To Balance Power Demand and Power Availability through Renewable Energy in India

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Abstract*---*At present India power generation growth is gradually increasing with the time and some are unexpected large generation state but as per time, demand is also increased. Optimization of wind-biomass hybrid generation system in Maharashtra and Kerala can balance the difference of demand and availability. In this paper determination of two states i.e. Kerala & M.H. power demand and generation is minimum in Kerala but highest demand and generation in M.H.so results shows as yearly demands fulfill by hybrid generation system. Power generation through renewable energy to fulfill load of M.H. & Kerala.

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Key words: - *Renewable Energy Distributed Generation, Biomass Energy, Wind Energy, MATLAB.*

I. INTRODUCTION

India is a country with more than 1.2 billion people accounting for more than 17% of world's population. It is the seventh largest country in the world with total land area of 3,287,263 sq kilometres. In recent years availability of power in India has both increased and improved but demand has consistently outstripped supply and substantial energy and peak shortages [1]. India has a large verity of renewable and non-renewable energy resources still it suffers lack of generation[2]. Most of the power generation in India is carried out by conventional energy sources, coal and mineral oil-based power plants which contribute heavily to greenhouse gases emission. This focuses the solution of the energy crisis on judicious utilization of abundant renewable energy resources [3]. Power demand and availability in Maharashtra is higher than other state and in Kerala it is lowest.[9] This result paper shows that the power difference in these two states can be balanced by using the renewable sources of energy i.e. wind energy and biomass for the generation of power.

II. RESEARCH SUMMURY

The objective of design of simulation model of hybrid system is to minimize the difference or balance the power demand and availability. MATLAB programming optimize in such way to give the idea about the different selecting units such as it gives the idea about how many number of wind turbines and for biomass dry input are used to fulfill the demand. On other words we can say that it also select the optimal generation system according to load demand.

Table 1-: Literature survey and methods

Sr. No.	Author name	Technology/ method	Analysis	Objective	Effects
1	Frede Blaabjerg & Ke Ma	Wind turbine system with power electronic system.	Global	Power electronic future for wind turbine system	Stable power generation.
2	Lucian Ioan Dulau, Mihail Abrudean & Dorin Bica	Distributed Energy Resources (DER)	On Grid & Off g Grid	Effects of DG in Electric power system	DG provides reduction in power losses
3	Ankur Omer, Smarajit Ghosh & Rajnish Kaushik	Issues, challenges and opportunities	India	Power system issues and opportunity in India	change in planning strategies from the traditional approach of increasing generation
4	E. Neria, B. Rugani b, E. Benettob, S. Bastianoni	Unit Emergy Values (UEV) & Unit Embodied Energy Value	Italy	To advance the characterization of wood biomass species by using the emergy principles	the worth of wood biomass resources by applying the EME methodology
5	In this paper	Analysis for power balance between energy demand and power availability	Maharashtra & Kerala	Programming of wind and Biomass energy generation	To bring balance between power demand and power availability

III. MODELING AND OPTIMIZATION OF HYBRID RENEWABLE GENERATION

As we are discussing on unbalance between power demand and availability we have chosen M.H. and Kerala as the area and population of the states are maximum and minimum. To calculate the data we know the formula for energy or power for wind farm

$$\text{Total power density} = \text{Totalpower}/A$$

$$= \frac{1}{2}\rho v^3$$

Total power produced

$$= \text{Efficiency} \times \text{Power density} \times \text{Area}$$

And for biomass consideration we can follow the calculations by the bellow formulas:

$$E = \eta * H_b * V_b$$

Where η= is the combustion efficiency of burners boilers(~60%)

H_b= is the heat of combustion per unit volume (calorific value) of biogas(20MJ/m^3at 10cm water gauge pressure, 0.01 atmosphere)

V_b = is the volume of biogas

$$E = \eta H_m F_m V_b$$

H_m= is the heat of combustion of Methane
F_m= is the fraction of the Methane in biogas
Volume of biogas can be given by

$$V_b = C * m_0$$

C is the biogas per unit dry mass of whole input and m_0 is the mass of dry input
The volume of fluid in the digester is given by

$$V_f = m_0/\rho_m$$

Where ρ_m is the density of dry material in fluid (~50kg/m^3)

The volume of the digester is given by

$$V_d = V_f t_r$$

. Where V_f is the flow rate of the digester fluid and t_r is the retention time in the digester(~8 to 20days)

In present work, results are taken for the standard input and output settings whose details are for Maharashtra the model is of 13 turbine system for wind model which is capable to generate the power 303MW. And for the Kerala model 8 turbine system is required to generate the required power of 55MW. For biomass the dry input required is 3021100kg/day and for Kerala 650100kg/day.

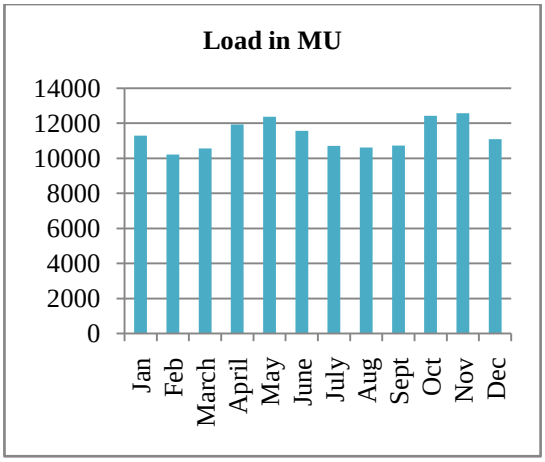

Fig.1: Load data set Maharashtra

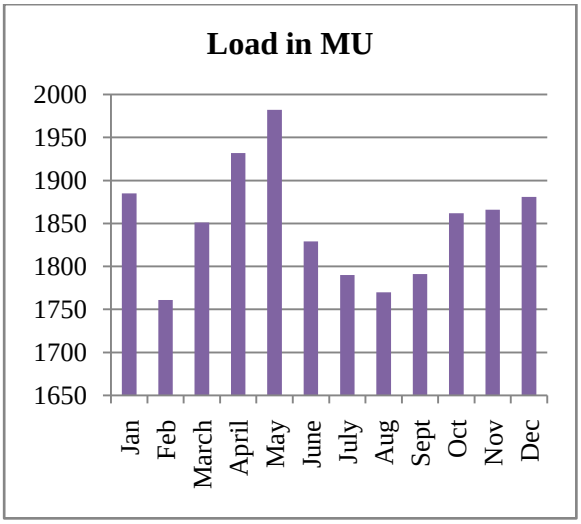

Fig.2: Load data set Kerala

Table 2: climatic data set for M.H.

Sr. No.	Month	Solar radiation (kWh/m^2/day)	Wind speed (m/s)
1	Jan	5.08	2.89
2	Feb	5.75	3.82
3	March	6.48	4.49
4	April	6.86	4.97
5	May	6.57	5.36
6	June	4.34	5.79
7	July	3.52	6.50
8	Aug	3.56	5.91
9	Sept	4.48	3.90
10	Oct	5.11	2.99
11	Nov	4.99	2.89
12	Dec	4.74	2.71

Table3: climatic data set for Kerala

Sr. No.	Month	Solar radiation (kWh/m^2/day)	Wind speed (m^2/s)
1	Jan	5.68	3.69
2	Feb	6.24	3.52
3	March	6.66	3.74
4	April	6.12	3.89
5	May	5.49	4.48
6	June	4.04	5.96
7	July	4.25	5.59
8	Aug	4.72	5.34
9	Sept	5.36	4.44
10	Oct	4.85	3.57
11	Nov	4.92	3.30
12	Dec	5.22	4.04

IV. RESULTS AND DISCUSSION

Table. 4: Simulation model output

Energy source		Generated power	Required power	Difference between demand and availability
Wind	M. H.	302.515MW	303MW	>0.51
	Kerala	55.61MW	55MW	<0.61
Biomass	M.H.	303.560MW	303MW	<0.560
	Kerala	55.752MW	55MW	<0.752

The above table shows the optimized simulation results of the simulation models of wind and biomass system for the required power for the state M. H. and Kerala. And this can be balanced the power between demand and availability.

1. Balance between power demand and availability, in M.H. and Kerala.
2. Design more hybrid system with renewable energy and distributed generation.

According to optimization result of hybrid generation through biomass-wind energy total load is less then total generation in M.H. and Kerala. Total generation will be607.075MW in M.H. 111.362MW in Kerala in 2016 so optimization will fulfill demand in year 2-016.

V. CONCLUSION

A hybrid system through renewable energy and distributed generation is helpful to the solution of power demand and availability balancing and it is fulfill the require power output for the state Maharashtra and for region Kerala. This generated power will bring balance in between power demand and power availability in these two states. And this generation can be done in other state too which may help to bring power balance in all over the country.

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