Overview of the Best Practices and Standards Development for the Collection and Use of Solar Resource Data for Solar Energy Applications

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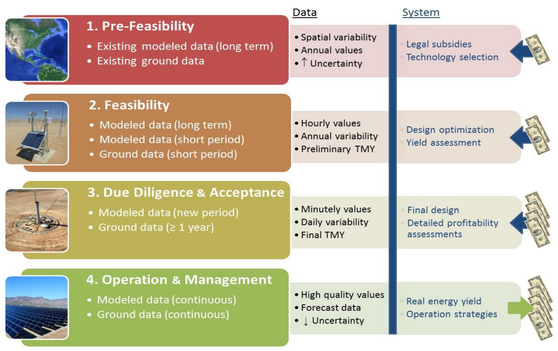
Abstract

- To help stakeholders stay aware of the latest research in solar resource data, the National Renewable Energy Laboratory (NREL), in collaboration with the International Energy Agency (IEA) Photovoltaic Power Systems Programme (PVPS) Task 16 and the Solar Power and Chemical Energy Systems (SolarPACES) technology programs, published in 2021 the third edition of the *Best Practices Handbook for the Collection and Use of Solar Resource Data for Solar Energy Applications*. This update includes 10 chapters and contributions from 41 authors from 14 countries.
- NREL and national and international collaborators continue to update and develop solar resource standards through ASTM, the International Organization for Standardization (ISO), and other international standardization bodies. These standards contribute to increased accuracy in the measurement of the solar resource available to solar energy systems and boost the development and improvement of radiative models.

Highlights of the Best Practices Handbook

The handbook is a valuable reference for the collection and interpretation of solar resource data for project developers, engineering procurement construction firms, utility companies, system operators, energy suppliers, financial investors, organizations involved in planning and managing solar research programs, and others involved in solar energy systems planning and development.



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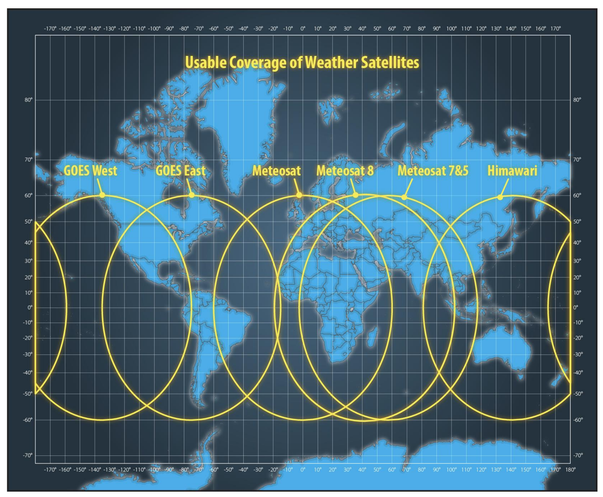
The handbook summarizes techniques used to measure and develop estimates of solar resources from radiometers and weather satellite data and numerical model predictions.



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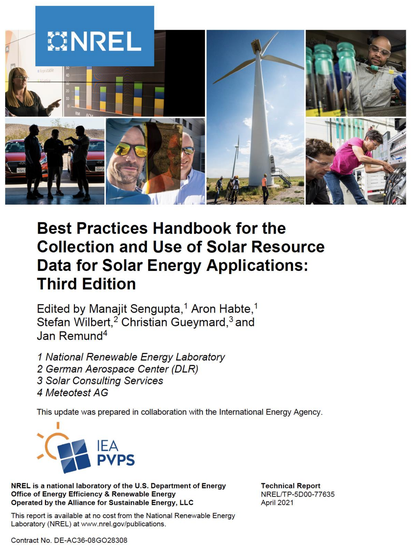

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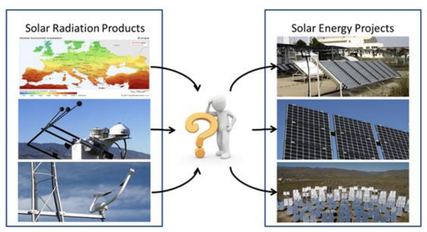
The handbook includes application techniques for the various stages of project development, from prefeasibility to routine operations.



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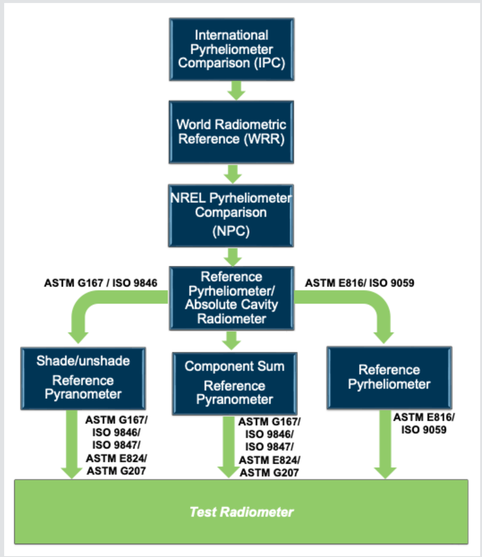
Highlights of International Standards

Standards and Traceability: Pyranometers and Pyrheliometers



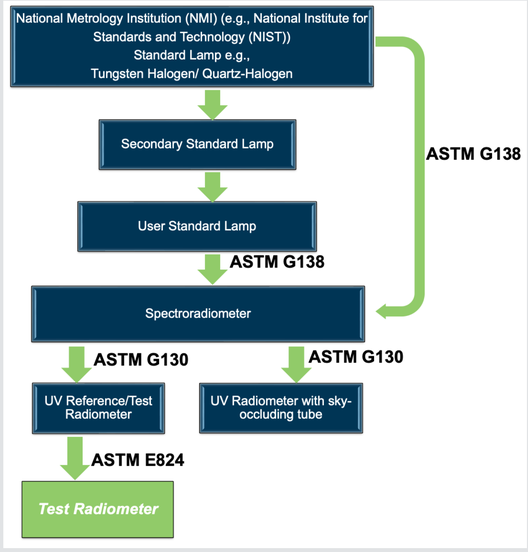
ISO/TC 180/SC 1 Climate – Measurement and Data

- ISO 9059:1990 Solar energy – Calibration of field pyrheliometers by comparison to a reference pyrheliometer
- ISO 9846:1993 Solar energy – Calibration of a pyranometer using a pyrheliometer
- ISO 9847:1992 Solar energy – Calibration of field pyranometers by comparison to a reference pyranometer

ASTM G03.09 Radiometry Subcommittee

- E816-15 Standard Test Method for Calibration of Pyrheliometers by Comparison to Reference Pyrheliometers
- E824-10(2018)e1 Standard Test Method for Transfer of Calibration From Reference to Field Radiometers
- G167-15 Standard Test Method for Calibration of a Pyranometer Using a Pyrheliometer
- G207-11(2019)e1 Standard Test Method for Indoor Transfer of Calibration from Reference to Field Pyranometers

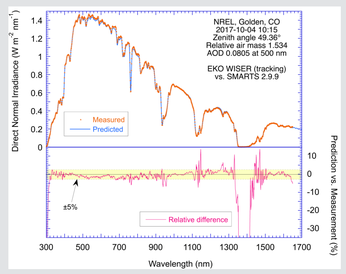
Standards and Traceability: Spectroradiometers and Ultraviolet Radiometers



ASTM G03.09 Radiometry Subcommittee

- G130-12(2020) Standard Test Method for Calibration of Narrow- and Broad-Band Ultraviolet Radiometers Using a Spectroradiometer
- G138-12(2020)e1 Standard Test Method for Calibration of a Spectroradiometer Using a Standard Source of Irradiance

Standard Reference Solar Spectral Energy Distributions



ASTM G173 vs. Measured Spectral Data

ASTM G03.09 Radiometry Subcommittee

- G173-03(2020) Standard Tables for Reference Solar Spectral Irradiances: Direct Normal and Hemispherical on 37° Tilted Surface
- G177-03(2020) Standard Tables for Reference Solar Ultraviolet Spectral Distributions: Hemispherical on 37° Tilted Surface
- G197-14(2021) Standard Table for Reference Solar Spectral Distributions: Direct and Diffuse on 20° Tilted and Vertical Surfaces

ISO/TC 180/SC 1 Climate – Measurement and data

- ISO 9845-1:1992 Solar energy – Reference solar spectral irradiance at the ground at different receiving conditions -- Part 1: Direct normal and hemispherical solar irradiance for air mass 1,5

IEC/TC 82 – Solar photovoltaic energy systems

- IEC 60904-3:2016 Photovoltaic devices – Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data

CIE/TC 2-88 – Physical Measurement of Light and Radiation

- CIE 241:2020 Recommended reference solar spectra for industrial applications

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