

Introduction to Special Issue on PV Systems Performance and Reliability

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The papers in this special issue have been selected from the systems and balance-of-systems sessions at the 1998 Photovoltaic Performance and Reliability Workshop. The workshop was held November 3-5, 1998 and hosted by the Florida Solar Energy Center, Cocoa Beach, Florida under sponsorship of the US National Center for Photovoltaics (National Renewable Energy Laboratory and Sandia National Laboratories).

The topics and issues addressed by these papers were identified in an invited review paper on PV systems by the guest editors. Their work was published earlier this year in Volume 7, Number 1 of *Progress in Photovoltaics* ('Photovoltaic Systems: An End-of-Millennium Review'). Experts in the PV community were asked to make presentations on these topics at the workshop. The papers that follow are the results of that effort. We have organized the papers by topic: (1) codes and standards; (2) reliability; (3) design issues; and (4) commercialization.

Codes and Standards

The paper by Bower and DeBlasio presents an update on testing and installation requirements for PV systems in the United States. Both authors are very active and chair groups that address these issues (Bower with the National Electrical Code and DeBlasio with IEEE and IEC standards) both here in the US as well as internationally. We feel systems are safe; and the main reason for this conclusion is the development and implementation of good engineering practices for PV systems -- a direct result of codes and standards work.

Reliability

Other than initial system cost, no issue dominates user concerns with PV more than reliability. Two papers address this topic. The paper by Maish develops a framework whereby the very complex issue of system reliability can be understood and quantified in terms of cost and system value. The author summarizes the reliability status of a variety of system applications and defines the needs and urgency for developing a qualified system reliability database. The paper by Stefanac addresses a major issue identified by Maish, that of inverter reliability. Stefanac describes the implementation of the ISO 9000 standards of quality management and quality assurance in the production of Omnion inverters and the improvements in product reliability of recently manufactured units.

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Design Issues

Three papers address questions regarding system design. The paper by Rosenthal presents a model that has been used to analyze remote diesel engine-based power systems and to evaluate the cost-benefit opportunities for power system improvement through the use of hybrid PV systems. The paper by Ginn examines the testing and development of a key component of the hybrid power system, namely the power processing unit. The author emphasizes the importance of battery management, generator selection, and site load management to hybrid system performance. Whitaker and Real address a major issue dealing with collector efficiency impacts on installed system cost. The authors have examined recent experience with system area-related costs and have identified technical and economic conditions under which collector efficiency can significantly impact system cost.

Commercialization

A set of four papers reflects progress in commercializing PV systems; each paper addresses a unique customer focus and the attendant issues associated with system application, performance, value, customer acceptance, and market sustainability. The paper by Ventre describes the effort within the state of Florida to support and expand the use of photovoltaics in buildings. This program is focused on rooftop applications with an aggressive approach that provides technical assistance to a system owner. The paper by Duncan describes an implementation process developed within the US Bureau of Land Management that meets the agency's needs for cost-effective remote power generation using PV. With jurisdiction over 10 percent of the land area in the US, this agency offers significant opportunities for PV systems within the federal government. The paper by Hester and Bensley describes progress made and lessons learned through the premier commercialization effort for PV systems in the US, the Utility Photovoltaic Group's TEAM-UP program. TEAM-UP focuses on energy service providers and the implementation of over 2000 systems, in excess of 7 megawatts of PV in total. With these three papers, commercialization issues associated with state, federal government, and electric utility customers have been addressed. We complete this effort with the paper by Rogers, which examines lessons learned through a successful PV leasing enterprise in the international marketplace.