CIGRE Study Committee B5

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG N° B5.74	**Name of Convenor:** Pablo H. Flores (BR) **E-mail address**: hpablo@cgteletrosul.gov.br	
Strategic Directions #: 1		**Sustainable Development Goal #: 9**
The WG applies to distribution networks: ☒ **Yes /** ☐ **No**		
Potential Benefit of WG work #: 1, 2, 4, 6		
Title of the Group: Busbar Protection Considerations When Using IEC 61850 Process Bus		

Scope, deliverables and proposed time schedule of the WG:

Background:

Migration toward all-digital substation Protection, Automation and Control (PAC) systems requires that all PAC functions are implemented based on measurements acquired locally at the power apparatus and shared over a communications network, with commands actuated over the network as well. This includes protection of the substation busbar itself.

Tripping for a busbar fault disconnects many network elements and considerably disrupts power flows in the system. Security, speed, and selectivity of busbar protection are therefore extremely important. The busbar protection scheme is often used to perform breaker failure protection, or at a minimum to execute the breaker failure trip command by identifying the correct breakers to trip. This function makes the busbar protection scheme even more critical. Distributed busbar protection schemes with *bay units* used to measure currents, acquire breaker and disconnect switch status signals, and actuate the breakers, and with a *central unit* used to process the data and perform the differential protection, are known for about three decades. These schemes use proprietary technology and they do not allow the bay units to be shared as a part of protection schemes for the network elements connected to the protected busbar.

The introduction of the IEC 61850 standard enables replacing these legacy schemes by open-standard (process-bus based) schemes where interoperable merging units (MUs) provide the current, voltage, and breaker and disconnect switch status measurements, and actuate the circuit breakers. In this new interoperable architecture, MUs may be of different makes and models and are shared between the network element protective relays and the busbar protection scheme. Merging Units may be implemented as so-called Stand-Alone Merging Units (SAMU - IEC 61869-13) connected to conventional instrument transformers or associated with Low Power Instrument Transformers (LPIT – IEC 61869-7, -8). IEC 61869-9 (replacing UCA 9-2LE guidelines) defines the IEC 61850-9-2 profile of the sampled values streams published. IEC TC95 is presently drafting requirements for digitally interfaced protection functions.

These new schemes require careful considerations in relation to several technical issues, migration strategies, testing and commissioning, maintenance and lifecycle management.

Scope:

1. Merging Unit dynamic response requirements for secure and dependable busbar protection (measuring chain interoperability). Busbar protection settings recommendations to account for differences in the MU dynamic response.

2. Preferred architectures for process-bus protection schemes that share MUs with network element protection schemes (networking, time synchronization, etc.).
3. Busbar protection redundancy considerations including separation and independence of the primary and backup schemes while also allowing cross-usage of data from redundant MUs.
4. Migration recommendations for hardwired centralized busbar protection schemes and legacy distributed protection schemes.
5. Breaker failure protection considerations in process-bus based busbar protection schemes.
6. Time overcurrent backup application considerations in process-bus based busbar protection schemes including placement in the central unit or in the MUs that integrate protection functions.
7. Busbar protection functionality, security and dependability enhancements possible due to additional measurements (CT failure detection, enhanced security for hardware and other failures by using data cross-checking).
8. Best practices for busbar protection configuration using IEC 61850 logical node and substation configuration data structures. Opportunities for auto-configuration and software-assisted configuration.
9. Testing, commissioning and maintenance issues when sharing MUs between busbar protection scheme and other network element protection schemes.
10. Advantages and disadvantages of integration process-bus based busbar protection schemes and network element protection (centralized protection schemes).

References:

- TB 431 (WG B5.16): *Modern Techniques for Protecting Busbars in HV Networks*
- TB 768 (WG B5.24): *Protection Requirements on Transient Response of Digital Acquisition Chain*
- Draft Report of WG B5.59: *Requirements for Near-Process Intelligent Electronic Devices*
- Draft Report of WG B5.69: *Experience Gained and Recommendations for Implementation of Process Bus in Protection, Automation and Control Systems*

Deliverables:

☒ Technical Brochure and Executive Summary in Electra
☐ Electra Report
☐ Future Connections
☐ CSE
☒ Tutorial
☒ Webinar

Time Schedule: start: January 2021 **Final Report**: December 2025

Approval by Technical Council Chairman:

Date: October 30th, 2020

Table 1: Strategic directions of the Technical Council

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 on the environment and sustainability (in case the WG shows a direct contribution to at least one SDG)
4	Preparation of material readable for non-technical audience

Table 2: Environmental requirements and sustainable development goals

	CIGRE selected the 7 SDGs that are the most relevant to CIGRE. In case the WG work refers to other SDGs or do not address any specific SDG, it will be quoted 0.
0	Other SDGs or not applied
7	**SDG 7: Affordable and clean energy** Increase share of renewable energy; e.g. expand infrastructure for supplying sustainable energy services; ensure universal access to affordable, reliable, and modern energy services; energy efficiency; facilitate access to clean energy research and technology
9	**SDG 9: Industry, innovation and infrastructure** Facilitate sustainable infrastructure development; facilitate technological and technical support
11	**SDG 11: Sustainable cities and communities** Increase attention on sustainable and resilient buildings utilizing local (raw) materials, power for electric vehicles, strengthening long-line transmission and distribution systems to import necessary power to cities, developing micro-grids to reinforce the sustainable nature of cities; protect and safeguard the world's cultural and natural heritage; reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and waste management
12	**SDG 12: Responsible consumption and production** E.g. Promote public procurement practices that are sustainable; address reducing use of SF6 and promote alternatives, encourage companies to adopt sustainable practices and to integrate sustainability information into their reporting cycle, address inefficient fossil-fuel subsidies that encourage wasteful consumption
13	**SDG 13: Climate action** E.g. Increase share of renewable or other CO_2-free energy; energy efficiency; expand infrastructure for supplying sustainable energy; strengthen resilience and adaptive capacity to climate-related hazards and natural disasters; integrate climate change measures into national policies, strategies and planning; improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
14	**SDG 14: Life below water** E.g. Effects of offshore windfarms; effects of submarine cables on sea-life
15	**SDG 15: Life on land** E.g. Attention for vegetation management; bird collisions; integration of substations and lines into the landscape

Table 3: Potential benefit of work

1	Commercial, business, social and economic benefits for industry or the community can be identified as a direct result of this work
2	Existing or future high interest in the work from a wide range of stakeholders
3	Work is likely to contribute to new or revised industry standards or with other long term interest for the Electric Power Industry
4	State-of-the-art or innovative solutions or new technical directions
5	Guide or survey related to existing techniques; or an update on past work or previous Technical Brochures
6	Work likely to contribute to improved safety.