834
Arunachal Pradesh	8.65	39
Assam	13.76	663
Bihar	11.20	2493
Chhattisgarh	18.27	1783
Goa	0.88	358
Gujarat	35.77	8020
Haryana	4.56	4142

Himachal Pradesh	33.84	776
Jammu & Kashmir	111.05	1155
Jharkhand	18.18	1995
Karnataka	24.70	5697
Kerala	6.11	1870
Madhya Pradesh	61.66	5675
Maharashtra	64.32	11926
Manipur	10.63	105
Meghalaya	5.86	161
Mizoram	9.09	72
Nagaland	7.29	61
Odisha	25.78	2377
Punjab	2.81	4772
Rajasthan	142.31	5762
Sikkim	4.94	36
Tamilnadu	17.67	8884
Telangana	20.41	-
Tripura	2.08	105
Uttar Pradesh	22.83	10697
Uttarakhand	16.80	900
West Bengal	6.26	5336
UTs	2.84	3840
Total	748.98	99533

Source : ministry of new and renewable energy, govt. of India



The total investment in setting up 100 GW will be around Rs. 6,00,000 cr. In the first phase, the Government of India is providing Rs. 15,050 crore as capital subsidy to promote solar capacity addition in the country. This capital subsidy will be provided for Rooftop Solar projects in various cities and towns, for Viability Gap Funding (VGF) based projects to be developed through the Solar Energy Corporation of India (SECI) and for decentralized generation through small solar projects. The Ministry of New and Renewable Energy (MNRE) intends to achieve the target of 1,00,000 MW with targets under the three schemes of 19,200 MW. Apart from this, solar power projects with investment of about Rs. 90,000 crore would be developed using bundling mechanism with thermal power. Further investment will come from large Public Sector Undertakings and Independent Power Producers (IPPs). State Governments have also come out with State specific solar policies to promote solar capacity addition. The Government of India will also approach bilateral and international donors as also the Green Climate Fund for achieving this target.

To facilitate such a ambitious and massive target, the Prime Minister's Office has been pushing various Ministries to initiate supporting interventions, like:-

1. incorporating changes in land use regulations and tenancy laws to facilitate aggregation and leasing of land by farmers/ developers for solar projects;
2. identification of large chunks of land for solar projects;
3. identification of large government complexes/ buildings for rooftop projects;
4. clear survey of wastelands and identification of transmission/ road infrastructure using satellite technology for locating solar parks;
5. development of power transmission network/ Green Energy Corridor;
6. setting up of exclusive parks for domestic manufacturing of solar PV modules;
7. provision of roof top solar and 10 percent renewable energy as mandatory reform under the new scheme of Ministry of Urban Development;
8. amendments in building bye-laws for mandatory provision of roof top solar for new construction or higher FAR;
9. considering infrastructure status for solar projects; raising tax free solar bonds; providing long tenor loans; making roof top solar a part of housing loan by banks/ NHB and extending IIFCL credit facility to such projects by the Department of Financial Services;
10. suitable amendments to the Electricity Act for strong enforcement of Renewable Purchase Obligation (RPO) and for providing Renewable Generation Obligation (RGO);
11. incorporating measures in Integrated Power Development Scheme (IPDS) for encouraging distribution companies and making net-metering compulsory.

Some of the Advantages of Solar Energy Which Makes it All The More Suitable for India are as Follows

1. Solar energy is a clean, renewable resource that is continuously supplied to the earth by the sun.
2. Solar power can contribute to the long term energy security of India, and reduce dependence on fossil fuels that put a strain on foreign reserves and the ecology as well. The new solar target of 100 GW is expected to abate over 170 million tones of CO2 over its life cycle.
3. The solar manufacturing sector will get a boost with this long term trajectory of solar capacity addition. This will help in creation of technology hubs for manufacturing. The increased manufacturing capacity and installation are expected to pave way for direct and indirect employment opportunities in both the skilled and unskilled sector.
4. Solar energy generation system can be installed anywhere. Solar panel can be easily placed in houses. So it is very suitable for the rural and remote areas.

Suggestions

1. The capital cost of the solar power equipments is higher then the conventional sources of energy. Efforts are required to be made for reduction of capital cost of solar power projects to make it comparable with thermal and other sources of conventional energy.
2. Public and private sector role in solar energy development needs to be redefined.

Conclusion

Solar Energy possesses tremendous potential in bridging India's energy demand-supply gap in the future. There are various challenges for this industry, including lowering cost of production, increasing R&D, public awareness and financing infrastructure. Considering India's solar potential and its international commitment towards green and climate friendly growth trajectory, the government has taken various path-breaking decisions. The government has launched various policies and subsidy schemes to encourage growth of the solar industry. If these initiative work as planned, it is only a matter before India becomes one of the world leaders in Solar Energy.

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