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Simulation of Fuel Cell in Power System and Study For Electric Vehicles

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Abstract *– Now a days, maximum industrial devices are mainly supported electronic devices like programmable logic controllers and electronic drives. The electronic devices are really sensitive to disturbances and subsided tolerant to power quality problems like voltage sags, swells and harmonics problems . Voltage dips are thought of to be one in each of the foremost severe disturbances to the industrial equipments. Another power electronic resolution to the voltage regulation is that the use of a dynamic voltage restorer m(DVR). DVRs are a class of custom power devices for providing reliabledistribution power quality. Power Quality problems comes as an outsized vary of disturbances like voltage sags/swells, flicker, harmonics distortion, impulse transient, and interruptions.*

Keywords: **electric vehicle; Power system of vehicle; Fuel cell vehicle; Solar vehicle**

I. INTRODUCTION

In Electricity has become one basic need in today's world to get advancements in technology, population growth, raising standards of living in most parts of the world and wide spread industrialization. It has become one of the parameters by which the economic growth of a country is measured. Fig.no 1-1 shows the world wide energy consumption from 1990-2021 in.

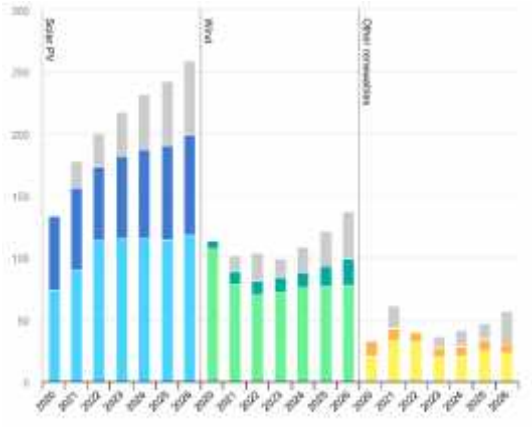

Fig.no 1 shows , at least 74.4 GW of SOLAR ENERGY SYSTEM power was added to the global SOLAR ENERGY SYSTEM market.

Electrical generation is done by using different sources of electricity such as non-renewable and renewable energy sources. Non-renewable sources use fossil fuels, coal, gas and nuclear resources, which are finite and increase the

greenhouse effects and ocean waters pollution, problem for earth's environment. To solve the problem using non-renewable sources of electricity, the electricity supply industry is gradually moving to the use of renewable energy sources.

II .SOLAR ENERGY SYSTEM

In Solar energy system system the combination of SOLAR ENERGY SYSTEM modules are connected in series and parallel to meet a required voltage, current and power . A SOLAR ENERGY SYSTEM is made up of semiconductor materials, such as silicon or germanium. A typical SOLAR ENERGY SYSTEM is the n-type and p-type semiconductor materials exhibiting different electrical properties. When a SOLAR ENERGY SYSTEM absorbs a photon of sunlight, free electron and holes are created at the positive and negative junctions of the semiconductor assembly and generates DC power. The power generated by the SOLAR ENERGY SYSTEM are collected through metallic contacts connected on both sides of the cell as shown in Fig.no 2.

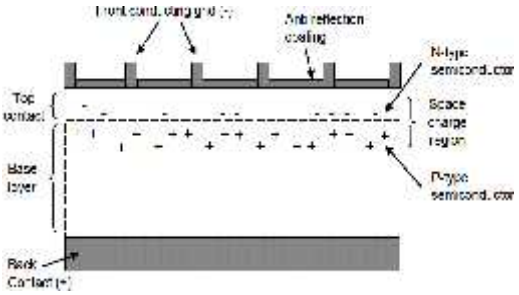

Fig.no 2. The basic structure of SOLAR ENERGY SYSTEM

The output of SOLAR ENERGY SYSTEM during different operating conditions are presented by V-I curve and P-V curve as shown in Fig.no 3-2, where, *Voc* is open circuit voltage, *Isc* is short circuit current and *VmpImp* is maximum voltage and current at maximum power point.

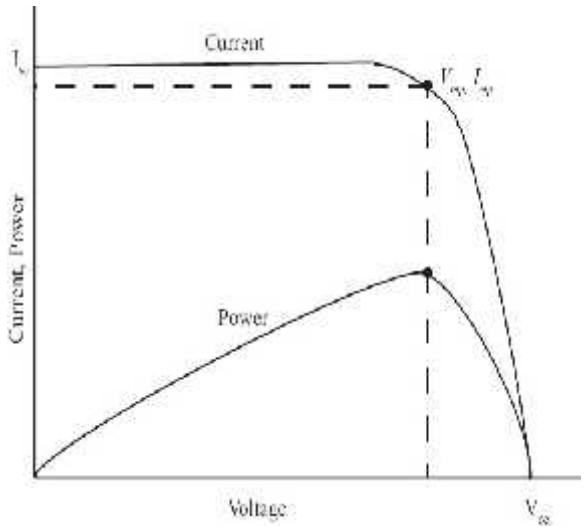

Fig.no 3 I-V and P-V curve of SOLAR ENERGY SYSTEM .

To model the SOLAR ENERGY SYSTEM , it is important to understand the properties of I-V characteristics.

same.

III. METHOD

The modeling and control techniques used by all the components of the SOLAR ENERGY SYSTEM -ESBS will done in this work . The two main subsystems of the SOLAR ENERGY SYSTEM -ESBS are shown in Fig.no 4,

(1) The SOLAR ENERGY SYSTEM sub- system comprising a DC-DC converter and the MPPT control, with the DC- AC converter.

(2) The Solar energy system sub-system comprises a bi-directional converter, with inverter. Each subsystem connects to with the AC grid and a load, as shown in the Fig.no 4.

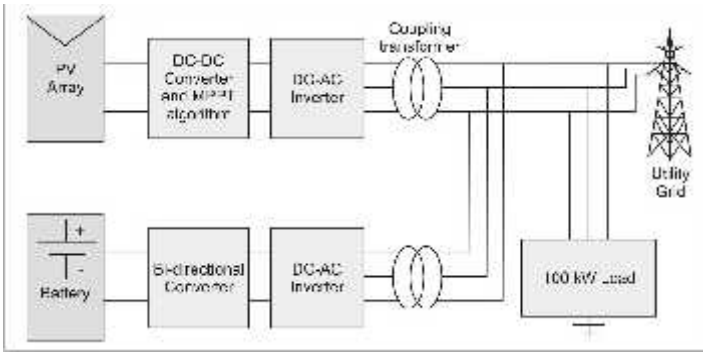

Fig.no 4. Proposed Solar energy system -ESBS system.

MATLAB Simulink

MATLAB Simulink has been extensively used for simulation of the SOLAR ENERGY SYSTEM -ESBS . Simulink is a modeling and calculation platform is extremely flexible and provides the opportunity to design models. For this thesis, several tool boxes from MATLAB Simulink have been used to model different components that allow testing of the SOLAR ENERGY SYSTEM s under different test conditions. The Simulink implementation of this system facilitated the simulation, for example, it allowed modeling the value of irradiance (and its variation) that computed the output current produced by the Solar energy system module.

SOLAR ENERGY SYSTEM Modelling

A basic model for this work is as shown in Fig.no 4-2. A SOLAR ENERGY SYSTEM array of 100-kW has been connected to a load and 25-kV AC grid with a DC-DC boost converter and a 3-phase 3-level VSC followed by 250V/25kV .

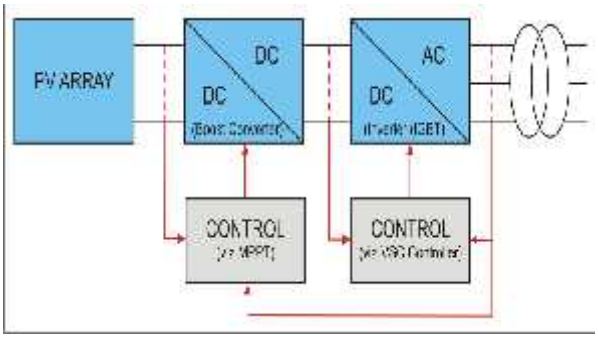

Fig.no 5 Modelling of SOLAR ENERGY SYSTEM system.Stack.

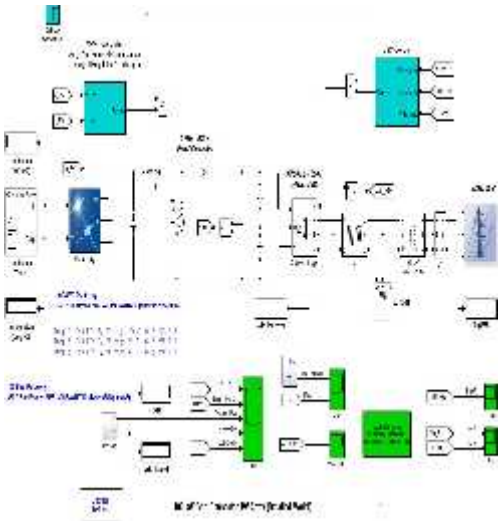

Fig.no 6. Model of MATLAB Simulink of the SOLAR ENERGY SYSTEM.

IV. RESULT

The voltage and current characteristics of SOLAR ENERGY SYSTEM module under changed irradiance had been shown in Fig.no 7. The output Current SOLAR ENERGY SYSTEM module is linearly connected with related with the amount of irradiance. The irradiance also affects the voltage of the SOLAR ENERGY SYSTEM module, but very less. Due to change in irradiance, the overall power of the SOLAR ENERGY SYSTEM module also changes . Decreasing the irradiance will reduce the overall performance of the SOLAR ENERGY SYSTEM module..

Increasing the temperature reduces the performance of the SOLAR ENERGY SYSTEM panel.

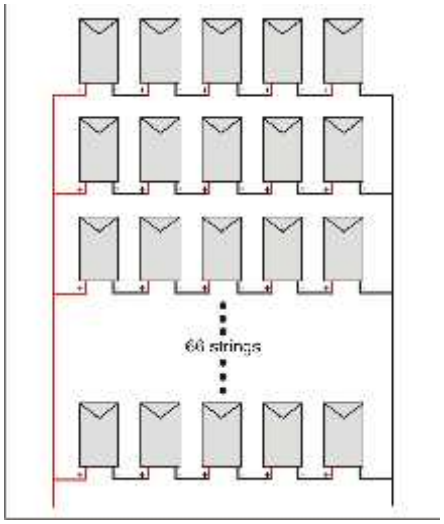

Fig.no 7 SOLAR ENERGY SYSTEM module connected in series and parallel

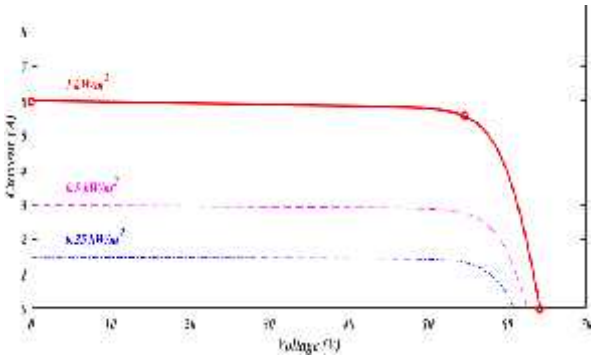

Fig.no 8. I-V Characteristics of the SOLAR ENERGY SYSTEM module under changed irradiance.

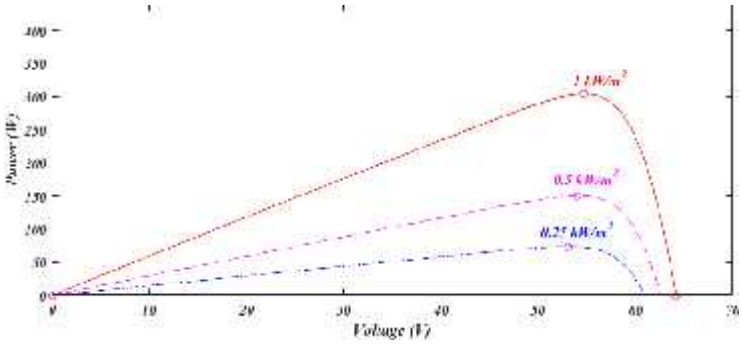

Fig.no 9. P-V Characteristics of the SOLAR ENERGY SYSTEM module under changed irradiance.

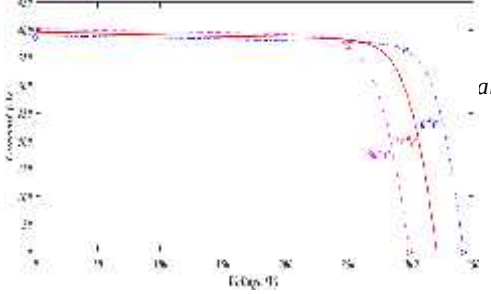

Fig.no 10. I-V Characteristics of the SOLAR ENERGY SYSTEM array under changed temperature.

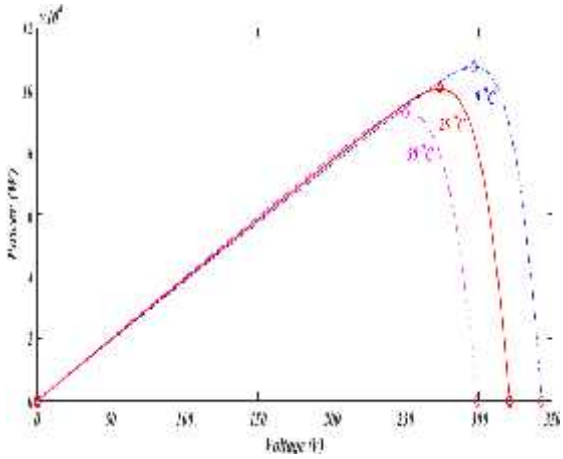

Fig.no 11. power -voltage Characteristics of the SOLAR ENERGY SYSTEM array under changed temperature.

Simulation test results are organized into four test as shown below :

Test no 1: SOLAR ENERGY SYSTEM Performance

Performance of SOLAR ENERGY SYSTEM is analyzed in this test . SOLAR ENERGY SYSTEM consists of solar array, boost- type converter inverter, filter, and it is connected to load and grid.

It has two parts –

Part (1)- The irradiance and temperature is constant, the SOLAR ENERGY SYSTEM array generates electricity delivers power to the electrical load. The simulation starts at condition (1000 W/m2 and 25 ºC) when the maximum output power (100.0 kW) can be obtained from SOLAR ENERGY SYSTEM array.

Part (2)- change in solar irradiance from 1000 W/m2 to 250 W/m2. The output from the SOLAR ENERGY SYSTEM array down to 24.3 kW. Also the temperature change from 25 ºC to 50 ºC output power of SOLAR ENERGY SYSTEM array changed from 100.0 kW to 93 kW.

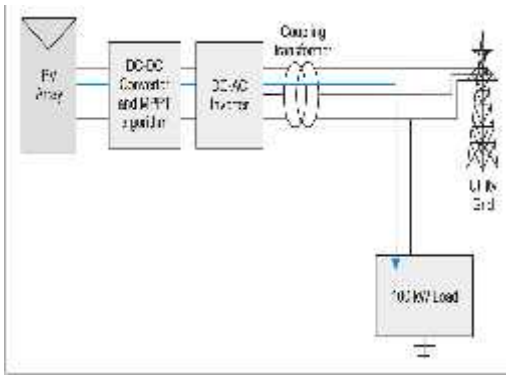

Fig.no 12 Energy flow of SOLAR ENERGY SYSTEM system.

The simulation result for Test 1 are obtained as follows:

1. Steady-state condition
2. under changed operating conditions.
3. SOLAR ENERGY SYSTEM -ESBS network.

V. CONCLUSION

As The MATLAB/Simulink is used to carry out the simulations of the SOLAR ENERGY SYSTEM -ESBS system. The design of the SOLAR ENERGY SYSTEM system model comprises the SOLAR ENERGY SYSTEM array, a boost-type DC/DC converter with a MPPT connect to a load and a power grid. The design of ESBS model comprises the battery back up.

The main objective of the twork was to investigate the effectiveness of an connected SOLAR ENERGY SYSTEM- ESBS is capable to provide a constant power to an AC load, when the conditions changes in term of irradiance and temperature. The ESBS is connected parallel with SOLAR ENERGY SYSTEM reduced the modeling,

The SOLAR ENERGY SYSTEM -ESBS system model is performed for different conditions to find out the effects in output power. The results show that when the output power of the SOLAR ENERGY SYSTEM changes, the ESBS system fulfill the required power to provide a constant power supply to the load side .

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