

CIGRE Study committee C6

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG C6.48

NAME OF THE CONVENOR

Gouveia Clara (PORTUGAL)

TITLE

DER's integration in Distribution Systems Operation and Control

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

- 2 / potential interest from a wide range of stakeholders
- 4 / state-of-the-art or innovative solutions or directions
- 5 / Guide or survey on techniques, or updates on past work or brochures

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-of-the-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

- 7 / Affordable and clean energy
- 9 / Industry, innovation and infrastructure

BACKGROUND :

While expanding the electricity grid through new interconnections and other grid reinforcement activities is a part of electrification and decarbonization investments, it will not ensure a stable and efficient operation of future power systems. Increased complexity of operation due to increased integration of inverter-based resources, such as renewable energy-based generation and energy storage systems, and increased load variability require an active management approach.

DER connected to distribution networks, either individually or in microgrids, energy communities or Virtual Power Plants (VPP), are expected to provide grid support based on market-based services for frequency regulation and congestion management for both transmission and distribution networks.

This will represent a new paradigm in power system operation, particularly for distribution networks, integrating a significant share of renewable energy generation and other flexible distributed energy resources, such as energy storage, electric vehicles, and heat pumps. Future power system operation will be based on three main pillars:

- Distribution network observability, which ensures the monitoring, estimation, or forecasting of the power system's main variables (frequency, voltage, current, power) necessary to assess the system's security, and prevent or detect congestions or other technical problems timely. Furthermore, it is essential to establish adequate mechanisms to share information between relevant system actors, such as TSOs and DSOs, ancillary and flexibility markets, aggregators, DER plants, and consumers/prosumers.
- Preventive management and control for secure and efficient operation. Supported by accurate forecasting tools, advanced diagnostic and predictive maintenance, network operation will take a preventive approach to define contingency plans, flexibility needs, and optimal control strategies for network assets, supported by accurate forecasting tools.
- Coordinated operations at different levels:
 - Coordination of operation during steady state and contingency between DSO and TSO
 - Coordination of network operations with electricity markets, aggregators, and other external providers of flexibility
 - Combining preventive and corrective control provided both from centralized and decentralized automation systems.
 - Coordinated operation at different voltage levels for congestion management, voltage control and fault management and system restoration

PURPOSE / OBJECTIVE / BENEFIT OF THIS WORK :

The objective of this WG is to map the current evolution of power system operation and control strategies, particularly at distribution systems, as they face increased integration of Distributed Energy Resources (DER). The WG will address the status of the implementation of advanced distribution management strategies that tackle observability, preventive management, and coordinated operation strategies with TSO, aggregators, and flexibility markets.

Considering results from pilot projects and other innovation initiatives, the WG will oversee the expected challenges and evolution of distribution system control.

SCOPE :

The working group would investigate and report on:

1. Define current power system operation scenarios, considering current challenges faced by different distribution network operators, TSO/DSO coordination schemes and distribution system architectures, and current capabilities.
2. Common practice for DER integration, namely grid connection requirements at the different voltage levels, communication architecture with DSO and TSO management systems, and mapping of data exchange with TSO and DSO. Risk identification and assessment for various DERs will also be addressed. This includes connection with microgrids, energy communities, and Virtual Power Plants.
3. Data integration and network modeling. Understanding the value of data, TSOs, and DSOs have been working towards improving data processing and sharing between systems and departments. This is particularly relevant for distribution networks, where network modeling at the MV and LV levels can leverage from different sources fo data (e.g. smart meters, RTUs, LV sensors) historical data for error detection, topology mapping, and estimation of network conductor characteristics.
4. Observability of distribution networks, focusing on monitoring strategies, particularly in LV networks, adoption of state estimation, and forecasting applications for loads and generation.
5. Operation planning of distribution network operation, considering the implementation of preventive management strategies, taking advantage of DER flexibility and network assets.
6. Coordination with real-time operation and automation strategies, considering smart substation and local active management strategies, including relevant devices for DERs integration with capabilities of adaptive voltage support and power quality management.
7. International examples and experiences.
8. Future prospects in power system operation and control, particularly at the distribution level.

Remarks:

Relevant previous related activities which the work of this WG will be based on, include:

- CIGRE TB 591 Planning and optimization methods for active distribution systems, WG C6.19, 2014.
- CIGRE TB 936 Enhanced Information and Data Exchange to Enable Future TSO-DSO Coordination and Interoperability, JWG D2/C2.48, 2024
- CIGRE TB 845. TSO-DSO Co-Operation Control Centre Tools Requirements, WG C2.40
- CIGRE TB 711 Control and automation systems for Electricity Distribution Networks (EDN) of the future, 2017
- TB 929 Advanced Consumer-Side Energy-Resource Management Systems, JWG D2/C6.47, 2024
- TB 932 Aggregation of Battery Energy Storage and Distributed Energy Resources, WG C6.43

DELIVERABLES AND EVENTS

Deliverables Types

Time schedule

Q3	2025	Recruit members (National Committees, WiE, NGN)
Q4	2025	Develop final work plan
Q2	2027	Draft TB for Study Committee Review
Q4	2027	Final TB
Q3	2028	Tutorial
Q3	2028	Webinar

APPROVAL BY TECHNICAL COUNCIL CHAIRMAN:

Rannveig S. J. Loken
August 02nd, 2025