IEC TS 62898-1

Edition 1.0 2023-08

TECHNICAL SPECIFICATION

AMENDMENT 1

Microgrids –
Part 1: Guidelines for microgrid projects planning and specification

IEC TS 62898-1:2017-05/AMD1:2023-08(en)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.240.01 ISBN 978-2-8322-7435-4

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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MICROGRIDS –

Part 1: Guidelines for microgrid projects planning and specification

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Amendment 1 to IEC 62898-1:2017 has been prepared by subcommittee 8B: Decentralized electrical energy systems, of IEC technical committee 8: System aspects of electrical energy supply.

The text of this Amendment is based on the following documents:

Draft	Report on voting
8B/165/DTS	8B/179/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 Amendment 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 62898 series, published under the general title *Microgrids*, can be found on the IEC website.

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- withdrawn,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

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INTRODUCTION

Replace the second paragraph, beginning with "This part of IEC 62898 defines the guidelines for the general planning and design of microgrids" *with the following new text.*

This part of IEC 62898 defines the guidelines for the general planning and design of microgrids, IEC TS 62898-2 defines the general technical requirements for operation and control of microgrids, IEC TS 62898-3-1 defines the technical requirements for protection and dynamic control of microgrids, IEC TS 62898-3-2 defines the technical requirements for energy management systems of microgrids, IEC TS 62898-3-3 defines the technical requirements for self-regulation loads of microgrids, and IEC TS 62898-3-4 defines the technical requirements for microgrid monitoring and control systems. IEC TC8/SC8B/JWG1 is responsible for the development of these TS.

3 Terms and definitions

3.5
earth
ground

Replace the existing definition and source with the following:

part of the earth that is in electric contact with an earth electrode and that has an electric potential not necessarily equal to zero

[SOURCE: IEC 60050-195:2021, 195-01-03, modified – The adjective "local" has been removed from the term.]

3.6
earthing arrangement
grounding arrangement

Replace the existing definition and source with the following:

all electrical means involved in the earthing of a system, installation or equipment

Note 1 to entry: Electric connection and devices used for earthing are examples of electrical means.

[SOURCE: IEC 60050-195:2021, 195-02-20]

3.7
earthing conductor
grounding conductor

Replace the existing definition and source with the following:

conductor forming a conductive path between a conductive part and an earth electrode

[SOURCE: IEC 60050-195:2021, 195-02-03]

3.8
electromagnetic compatibility
EMC

Replace the existing source with the following:

[SOURCE: IEC 60050-161:2018, 161-01-07]

3.9

distributed energy resources
DER

Replace the existing definition with the following:

generators (with their auxiliaries, protection and connection equipment), including loads having a generating mode (such as electrical energy storage systems), connected to a low-voltage or a medium-voltage network

[SOURCE: IEC 60050-617:2017, 617-04-20]

3.15

island

Replace the existing definition and source with the following.

part of an electric power system that is electrically disconnected from the remainder of the interconnected electric power system but remains energized from local electric power sources

Note 1 to entry: An electric island can be either the result of the action of automatic protections or the result of a deliberate action.

Note 2 to entry: An electric island can be stable or unstable.

Note 3 to entry: Inside the electric island, generators and loads can be any combination of customer-owned and utility-owned units.

[SOURCE: IEC 60050-692:2017, 692-02-11, modified – The term "electric" has been removed from the term., Note 3 to entry has been added.]

3.16

isolated microgrid

Replace the existing definition with the following:

group of interconnected loads and distributed energy resources with defined electrical boundaries forming a local electric power system at distribution voltage levels, that cannot be connected to a wider electric power system

Note 1 to entry: Isolated microgrids are usually designed for geographical islands or for rural electrification.

Note 2 to entry: A microgrid capable of being connected to a wider electric power system is also called non-isolated microgrid or embedded microgrid.

[SOURCE: IEC 60050-617:2017, 617-04-23, modified – Note 2 to entry has been added.]

3.22

microgrid

Replace the existing definition and notes to entry with the following:

<in an electric power system> group of interconnected loads and distributed energy resources with defined electrical boundaries forming a local electric power system at distribution voltage levels, that acts as a single controllable entity and is able to operate in island mode

Note 1 to entry: This definition covers both (utility) distribution microgrids and (customer owned) facility microgrids.

[SOURCE: IEC 60050-617:2017, 617-04-22]

5 Purpose and application of microgrids

5.2 Application of non-isolated microgrids

Replace the last sentence of the last paragraph, beginning with "Certain equipment to improve power quality and reliability" *with the following new text:*

Certain equipment to improve power quality and reliability, for example energy storage systems, harmonics filters, and reactive power compensators should be installed in the microgrid if needed.

5.3 Application of isolated microgrids

Replace the last sentence of the first paragraph, beginning with "Therefore, such a microgrid" *with the following new text:*

Therefore, such a microgrid should contain sufficient energy storage capacity and dispatchable generation capacity.

13 Technical requirements for control, protection and communication systems

13.2 Protection relays and automatic protection devices

13.2.4 Load shedding in a microgrid

Delete, in the first sentence, the redundant word "voltage" *in front of the word* "protection".

14 Evaluation of microgrid projects

14.3 Economic benefits

Add, after the first paragraph, the following new text:

The calculation of the economic benefits should also consider the net present value, where the cash flow during the life time is discounted back to its present value.

$$Net\ Present\ Value = \sum_{t=0}^{N} \frac{R_t}{(1+i)^t} \quad (1)$$

where

t is the time step during the lifetime;

R_t is the cash flow during t^{th} time step;

i is the interest rate.

The costs of power plants are assessed according to their variable and fixed costs. The simplified linear equation given in Formula (1) shows the cost function:

$$K_{\text{sum}} = K_{\text{fix},P} + K_{\text{var},P} = K_{\text{fix},P} + T_{\text{a}} \times k_{\text{var},P} \quad (2)$$

where

K_{sum} are the total costs;

$K_{\text{fix},P}$ are the total fixed costs for the power capacity component;

$K_{\text{var},P}$ are the total variable costs for the power capacity component;

$k_{\text{var},P}$ are the variable costs for the power capacity component in monetary unit per kWh;

T_{a} are the yearly full load hours.

For energy storages, a similar formula (see Formula (3) may be used to assess the levelized cost of storage (i.e. overall power-specific cost).

$$\frac{K_{\text{sum}}}{P_{\text{max}}} = k_{\text{fix},P} + a_{\text{L}} \times \left(k_{\text{var},P} \times \frac{1}{2} T_{\text{P}} + k_{\text{sum},E} \times \frac{1}{2} T_{\text{C}} \right) \quad (3)$$

where

T_{P} is the examined period (e.g. 1 year);

T_{C} is the cycle time of the storage oscillation (e.g. 24 h);

a_{L} is the load factor, given as dimensionless number in [0;1];

$k_{\text{fix},P}$ are the fixed costs for the power capacity component of period T_{P} in monetary unit per kW;

$k_{\text{var},P}$ are the variable costs for the power capacity component in monetary unit per kWh;

$k_{\text{sum},E}$ are the total costs for energy capacity component of period T_{P} in monetary unit per kWh.

For further explanation, see Annex E.

Add, after subclause 14.6, the following new subclause 14.7:

14.7 Life-time energy balance of resources

Life cycle analyses for power generating facilities may use the EROI approach (Energy Return on Energy Invested) as useful evaluation criterion. The EROI value is the ratio of provided useful energy during the facility's lifetime to the embodied energy of that facility.

$$\text{EROI} = \frac{\text{Energy provided during lifetime}}{\text{Embodied energy}} \tag{4}$$

An analogy in the domain of energy storage systems is the ratio of cumulated energy throughput to the embodied energy. This key figure is known as ESOI (Energy Stored on Energy Invested).

NOTE The ESOI serves not to assess the monetary costs of an energy storage system but provides a useful characteristic number for the energetic costs for life-cycle analysis.

$$\text{ESOI} = \frac{\text{Energy stored}}{\text{Embodied energy}} = \frac{\lambda(D) \times D \times \eta}{\varepsilon} \tag{5}$$

where

λ is the cycle life (e.g. 5 000);

η is the round trip efficiency of an energy storage system (e.g. 0,8);

D is the depth of discharge (DoD);

ε is the embodied energy per energy capacity (dimensionless).

Annex A − Business use case A Guarantee a continuity in load service by islanding with microgrids

In the first paragraph, replace "IEC TS 62913-2-1" *with* "IEC TS 62913-2-1:2019"*, and delete footnote 2).*

Annex B − Business use case B Optimize local resources to provide services to customers inside the microgrid

In the first paragraph, replace "IEC TS 62913-2-1" *with* "IEC TS 62913-2-1:2019".

Annex C − Business use case C Electrify remote areas using renewable energy sources

In the first paragraph, replace "IEC TS 62913-2-1" *with* "IEC TS 62913-2-1:2019".

C.3 Objectives

Replace the second paragraph beginning with "This BUC implies" *with the following:*

This BUC implies that microgrid is one of the solutions to promote electrification for far rural areas or islands with integration of renewable energy resources (or distributed energy resources).

Annex D − Business use case D Optimize local resources to provide services to the grid/disaster preparedness

D.1 General

Delete, in the first sentence, the words "future" *and* "to come".

Add, after Annex D, the following new Annex E: