

Efficient way of using Solar System to the Households' Normal Applications

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Abstract

This paper discusses about how a solar cell can be used efficiently and effectively for normal home usages such as: pumping water to the overhead tank and other home electrical goods. Efficient and effective usage of solar energy is analyzed by focusing on (i) minimizing the losses in the complete process of converting the solar energy into electrical energy, (ii) maximizing the power extraction from the solar cell by implementing the Maximum Power Point Traction (MPPT) controller and (iii) end terminal usage is also controlled based on the status of available energy. As a result it was found that the implemented system is the best for electrifying the households using the solar system. This research paper will be organized with the following study information: (i) literature review on existing solar application systems, (ii) MPPT controller to extract maximum power out of the available power from the solar cells, (iii) study on battery charging controller applied in solar power systems, (iv) application study of a solar system to pump water to the overhead tank, (v) efficient use of pump load to base on status of the energy in the battery storage system. The simulation study is carried out using PSCAD/EMTDC simulation package. Here a MPPT control is implemented to study the improvement on the solar system's performance. A DC-DC converter (0-36 varying voltage at open circuited solar terminals to 12 fixed voltage at battery terminals) is modeled to match the solar output and battery bank and a DC-AC inverter is used to provide 230 V AC supply to the home circuits. A supervisory control is developed in this paper to detect the overhead tank water level to operate the water pump with pre-defined operational strategies. Further a facility is also added as a supervisory control to indicate level of energy available in the system in percentage. This will help for smart operations of the house holders to effectively use the energy with pre-plan. Finally a practically implemented solar system at a house hold application is studied. Here one of the houses, which were already using the solar system, is taken for study. The proposed supervisory control system is embedded with normal operation of the implemented solar system in the house. The performance of the solar system with proposed modifications has proven the effective and efficient operation of the house hold solar system.

In conclusion in this research; literature review, studies in simulation and practically implemented system is discussed. A control including supervisory observation on stage of the energy is presented. It is confirmed that the solar system can be made effectively and efficiently through supervisory controls implemented embedded to the existing solar technologies. This also allows smart operations if the house owners required. Every year, it can be observed that the cost of the solar system is decreasing. This also increases the usage of solar system. Therefore the proposed supervisory control will help the households' appliance to increase the economic viability on using solar systems.