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PEAK LOAD DEMAND MANAGEMENT IN SUBSTATION USING RENEWABLE ENERGY SOURCES

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Abstract: *This project presents the peak load demand management in substation with My RIO Protocol. This aims in making use of renewable energy sources during the peak load times. The management of peak load in day to day life is a difficult task. The demand for power can be reduced by interfacing normal generated power with EB source. The loads in the distribution systems can be continuously monitored and controlled in the substation by using LabVIEW Software with My RIO Protocol. The energy generated by means of solar and wind is stored in the lead acid battery. The readings are monitored simultaneously When there are changes in the base load i.e., increase in peak load, the renewable energy saved in the battery is made use. The inverter is used to convert the dc voltage from the battery to ac voltage. The AC supply is being given to the distributed systems. An output of 85W is being obtained as output. The output obtained can be used for domestic loads like lights, fans, etc. The proposed project aims in minimizing the power cut, reducing the demand of fuel for the upcoming generations and also to meet up the energy crisis. Solar and wind energy is free from pollution since it does not rely on fossil fuels like other power plants.*

Key Words: Renewable Energy Sources- Solar and Wind, Peak load demand, LABVIEW, Monitoring and Controlling.

1. INTRODUCTION

Due to increase in energy consumption and depletion of fossil fuels, the renewable energy sources have become common in our daily life. Nowadays, solar and wind energy power generations are rapidly growing when compared to other renewable energy sources. In India, solar potential is high and wind power generations have the limitation of medium wind profile, low plant factor and saturation of optimal wind locations. Solar irradiation is abundant in India with 300 clear sunny days in a year. In this project, solar and wind power are utilized at the time of peak load in the distributed stations. The solar and wind energy are being stored in the battery which can be made use at the peak load times. The load management is done by using the software and it is monitored continuously.

2. RELATED WORK

There are several number of papers that have been published and some authors has discussed about the use of renewable energy resources to minimize the power crisis. The proposed method is to make use of renewable energy sources like solar and wind at the time of peak loads to minimize the power demand. We are using MY RIO protocol as a medium to monitor and control the loads in distribution systems. The desired outcome of this project is when there is increase in power demand, the renewable sources are made use. The controlling switching unit is used to on\off the renewable energy sources manually in the substation, based on energy demand. The DC energy stored in the battery is converted into AC supply by using an inverter. The output power from the inverter is used to provide

power to the distributed systems. The proposed method monitoring and controlling has to be done in LabVIEW Software by using MY RIO as the protocol. LabVIEW is mainly used for load management and we can take annual report of power demand for each state and district [1].

3. BLOCK DIAGRAM

Solar and wind energy are utilized during the peak load demand times. As usual, the EB power flows continuously to the distributed loads. The load management is done by using LabVIEW. NI myrio-1900 real time Processor is used to monitor and control. When there is change in the normal power flow i.e., increase in power demand, the renewable energy resources can be used. When the power demand goes higher than the normal level, the controller switching units are made to operate manually to on the renewable energy source which is stored in the battery. The variable energy from the solar and wind are converted into constant energy by using the charge controller and are stored in the battery. When the value goes higher, the DC energy from the battery source is being converted into AC by using an inverter. The AC supply can be given to the distributed loads in order to satisfy the power demand. Figure 1 shows the block diagram.

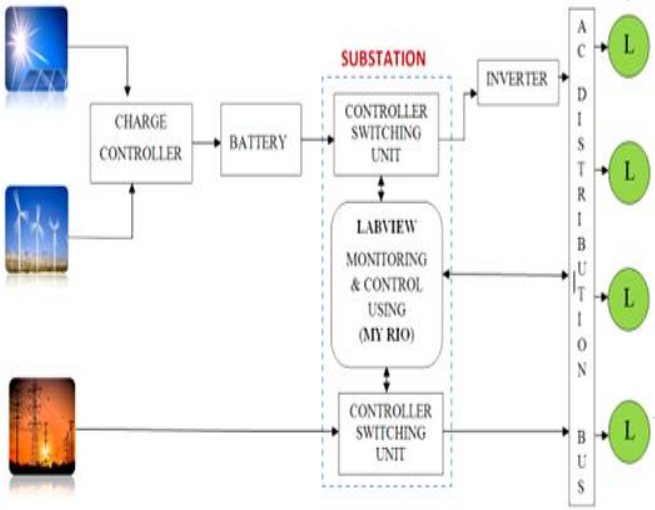

Fig -1: BLOCK DIAGRAM

4. FLOWCHART

The flowchart for the proposed method is shown in the Figure 2.The following are the necessary conditions to determine whether to use renewable energy or the energy from EB Source.

- When the value of base power is less than X, the generated power goes directly to the distribution systems.
- When the value of base power is greater than X, there occurs demand for power.

During that time, the renewable energy stored in the battery is made use. The dc energy from the battery is converted into AC power and it is given to the distributed loads.

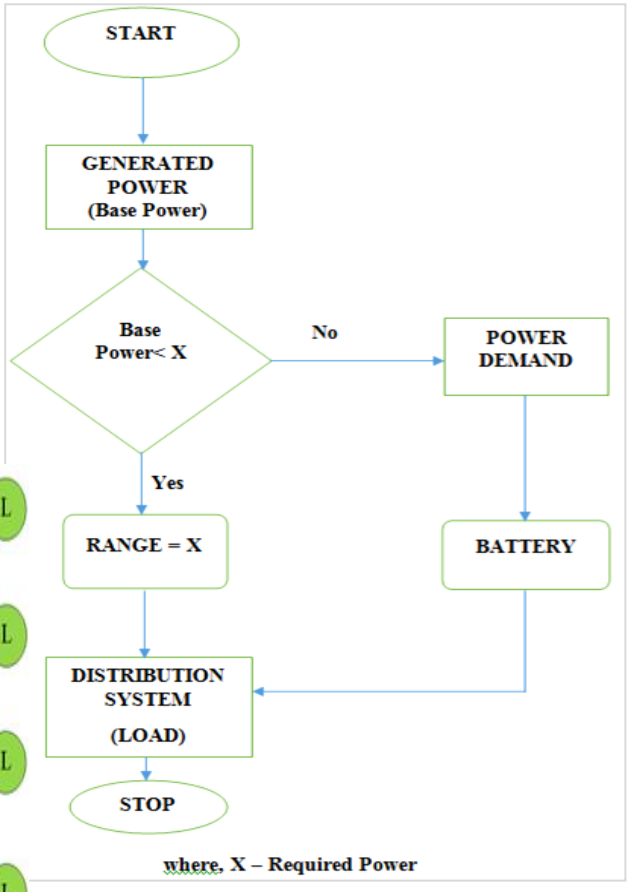

Fig -2: FLOWCHART OF PROPOSED METHOD

5. SIMULATION

The circuit is simulated using National Instrument's LabVIEW Software with MY RIO Protocol. By using this software, load management can be done continuously by monitoring and controlling the loads in the distribution systems.

5.1 SIMULATION OF SOLAR WITH BATTERY

Figure 3 & 4 shows the Simulation circuit and output for solar panel with Charge Controller. The Solar Panel with simulation is validated under Multisim Software. This circuit contains Solar panel, Voltage regulator, filter circuits which is connected to the load. DC Input voltage of 35V irradiation is given to Solar Panel. Solar panel radiates the maximum voltage and connects to the Charge Controller. Charge Controller regulates the voltage and energy is stored in the battery.

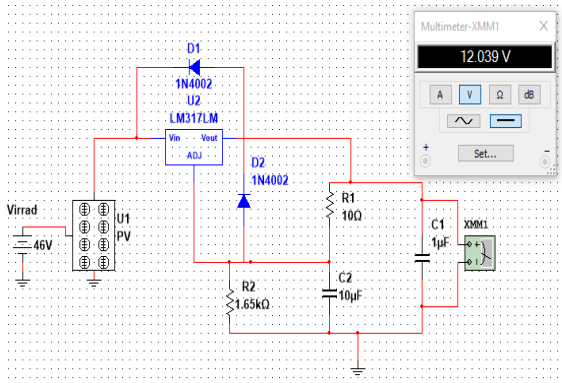

Fig -3: SIMULATION CIRCUIT

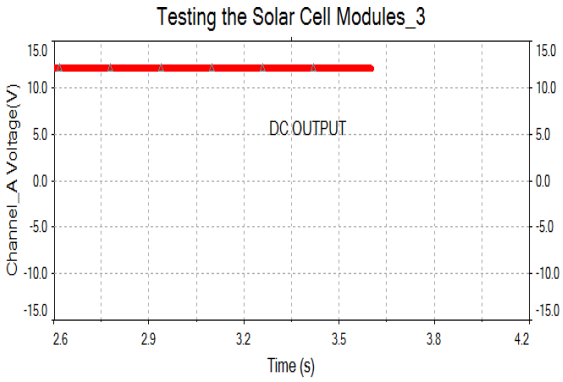

Fig -4: SIMULATION OUTPUT

5.2 SIMULATION OF INVERTER

At the time of power demand, the energy stored in the battery is made use. The monitoring and controlling is done continuously. The controller switching units are turned on manually in the substation and the energy stored in the battery is converted into AC by using an inverter. The simulation is done in the LabVIEW Software. The AC Output obtained from the inverter is given to various loads such as domestic loads, industrial loads, commercial loads, traction loads, etc. Figure 5 & 6 shows the Simulation circuit and output of the Inverter.

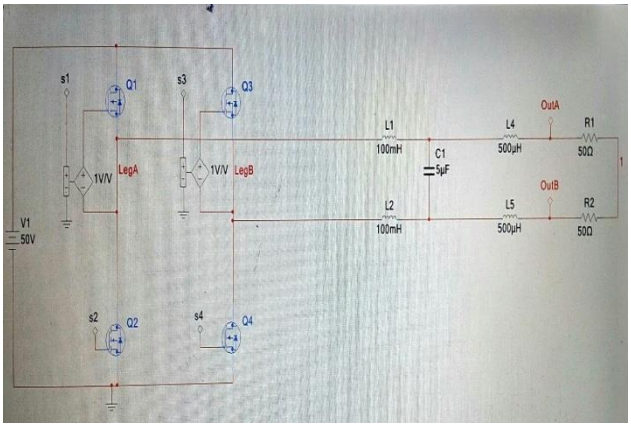

Fig -5: SIMULATION CIRCUIT

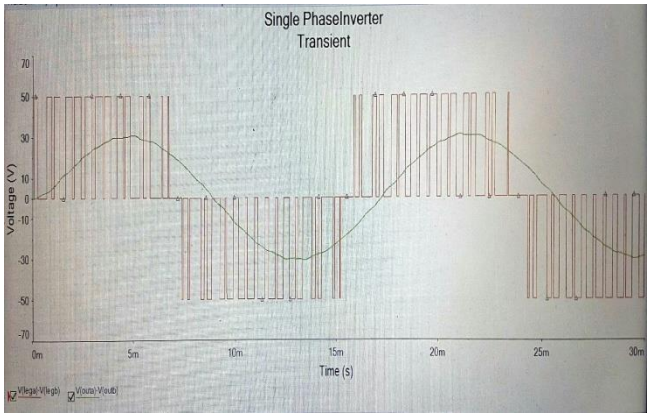

Fig -6: SIMULATION OUTPUT

6. HARDWARE RESULTS

The energy is generated by means of renewable energy sources such as solar and wind. The energy generated from the solar panel is 25W. The voltage at maximum power is 21.5V. Similarly, the energy generated from the wind is 20W. The voltage at maximum power is 12V. The variable voltage from the solar and wind is given to the charge controller. The MyRIO is used as a protocol. The variable voltage is given to the voltage divider circuit since the My RIO kit requires an input of 5V. The hardware output is viewed. The solar panel circuit and output is shown in the Figure 7 & 8.

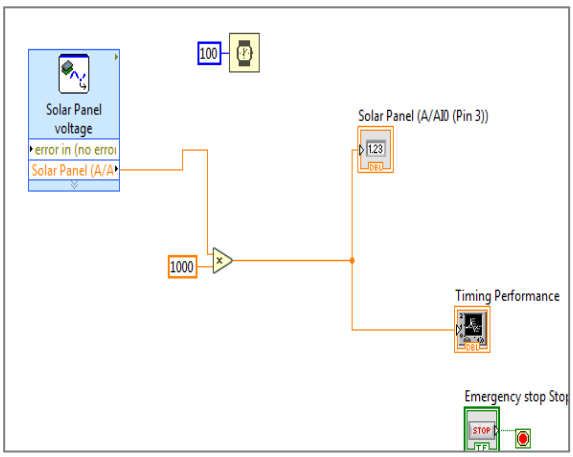

Fig -7: Solar Panel Circuit

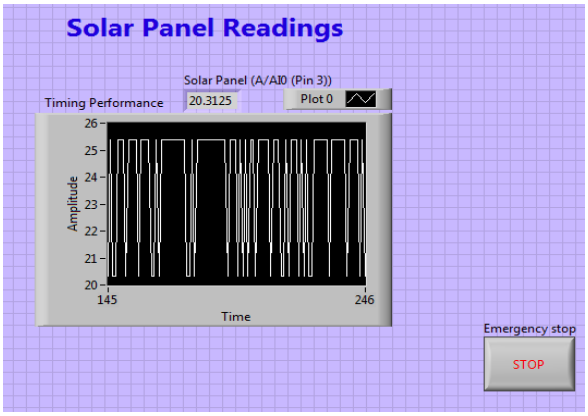

Fig -8: Solar Panel Output

The solar panel output is obtained in the MyRIO. The DC energy is stored in the battery. The solar panel readings are being given the battery. The circuit of battery along with the solar panel is shown in the Figure 9.

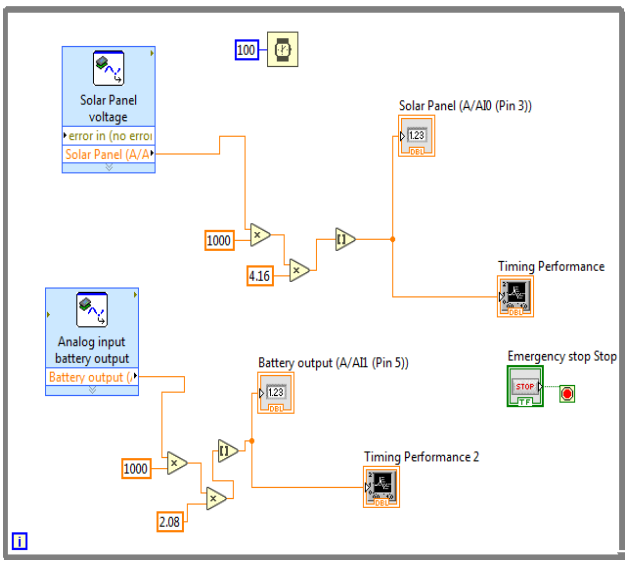

Fig -9: Solar Panel Circuit with Battery

The solar panel output of 25W is given to MyRIO. The battery used here is lead acid battery to produce a output of 13V. The output of the battery is connected to the MyRIO Port. The battery performance when connected to the solar panel is shown in the Figure 10. The output of 13V is obtained from the battery.

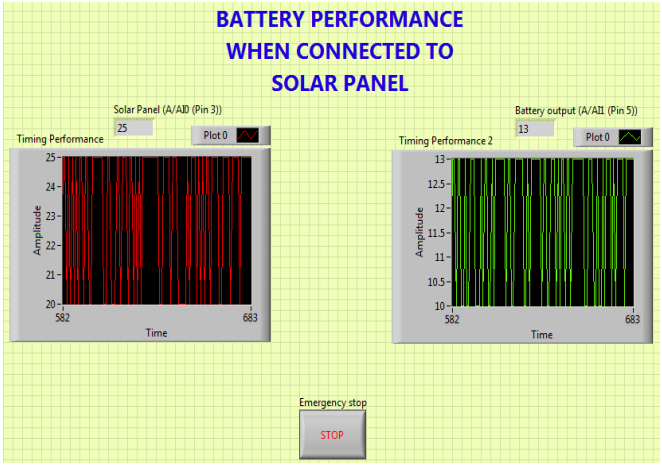

Fig -10: Solar Panel Circuit with Battery

The dc energy is stored in the battery. When there is peak in the energy demand, the energy stored in the battery is made use. The base load power is given to the distributed systems as usual. The proposed method is made efficient only when there are changes in the base load i.e., the increase in peak load. The load management is done continuously. The readings in the solar panel are monitored simultaneously. The inverter is used to convert the dc voltage from the battery to ac voltage. The AC supply is being given to the distributed system. An output of 85W is being obtained as output. The output obtained can be used for domestic loads like lights, fans, etc.

The renewable energy stored is utilized to provide energy to the domestic appliances during the peak load times. The hardware image of the proposed method with the energy utilized by the load is shown in the Figure 11.

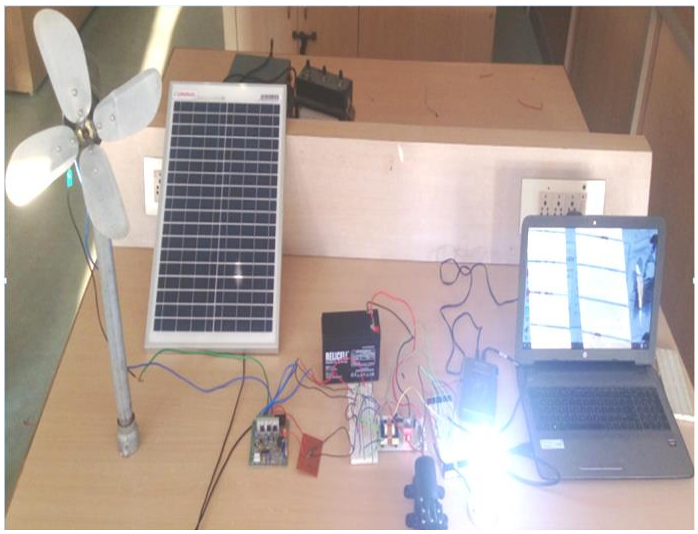

Fig -9: Hardware Image

7. CONCLUSION

Peak load demand management in the substation is simulated by using LabVIEW software with MY RIO Protocol. This method would be a best alternative to minimize the power crisis and to save the non-renewable energy sources for the future generations. In simulation part, solar panel is simulated by using Multisim software. The solar panel 12V output is stored by battery. Load Management is done continuously by monitoring and controlling the loads by using LabVIEW. The controller switching units are turned on manually when there is peak demand. In the proposed method, when there is peak demand the energy stored in the battery is converted into AC by using inverter. The simulation of the inverter is done in the LabVIEW software. The hardware results are obtained with MyRIO Protocol. The results obtained are used to provide energy to the domestic loads. The hardware is implemented and the results were analyzed successfully.

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