Development of Smart Street Light System Using Hybrid Energy

S. R .Meshram[1], Mane G[2], Sonawane M[3], Lashkare G[4], Narawade R[5]
[1, 2, 3, 4, 5] Department of Mechanical Engineering
[1, 2, 3, 4, 5] Sinhgad Institute of Technology, Lonavala

Abstract- *The objective of this paper is to show that a precise study of renewable energy potential is indispensable before implementing a renewable energy system. The growing demand of energy coupled with increasing attention to the environment impact have forced in last many years towards the study and development of new strategies in order to reduce primary energy consumption. The purpose of our project is to describe the smart street lighting system with an approach to accomplish the demand for flexible public lighting system using renewable energy system. The system is less polluted and has an higher efficiency over the conventional one. A convenient &cost-effective solution would be hybrid power systems which can reduce dependency on grid supply, improve reliability. In the context of climate change in the world at the global level, various actions are taken for the development of Renewable Energy and particularly solar energy. Many technology solutions have been proposed such as solar hybrid collector whose objectives is to improve the PV panels performance by recovering heat losses with the heat removal Fluid. The process of developing smart street light system occurs through 3 main stages Production ,Transmission and Distribution .The project has the scope in Rural and Urban areas where we can get a natural resources like wind energy .The result shown by the experimental and theoretical data that has been able to predict the energy generation through hybrid system.*

Keywords- Photovolatic Cell, Solar Panel , Wind Turbine, Inverter, Battery, Microcontroller.

I. INTRODUCTION

The term renewable is used to refer to methods that don't pollute (or pollute less than the non-renewable sources) and that are friendlier to the environment than the traditional methods. The Non-Renewables sources also called traditional power sources contribute more to the pollution of the environment of our planet. However, these methods are more common since their technologies were developed and implemented first globally in comparison with the renewable sources which are relatively new technologies. The second stage stated as the "Transmission Stage" refers to the big power lines of high voltage ranging from 345kV to 1000 kV that are used to deliver electricity through long distances from the power plants to the cities and towns where it is consumed. The third stage known as the "Distribution Stage" is the complex electric network within the cities and towns which delivers lower voltage electricity to the different homes, hospitals, factories, campuses, etc. The distribution power lines as well as the higher transmission lines and all of their related components are property of the electric provider, the city or the state governments depending on the contract. The components of the 1st, 2nd and 3rd stage all together are commonly referred to with the term Power Grid. However for the 3rd stage (distribution), the end user is the owner of the electric components and lines of their own house, business, hospital or other, usually starting at the meter (where sometimes the feeders are also property of the end user depending on the contract) and this last network of lines and components are known as Micro-Grids. During the past decade, the number of renewable energy sources has increased dramatically. It is forecasted that the growth of green energy generation will increase even further. Policy makers in developed countries create many incentives in favour of the development of low-carbon technologies and subsidise green energy generation. This should help to reduce carbon footprint and climate change. On the other hand, most of renewable energy comes from generators that are inherently very hard to control, thus it introduces further complexity in system balancing task.to overcome all the disadvantages possessed by the conventional method of electricity generation and transmission distributed energy generation is being preferred and promoted. There are several ways by which electricity can be generated locally using renewable sources such as solar, wind, biogas, etc 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. Therefore, suitable energy storage systems will be required for 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. The cost effective solution would be hybrid power systems which can reduce energy storage requirements.

II. LITRETURE REVIEW

Boneya.B et.al [2011] studied that design of a photovoltaic -wind hybrid power generation system for Ethiopian remote area with A hybrid power generation system which comprises of PV arrays, wind turbines and diesel generator with battery banks and power conditioning units has been discussed in this paper. The design of standalone electric power supply system for a model community has been conducted based on the investigation of wind energy and solar energy potentials of the area understudy.

Gilles Notton et.al [2010] analysed on topic Hybrid Photovoltaic/Wind Energy Systems For Remote Locations and with the lce depends on the renewable energy potential quality. For windy sites, more than 40% of the total production is provided by the WT, while for no-windy regions, the WT contribution represents only 20% of total production energy.

Dr.Katti P.K. et.al [2011**]** studied Rural Electrification Through Solar and Wind Hybrid System: A Self Sustained Grid Free Electric Power SourceIn India, more than 200 million people live in rural areas without access to grid-connected power. A convenient & cost-effective solution would be hybrid power systems which can reduce dependency on grid supply, improve reliability.

ErsanKabalci et.al [2013] To Design and analysis of a hybrid renewable energy plant with solar and wind power. The solar and wind energy sources, as being the most widely used renewable energy sources, are modelled separately and collected together to build a distributed generation system in the graphically presented Simulink model.

Chandel S.S et.al [2015] analysed the 7Review of recent trends inoptimization techniques for solar photovoltaic–wind based hybrid energy systems. From this is article It is found that different optimization methods used have different convergence speed,accuracy level; performance efficiency. and computation speed so selection of suitable approach may change with user requirements,type of applications etc.

ThiloBocklisch et.al [2015] Hybrid energy storage systems for renewable energy applications.hess are an interesting and very promising flexibility technology, which can help to cover short-, mid- and longterm fluctuations in a future sustainable, 100%-renewable energy system.

QunwuHuang et.al [2014] Multi-turbine wind-solar hybrid system. the electricity performance of the new hybrid system was studied by the TRNSYS software, compared with the traditional wind-solar hybrid system.

AbdellatifMiraoui et al [2008] studied on topic as Sizing optimization of a stand-alone street lighting system powered by a hybrid system using fuel cell, PV and battery. A configuration coupling a 148W photovoltaic generator with 128Wfuel cell and a 2.54 kWh battery can power a street light allthe year round in a region like Geneva (Switzerland)

Nicolas Lopez et al [2011] An approach to hybrid power systems integration considering different renewable energy technologies. In the present work, a modeling and simulation methodology using a micro power optimization software (HOMER®) to solve the multi-objective renewable energy integration problem considering various renewable energy technologies was presented.

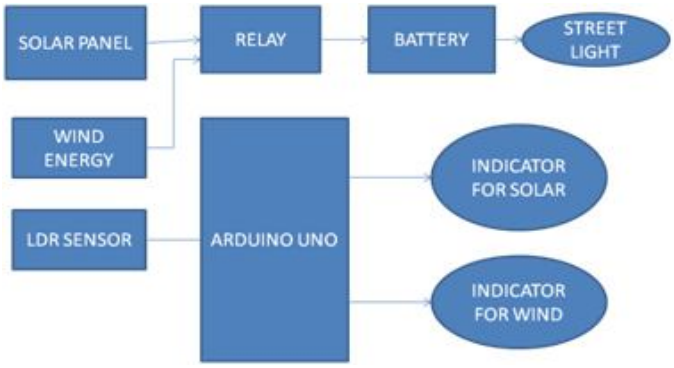
GetachewBekele et al [2011] Feasibility study of small Hydro/PV/Wind hybrid system for off-grid rural electrification in Ethiopia.GIS based hydrological and empirical estimations are used to determine the flow rate at the site and it is found to be in the range of 39–7666 l/s with a mean annual flow rate of 1540 l/s.

III. METHODOLOGY

The Methodology of the project passes through following stages

A. System Configuration

Solar-Wind hybrid power plant consists of mainly the solar cells and an alternative for solar i.e. wind mills. The energy is being produced from the two with a combination. Further the energy is fed to the hybrid controller. The energy from the battery is fed to the load as per the requirement. The functional block diagram of solar-wind hybrid power plant is shown



B. Experimental Procedure And Working

1) The solar energy can be directly converted into electrical energy by means of photovoltaic effect, i.e. conversion of light into electricity. Generation of an electromotive force due to absorption of ionizing radiation is known as photovoltaic effect.
2) The energy conversion devices which are used to convert sunlight to electricity by use of the photovoltaic effect are called solar cells.
3) Photo voltaic energy conversion is one of the most popular nonconventional energy source. The photovoltaic cell offers an existing potential for capturing solar energy in a way that will provide clean, versatile, renewable energy. This simple device has no moving parts, negligible maintenance costs, produces no pollution and has a lifetime equal to that of a conventional fossil fuel.
4) Photovoltaic cells capture solar energy and convert it directly to electrical current by separating electrons from their parent atoms and accelerating them across a one way electrostatic barrier formed by the function between two different types of semiconductor material.
5) Battery storage: the simplest means of storage on a smaller moderate scale is in electric storage batteries, especially as solar cells produce the direct electric current required for battery charging. The stored energy can then be delivered as electricity upon discharge. The common idea acid storage batteries, such as are used in automobiles, are not ideal for this purpose, but they are probably the best presently available. Extensive research in progress should lead to the development of more suitable batteries. A possible alternative is to use the direct current from solar cells to decompose water into hydrogen and oxygen gases. These gases would be stored in a suitable form and utilized as needed to generate electricity in a fuel cell.
6) Inverters these are the devices usually solid state, which change the array DC output to AC of suitable voltage, frequency, and phase to feed photo voltaically generated power into the power grid or local load, as shown in figure. These functional blocks are sometimes referred to as power conditioning. A general type of inverter circuit which is found best suitable for the utility application is shown in fig. the current can be used in two modes: as an inverter changing DC to AC or as a rectifier changing AC to DC, thus charging the battery. It is clear that the system photovoltaic offers the option of DC power, AC power, hydrogen and oxygen fuels in either gas or liquid forms from which electricity can be generated. The system has many advantages and disadvantages.
7) Solar Photovoltaic Array:The solar photovoltaic array consists of an appropriate number of solar cells connected in series and or parallel to provide the required current and voltage. The array is so oriented as to collect the maximum solar radiation throughout the year.

IV. CONCLUSION

From this paper it is concluded that by integrating and optimizing the solar photovoltaic and wind systems, the reliability of the systems can be improved and the unit cost of power can be minimized A PV wind hybrid systems is designed for rural electrification for the required load at specified Deficiency of Power Supply Probability (DPSP). A new methodology has been developed to determine the size of the PV wind hybrid system using site parameters, types of wind systems, types of solar photovoltaic system, number of days of autonomy of battery and life period of the system .Under current acute power shortages cenario with increasing cost of natural gas ,coal and turbine fuel and due to their impact on environment, there is a very urgent and great need of finding alternate source of energy to generate electricity. There are several ways by which electricity can be generated using renewable sources such as solar, wind, biogas, etc. Individual generation solar and wind energy is costlier. Solar and wind energy integrated technologies have great potential to benefit our nation. They can diversify our energy supply, reduce our dependence on imported fuels, improve the quality of the air we breathe, offset greenhouse gas emissions, and stimulate our economy by creating jobs in the manufacturing and installation of solar and wind energy systems. By using solar and wind integrated system we can electrify remote area also it is applicable for metro cities in future to avoid unwanted load shedding.The LCE depends on the renewable energy potential quality. For windy sites, more than 40% of the total production is provided by the WT.

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