Power quality issues in grid integration of solar energy system

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Abstract: - Integration technology has become important due to the world's energy requirements which imposed significant need for different methods by which energy is produced. Integration of solar energy into non- renewable sources is important as it reduces the rates of consuming of non-renewable resources. With the dual goal of expanding utility scale penetration and addressing new challenges connecting large scale solar installations in higher penetrations to the electric grid. Our project outlines power quality issues and challenges encountered during the grid integration of solar photovoltaic energy systems.

Key Words: — ***Grid integration, Solar photovoltaic cell, Renewable resources.***

I. INTRODUCTION

The Internet of Things (IoT) describes the network of physical objects— "things"—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. The Internet of Things is transforming our physical world into a complex and dynamic system of connected devices on an unprecedented scale. IoT is creating a giant network where all the devices are connected to each other and providing them with the capability to interact with each other. This is driving the automation to a next level where devices will communicate with each other and make decisions on their own without any human interventions. As per the Cisco report, IoT will generate $14.4 trillion in value across all industries in the next decade.

A. Overview

We require electricity for operating almost all the appliances we use in our day-to-day life. So, it has become an indispensable part of our life. Now there are two ways to produce electricity first by using on- renewable sources of energy and second by renewable sources of energy.

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With increase in population and advancement of technology, consumption of electricity is also increasing exponentially. Simultaneously, we have to increase the production of electricity also in order to meet the demands of growing population. The biggest disadvantage with the usage of conventional resources is that their usage causes pollution due to the production of various pollutants like ash in case of a coal power plant, smoke in case of diesel power plant, radioactive material in case of nuclear power plant. Maintaining these pollutants is not an easy task and it also requires a lot of money. So, we have to find some other methods to produce electricity. The best possible way is by using non-conventional sources of energy. Out of all the possible options available in non-conventional sources of energy, solar and wind are the best methods. As tidal energy can be used only on the sea shores, ocean thermal energy can used in the middle of the sea and its setup is also very difficult. While solar are available in all the areas of the world and setting up their power plant is also not a cumbersome task. We are implementing a system in that the load with interfaced with GRID and renewable energy based inverter.

B. Problem statement

"To propose a system to implement and to mitigate the power quality problems, issues for integration of Distributed Energy system to the grid, considering solar PV system."

C. Objectives

The primary objective of the project is to utilize the available renewable energy in the nature without causing any harmful effects to the human lives and environment. The main objectives of the project include: Generate power from solar system. Store generated power in Battery and convert in AC for load. Monitor and Display in LCD about power quality issue.

D. Existing system

In case of irrigation load the load is fed during the night time or off-peak load time and this is fed by conventional grid. On other hand power generated by RES like solar PV is generated during day time so we can use this power for irrigation purposes instead of storing the energy for later time which increases the cost of the overall system. Using the solar water pumping for irrigation gives very high efficiency approx. 80% to 90% and the cost of solar water.

Pumping is much lesser than the induction motor pumping type. In large solar PV plant output power is fluctuating during the whole day and this power is fed to the grid and continuously fluctuating power gives rise to the security concern to the grid for making stable grid. Solar PV plant owner have to install the different type of storage system which gives additional cost to the plant owner. Once the storage system is fully charged then this storage element gives no profit to the system owner. Therefore, solar based water pumping system may be installed instead of storage system. The major disadvantages are harmonics, slow response, low reliable, poor voltage and frequency control.

E. Proposed system

Classification of various Power Quality Issues used by different researchers has been done and put for reference. Application of various techniques as applied to mitigate the different Power Quality problems is also presented for consideration. Power Electronics interface not only plays a very important role in efficient integration of solar energy system but also to its effects on the power-system operation especially where the renewable energy source constitutes a significant part of the total system capacity. Electricity generation using renewable resources is often taking place in small scale due to disperse nature of the recourses.

The size of these generators typically varies from a few hundreds of kilowatts to several megawatts. The types of grid interfaces used with Photovoltaics' Power electronics converter & Induction generator/ Power electronics converter. In our project, recent ongoing trends in grid integration of solar energy system is presented. Renewable Energy systems.

F. Scope

Energy from Solar for power generation is a promising solution pleasing the demands of both the rural and urban population. Utilizing the renewable energy can overcome several issues in the environment like environmental pollution, degradation of fossil fuels leading to global warming can be reduced therefore, and the ecological balance and climatic conditions can be maintained. We can supply to GRID also, in case our consumption less and generation is more. Whenever we are using GRID and renewable power the power quality is main point. So in this project we are also monitoring different power quality parameters**.**

II. LITERATURE SURVEY

Bharat Raj Singh1, Bal Krishna Dubey, International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 01.

Developing hybrid systems is one of the most convenient and effective solution for producing electricity as compared to non-renewable energy resources. It is not only less costly but also it does not cause any harm to the environment. Another thing is that it can be used to generate electricity in hilly areas, where it is quite difficult to transmit electricity by conventional methods. Depending on the requirement its setup can be decided. All the people in this world should be motivated to use non-conventional resources to produce electricity in order to make them self-reliable to some extent. Long life span, less maintenance are some of its plus point. It just requires some high initial investment. Shashti Layyar, Tushar Saini, International Journal of Engineering and Technical Research (IJETR) ISSN: 2321-0869 (O) 2454-4698 (P) Volume-8, Issue-7.

This paper presents solar and wind hybrid energy system with battery storage along with AC mains supply. This, configuration allows the three sources to the battery as well as supply the load separately or simultaneously depending on the availability of the energy sources. In many rural area of India, electricity has not reached their home yet as well as many people face load shedding problem. A hybrid design of battery charging system and its implementation has been explained in this paper. Besides AC mains supply charging, solar PV, wind energy also charges the battery whenever it is available through a charge controller. The main objective of this paper is to assess the feasibility and economic viability of utilizing hybrid Solar–Wind– battery based standalone power supply systems to meet the load requirements. This paper proposes a unique standalone

hybrid power generation system, applying advanced power control techniques fed by four power sources are wind power, solar power, storage battery and diesel engine generator, and which is not connected to a commercial power system. This electrical power can utilize for various purpose.

Generation of electricity will be takes place at affordable cost. This paper deals with the generation of electricity by using two sources combine which leads to generate electricity with affordable cost without damaging the nature balance. Ashish S. Ingole, International Journal of Scientific and Research Publications, Volume 5, Issue 3, March 2015 1 ISSN 2250-3153 This paper deals with the generation of electricity by using two sources combine which leads to generate electricity with affordable cost without damaging the nature balance Basically this system involves the integration of two energy system that will give continuous power. Solar panels are used for converting solar energy and wind turbines are used for converting wind energy into electricity.

III. METHODOLOGY

We are using solar panel here for generate the power using sun light. After generate the power solar panel pass send to DC-to-DC converter and DC to DC converter will make it stable output. After this section the Energy will get store in battery bank. This battery stored energy will be connected with inverter section and inverter section we are using here for converter DC into 220-volt AC.

We are using and interfacing the GRID supply also using Relay module. Sensor will provide information about renewable power and based on that information the relay will get trigger automatically and load will get switch from renewable power to GRID and GRID to renewable power automatically. The other sensor also interfaced here for different parameter reading. Sensor will read information and will send to microcontroller. Microcontroller will process data and display in 16X2 LCD display.

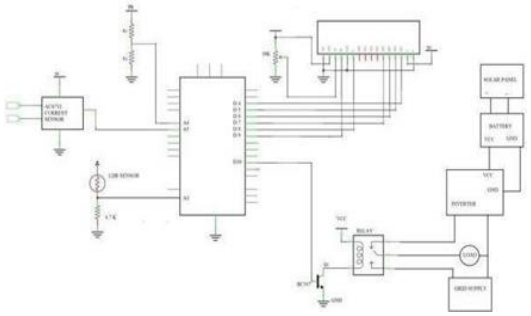

Fig.1. Circuit Diagram

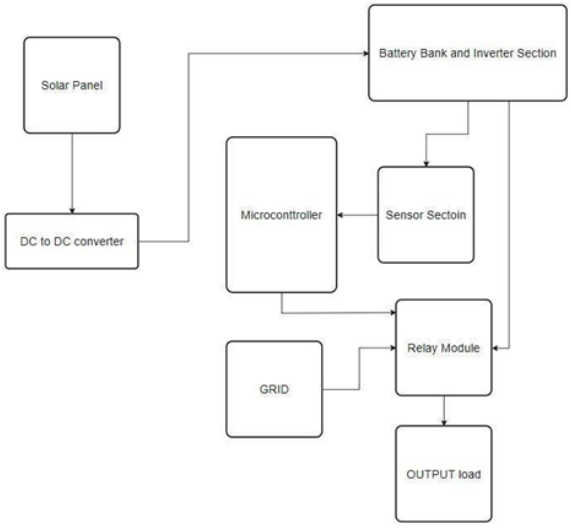

Fig.2. Block Diagram

IV. WORKING

To begin with the solar panel is connected to the rectifier where it allows current in only one direction. Then the connection goes to IN 4007 DC to DC converter and further stable DC output goes to battery The battery output goes to two section one is voltage sensor and other one is inverter section. In voltage sensor the voltage is read and future information goes to Atmega 328p microcontroller. And the ACS 712 current sensor is also sends in information to the microcontroller Now in inverter section 12v DC is converted to 12v AC and output of inverter section goes to step up transformer where it is stepped up to 220v AC We have three relays in total one relay is connected to the inverter section for switching. The other two relays are used to automatically switching from the solar power and the grid power. The output from the two relays is connected to the load.

V. RESULT

This project we are implementing for power quality monitoring of grid and solar system. This solar panel will convert sun light energy into electric energy. We are using DC to DC converter in this implementation for make control the generated output of solar panel. So, the outcome this section output will be stable and for convert into in AC we are using inverter section.

After adding inverter section in our implementation, we will able to run AC load. Inside GRID we are interfacing sensor for reading parameter of grid like voltage sensor, current sensor

and frequency sensor. Based on Real time GRID condition this sensor will able to read information from GRID. Based on sensor information microcontroller will process this data and GRID and Solar Source will get interchange trigger the relay switch automatically based on sun availability and sensor information. So, finally user will get continuously output without any interrupt.

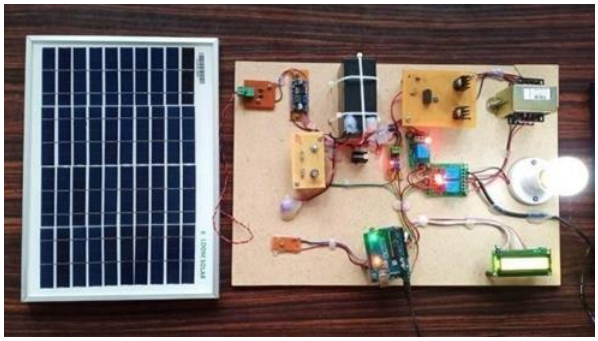

Fig.3. Final Model

A. Output

Fig.4. Current Measure

Fig.5. Voltage Measure

VI. CONCLUSION

Integrating PV system to the grid allows uninterrupted power supply, one of the major applications for PV panels is on roofs and facades, PV should also be considered as a building material in itself, architects and the building industry are urged to integrate PV into their designs rather than making PV a haphazard add-on and highlighting advantages of grid integrated solar system. Finally, Research and Development in the grid integration of solar PV system is expected to play a major role in meeting the impending energy crisis.

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