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Renewable energy off-grid systems -
Part 200: System selection and design

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Renewable energy off-grid systems - Part 200: System selection and design

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IEC TS 62257-200 has been prepared by IEC technical committee 82. Solar photovoltaic energy systems. It is a Technical Specification.

This first edition cancels and replaces the second edition of IEC 62257-4 published in 2015. It constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) The previous edition focussed on isolated electrification systems provided through projects only. This version includes isolated electrification systems that could be supplied directly to a user by a system supplier.
b) Information that was previously included in IEC TS 62257-2 that was directly relevant to system design has been moved to be included in this version.

c) The operation of numerous micropower plants typologies has changed due to changes in features and functions of inverters. The typologies of the various powerplants have been updated to reflect these changes.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
82/2505/DTS	82/2573/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 62257 series, published under the general title *Renewable energy off-grid systems*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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

– reconfirmed,
– withdrawn, or
– revised.

INTRODUCTION

The IEC 62257 series provides technical standardization to different stakeholders (including but not limited to project developers, financing agencies, testing agencies, installers, etc.) involved in electrification projects for access to electricity for those not solely connected to the regional grid, through the setting up of off-grid renewable energy and hybrid systems (including micro-grids) with a voltage less than or equal to 1 000 V for AC (alternating current) or a voltage less than or equal to 1 500 V for DC (direct current).

Access to electricity is one of the predominant policy actions designed to increase the well-being of populations, together with access to clean water, improved healthcare, education, personal advancement and economic development. Increasing access to electricity through utilization of renewable off-grid electricity also directly or indirectly supports various United Nations Sustainability Development Goals (https://sdgs.un.org/goals), depending on the application.

Several strategies can be adopted to implement electrification and improve access to electricity in rural and urban settings, including the ability for connection to a national or regional electricity grid. The IEC 62257 series applies to cases where the utility grid is too far away, the individual demand centres are too small to make grid access economical, off-grid solutions provide an economical option, and where autonomous power systems can be used to supply these services.

These technical specifications are used to:

a) choose the right solution for the right place with the optimal technology,

b) design, purchase and install the product(s) or system to optimal compliancy,

c) operate and maintain the system.

The IEC 62257 technical specifications focus on enabling access to electricity by concentrating on, but not being specific to, developing countries. This series is not to be considered as all-inclusive for access to electricity. That means that the technical specifications could be used for rural electrification, also for electrification of remote sites in developed countries, or any requirement for electricity access that cannot be met by attaching solely to the national utility grid. They promote the use of renewable energies, but at this time they do not deal with clean-energy mechanisms development (CO_2 emissions, carbon credit, etc.). The series does allow for other types of energy, such as diesel generators, to be included as part of a hybrid renewable energy off-grid system.

This consistent set of documents can be considered as a whole, with different parts focusing on specific aspects of renewable energy off-grid systems. However, several parts are intended to be read as stand-alone documents depending on their intended application. IEC TS 62257-100 provides an overview of the various topics covered by this series. Additionally, the content and scopes of individual documents, available at the website webstore.iec.ch, provide potential users with the intended application for each document. For further information on planned documents to be published under the new IEC 62257 numbering scheme, IEC TC 82 committee members can refer to the annex in the JWG1 Program of Work circulated after each JWG1 meeting, or to the Planned Work Programme on the www.iec.ch TC 82 website.

One of the main objectives of this series is to provide the minimum sufficient recommendations, including items for safety, sustainability of systems and at the lowest life cycle cost, relevant to the renewable energy and hybrid off-grid systems field of application.

1 Scope

This part of IEC 62257 provides a method for describing the results to be achieved by the electrification system independently of the technical solutions that could be implemented.

The purpose of this part of IEC 62257 is to provide a method to assist designers of renewable energy systems, project contractors and project developers to design the electrification system for isolated sites while matching the identified needs. This part of IEC 62257 assesses the needs of the users and the different power system architectures which can be used for meeting these needs. In relation to the needs of the different participants to the project, functional requirements to be achieved by the production and distribution subsystems are listed.

In Clause 4, the functional requirements of off-grid electrifications systems are described. These include the micropower plant, distribution system for isolated microgrids and the user's electrical installation providing power to their loads.

In Clause 5, the types of micropower plants that can be installed within an individual electrification system (IES) or isolated microgrid are described.

In Clause 6, resource assessment (solar, wind, hydro, biomass) and data sources (PVGIS, Global Solar Atlas, NASA POWER, etc.) are outlined.

In Clause 7, the requirement to undertake load energy assessment is described and includes the relationship between the available energy, the design of the system and the user's expectation.

In Clause 8, the information that has been used in the design process and should be specified in any design documentation to allow the participants to select the equipment or component able to fulfil the functional requirements are listed.

To allow and facilitate the management of the micropower plant and the maintenance of the whole electrification system, some information is collected and monitored.

In Clause 9, the required measurement parameters for each component (PV, wind, hydro, genset, battery, inverters, controllers) to support operation and maintenance are listed.

The steps to follow this part of IEC 62257 when designing an off-grid electrification system are as follows:

Step 1: Conduct a resource assessment (see Clause 6).

Step 2: Conduct a load assessment (see Clause 7).

Step 3: The designer uses the information obtained in the two assessments to determine the type and configuration of the micropower plant (see Clause 5) and to select or specify the micropower plant components (equipment) (see Clause 8).

Step 4: The designer should develop a monitoring plan that will support the ongoing operation and maintenance of the off-grid electrification system (refer to Clause 9).

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*

3 Terms and definitions

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

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

– IEC Electropedia: available at https://www.electropedia.org/

– ISO Online browsing platform: available at https://www.iso.org/obp

3.1
battery system
system comprising one or more cells, modules or batteries

Note 1 to entry: Depending on the type of technology, the battery system can include one or multiple battery management systems, battery management modules, auxiliary supporting or protective equipment for the system.

3.2
dispatchable power system
generating system that is capable of generating electricity as required by its interconnected electrical distribution system

Note 1 to entry: For example, a fuel-based engine-powered generator is dispatchable.

3.3
distributed RE micropower plant
micropower plant that uses a single resource and is interconnected at the users' electrical installation

3.4
distribution system
electrical facility and its components including poles, transformers, disconnects, relays, isolators and wires for the purpose of distributing electrical energy from micropower plant to customers

3.5
genset
GS
engine-generator set consisting of a fuel-driven engine coupled to an electric generator

3.6
hybrid system
multi-sources system with at least two different kind of generation technologies