CIGRE Study committe B5

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG B5.89

NAME OF THE CONVENOR
LOPES Felipe (BRAZIL)

TITLE
Protection Redundancy and Backup for Modern Power Systems

THE WG APPLIES TO DISTRIBUTION NETWORKS: YES

ENERGY TRANSITION
3 / Digitalization
6 / Solar PV and Wind

POTENTIAL BENEFIT OF WG WORK
1 / commercial, business, social, economic benefits
3 / likely to contribute to new or revised industry standards
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-ofthe-art technological advances
2 / Making the best use of the existing systems

SUSTAINABLE DEVELOPMENT GOAL
0 / Other SDGs or not applied

BACKGROUND :

Power system protection is a mission-critical function. Protection system redundancy and backup are commonly used to achieve the required high level of protection availability and dependability. When engineering for redundancy and backup, practitioners are often guided by interconnection requirements as well as assumptions about failure modes and reasonable contingencies. As a result, redundancy and backup design tends be a relatively subjective field of protection engineering. How much backup is needed? And when is the backup excessive not only adding cost but also increasing the probability of unintended operations? Few international reports and standards cover these topics in detail. The last relevant CIGRE B5 work on this topic dates to 1999 [1].

Remote backup guards against a catastrophic failure of multiple systems in a substation, typically by using distance protection elements. Remote backup is one of the pillars of any protection backup philosophy. However, inverter-based resources (IBRs), HVDC links, and unconventional fault current sources in general, dramatically challenge the distance protection principle especially in remote backup applications when the infeed effect may be extremely high.

PURPOSE / OBJECTIVE / BENEFIT OF THIS WORK :

This work will explore best practices for redundancy and backup, especially in the context of unconventional and weak sources in modern power systems. The work will focus on new challenges including weak sources with unconventional fault response and DC links, as well as on new opportunities including availability of protection channels and reduction of hidden failures through protection system self-checking and monitoring.

The discussion on redundancy will focus on the functional redundancy (conceptual discussion about the need to double some parts of the protection systems in order to increase the dependability). The way the expected functional redundancy should be concretely implemented in a given technology will not be addressed in this work.

SCOPE :

The work will cover the following topics:

1. Impact of protection availability requirements for keeping bulk electric system assets in service, including temporary exceptions, on redundancy and backup.
2. Protection functional redundancy and backup fundamentals (including redundant relays, redundant DC power, dual breaker trip coils, breaker failure protection, redundant protection channels with diverse paths, remote backup).
3. Best practices for selecting reasonable contingencies for both the primary system and the protection system when deciding on the need, scope, and settings for backup protection.
4. Impact of weak unconventional sources on overcurrent and distance backup protection, distance element logic with enhanced performance in weak system conditions, and the role of voltage-based protection in backup protection applications.
5. Remote backup protection considerations near DC links.
6. The role of protection communications channels, breaker failure protection, and protection system self-monitoring in lowering requirements for remote backup.
7. Enhancing selectivity during backup protection trips (examples: bus splitting, backup protection near very large generating stations).
8. Impact of the primary system configuration on backup protection, best practices for lowering the requirements and complexity of backup protection.
9. Optimizing backup, redundancy, self-monitoring, and periodic maintenance as all these factors together affect protection availability and dependability.
10. Lessons learned from backup protection operations and recommendations for relay design, standards, and applications.

Out of scope:

1. This work will leverage [1] and avoid unnecessary repetition of the material already covered there.
2. This work will avoid differentiating between different relay and protection scheme types, communications channel types, self-checking methods, periods maintenance programs, etc. unless required from the redundancy and backup consideration point of view (for example, permissive vs. blocking line protection schemes).
3. This work will avoid discussing how the expected functional redundancy should be implemented in a given technology (for example digital or virtual substation)
4. This work will will attempt to provide guidance that is universally applicable to protection of networks hosting IBR without having to make detailed assumtions about them.

References

[1] CIGRE Working Group 34.01, “Reliable Fault Clearance and Back-up Protection”, TB 140, 1999.

DELIVERABLES AND EVENTS

Deliverables Types

Time schedule

Q3	2025	Recruit members (National Committees)
Q4	2025	Develop final work plan
Q1	2029	Draft TB for Study Committee Review
Q2	2029	Final TB

APPROVAL BY TECHNICAL COUNCIL CHAIRMAN:

Rannveig S. J Loken
September 29th, 2025