FIRST OPERATING YEAR OF PHOTOVOLTAIC BUS STOP INSTALLED AT EDUCATIONAL THAI UNIVERSITY

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ABSTRACT

This paper summarizes one year of monitoring of 560 W_P photovoltaic (PV) bus stop that to be installed at the Faculty of Engineering, Rajamangala University of Technology Thanyaburi (RMUTT), Klong 6 Thanyaburi district, Pathumthani province of Thailand. The purpose of this work is to analyze the performance of the PV system. The system has been fully monitored since May 2006 and the PV system consists of 7 silicon polycrystalline modules and a controller or regulator of BP solar # GCR 3000 including an inverter of model # 1600 watts power surge. The daily system energy yield that can be produced is about 4000 watts-hour. An average total efficiency of PV bus stop system is approximately 18 percent.

1. PV BUS STOP SYSTEM DESCRIPTION

As can be seen from Fig. 1, the 560 W_P PV bus stop system has been installed at RMUTT in Thailand. The 7 PV modules, the power rating of each module is 80 W_P, are connected in series to produce maximum current with 12 volts as nominal system voltage to supply the load for fluorescent lamps. Each lamp has power consumption of 36 watts. The total number of fluorescent lamps is 14 that to be used during night time on approximately 3 hours between 18.00 and 21.00 hours daily. The operating time has been controlled by computer programming from the controller or regulator. This PV project, the two batteries with maintenance free sealed lead acid type #DJM12120 have been mounted. The rating of voltage and ampere-hour are 12 volts and 120 ampere-hours respectively.

The design of PV module sizing is mainly based on the climatic data on inclined surface at latitude angle of Pathumthani province of Thailand and daily load demand. The PV module sizing for installation can be determined from a computer program that to be developed in this work. Accordingly, the PV modules have been mounted on the top of the structure of PV bus stop. They having a slope of angle is about 14°. This is the latitude angle of Pathumthani province of Thailand, facing to the south of a compass. The DC output from the array is transmitted to the inverter through a main switch in the inverter case.

A controller or regulator of BP solar # GCR 3000 has been mounted to control the state of charge and discharge of the battery. Maximum rating of current for this type is about 30 A. This charge control is specifically developed for charging battery powered by photovoltaic modules. It includes an LCD display that provides continuous battery storage and state of charge of the battery. Nevertheless, the controller is certainly the heart of the energy management of PV power system. This is because it controls the energy of the battery and the way it is spent on the different parts of the system. Accordingly, the design of an additional control circuit was experimentally done in the project work. Basically, the operating voltage of this system is 12 volts approximately. A solar charging controller with 30 A rated has been used. For an inverter, the AC output voltage and frequency vary continuously as a function of the irradiation.

Fig. 1 PV bus stop system operated on night time.

2. MONITORING PV BUS STOP SYSTEM DESCRIPTION

Monitoring PV bus stop system was carried out since May 2006. Some electrical parameters of the PV system were measured and were also recorded. The following parameters were measured.

(a) DC and AC both are recorded in terms of current and voltage.

(b) Daily AC energy production.

(c) Load current at full load

During the first operating year, some technical problems were occurred. Sample problems can be addressed as follows:

Firstly, the cable sizing for wiring from the output terminal of PV modules to the input terminal of the regulator was not suitable. As a result, electric insulator of the cable got damage. Then PV system was not working about one week in January 2007.

Secondly, the regulator has been changed into the new one. This is because it got a technical damage during night time load in March 2007.

Thirdly, one of two external ammeters that to be mounted on the case of control box was failure because of its malfunctions.

Referring to the system performance evaluation shown that the efficiency of the PV modules does not strongly depend on irradiance. The system efficiency in terms of an inverter and regulator are 95 and 85 percent respectively.

3. LESSONS LEARNED

- Guidelines for maintenance of system are required and should be made available in an easy to understanding way to attract social university.
- It is very important to involve the people as early as possible and to give them the opportunity to develop their own ideas.
- Typical design requirements for PV systems should be reported or be summarized and presented on the internet.
- the advantages from installation of PV systems have been asked
- the economic factor of PV systems was found to be a critical factor that has to be addressed in order to attract these people for interesting PV systems.
- the cost of PV systems has been mentioned as a major drawback for the adoption of PV in social university premises.
- The funding mechanisms available to social university are a key factor for the effective implementation of PV in this area.

4. CONCLUSION

The first PV bus stop system has been installed at RMUTT, Thailand, there are no completely serious problems for all PV modules during first operating year. Daily performance ratio of the system has been relatively high. In fact, it quite exceeds value of 0.75. An average total efficiency of PV bus stop system is approximately 18 percent. Generally, the PV system has been working very well.

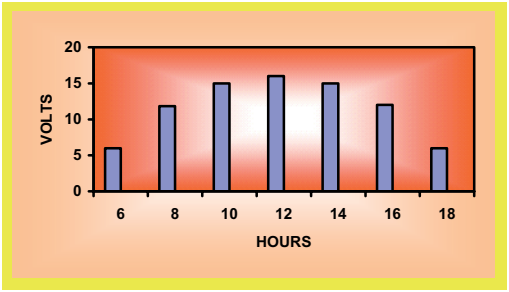

Fig. 2 Average output voltage generated by PV modules of PV bus stop system.

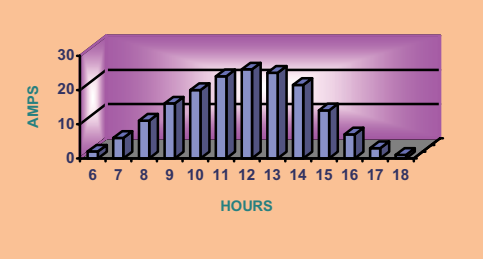

Fig. 3 Average output current generated by PV modules of PV bus stop system.

5. REFERENCES

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