IEEE Guide for Array and Battery Sizing in Stand-Alone Photovoltaic (PV) Systems

IEEE Standards Coordinating Committee 21

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Abstract: A method for properly sizing the PV array and battery for stand-alone PV systems where PV is the only charging source is recommended (in conjunction with IEEE Std 1013™). Load calculations and determination of solar radiation in the sizing of the system need special attention. Additionally, the critical nature of the load in deciding an acceptable annual availability needs to be considered.

Keywords: battery sizing, photovoltaic systems, PV array sizing

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Introduction

This introduction is not part of IEEE Std 1562-2007, IEEE Guide for Array and Battery Sizing in Stand-Alone Photovoltaic Systems.

This guide is intended to assist system designers and end users in sizing stand-alone photovoltaic (PV) systems. This guide uses the "Peak Sun-hour" method of sizing. Systems are sized based upon the worst case month using monthly solar irradiance and load demand. This document is not intended to be used for grid-connected or hybrid systems, where the systems are generally designed for annual values. Refer to IEEE Std 1561™ for hybrid designs.

Two critical pieces of information are required for the proper sizing of the PV array and battery in a stand-alone PV system: accurate load data and accurate solar radiation data. The performance of the system will be only as good as these data.

A computer sizing program is recommended for critical applications.

The annexes contain information on photovoltaic module technology, charge controllers, module tilt angles, and sizing examples using the System Sizing worksheet.

This guide should be used in combination with IEEE Std 1361™, IEEE Guide for Selection, Charging, Test and Evaluation of Lead-acid Batteries Used in Stand-Alone Photovoltaic Systems, and, IEEE Std 1013™-2007, IEEE Recommended Practice for Sizing Lead-acid Batteries for Photovoltaic Systems. Together, these documents will provide the user with a general guide to sizing and designing the PV array storage batteries for stand-alone PV systems.

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Contents

IEEE Guide for Array and Battery Sizing in Stand-Alone Photovoltaic (PV) Systems

1. Overview

This guide was written to provide a method for sizing the array and the battery, when used in conjunction with IEEE Std 1013™,[1] for stand-alone photovoltaic (PV) systems. Use of this document by funding organizations, PV system integrators, and consumers should provide the means for improved system performance and operating life. This document is intended to provide a means of sizing a stand-alone PV system to meet the load demand in a cost-effective manner.

1.1 Scope

This guide provides information to assist in sizing the array and battery of a stand-alone photovoltaic system. Systems considered in this guide consist of PV as the only power source and a battery for energy storage. These systems also commonly employ controls to protect the battery from being over- or under-charged, and may employ a power conversion subsystem (inverter or converter).

This guide is applicable to all stand-alone PV systems where PV is the only charging source. This guide does not include PV hybrid systems nor grid-connected systems. This guide covers lead-acid batteries only; nickel-cadmium and other battery types are not included. This guide does not include the sizing of the system controller, inverter, wiring, or other system components.

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[1] Information on references can be found in Clause 2.