



## COPY RIGHT

**2018 IJIEMR.** Personal use of this material is permitted. Permission from IJIEMR must be obtained for all other uses, in any current or future media, including reprinting/republishing this material for advertising or promotional purposes, creating new collective works, for resale or redistribution to servers or lists, or reuse of any copyrighted component of this work in other works. No Reprint should be done to this paper, all copy right is authenticated to Paper Authors

IJIEMR Transactions, online available on 23<sup>rd</sup> February 2018. Link :

<http://www.ijiemr.org/downloads.php?vol=Volume-7&issue=ISSUE-2>

Title: Enhancing Various Parameters of Rural Telephony For Hybrid Wind Solar Power System.

Volume 07, Issue 02, Page No: 590 - 596

Paper Authors

**\* THARA SINGH AMGOTH.**

\* State Board of Technical Education and Training.



USE THIS BARCODE TO ACCESS YOUR ONLINE PAPER

To Secure Your Paper As Per **UGC Guidelines** We Are Providing A Electronic Bar Code



## ENHANCING VARIOUS PARAMETERS OF RURAL TELEPHONY FOR HYBRID WIND SOLAR POWER SYSTEM

**THARA SINGH AMGOTH**

Deputy Secretary (Academic Audit Cell),  
State Board of Technical Education and Training,  
Tank bund Road, Hyderabad-500063, India  
[tharasingha@gmail.com](mailto:tharasingha@gmail.com)

### ABSTRACT:

In recent times, hybrid renewable energy systems are increasingly being utilized to provide electricity in remote areas especially where the grid extension is considered too expensive. Telecom providers, due to rapid expansion of cell phone subscriber base in India are facing tough challenges to ensure the reliable back up power for telecom base stations. This is particularly so in rural areas where availability of power is uncertain. Currently, diesel generators are used to ensure continuous power supply. This increases greenhouse gas emission, fuel cost and requires regular maintenance. Use of renewable energy overcomes these limitations and provides a long term sustainable solution. Hence, in this paper, telecom power supply using hybrid wind/solar photovoltaic (PV) energy systems is proposed. Utility grid/diesel generator is used only for backup purpose. Hybrid power system can be used to reduce energy storage requirements. The PV-wind hybrid system returns the lowest unit cost values to maintain the same level of DPSP as compared to standalone solar and wind systems. For all load demands the levelised energy cost for PV-wind hybrid system is always lower than that of standalone solar PV or wind system. The PV-wind hybrid option is techno-economically viable for rural electrification. The simulation results for the existing and the proposed models are compared. This system is more cost effective and environmental friendly over the conventional diesel generator. It should reduced approximate 70%-80% fuel cost over conventional diesel generator and also reduced the emission of CO<sub>2</sub> and other harmful gasses in environments. It is expected that the newly developed and installed system will provide very good opportunities for telecom sector in near future.

**Keywords:** Hybrid PV/Wind energy system, Mobile telephony base station, Wind turbine, PV-solar.

### 1.0 INTRODUCTION:

Nowadays, electricity is most common power source in human life. As the living standard is improving, the dependence on electricity becomes stronger. Non renewable are the ones that decays partially or vanish with the time such as coal, oil, natural gas, woods and radioactive material. These sources are harmful for climate due to this temperature of earth is increasing day by day. Renewable energy source are the ones that are persistently

available and renewing itself with time. There is a growing awareness that renewable energy such as photovoltaic and wind power has an important role to play in order to fulfil the requirement. More than 200 million people live in rural areas without access to grid-connected power. In India there are many villages' remains to be un-electrified and the supply of electricity due to inherent problem of location and economy. The cost to install and service

the distribution lines are considerably high for remote areas and due to increase in transmission line there will be losses in power supply. India is characterized by severe energy deficit. 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. Hybrid power systems can be used to fulfil the requirement of electricity. This system is cost effective as well as none polluting and very useful for rural areas.

## **2.0 LITERATURE REVIEW:**

**M. Muralikrishna et al (2017)** The technical feasibility of PV-wind hybrid system in given range of load demand was evaluated. The methodology of Life Cycle Cost (LCC) for economic evaluation of stand-alone photovoltaic system, stand-alone wind system and PV-wind hybrid system have been developed and simulated using the model.

**I.A. Adejumbi et al (2014)** development of an indigenous technology hybrid Solar -Wind Power system that harnesses the renewable energies in Sun and Wind to generate electricity. Here, electric DC energies produced from photovoltaic and wind turbine systems are transported to a DC disconnect energy Mix controller.

**Kanzumba Kusakana et al (2013)** investigates the possibility of using hybrid Photovoltaic Wind renewable systems as primary sources of energy to supply mobile telephone Base Transceiver Stations in the rural regions. The selection criteria include the

financial viability, fuel consumption and CO<sub>2</sub> emissions for a project life time of 20 years.

**Subodh Paudel et al (2012)** presents a feasibility assessment and optimum size of photovoltaic (PV) array, wind turbine and battery bank for a standalone hybrid Solar/Wind Power system (HSWPS) at remote telecom station of Nepal at Latitude (27023'50'') and Longitude (86044'23'') consisting a telecommunication load of Very Small Aperture Terminal (VSAT), Repeater station and Code Division Multiple Access Base Transceiver Station.

**M. Vilsan et al (2011)** describes a stand-alone hybrid wind-photovoltaic power plant for a remote telecommunication system located on the Black Sea Coast. First, the wind and solar potential of the site and also the load profile were assessed. The power system was tested and monitored for one year under real conditions in the authors' test facility, also located on the Black Sea Coast.

## **3.0 RESEARCH METHODOLOGY:**

### **HYBRID WIND - SOLAR POWER SYSTEM**

Hybrid Wind-Solar System for the rural exchanges can make an ideal alternative in areas where wind velocity of 5-6 m/s is available. Solar-wind power generations are clear and non-polluting. Also they complement each other. During the period of bright sunlight the solar energy is utilized for charging the batteries, creating enough energy reserve to be drawn during night, while the wind turbine produce most of the energy during monsoon when solar power generation is minimum. Thus the hybrid combination uses the best of both means and can provide quality, stable power

supply for sustainable development in rural areas.

The hybrid solar and wind power system (HSWPS) works in two modes as: direct and indirect mode. The existing system implemented consisting Code Division Multiple Access Base Transceiver Station (CDMA BTS), Very Small Aperture Terminal (VSAT) and Repeater Station and works in indirect mode, which means that power generation from renewable energy is stored in the battery and the energy stored in the battery is delivered to the load.

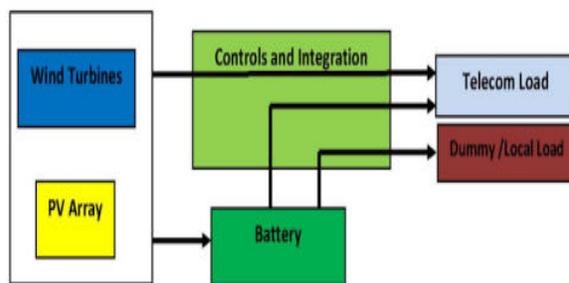


Fig shows Block Diagram of Hybrid Solar Wind Power System (HSWPS)

### Photovoltaic (PV) modules:

Photovoltaic (PV) modules convert sunlight into direct current (dc) electricity. Modules can be wired together to form a PV array that is wiring modules in series the available voltage is increased. However either way, the power produced is the same since watts (power) equals voltage time's amperes. A typical PV module measures about 0.5 square meters (about 1.5 by 3.5 feet) and produces about 75 watts of DC electricity in full sun.

**Wind turbine:** Wind turbine works the opposite of a fan. Instead of using electricity to make wind, like a fan, use wind to make electricity. Most turbines have either two or three blades. These vertical axis wind turbine

works on low dens air and at low pressure region.

Double stage Vertical axis wind turbine is a type of wind turbine where the main rotor shaft is set vertically and the main components are located at the base of the turbine. Among the advantages of this arrangement are that the alternator and breaks can be placed close to the ground, which makes these components easier to service and repair, and that these system is not need to be pointed into the wind. Wind turbine consists of a circular shaft made up of mild steel with double stage of total four airfoils made of aluminium for light weight. This shaft is supported by a rectangular stand as shown in made up of cast iron. At the end of the shaft, space is provided for attaching the alternator and breaks to acquire torque we took the watts we are expecting, or HP, and divide out the RPM to convert the power output of torque. A tipped sideways, with the axis perpendicular to the wind streamlines, functions similarly to vertical axis wind turbine.

**Battery Model For any hybrid renewable energy systems,** there is excess and deficit of energy at any instant of time. If the renewable resources system produces excess energy than the power demanded by the load, the extra energy should be stored. Also, if the renewable resources system produces less energy than the power demanded by the load, then storage system should satisfy the load. So, storage system is indispensable for any renewable energy stand-alone systems. There are various storage technologies to store the energy from renewable sources such as batteries, hydrogen combined with fuel cells. It considers charging and discharging condition of battery with

relevant technical specification is considered for the purposes of this study.

### Sizing of the proposed hybrid power system:

There are several methods of sizing hybrid PVWind systems such as: the yearly monthly average method; the most unfavorable month method or the Loss of Power Supply Probability (LPSP) method. The other methods of sizing use software packages. In this study we have the data of the most unfavorable months. From Table 2 the unfavorable irradiation month and unfavorable wind speed month are December and January, respectively. So we can apply the most unfavorable method for our hybrid system sizing as follows. The monthly energy produced by the system per unit area is  $EPV,m$  (kWh/m<sup>2</sup>) for photovoltaic,  $EW,m$  (kWh/m<sup>2</sup>) for wind energy and  $EH,m$  (kWh/m<sup>2</sup>). The worst month is a function of the

monthly load demand, the renewable energy resources and of the system components' performance. The size ( $m^2$ ) of the generator needed to ensure full coverage (100%) load ( $E_{Load}$ ) during a month is given by:

$$A_i = \max\left(\frac{E_{Load,m}}{E_{i,m}}\right)$$

$A_i$  represents the size in  $m^2$  of the PV or wind component. The total energy produced by the photovoltaic or wind generators and supplied to the load is expressed as:

$$\sum E_i A_i = E_{Load}$$

with:

$$E_i \cdot A_i = f_i \cdot E_{Load}$$

Where  $f_i$  is the fraction of the load supplied by the PV or wind sources. At every moment, the sum of the fractions of energy contribution from each component supplied to the load must be equal to 1.

## 4.0 RESULTS:

Parameter	Configurations		
	PV/diesel/battery hybrid system (best optimal)	PV/wind/diesel/battery hybrid system (second best optimal)	Stand-alone diesel system (third best optimal)
PV capacity (kW)	10	10	–
Wind turbine capacity (kW)	–	1	–
Diesel generator capacity (kW)	5.5	5.5	5.5
Battery capacity (no)	64	48	32
Converter capacity (kW)	4	4	4
Dispatch strategy	CC	CC	CC
Total capital cost (\$)	44,393	48,369	13,825
Total NPC (\$)	69,811	76,023	245,855

Total annual capital cost (\$/year)	3473	3784	1081
Total annual replacement (\$/year)	1383	1623	2664
Total O&M cost (\$/year)	720	731	9151
Total fuel cost (\$/year)	249	243	6477
Total annual cost (\$/year)	5461	5947	19,232
Operating cost (\$/year)	1988	2163	18,151
Cost of energy (COE) (\$/year)	0.409	0.445	1.44
PV production (kWh/year)	17,241	17,241	–
Wind production (kWh/year)	–	775	–
Diesel production (kWh/year)	654	611	17,823
Total electricity production (kWh/year)	17,896	18,627	17,823
AC primary load serve (kWh/year)	13,359	13,359	13,359
Renewable fraction (%)	95.1	95.4	0
Capacity shortage (kW)	0	0	0
Unmet load (kWh/year)	0	0	0
Excess electricity (%)	9.6	13.5	0
Fuel consumption (L/year)	224	221	5888

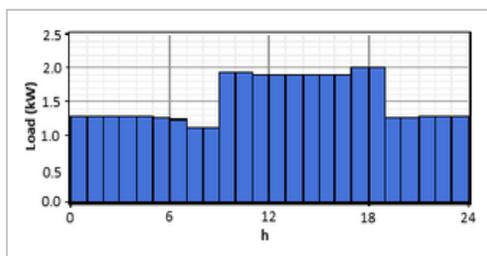


Figure shows Off-grid hybrid PV–wind–diesel powered mobile base station.

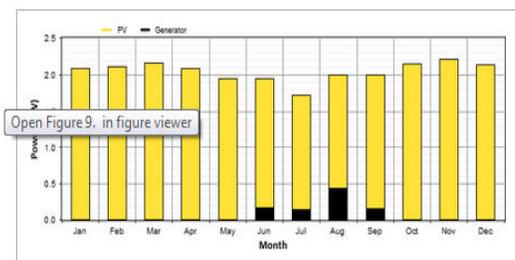


Figure shows Monthly average electricity production of PV/diesel/battery hybrid system

## 5.0 CONCLUSIONS:

Thus, it can be concluded that proposed system finds pragmatic applications in sizing and analyzing HSWPS. In addition, the size of the battery bank is reduced to 36% and overall 29% reduction in the total cost of the system. To provide better network services mobile operator installed new mobile base stations. Power is main issue for remote or isolated areas base station, because grid extension is not feasible. In these sites the above proposed renewable base hybrid system is most viable solution. These solutions of power supply to the telecom base station are cost effective and available throughout the year. The circumstance of each sites are studied in order to decide the feasible combination of alternative energy resources. Alternate power solutions are not commonly used in mobile telecommunication system today but are actively evaluated for remote and isolated areas over worldwide. With the help of above pre-feasibility study the solar and wind hybrid energy system are most viable power solution for mobile base station in Indian sites over conventional diesel generator.

## REFERENCES:

1. M. Muralikrishna, V. Lakshminarayana, (2017), "Hybrid (Solar and Wind) Energy Systems For Rural Electrification", ARPN Journal of Engineering and Applied Sciences, ISSN 1819-6608, VOL. 3, NO. 5, PP: 50-58.
2. I.A. Adejumobi, S.G. Oyagbinrin, F. G. Akinboro, M.B. Olajide, (2014), "Hybrid Solar And Wind Power: An Essential For Information Communication Technology Infrastructure And People In Rural Communities", IJRRAS 9 (1), PP: 130-138.
3. Kanzumba Kusakana, Herman Jacobus Vermaak, (2013), "Hybrid renewable power systems for mobile telephony base stations in developing countries", Renewable Energy, vol no: 51, PP: 419-425.
4. Subodh Paudel, J.N. Shrestha, Fernando J. Neto, Jorge A.F. Ferreira, Muna Adhikari, (2012), "Optimization of Hybrid PV/Wind Power System for Remote Telecom Station", IEEE International Conference on Power and Energy Systems (ICPS).
5. M. Vilsan, I. Nita, (2011), "A hybrid wind-photovoltaic power supply for a telecommunication system", 19th International Conference on Telecommunications Energy, ISBN: 0-7803-3996-7.
6. Sandra, E., H. Bernhoff and M. Leijon, 2008, Evaluation of different turbine concepts for wind power. Renewable Sustainable Energy Rev., 12: 1419-1434.
7. B.D. Shakya, Lu Aye, P. Musgrave, "Technical feasibility and financial analysis of hybrid wind-photovoltaic system with hydrogen storage for Cooma", International Journal of Hydrogen Energy, vol.30, pp.9-20, 2005.
8. Naikodi, A., Solar-Wind Hybrid Power for Rural Indian Cell Sites, IEEE International Energy Conference



# International Journal for Innovative Engineering and Management Research

*A Peer Reviewed Open Access International Journal*

[www.ijemr.org](http://www.ijemr.org)

- (ENERGYCON 2010), Manama, Bahrain pp: 69 - 72, Dec. 2010.
9. P. Neema, S.Rangnekar, Pre-feasibility Study of PV-Solar /Wind Hybrid Energy System for GSM Type Mobile Telephony Base Station in Central India, 2nd International Conference on Computer and Automation Engineering (ICCAE),Singapore pp: 152 - 156, Feb. 2010.