CIGRE Study committe C6

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG C6.49

NAME OF THE CONVENOR
Hatziargyriou Nikos (GREECE)

TITLE
Virtual power plant (VPP) aggregation of distributed energy resources (DER)

THE WG APPLIES TO DISTRIBUTION NETWORKS: YES

ENERGY TRANSITION
1 / Storage
3 / Digitalization
5 / Grids and Flexibility
6 / Solar PV and Wind
7 / Consumers, Prosumers and Electrical Vehicles

POTENTIAL BENEFIT OF WG WORK
1 / commercial, business, social, economic benefits
2 / potential interest from a wide range of stakeholders
3 / likely to contribute to new or revised industry standards
4 / state-of-the-art or innovative solutions or directions

STRATEGIC DIRECTION
1 / The electrical power system of the future reinforcing the End-to-End nature of CIGRE: respond to speed of changes in the industry by preparing and disseminating state-ofthe-art technological advances
2 / Making the best use of the existing systems
3 / Focus of the environment and sustainability (in case the WG shows a direct contribution to at least one SDG)

SUSTAINABLE DEVELOPMENT GOAL
9 / Industry, innovation and infrastructure

BACKGROUND :
Virtual power plants (VPP) have become an important element in the management and support of electric power systems (EPS). They have gained importance in the context of a high penetration of renewable energy resources, mostly solar PV systems, and energy storage systems, mostly battery energy storage systems, particularly at the distribution level. The main functions of the VPP are to provide grid services to the EPS at the distribution level, and, if capacity is sufficient, at the transmission level. Services comprise power and energy, and ancillary services, including voltage and frequency support and contribute to the restoration of the EPS in the event of large contingencies and blackouts. Other services include reliability and resilience services, the latter applicable in the event of extreme weather events.

There are many types of VPPs currently being installed, operated or proposed. A typical VPP aggregates distributed energy resources (DER) connected to the distribution grid, not necessarily in the same feeder, including power generation from renewable energy resources (RES), mostly solar PV and possibly wind, battery energy storage systems (BESS), combined with RES or as separate systems, and demand response (DR), including controllable (heating, ventilation and air conditioning) and curtailable loads (hot water heaters, electric heating).

PURPOSE / OBJECTIVE / BENEFIT OF THIS WORK :

The working group addresses the different aspects of a VPP, starting from the nature of the asset and their configuration within the VPP for the provision of grid and ancillary services. The needs, expectation and requirements of the distribution system operator (DSO) are taken into account. The specification of the VPP functions are developed based on these considerations. The deployment, configuration, and management of the VPP are addressed. Interconnection and integration requirements are presented. The document discusses elements of the economic and business case within applicable regulatory frameworks. Findings of previous working groups related to issues of DER integration and aggregation, grid services, and distribution grid operation will be included as appropriate.

SCOPE :

The following list of topics are addressed by the working group:

1. VPP assets – Aggregation of generation from conventional dispatchable resources, non-dispatchable RES, and energy storage (electrical and thermal). Importance of dispatchable generation. Aggregation of DR assets, including controllable and curtailable loads. Asset characteristics, flexibility, availability and required features for the provision of grid services as dictated by the operation of the EPS under normal and contingency conditions.
2. Grid services and ancillary services provision using aggregated DER assets within a VPP structure – Categorization of EPS support and services required to operate the distribution system. Grid services, including energy and capacity. Ancillary services, including voltage and frequency support and control. Other services including congestion management, and reliability and resilience support. VPP nodal injections within the EPS. Requirements for the provision grid services to the transmission system.
3. VPP structures, features, and functions – Distributed VPP structures, microgrid configurations. VPP functions, including generation production estimation, forecasting and scheduling from all sources, and dispatch of assets for the provision of grid and ancillary services including data security technology. Benefits of artificial intelligence and data driven tools in managing VPP assets.
4. VPP grid integration and interconnection requirements for the provision of grid services – Role of the DSO in the deployment and the operation of a VPP. Applicable grid codes. Impact of VPP operation on the EPS under normal operation and contingencies associated with the EPS and VPP operations.
5. Business cases for VPP stakeholders – Establishing the value of the EPS services provided under different operating modes – Impact of market structures on the business case – Tools, use cases, stakeholders (single, multiple) interests, and implementation considerations. Experiences and case studies, regional considerations, ownership and operation.
6. Regulatory framework and jurisdictional constraints for grid service delivery – Regulatory framework facilitating the deployment and justifying the business case for a VPP in the provision of grid services. Market deployment considerations and constraints.

Guidelines, recommendations and best practices.

DELIVERABLES AND EVENTS

Deliverables Types

Electra report
Technical Brochure and Executive Summary in Electra
Tutorial
Webinar

Time schedule

Q3	2025	Start Working Group
Q1	2028	Draft TB
Q3	2028	Final TB
Q3	2028	Tutorial

APPROVAL BY TECHNICAL COUNCIL CHAIRMAN:

Rannveig S. J. Loken
August 02nd, 2025