Purpose of Research

For great utilization of renewable energy resources, many PV (Photovoltaic) systems, with high reliability and a lifetime of 20 years or more, are expected to be installed. However, daily weather changes can greatly affect their power output, and thus the problem occurs that a PV system may not be noticed. Accordingly, in order to maintain the performance of a PV system for many years, it is essential to monitor the system and analyze the monitoring data. Our group is developing a failure detection system which can monitor and diagnose a wide range of PV systems (from rooftop to mega-solar plants) at low cost and in a simple manner.

Summary of Research

To effectively diagnose a PV system, its power output and the energy input (solar irradiance) must be monitored. However, an on-site pyranometer is rarely installed in a typical rooftop PV system. We have developed and are using a Web-based self-diagnosis support system, which diagnose PV systems based on the data from pyranometers installed at nearby weather stations and public buildings. For mega-solar and other large power plants that are often monitored by on-site pyranometry, we are developing a method to detect a small (a few %) power decrease by detailed analysis of data obtained by measuring over periods of 1 min.

Comparison with Conventional or Competitive Technology

From web-based self-diagnosis for domestic PV systems to complex analysis of mega-solar plants, the energy conversion of a PV system is analyzed and its health is evaluated using our model. Our model can also predict power output based on weather information with high accuracy.

Expected Applications

- Self-diagnosis support for actual PV systems.
- Evaluation of health of large PV plants.
- Pre-construction power generation prediction and profitability assessment for a new plant.

Challenges in Implementation

- Make server environment and optimize system to enable use of the self-diagnosis support system by many users.
- More pyranometer sites required.

What We Expect from Companies

- Pyranometer installation and provision of data by power plants.
- Joint study proposals for server system installation and web system optimization.

Future Developments

Use satellite data for better solar irradiance estimation. Deploy the self-diagnosis support system throughout Japan.

Points

Advanced analysis system to detect a problem in a PV system based on minimal monitoring data.

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