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## SOLAR POWER SUPPLY FOR TRIBAL AT ZERO BILLING FOR KORBA DISTRICT VILLAGE

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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.

## 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.

**Tables**:

*Table1. 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% |

**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.

**Korba Coordinates**: The latitude of Korba, Chhattisgarh, India is 22.363848, and the longitude is 82.734840.
Longitude: 82.734840 UTM Zone: 44Q
Latitude: 22.363848 UTM Easting: 678,630.78

According to (http://www.synergyenviron.com/tools/solar-irradiance/korba%20india)
**PR value (depend on the site, the technology, and sizing of the system):**
    a.   Inverter losses (4% to 10 %)
    b.   Temperature losses (5% to 20%)
    c.   DC cables losses (1 to 3 %)
    d.   AC cables losses (1 to 3 %)
    e.   Shadings 0 % to 80%!!! (Specific to each site)
    f.   Losses at weak radiation 3% to 7%
    g.   Losses due to dust, snow... (2%)
    h.   Other Losses (?)

## MATERIALS AND METHODS
**Estimation of Solar Power System:** formula to estimate the electricity generated in the output of a photovoltaic system is:

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

**A**         = Total solar panel Area (m²)
**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
**Figure**:
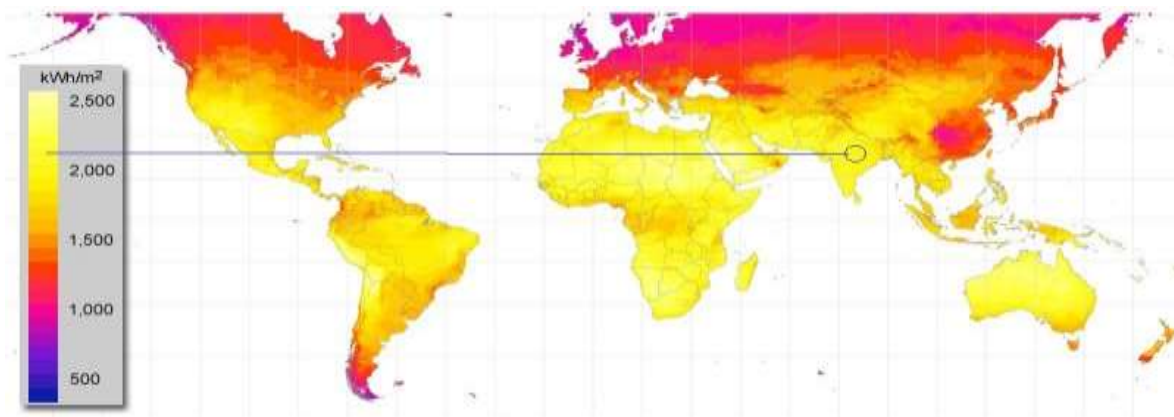


*Figure1. Yearly sum of global irradiance*
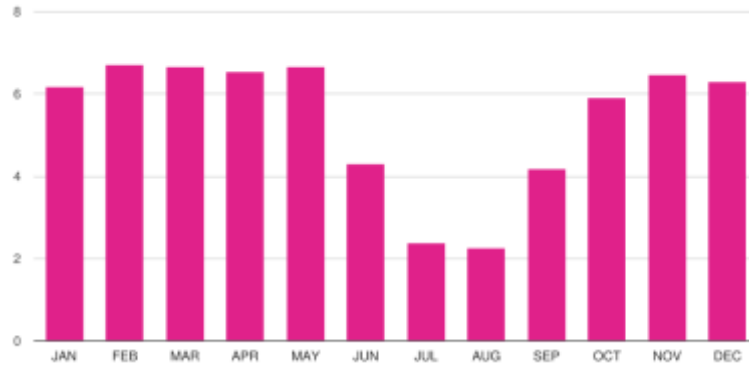
**Korba, Chhattisgarh, India Average Direct Normal Irradiance:**
Latitude : 22.35   Longitude : 82.75
Source: (NREL) Month Solar Irradiance (DNI)
(http://synergyenviron.com /tools/solar-irradiance/korba%20india)

JAN  = 6.18
FEB = 6.72
MAR= 6.66
APR = 6.53
MAY = 6.67
JUN = 4.31
JUL = 2.38
AUG =  2.25
SEP = 4.19
OCT = 5.92
NOV = 6.46
DEC = 6.31



Annual Average: 5.52 kWh/m2/day

## RESULTS AND DISCUSSION
To setup a zero billing solar power station of a village of Chhattisgarh can be estimated and planed by following:
**Tables**:

*Table2. 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 aver 1250 kWh/m².an**
 ➢ **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 25 oC assumed.**

**Formulae:**

$A = E / (r * H * PR)$
$A = 1337944 / (15 * 1250 * 0.75)$
**$A = 9520 \ m^2$**

Hence PV area of installation is **9520 m² Solar power plant needs to make free billing off grid power generation for per villages near Bilaspur. That will provide 25 long years free billing services accordingly to PV normal life span.**

## CONCLUSION

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 favor 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.

## ACKNOWLEDGEMENTS

## REFERENCES

[1] Nidhiverma, Ishaandua, Naresh kumara, "Scenario of Rural Electrification in India- Challenges and Impact", Int. Journal of Engineering Research and Applications ISSN : 2248-9622, Vol. 4, Issue 12( Part 3), December 2014.

[2] James Cust, Anoop Singh and KarstenNeuhoff "Rural Electrification in India Economic and Institutional aspects of Renewables" December 2007 EPRG 0730 & CWPE 0763.

[3] Gowtham D, Royrichard T, "Hybrid Distributed Power Generation System using PV and Wind Energy", International Journal of Computer Applications, National Conference Potential Research Avenues and Future Opportunities in Electrical and Instrumentation Engineering 2014.P.Mariaraja1, B.Brindha Sakthi2, "Performance of Distributed Power Generation System using MPPT", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering 2014.

[4] Carrasco, J. Franquelo, L.Bialasiewicz, J. Galvan, Portillo Guisado, R. Prats, M. Leon and Moreno-Alfonso, "Power-electronic systems for the grid integration of renewable energy sources: A survey", IEEE Trans. Ind. Electron vol. 53, no. 4, pp. 1002–1016, Jun. 2006.

[5] SHamidat, B. Benyoucef and M.T. Boukadoum "New approach to determine the performances of the photovoltaic pumping system".

[6] Mr. Prince A Basheer1, Mr. Rahul Charles, Ms. Anju Jacob, "Advanced Control of Grid Interfacing Inverter", International Journal Of Innovative Research In Electrical, Electronics, Instrumentation And Control Engineering Vol. 3, Issue 11, November 2015.

[7] T.Thillainayaki1, P.Shanthi2 "Grid Interconnection of Renewable Energy Sources at the Distribution Level with Power Quality Improvement Features", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering April 2014.

[8] P. Jintakosonwit, H. Fujita, H. Akagi and S. Ogasawara, "Implementation and performance of cooperative control of shunt active filters for harmonic damping throughout a power distribution system", IEEE Trans. Ind. Appl., vol. 39, no. 2, pp. 556–564, Mar./Apr. 2003.

[9] J. P. Pinto, R. Pregitzer, L. F. C. Monteiro, and J. L. Afonso, "3-phase 4-wire shunt active power filter with renewable energy interface", presented at the Conf. IEEE Renewable Energy & Power Quality, Seville, Spain, 2007.

[10] Distributed vs. Centralized Power Generation Woods Institute for the Environment Uncommon Dialogue Large - Scale Solar Technology and Policy Forum, April 8 - 9, 2010.

[11] M. Singh, V. Khadkikar, A. Chandra and R. K. Varma, "Grid interconnection of renewable energy sources at the distribution level with power quality improvement features," IEEE Trans. Power Del., Jan. 2011.

[12] B. Renders, K. De Gusseme, W. R. Ryckaert, K.Stockman, L. Vandevelde and M. H. J. Bollen "Distributed generation for mitigating voltage dips in low-voltage distribution grids, " IEEE Trans. Power. Del, Jul. 2008

[13] F. Blaabjerg, R.Teodorescu, M. Liserre and A. V. Timbus, "Overview of control and grid synchronization for distributed power generation systems," IEEE Trans. Ind. Electron., vol. 53, no. 5, Oct. 2006.

[14] J. M. Carrasco, L. G. Franquelo, J. T. Bialasiewicz, E. Galván, R, C.P. Guisado, M. Á. M. Prats, J. I. León, and N. M. Alfonso, "Power electronic systems for the grid integration of renewable energy sources: A survey," IEEE Trans. Ind. Electron., Aug. 2006.

[15] P. Rodríguez, J. Pou, J. Bergas, J. I. Candela, R. P. Burgos and D. Boroyevich, "Decoupled double synchronous reference frame PLL for power converters control," IEEE Trans. Power Electron, vol. 22, no. 2, Mar. 2007.

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