

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Photovoltaic (PV) module performance testing and energy rating –
Part 4: Standard reference climatic profiles**

**Essais de performance et caractéristiques assignées d'énergie des modules
photovoltaïques (PV) –
Partie 4: Profils climatiques de référence normalisés**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**PHOTOVOLTAIC (PV) MODULE PERFORMANCE TESTING
AND ENERGY RATING –****Part 4: Standard reference climatic profiles****FOREWORD**

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International Standard IEC 61853-4 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
82/1442/FDIS	82/1452/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61853, published under the general title *Photovoltaic (PV) module performance testing and energy rating*, can be found on the IEC website.

This standard contains attached files in the form of zip files. These files are intended to be used as a complement and do not form an integral part of the standard.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This International Standard series establishes IEC requirements for determining PV module performance in terms of power (watts), specific module energy rating (kWh/kW) and climatic specific energy rating (dimensionless). It is written to be applicable to all PV technologies including non-linear devices. The methodology does not take into account either progressive degradation or transient behaviour such as light induced changes and/or thermal annealing.

This series consists of four parts:

- IEC 61853-1: *Photovoltaic (PV) module performance testing and energy rating – Part 1: Irradiance and temperature performance measurements and power rating*, which describes requirements for evaluating PV module performance in terms of power (watts) rating over a range of irradiances and temperatures;
- IEC 61853-2: *Photovoltaic (PV) module performance testing and energy rating – Part 2: Spectral responsivity, incidence angle, and module operating temperature measurements*, which describes test procedures for measuring the effect of varying angles of incidence and sunlight spectra as well as the estimation of module temperature from irradiance, ambient temperature, and wind speed;
- IEC 61853-3: *Photovoltaic (PV) module performance testing and energy rating – Part 3: Energy rating of PV modules*, which describes the calculations for PV module ratings; and
- IEC 61853-4: *Photovoltaic (PV) module performance testing and energy rating – Part 4: Standard reference climatic profiles*, which describes the standard time periods and environmental data set that shall be used for the energy rating calculations.

PHOTOVOLTAIC (PV) MODULE PERFORMANCE TESTING AND ENERGY RATING –

Part 4: Standard reference climatic profiles

1 Scope

This part of IEC 61853 describes the standard reference climatic profiles used for calculating energy ratings.

IEC 61853-1 describes requirements for evaluating PV module performance in terms of power (watts) rating. IEC 61853-2 describes test procedures for determining module temperature from irradiance, ambient temperature and wind speed, a method for measuring angle of incidence effects, and spectral responsivity. IEC 61853-3 describes the calculation of PV module energy rating values, using the data from IEC 61853-1, IEC 61853-2 and IEC 61853-4.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC TS 61836, *Solar photovoltaic energy systems – Terms, definitions and symbols*

IEC 61853-3, *Photovoltaic (PV) module performance testing and energy rating – Part 3: Energy rating of PV modules*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 61836 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Standard reference climatic profiles for energy rating

4.1 General

The defined conditions contained within this document shall be used in IEC 61853-3 to obtain an energy rating. A fixed number (6) of standard reference climatic profiles are tabulated, representative of global regions relevant for the application of photovoltaics. The irradiance and ambient temperature data are representative of typical conditions over each region, but are to be considered as average values. The spectrally resolved irradiances are derived from satellite data.

4.2 Data format

For each standard reference climatic profile the following are defined:

- a) The PV module mounting conditions. The modules are assumed to be mounted in a fixed position on free-standing racks.
- b) The orientation and a fixed inclination angle (β). The inclination angle β is fixed at 20° from horizontal, and the module orientation is facing towards the equator.
- c) Climatic data tabulated as hourly values over one full year, listed as days one through 365. For each standard reference climatic profile the following are defined:
 - The total of the hourly global in-plane irradiance values for the reference climatic profile (H_p)
 - Climatic data tabulated as hourly values over one full year, listed as days one through 365. The parameters reported are:
 - Year
 - Month
 - Day
 - Hour (local solar time)
 - Ambient temperature (T_{amb})
 - Wind speed at module height (v)
 - Sun elevation
 - Sun incidence angle (to the normal of the module) (θ)
 - Global horizontal irradiance (G_h)
 - Direct horizontal irradiance (B_h)
 - Global in-plane irradiance (G)
 - Direct in-plane irradiance (B)
 - Spectrally resolved global in-plane irradiance (W/m^2) for a set of discrete bands ($G(\lambda)$), with band intervals given in the tabulated data sets.

4.3 Reference climatic profiles

For all the climatic profiles, the following fixed conditions are applicable;

Fixed open-rack module mounting conditions;

The rack is equator-facing with a fixed inclination angle of 20° .

The climatic data are defined for the locations listed in Table 1.

Table 1 – List of the climatic data sets for energy rating

Data set number	Latitude	Type	Total yearly global in-plane irradiance H_p (kWh/m²)
1	1°S	Tropical humid	1677,7
2	33°30'N	Subtropical arid (desert)	2295,5
3	33°22'N	Subtropical coastal	1496,6
4	56°N	Temperate coastal	972,9
5	34°N	High elevation (above 3 000 m)	2139,1
6	57°N	Temperate continental	1266,0

The climatic data is tabulated in attached files in the form of zip files.

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