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An Approach to Design a Smart Grid Tied System with Increased Efficiency and Reduction of System Complexity for Solar Power

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Abstract: ***Energy is vital for the progress of a nation and it has to be con-served in a more efficient manner and reduced system complexity. In this paper we proposed a design of a smart grid system without storage device. This system is capable to feed solar energy to power grid when grid power is available and backup the on-site load as well when the grid power is unavailable. The total system is controlled with the help of some the sensors , converter and a micro-controller. As a whole a significant reduction in the system costs and efficient system performance can be realized.***
Keywords: Relay, PV System ,Net Metering, Off Grid System, Grid Tied System.

I. INTRODUCTION

Smart Grid technology is digital technology which have provide effective monitoring,control and distribution of electric power to the consumer via two way digital communication. Power systems are fundamentally reliant on control, communications, and computation for ensuring stable, reliable, efficient operations

This system is capable to feed solar energy to the utili-ty power grid when grid power is available and backup the on-site load as well when the grid power is unavailable. The Smart Grid will be characterized by a two-way flow of electricity and information to create an automated, widely distributed energy delivery network. It incorporates into the grid the benefits of distributed computing and communications to deliver real-time information and enable the near instantaneous balance of supply and demand at the device level. Smart grid improvements will also integrate with intermittent energy sources that pose a challenge to the current system, like wind and solar power. New technologies will encourage consumers to invest in distributed generation,‖ or locally-generated power sources, such as solar panels on a home, to supplement their power needs.

Making such investments worthwhile to consumers also requires regulatory change to allow different pricing contracts. For example, a home could be powered by its own solar energy during the day, and the consumer could sell any16extra energy produced by his or her panels back to the larger grid (this contract option is called―net metering‖).

Off Grid System-In this system PV system generats power this power is stored in battery via power conditionar then it can be used as a dc power directly or used as ac power via passing it through inverter but problem with the system is it require large battery and bulk inverter if it is used as dc or ac power and other disadvantage of the system is 30% power loss because it is stored in a battery and transmission losses.

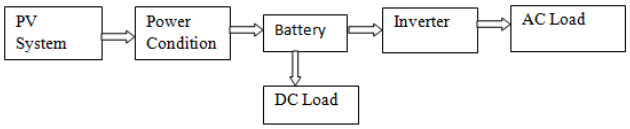

Fig -1 Off Grid System

II. PROPOSED MATHEDOLOGY

Grid Tied System-A newly designed grid-tied PV system is shown in Fig.2. Here the grid-tied PV system is consists of an internal processing junction box with its three end point. These are solar power, utility power grid and Residential load. Here this system al-ways tries to feed the solar power to the utility power grid. At the same time the residential load will consume the power from the utility power grid. But if the grid power is unavaila-ble then the residential load demand will be supplied by the solar power.

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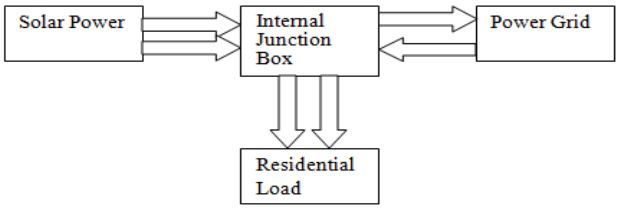


Fig -2 Grid Tied System

III. PRINCIPLE OF WORKING

If power is available in the grid The operation of the system is completely depends upon the two relay and their working method (normally Open and normally Closed).First solar pannel is produces solar power then it is well conditioned by various power conditioners. The power produced by power conditioner is then supplied to utility grid this can be done when relay 1 is in normally opened mode and at the same time residential loads will be supplied by utility grid if relay 2 is normally closed mode and power is available in grid. If power is not available in grid residetial loads will be supplied by directly from the solar pannel by normally closed of relay 1 and normally opened by ralay 2. Again if there is any overloading situation due to the residential load the relay 1 will be operate to normally closed the connection and ensure the safety of the system. At the same time it will generate a signal to the consumer for reducing the load. This is how the system will operate with a most efficient manner.

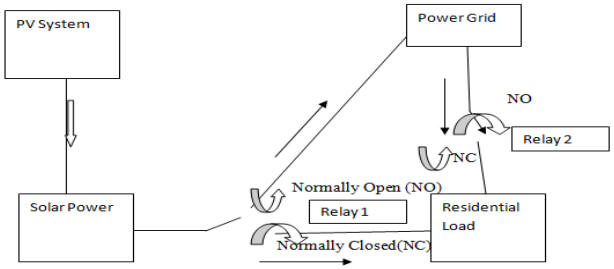
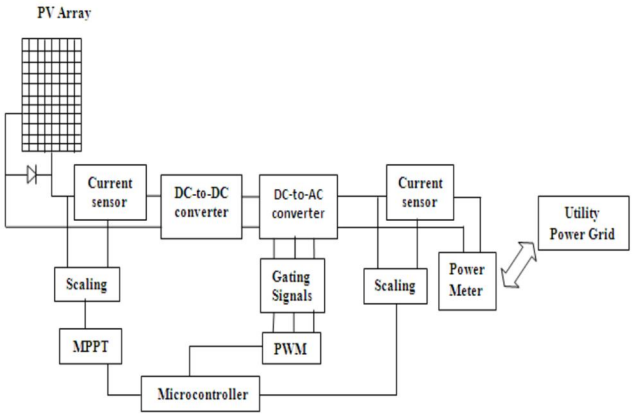


Fig-3 Principle of working by using two relay

IV. CONTROL SYSTEM OF METHEDOLOGY

The system block diagram consists of solar PV array, MPPT charge controller, DC to DC converter, High efficient Grid Tie inverter, AC three phase synchronizer, Microcontroller, DC power measuring device, CT, PT, ADC (Analogue to Digital converter), Relays and Metering device. We can describe all those elements in three parts. The power output of a PV array depends on the voltage level where it operates under a given condition of irradiance and cell-surface temperature. For efficient operation, a PV array should operate near at the peak point of. Various Maximum Power Tracking (MPPT) techniques have been proposed. The MPPT device of the block diagram in always tries to stable the PV output voltage and also ensure the maximum power output of the PV system.



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The inverter is the heart of the PV system and is the focus of all utility-interconnection. An inverter is a device that converts direct current to alternating current. The PV inverters are classified into two categories, Stand Alone Type and Synchronous Grid Tie Type. Synchronous inverter is a special type of inverter which is specially designed for solar panel. This type of inverter always collect the data of voltage and frequency of utility power grid by a AC synchronizer and synchronize the inverter output with the utility power grid. So that, it is possible to install a medium to large-size PV array.

V. CONCLUSION

This paper is proposed a methodology which can identify the benefit of designing a user (utility and industry) friendly system that increases the efficiency and reliability by promoting two-way communication to optimally exchange the available electricity with the help of smart grid technologies. System lambda which is the minimum cost of producing the next megawatt hour by a typical utility is determined. Utility and Industry operations, and them earning of Integrated Industrial Electric System. Brief notes on Smart Grid, its Technologies and the anticipated saving with the use of these technologies is presented.

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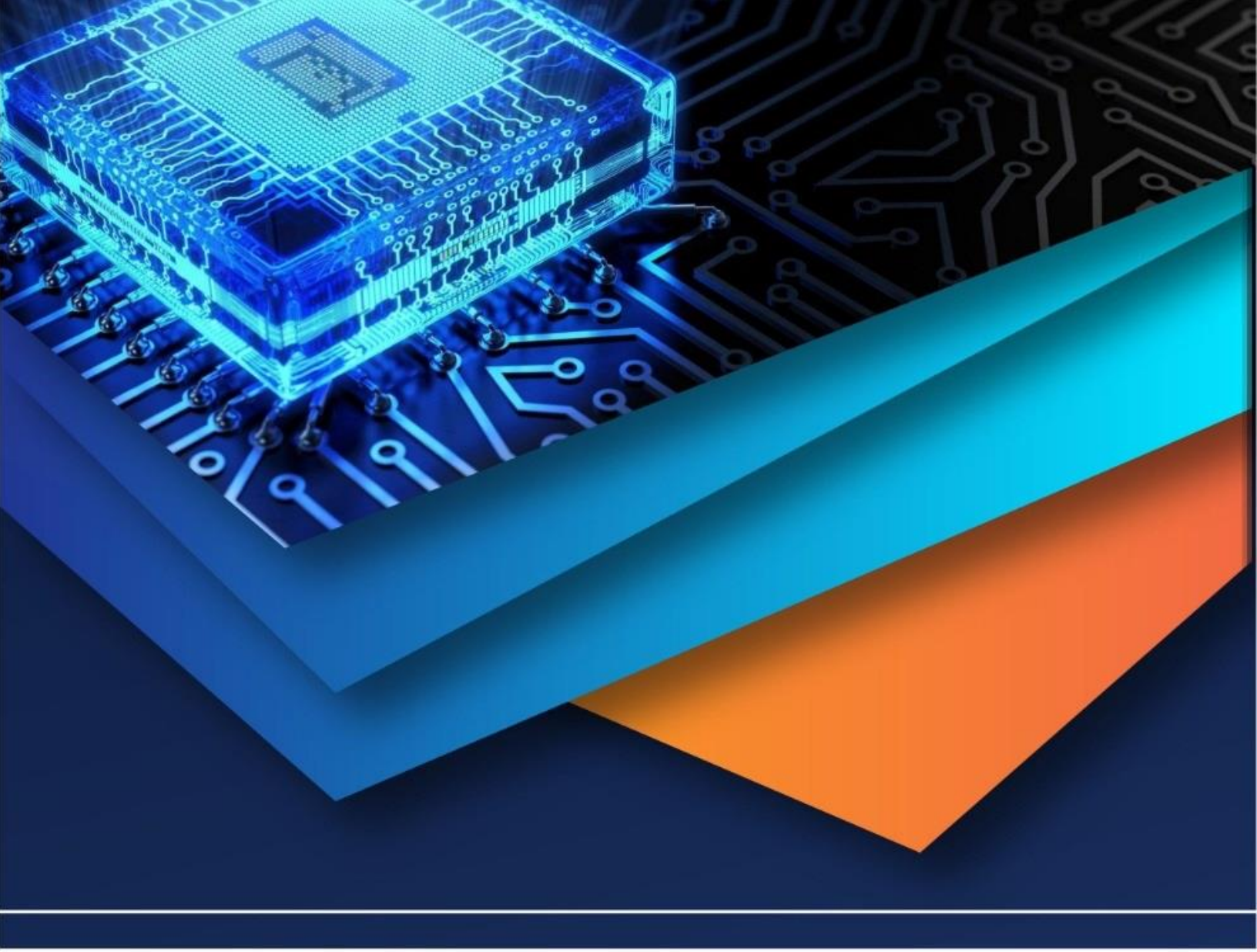

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