CIGRE Study Committees B2 and D2

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

JWG B2/D2.72	**Name of B2 Convenor:** Ying CHEN (CN) **E-mail address**: leobodhi@163.com **Name of D2 Secretary**: Akshat KULKARNI (UK) **Email address:** akulkarni@orxagrid.com
Technical Issues #[2]: 2, 7, 8, 9, 10	**Strategic Directions #[3]:** 1, 2, 3
The WG applies to distribution networks[4]: Yes	
Potential Benefit of WG work #[5]: 1, 2, 6, 7	
Title of the Group: Condition Monitoring and Remote Sensing of Overhead Lines	

Scope, deliverables and proposed time schedule of the WG

Background:

Condition monitoring (CM) and remote sensing (RS) of overhead lines (OHL) refer to real-time continuous monitoring of passages, operational status of lines and towers, operation type parameters of lines and meteorological conditions of corridors by adopting wireless data transmission. They help to operate OHLs safely. Because of the growing number of OHLs, especially those crossing uninhabited remote areas where challenges arise like inconvenient transportation, operation & maintenance (O&M) difficulties, complex equipment conditions and low inspection efficiency, the traditional line inspection methods prove to be inadequate.

A number of standards and technical brochures have been developed in IEC, IEEE and CIGRE to address O&M, condition monitoring and remote sensing issues. However, none of these publications specifically address the CM devices and RS of OHL in such aspects as

- selection of installation sites
- power supply, signal transmission and environmental suitability of remote sensors
- data acquisition, storage and analysis method
- physical security and network security of the monitoring devices
- testing and verification
- wide-area RS-based status detection

Due to the lack of such standards, CM devices and remote sensors are endangered to have poor environmental suitability and high failure rates. Some of the common problems are: a) failures or distortion of CM and/or RS information, b) poor suitability of the power supply method of conventional monitoring devices - solar energy plus storage batteries - at unfavourable weather conditions, c) no access to GPRS service - the way conventional monitoring devices use to transmit information. Due to severe operating conditions, monitoring devices and remote sensors in uninhabited areas exhibit even higher failure rate and short life expectancy.

Scope:

This WG intends to specify CM and RS for OHL concerning the selection of installation sites, design, power supply, signal transmission and environmental situations of CM and remote sensors. It also covers methods of acquiring, storing and analysing data, physical and cyber safety of the monitoring devices, tests and verification, and wide-area RS-based status

detection. Improving the level of monitoring the operational status of an OHL and improving safety and reliability of the line operation is also an aspect.

The particular technical topics to be addressed by the WG are:

1. How to select parameters and installation sites of the CM devices for OHL

The Working Group will collect data regarding the types, parameters and installation sites of the CM devices for the OHL in various uninhabited areas and investigate relevant technical requirements depending on climatic and operating conditions. The necessity of installing CM devices, the type and quantity of the installed devices and the resulting economic benefits will be investigated. The technical requirements for the installation position and parameters of the CM device will be studied and summarized. Special aspects like CM for old lines and protection against thefts of towers or members will be considered as well.

2. How to select technical parameters for CM devices

Research will be carried out about the technical requirements of CM devices concerning power supplies, signal transmission, sealing performance, dielectric properties, aging resistance, temperature and humidity under the environmental conditions of various uninhabited areas.

3. How to test and verify the performance of the CM devices

The studies will focus on the test requirements of the CM devices and their associated communication devices (integrated into CM devices or part of the CM solution) for accessing into the grid, and give advice on the performance tests and verification requirements.

4. How to determine parameters and detection methods of wide-area remote sensing

The reflection, absorption, transmission and radiation of electromagnetic waves vary with the topographic and geological conditions of uninhabited areas. The determination of the parameters and detection methods of wide-area RS depending on the geological conditions remains an urgent issue to be solved. The electromagnetic wave images based on satellite/air-borne RS and the technical requirements for detecting transmission corridor status will be studied under the geological conditions of typical uninhabited areas, such as e.g. landslides, mudslides, and geological subsidence.

5. How to use IoT (Internet of Things) devices and technologies for CM and RS of OHL

….The usage of IoT sensors and related communication networks and data services (such as Low Power Wide Area Networks and cloud services) for grid monitoring applications is an opportunity currently under investigation by the Utilities. The Working Group will build up from existing experiences for evaluating the applicability of IoT technologies in severe climatic and operating conditions and their capability to meet the technical requirements of OHL in uninhabited areas with no access to telecom infrastructures.

6. How to treat and obtain valuable information from the acquired data

….Large volumes of data are expected to be generated by the installed sensors. The WG will evaluate how data analytics and visualization techniques can be applied to extract insights to maintenance teams. Also, data management strategies will be discussed, like criteria to store, delete and archive data.

7. How to incorporate the usage of CM and RS in maintenance activities

….The WG will evaluate principally how the introduction of these technologies can aid maintenance teams in their decisions, by acting when the system detects a degradation in OHL components. The conclusions for maintenance philosophy are not part of the scope

8. How to design the solution whilst maintaining the security of infrastructure

….The WG will evaluate the preferred approach for introducing such technologies into the

network while maintaining the security of the OHL components during the local and remote access of devices.

Interface
WG B2.68 “Sustainability of Conductors and Fittings”. The scope of this WG includes identifying requirements for condition monitoring of OHL components and initiating discussions on “How” to collect data.

Deliverables:

☒ Technical Brochure and Executive Summary in Electra

☐ Electra Report

☒ Tutorial[6]

☐ Webinar[6]

Time Schedule: start: April 2019 **Final Report**: End 2022

Approval by Technical Council Chairman:

Date: April 2nd, 2019

Notes: [1] Working Group (WG) or Joint WG (JWG), [2] See attached Table 1, [3] See attached Table 2, [4] Delete as appropriate, [5] See attached Table 3, [6] Presentation of the work done by the WG

Table 1: Technical Issues for creation of a new WG

1	Active Distribution Networks resulting in bidirectional power and data flows within distribution levels up to higher voltage networks
2	Digitalization of the Electric Power Units (EPU): Real-time data acquisition includes advanced metering, processing large data sets (Big Data), emerging technologies such as Internet of Things (IoT), 3D, virtual and augmented reality, secure and efficient telecommunication network
3	The growth of direct current (DC) and power electronics (PE) at all voltage levels and its impact on power quality, system control, system operation, system security, and standardisation
4	The need for the development and significant installation of energy storage systems, and electric transportation, considering the impact they can have on the power system development, operation and performance
5	New concepts for system operation, control and planning to take account of active customer interactions, and different generation types, and new technology solutions for active and reactive power flow control
6	New concepts for protection to respond to the developing grid and different generation characteristics
7	New concepts in all aspects of power systems to take into account increasing environmental constraints and to address relevant sustainable development goals.
8	New tools for system technical performance assessment, because of new Customer, Generator and Network characteristics
9	Increase of right of way capacity through the use of overhead, underground and submarine infrastructure, and its consequence on the technical performance and reliability of the network
10	An increasing need for keeping Stakeholders and Regulators aware of the technical and commercial consequences and keeping them engaged during the development of their future network

Table 2: Strategic directions of the Technical Council

1	The electrical power system of the future: respond to speed of changes in the industry
2	Making the best use of the existing systems
3	Focus on the environment and sustainability
4	Preparation of material readable for non-technical audience

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.
7	Work addressing environmental requirements and sustainable development goals.