CIGRE Study Committee B2

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG B2.79	**Name of Convenor:** George Watt (CANADA) **E-mail address**: george.watt.ca@gmail.com
Strategic Directions #[2]: 1, 2, 3	**Sustainable Development Goal #[3]:** 9, 13
The WG applies to distribution networks: ☒ Yes / ☐ No	
Potential Benefit of WG work #[4] : 1, 2, 3, 4, 5, 6	
Title of the Group: Enhancing Overhead Line Rating Prediction by Improving Weather Parameters Measurements	

Scope, deliverables and proposed time schedule of the WG:

Background:

Global climate change has motivated many countries to invest in Renewable Energy Sources (RES). For example, the European Union has the goal to have 20% of electricity generation coming from renewable sources by 2020. Besides the benefits the RES has for the environment, it also represents a challenge for electrical network operators.

Weather always plays a critical role in the operation of overhead lines. It has a significant impact on the electrical performance, in particular the ampacity, and economics of the electrical power networks.

Weather data is systematically collected or measured, monitored and analyzed since the late 1800's. As the technology advances, the demand for better understanding of the effects and accurate forecast are particularly evident by many overhead line engineers and network operators.

Asset optimization, reinforcement or expansion of the network seems to be necessary to achieve most goals on RES inclusion. Network optimization techniques such as use of Dynamic Line Rating (DLR) provide information to operators in real-time for better decisions in system operations.

Focusing on the line ratings (ampacity), the dynamic nature of the weather elements offers an economic opportunity to maximize the ampacity of overhead line conductors in the power system operation depending not only on a conservative static rating (e.g. mid-summer day) but also the prevailing weather conditions. Recent CIGRE work on dynamic line rating illustrates that its use has major advantages.

The thermal performance of overhead transmission and distribution lines can significantly impact on the overall reliability of supply and potentially exposes the network to higher risks.

The line rating forecasting for an overhead line could be in principle computed from the corresponding weather forecasting in the surroundings of the line. However, the results can

be improved to ascertain better quality and higher precision that the electrical power system needs.

The commercial weather forecast involves weather stations at distances far apart from each other[1]. The measured parameters work as initial and boundary conditions to solve a set of differential equations, which build a model to physically describe the atmosphere. For line rating forecasting, a collection of distributed weather data along the transmission network is important to obtain an accurate representation of the environment that the conductors are exposed.

Technical studies and literatures have been written on individual subject matters, such as, weather parameters, line rating determination, conductor thermal performance, etc. for years.

The objective of this working group will be to add value to existing transmission and distribution lines by looking into the current approaches of distributed environmental measurements such as techniques, development, utilization, performance, and applications for line rating prediction.

CIGRE technical documents will be referenced are: TB299, TB498, TB601, as well as the CIGRE Green Book "Overhead Lines" and Session Papers and Proceedings. The work in progress of WG B2.59 and JWG D2/B2.72 will be monitored and referenced.

Scope:

The general scope of this working group includes:

- Conduct review on current approaches of distributed environmental measurements with respect to line rating prediction application.
- Describe the data driven tools and evaluation of commercially available technologies and emerging technologies on weather measurements.
- Discuss impact of influential weather parameters such as seasonal, daily, local, regional, etc.
- Review general design considerations including weather model for line rating prediction and performance based on previous relevant CIGRE work.
- Develop case studies based on utility experiences with applications of weather data.
- Identify new standards and guides (IEC, EN, IEEE, etc.) dealing with certain aspects of the topic.

Specific topics to be considered are:

- Weather data aspects – sources: climate change effect including consolidation of long-term measurements, characteristics; historical statistics, distribution, spatial effect, strategy and practices
- Data management – collection, processing, archiving, extraction, access, repository, etc.

[1] In the case of the weather sensor network from the German Meteorological Service (Deutscher Wetterdienst, DWD), the mean distance between 172 primary weather stations distributed over the whole country is 46 km

- Brief overview of effect of weather model and parameters on line rating.
- Prediction methodology and analytical modelling aspects of weather parameters for line rating calculations
- Environment aspects – terrain, vegetation, man-made objects (buildings, infrastructures, other energy facilities (wind farms, solar farms)
- Hotspot analysis – historical evaluation of weather conditions along the overhead line in order to find the regions of high probability of minimum ampacity values
- Limitations and constrains aspects – effectiveness and concerns, system economics (arrangements, durability, maintenance, costs).
- Risk management – performance (reliability & security), operation, construction and maintenance practices, safety, cost / benefit, accuracy of statistics.
- Case studies – performance, applications, pilot projects, etc.
- Potential benefits of application of weather measurements for other applications for overhead lines operations, such as insulation, lightning protection, conductor motions, etc.

Deliverables:

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

Time Schedule: start: May 2020 Final Report: May 2022

Approval by Technical Council Chairman:

Date: March 30th, 2020

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.