“DEVELOPMENT OF ENERGY MANAGEMENT SYSTEM (EMS) FOR SOLAR PHOTOVOLTAIC POWER PLANT TO SUPPLY POWER FOR COTTAGE INDUSTRIES WITHOUT USING BATTERY BANK” (42S_BE_1473)

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INTRODUCTION

Energy has different forms and there is a formula for each one. It is important to realize that in physics today we have no knowledge about all the forms. There an urgent need to accelerate the development of advanced clean energy technologies in order to address the global challenges of energy scarcity. Solar Photovoltaic is a key technology option to realize the shift to decarbonize energy supply and it is projected to emerge as an attractive alternative energy sources in future.

India needs to focus on developing its own source of energy. Our major energy sources that is, oil and coal are imported in large quantities. Even with the development of nuclear energy, India will be dependent on other nations for fuel. To sustain economic growth India must utilize its immense potential in solar energy.

The main components of solar PV power plant are solar PV panel, charge controller, storage device, utility. In this project we mainly focus on the storage device.

PROJECT BACKGROUND

In existing solar power plants, batteries are the storage device which has many disadvantages such as Ageing-one of the major disadvantage of batteries is that they suffer from aging. It is not only time dependant but also depends on charge discharge cycles the battery has undergone. Often battery withstands 500-1000 charge discharge cycle before their capacity falls.

Protection required-batteries are not robust as some other rechargeable technologies. They require protection from being overcharged and discharged too far. In addition to this they need to have a current maintained within safe limits.

Frequent replacement-the lifespan of batteries is around 2-3 years whereas the lifespan of solar power plant lasts for many years. Frequent replacement of storage device increases the maintenance cost of the system.

Disposal of waste-the waste obtained after the usage of batteries produce toxics which are harmful to the environment. Hence disposal of the waste is difficult.

Hence introducing a new storage device which overcomes all these disadvantages is very important.
This project proposes the replacement of conventional batteries with a HYBRID ULTRA CAPACITOR.

**OBJECTIVE**

- To develop an EMS to utilize the solar PV power without a battery bank.
- To provide stand-by power supply during day times through solar panel using super capacitor for remote areas without using back-up batteries.
METHODOLOGY

BLOCK DIAGRAM

COMPONENTS USED
- Solar panel (100Wp)
- EMS
- Hybrid ultra capacitor (2500F)
- PMDC MOTOR (60W)
- Pedal controller
- Load (Sewing machine)

The solar radiations falling on the solar panel gives DC power output which is then fed to the energy management system.

EMS has three ports namely
- PV output port
- HUC port
- Load port

The main function of EMS is to control the flow of charges from source to load in an efficient way and to provide necessary protections and to ensure optimum utilization of the energy. As per the characteristics of HUC it has fast charging and discharging time. Hence the system is designed in such a way that HUC charges from the PV source and discharges through the load continuously.
The load selected here is a sewing machine any DC load can be selected as per the requirements. The main reason behind selecting this load is that it operates with frequent breaks

**RESULT**

- The motor operated continuously without any break when the input current was 5A.
- The speed observed was 2550 to 2600 rpm.
- The surge current drawn from the motor was around 10 to 14A.
- The study current drawn from the motor was 4 to 6 A.
- The current from the PV source was varying from 2A to 5A.

**CONCLUSION**

The stand-alone and decentralized solar PV system requires huge battery bank to store the energy which has lots of disadvantages. So to overcome this disadvantages a solar power system fed by a PV source with a HUC storing system is designed which reduces the operating cost, and also reduces frequent replacement of components. The super capacitor has the fastest charging time compared to all other storage devices and also guarantees a longer lifetime in terms of charge cycles and has a large range of operating temperature. The experimental results of this project conclude that when a constant supply around 5A is supplied from the PV source, the system can operate continuously without any distortion. The quality of the output can be improved by increasing the number of HUC.

**FUTURE SCOPE**

**Economic analysis**

Ways of decreasing the initial cost of the system has to be analyzed. This may be achieved by

- Decreasing the capacity and number of units of the HUC.
- Decreasing the size of the PV panel used.
Reducing the size of the system

Decreasing the size of HUC and the PV panel in turn decreases the size of the system.

Ways of decreasing the size of EMS has to be analyzed.

Increasing the operating duration

The ways of occurrence of losses has to be analyzed and rectified in order to achieve longer operating duration

Working on larger loads

The EMS which we have designed operates for a maximum power of 100W. this has to be further increased to meet larger load demands.

Working of AC load

An invertor which matches the rating of HUC has to be designed to run an AC utility.

Development of data logger

Designing a data logger makes the experimental study easier and the results will be more accurate. It also gives information about the working duration of the load with which the work analysis becomes easy