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Performance analysis of thin-film Photovoltaic (PV) technologies in an embedded generation network

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Thin-film photovoltaic (PV) technology has been around for quite some time with varying performance for the different technologies. A major shortcoming of thin-film PV modules compared to crystalline PV technology is their shorter guaranteed operational lifespan as they degrade faster. In this study, the performance of thin-film technology operating in an outdoor environment is monitored and analysed.
An embedded generation network has been established by the PV Research group at Nelson Mandela University. The network is currently based at the PV Outdoor Research Facility (ORF) on the Nelson Mandela University, South Campus in Port Elizabeth. This embedded generation network contains three kW-scale grid-connected PV arrays comprising of various thin-film technologies. These technologies are Cadmium Telluride (CdTe), Copper Indium diselenide (CIS) and amorphous Silicon (a-Si). Custom designed and built data loggers were used to acquire AC and DC data for the various PV systems, as well as relevant meteorological data. a LabVIEW program was developed and used to process the respective datasets and for analysis. This paper presents and discusses the performance data of these three arrays over an extended period of time. A thorough comparison of the energy production is given, together with preliminary performance loss and degradation. From the data acquired, it is observed that the CIS and CdTe systems have higher performance ratios of the order of 85 %, while the performance ratio of the a-Si system consistently below 80 %.

Key words: PV systems, Thin-film technology, embedded generation, performance monitoring, PV modules

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