CIGRE Study Committee D2

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG [1]N° D2.55	**Name of Convenor: Kunlun Gao** (CN)
Strategic Directions #[2]: 1	**Sustainable Development Goal #[3]:9**
The WG applies to distribution networks: ☒ Yes / ☐ No	
Potential Benefit of WG work #[4] : 4	
Title of the Group: Application of 5G Technology to Smart Grids	

Scope, deliverables and proposed time schedule of the WG:

Background:

Data, connectivity, and intelligence are identified as the three core elements of industry digitalization. Being a new technology, the fifth-generation mobile communication technology (5G) has become a popular topic in both academia and industry recent years. 5G is known for its high bandwidth, low latency and supporting a large number of connections in communication, thereby providing superb technical support for the Industrial Internet. With the proliferating development of industry chain, deep application explorations for 5G had been made in telemedicine, vehicular networking, intelligent manufacturing and other industries.

Many countries in the world have built power communication networks based on fiber-optic dedicated lines, covering power plants, substations, dispatching centers, etc. However, they are not capable of supporting the flexible access of massive, decentralized devices in user-side environment and distribution networks, which has become one of the major bottlenecks for smart grid.

Smart grid has comprehensive demands for access communication, including ubiquitous terminal access capacity, differentiated service carrying capacity and high strength cyber-security isolation ability. Thus, 5G technology is considered as the potential choice to solve this dilemma. At present, exploring the potentials of 5G technology in smart grid has already been carried out worldwide. In the business scenario of electricity information acquisition, real-time collection of metering data from thousands of users can be achieved through 5G. Moreover, with the introduction of 5G, low latency and reliable business isolation of 5G can ensure the accuracy and security of the Phasor Measurement Unit (PMU) application.

In addition, slicing technology, deterministic communication, and other key characteristics of 5G can promote a smart grid with a wide variety of intelligent use cases. In light of this, it is essential to study the uses of 5G in smart grid, which is the primary focus of this working group. With the formation of this group, further study can subsequently be conducted on the integration of 5G and edge computing, security enhancement, and Augmented/Virtual Reality (AR/VR) technology.

This technology will be increasingly utilized within the scope of most CIGRE's study Committees. The new WG will focus on common technology developments, and other related SCs will focus on 5G applications under their own scopes.

Scope:

The goal of the WG is providing timely reports on 5G application in power industry, including recommendations and best practices for related specifications and designs. The WG will cover:

1. The Developmental Trend of 5G Application in Industrial Fields

Research on the development of 5G industry and application, especially on smart grid.
Research on the state of global standards of 5G in Industrial fields.

2. 5G Key Technologies

Research on several key technologies of 5G.

3. Adaptability analysis of 5G for Smart Grid Applications

Research on the limitations and challenges in communication condition for smart grid.
Research on communication requirements and suitability of 5G on typical smart grid applications，including:

- Supervisory Control and Data Acquisition (SCADA);
- Distribution differential protection;
- Electric power metering;
- PMU;
- Distribution automation;
- Precise load control;
- High definition video monitoring.

4. End to End Solution on Smart Grid 5G

Research on special problems in adaptation of 5G in smart grid, and a common end to end adaptation solution will be provided, including:

- End to end network deployment;
- Network self-management and interface;
- Terminal positioning and timing;
- Enhancement on network security;
- Specific solution on 5G slicing;
- Specific solution on 5G deterministic networking.

5. Typical Practices on Smart Grid 5G

Research on some typical practice schemes in smart grid with the introduce of 5G:

- Pilot operation of differential protection in distribution network;
- Demonstration and application of micro synchronous phasor measurement device in distribution network;
- Pilot operation of precise load control.

6. Prospect

Future development of 5G in smart grid.

Joint work with other SCs: Liaison experts from SC B5 will be invited.

Deliverables:

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

Time Schedule: start: Jan. 2022 **Final Report**: Jan. 2024

Approval by Technical Council Chairman:

Date: August 17th, 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.