DESIGN AND DEVELOPMENT OF SOLAR PV POWER SOURCE FOR RO SYSTEM

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Introduction:
A Reverse Osmosis Water purification System incorporates a high torque low speed DC motor to pump water. Single phase AC supply is converted to DC to run the motor. Frequent power cuts due to energy crisis affect performance and efficiency of DC motor present in the purifier. Solar PV power source are viable options for conserving generating power of the grid and to use DC supply to run the DC motor of purifier. The Design and development of SPV for RO system is reliable and efficient. System deals with design of OP-Amp based DC charge controller. During non availability of sunlight automatic switching from DC to AC source takes place. Charge controller has an inbuilt battery management system which will also take care of deep discharge protection and cut off the load when battery reaches a certain level.

Objectives:
The project carried out has some objectives which are as follows:
• To use direct DC power from Solar PV Power Source to run the motor since there is continuous supply of AC power to the purifier.
• To conserve the AC energy used by the water purifier.
• To develop an efficient charge controller with automatic switching mechanism from DC to AC.

Methodology:
This section consists about the concept and design of the proposed project with circuit diagram of Charge controller and block diagram of SPV Power Source for RO System.
Charge controller mainly consists of Op amp IC 741, which has been used as a comparator. Pin #3 which is the inverting input of the IC is referenced with a fixed voltage of 4.7 V through the respective zener/ resistor network.
The other input is applied with the sensing voltage which is actually the voltage merged from the supply. As the voltage at pin 2 rises above 4.7 mark the output of the Op-amp goes low switching off the mosfet and cutting off the voltage to the battery. The mosfet is selected as per the Ah rating of the battery. The 10K preset is adjusted to set the full charge level. 22K preset is used for detecting the lower threshold of the battery. Zener diode is used to keep constant voltage across it.

Design steps of SPV for RO system and are as follows:
- Step 1: Energy estimation.
- Step 2: Electronic component selection.
- Step 3: Battery sizing.
- Step 4: SPV sizing.

Finally the determining the number of PV modules required.

**Block Diagram:**

- Op-amp based DC charge controller is used to regulate DC voltage and current from the solar PV panel.
- Charge Controller also has an inbuilt battery management system which monitors charging and discharging of battery.
- DPST switch is provided to switch from DC to AC in the absence of solar energy and vice versa.

**Results and Conclusions:**

Studies on the Energy consumption of a RO system to run the DC motor have been done to design the solar PV power source. A typical DC motor used in household purifier requires DC voltage and current of 48V and 1.2A respectively. The model is designed using four 12V 1.3A solar panels by connecting them in series. The functional block diagram and details of circuitry are presented. Battery backup is provided to drive the loads even during less sunshine hours. Smart switching mechanism for changing the supply to the load from DC to AC source in the absence of sunlight and vice versa is provided. Testing of the designed model has been carried out in EEED, BEC Bagalkot. It is observed that when the output of the panel is between 44V and 55V, the panel drives the load as well as charges the battery and in the absence of sunlight the battery discharges to run the load. LEDs are provided to indicate the type of power source being used to run the motor. Hence it resulted in saving 4.5% of energy for a family consuming 80 units per month.
Future scope:

This work can be further carried out as a future scope in order to develop a comprehensive solar power source for solar energy harvesting as follows;

- Design a SPV source to implement on large scale.
- Design a circuitry to monitor the health of the purifying membranes.
- Commercialization of the designed power pack to a product level.