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Power System And Economics Of Scale-Review

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Abstract: The design of the hybrid system consists of Solar panels, Wind turbines, Biogasifier unit along with the energy storage system ,conversion unit and DG-Generators. The model of a Solar, Wind, Bio gasifier, DG Energy system with a battery bank for providing electricity for an off-grid system is consider,the hourly data was used and ascended to achieve the load demand for the purpose of a typical electric load size for the renewable hybrid system adjusting the data of a typical load as the hourly, daily and sessional trains are maintained. The system is basically designed for household loads for a remote area. The considered area has good availability of the renewable resources throughout the year. Here we can enhance the hybrid system by improving the size of component used in it with the least optimal levelized cost of energy by curtailing the net present cost of the system by applying the major global optimization techniques.

Keywords :HRES, LCOE, Renewable Energy, Hybrid System.

1. *Introduction :*

The strategy of the system consists of Solar panels, Wind turbines, Biogasifier unit along with the energy storage system, conversion unit and DG-Generators as shown in Fig 1. It can be on-grid or off-grid.

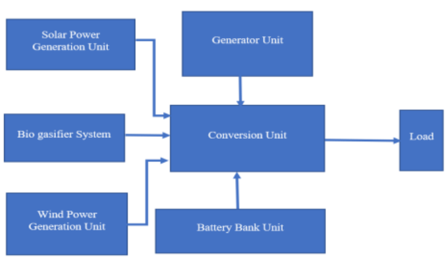

Fig 1:Hybrid System

The basic structure of the hybrid system is shown in the figure1 . It consist of Solar panels ,Wind Turbines, Bio gasifier , DG and a Battery bank along with the converting unit. The converting unit will have bidirectional converters so as to meet the requirements of the system. There may be a dump load or deferrable load or an pumping station in case of an off grid system or there may be electrical grid or utility grid.. As the benefits of solar and wind energy systems were more generally recognised, system designers began searching for ways to include them.

2. *Literature Review*:

This segment analyses the conventional works related to the cost analysis which is used for reducing the total net cost analysis of hybrid energy storage systems. Also, it discussed about the challenges, pros, and cons associated to the techniques.

The design and implementation of a hybrid energy system for a community is a difficult task because the input parameters of the sources considered vary randomly over time and are also independent of load requirements configurations, criteria selection, sizing, control methodologies, and energy management technologies. [13] discusses several mathematical analysis and simulation models for the system's components.

Borowy and Salameh (1996) established a method for calculating the optimal size of a battery bank and PV array for a hybrid PV wind system. For a given load and a loss of power supply an optimum number of PV modules and batteries have been determined based on the cost analysis. They concluded that the optimum mix of PV modules and batteries depends mainly on the load of the particular site and dependability of the hybrid system.Beyer et al (1996) developed a set of equations that linked the size of the hybrid system components namely the wind, photovoltaic and battery system directly with parameters that characterized the meteorological conditions at the respective site for a high level of reliability. But this approach is restricted to the case systems with a low loss of load probability.

Elhadidy and Shaahid (1999) investigated the viability of a wind-solar hybrid power system for the Saudi Arabian city of Dhahran. Bhave (1999) investigated the technological and economic viability of a solar photovoltaic-wind hybrid system.

Bonanno et al,created a logistical model for evaluating the performance of hybrid generating systems . The unique element was the addition of an extra fictional source to the hybrid system in order to achieve the power electric balance at the busbars during the simulation stage in the event of undersized components.

The auxiliary source served as a compensating supply for any power imbalance in the power plant during the power load request, allowing the simulation runs to continue uninterrupted

The goal was not to pretend to discover a single best solution, but rather an organised method of assessing the connection between characteristics and uncertainties, weeding out many weaker ideas and leaving only those that constituted a fair compromise.

The capital expenditure and loss of load were the characteristics to reduce, while the load demand and availability of renewable energy sources were the uncertainties under which the design should be carried out. The answers were selected using the trade-off method's choice theory.

3. *Research Methodology*:

The cost of a hybrid system is decided mainly by two factors: the cost of the system and the quantity of usable energy generated, i.e. not energy production but energy genuinely utilised for consumption. When discussing the economics of a system, other variables like as the cost of conventional energy, the system's lifespan, maintenance expenses, and financial costs are taken into account.The cost of the system is mainly determined by the cost of the various components that comprise the system, as well as the cost of the renewable energy producers themselves.

Let us focus on the cost calculation , the objective function ,the constraints and some other aspects which are useful in the analysis. So first of all we will see the restraints of the hybrid renewable energy system ,the two main constraints are the state of charge of the battery and second one is the load demand.

SOC of the battery is the state of charge of the battery.The battery will have a minimum SOC value. Most of the manufacturers recommend above twenty percent , but we can set the SOC as per the requirements of the system.

The second constraint is the load demand. We have to meet the load demand at each and every interval as we are doing yearly stimulations. So there should not be loss of liability. There should be hundred percent liability. There should be no loss of the load and load is met at every interval.

Now lets discuss the fitness function. So in the model we can use annualized system cost or levelized cost of energy as the objective function or the fitness function .

So we have to minimize the annual cost of the System and the LCOE in it's basic form is given by, dividing the annual system cost by the total useful energy served in the year.

The annualized system cost is given by these three factors namely, total capital cost of the system, the operational and maintenance cost of the component and the replacement cost. We will also calculate capital recovery factor, because this is needed for the calculation of the annualized system cost , as we have to use the annualized factor and not the overall factor.

Flow Chart:

Next is the flow chart, a simplified form of flowchart is shown in the Fig 2, which follows the operational strategy and will be executed each year, not once but it will run for each hour throughout the year for a yearly stimulation.

If the stimulation is for hourly basis then it will be stimulated after each hour. So they are eight thousand, seven hundred sixty hours in an year and it will be stimulating the scenarios considered in the flowchart for eight thousand, seven hundred sixty times.

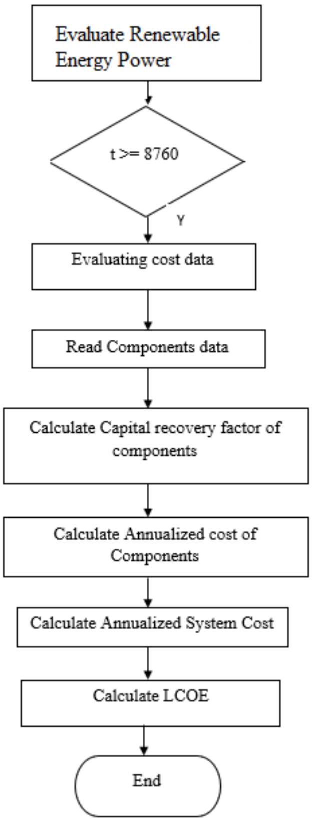

Fig 2:Flow Chart Of Hybrid System

4. *Conclusion*:

A method for optimization of stand-alone system is accessible in this paper.So,in the stand alone model the desirable fitness function is Annualised system cost and Levelized cost of energy.Here we areenhancing the hybrid system with the least optimal levelized cost of energy(LCOE) by curtailing the net present cost of the system.

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