RURAL ELECTRIFICATION PROGRAMME THROUGH SOLAR PHOTOVOLTAICS IN ODISHA, INDIA

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Abstract

In India, over 80,000 villages remain to be un-electrified and particularly in the state of Odisha, 9326 villages are still to be electrified. Odisha is situated in south of Tropic of Cancer between latitude 17 – 23^0N and receives nearly 5-6 kWh/m^2/day of solar radiation. As Odisha receives an abundance of solar radiation throughout the year except for some interruption during the monsoon and winter seasons, it has a vast potential for harnessing very large quantities of solar power. Moreover, large portions of the western part of the state, far away from the coasts, are in rain shadow areas, which receive solar radiation round the year, virtually, without any interruption. This study attempts to establish the challenges associated to solar energy scenario in rural living of Odisha with a glimpse of the presently operating government projects and projects to be installed based on solar technology.

Keywords: Renewable energy, Solar energy, Salepada, Chuktia-bhunjia

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1.INTRODUCTION

Energy is the ultimate factor responsible for both industrial and agricultural development. The use of renewable energy technology to meet the energy demands has been steadily increasing for the past few years, however, the important drawbacks associated with renewable energy systems are their inability to guarantee reliability and their lean nature. Import of petroleum products constitutes a major drain on our foreign exchange reserve. Renewable energy sources are considered to be the better option to meet the challenges.

More than 200 million people, live in rural areas without access to grid-connected power. In India, over 80,000 villages remain to be un-electrified and particularly in the state of Odisha, 9326 villages are still to be electrified[4]. There is difficulty to supply electricity due to inherent problems of location and economy of these places. The costs to install and service the distribution lines are considerably high for remote areas. Also there will be a substantial increase in transmission line losses in addition to poor power supply reliability. In most of the remote and non-electrified sites, extension of utility grid lines experiences a number of problems such as high capital investment, high lead time, low load factor, poor voltage regulation and frequent power supply interruptions.

At present, standalone solar photovoltaic and wind systems have been promoted around the globe on a comparatively larger scale. These independent systems cannot provide continuous source of energy, as they are seasonal. For example, standalone solar photovoltaic energy system cannot provide reliable power during non-sunny days. The standalone wind system cannot satisfy constant load demands due to significant fluctuations in the magnitude of wind speeds from hour to hour throughout the year. Therefore, energy storage systems will be required for each of these systems in order to satisfy the power demands. Usually storage system is expensive and the size has to be reduced to a minimum possible for the renewable energy system to be cost effective. Hybrid power systems can be used to reduce energy storage requirements.

On an average Odisha receives nearly 5-6 kWh/m^2/day of solar radiation. The climate data of Odisha is given in Table 1.

Table 1.Climate data of Odisha

Average number of Sunny days in a year:	300 days

Number of partial Sunny days in a year:	30 days
Total overcast days in a year :	35 days
Highest ambient Temperature in summer:	45^0 C
Highest ambient Temperature in winter:	27^0 C
Lowest Temperature in winter:	3^0C

The potential of renewable energy in Odisha is shown in Table 2 which shows that the state has vast feasible potential of solar energy to the tune of 8000 MW. Solar energy is being exploited in Odisha, mainly for village electrification. However, there are some other usages in respect of Solar Thermal energy as well. In Odisha, Orissa Renewable Energy Development Agency (OREDA) is mainly looking after all renewable energy activities and their popularisation. Since its inception, OREDA has provided renewable energy solutions to more than 2.00 lakh households in the state by providing photovoltaic power plants, home light systems , street light systems, biomass gasifiers and Biogas plants.

A recent study by the MNES on comparison of relative costs of electrification of remote villages through conventional grid and the SPV power basing on the net present value of life cost over a period of 20 years reveals that solar electrification is more economical for villages located beyond 3 kms in hilly areas and 7 kms in plains from the grid [7]. Moreover potential PV Systems when used on a large scale cuts down the need for extending the distribution grids in rural areas and the resultant losses in transmission.

Photovoltaic (PV) solar home systems (SHSs) are often the least expensive electrification option in sparsely populated areas with low electric loads. Typically consisting of a 10- to 50-watt peak (Wp) PV module, a rechargeable lead-acid battery, and sometimes a charge controller, the systems generate modest amounts of electricity for lights, radio, television, and other small appliances. Solar home systems have social, economic, and non-GHG environmental benefits. Vastly superior to kerosene lamps, electric lights enable families to extend their days after sunset

productively and enjoyably, by studying, working, or simply cooking and eating dinner in a well lit home. Reducing the need to store and burn kerosene improves air quality and safety. The systems also ease access to information and entertainment via radio and television, and help families carry on income-generating activities.

Table 2.Potential of Renewable Energy in Odisha

Sl. No	Renewable Energy Source	Gross Potential (MW)	Feasible Potential (MW)
1	Solar Photovoltaic	40,000	8000
2	Solar Thermal	10000	2000
3	Wind	1700	910
4	Biomass-paddy husk	300	250
5	Biomass – paddy straw	600	250
6	Other Biomass	800	250
7	Biodiesel	300	150
8	Small Hydro Project	120	120
	Total	53820	11820

2. Study of Rural Village Electrification Program (RVEP) in Odisha

This program started in Odisha during 2006-07.The objective of the programme is electrification of those unelectrified remote villages and hamlets where grid connectivity is either not feasible or not cost effective. The State of Odisha has completed substantial advancement in respect of village electrification by means of Solar PV programmes. In Odisha, 9326 villages and a large number of hamlets are still to be electrified. Some PV systems are being employed for village electrification programme and some are sanctioned for installation. OREDA has also

installed an enormous number of Solar Street lights in several remote areas of Odisha and supplied a large number of solar lanterns asshown in Table 3.

Table 3 Solar systems in Odisha

Home Lighting Systems	5182 Nos
Street Lighting Systems	5486 Nos.
SPV Power Plants	63 Nos
Solar Lanterns	9603 Nos
SPV operated TV	58 nos
SPV pumping system	51

Up to 2009-10, 589 remote villages have been covered under this Programme as detailed below.

FY	No. of villages sanctioned	No. of villages dropped due to grid connectivity and other reasons	No. of villages completed
2006-07	197	5	185
2007-08	0	0	0
2008-09	91	4	86
2009-10	371	50	318
Total	**659**	**59**	**589**

During 2010-11 a total of 770 villages in 8 districts have been sanctioned by MNRE, GOI as detailed below.

Sl	District	No. of	No. of villages

No		villages	electrified
1	Kandhamal	161	38
2	Nayagarh	37	22
3	Rayagada	384	172
4	Angul	24	24
5	Debagarh	17	11
6	Sambalpur	27	7
7	Mayurbhanj	11	11
8	Gajapati	109	89
	TOTAL	**770**	**374**

Number of villages in different districts of Odisha identified for electrification through renewable energy is shown below.

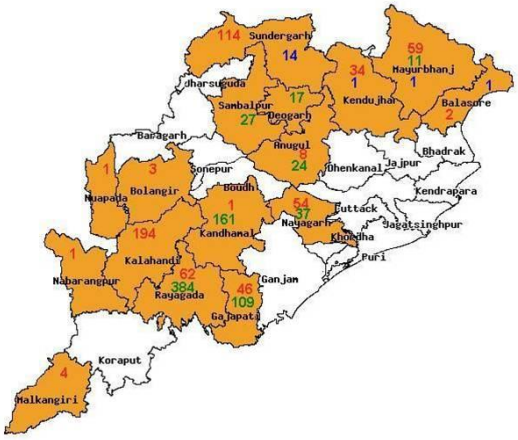

Fig. 1 Number of villages identified under RVEP

Solar Lighting System

Under this program solar street lights, home lights and small solar power plants are provided to eligible users at subsidized prices. Under this program during 2010-11, the following activities have been done

- 88 solar streetlights have been installed in Keonjahr, Sundargarh,Khurda, Puri and Ganjam districts.The cumulative achievement comes to 5486 sets of SPV SLS (Table 3).
- A 2kW solar power plant has been commissioned in Eco-tourism complex in Berhampura Island in Chilika Lake.

- One 650 Wpk SPV Power plant has been commissioned at Badatemera Sevashrama of Nowrangpur district. The power plants provide illumination to10 rooms and power a TV for use by the inmates of the Ashram.
- One 2kwp SPV Power Plant in PALIA Sevashrama of Nawarangpur district to supply power for illumination is in progress.
- One 6 kwp SPV Power plant & 1800 wp SPV pump system in Government Higher Secondary School of Nawarangpur district for illumination & water supply to the institution is in progress.
- During 2011-12, one 2 MW grid connected solar power plant has been installed at Bhusandpur by MGM group.

Electrification of two remote villages namely, Udal and Tentulikhol in Kishorenagar block of Angul district have been completed by OREDA with installation of SPV LED Home Lighting Systems and Street Lighting Systems. Proposal for electrification of Gunupur High School in Thuamul Rampur block of Kalahandi district with power supply through SPV Power Plant is in progress.

Electrification of hamlet (Salepada hamlet)

Salepada is a small hamlet of the Gatibeda revenue village in Sunabeda GP of Komna block. Situated in the midst of the scenic Sunabeda plateau it is a hamlet surrounded by forest and natural habitat. A total number of 40 households are located in the village, which houses a total population of 206 inhabitants. The people belong to the Chuktia-bhunjia tribe who are a primitive tribe and were given recognition under the 8th five-year plan. A micro-project for the tribe under the aegis of Chuktia-Bhunjia Development Agency (CBDA) has been constituted for their holistic development. This agency is implementing welfare work for the people of that area pertaining mainly to their socio-economic development. The Chuktia-Bhunjias have lived in deprivation for ages. Centuries of darkness had prevailed over the place, so the need for light to penetrate the dark was felt immensely. The geographically hostile location of the hamlet in the plateau region and its incompatible distance from the grid makes the extension of conventional power a far-fetched proposal since grid cannot be extended to certain locations due to logistic and environmental conditions. So the need was to look for alternative sources of power

generation. Under such circumstances the only alternative was non-conventional power generation. Salepada possesses sufficient shadow free open space and receives adequate solar insulation for about 300 days a year. Average sunshine hours per day are around 6-7 hours. Thus the SPV power plant was better suited to the locale. A 2 kw size SPV plant was established. Number of Home lights installed was 85 along with 8 lights for street illumination of the area. Each home received 9 watt CFL for illumination purpose. Besides for community use 5 extra points including a TV point and 8 streetlights of 11 watt each were provided. A 2 Kw PV power plant can easily cater to the total load of 0.944 Kwp. Illumination for 5 hours per day, 5p.m.-11p.m., had been fixed. The supplier took up the responsibility for post-operation and maintenance of the plant in the coming decade.

Fig.2 Solar home light system in kitchen

Fig.3 Solar street light system

New solar projects cleared by State Technical Committee

The Odisha government has approved many solar power projects. According to OREDA, potential of solar PV power of The Odisha government has approved many solar power projects. With this, the total envisaged solar power capacity in the state has gone up to 351 MW from 294 MW earlier (Table 4).

Table 4. Solar projects sanctioned and to be commissioned in Odisha

Sl No	Name of Plant	DC Peak Power	Place of installation
1	Skygen Infrabuild	5 MW	Khurda District
2	Rajratna Energy Holdings	10 MW	Dhenkanal District
3	Konark Kranti Energy	5 MW	Dhenkanal District
4	Sunark Solar	20 MW	Khurda District
5	Sunark Solar	3 MW	Khurda District Roof top scheme
6	MGM Minerals	5 MW	Khurda District Roof top scheme
7	Abacus Holdings,	3 MW	Ganjam District Roof top scheme
8	Orion Solar Projects	3 MW	Roof top scheme Cuttack District
9	Skygen Infrabuild	3 MW	Roof top scheme Khurda District
10	ACME Telepower	100 MW	Bolangir, Khurda
11	Grid Power Pvt Ltd	25 MW	Khurda
12	DUET Solar Projects Pvt Ltd	60 MW	Nawarnagpur, Koraput, Phulbani, Bolangir, Dhenkanal, Sambalpur
13	EIO Six Orissa Pvt Ltd	20 MW	Bolangir
14	Cambridge Energy Pvt Ltd	5 MW	Ganjam
15	Abacus Holding Pvt Ltd	5 MW	Nawarangpur
16	Green O Projects	10 MW	Khurda

17	Reliance Industries Ltd	5 MW	Khurda

3. CONCLUSION

As many solar power projects have come up to the State, time has come to explore the available solar energy instead of consuming conventional energy sources like coal, natural gas etc. Un-approachable hamlets like Salepada in Koraput districts which could not be electrified by Grid electricity in near future has been illuminated using solar PV system. Many such hamlets and un-electrified villages particularly in remote tribal villages in Odisha may be electrified with abundant solar energy available in these areas. Govt. should welcome as many as companies to establish the solar projects in Odisha and provide all facilities and incentives for the projects.

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