

STANDARDS

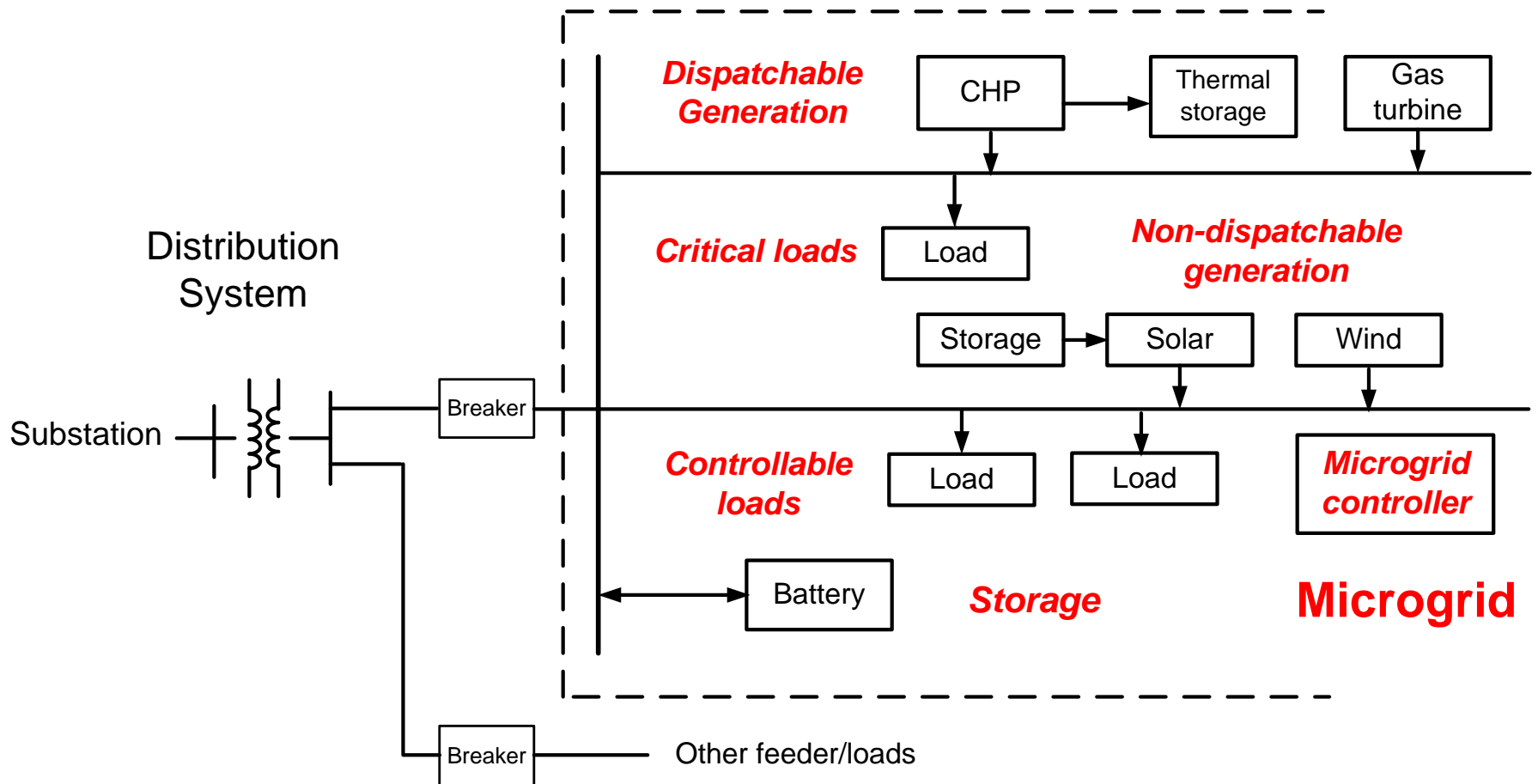
Microgrid Controllers

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IEEE p2030.7 Working Group, Secretary

Microgrid – generic structure and operation

Grid resilience and stability – Grid energy security – Integrating renewable sources – Islandable – Grid ancillary services – Markets



Need for standardization of microgrid controllers

- Microgrid technology is being deployed in a number of places and for different applications and contexts and new standards are required to facilitate deployment
- Standards are now under development by the IEEE SA, taking into account the nature and configuration of microgrids, which integrate Distributed Energy Resources (DER), including distributed generation and storage, and controllable loads (Demand Response)
- Defining generic functions between the control and power functions of microgrid components and its controller simplifies the design, configuration and operation of microgrids.
- Interoperability requirements facilitates deployment

IEEE Standards Association – microgrid controllers

- Standardization efforts – included in a series of 2 standards
 - P2030.7 – Specification of Microgrid Controllers
 - P2030.8 – Testing of Microgrid Controllers – based on the functional specification defined in P2030.8
- Interoperability requirements an integral requirement and a principle in the development of standards
- Participants
 - Manufacturers offering microgrid controller configuration platforms
 - Consultants configuring microgrids and service providers
 - Utilities and distribution system operators
 - Government and research laboratories

P2030.7 – Specification of Microgrid Controllers

- **New standard approved by IEEE SA, June 2014**
- **Officers:** Chair: Geza Joos, McGill University; Vice-Chair, Russell Neal, Consultant; Secretary: Jim Reilly, Consultant
- **Core functions**
 - Core functions – define the microgrid as system that manages itself, can operate autonomously or grid connected, and connects to and disconnects from the main distribution grid for the exchange of power and the supply of ancillary services
 - Scope of the standard
 - addresses the functions of the controller that are common to all microgrids, regardless of topology, configuration or jurisdiction
 - presents the control approaches required from the distribution system operator and the microgrid operator
 - links the functional specification with testing procedures

P2030.8 – Testing of Microgrid Controllers

- **New standard approved by IEEE SA, June 2015**
- **Officers:** Chair: Ward Bower, Ward Bower Innovations; Vice-Chair, Erik Limpaecher, MIT Lincoln Lab; Secretary: Geza Joos, McGill University
- **Elements under test – Core functions as a key to the operation of microgrids**
 - Functional specification and control functions – see P2030.7
 - Scope of the standard
 - Develop a set of testing procedures allowing the verification, the quantification and verification of the performance with expected/defined minimum requirements for the different functions of the microgrid controller common to all microgrids
 - Define a set of testing and performance metrics for design specification and product comparison purposes

P2030.7 – Functional specification guiding principles

- Approach to developing the standard – guiding principles
- Define a generic microgrid with core devices and elements common to microgrids
- Identify the main functions and features common to microgrids – microgrids are assumed to have grid connection and islanding capabilities
- Identify generic classes of functions, internal to the microgrid, and external to the microgrid, defining the interactions with the Distribution Management System (DMS)

P2030.7 – Functional specification standardization

- Standardization efforts – requirement for universal applicability
- Defining minimum required core functions of microgrids
- Defining core functions associated with steady state operation and transitions between grid connected and islanded modes – the basic modes of operation of microgrids
- Defining core functions with verifiable and quantifiable performance

P2030.7 – Core function definition and testing

- Core functions defined in the standard
 - Transition function – defines the controller operation in transition from grid connected and islanded mode and reconnection
 - Dispatch function – defines the set-point of DERs and controllable loads in grid connected and islanded modes
- Core function testing in P2030.8 – approach
 - Define a generic microgrid that could form an environment suitable for testing microgrid controller general functions
 - Create grouping of generic functions that can be tested from the perspective of the point of connection to the distribution grid
 - Define functions that are testable using practical environments and approaches to be defined in P2030.8

P2030.8 – Testing approaches – scenarios

- Transition function – testing using scenarios
 - Planned and unplanned islanding (fault scenarios) – transition process
 - Reconnection – transition process
 - Define initial (pre-existing) conditions – impact on transitions
 - Involvement of control decisions and actions defined by the dispatch function
- Dispatch function – steady state operation – scenarios
 - Grid connected mode – supplying loads and meeting P and Q interconnection requirements
 - Islanded mode – balancing generation and load

P2030.8 – Test metrics

- Performance criteria/metrics considered
 - Ability to maintain stable operation and required power quality in the microgrid under all circumstances
 - Ability to meet the interconnection requirements (V, P and Q)
- Metrics – use of existing standards (V and f) or utility grid codes
- Measurement and instrumentation defined
 - Type of measurement and time scale – dependent on the variable being measured
 - Instrumentation – sensors, measurement and recording
 - Accuracy of measurements
 - Data collection and analysis, presentation

Concluding remarks

- Target completion dates
 - P2030.7 – June 2017
 - P2030.8 – September 2017
- Next steps in the application of the standards
 - Trial use of the standards on on-going projects
 - Microgrid controller certification enabled by the standards – implementation approach