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Solar Power Supply for Tribal Zone at Zero Billing

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Abstract: This project describes a cost-effective improvement of Electrical Power Generation System by using Solar Energy System for tribal people so that they can use this system as their regular power source and stay disconnected from National or State Power Supply Grids. Thus, the Electrical Power is available with the minimum cost and pollution free to anywhere in the world. This process reveals a unique step in electricity generation and availability from natural resources without hampering the ecological balance. We can have an uninterrupted power supply from the natural resources without making any sort of environmental pollution. Moreover, this process yields the least production cost for electricity generation. It will bring a pollution and accident-free homogeneous nature to safeguard the world in a unique way.
Keywords: Homogeneous nature, Harmonics, Environmental pollution, Solar Energy, Tribal people, hampering the ecology.

I. INTRODUCTION

Solar Photovoltaic (SPV) technology is one of the most matured renewable energy (RE) technologies and there is an increasing demand of SPV installation both in grid-connected as well as off-grid stand-alone modes. Although in recent years, the penetration of solar PV installation has increased substantially due to several initiatives, it is yet to be considered as one of the mainstream renewable energy technologies. The main problem with solar PV system is its high cost of investment for producing desired power level of electricity which comes from high manufacturing cost of solar modules PV compounded with its low conversion efficiency. Most of the times, the power conversion system associated with the solar PV generating unit can cost up to 40% of the total cost. PV system, in general, is designed to deliver a specific amount of energy as per the requirement of the applications. Therefore, purchase and installation of all PV system will eventually be based on predicted or guaranteed energy production. To make the solar PV system commercially successful, the cost of generation of electricity of solar PV system needs to be reduced which calls for the development of a low cost, high efficient power conversion systems or schemes for delivering required electrical power. Hence it is always difficult to design the most efficient power converters and to gain the performance to ensure maximum power absorb from solar modules along with good power quality, reliability, and efficiency.

Table I Power consumption detail list by villages

Ruler Villages of Bilaspur Area	Average daily Consumption	Per year increment of daily Consumption
Ratga	4182 kwh	9.11%
Karsiwa	3804 kwh	7.16%
Khurpa	3963 kwh	7.52%
Nimdha	5219 kwh	9.81%
Bandhauri	2657 kwh	6.39%
Darmohali	3094 kwh	6.89%
Masurikhar	3451 kwh	8.06%
Dongariya	3177 kwh	7.23%
Gudumdeori	2456 kwh	5.25%
Dhanpur	4653 kwh	8.41%

A. PR

PR (Performance Ratio) is a very important value to evaluate the quality of a photovoltaic installation because it gives the performance of the installation independently of the orientation, inclination of the panel. It includes all losses.

B. Korba Coordinates

The latitude of Korba, Chhattisgarh, India is 22.363848, and the longitude is 82.734840. Longitude: 82.734840 UTM Zone: 44Q

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Latitude: 22.363848 UTM Easting: 678,630.78
According to (http://www.synergyenviron.com/tools/solar-irradiance/korba%20india)

C. PR value (depend on the site, the technology, and sizing of the system)

1) Solar energy losses

a) Power demand per house: 22W
b) Inverter losses (4% to 10 %)
c) Temperature losses (5% to 20%)
d) DC cables losses (1 to 3 %)
e) AC cables losses (1 to 3 %)
f) Shadings 0 % to 80%!!! (Specific to each site)
g) Losses at weak radiation 3% to 7%
h) Losses due to dust (2%)
i) Other Losses (?)

II. METHODOLOGY

A. Estimation of Solar Power System

To estimate the electricity generation in the output of a photovoltaic system is:

$$E = A * r * H * PR$$

A = Total solar panel Area (m^2)
E = Average Energy of 10 villages (kWh/an)
r = Solar panel yield or efficiency (%)
PR = Performance ratio, coefficient for losses (range between 0.5 and 0.9, default value = 0.75)
H = Annual average solar radiation on tilted panels (shadings not included)

'r' is the yield of the solar panel given by the ratio: electrical power (in kwp) of one solar panel divided by the area of one panel.

'H' is the annual average solar radiation on tilted panels. You can find this global radiation value here: Solar radiation data

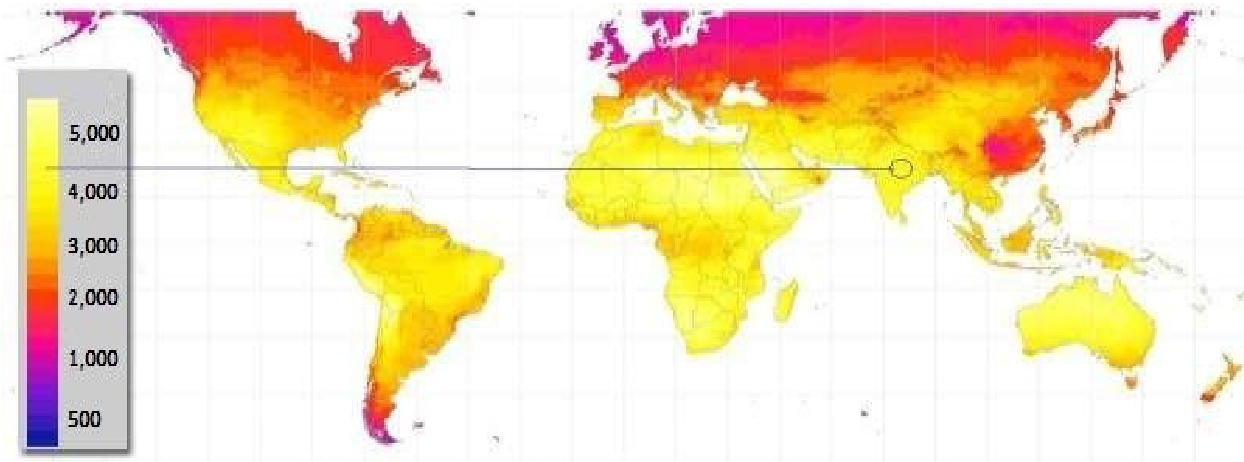

Fig 1 Yearly sum of global irradiance

B. Korba, Chhattisgarh, India Average Direct Normal Irradiance

Latitude: 22.35 and Longitude: 82.75
Source: (NREL) Month Solar Irradiance (DNI)
(http://synergyenviron.com/tools/solar-irradiance/korba%20india)

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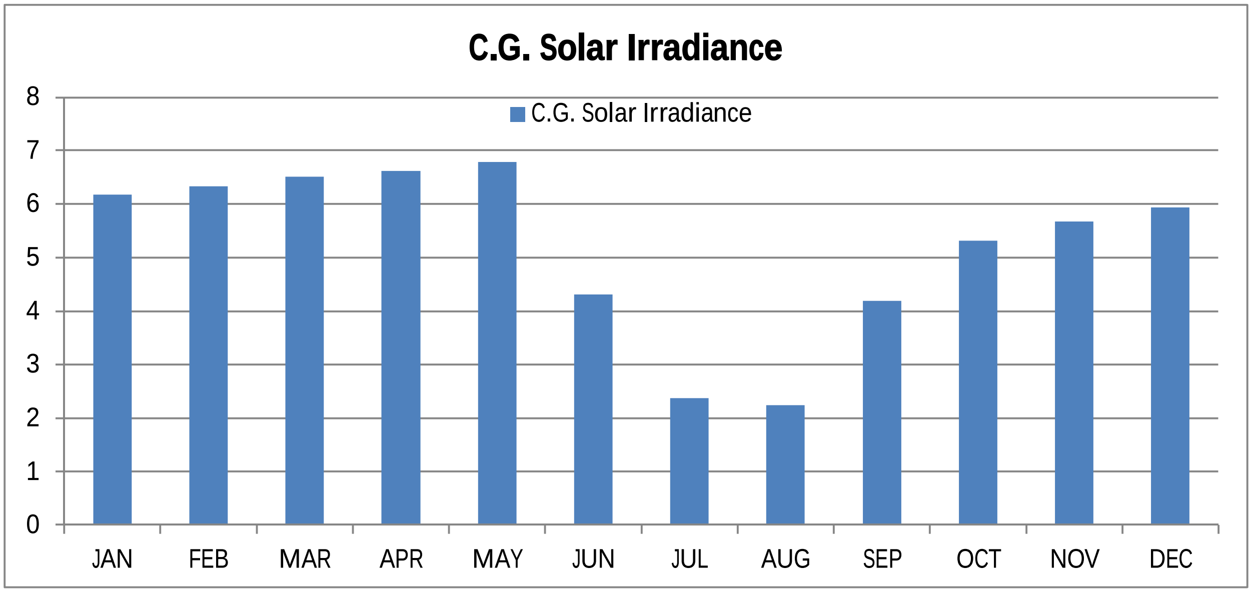

Fig 2 Yearly global irradiance Chhattisgarh

C.G. Solar Irradiance Annual Average: 4.64 kWh/m2 see fig 4.6 and table 2
According to (http://www.synergyenviron.com/tools/solar-irradiance/korba%20india)

TABLE II Solar Irradiance Annual

Month --->	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Kwh/m2 --->	6.18	6.33	6.51	6.62	6.78	4.31	2.38	2.25	4.19	5.32	5.67	5.93

III. RESULT AND DISCUSSION

To setup a zero billing solar power station of a village of Chhattisgarh can be estimated and planed by following:

TABLE III Losses details (depend of site, technology, and sizing of the system)

Type of Loss	Amount
Inverter losses (6% to 15 %)	8%
Temperature losses (5% to 15%)	8%
DC cables losses (1 to 3 %)	2%
AC cables losses (1 to 3 %)	2%
Shadings 0 % to 40% (depends of site)	3%
Losses weak irradiation 3% yo 7%	3%
Losses due to dust, snow... (2%)	2%
Other Losses	0%

PR = (1- Inverter losses) *(1- Temperature losses) *(1- DC cables losses) *(1- AC cables losses) *(1- Shadings losses) *(1- Losses weak irradiation) *(1- Losses due to dust, snow)
PR = (1-8)*(1-8)*(1-2))*(1-2))*(1-3))*(1-3))*(1-2))
PR (Performance ratio, coefficient for losses) = 0.75
Average energy of 10 villages = 3665.6 kWh/day
E = 1337944 Energy kWh/an used
r = solar panel yield (15%)

H = Annual average 1250 kWh/m²

PR = Performance ratio, coefficient for losses 0.75

Total power of system = 3.0 kWp

90% efficiency in the grid inverter or battery charger assumed.

Solar Panel rating using 1 kW / metre square Standard Test Conditions (STC) at 25ºC assumed.

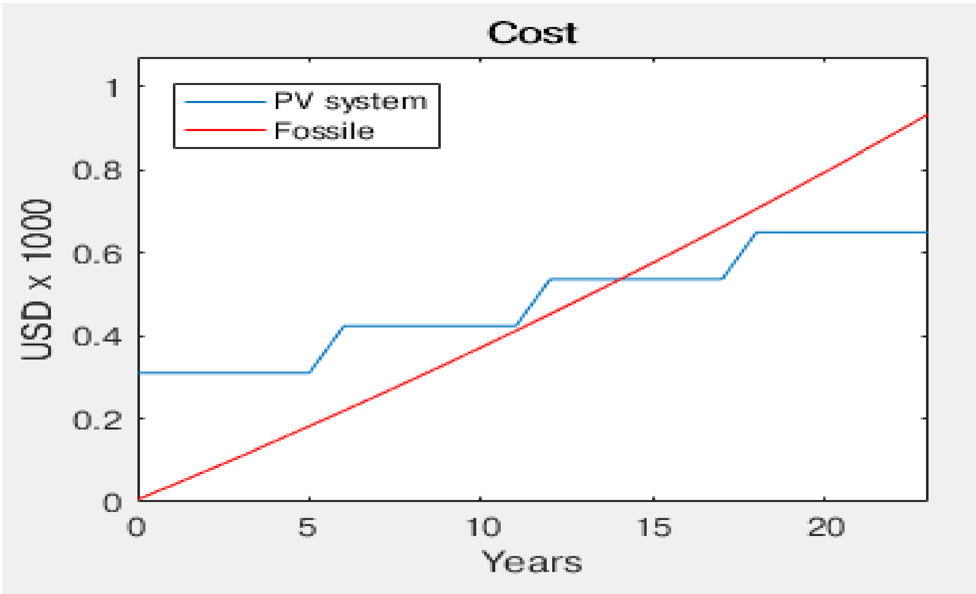

Fig 2 Analysed comparison between solar electricity and Fossil electricity

The analysis of mini solar gird shows that after implement of this solar system for 8 to 10 years system will become very close to zero billing system.

IV. CONCLUSIONS

A case from the Chhattisgarh State, where INR 25 per household per month, given by the government, was pooled by CREDA to create proper infrastructure facilities for providing the required maintenance of the SHS and SMGs. It is also observed that the delivery networks, as well as the technological performance, are comparatively better placed for solar PV than for other off-grid technologies such as micro hydro and biomass gasifiers. The analysis also revealing financial toughness and private sector involvement are the two main factors that resist in higher penetration of solar PV technology to enhance rural electricity access. However, micro-credit being provided independently of income level, financial assistance from the government programs seems to have either not penetrated into the lower income households or the current financial scheme are not in favour of their income level. The relatively high-interest rates and requirement of a down payment still prevent economically challenged households to procure solar lighting solutions on the available financing options. The main issue which calls for immediate action is rationalizing of the interest rate for micro-lending to cover poor households and wider coverage through less transaction cost.

V. ACKNOWLEDGMENT

She authors acknowledge the support of the Central Solar Power Plant because it brings much technical and financial advantage for the target tribe. Also, this formation of establishing power plant with renewal energy will become the future glimpse of the effective power system.

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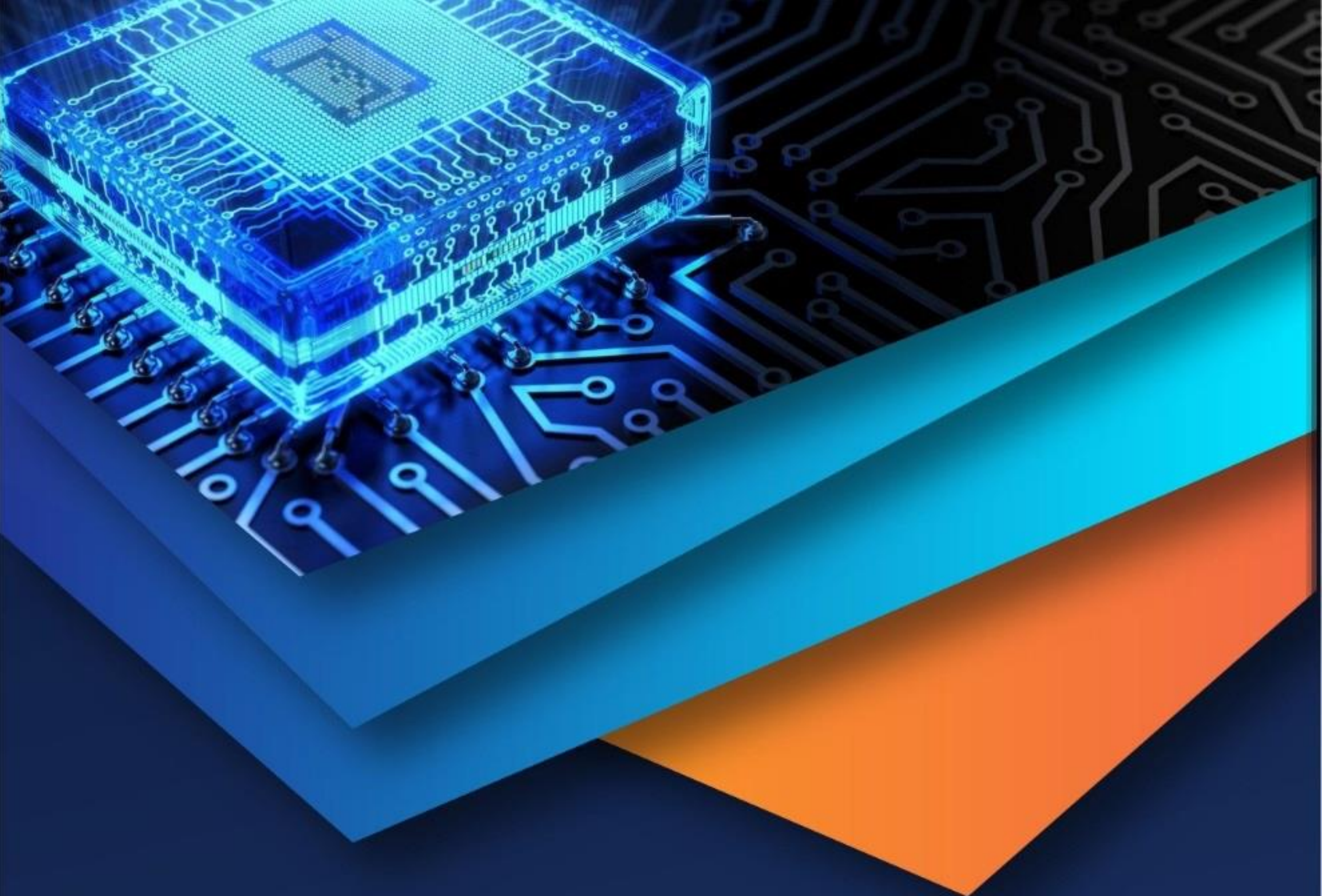

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