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IEEE Standard for the Testing of Microgrid Controllers

IEEE Power and Energy Society

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Transmission and Distribution Committee

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IEEE Standard for the Testing of Microgrid Controllers

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of the
IEEE Power and Energy Society

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Abstract: A set of testing procedures that enable verification, quantification of performance, and comparison of the performance with expected minimum requirements of the different functions of the microgrid controller are developed in this standard. The functions tested are microgrid controller functions that are common to the control of all microgrids regardless of topology, configuration, or jurisdiction. It aims to present metrics for a comparison of the control functions required from both the microgrid operator and the Distribution System Operator (DSO). This standard is functionality-driven and focuses on a modular approach to the implementation of the functional requirements.

Keywords: compliance testing, core functions, dispatch, distributed energy resources, distributed energy storage, distributed generation, electric distribution systems, energy management system, grid-connected, IEEE 2030.8™, initiating event, interconnection agreement, interconnection requirements, islanded, microgrid, microgrid controller, microgrid control system (MGCS), microgrid system, planned islanding, point of interconnection (POI), power quality, reconnection, ride through, standards, steady state (SS), transition, unplanned islanding

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Introduction

This introduction is not part of IEEE Std 2030.8-2018, IEEE Standard for the Testing of Microgrid Controllers.

The technologies and operational concepts to connect, integrate, and manage microgrids with distribution systems are being deployed with a variety of control methodologies. To fully realize the benefits of interconnected microgrids and avoid negative impacts on system reliability, there is a need for a single standard that specifies the testing requirements for microgrid controllers at the point of interconnection (POI). This standard provides the testing requirements for microgrid controllers by defining uniform initial conditions, initiating events, measurement criteria, and requirements relevant to the performance and operation of microgrid controller and/or the microgrid system being controlled at the point of the interconnection.

The intent of this standard is to define the test initial conditions, initiation events, and testing needed to characterize and validate the controller operations and functionality of the microgrid controller in a manner that can be universally adopted. The defined measurements include the real and derived quantities associated with the tests. The universality relates to the technical requirements of testing while providing a common information for a wide range of stakeholders, e.g., vendors, utilities, energy service companies, developers, codes and standards organizations, regulators and legislators, and governing bodies.

This standard establishes the criteria and requirements for testing the microgrid control system (MGCS) at the POI. It is not designed as a detailed set of step-by-step requirements for testing microgrid controllers or MGCSs. This standard provides the testing criteria to assess the functional technical requirements that are universally needed to assure a technically reliable operation of the microgrid at the POI. Any additional requirements are not to be implemented to the detriment of the functional technical requirements of this standard.

This standard defines the testing requirements of a microgrid controller system as defined in IEEE Std 2030.7™.[1]

[1]Information on references can be found in Clause 2.

Contents

IEEE Standard for the Testing of Microgrid Controllers

1. Overview

1.1 Scope

A key element of microgrid operation is the microgrid controller and more specifically the energy management system. It includes the control functions that define the microgrid as a system that can manage itself, and operate autonomously or grid-connected, and seamlessly connect to and disconnect from the main distribution grid for the exchange of power and the supply of ancillary services, including to the distribution system to which it is connected. It is recognized that microgrid components and operational solutions exist in different configurations with different implementations. The scope of this standard is to develop a set of testing procedures allowing the verification, the quantification of the performance, and a comparison of the performance with expected minimum requirements of the different functions of the microgrid controller that are common to the control of all microgrids, regardless of topology, configuration, or jurisdiction. It aims to present metrics for a comparison of the control functions required from both the microgrid operator and the Distribution System Operator (DSO). A set of testing and performance metrics is developed.

1.2 Purpose

The reason for establishing a standard for testing microgrid controllers, in the context of enabling interoperability of the different controllers and components needed to operate the controller through cohesive and platform-independent interfaces, is to establish standardized testing procedures. This approach should allow for flexibility and customization of components and control algorithms to be deployed without sacrificing "plug-and-play" or limiting potential functionality, while helping to ensure minimum requirements are met and establishing comparative performance indices. The standardization focuses on testing functional requirements, while recognizing that there are many possible hardware and software implementations of the same microgrid controller generic functions. The interoperability with various Distributed Energy Resources (DER) interfaces and other electrical system interfaces within the microgrid is be considered. A standardized set of testing procedures should facilitate the wide adoption of standard microgrid controller functional and performance requirements by vendors and utilities, including the DSO, for ease of interfacing with the Distribution Management System (DMS). The standard is functionality-driven and focuses on a modular approach to the implementation of the functional requirements.

1.3 Limitations

This standard does not address any design, planning, or operation related topics such as protection coordination, DER control schemes within the microgrid, nature and capabilities of the DERs, or classification of loads. The standard only addresses testing of the functional requirements applicable to all microgrid control systems (MGCSs), regardless of configuration. The testing requirements in this standard are functional and