



# Modeling and Performance Analysis of Microgrid Using Fuzzy Logic Controller

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**ABSTRACT:** Fuzzy logic based voltage controller is proposed for hybrid generation scheme. It uses solar and wind energy for isolated applications. Microgrid involves different energy systems or energy sources. Here we are using solar energy system and wind energy system. To improve the generating performance & implementation of power utilization, we are using the hybrid PV-wind system. It gives better result as compare to individual sources. On the contrary side, PV-wind hybrid system has environmental benefits such as reduction of carbon emission due to use of renewable energy resources. Fuzzy logic control based maximum power point tracking(MPPT) approach is used to improve the efficiency and robustness of the solar photovoltaic (PV) power generation and establishes a model of grid-connected PV system by Matlab/Simulink environment which reflect the characteristics of the system accurately. We are using battery for energy storage purpose. It gives continuous power, compelling use of renewable energy resources. It enhances life time of battery, minimized utilization of diesel and reduces the emission of CO<sub>2</sub>.

**KEYWORDS:** Maximum power point tracking , Fuzzy Logic Controller

## I.INTRODUCTION

During the past few decades the advanced technological nation of the world has brought us to the position of energy crisis. Many developing countries have also been engaged in this race during last two decades. It is now widely recognized that the fossil fuels and other conventional resources, which are used in generation of electrical energy, may not be sufficient to keep pace with ever increasing world demand for electrical energy. For meeting this demand and avoiding crises in supply would be improved if new and alternative energy source could be developed. Fortunately many such sources exist. Undoubtedly many of these resources would be exploited more and more in future. Solar energy is the most abundant and constant source of energy. It is available in the form of solar radiation. Especially in countries like India where the government is facing oil crunch, PV energy which is available in abundance throughout the year will be very important. Sun radiates  $1.74 \times 10^{17}$  W of power per hour to the earth .Wind energy is also a significant energy source which is used in power generation programs of many countries including India.

Because of the various advantages such as simplicity of allocation, high dependability, absence of fuel cost, low maintenance and lack of noise the photovoltaic (PV) generation is assuming increased importance as a renewable energy sources application.

The working principle of solar panel is when light radiation falls on a p-n junction, a voltage is generated. The primary power comes from the striking photons. Solar radiation is used to generate electricity. As the world electricity demand is increasing, the use of photovoltaic system is attracting more and more attention of power planners.

Among the renewable energy sources, wind energy also seems to be prominent and quite promising for electric power generation. Wind energy conversion has been found economic as compared to the cost of fossil fuels which are rising at a much faster rate. Therefore, the study of induction generators has regained importance, as they are particularly suitable for wind and small hydro power plants.

## II.SYSTEM MODEL AND DISCUSSION

A system includes hybrid scheme generation using solar system and wind system. These systems are used to generate the power. Microgrid can be used with utility grid or it can disconnect from utility grid and operate separately. As we are using renewable energy sources , availability of these sources can not be predicted or these are not available all the

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time. Therefore, to store the energy so as to use it during peak demand hours we are using battery system as energy storage system. We are using fuzzy logic controller to improve the power utilization. Figure 1 shows the block diagram of the system.

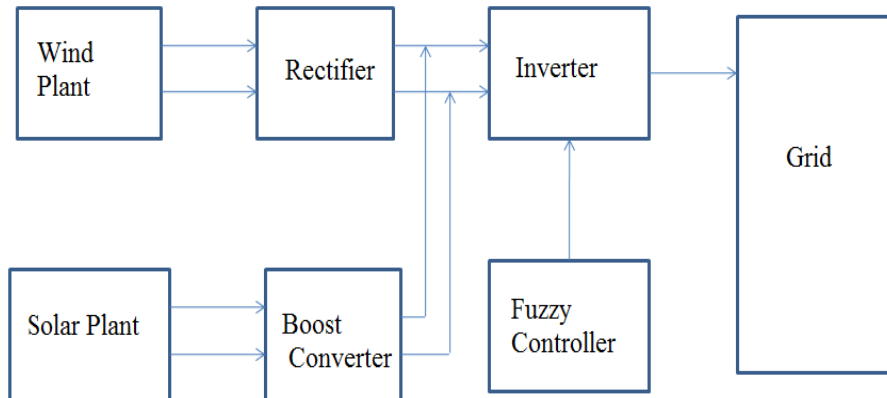
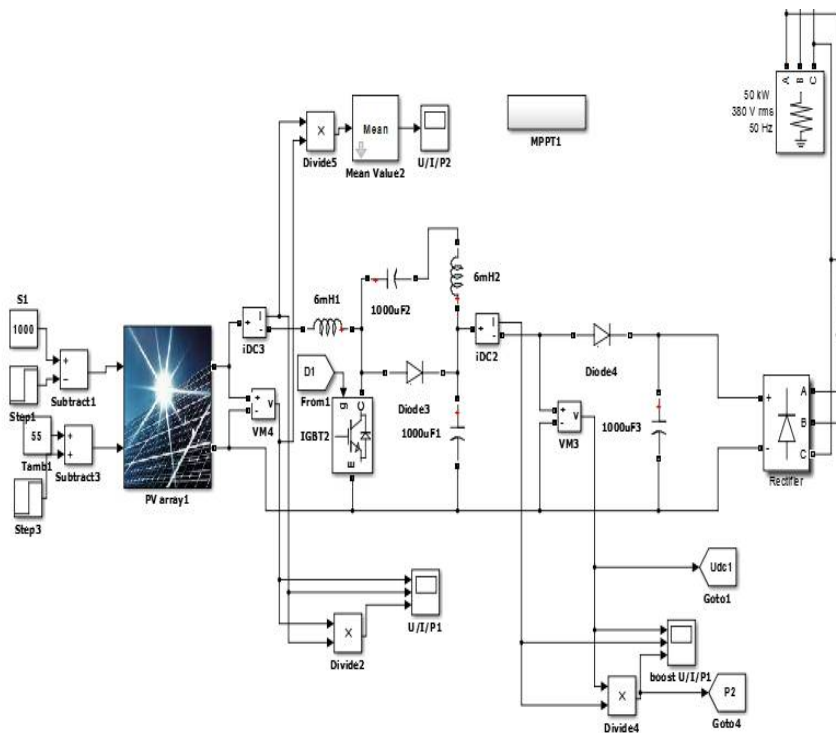


Fig. 1 Microgrid including solar and wind plant

Fig 2 shows the simulation diagram for solar plant. For solar plant we are considering temperature and radiation as inputs. We are using MPPT to get maximum power from the solar module under particular conditions. Maximum power varies with the solar radiance and ambient temperature.



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Fig. 2 Circuit diagram of solar plant





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## III. RESULT AND DISCUSSION

Fig 5 shows the output waveforms of wind plant. This is the output which we are getting at scope 1 shown in fig 3. This is the output when wind speed is 20 m/s.

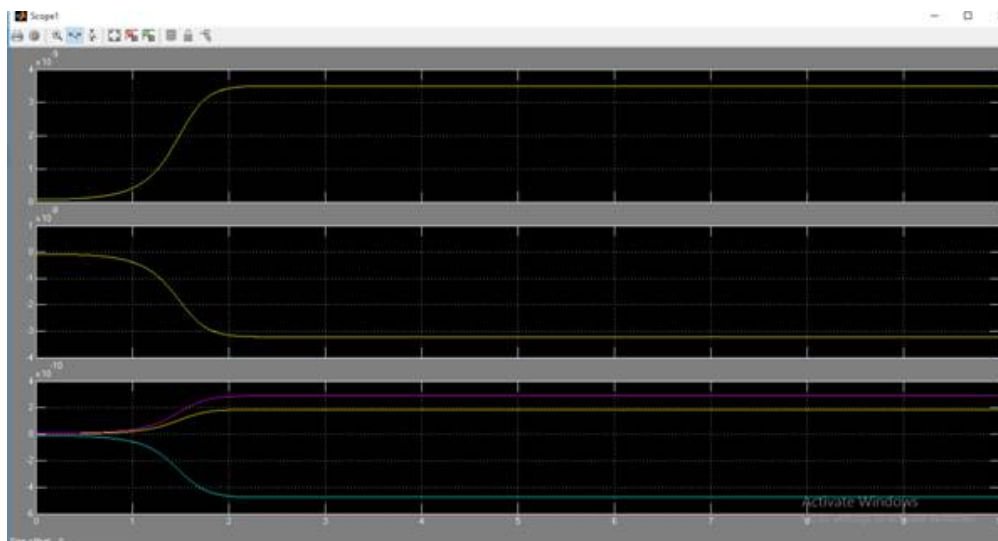


Fig. 5 Output waveforms of wind plant

Fig 6 shows the output waveforms of complete simulation including solar and wind plant. We are using FLC to stabilize the output waveforms. This is the output which we are getting at scope 2.



Fig. 6 Output of hybrid system (solar and wind)

## IV. CONCLUSION

A fuzzy logic controller suitable for solar and wind hybrid energy conversion for isolated applications. The wind and solar hybrid power system is simulated using MATLAB. MPPT control is applied for wind and solar sources to make the system efficient. The variations in duty-cycle to maintain constant load voltage with variations in irradiation and



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wind speed is achieved with the proposed fuzzy logic controller with optimized rule base. Hybrid power system supplies AC load and DC load so it is suitable for all applications like remote areas, villages and hill stations. The output results show that the using Fuzzy logic based system is more effective, energy management controller controls hybrid power system to provide uninterrupted power, minimizing usage of diesel, effective utilization of sources. Since the usage of diesel generator is minimized emission of harmful gases from it is minimized.

## V.FUTURE SCOPE

It is almost impossible to have an algorithm suitable for all situations. It is, therefore, important to consider some of the situations for which the further study is required. Suggested below are the few areas which can be further explored to improve the microgrid operation and energy storage schemes to evaluate the practicality of the proposed (i) Wind-Diesel and (ii) PV-Wind-Diesel hybrid systems in isolated and grid connected modes, a number of pragmatic issues such as control and grid integration aspects can be taken into consideration for the microgrid and energy storage schemes. Microgrids can meet the needs of a wide range of applications in commercial, industrial, and institutional fields. Larger microgrid applications include communities ranging from neighbourhoods to the small towns to military bases. Conventional grids can be replaced by microgrid in future because of its advantages.

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