Grid Architecture Component Class Specification

Component Class Designation: Distributed Energy Resource (DER)

Summary Overview

A DER is 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 photovoltaic (PV), wind, combined heat and power (CHP), energy storage, demand response (DR), electric vehicles (EVs), microgrids, and energy efficiency (EE) [1].

This specification draws a distinction between operational DER such as Demand Response, Distributed Generation and Distributed Storage, and DER used for planning purposes (which includes energy efficiency).

Definitions

Demand Response – Changes in electric usage by end-use customers 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 [2].

Distributed Generation – Electric generation that is not centralized and connected to transmission, but rather is decentralized and connected to distribution; individual units are typically much smaller in generation capacity than centralized generation plants [2]. CHP is a type of distributed generation.

Distributed Storage – Energy storage systems that are not centralized in nature. Electric vehicles are an example of distributed storage.

Microgrid – Electricity distribution systems containing loads and Distributed Energy Resources (such as distributed generators, storage devices, or controllable loads) that can be operated in a controlled, coordinated way either while connected to the main power network or while islanded. A Microgrid is under the control of a single management entity [2].

Combined Heat and Power (CHP) – Electric generation that is not centralized and connected to transmission, but rather is decentralized and connected to distribution; individual units are typically much smaller in generation capacity than centralized generation plants [3]. Also known as cogeneration.

Component Class Description

Purpose and Function

The purpose of DERs is to supply power or ancillary services to a distribution grid in a direct but decentralized manner. This contrasts with the conventional model of centralized electric power generation and transmission. The use of DERs can result in more efficient and modular provisioning of energy and services since the source is inherently closer to the load and generally smaller than conventional centralized generation sources. DERs are often based on renewable sources of energy, such as solar PV or wind, which may provide a positive environmental incentive for their use. DERs may also be aggregated so that control mechanisms are in place to support provisioning of bulk ancillary services to transmission or distribution grids [4].

Key externally visible properties

Since solar PV and energy storage devices are both a form of DER, the properties of the associated component class models [5, 6] apply here.

Interface descriptions

Energy Input interface – connection to the electric grid for energy input to the DER, and/or the physical mechanism that the DER uses to generate power, such as solar PV or wind.

Energy Output interface – connection for energy output from the DER.

Control interface – interface through which external control may be exercised. This includes dispatch, ancillary services signals, and emergency condition controls.

Table of relevant standards

Standard Name	Description	Version/Date

List of Attached Documents

Document Name/File Name	Description	Version/Date

References

No.	Reference
1	NARUC Manual on Distributed Energy Resources Rate Design and Compensation. NARUC, Washington, D.C., 2016.
2	Grid Architecture Power Systems Glossary, 2016.
3	(2019, January 14). Combined Heat and Power Basics, retrieved from https://www.energy.gov/eere/amo/combined-heat-and-power-basics
4	Grid Architecture Component Class Specification – DER Aggregator.docx

5	Grid Architecture Component Class Specification – Storage v0.2.docx
6	Grid Architecture Component Class Specification – Solar PV.docx
7	Grid Architecture Component Class Specification – Inverter.docx

Version History

Action	Date	Description	Author(s)
Created	14 January, 2019	Initial draft	B. Kelley