

CHAPTER 1

INTRODUCTION

1.1 Background

In the remote areas of Thailand, provision of the basic supply of water, electricity and access to telecommunications is a milestone in the national efforts to increase living standards. For this reason, National Energy Policy Office (NEPO) decided to support the dissemination of photovoltaic powered applications in the field.

According to information from Solar Energy Research and Training Center (SERT), about 92 % of Thai village were connected to the public grid in 1998 or, on the other hand, approximately 500,000 people did not have access to electricity in Thailand. The Provincial Electricity Authority of Thailand, PEA, estimates that besides all efforts in extending the public power lines into the remote villages, about 3,000 villages will remain not connected to the public grid in the near future.

In the past years, the PV activities in remote areas were concentrated mainly on three application fields: photovoltaic powered battery-charging stations for private electricity supply, photovoltaic powered telecommunication stations to operate public telephones in the villages and photovoltaic powered water pumping stations to supply the villages with water for household applications.

In 1997, the number of installed systems was estimated to be 1000 battery charging stations and 620 PV pumping stations. The fraction to the overall installed PV capacity in Thailand is given in table 1. It is important, to highlight that the mentioned activities in Thailand are planned and financed mainly through Thailand's own financial resources from within the Nation Energy Conservation and Promotion Act.

Table 1 Installed PV capacity in Thailand. (Source: Department of Energy Development and Promotion, Ministry of Science, Technology and Environment, 1999.)

Application	Installed capacity (kW)	%
PV Battery Charging	1520	34.5
Telecommunication	1510	34.3
PV Water Pumping	890	20.2
PV Village Electrification	280	6.4
Education	100	2.3
Others (Health Care, Navigation etc.)	100	2.3
Total	4400	100

A continuous ongoing project for the installation of the PV systems in table 1 in remote areas is intended despite of the difficult economic situation in Thailand. A relatively new PV application field which is assumed to grow remarkably in the next years is – beside the number of grid connected systems in the capitals – the

installation of PV hybrid systems either for village power supply or for individual houses.

The PV water pumping systems and the PV battery charging stations are, although not identical in components and technical details, standardized to a high degree in concept as well as in design. In spite of the large number of installed systems, there is little detailed knowledge about the technical reliability of these systems, their use and about their acceptance and utilization on the user's side. The information that is available depends mainly on the communication between users and the responsible departments of Civil Works (usually located in the Provincial capitals), whether a system failure has occurred or dissatisfaction by the users is recognized. A systematic monitoring of these PV systems has not been carried out up to now.

Most of the PV water pumping systems are designed for providing water for domestic use. The water is pumped from ground water sources or ponds and is stored in tanks near the center of a village. Beside this storage, the system consists of a PV array, an inverter and of the motor / pump unit.

The objective of this study is to determine the appropriateness of the system under typical working conditions and its technical performance as a model for all systems installed. The data acquired will also be a base to determine future improvements and developments for PV pumping applications in Thailand.

1.2 Objective

- 2.1 To evaluate the technical performance of PV water pumping system.
- 2.2 To find the possible technical improvements to increase system efficiency.

1.3 The place of study

The system used for this study was installed at Nong Sanuan village, Bangmulnak, Phitchit, Thailand. The data collection started on 3 October 1997 and was completed on 30 September 1998.

1.4 Scope of work

- Find the optimum technical design for PV water pumping for Nong Sanuan village, Bangmulnak, Phitchit.
- Find the efficiency of the system and each major part of the PV system, inverter system and motor/pump system by using the relationships of each parameter in the system.
- Use collected data from the MODAS data logger that started to collect on 3 October 1997 and finished 30 September 1998.
- Used collected data from 7.00 to 18.00 at 10 minute intervals.
- Find the simulation equations of the system and each part.