Thesis Title	Performance of a PV - Generator Hybrid System at Chachoeng - Sau Wild Life Research Station
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Abstract

The PV - generator hybrid system installed at Chachoeng - Sau Wild Life Research Station is the only stand alone hybrid system in the country that has been monitored and reported. Initial assessment of renewable energy sources at the site indicates a possibility of using solar, wind and hydraulic energy for electricity generation. Solar energy was the first renewable energy source selected.

In mid 1995, prior to this research work, a PV - generator hybrid system was installed. The PV panels utilized had been previously used for about 5 year.

The system was designed to provide a daily electricity load of 21 kWh at the daily insolation of 2.84 kWh / m^2.day. It would have consisted of a 6.3 kWp PV array, a 85.6 kWh battery bank and a 3 kW diesel generator. Due to limited budgets the actual system installed had a 1.1 kWp PV array, a 30 kWh battery - bank and a 3 kW diesel generator. The system incorporated 2 inverters (2 kW and 6 kW) and 2 transformers (2 kW and 3 kW). For operation it was designed such that the PV array would provide electricity to the load until the battery voltage was lower than the inverter operating voltage, then the diesel generator would be manually started.

At the beginning of the research in mid 1996 it was decided that such operation was not appropriate. As the battery bank was undersized, energy was drawn out of the battery to levels lower than the threshold value and then was no adequate recharging of battery. This resulted in deterioration of some batteries. During this research work two different system operation methods were adopted. First, the generator would provide electricity during the peak time (18.00 - 22.00 hrs.)while the PV array took care of the remaining time. Later on, a battery charging unit was added to the diesel generator so that the generator simultaneously provided electricity to load as well as charging battery.

However, the PV system could not provide adequate electricity for the load. Some PV panels were damaged and most batteries had severely deteriorated. The PV array could not effectively charge the battery bank even when there was enough solar radiation.

It is founded that

1. the efficiency of the PV array was about 6 %. This figure is low comparing with reports on other PV systems in Thailand. This can be attributed to damaged PV panels, mismatching between panels, non optimum operating point of the PV array with respect to the battery bank, and deteriorated batteries,

2. the utilization factor of the PV array was 2.35 kWh / kWp. This value is low due to the reasons given above.

3. The battery life was shortened. This resulted from a daily depth of discharge larger than 50 % and inadequate recharging of batteries, and

4. the efficiencies of inverters and transformers were less than normal circumstances owing to their operation below ratings and high harmonics generated by inverters.

In conclusions, the PV and the battery subsystems of this hybrid system were undersized. Operation of the system prior to this research had shortened battery life. This coupled with damaged PV panel resulted in low stability and reliability of the

PV subsystem in the hybrid system. We conclude that batteries are a very important subsystem that could significantly effect the reliability of a hybrid system operation. Operation and maintenance of batteries should be adequately supervised.

Keywords : Stand Alone Hybrid System / Photovoltaic Electricity Generation / Diesel Generator