

SPIDERWG Terms and Definitions

Working Document

SPIDERWG Coordination Subgroup

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This is a working document intended to provide the NERC System Planning Impacts from Distributed Energy Resources Working Group (SPIDERWG) with clear definitions for use in discussions and documentation.

Purpose

This document provides a preferred set of working definitions and acts as a useful reference for terms describing or related to distributed energy resources (DERs). The document is intended to provide working definitions that should lead to consistent use of terms in NERC System Planning Impacts from Distributed Energy Resources Working Group (SPIDERWG) deliverables and discussions. SPIDERWG recognizes that various sources use identical terms related to DERs with different context-specific meanings. Other industry definitions are included for the readers' convenience in Appendix D. Terms may continue to change and be added during the development of SPIDERWG activities, and these terms may be used as future reference for any updates to the NERC Glossary of Terms.

Disclaimer

The definitions in this document may not represent official definitions adopted in the NERC Glossary of Terms. The terms also may not be appropriate in all contexts and may not apply to all sectors of the industry or regions. While SPIDERWG has adopted these preferred terms for its use, further discussion may be needed prior to incorporation into the NERC Glossary of Terms.¹

Since this is a working document, updates may be posted periodically. Please check the SPIDERWG webpage² for the most current version. Comments and recommendations for additions or modifications should be directed to the SPIDERWG Coordination subgroup: spiderwg_coordination@nerc.com.

Terms and Definitions Related to DER

The following terms in Table 1 are deemed the preferred working definitions for DER and related terminology used to describe DERs. Some definitions have been adapted from existing terminology used in other industry groups such as the NERC Distributed Energy Resource Task Force (DERTF).³ Supporting informative diagrams are provided in Appendix A to clarify use of the definitions. Appendix D provides other definitions used by other agencies or organizations and are identified with an "*" in Table 1.

¹ https://www.nerc.com/files/glossary_of_terms.pdf

² [https://www.nerc.com/comm/PC/Pages/System-Planning-Impacts-from-Distributed-Energy-Resources-Subcommittee-\(SPIDERWG\).aspx](https://www.nerc.com/comm/PC/Pages/System-Planning-Impacts-from-Distributed-Energy-Resources-Subcommittee-(SPIDERWG).aspx)

³ https://www.nerc.com/comm/Other/essntlrbltysrvctskfrDL/Distributed_Energy_Resources_Report.pdf

Table 1: Recommended Terms Related to DER

Term	Definition	Source
Distributed Energy Resource (DER)*	Any Source of Electric Power located on the Distribution System. <i>*Note: Loads and Demand Response do not produce electric power and are therefore not included in the definition of DER.</i>	NERC SPIDERWG
Source of Electric Power	Resources that inject or exchange power ⁴ (e.g., Distributed Generation and Energy Storage Facilities)	NERC SPIDERWG
Distribution System*	The electrical facilities that are located behind a transmission-distribution transformer that serves multiple end-use customers. ⁵	NERC SPIDERWG
End-Use Customer	Any entity with an individual meter that is interconnected to the distribution provider’s system for the purpose of receiving or exporting electric power.	NERC SPIDERWG
Distributed Generation* (DG)	Electric generation facilities connected to an Area Electric Power System ⁶ through a Point of Common Coupling; a subset of DER.	IEEE 1547-2003 ⁶
Energy Storage Facility	An energy storage device or multiple devices at a single location capable of receiving electric energy from the grid and storing it for later injection of electric energy back into the grid. May be any of various technology types, including electric vehicles with bidirectional supply equipment.	NERC DERTF ⁷
Demand Response* (DR)	Changes in electric usage by demand-side resources from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized.	Federal Energy Regulatory Commission (FERC) ⁸
Interruptible Load	Demand that the end-use customer makes available via contract or agreement for curtailment	NERC Glossary of Terms
Energy Efficiency (EE)	Programs that are aimed at reducing the energy used by specific end-use devices and systems, typically without affecting the services provided.	US Energy Information Administration (EIA) ⁹
Load Modifier*	Load reduction or load modifying activities or controls that include: energy efficiency, demand response, loads providing ancillary services, and interruptible loads	Adapted from 2020 CE Demand Forecasting practices ¹⁰

⁴ In this case, onto the distribution grid.

⁵ Refer to Figure A.1 for an illustration to support this definition.

⁶ <https://standards.ieee.org/standard/1547-2003.html>

⁷ https://www.nerc.com/comm/Other/essntlrbltysrvctskfrcdl/Distributed_Energy_Resources_Report.pdf

⁸ <https://www.ferc.gov/industries/electric/indus-act/demand-response/dem-res-adv-metering.asp>

⁹ <https://www.eia.gov/tools/glossary/index.php?id=D>

¹⁰ <https://efiling.energy.ca.gov/getdocument.aspx?tn=226392>

Table 1: Recommended Terms Related to DER

Term	Definition	Source
Distributed Demand Modifying Resource	Distributed energy resources combined with other demand-side programs that modify the net demand at the customer meter <i>* Note: This equates to DERs plus Load Modifiers at the transmission-distribution interface.¹¹</i>	Altered from 2020 CEC Demand Forecasting practices
Bulk Power System	(A) facilities and control systems necessary for operating an interconnected electric energy transmission network (or any portion thereof); and (B) electric energy from generation facilities needed to maintain transmission system reliability. The term does not include facilities used in the local distribution of electric energy. (Note that the terms “Bulk-Power System” or “Bulk Power System” shall have the same meaning.)	NERC Glossary of Terms
Transmission System	An interconnected group of lines and associated equipment for the movement or transfer of electric energy between points of supply and points at which it is transformed for delivery to customers or is delivered to other electric systems.	NERC Glossary of Terms
Subtransmission System	The networked Bulk Power System operated at less than 100 kV, but still above primary and secondary distribution voltage levels (e.g., greater than 35 kV).	NERC SPIDERWG
Behind-the-Meter Generation (BTMG)	A generating unit or multiple generating units at a single location (regardless of ownership), of any nameplate size, on the customer's side of the retail meter that serve all or part of the customer's retail load with electric energy. All electrical equipment from and including the generation set up to the metering point is considered to be behind the meter. This definition does not include BTMG resources that are directly interconnected to BES transmission.	NERC DERTF ¹²
Microgrid*	A localized group of electricity sources and loads that normally operates connected to and synchronous with the traditional wide area synchronous grid (Macro grid), but can also disconnect to "island mode" — and function autonomously as physical or economic conditions dictate.	LBNL
Cogeneration*	Production of electricity from steam, heat, or other forms of energy produced as a by-product of another process.	NERC Glossary of Terms

¹¹ Refer to Figure A.2 for proposed framework.

¹² https://www.nerc.com/comm/Other/essntlrbltysrvctskfrcdl/Distributed_Energy_Resources_Report.pdf

Table 1: Recommended Terms Related to DER

Term	Definition	Source
Emergency, Stand-by, or Back-Up Generation (BUG)	A generating unit, regardless of size, that serves the customer’s standby requirements, typically when there is an outage, and is not normally operated in parallel with the Area Electric Power System. This definition only applies to resources on the utility side of the customer retail meter.	NERC DERTF ¹³
Cogeneration Micro-Grid *	<p>Production of electricity from steam, heat, or other forms of energy produced as a by-product of another process.</p> <p>May range in size and complexity from a single “smart” building to a larger system such as a university campus or industrial/commercial park. Typically refers to a system that is connected at distribution primary or secondary voltage.</p>	NERC Glossary of Terms Used in NERC Reliability Standards ¹⁴

* Appendix D provides other definitions used by other agencies or organizations.

¹³ https://www.nerc.com/comm/Other/essntlrlbltysrvckstskfrcl/Distributed_Energy_Resources_Report.pdf

¹⁴ https://www.nerc.com/files/glossary_of_terms.pdf

Appendix A: Descriptive Figures

This appendix includes descriptive figures that are used to describe DERs and associated terms.

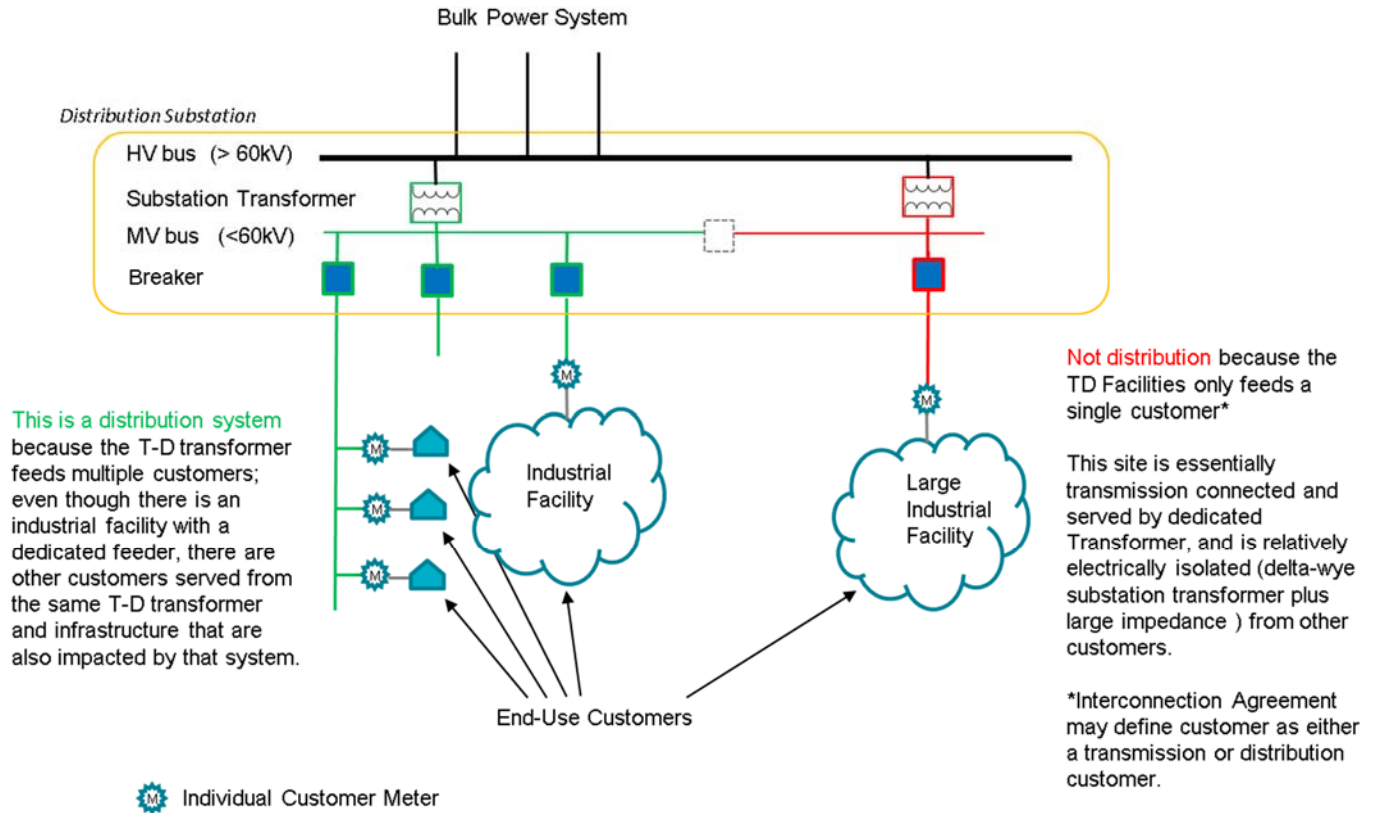


Figure A.1: Illustrative Example of a Distribution System

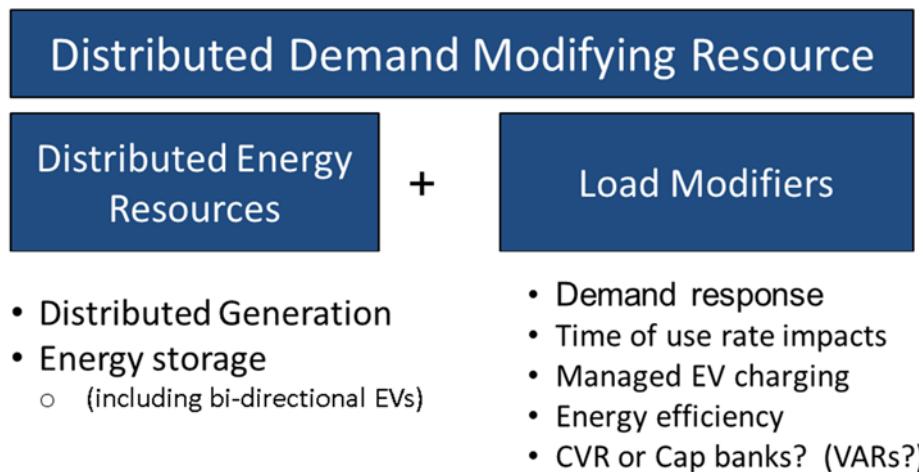


Figure A.2: Proposed Framework of DER plus Load Modifier

Appendix B: DER-Related Terms

This appendix provides industry terms that are commonly used and associated with DER-related concepts. Table B.1 lists each term, its associated definition, and the source of that definition.

Table B.1: Terms for DER-Related Concepts		
Term	Definition	Source
Authority Governing Interconnection Requirements (AGIR)	A cognizant and responsible entity that defines, codifies, communicates, administers, and enforces the policies and procedures for allowing electrical interconnection of DER to the Area EPS. This may be a regulatory agency, public utility commission, municipality, cooperative board of directors, etc. The degree of AGIR involvement will vary in scope of application and level of enforcement across jurisdictional boundaries. This authority may be delegated by the cognizant and responsible entity to the Area EPS operator or bulk power system operator.	IEEE 1547-2018 ¹⁵
Cease to Energize	Cessation of active power delivery under steady-state and transient conditions and limitation of reactive power exchange.	
Mandatory Operation	Required continuance of active current and reactive current exchange of DER with Area EPS as prescribed, notwithstanding disturbances of the Area EPS voltage or frequency having magnitude and duration severity within defined limits.	
Momentary Cessation	Temporarily cease to energize an EPS, while connected to the Area EPS, in response to a disturbance of the applicable voltages or the system frequency, with the capability of immediate Restore Output of operation when the applicable voltages and the system frequency return to within defined ranges.	
Permissive Operation	Operating mode where the DER performs ride-through either in mandatory operation or in momentary cessation, in response to a disturbance of the applicable voltages or the system frequency.	
Ride-Through	Ability to withstand voltage or frequency disturbances inside defined limits and to continue operating as specified. The modes of operation for ride-through include: Mandatory Operation, Permissive Operation and Momentary Cessation.	
Trip	Inhibition of immediate return to service, which may involve disconnection. NOTE—Trip executes or is subsequent to cessation of energization	
DER Aggregation	A virtual resource formed by aggregating multiple DG, BTMG, or ES devices at different points of interconnection on the distribution system. The BES may model a DERA as a single resource at its “virtual” point of interconnection at a particular T-D interface even though individual DER comprising the DERA may be located at multiple T-D interfaces.	NERC DERTF
Under voltage Load Shedding Program	An automatic load shedding program, consisting of distributed relays and controls, used to mitigate undervoltage conditions impacting the Bulk Electric System (BES), leading to voltage	NERC Glossary of Terms Used in

¹⁵ <https://standards.ieee.org/standard/1547-2018.html>

Table B.1: Terms for DER-Related Concepts

Term	Definition	Source
	instability, voltage collapse, or Cascading. Centrally controlled undervoltage-based load shedding is not included.	NERC Reliability Standards
Under frequency Load Shedding Program	Programs which are meant to arrest declining frequency and assist recovery of frequency following underfrequency events and provide last resort system preservation measures.	FERC Order No. 763

Appendix C: Terms and Definitions related to DER Modeling Concepts

The following definitions in Table C.1 are specifically used to describe DER modeling for planning assessments. These definitions have been developed by NERC SPIDERWG and the NERC Load Modeling Task Force (LMTF) prior to the formation of SPIDERWG, and are provided here for industry reference.

Table C.1: Terms for DER-Modeling Concepts		
Term	Definition	Source
Utility-Scale Distributed Energy Resource (U-DER)	DER directly connected to the distribution bus or connected to the distribution bus through a dedicated, non-load serving feeder. These resources are specifically three-phase interconnections, and can range in capacity, for example, from 0.5 to 20 MW although facility ratings can differ.	NERC LMTF ¹⁶
Retail-Scale Distributed Energy Resource (R-DER)	Typically Behind-the-Meter DER that reduces customer load demand. These DER include residential, commercial, and industrial customers. Typically, the residential units are single-phase while the commercial and industrial units can be single- or three-phase facilities.	NERC LMTF
DER_A Dynamic Model	Dynamic model used in RMS positive sequence stability simulations used to represent either individual U-DERs or aggregate amounts of R-DERs.	NERC SPIDERWG ¹⁷

¹⁶ https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Reliability_Guideline_-_Modeling_DER_in_Dynamic_Load_Models_-_FINAL.pdf

¹⁷ https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Reliability_Guideline_DER_A_Parameterization.pdf

Appendix D: Other Applicable DER-Related Definitions

The following definitions in Table D.1 are other definition used by industry when describing DER or DER-related terms. They are provided here as a useful reference for industry.

Table D.1: Alternate Definitions for DER-Related Concepts

Term	Definition	Source
Distributed Energy Resource (DER)	A source or sink of power that is located on the distribution system, any subsystem thereof, or behind a customer meter. These resources may include, but are not limited to, electric storage resources, distributed generation, thermal storage, and electric vehicles and their supply equipment.	FERC Energy Primer ¹⁸
	A resource sited close to customers that can provide all or some of their immediate electric and power needs and can also be used by the system to either reduce demand (such as energy efficiency) or provide supply to satisfy the energy, capacity, or ancillary service needs of the distribution grid. The resources, if providing electricity or thermal energy, are small in scale, connected to the distribution system, and close to load. Examples of different types of DER include solar PV, wind, Combined Heat and Power plants (CHP or Cogeneration), energy storage, demand response (DR), electric vehicles (EVs), microgrids, and energy efficiency (EE).	National Association of Regulatory Utility Commissions (NARUC) ¹⁹
	Any resource on the distribution system that produces electricity and is not otherwise included in the formal NERC definition of the Bulk Electric System (BES).	NERC DERTF
	A source of electric power that is not directly connected to a bulk power system. DER includes both generators and energy storage technologies capable of exporting active power to an EPS. An interconnection system or a supplemental DER device that is necessary for compliance with this standard is part of a DER NOTE 1—Controllable loads used for demand response are not included in the definition of DER.	IEEE 1547-2018
	Distribution-connected distributed generation resources, energy efficiency, energy storage, electric vehicles, and demand response technologies, are supported by a wide-ranging suite of California Public Utilities Commission (Commission) policies	California PUC ²⁰
	DER are resources qualified to participate in NYISO’s Energy, Ancillary Services, and/or Capacity markets that are (i) capable of changing its load, or (ii) capable of injecting 20 MW or less onto the transmission and/or distribution system, at the NYISO’s direction.	NYISO ²¹

¹⁸ https://www.ferc.gov/sites/default/files/2020-06/energy-primer-2020_0.pdf

¹⁹ <https://pubs.naruc.org/pub/19FDF48B-AA57-5160-DBA1-BE2E9C2F7EA0>

²⁰ [https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Commissioners/Michael_J_Picker/DER%20Action%20Plan%20\(5-3-17\)%20CLEAN.pdf](https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Commissioners/Michael_J_Picker/DER%20Action%20Plan%20(5-3-17)%20CLEAN.pdf)

²¹ <https://www.nyiso.com/documents/20142/1391862/Distributed-Energy-Resources-2017-Market-Design-Concept-Proposal.pdf/122a815f-b767-e67f-0a8f-323e5489c2b1>

Table D.1: Alternate Definitions for DER-Related Concepts

Term	Definition	Source
Distributed Generation (DG)	A generator that is located close to the particular load that it is intended to serve. General, but non-exclusive, characteristics of these generators include: an operating strategy that supports the served load; and interconnection to a distribution or sub-transmission system (138 kV or less)	US EIA ²²
Cogeneration	A generating facility that produces electricity and another form of useful thermal energy (such as heat or steam), that is used for industrial, commercial, heating, or cooling purposes	FERC ²³
MicroGrid	A group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.	Lawrence Berkeley National Laboratory (LBNL) ²⁴
	An aggregation of multiple DER types behind the customer meter at a single point of interconnection that has the capability to island. May range in size and complexity from a single “smart” building to a larger system such as a university campus or industrial/commercial park. Typically refers to a system that is connected at distribution primary or secondary voltage.	LBNL
Controllable Load	The load of particular consumers which under contract must be reduced, for a limited period of time, at the request of the distribution supply undertaking	International Electrotechnical Commission (IEC) ²⁵
	The participation of customers in electricity markets by changing their electricity consumption patterns in response to the price signals or incentive mechanisms from DR service providers.	IEEE Std 2030.6-2016 ²⁶
Demand Response	Demand response programs are incentive-based programs that encourage electric power customers to temporarily reduce their demand for power at certain times in exchange for a reduction in their electricity bills. Some demand response programs allow electric power system operators to directly reduce load , while in others, customers retain control. Customer-controlled reductions in demand may involve actions such as curtailing load, operating onsite generation, or shifting electricity use to another time period. Demand response programs are one type of demand-side management , which also covers broad, less immediate programs such as the promotion of energy-efficient equipment in residential and commercial sectors.	US EIA ²⁷

²² <https://www.eia.gov/tools/glossary/index.php?id=D>

²³ <https://www.ferc.gov/resources/glossary.asp>

²⁴ <https://building-microgrid.lbl.gov/microgrid-definitions>

²⁵ <http://www.electropedia.org/iev/iev.nsf/display?openform&ievref=603-04-42>

²⁶ <https://ieeexplore.ieee.org/document/7784695/>

²⁷ <https://www.eia.gov/tools/glossary/index.php?id=D>