Renewable Energy Sources for Remote Area Application

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ABSTRACT

The importance of the electricity in this era is enormous. Human life directly or indirectly influenced by the electrical energy.The aura of each and every system in the world is majorly influenced by this form of energy. Pro-active development of the worldisaced with the help of this commodity.Althoughpursuing this much of importance, still some of the human communities are away from it. Most probably tribe community's lives in hamlets, situated on geographically challenged areas where the basic infrastructure can't be laid down by the Governments. It is possible with the help of natural renewable energy sources which are available locally and in abundance.Integration of such sources produces a great potential to electrify such tribal hamlets. With this IRES(integration of renewable energy sources) system the environmental issues like GHGS, CO_2 emission also be addressed. This integration of sources can be well modeled in tool MATLAB or HOMER. In this Paper the analysis of integration of RE sources for DSM (Demand side management) is done by taking example of tribe community.

KEYWORDS

IRES (integration of renewable energy sources), GHGS (greenhouse gasses), DSM (demand side management), MATLAB, HOMER.

INTRODUCTION

The responsibility for every government to provide the basic facility to the citizens of the country. Due to some geographical condition it is difficult to provide the all necessary infrastructure for electrification. It is not possible geographically and economically for remote and tribe community to offer electricity because it is difficult to erect the overhead lines at that site. For this situation Renewable Energy sources is the natural and endowed choice. The local sources of renewable energy can be well integrated for fulfilling the electricity need of community. Without electricity the life quality of community gets affected. Due to lack of facilities there may be possibility people get migrated towards the urban area but this leads to further conjugative problems [1].it is also true that getting electrified through domestic power supply have its environmental impacts like GHGS and global warming problems.by integrating the renewable energy sources available locally will able to supply the energy as per requirement. This integration of energy sources are in off grid fashion .it reduces all transmission line. Distribution network etc. very sophisticated off grid system able to provide all the issue very neatly[2]. The renewable sources are intermittent in nature. So depending on only one source is difficult, instead of this the integration of different energy sources are fruitful for the off grid system. This system is called as Hybrid Energy System. This system possesses more potential for providing electricity. As per the availability of sources most of the time solar, wind, Bio and hydro

sources are integrated [3]. Many models are developed for he off grid energy like storing energy in Battery system and utilize it for different application.Electrifying this tribe society will lead to improve their socioeconomic condition. Good education, employment chances and many more positive initiatives for empowering the community will takes place. Earlier demand for such system is increasing to utilize same system for the rural as well as urban areas [4]. In this paper the benefits of IRES (Integration of Renewable energy sources) for remote. Tribal hamlets are analyzed.

DIFFERENT ENERGY SOURCES

SOLAR ENERGY

Directly or indirectly, virtually all energy we use is derived from solar energy: wind is created when solar energy creates differences of temperature on areas of the earth's surface, biomass energy is derived from solar energy that has been captured and stored, and fossil fuels are derived from biomass that has been trapped and transformed by geologic processes over millions of years. Direct solar energy technologies harness the energy of solar irradiance to produce electricity using photovoltaic (PV) and concentrating solar power (CSP), to produce thermal energy (heating or cooling, either through passive or active means), to meet direct lighting needs and, potentially, toproduce fuels that might be used for transport and other purposes. (Fig 1)

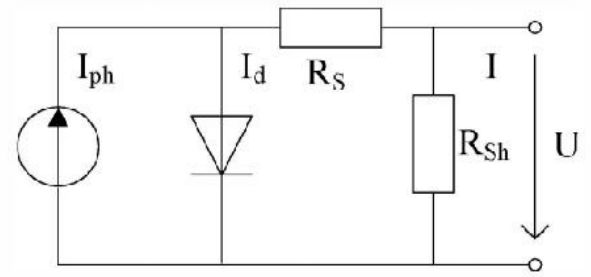

Fig 1: Equivalent circuit diagram of PV solar cell[6]

The voltage equation of PV cell is given by the equation

$V_{oc} = (AKT_C/e)*Ln\ (I_{ph}+I_0-I_c)/(I_0-Rs)*Ic$

Where e= Electron charge (1.6×10^{-19}C)

A= Identity factor

K= Boltzmann constant (1.38×10^{-23} J/K)

I_c= cell output current, A

I_{ph}= photocurrent, function of irradiation level and junction temperature (A)

I_0= Reverse saturation current of diode.

T_C= Reference cell operating temperature

V_0=Cell output Voltage, V.

WIND ENERGY

Wind energy harnesses the kinetic energy of moving air. The primary application of relevance to climate change mitigation is to produce electricity from large wind turbines located on land (onshore) or in sea- or freshwater (offshore). Onshore wind energy technologies are already being manufactured and deployed on a large scale. Offshore wind energy technologies have greater potential for continued technical advancement. Wind

electricity is both variable and, to some degree, unpredictable, but experience and detailed studies from many regions have shown that the integration of wind energy generally poses no insurmountable technical barriers. Overthe past two decades, wind technology has improved significantly with turbines as large as 6 MW and costs below $2 million per megawatt of installed capacity; large wind farms with several hundred megawatt capacities are being deployed over several months.(fig 2)

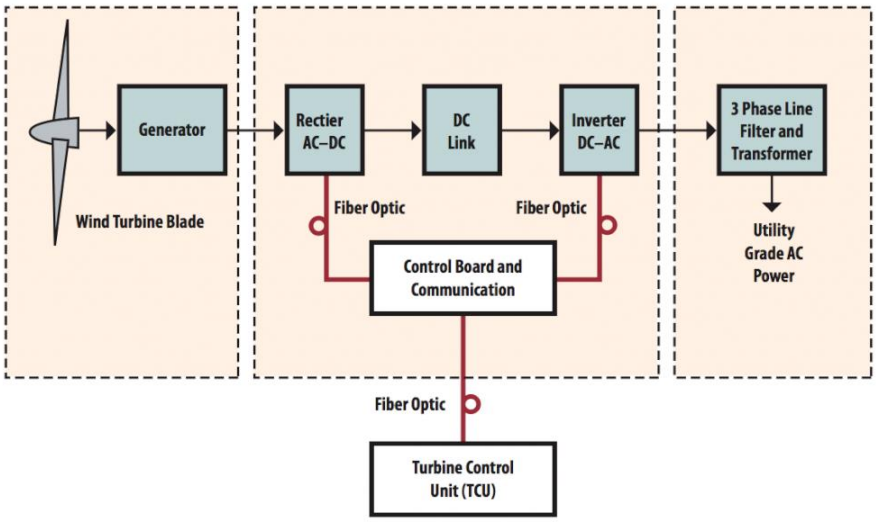

Fig 2: equivalent circuit diagram of wind power[6]

Wind power output is given by following equation

$P_W = 1/2 \times \rho \times A \times V^3$

Where M = Mass of Air

ρ= air density

A= Rotor swept area

V= Volume

BIO ENERGY

Bioenergy can be produced from a variety of biomass feedstock including forest, agricultural and livestock residues; short-rotation forest plantations; energy crops; the organic component of municipal solid waste; and other organic waste streams. Through a variety of processes, this feedstock can be directly used to produce electricity or heat, or can be used to create gaseous, liquid, or solid fuels. The range of bioenergy technologies is broad and the technical maturity varies substantially. Some examples of commercially available technologies include small- and large-scale boilers, domestic pellet-based heating systems, and ethanol production from sugar and starch. Bioenergy is abundance in the rural areas. Day by day the increase in demand of power due to increasing population arises energy crisis, Bio energy have the potential for providing the large amount of power for future.

GEOTHERMAL ENERGY

Geothermal energy utilizes the accessible thermal energy from the Earth's interior. Heat is extracted from geothermal reservoirs using wells or other means. Reservoirs that are naturally sufficiently hot and permeable are called hydrothermal reservoirs, whereas reservoirs that are sufficiently hot but that are improved with hydraulic stimulation are

called enhanced geothermal systems (EGS). Once at the surface, fluids of various temperatures can be used to generate electricity or can be used more directly for applications that require thermal energy, including district heating or the use of lower-temperature heat from shallow wells for geothermal heat pumps used in heating or cooling applications. Hydrothermal power plants and thermal applications of geothermal energy are mature technologies, whereas EGS projects are in the demonstration and pilot phase while also undergoing R&D. When used to generate electricity, geothermal power plants typically offer constant output.

NEED OF IRES

Locally available non-conventional sources have the strength to supply the energy but it is also true that single source cannot provide energy continuously because of the intermittent nature of energy sources [1]. Reliability issues arise because of intermittent sources. In order to give the continuous supply, one or more energy sources need to be integrated that is called as hybrid energy sources. By hybrid energy sources this forms of energy is converted into single energy source of energy. Such one energy source has more capability to provide reliable and continuous energy supply [2]. While integrating these sources most of the time solar and wind is preferred. Still there is scope for integration for the locally available sources i.e. bio, hydro etc. not only foe electricity supply but also more applications [3]. This hybrid models is beneficial in the socioeconomic way for the country. In this world having the developed power system indicates the Strength of that nation. Education to industrialization everything gets improved by the availability of the power. Tribal society's which are struggling for their basic needs. By the time passes they get deter point of view towards life [4]. So for the overall development of such tribe hamlets do not have better option than this off grid hybrid renewable sources.

BLOCK DIAGRAM OF SYSTEM

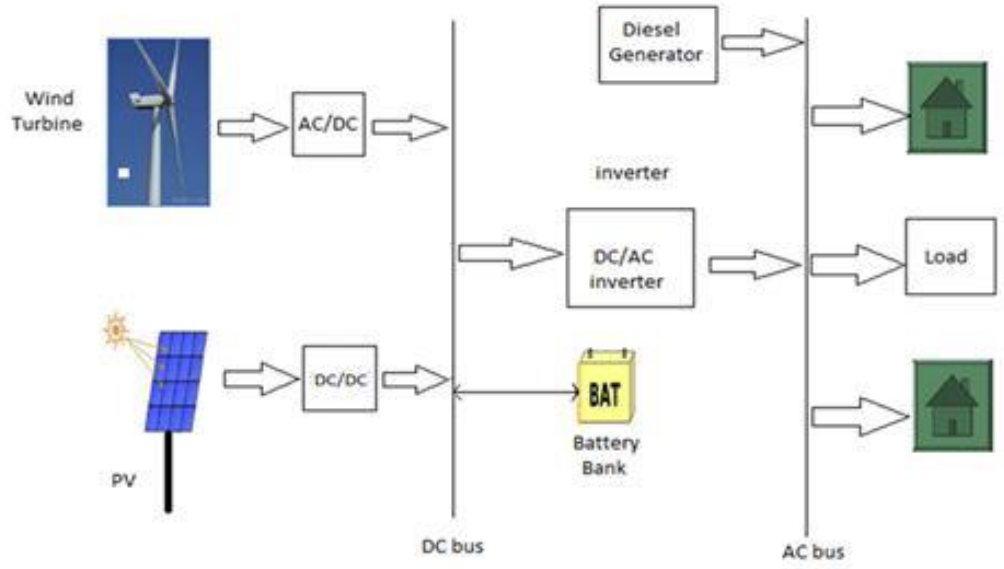

Figure 3 : Block diagram of hybrid system [5]

Block diagram for hybrid system is as shown above, which consist of combination of two or more devices. Here only two sources are shown. Most probably the combination of wind energy and solar energy is best choice for the electrification in off grid manner.in the diagram the output of solar and wind is integrated together and gives to the inverter. The

output of inverter is given to the load such as house, school, office etc. also the power from it can be stored in battery bank and then it will be utilize in night time [5]. (Fig 3)

MNRE INITIATIVES FOR OFF GRID

Remote Village Electrification Programmed (as on 30th June, 2013)

1. Total Villages and Hamlets sanctioned: **12771** (10131+2640)

2. Total Villages and Hamlets completed: **10154** (7971+2183)

3. Total Villages and Hamlets under implementation: **1573** (1358+215)

4. Total Villages and Hamlets dropped by the States: **1044** (802+242)

(out of the sanctioned projects)

CONCLUSION

Nowadays to have electricity is basic need of human life. Though there are some areas which are isolated from getting electrified. There are few remote area, tribe hamlets still away from reach of electricity. This will affect the socioeconomic growth of such communities. The people are struggled for the basic needs like water, health; education etc. for such people to bring them into main stream society electricity is must. Because of geographical condition it is difficult for government to give them grid connectivity. Renewable energy is the eternal sauce for the electricity purpose, which can offer power both either in on grid or off grid. Also utilizing renewable sources reduces all the environmental issues like GHGS, Carbon footprint etc. so for more reliable, environment friendly power Renewable source is endowed.

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