

Empirical Study on the Hybrid Power Generation System with Photovoltaic and Pumped Storage Hydropower

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Abstract

Solar power has huge and abundant potential all over the world and is by nature a clean energy. Its availability is barely uneven all over the world, which is a good advantage in designing onsite energy supply system. However, its output cannot be controlled to match the onsite demand and using dry cell batteries as its storage has drawbacks in durability and disposal. Technological breakthrough from this aspect is indispensable for its further diffusion.

This empirical study aimed at investigating the feasibility of hybrid power generation system with photovoltaic and pumped storage hydropower and was carried out as a project to set up an isolated power system with this hybrid generation to supply electricity to unelectrified rural villages in northern Laos, where the development of infrastructure is lagging behind even within Laos despite the existence of hydropower potential. The project, sponsored by New Energy and Industrial Technology Development Organization (NEDO) of Japan, was contracted by the Tokyo Electric Power Company from October 2003 and ended in March 2005.

There had been various challenges that faced the project team until the completion of the construction works, such as selection of an appropriate project site, logistics for transporting material and equipment to the site where road conditions are poor, training of local staff for the system's sustainable operation and maintenance after the project, considerations for environmental protection, and activities for gaining support from local villagers who had not been familiar with using electricity in their lives. Clearing these hurdles one by one, the construction works completed in January 2005, and after three month's test run, it started the commercial operation in April 2005. Since then the power station has been operated and maintained at the hand of local villagers.

Test results proved that this power supply system provides high enough quality of electricity supply (voltage and frequency). The problem of limited power supply, caused by the frequent start/stop of pumping motor with the fluctuating input from solar power generation, was mitigated to a certain extent by using water inflow from the river for additional power hydropower generation. This project also gave us the sense of proud of contributing to rural electrification, and I really wish this power station would continue supplying electricity to the villagers sustain ably.