International Journal of Engineering Technology Science and Research
IJETSR
www.ijetsr.com
ISSN 2394 – 3386
Volume 5, Issue 2
February 2018

An approach towards feasibility Survey to Overcome the Electric Power Deficiencies at Various States of India

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ABSTRACT: *In this paper, a thorough study about per capita power consumption of each state and union territory (in KWH) has been done by dividing the country into five regions- east, west, north, south and north east. The power requirement for each state and union territories has also been surveyed. Thus after analysis, it has been observed that there is power deficit in sixteen states of India of 38917 million KWH. In this paper, solution for this Energy deficiency has been prescribed using renewable energy. Considering the geographical position of the state different approaches such as solar, bio gas, hydro power, geothermal, wind, tidal and hydro power generations have been considered. Since maximum part of the country falls under tropical, sub-tropical climatic condition, solar photovoltaic power generation technique is found to be the most viable approach as the Solar Irradiance is abundant in maximum part of the country. The average Solar Irradiance (kWh/ m^2/ Day) and the area of the individual states in km^2has also been obtained. Considering only one percent of the area to be used for solar generation, the total solar power generation capability has been calculated, which can irradiate the energy crunch completely from our country.*

KEYWORDS: Solar Irradiance, Renewable Energy, Solar PV Potential, Environmental effect, Solar Radiation.

I. INTRODUCTION

The rate of GDP in India is increasing by 5.7 %(2017-2018) [1]. In this country 31% of the households still lacks electricity [2]. Fossil fuel is decreasing day by day. Till date India needs to import 77.6% of its total consumption of crude oil i.e. 120600 (thousand metric tons) of crude oil [3]. This has a great impact on the economy of the country. Thus to economically flourish the country, use of renewable energy sources has become mandatory. Five different ministries have structurally handled the Indian energy sector, among them the Ministry of New and Renewable Energy. India is probably the only country in the world with a dedicated ministry for renewable energy development. The country ranks fourth in the world in terms of total energy consumption and needs to accelerate

In this paper, the power requirement for each state and union territories has also been surveyed. The per capita power consumption of each state and union territory (in KWH) has been surveyed. The total power generated has also been analyzed. From the difference, the total power deficit has been obtained. It has been observed that there is power deficit in sixteen states of India of 38917 million KWH in India. To eradicate this use energy crunch, use of renewable energy has become the only prescribed solution. For determining the type of renewable energy to be used, the geographical position of each state has been considered and different approaches such as solar, bio gas, hydro power, geothermal, wind, tidal, hydro power generation approaches have been prescribed. Since maximum part of development of the energy sector to meet its growth the country falls under tropical, sub-tropical climatic aspirations. [4]India is abundantly endowed with renewable energy in the form of solar, wind, hydro and bio-energy.

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condition, solar photovoltaic power generation technique is found to be the most viable approach as the Solar Irradiance is abundant in maximum in India is 200 MW/km square. With a geographical area part of the country. Further, solar energy is clean, of 3.287 million km square, this amounts to 657.4 million inexhaustible, environment friendly and a potential MW.[6]Most part of India receive 4-7 kWh/m^2/day of solar resource among the various renewable energy options. Indian states receives 1800 to 2200 hours of sun each year, is putting together a plan to develop at least 50MW of PV power plants. The potential for solar PV in Rajasthan, with its vast area of sunny desert, is of paramount quantity. In the state of Gujarat, for example, where 500MW plant was commissioned in the recent years. In this paper, the area of each state has been surveyed. The average Solar Irradiance (KWh/m^2/day) has been also studied. Then state wise the area of land in acres of the states having potential in solar power, required to achieve this deficient power generation, and has been calculated. All the losses occurring during instation of the solar panels have also been considered.

II.SOLAR RADIATION DATA FOR INDIA

radiation with 250 – 300 sunny days in a year. The direct normal Solar Radiation can be shown in figure 1. Therefore solar radiation is a key factor determining electricity produced by the photo voltaic (PV) systems which is usually obtained using Geographical Information System (GIS).

III.SOLAR PV POTENTIAL

The solar irradiation towards a horizontal or inclined surface differs depending on the latitude of the place .For understanding the amount of solar irradiance in India, the geographical position of our country is needed to be considered. There is a huge resource of solar energy that can be obtained from India due to its geographical location from 8 degree north to 36 degree North latitude. The sunlight duration in Kolkata, India is quite high with average sunrise time 5:12a.m. in the morning and sunset time 5:59p.m. in the evening.[7]

The longest day is on 22nd June with sunrise time at 4:53a.m and sunset time at 6:25p.m.The shortest day is on 22nd of December with sunrise time at 6:12a.m. and sunset time of 16:57p.m.[8] This huge amount of solar resource potential gets wasted which can be utilized for the development of the nation.

IV. STATE WISE ANALYSIS

A state wise analysis has been done and the renewable energy solution has been prescribed. A chart has been prepared considering the parameters like per capita power consumption of the state (in KWH), Power Deficit (in Million KWH), prescribed Energy Solution, area of the state in square km, Average Solar Irradiance(kWh/m^2/Day).All these parameters have been obtained from CEA[9] ,CERI[10] ,MNRE[11] and Synergy[12].

India lies within the latitudes of 7 degree north and 37 degree North.[5] India is endowed with rich solar energy resource. The average intensity of solar radiation received

Then state wise the area of land in acres of the states having potential in solar power , required to achieve this deficient power generation, has been calculated considering all the losses that occur during installation of solar panels. The number of sunny days is considered to be 300 as India generally has 45 rainy days and 20 dark days in a year.

V. CALCULATIONS

The formula used for calculation of Mega Watt peak energy achieved is as follows: considered. The different types and amount of loss occurring are as follows:

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1) Captured loss 2%

Unit Generated = (Q * 10^6 * I * 300)/1000

Here,

2) DC cable loss 2% 3) Inversion loss 6%

4) Transformer loss 2%

5) Other uncounted loss 2%

Q= Mega Watt peak achieved

I =Average Solar Irradiance (kWh/m^2/Day)

The multiplication by 300 is done because India gets three hundred sunny days in average. Forty five days are rainy days and twenty days are dark days. We have the values for Unit generated from CEA and Irradiance from Synergy. Thus the value of Q i.e. Mega Watt peak achieved has been obtained from there.

Thus total loss accounts to be 14% of the total energy. Thus for obtaining the real value of Q i.e. Mega Watt peak achieved the value is being multiplied by 0.86.

For generation of one Mega Watt of energy 2.5 acre of land is required. Thus state wise the land required in acres to implement solar panels to completely irradiate the power deficiency in that state has been calculated in the chart.

Then the losses occurring during the power generation through solar panel is also being

Table: State wise acres of land required for setting up Solar Power Panels to eradicate power deficiency from India

STATE	Per capita power consumption of the state(in KWh)	Power Deficit(in MU)	Prescribed Energy Solution	Area of the State(in km^2)	Average Solar Irradiance (kWh/m^2/Day)	Calculated acres of land to generate the electricity to remove the power deficiency
Jammu and Kashmir	968	- 2438	Bio Gas/Solar	101387	4.81	3632.5
Himachal Pradesh	1144	295	Hydel/Geothermal	55673		
Punjab	1663	-3784	Solar	50362	4.63	5857
Uttarkhand	930	-335	Solar	53483	5.44	441
Haryana	1491	1269	Solar	44212		
Rajasthan	811	-170	Solar	342239	5.63	216

Uttar Pradesh	386	-7044	Solar	240928	4.27	11822
Madhya Pradesh	618	8853	Solar	308245		
Chhattisgarh	921	1546	Solar	135191		
Jharkhand	750	-2796	Solar	79714	5.15	3890
Odisha	837	660	Solar/wind	155707		
West Bengal	506	-7257	Solar	88752	4.12	12623
Bihar	117	-6656	Solar	94163	4.37	10915
Goa	2004	-1	Tidal / Wind / Solar	3702		
Gujarat	1558	4380	Tidal / Wind / Solar	196024		
Maharastra	1054	22100	Solar / Wind	307713		
Andhra Pradesh	1013	-4136	Tidal / Wind / Solar	162968	5.27	5624
Karnataka	873	3240	Tidal / Wind / Solar	191791		
Kerala	536	1095	Tidal / Wind / Solar	38863		
Tamil Nadu	1210	11649	Tidal / Wind / Solar	130058		
Telengana	661	-1830	Tidal / Wind / Solar	112077	5.27	2452
Assam	209	-2082	Small Hydro	78438	3.82	3906
Manipur	207	-37	Small Hydro	22327	4.66	57
Mizoram	429	56	Small Hydro	21081		
Nagaland	223	-127	Small Hydro	16579	4.46	204
Meghalaya	613	-150	Small Hydro	22429	3.73	288

Tripura	223	1073	Small Hydro	10486		
Arunachal Pradesh	503	-74	Small Hydro	83743	3.33	159
Sikkim	845	531	Small Hydro	7096		

VI. OBSERVATION:

In this chart a thorough study has been done on the states which are still lacking power. The effectiveness of this project is very high because with a population of 1.33 billion people[13], around 100,000 villages and 450 million people still do not have electricity. In the above chart the amount of area (in acres) for each state that has to be used to implement solar panels to eradicate the power deficiency has been calculated. It has been seen that the solar potential of the states is so huge, that it is capable of completely eradicating the energy crisis from our country. Thus solar implementations in a developing country like India has become a must.

VII. CONCLUSION

The sun is tremendous source for generating clean and sustainable electricity without toxic pollution or global warming emissions. In this paper it has been discovered that the solar energy is capable of completely eradicating energy crisis from our nation .The use of solar as a form of energy embellishes the sustainable form of life these people have been leading while also advancing them in technology toward an increased standard in living. For each state having power deficiency, the amount of land required in acres to install solar panels to completely eradicate this energy crunch has been calculated.

The future work involves the implementation of PV modules on buildings and habitat sectors as because depending on their locations, solar facilities can raise concerns about land degradation and habitat loss. India is mainly an agricultural country. Thus land is of high importance. Agro-voltaic techniques falls under future scope of work where land can be used for both agriculture as well as implementation of Solar panels.

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