

TECHNICAL REPORT



Microgrids – iTeh STANDARD PREVIEW
Part 4: Use cases (standards.iteh.ai)

IEC TR 62898-4:2023

<https://standards.iteh.ai/catalog/standards/sist/0464125e-d432-41dd-ac2e-a45cb9d9aa2f/iec-tr-62898-4-2023>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2023 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 Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
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 corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

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 It also gives information on projects, replaced and withdrawn publications.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 Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

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 once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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: sales@iec.ch.

[IEC TR 62898-4:2023](https://standards.iteh.ai/catalog/standards/sis/0464125e-d432-41dd-ac2e-a45cb9d9aa21/iec-tr-62898-4-2023)

<https://standards.iteh.ai/catalog/standards/sis/0464125e-d432-41dd-ac2e-a45cb9d9aa21/iec-tr-62898-4-2023>

TECHNICAL REPORT



Microgrids – iTeh STANDARD PREVIEW
Part 4: Use cases (standards.iteh.ai)

[IEC TR 62898-4:2023](#)

<https://standards.iteh.ai/catalog/standards/sist/0464125e-d432-41dd-ac2e-a45cb9d9aa2f/iec-tr-62898-4-2023>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.240.01

ISBN 978-2-8322-6645-8

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

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references	8
3 Terms, definitions, and abbreviated terms	8
3.1 Terms and definitions.....	8
3.2 Abbreviated terms.....	11
4 Overview of the document	12
5 Role model associated to decentralized electrical energy systems.....	12
5.1 Role model based on SGAM	12
5.2 Business roles	13
5.3 System roles.....	15
5.4 Clarifications on some roles and further detailing concepts	20
6 Microgrids use cases	22
6.1 General.....	22
6.2 List of business use cases identified	22
6.3 Use case methodology applied to microgrid domain	23
6.4 Guarantee a continuity in load service by islanding (BUC A)	25
6.4.1 General	25
6.4.2 Scope	25
6.4.3 Objectives	25
6.4.4 Operation of use case and technical issues	26
6.5 Electrify areas using renewable energy resources (BUC B).....	29
6.5.1 General	29
6.5.2 Scope	29
6.5.3 Objectives	29
6.5.4 Operation of use case and technical issues	29
6.6 Optimize local resources to provide services to customers inside the microgrid (BUC C).....	30
6.6.1 Scope	30
6.6.2 Objectives	30
6.6.3 Operation and related technical issues	31
6.7 Optimize local resources to provide services to the area EPS for disaster preparedness and power quality (BUC D)	33
6.7.1 Scope	33
6.7.2 Objectives	33
6.7.3 Operation of use case and technical issues	34
6.8 Develop larger energy systems by interconnection of isolated microgrids (BUC E)	34
6.8.1 Scope	34
6.8.2 Objectives	34
6.8.3 Operation of use case and technical issues	35
6.9 Optimize energy supply cost and exploitation of local assets inside community-run distribution utility by managing local resources (BUC F).....	36
6.9.1 Scope	36
6.9.2 Objectives	37
6.9.3 Operation and related technical issues	37

6.10	List of system use cases	40
7	Coordination with other IEC Standards	47
7.1	Links with IEC 61968-1	47
7.2	Links with IEC 61968-5	49
7.3	Links with IEC TR 61850-90-23.....	51
7.4	Links with the IEC 62898 series	53
7.4.1	General	53
7.4.2	Links with IEC TS 62898-1	53
7.4.3	Links with IEC TS 62898-2	53
7.4.4	Links with IEC TS 62898-3 series	54
7.5	VPP related standards	56
7.6	Prosumer electrical installations.....	58
8	Perspectives.....	59
	Annex A (informative) Business use case A, Guarantee a continuity in load service by islanding the microgrid, in IEC 62559-2 template	60
	Annex B (informative) UML microgrid use case repository.....	64
	Bibliography.....	65
	Figure 1 – The Smart Grid Architecture Model (CEN-CENELEC-ETSI, 2014).....	13
	Figure 2 – Schematic view of the different types of electric power systems.....	21
	Figure 3 – Graphic user guide for DER related terms and concepts	22
	Figure 4 – Schematic vision of the microgrids business use cases	23
	Figure 5 – Process for SUC edition for each BUC	25
	Figure 6 – Illustration of a microgrid for electrifying remote areas using renewable energy resources	30
	Figure 7 – Representation of the power regulation and control of a microgrid	33
	Figure 8 – Illustration of an area with microgrids and local energy supply systems without interconnection	35
	Figure 9 – Illustration of the connection between microgrids and local energy supply systems of an area	36
	Figure 10 – Customer regulation and EMS connection options	40
	Figure 11 – Interface Reference Model (IEC 61968-1)	48
	Figure 12 – Architectural options for DERMS deployment (from IEC 61968-5)	49
	Figure 13 – Request-and-reply message exchange pattern for the creation of a DER Group (from IEC 61968-5).....	50
	Figure 14 – Notification message exchange pattern for the creation of a DER Group (from IEC 61968-5)	51
	Figure 15 – First set of sub-roles attached to a DER (microgrid) deduced from IEC 61850-7-420	52
	Figure 16 – Current role transpositions into LNs according to IEC 61850-7-420	53
	Figure 17 – Function mapping among subparts in the IEC TS 62898-3 series	54
	Figure 18 – VPP composition diagram	56
	Figure 19 – Centralized control mode architecture	57
	Figure 20 – Decentralized control mode architecture.....	57
	Figure 21 – Example of prosumer's low-voltage electrical installation	58
	Figure B.1 – UML microgrid use case repository	64
	Figure B.2 – System use case illustration	64

Table 1 – Business roles of the domain..... 13
Table 2 – System roles of the domain 16
Table 3 – List of microgrids system use cases 41

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[IEC TR 62898-4:2023](#)

<https://standards.iteh.ai/catalog/standards/sist/0464125e-d432-41dd-ac2e-a45cb9d9aa2f/iec-tr-62898-4-2023>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MICROGRIDS –

Part 4: Use cases

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.

IEC TR 62898-4 has been prepared by subcommittee SC 8B: Decentralized electrical energy systems, of IEC technical committee 8: System aspects of electrical energy supply. It is a Technical Report.

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

Draft	Report on voting
8B/120/DTR	8B/142/RVDTR

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 Report 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/standardsdev/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 "<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.

IMPORTANT – The "colour inside" logo on the cover page of this document 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.

ITEH STANDARD PREVIEW
(standards.iteh.ai)

[IEC TR 62898-4:2023](https://standards.iteh.ai/catalog/standards/sist/0464125e-d432-41dd-ac2e-a45cb9d9aa2f/iec-tr-62898-4-2023)

<https://standards.iteh.ai/catalog/standards/sist/0464125e-d432-41dd-ac2e-a45cb9d9aa2f/iec-tr-62898-4-2023>

INTRODUCTION

This document provides a set of use cases related to microgrids, as a form of "decentralized energy system". Decentralized energy systems are small energy systems containing loads and distributed energy resources (generation, storage) with decentralized management for energy supply. This document completes the SC 8B roadmap for decentralized electrical energy systems. The goal is to explain the methodology retained on the microgrid sub-domain, which is a kind of decentralized system. This methodology, based on IEC 62913-1, describes high-level use cases (business use cases) covering the main typical usage of microgrids, and details some of them through system use cases. The proposed list of use cases is a first version, proposed for review; the goal is to cover all use cases with the same level of depth.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[IEC TR 62898-4:2023](#)

<https://standards.iteh.ai/catalog/standards/sist/0464125e-d432-41dd-ac2e-a45cb9d9aa2f/iec-tr-62898-4-2023>

MICROGRIDS –

Part 4: Use cases

1 Scope

In line with the methodology specified in IEC SRD 62913-1, this document describes business use cases (high-level use cases covering the main typical usage of microgrids) and details some of them. System use cases linked to those business use cases are listed and briefly described for contextualizing the main functions to be performed for managing microgrids. Ultimately, the goal of this document is to provide a consistent level of detail for all business use cases. The document details the methodology retained to develop system use cases from the business use cases.

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 SRD 62913-1, *Generic smart grid requirements – Part 1: Specific application of the Use case methodology for defining generic smart grid requirements according to the IEC systems approach*

[IEC TR 62898-4:2023](#)

3 Terms, definitions, and abbreviated terms

[IEC TR 62898-4:2023](#)

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC SRD 62913-1 and the following 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>

3.1.1

black start

start-up of an electric power system from a blackout through internal energy resources

[SOURCE: IEC 60050-617:2017, 617-04-24]

3.1.2

distributed energy resources

DER

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]

3.1.3 distributed energy resource management system DERMS

system which, on behalf of other interested systems, manages the communications and control of individual distributed energy resources (DER), and can do this with a variety of field message protocols, and aggregates this information and communicates with other utility systems, such as a distribution management system (DMS)

3.1.4 distributed generation DG

generation of electric energy by multiple sources which are connected to the power distribution system

[SOURCE: IEC 60050-617:2009, 617-04-09, modified – The preferred terms "embedded generation" and "dispersed generation" have been omitted.]

3.1.5 distribution management system DMS

integration of business processes, hardware, software, and telecommunications equipment that provide effective tools to manage the operational business processes related to network management, outage management, power quality and other supporting operational practices

[SOURCE: IEC TS 61968-2:2011, 2.88]

3.1.6 electrical energy management system EEMS

system monitoring, operating, controlling and managing energy resources and loads of the installations

Note 1 to entry: This equipment can be stand-alone or integrated in other larger equipment such as a home and building electronic system.

[SOURCE: IEC 60364-8-1:2019, 3.2.1, modified – Note 1 to entry has been added.]

3.1.7 electrical energy storage EES

installation able to absorb electrical energy, to store it for a certain amount of time and to release electrical energy during which energy conversion processes can be included

EXAMPLE A device that absorbs AC electrical energy to produce hydrogen by electrolysis, stores the hydrogen, and uses that gas to produce AC electrical energy is an electrical energy storage.

Note 1 to entry: The term "electrical energy storage" may also be used to indicate the activity that an apparatus, described in the definition, carries out when performing its own functionality.

Note 2 to entry: The term "electrical energy storage" should not be used to designate a grid-connected installation; *electrical energy storage system* (3.1.8) is the appropriate term.

3.1.8 **electrical energy storage system** **EES system** **EESS**

installation with defined electrical boundaries, comprising at least one electrical energy storage, which extracts electrical energy from an electric power system, stores this energy internally in some manner and injects electrical energy into an electric power system and which includes civil engineering works, energy conversion equipment and related ancillary equipment

Note 1 to entry: The EES system is controlled and coordinated to provide services to the electric power system operators or to the electric power system users.

Note 2 to entry: In some cases, an EES system may require an additional energy source (non-electrical) during its discharge, providing more energy to the electric power system than the energy it stored. Compressed air energy storage is a typical example where additional thermal energy is required.

3.1.9 **electric power system** **EPS**

composite, comprised of one or more generating sources, and connecting transmission and distribution facilities, operated to supply electric energy

Note 1 to entry: A specific electric power system includes all installations and plant, within defined bounds, provided for the purpose of generating, transmitting and distributing electric energy.

[SOURCE: IEC 60050-692:2017, 692-01-02]

3.1.10 **isolated microgrid**

group of interconnected loads and distributed energy resources forming a local electric power system at distribution voltage levels not currently capable of being 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: The definition includes a modification with respect to the IEC 617-04-23 to consider the fact that in the future, an isolated microgrid may be connected to an electric power system thanks to grid extension (this feature is explored further in this document).

[SOURCE: IEC 60050-617:2017, 617-04-23:2017, modified – In the definition, "with defined electrical boundaries" has been deleted, and "that cannot be connected" has been replaced with "not currently capable of being connected".]

3.1.11 **microgrid**

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 either grid-connected or 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]

3.1.12 **prosumer's electrical installation** **PEI**

electrical installation connected to a public distribution network or not able to operate with one or both of local power supplies and local storage units, and that monitors and controls the energy from the connected sources delivering it to one or more of loads, local storage units, and public distribution network

3.1.13 virtual power plant VPP

group of distributed energy resources which combine to function as a dispatchable unit

Note 1 to entry: A virtual power plant can be used for the purpose of participating in the electricity market or aggregating ancillary services.

[SOURCE: IEC 60050-617:2017, 617-04-27]

3.2 Abbreviated terms

BUC	business use cases
CIM	common information model
DC	direct current
DER	distributed energy resource(s)
DERMS	distributed energy resources management system
DG	distributed generation
DMS	distribution management system
DSO	distribution system operator
EEMS	electrical energy management system
EES	energy storage system
EESS	electrical energy storage system
EMS	energy management system
EV	electric vehicle
EPS	electric power system
FACTS	flexible alternating current transmission system
HV	high voltage
HVDC	high voltage direct current
IEC	International Electrotechnical Commission
LV	low voltage
MV	medium voltage
POC	point of connection
PEI	prosumer's electrical installation
PQ	power quality
REP	retail energy provider
SCADA	supervisory control and data acquisition
SMU	system management unit
SUC	system use cases
SyC	system committee
TSO	transmission system operator
UML® ¹	Unified Modeling Language™
VPP	virtual power plant

¹ UML® and Unified Modeling Language™ are trademarks of The Object Management Group. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named.

4 Overview of the document

In line with the methodology specified in IEC SRD 62913-1, this document describes business use cases (high-level use cases covering the main typical usage of microgrids) and details some of them.

Like any business use cases, these use cases attempt to be agnostic from any solutions or systems used for supporting the implementation of these use cases.

System use cases linked to those business use cases are listed for contextualizing the main functions to be performed for managing microgrids. For each of these, a short description and the involved system roles are listed with the intent to lay out technical requirements for further analysis. In the current document, not all the business use cases are covered in detail. Ultimately, the goal of the document is to provide a consistent level of detail for all business use cases. The document details the methodology selected to develop system use cases from the business use cases.

This work feeds the setting up of the standardization roadmap for decentralized energy systems, in the specific case of microgrids.

This means that this work will be followed by three next steps.

- Derive from these use cases some high-level objects to be standardized to ensure the implementation of a standard based solution for microgrids.
- Identify standards or standardization initiatives relevant in the context of microgrids and engage in a collaboration for coordination.
- Conclude on possible standardization recommendations to SC 8B or other TCs/SCs in IEC. Standardization activities could proceed with cooperation of concerned TC/SCs and SyCs, including but not limited to IEC SyC Smart Energy, SyC LVDC, TC 22, TC 57, TC 64, TC 82, TC 88, TC 95, TC 120.

Some additional benefits are expected from the content of this document:

- harmonization of the vocabulary related to microgrids across IEC initiatives;
- harmonization of the roles and functions;
- harmonization of the context of standardization for features cross cutting the IEC organization.

By nature, such a document is expected to evolve in order to reflect in the closest way market needs related to microgrids usage.

The proposed list of system use cases is a first version, proposed for review; the ultimate goal is to cover all use cases with the same level of depth.

5 Role model associated to decentralized electrical energy systems

5.1 Role model based on SGAM

The grouping of roles and actors (systems, components, operators, etc.) is based on a commonly accepted breakdown model, the EU M490 smart grid conceptual model Smart Grid Architecture Model (SGAM) in order to apprehend its complexity and to help maintain a global vision. SGAM is described in detail in IEC TR 62357-1 and IEC SRD 63200. IEC established a link between the SGAM framework and the use case methodology through key concepts: roles, business processes, activities, systems and functions in IEC SRD 62913-1. The SGAM framework enables the design of new smart grid architecture components to be organized on a three-axis basis (see Figure 1).

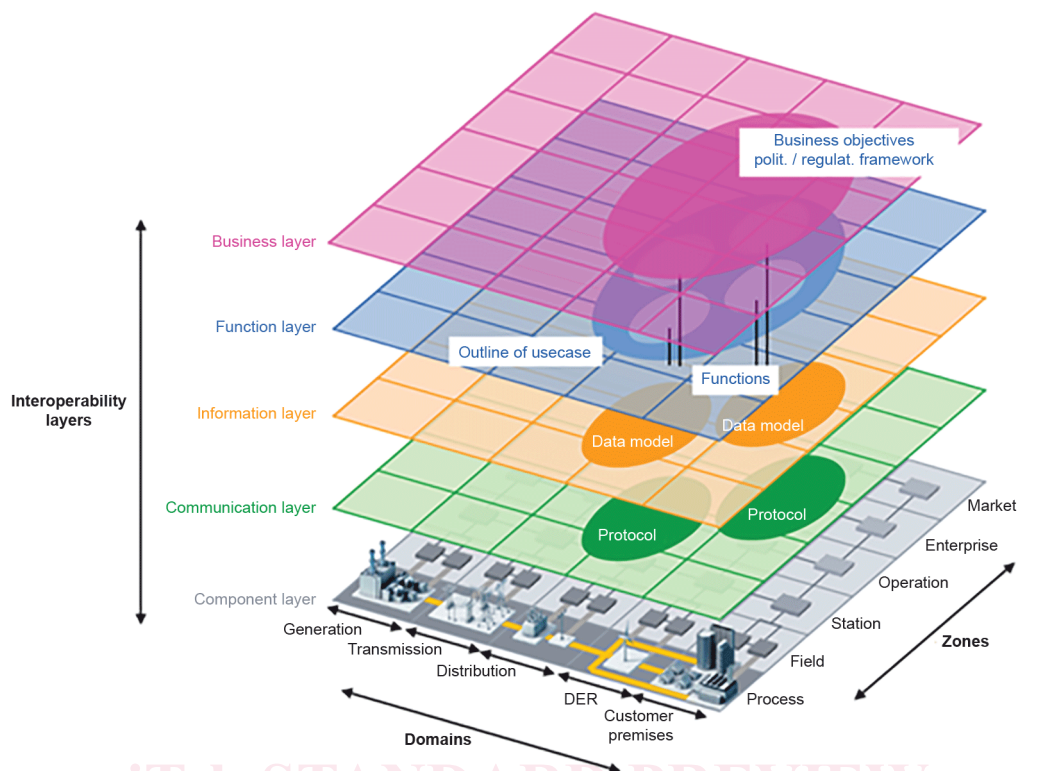


Figure 1 – The Smart Grid Architecture Model (CEN-CENELEC-ETSI, 2014)

5.2 Business roles

Table 1 lists the business roles that have been identified so far by IEC SyC Smart Energy following the guidelines for role modelling of IEC SRD 62913-1. This list is not exhaustive and will be updated as the use cases are drafted.

Table 1 – Business roles of the domain

Business roles	Definition
Generation and DER roles	
DER owner	Responsible party for overall market and financial decisions and contracts related to DER including microgrid design and operations
DER operator	Responsible party for operational aspects of the facilities and their DER systems including real time microgrid operations
Flexibility aggregator	A party which aggregates flexibilities for its customers. Can activate flexibility sites. Equivalent to retail energy provider (REP) in this document.
DER equipment manufacturer	Entity that produces, tests, sells, and implements DER systems
Producer	Party generating electric energy. Additional information: This is a type of grid user. [SOURCE: IEC 60050-617:2009, 617-02-01]
Prosumer	Network user that consumes and produces electrical energy [SOURCE: IEC 60050-617:2017, 617-02-16]
Decentralized electricity producer	Electricity producer with generator(s) connected to the distribution grid. Production can be dispatchable or non-dispatchable. This is a type of producer.
Power plant operator	Responsible party for operational aspects of a power plant