

TECHNICAL SPECIFICATION



**Recommendations for renewable energy and hybrid systems for rural electrification –
Part 1: General introduction to IEC 62257 series and rural electrification**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2015 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 60 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

TECHNICAL SPECIFICATION



**Recommendations for renewable energy and hybrid systems for rural electrification –
Part 1: General introduction to IEC 62257 series and rural electrification**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 27.160

ISBN 978-2-8322-2914-9

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	6
3 Terms, definitions and abbreviations	7
4 Methodology for rural electrification using hybrid renewable energy systems.....	8
4.1 Rural electrification: which solution to choose?	8
4.2 Decentralized electrification requiring a range of systems	10
5 How to use the IEC 62257 series for a rural electrification project	12
5.1 Overview.....	12
5.2 Review of the IEC 62257 series: links with the phases of a rural electrification project (see Table 3)	15
5.2.1 Opportunity study	15
5.2.2 Specification of a project	15
5.2.3 Feasibility study of a project	17
5.2.4 Detailed technical studies	18
5.2.5 Implementation of a project.....	19
5.2.6 Validation of a project.....	20
5.2.7 On field operation	21
Annex A (normative) Terms, definitions and abbreviations in use in the IEC 62257 series.....	23
Figure 1 – Example of electrification progress following a master plan methodology	9
Figure 2 – Example of electrification of a village using both CESs and IESs	10
Figure 3 – Contractual relationship between project participants – (IEC TS 62257-3:2015, Figure 1)	16
Figure 4 – Example of the content of a non-technical preliminary study – (IEC TS 62257-2:2015, Figure 1)	18
Figure 5 – TN-C-S system – (IEC TS 62257-5:2015, Figure B.2).....	19
Figure 6 – Phase A battery endurance test – (IEC TS 62257-8-1:2007, Figure 2).....	20
Figure 7 – Test 3, operating cycles – (IEC TS 62257-9-6:2008, Figure 3)	21
Table 1 – Some advantages and disadvantages of the proposed single and multiple user systems	11
Table 2 – Contents of the 62257 series.....	13
Table 3 – Utilization of the different parts of the IEC 62257 series according to the main project phases.....	14
Table 4 – Combined categorization – (IEC TS 62257-2:2015, Table C.1)	17
Table 5 – Service specification (example) – (IEC TS 62257-2:2015, Table C.2)	17
Table 6 – Verification of the adherence to commitments – (IEC TS 62257-6:2015, Table 8)	21
Table 7 – AOMR participant involvement – (IEC TS 62257-6:2015, Table 3)	22

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RECOMMENDATIONS FOR RENEWABLE ENERGY
AND HYBRID SYSTEMS FOR RURAL ELECTRIFICATION –****Part 1: General introduction to IEC 62257 series and rural electrification****FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62257-1, which is a technical specification, has been prepared by IEC technical committee 82: Solar photovoltaic energy systems. It was developed in cooperation with other IEC technical committees and subcommittees dealing with renewable energies and related matters, namely IEC technical committee 21 (Secondary cells and batteries), subcommittee

21A (Secondary cells and batteries containing alkaline or other non-acid electrolytes), IEC technical committee 64 (Electrical installations and protection against electric shock), IEC technical committee 88 (Wind turbines).

This third edition cancels and replaces the second edition issued in 2013. It constitutes a technical revision.

The main technical changes with regard to the previous edition are as follows:

- Redefine the maximum AC voltage from 500 Va.c. to 1 000 Va.c., the maximum DC voltage from 750 Vd.c. to 1 500 Vd.c. and removal of the limitation of 100 kVA system size. Hence the removal of the word “small” in the title and related references in this technical specification.

This technical specification shall be used in conjunction with the other documents of the IEC 62257 series.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
82/942/DTS	82/979/RVC

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

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

A list of all parts in the IEC 62257 series, published under the general title *Recommendations for renewable energy and hybrid systems for rural electrification*, 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 publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Rural electrification is one of the predominant policy actions designed to increase the well-being of rural populations together with access to clean water, improved healthcare, education, personal advancement and economic development.

Several strategies can be adopted to implement rural electrification. Rural electrification can be completed through connection to a national or regional electrification grid. The IEC 62257 series applies to cases where the grid is too far away (too costly) or the individual demand centres are too small to make grid access economic, where autonomous power systems may be used to supply these services.

This series IEC 62257 provides technical specifications to different players involved in rural electrification projects (such as project developers, project implementers, installers, etc.) for the setting up of renewable energy and hybrid systems with AC voltage below 1 000 Vac and DC voltage below 1 500 Vdc.

These specifications are recommendations:

- a) to choose the right system for the right place,
- b) to design the system,
- c) to operate and maintain the system.

The specifications focus on rural electrification concentrating on, but not specific to, developing countries. They must not be considered as all inclusive to rural electrification. That means that they could be used for rural electrification or electrification of remote sites in developed countries also. They try to promote the use of renewable energies in rural areas, but they do not deal with clean mechanisms development at this time (CO₂ emission, carbon credit, etc.) Further developments in this field could be introduced in future steps.

This consistent set of documents is best considered as a whole with different parts corresponding to items for safety, sustainability of systems and at the lowest life cycle cost as possible. One of the main objectives is to provide the minimum sufficient requirements, relevant to the field of application, that is: renewable energy and hybrid off-grid systems.

RECOMMENDATIONS FOR RENEWABLE ENERGY AND HYBRID SYSTEMS FOR RURAL ELECTRIFICATION –

Part 1: General introduction to IEC 62257 series and rural electrification

1 Scope

This part of IEC 62257 first introduces a methodology for implementing rural electrification using autonomous hybrid renewable energy systems.

Secondly, it provides a guide for facilitating the reading and the use of the IEC 62257 series for setting up decentralized rural electrification in developing countries or in developed countries, the only difference being the level of quality of service and the needed quantity of energy that the customer can afford.

The IEC 62257 series is designed as follows:

- Parts 2 to 6 are methodological supports for the management and implementation of projects.
- Parts 7 to 12 are technical specifications for individual or collective systems and associated components.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC TS 62257-2:2015, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 2: From requirements to a range of electrification systems*

IEC TS 62257-3:2015, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 3: Project development and management*

IEC TS 62257-4:2015, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 4: System selection and design*

IEC TS 62257-5:2015, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 5: Protection against electrical hazards*

IEC TS 62257-6:2015, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 6: Acceptance, operation, maintenance and replacement*

IEC TS 62257-7, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 7: Generators*

IEC TS 62257-7-1, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 7-1: Generators – Photovoltaic arrays*

IEC TS 62257-7-3, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 7-3: Generator set – Selection of generator sets for rural electrification systems*

IEC TS 62257-8-1:2007, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 8-1: Selection of batteries and battery management systems for stand-alone electrification systems – Specific case of automotive flooded lead-acid batteries available in developing countries*

IEC TS 62257-9-1, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 9-1: Micropower systems*

IEC TS 62257-9-2, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 9-2: Microgrids*

IEC TS 62257-9-3, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 9-3: Integrated system – User interface*

IEC TS 62257-9-4, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 9-4: Integrated system – User installation*

IEC TS 62257-9-5, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 9-5: Integrated system – Selection of stand-alone lighting kits for rural electrification*

IEC TS 62257-9-6:2008, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 9-6: Integrated system – Selection of Photovoltaic Individual Electrification Systems (PV-IES)*

IEC TS 62257-12-1, *Recommendations for renewable energy and hybrid systems for rural electrification – Part 12-1: Selection of self-ballasted lamps (CFL) for rural electrification systems and recommendations for household lighting equipment*

3 Terms, definitions and abbreviations

For the purposes of this document, the following terms, definitions and abbreviations apply. The main glossary used in the IEC 62257 series is given in Annex A.

3.1

Collective Electrification System

CES

micropower plant and microgrid that supplies electricity to multiple consumption points using a single or multiple energy resource points

3.2

GS

general specification

3.3

hybrid system

multi-energy sources system

3.4

Individual Electrification System

IES

micropower plant system that supplies electricity to one consumption point usually with a single energy resource point