Electrical rating of concentrated photovoltaic (cpv) systems: Long-term performance analysis and comparison to conventional pv systems

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Abstrak

The dynamic nature of meteorological data and the commercial availability of diverse photovoltaic systems, ranging from single-junction silicon-based PV panels to concentrated photovoltaic (CPV) systems utilizing multi-junction solar cells and a two-axis solar tracker, demand a simple but accurate methodology for energy planners and PV system designers to understand the economic feasibility of photovoltaic or renewable energy systems. In this paper, an electrical rating methodology is proposed that provides a common playing field for planners, consumers and PV manufacturers to evaluate the long-term performance of photovoltaic systems, as long-term electricity rating is deemed to be a quick and accurate method to evaluate economic viability and determine plant sizes and photovoltaic system power production. A long-term performance analysis based on monthly and electrical ratings (in kWh/m2/year) of two developed CPV prototypes, the Cassegrain mini dish and Fresnel lens CPVs with triple-junction solar cells operating under the meteorological conditions of Singapore, is presented in this paper. Performances are compared to other conventional photovoltaic systems.