Grid Architecture Component Class Specification

Component Class Designation: Microgrid

Summary Overview

A microgrid is defined (by DOE) as a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that act as a single controllable entity with respect to the grid and can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode. Microgrids may vary in terms of electrical and geospatial extent, and in terms of ownership and participation entities (see Figure 1).

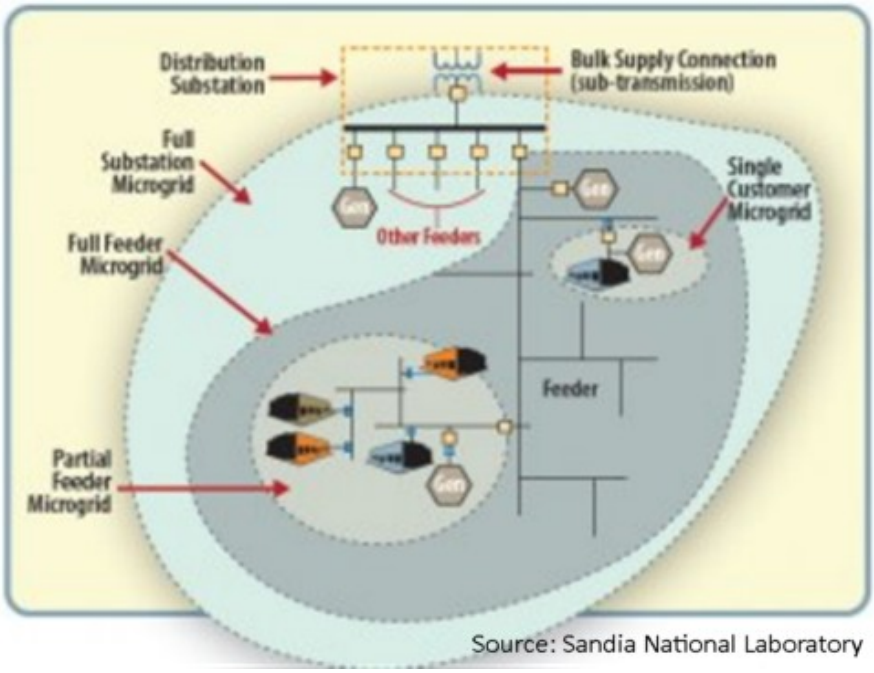

Figure 1 Microgrid Domain Examples

Some microgrids are community arrangements, whereas others are owned and operated by a single organization, such as a military base or university campus.

Definitions

Islanding – Islanding refers to the condition in which a distributed generator (DG) continues to power a location even though electrical grid power from the electric utility is no longer present. For intentional islanding, the local circuit disconnects from the grid, and forces the distributed generator to power the local circuit.

Point of Common Coupling – The PCC is a point in the electrical system where multiple customers or multiple electrical loads may be connected. According to IEEE-519, this should be a point which is

accessible to both the utility and the customer for direct measurement. Microgrids that are physically remote may not have a main grid PCC.

Single-user microgrid – a microgrid for a single entity such as a military base or university campus; a reason for such an arrangement is resilience in the event of main grid outages.

Multi-user microgrid – a microgrid that serves or encompasses multiple owners or loads and possibly generation sources; such arrangements exist in rural communities and more recently in urban (smart city) environments. Some community microgrids may include other energy networks such as district heating.

Network of microgrids – a collection of microgrids with electrical interconnections and a coordination mechanism that enables the set to function as a mutually supportive group; individual microgrids may interchange power in a manner similar to how balancing authority areas operate.

Single-connection microgrid – a microgrid with a single point of interconnection to a grid, and that can be treated as an edge resource. A single-connection microgrid may be a single or multi -user microgrid.

Multi-connection microgrid – a microgrid with more than one point of interconnection to components of a grid; it requires more complex coordination with connected neighbors than a single-connection microgrid. A multi-connection microgrid may, for example, participate in a network of microgrids, or function as a resource that sits between a conventional grid and other edge resources; topological arrangements are not necessarily limited to these examples, though.

Component Class Description

Purpose and Function

The purpose of a microgrid is to provide local electric power due to remoteness from a main power grid, or to provide resilience in the event of main grid failures, or to support local energy source choice. The microgrid operates as a small scale power generation and distribution system, with the ability to connect to and use power from a main grid, or to run in an isolated fashion. A microgrid also may be capable of supplying energy to a main grid.

The functions of the microgrid include local generation and distribution, interconnection with a main grid where appropriate, and internal balance and frequency regulation when isolated from the main grid.

A distinction is drawn here between microgrids with a single interconnection point and microgrids with multiple interconnection points to highlight the additional coordination and interfacing requirements inherent to multi-connection microgrids, as well as the implications to the overall resilience of electric grids.

Key externally visible properties

Separability – the microgrid can isolate itself from a main grid, and reconnect with proper synchronization

Self containment – a microgrid can provide its own power generation, balance, and stabilization when isolated from a main grid, meaning that it does not need control signals, timing, or grid state information when operating in isolation

Interface descriptions

PCC – the Point of Common Coupling is the boundary across which electricity passes, along with protection and control signals. Grid electrical variables can be measured here for the microgrid to establish synchronized reconnection after islanding, and to determine when to island in the event of grid failure or other specified conditions or events. The grid can also measure here to determine some elements of microgrid state.

Table of relevant standards

Standard Name	Description	Version/Date
IEEE 519	Standard Practices and Requirements for Harmonic Control in Electrical Power Systems	
IEEE 1547	Standard for Interconnecting Distributed Resources with Electric Power Systems	
IEEE P2030.7	Standard for the Specification of Microgrid Controllers	

List of Attached Documents <list Visio drawing packages, Xcel spreadsheets, etc.; add rows as needed>

Document Name/File Name	Description	Version/Date

Version History

Action	Date	Description	Author(s)
created	21 June 2016	Initial draft	jd taft