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A Cost Efficient Solar Home Power System - A Substitute Solution

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Abstract – In the present paper, a solar (PV) home power system integrating with conservative DG sets has been proposed for a grid deprived areas for rural India. The main object of this paper is optimal design of a solar (PV) powered power supply system to create green power and reduce the use of conventional DG sets resulting in abridged cost of operation and preservation.

Keywords: - Power supply; Photovoltaic (PV); Solar Hybrid System

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INTRODUCTION

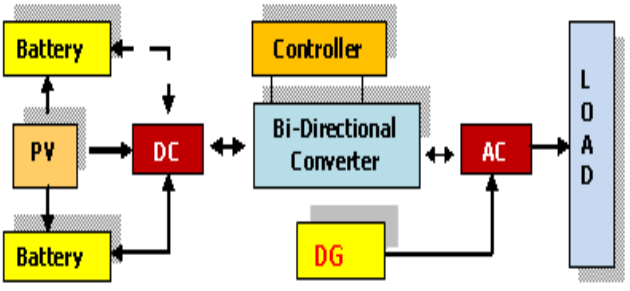
Energy is the basic need of human being life and with the rapid growth of population; its demand is increasing day by day in urban as well as in rural sectors of the nation. The people living in the remote rural area of Indian villages are still disadvantaged of electrical supply from the conventional grid source. The Diesel Generator (DG) sets are being used by rural masses as an alternative source of power but its operation is limited due to high cost of fuel and high preservation. This forces the scientist and engineers to look for non-conventional sources of energy which can easily be made available free of cost or at negligible cost and at the same time its conversion technology to manufacture electricity must be simple and cost effective. Many stand- alone and hybrid devices using renewable energy sources like solar photovoltaic, wind, biomass, biogas and / or mini /micro hydro has been developed in the past and reported by many authors [1, 2, 3, 5, 6] but their availability, complexity in design & operational feature, difficulty in getting the system or its spare parts and shortage of trained manpower have resulted in less fame among rural masses. In the present study, a solar (PV) power system has been proposed with simple technology which can labor as a separate device or as a primary source of hybrid power supply system (i.e. integrating PV system with DG set). The simple skill of hybrid power supply system offers the following benefits:

- Flexibility of technology by rural masses
- Improved dependability
- Reduced emissions of hazardous gasses and contamination
- Provide continuous power supply
- Increased operational life
- Reduced cost and well-organized use of power

SYSTEM CONFIGURATION AND OPERATION

The solar (PV) home power system consists of the following:

- PV module
- Battery
- Bi-directional Power Converter
- Controller unit
- DG set as a standby source



The primary source of power supply to rural houses is the PV power. Load power is managed either by PV system or stand by another DG source. The power converter unit of the PV system takes the low 12V DC voltage input from PV energy source, stored in battery, as shown in Figure 2 and convert it into usable 220VAC, 50Hz output with the help of a centre tapped transformer (Tr) based push-pull configured

BJT/MOSFET bi- directional converter(inverter) circuit. The controller circuit generates PWM pulses to The primary source of power supply to rural houses is the PV power. Load power is managed either by PV system or stand by option DG source. The power converter unit of the PV system takes the low 12V DC voltage input from PV energy source, stored in battery, as shown in and convert it into usable 220VAC, 50Hz output with the help of a centre tapped transformer (Tr) based push-pull configured BJT/MOSFET bi-directional converter(inverter) circuit. The controller circuit generates PWM pulses to directional feature AC power is transferred to DC power which charges the battery under low charged circumstance.

MODE OF SYSTEM OPERATION

- **During Day Time**

Solar is the primary choice and only starting place of energy while the generator is off. Solar (PV) DC power, sharing with one of the pre stored charged battery, is rehabilitated into AC power by converter for the load (s) and at the same time charges the other battery.

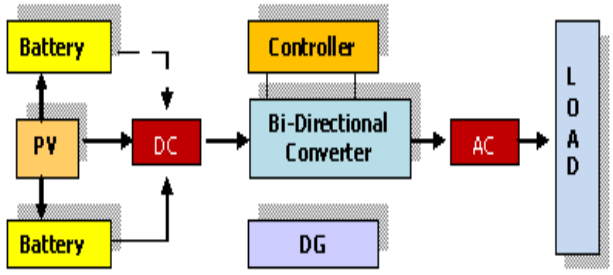


Figure - Operation of System during daytime

INVERTER DESIGN

The solar inverter is a critical component of an entire solar energy system. It performs the conversion of the variable DC output of the PV cells into a clean sinusoidal 50Hz [1] current suitable for supplying the commercial electrical grid or local electrical network. Inverters are usually sized according to the maximum required continuous power output. Most inverters are capable of handling three to six times more power than their rated size for short periods of time in order to accommodate surge currents which occur when starting a motor .An inverter needs to be sized to cover peak or non-surge peak load [1]. Sizing of the inverter in hybrid power supply system Inverter sizing consists in calculating the number of inverters needed for the PV system. In small hybrid systems such as these, one inverter is enough to supply the power but for a larger hybrid system more inverters may be needed. When you select an inverter you must have a DC voltage equal to your inverter DC voltage and have an AC voltage and frequency equal to your home and utility values [2].

POWER SUPPLY FOR POWER RELIABILITY

Power supply from the national grid is inefficient and unreliable, hence the need to provide alternative source of power, [3]. Electrical power supply from renewable sources is advantageous as the increasing Electrical demand is a scientific contribution to the peak demand on the grid. As individuals and companies generate their power through renewable energy, the stress on the grid is reduced. However, there is an ongoing interest in the possibility of making wider use of renewable energy, particularly in homes, offices and industries, for the purpose of lighting, heating and powering of appliances. In most rural and sub-urban regions do not have access to electricity supply. Where the Electrical energy is available, it is not reliable; hence inhabitants resort to other forms of energy such as wood, paraffin, and diesel generators, which pollute the environment and cause harm to man and plants [4].

CONCLUSIONS

Solar (PV) power system has a great potential in future as one of renewable energy technologies for off-grid power generation. The hybrid technology, integrating PV with DG, offers solution to off-grid power generation. The easy installation and maintenance free operational feature of the hybrid system created more popularity among the rural masses.

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