CIGRE Study Committee C4

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

JWG [1]N° C4/C2.62/IEEE	**Name of Convenor:** Athula Rajapakse (CANADA) **E-mail address**: Athula.Rajapakse@umanitoba.ca
Strategic Directions #[2]: 1, 2, 4	**Sustainable Development Goal #[3]:7**
The WG applies to distribution networks: ☒ Yes / ☐ No	
Potential Benefit of WG work #[4] : 1, 2, 4, 5	
Title of the Group: Review of Advancements in Synchrophasor Measurement Applications	

Scope, deliverables and proposed time schedule of the WG:

Background:

The commercial use of phasor measurement units by utilities started in the 1990s. A series of IEEE standards were published starting in 1995 to ensure consistent accuracy. Emergence of organizations such as the North American Synchrophasor Initiative (NASPI) has contributed to the deployment in real-world applications. CIGRE has published two major reports on the application of phasor measurement units, including CIGRE TB 702 “Application of PMUs for Monitoring Dynamic System Performance” published in 2017 and CIGRE TB 330 “Wide Area Monitoring and Control for Transmission Capability Improvement” in 2007.

The technology continues to rapidly evolve, and it is important to understand the current state of the technology. In 2017, the most common and mature applications were wide area monitoring, state estimation, and model validation. Out of these three applications, wide area monitoring is becoming common practice for TSOs of electrically interconnected systems. The protection and control applications are emerging. The experience of using remote synchrophasor measurements as feedback control signals is not widely reported by the industry.

IEEE currently has an active task force on Oscillation Source Location and a working group on Power System Dynamics Measurements in the Power System Dynamic Performance committee that should be coordinated with as they are investigating new applications for PMUs. CIGRE has an active working group focusing on PMU-based decision support tools for System Operators (WG C2.18) that will also be coordinated with.

The proposed working group will provide an updated review of specific PMU applications including:

- detection of subsynchronous resonance, very low frequency governor modes, control modes;
- improved situational awareness, PMU-enhanced state estimation (linear, three-phase, distributed, dynamic);
- voltage instability detection;
- on-line and off-line model parameter identification (generator, load, lines, short circuit level);
- emerging applications such as grid code compliance monitoring (voltage and frequency control, fault ride through performance, power quality, etc.), wide area protection and control systems (synchrophasor based backup protection, special protection systems, enhancements to FACTS and HVDC control, etc.) .

The working group will attempt to solicit and discuss the end-users experiences of equipment and software systems used to implement synchrophasor applications, with a view to identify issues encountered and solutions developed to overcome these issues.

Scope:

The aims of this work are:

1. To provide an updated overview of synchrophasor technology including standard updates. Cover (micro)PMUs for distribution system applications as an additional area.

2. To provide an updated view of industry and academia experience on the concentration, archiving, and use of PMU data.

3. To describe emerging applications and any technology gaps such as high dependency on reliable telecommunication, precise time synchronisation, signal latency, etc. requiring further research and development.

4. To discuss the end-user's experiences of deploying synchrophasor measurement systems and applications and elaborate additional specially tailored applications for enhancing secure power system operation.

5. Elaborate and deliver application examples for new specific PMU applications.

In order to achieve these objectives, it is proposed to establish a joint working group with SC C2 and IEEE. Close coordination with NASPI (https://www.naspi.org/) is important. From IEEE, the Power System Dynamic Performance committee is the preferred collaboration partner.

Deliverables:

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

Time Schedule: start: May 2021 **Final Report**: May 2023

Approval by Technical Council Chairman:

Date: March 28th, 2021

Notes: [1] Working Group (WG) or Joint WG (JWG), [2] See attached Table 1, [3] See attached Table 2 and CIGRE reference Paper: Sustainability – at the heart of CIGRE's work. [4] See attached Table 3

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.