

Title DETERMINATION OF PV MODULE POWER OUTPUT
DEGRADATION AFTER LONG TERM OPERATION

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ABSTRACT

Several studies have been conducted to measure the degradation in output power of PV modules especially in past two decades. Though most of the results conformed to the warranties provided by manufacturers, but many proved them void. To provide a solid base for economic calculations of projects it is very important to authenticate warranties by making measurements after long term field operation. It serves not only as feedback for manufactures but provides a true picture for user or investor. The previous studies become obsolete with the speedy changes in material and manufacturing processes. Moreover the behavior of modules needs to be monitored in diverse climatic conditions across the globe. This study was proposed to measure the output power of modules belonging to different technologies after long term operation in the hot & humid conditions of Thailand. Samples from the four lots of PV modules comprising on mono crystalline, poly crystalline and amorphous silicon, with different duration of field operation ranging from 9 to 14 years were tested for I-V curve characteristics (maximum Power, short circuit Current, open circuit Voltage and maximum power point current & voltage) under field conditions and measured values were corrected to Standard Test Conditions (STC) values by using correction procedure 1 inscribed in IEC 60891 standard. The corrected values of output power and other parameters were compared with nameplate data for calculation of degradation during the period of operation. The actual degradation in output power for two lots of mono and one lot of poly crystalline silicon was found remarkably high (3.9, 3.0 and 2 %/year respectively) when compared with the warranties (0.8-1%/year generally). However, interestingly the lot comprising on thin film amorphous-Si

modules showed higher values of output power than nameplate. There were no visible defects in the modules except yellowing and discoloring. The enhanced degradation rates can be attributed to the quality of modules along with the effects of harsh field weather conditions. The study will act as a feedback source for manufacturing facilities and will help improve quality issues. The improved reliability of the modules will lead to the development of PV technology and its installation, thus reducing the greenhouse gases as a result.