Update on IEEE P2030.14:
A Working Group to Develop a Guide for Virtual Power Plant Functional Specification for Alternate and Multi-Source Generation

Overview

- Changes in the industry with increasing distributed energy resources (DERs) and grid complexity are resulting in greater need for flexibility.
- Virtual Power Plants (VPPs) can help coordinate DERs to provide important grid services.
- IEEE Standard P2030.14 is a Working Group (WG) to develop a Guide to help ensure that VPPs integrate DERs efficiently while maintaining the integrity of the electric grid.
- This advisory reviews IEEE P2030.14, advancements made by the WG to date, and key considerations for electric cooperatives.

Introduction

The power system is changing, creating new flexibility needs due to factors like increased variability in net load, driven by climate changes, local generation such as behind-the-meter (BTM) solar, and more complex load control. Additionally, more renewable energy sources (RES) like solar and wind are being added to both distribution and transmission systems, along with energy storage options like battery storage (BESS). To meet these growing demands for flexibility, Virtual Power Plants (VPPs) can help by coordinating various distributed energy resources (DERs) to provide important grid services. IEEE 2030.14, which outlines the framework for the operation and management of VPPs, can help ensure that VPPs can efficiently integrate distributed energy resources (DERs), while maintaining grid reliability and enabling a more flexible, resilient energy system.

On June 29, 2023, IEEE Standard Association approved the Project Authorization Request (PAR) for an IEEE P2030.14 Working Group (WG) that will develop of Guide for virtual power plant functional specification for alternate and multi-source generation. NRECA has been an active member of this WG since its inception and hosted the inaugural meeting for the group in Arlington, VA on November 1, 2023. The goal of this involvement is to provide members with industry insights, cutting-edge VPP technology research, and a framework for consistent, reliable practices, promoting interoperability, efficiency, and safety in VPP operations.

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What is P2030.14?

IEEE P2030.14 is a Working Group (WG) focusing on developing a Guide that relates to virtual power plants (VPPs) and defines the VPP as an electric power plant capable of supplying electrical power to the electric grid and local loads. The Guide discusses the implementation of VPPs and VPP control systems, addresses their basic functional requirements, and proposes a set of core functions for the control systems. These functions include generation production estimation and scheduling from all sources; local load estimation and management; the provision of grid services (energy, capacity); and ancillary services (voltage and frequency control/support) to the electric power system (EPS). Generic requirements for grid interconnection and integration, and for interoperability with other EPS systems, are addressed. Islanded operation of a VPP feeding local loads and operating as a microgrid for enhancing energy supply security and resilience is discussed, within the context of existing IEEE microgrid standards.

What has changed?

Since our last advisory[1] on the IEEE P2030.14 standard earlier this year, the WG has made significant progress in refining the Guide for VPP operations. These developments focus on defining VPP assets, DER aggregation options, grid services, VPP configurations, features for reliable operation, controller function specifications and interoperability and interconnection requirements, moving the VPP Guide closer to finalization (slated for the first quarter of 2025). Details are as follows:

VPP Assets, Aggregation, and Configuration

- IEEE P2030.14 defines potential VPP assets (demand, resources), their types, and how they can interact with the existing electric system (see Figure 1).
- The Guide defines VPP as a system that aggregates and manages Distributed Energy Resources (DERs), like solar, wind, batteries, and controllable loads.
- DER assets capable of providing flexibility are classified in terms of the categories, including generation from conventional power sources (fossil fuels), generation from RES, energy storage, and demand response (controllable loads).
- The VPP uses a Distributed Energy Resource Management System (DERMS) to control these resources.
- VPP operates under a security-constrained economic dispatch framework, ensuring reliability within distribution and transmission systems.
- The VPP connects at one or more grid nodes to provide services to the grid.
- It can forecast energy production and participate in energy markets.
- VPP operations must adhere to physical grid constraints, ensuring proper injection of active (P) and reactive (Q) power.

[1] Advisory-IEEE-P2030-14-Workgroup-for-VPP-Guide-January-2024.pdf (cooperative.com)

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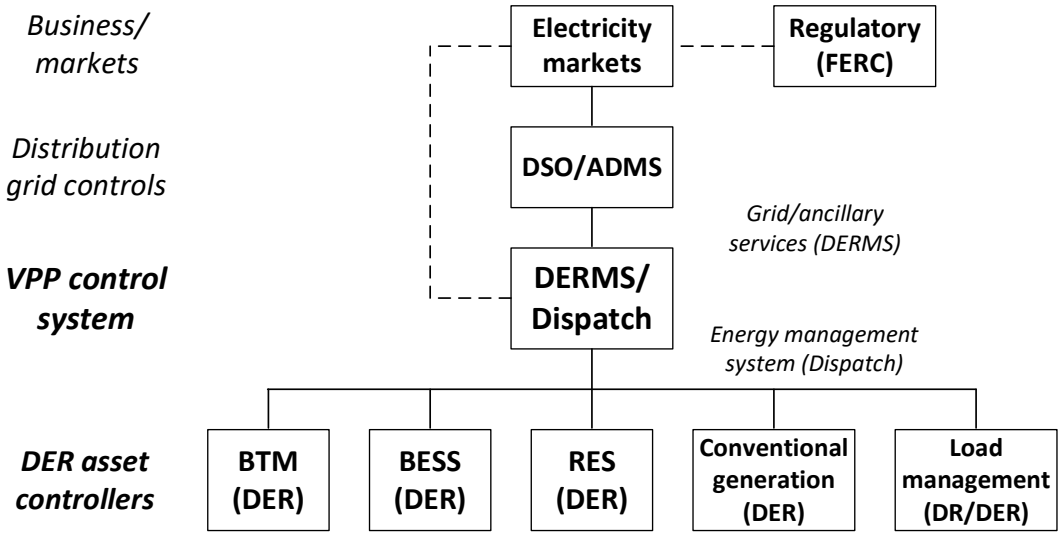

Figure 1: VPP Control System and Interaction with the Integrated Grid

VPP Controller Functions

- IEEE P2030.14 defines core functions and basic requirements for VPP control systems. The Guide includes three types of control functions: 1) control system core function, 2) energy management functions for dispatch, and 2) grid services functions.
- These control functions include an Energy Management System (EMS) for managing generation estimation, scheduling, and local load management, and a DERMS-type controller for managing grid services (energy, capacity) and ancillary services, like voltage and frequency control.
- The VPP dispatch function coordinates asset dispatch, similar to microgrid systems.

Interoperability and Interconnection

- VPP control systems interact with various grid levels, including VPP asset functions, transmission and distribution control functions, and system operator functions.
- The Guide defines EPS interconnection and management of grid/ancillary services, controlled by a DERMS-type controller.
- Interoperability requirements for VPPs are defined by adhering to existing standards and regulations relevant to their operation. Key standards include:
    - IEEE Std 1547-2018 (distribution) and IEEE Std 2800-2024 (transmission) for asset control.
    - Information and communication standards, such as IEEE Std 2030.5-2018 and IEEE Std 1815-2012, support communication systems and data models for asset control.
    - Smart grid standards, including IEEE Std 2030.7-2017 (microgrid) and IEEE Std 2030.11-2021 (DERMS).
    - Regulatory requirements, like FERC 2222-2022, guide VPP operations at the business and market level, as applicable.

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- P2030.14 specifies that VPP interconnection with transmission and distribution systems must comply with the interconnection rules of the relevant system operator (DSO, TSO, ISO).
- It also recommends the use of external assets for VPP operations through agreement with the relevant entities.

What is the impact on cooperatives?

The P2030.14 Guide will provide the following benefits for electric cooperatives:

- Cooperatives will find guidance and a structure for planning the integration of DERs into their operations, benefiting both the utility (grid services) and its customers (value for DR and BTM resources) in a way that posits reliability.
- It will put forth a VPP structure and control system that is required for the aggregation and the optimization of the operation of the mix of power generation and storage assets, and for the provision of grid and ancillary services. Thus, the IEEE P2030.14 Guide will provide a framework to cooperatives for the aggregation of DERs and opportunities for the management of DER as systems, rather than disparate, unmanaged interconnections.
- Compliance with interoperability standards ensures effective connections to the grid, although this may require investment in new technologies, such as communication infrastructure.
- Additionally, the P2030.14 VPP Guide will help co-ops diversify energy sources, improving resilience and supporting the use of additional renewables, as determined by the cooperative's specific needs.

What do cooperatives need to know or do about it?

The IEEE P2030.14 WG is where the trend to VPP and aggregation of DERs is being explored and discussed by a diverse group of stakeholders. VPPs, as articulated in IEEE P2030.14, are a new way for DERs to be aggregated and operated on distribution systems, which can benefit cooperative utilities, their consumers, G&T, and regulators by providing greater visibility and management over DERs connected to distribution systems and potentially enabling their participation in providing grid services.

IEEE P2030.14 extends the scope of VPPs to focus on power generation systems, in addition to load management and BTM DER. It goes beyond aggregation within a boundary, with generation serving specific loads, to a broad group of DERs within a balancing authority. It provides additional power and energy to the growing electrical load on the grid, by integrating conventional and alternate power generation systems, combined with renewable energy resources and storage. It offers more choices of resources for interconnection, beyond single solar farms or storage units. It can bring flexibility from a mix of resources that are not limited geographically.

In summary, by following the guidance provided by P2030.14, co-ops can:

- Familiarize themselves with VPP concepts, functionalities, and benefits for grid services and operational efficiency.
- Assess current infrastructure to identify necessary upgrades for VPP integration, including DERMS and communication tools.

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- Budget for investments in technology needed for effective VPP operation, such as forecasting and data management systems.
- Collaborate with technology providers, other co-ops, and regulatory bodies for knowledge sharing and resource optimization.
- Engage and inform their members about VPP initiatives, encouraging participation in demand response and renewable energy projects.
- Stay updated on relevant standards and regulations to ensure compliance and successful grid interconnection.
- Gain important insights for the consideration of energy models aligned with sustainability goals.
- Establish metrics to monitor VPP performance and impact on operations and member satisfaction.

How to Join IEEE P2030.14 Working Group

While NRECA will continue its traditional involvement with the various standard working groups, sharing the information with our co-op Network as appropriate and useful, and representing members' interests in the research and forums, any individual from a co-op can join the WG by contacting NRECA's Primary Representative, Ravindra Singh (Ravindra.Singh@nreca.coop).

At any time, any cooperative – whether or not participating in this WG – may also contact the NRECA Primary Representative for the IEEE P2030.14 working group, Ravindra Singh, with questions about P2030.14 meetings, presentations, and Guide.

Related Information

- Advisory: Invitation to IEEE P2030.14 Working Group on Virtual Power Plant Guide (January 2024)

Contact for Questions

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