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SIMULATION AND DESIGNING OF SMALL SCALE WIND ENERGY SYSTEM FOR RURAL AREA

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ABSTRACT- Wind energy is one of the best renewable sources for power generation since many years because wind is clean and unbounded. Small scale wind turbine (less than 100 kW rated) have been used for many application like home, villages and telecommunication facilities to produce electricity. The global growths in small scale wind turbine help to ensure the safety reliability and performance. This paper report simulation and optimization of small scale wind energy system for rural area and small scale turbine operated at 4m/s or above the 4m/s wind speed. This research is done for optimal design of wind energy system. The HOMER tool is use to simulate and design of small scale wind system for village. The proposed small scale wind system consists with wind turbine, generator, batteries, and converter. A typical model is constructed with HOMER tool.

Keywords: wind enery, small scale wind turbine, simulation, HOMER, wind power.

I. Introduction

In present year, interest in wind energy has been increasing and many researchers have attempted to develop the reliable wind energy system. The global market for wind energy system increases day by day. A small scale wind turbine that converts kinetic energy of wind into electrical energy. This turbine is used to generate power for home, business sector, village, cottages and telecommunication facilities in several areas. In present year, Fuel cost and environmental pollution is increases so, it is the most important issues for energy generation. Wind power is viable renewable energy source due to technology improvement and their implementation scale. As we know, wind energy can used for small installation not only for large system. In this article, we show about implementation of wind energy system for rural areas and optimize the cost. The paper report will discuss the different system to organize the generation of electricity with wind energy system. This report is eventually implemented and calculated for energy system. **[1-3]**

II. Literature Review:

Wind power is one of demanding renewable energy and due to boom of renewable energy, the attention of researcher's increases towards wind power. Otherwise, wind energy demand increases day by day which mainly fulfill by fossil fuel has brought increases greenhouse gas emission. So, greenhouse gas can be reduce by implementation of many action like renewable system growing, increasing energy plant efficiency, energy saving and recovery in the industrial field. The small scale wind energy system consists of wind turbine, generator, battery, converter and these all equipment is connected with ac and dc bus.

The proper selection of system component is based on area, sizing, operating cost and other parameter. The design of given system can be approaches through various method like graphics, probability technique, linear and non-linear program. This system is mainly based on mathematics and design of HBES through above method and this method is very complex and non-linearity of artificial and mathematical model. So, HOMER, Microsoft excel and MATLAB is used to avoid the complexity. The proper selection of wind system is based on primary load 1,026 kwh/day with 207 kw peak and it simulate and optimize through homer tool for small scale wind energy system used in rural area.**[2-6]**

In this research we consider the load for 53 house of village but firstly we take load data according to single household and these all data are manipulated for 53 house. Single household is consisting of 4 bedroom and wind speed data are taken from IMD. The primary load is based on various electrical equipment like 4 fan (60 w each),4 tube light(40 w each),1 television (110 w),1 refrigerator(200 w), 1 music system(125 w), 4 cooler (200 w each),jucier(1000w),1 motor pump(500w),1 washing machine (1000w) and these all load are manipulated and take average load for 53 house. We calculate average monthly load for summer (march-June), rainy (July-August), Shard (September-October) and winter (November to February). These load data are calculated according to basic requirement.

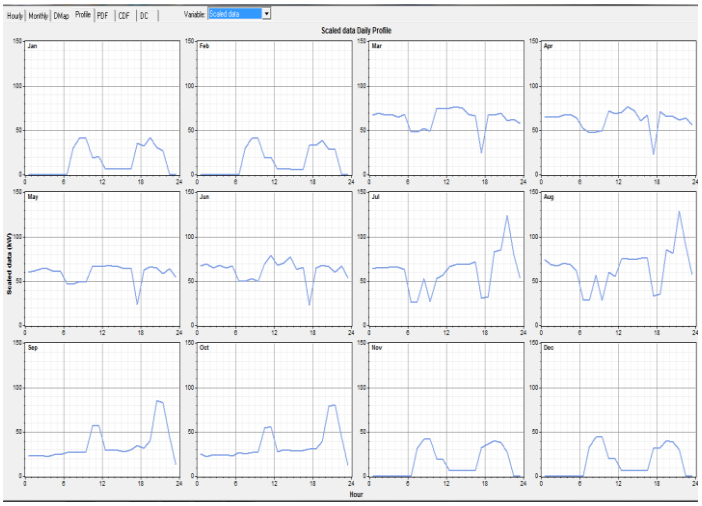


Fig.1 Daily Primary Load Demand Profile

The proposed **wind energy system component** consists of Generic 10 Kw turbine, Battery 6FM600D, Generator and Converter. The details of economic and technical parameters of these systems are shown in below table:

Wind system component	Variable parameter	Unit	Value
Wind	Rated Power	Kw	10
	Hub Height	Meter	25
Battery	Nominal Voltage	Volt	12
	Nominal Capacity	Ah	200
Converter	Efficiency	%	85-90
Generator	Life time	Hours	15000
	Minimum Load Ratio	%	30

Table 1: Component Specification Table

III. Methodology

The scope and implementation of small scale wind energy system is done through simulation and optimization technique with the help of hybrid optimization model for electrical renewable (homer). Before simulation process, we collect many data like average monthly wind speed collected by IMD and monthly average load is calculated by the rural households.

After collecting these data, the simulation process are done through HOMER tool to find the best result and optimum cost. The main aim of this research find the best result combination for electricity through small scale energy system for power generation. These steps are used for installation of small scale wind energy system. **[4]**

a) Assessing Site Suitability

Due to wind variability and local effects only sites could be suitable for installation of small wind turbines. The best judgment of site is done by engineers but initial condition can be taken by layman and following step for accessing site

b) Site Energy Demand

The energy demand of electric equipment and appliances for lighting, heating and other purpose using their power rating in kilowatt and no. of hours they used to estimate the total energy demand hourly daily and annual estimate made.

c) Turbine selection

Turbine selection is necessary for installation of using turbine to meet the supply power which is demanded by lighting, heating and other purpose. The actual size of turbine is depending on the wind regime and energy demand. For example, 104 w wind turbines are chosen for 250wh supply.

d) Siting

Siting means ground mounted and tower crane-top mounting were analyzed. It can make big difference within the same locality and following tip are given for siting of tower;

e) Safety Consideration

Siting the tower is avoiding above areas where people live, work or passes because wind generator may fall to the ground under storm condition or the tower itself. **[3-7]**

f) System design

The proposed wind energy system is mainly design for small scale off grid energy system. This system is consisting of small scale wind turbine, generator, battery and converter. The output of this system is stored in vision 6FM200D battery with 12V and this battery and turbine is connected to DC bus. The generator and primary load is connected to AC bus and converter is connected between AC and DC bus.

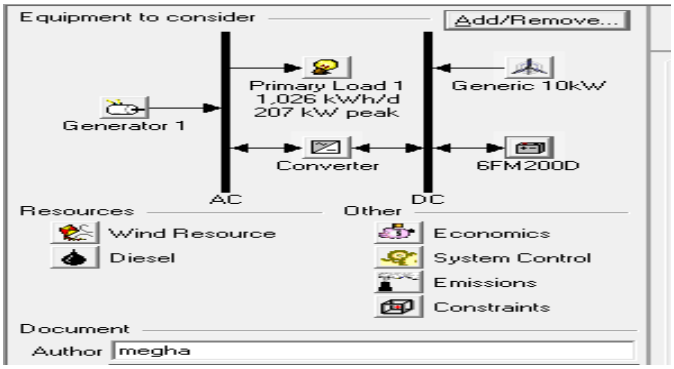
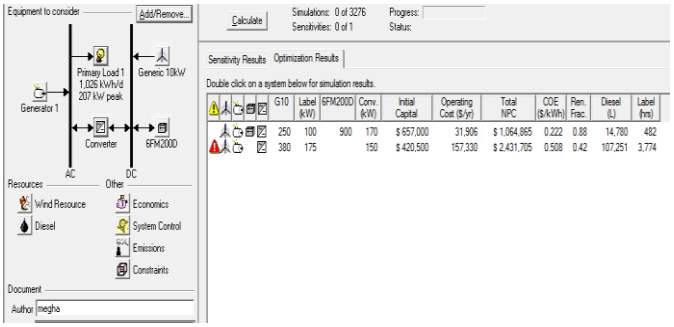


Fig. 2 A typical model of small scale wind energy system

IV. Result and discussion

a) Optimization result

The homer tool simulates given data and shows all possible result of small scale wind energy system according to their load. After this process it shows sensitive and optimal result with minimum cost.



The small scale wind energy system give best efficiency in month of March, April, May, June and this complete system also run at generator for supply full load in month of march ,April, May,July,Augest and October.

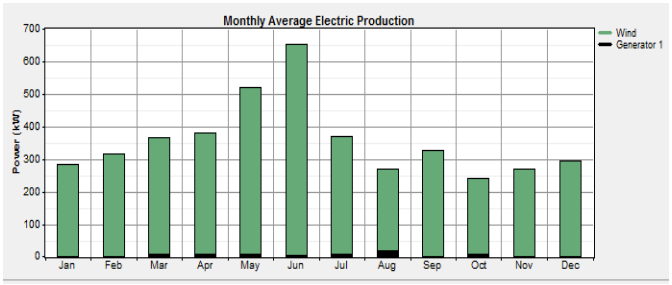


Fig.3 monthly average electrical production graph

V. Conclusion

In this paper a study on simulation and optimization of small scale wind energy system has been carried for village. In India, there are some rural areas where the power supply from grid is not reach due to some geographical problem but wind speed is very high. So, this HOMER tool shows the scope of small scale wind energy developed in village and these system generate power for 1,023kwh/d load with minimum cost is 0.22kwh/$. This homer tool also gives the best result for rural area to develop the wind energy system.

VI. Future scope

1. In this paper we use HOMER , Microsoft excel and MATLAB but in future we can used on different simulation studies as PSCAD,HOGA and many programming language for the actual performance.
2. Improvement in off grid and on grid renewable energy generation from wind.
3. Use cost effective renewable energy system for rural application to fulfill their requirement.
4. This research is done for small village and shows the minimum cost as their requirement but cost may be change by changing the turbine size and various parameters.

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Biography

Megha kumari was born in samastipur (Patna) Bihar on 20 may 1992.she did her B.Tech in electrical engineering under dual degree course and currently perusing M.Tech with energy engineering from Suresh Gyan Vihar University,Jagatpura, Jaipur.Her interest is in renewable energy source and she presently work on small scale wind turbine as alternative energy source. Her research includes the scope and potential of small scale wind energy system to maximize the electrical power and overcome the electricity requirement for future aspect.