MATLAB Based Generation of Power from Renewable Energy Sources

Prof..Komal P.Hole

Asst. Professor, Dept. of Electrical (Electronics & Power) Engg, VBKCOE Malkapur, Maharashtra, India

ABSTRACT

This Paper deals with the hybrid system which contain the components which are non-renewabe energy sources and this components are easily available in the environment the power generation parameter which is used in the system is wind farm, Fuel cell and PV-array this all components . By using this components there is no pollution occurs in the environments so this are the less expensive parameter. Here we used the wind farm which provides the power but the power from wind farm is having fluctuating nature so we used the PV-array.Also we used the vector control technique at the rotor side and grid side . In recent time large of industriliazation and other development is occurs so , we needs the power in large scale. In developing countries the advanced new techniques are implemented so that lots of research is get done for making the environment with services . Fuel cell technology is a moderately new energy-storing technology that has the potential to participate with the conventional present generation facilities. Modeling and simulations are in MATLAB Simulink.

Keywords:- Wind Energy Conversion System (WECS), SOFC (Solid Oxide Fuel Cell system), Wind Farm , PV array

1. INTRODUCTION

The developing industrialization and domestics, demand of power is increasing in large scale. To keep the healthy environment we have to produce power from the various renewable energy sources in environment friendly manner. In present the bulk ac power transmission are not economic and also complex to control the power flow. To stunned this problems wind turbine and photovoltaic generators are used. The proposed hybrid model is most suitable for all weather conditions. And also, it is very safe working atmosphere with the hybrid model. Wind and solar energy is unsteady and unpredictable, and harnessed in relatively small quantities spread over a large area. If it is not properly controlled, the power output of a wind farm and PV array could too small percentage only. In this paper permanent magnet synchronous generator is used with variable speed control employed. we know that the wind is not in continuous flow so we get the constant power so for that we need the additional source for generation for that we used the SOFC(Solid Oxide Fuel Cell) and PV-array. The vector control technique is used to control the generation of power.The WEC system is best for generation of power.

2. OPERATING PRINCIPLE

The stator is directly linked to the AC mains, that the wound rotor is fed from the Power Electronics Converter via slip rings to allow DFIG to control at a variation of speeds in response to fluctuating wind speed. The frequency of the grid voltage is always kept constant regardless of the wind speed (and thus the rotor speed), by the back-to-back converters. At sub-synchronous speeds the stator is producing the power but part of it has to be fed back to rotor. At super synchronous speeds both the rotor and stator are generating power to the grid. The slip power can flow in both directions, i.e. to the rotor from the supply and from supply to the rotor and hence the speed of the machine can be organized or controlled from either rotor- or stator-side converter in both super and sub-synchronous speed ranges. As a result, the machine can be controlled as a generator or a motor in both super and sub-synchronous operating modes recognizing four operating modes . the structure and the operational of a fuel cell are similar to that of a battery except that the fuel can be continuously fed into the cell.The Vector control scheme is present at the rotor side(RSC) And grid side converter(GSC).

3. COMPONENT OF SYSTEM: -

In our developing test cell model we provide the PV array and incerese the load demand so that to complete the target of the system we takes the PV array . Due to the fluctuating nature of the wind farm we take the module called as PV module so at the minimum presence of wind or in absence of wind we get the power from the PV array the PV array also delivered the power any time if power is get maximum then some power is get stored in the fuel cell here fuel cell is used for to stored the power and also for the production of electrical energy. Here power from the grid is 0.5 MW , power from the wind farm is 2 MW,then power from the fuel cell is 0.5 MW and our additional component that is PV array which gives the 0.5 MW generation our load demand is of 4 MW but system is sustain to 3.5 MW. So that the generating power some power laps in the reactive power .
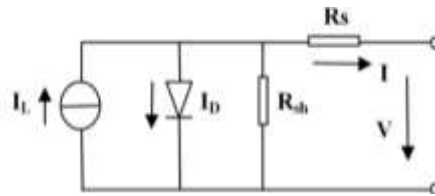
3.1 PV Cell

Fig.1:- Equivalent Circuit of PV Module

Normally, voltage output is based on solar irradiation and temperature of the cells. The converter is to get the voltage for which the peak value of power attained or gain from PV cell. The output variable is an increment value which increases or decreases the voltage reference of the PV array. Then the PWM duty cycle of the boost converter connected to the DC-link.

The PV-array is nothing but the solar panel component in the system it is generate power by using the renewable energy source solar the sun radiation is fed to the panel which converts these into the electrical power.

The construction and the working of a fuel cell is like to that of a battery excluding that the fuel can be constantly fed into the cell. The cell contains of two electrodes, anode (negative electrode) and cathode (positive electrode) divided by an electrolyte. Fuel is fed into the anode where electrochemical oxidation takes place and the oxidant is fed into the cathode where electrochemical reduction takes place to produce or harvest electric current and water is the primary product of the cell reaction The characteristic anode and cathode reactions for a hydrogen fuel cell are given by Equations-
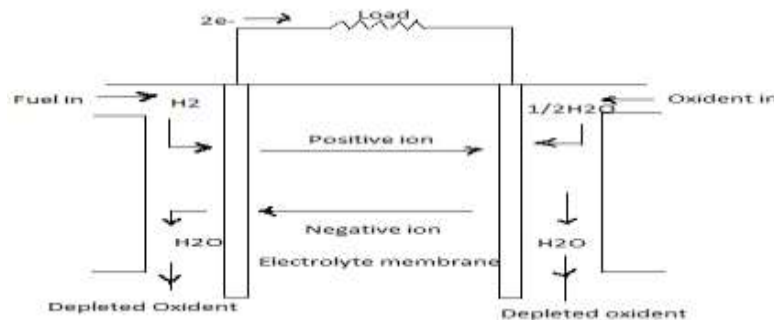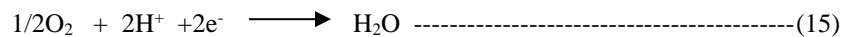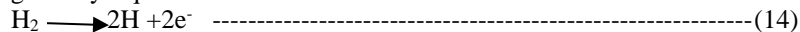
$$H_2 \longrightarrow 2H + 2e^- \ \text{---(14)}$$

$$1/2O_2 \ + \ 2H^+ \ +2e^- \longrightarrow \ H_2O \ \text{--(15)}$$

Fig 2 :-Solid Oxide fuel Cell

3.2 Wind Farm:-

The wind having te fluctuating nature so we need the another source for the continuous generation so we established the hbrid system with combination of fuel cell , PV-array and winf farm . If winf farm is fails to generate the electrical power in absence of wind then other source generate the power here fuel cell is utilised to generate the the power & also store the power.The whole system is given by
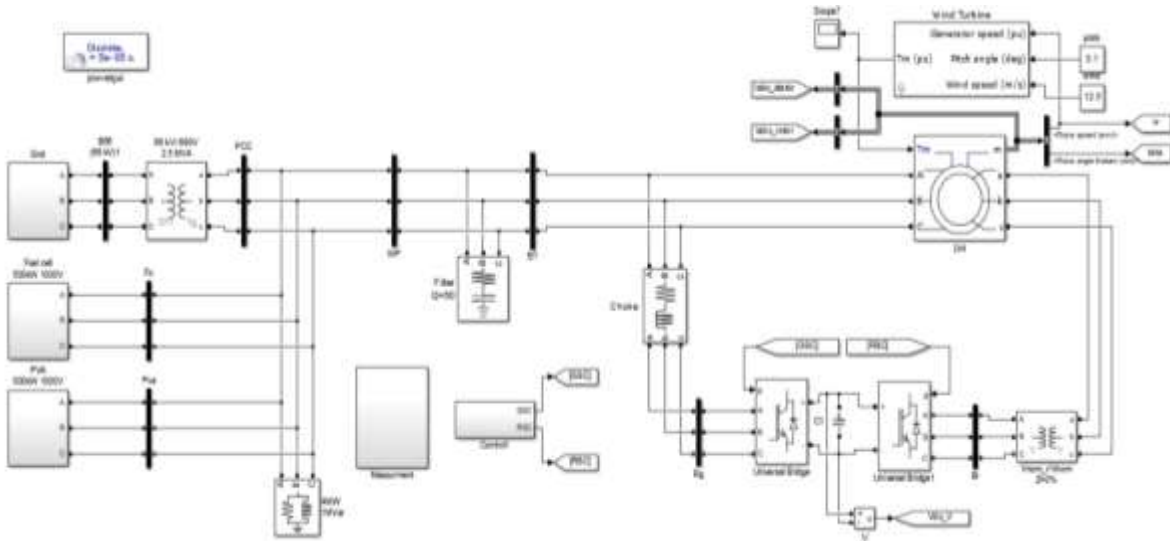
Fig 3. Simulink of Hybrid system with PV-array

4. RESULT

The develop system is carried out in the MATLAB software, The result is gives the result from its respective sources such as wind farm,fuel cell, and PV-array we need the constant power from the sources so that we need the reliable and constant nature output is given by
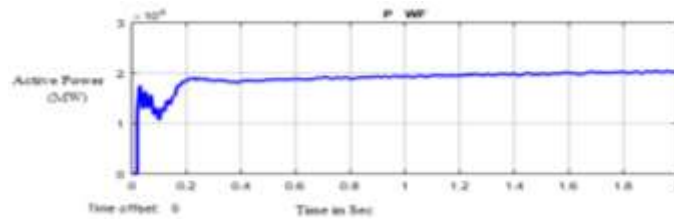

Fig 4:-Real Power output from wind farm

The power delivered form the wind farm is 2 MW we use the PV-array to provide the continuous power to the load. Then again we use the fuel cell thses fuel cell is utilized for creation of the electrical power and also used to stored the amount of enegy in it. The fuel cell having duel nature,the power delivered from the fuel cell is 0.5 MW. The power of graph is given by
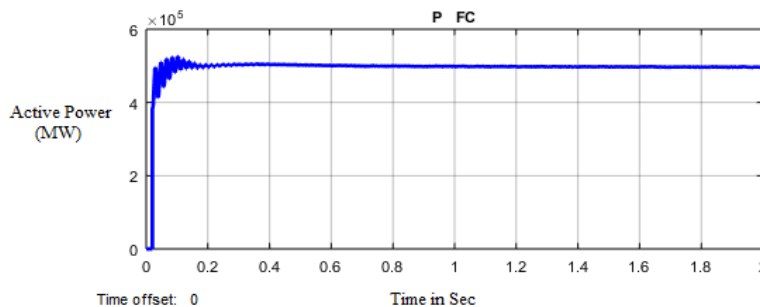

Fig 5:-Real Power delivered from the Fuel Cell

In that we provide the PV-array these PV module is used to delivered the result which is beneficial for our load demand our creation is improve and increase our output .The power delivered from the PV module is 0.5 MW and some power is from the grid is 0.5 MW, The PV -array contains the photo diode which convert the solar energy in to the electrical energy the power from the PV-array is
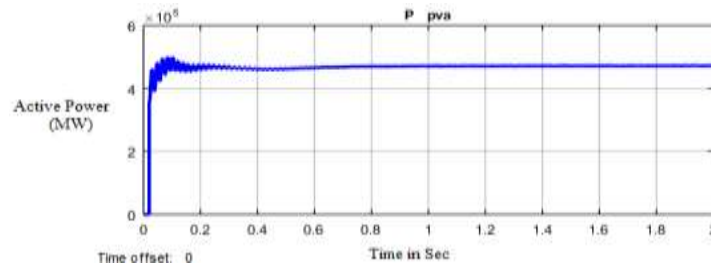
Fig 6:-Real power Provided from the PV-array

The sources like wind farm, fuel cell, PV-array is collected at the one point that point is known as the point of common coupling from tat point coupling the power is provided to load is 3.5 MW then this point is the power collection point . the power collected at these point is given by
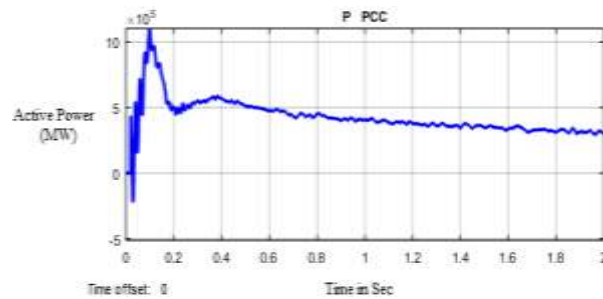

Fig 7 :-Power collection at PCC

The all parameters provide the combine power which are provided to the load then the these power is about the 4 MW it is the output power from the 4 sources which gives the power of 3.5 MW . The Power is given by
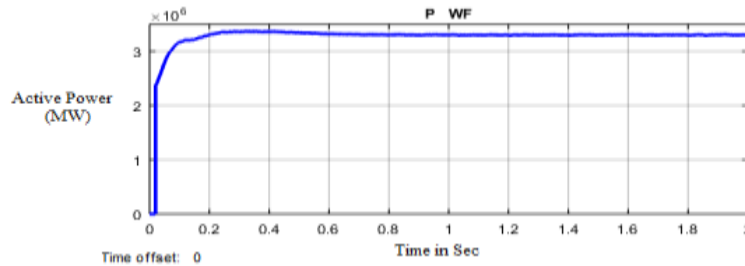

Fig 8:-Ovearall output power to the load

5. CONCLUSION

The simple , easy and most well-organized integrated windmill & Solar with DIFG and PV solar cell system are proposed with SOFC . The advantages of SOFC having strength and the easy to implement when compared to the other fuel cell & it is economically useful & pollution free . It also simplifies to estimate the wind mill structures simply and correctly. Also, this hybrid generation system takes a dissimilar quality that the wind-PV power naturally accompaniment to one another to positive amount, there by assisting constant output power for full day to the load. In future the fuel cell also taken in to the account to achieve not only the constant supply but also better battery life. The system with wind conversion is achieved by vector control at the grid side. So this got the positive response to the power generation.

6. REFERENCES

[1] P. Aravindan , S. Thangavel , M. Y. Sanavullah "Maximum Energy Extraction in Wind Solar Hybrid Energy Conversion System " Vol.63 in 2011.

[2] R. Jagatheesan, K. Manikandan "An Efficient Variable Speed Stand Alone Wind Energy Conversion System & Efficient Control Techniques For Variable Wind Applications" Vol. 5, Issue 1, Nov. 2012

[3] Gaurav Mishra , Ruchi Mishra " Control Strategy For Wind Energy And Hybrid Generating Systems Based On The Concept Of Power Electronics " Volume1 , Issue 3, Dec 2012.

[4]   Manaullah, Arvind Kumar Sharma , Jamia Milia Islamia,"Performance Comparison of DFIG and SCIG based Wind Energy Conversion Systems" November 2014.

[5]   Aggarwal Archna , Saini Lalit Mohan and Singh Bhim "Control Strategies for DIFG Based Grid Connected Wind Energy Conversion System" Vol.7 2014

[6]   Devender Sharma , Sushil Kumar , Shiba Arora "Modelling and Simulation of Solid Oxide Fuel Cell for Distributed Generation Using Simulink" Volume 3 Issue VI, June 2015 .

[7]   Rajesh K , A.D. Kulkarni , T.Ananthapadmanabha " Modelling and simulation of solar PV and DIFG Based Wind Hybrid system " August 2015

[8]   Said Chikha1 , Kamel Barra "Predictive Control of Variable Speed Wind Energy Conversion System with Multi Objective Criterions" March 2016 .

[9]   J. PULLA RAO, SHAHIMA SHERIEN "Control Scheme for a Stand-Alone Wind Energy Conversion System with Fuel Cell" Vol.08,Issue.02, February-2016

[10]   Pritesh P.Shirsath ,Anant Pise , Ajit shinde "Solar-Wind Hybrid Generation system"   Vol 4 Issue 2 April 2016