

CIGRE Study committee C2

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

JWG C2/C4.47

NAME OF THE CONVENOR

Giannuzzi Giorgio (ITALY)

TITLE

Wide Area Operational Security Systems to enable the Energy Transition

THE WG APPLIES TO DISTRIBUTION NETWORKS: NO

ENERGY TRANSITION

- 1 / Storage
- 3 / Digitalization
- 5 / Grids and Flexibility
- 6 / Solar PV and Wind

POTENTIAL BENEFIT OF WG WORK

- 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-of-the-art technological advances
- 2 / Making the best use of the existing systems

SUSTAINABLE DEVELOPMENT GOAL

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

BACKGROUND :

The energy transition is a worldwide ongoing process that implies fast decarbonisation and new electrical system “actors”: HVDC, wind farms, PV panels, storage, electrolyzers, aggregation of distributed loads/production. Operational security systems integrated in future control rooms should follow a similar progress.

The gradual decommissioning of rotating machines causes a general reduction of inertia and short circuit power that means a change of the dynamic response of the system. More in detail, the speediness of frequency and voltage transients increases (large values of the Rate of Change of Frequency - RoCoF) jointly with the over/undershoot of the electrical quantities during the transients.

On the other hand, the short circuit power reduction requires more effectivity the action provided by the remaining rotating machines in terms of performance and reactive reserve, driving the system to work at limit of the reactive reserve available, causing an increase of incidence of voltage instability phenomena.

The mix of the two previous elements is also the trigger of additional side effects; firstly, the potential inability of protections to guarantee the sufficient speediness in selectivity, sensitivity, reliability, detection and clearing the faults. Secondly the general tendency of the grids to work near to the stability margin, due to the increase of the impedance between different transmission paths and wide transmission angle spread. The consequence is the arise of interarea oscillations or the trigger of forced oscillations or transient instability cascading effects that drive the system to a splitting and, in the worst case, leading to a black out.

In this general context loads could play an important role; the “natural” stabilizing effect due to the rotating masses of motors and resistive components is more and more “intermediated” by the inverter controls, that partially decrease their effects.

Finally, the new generation of inverter-based production and the promising grid forming technology alongside the useful and innovative functions they constitute a question mark regarding potential mutual interactions that could be better studied and investigated only thanks a proper operational experience and pilot tests/projects.

In this evolving system, wide area operational security assessment tools are of paramount importance to provide enough situational awareness to modern control rooms.

PURPOSE / OBJECTIVE / BENEFIT OF THIS WORK :

The perimeter of “**Wide Area Operational Security Systems to enable the Energy Transition**” WG it is strictly related to the needs of Control Room and, in general, of the System Operation in terms of algorithms and tools devoted to support the Operation. Aspects related to cybersecurity will be not analysed.

Purpose of the work is to:

- Investigate the impact of the system changes of dynamics and related new phenomena seen in the Control Room discussing the different temporal phases (normal operation, alarm, emergency, restoration)
- Evaluate the algorithms, tools and systems that can improve the situational awareness of the Control Room
- Discuss the needs of the system about new wide area applications in terms of architectures, functions (wide area monitoring, regulation, automation, including Control Room applications devoted to wide area management), devices.

SCOPE :

Scope:

The work will involve following topics:

1. Discussion about conventional and new phenomena involving control room during different temporal phases of operation.
2. DC and AC superposed grids.
3. Examples from real life of dynamics impacting the Control Room.
4. Methodologies to monitor and improve situational awareness in the Control Room.
5. Functional requirements for the new generation of field devices.
6. RMS and EMT applications in control room.
7. Future system needs in terms of Wide Area Monitoring, Automation and Control and WADC (Wide-Area Damping Controller)
8. Innovative tools and algorithms. AI applications.
9. Real time assessment of grid services devoted to security
10. Use cases presentation.

DELIVERABLES AND EVENTS

Deliverables Types

Annual progress and activity report to Study Committee
Electra report
Technical Brochure and Executive Summary in Electra
Tutorial
Webinar

Deliverables schedule

- TutorialQ32028WG Tutorial
- Technical BrochureQ22028Technical Brochure
- WebinarQ22028Webinar
- Electra reportQ12028Electra
- Annual progress and activity reportQ12026Progress report

APPROVAL BY TECHNICAL COUNCIL CHAIRMAN:

Rannveig S. J. Løken
May 12th, 2025