CIGRE Study Committee B2

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG [1]N° B2.78	**Name of Convenor: Rob Stephen (ZA)** **E-mail address**: rob.stephen@cigre.org
Strategic Directions #[2]: 1	**Sustainable Development Goal #[3]:9,11**
The WG applies to distribution networks: ☐ Yes / ☒ No	
Potential Benefit of WG work #[4] : 4	
Title of the Group: Use of High Temperature Conductors in New Overhead Line Design	

Scope, deliverables and proposed time schedule of the WG:

Background:

High temperature low sag (HTLS) and high temperature conductors may be used in new lines to increase the line's thermal rating by 100% or more, without increasing significantly structure and foundation cost. The increased thermal capacity may reduce future power flow constraints due to unforeseen power flows, primarily after N-1 contingencies, or to avoid curtailment of renewable generation during periods of high generation. With the uncertainty of the magnitude and location of generation, the load on proposed lines is very difficult to predict. High temperature conductors may be one way to provide a more robust design which can cater for unexpected loading without increasing initial construction cost excessively.

The bulk of the CIGRE literature about high temperature conductors concerns the uprating existing lines. Although multiple types of high temperature conductors have been commercially available for many years, technical guidance regarding the application of these conductors in new lines has been limited.

Several WGs of SC B2 have addressed the use of high temperature conductors, primarily in uprating existing overhead lines.

- Active WG B2.55 "Conductors for the uprating of existing Overhead Lines"
- Active WG B2.58 "Vibration modelling of HTLS conductors – Self damping characterization"
- Active WG B2.66 "Safe handling and installation guide for HTLS conductors"
- TB 331 (2007) "Considerations relating to the use of high temperature conductors"
- TB 426 (2010) "Guide for Qualifying High Temperature Conductors for Use on Overhead Transmission Lines"
- TB 695 (2017) "Experience with the mechanical performance of non-conventional conductors"

Scope:

Identify those new line designs where the use of high temperature conductors can be considered. Enumerate the advantages and disadvantages as well as provide technical support for regulatory approval considering both environmental, safety, and economic issues. This will include life cycle costing.

The main tasks of the WG will include the following (note that the items will only refer to high temperature conductors):

1. Environmental issues
    - Right of way considerations
    - Reduction in tower height and line visibility
    - Structure geometry
2. Electrical considerations
    - Thermal rating
    - Line losses
    - Electric and magnetic fields EMF
    - Audible noise
    - Operational constraints
3. Mechanical considerations
    - Use of HTLS and high temperature conductors in bundle configuration
    - Sag, tension
    - Creep
    - Vibration/galloping mitigation
    - Ice accumulation
    - Hardware
    - Maintenance
4. Operations and maintenance
    - Tools and equipment
    - Live line maintenance considerations
    - Emergency operations
    - Monitoring of HTLS and high temperature conductors
    - Refurbishment considerations
5. Economical considerations Overall line design
    - Initial and life cycle cost
    - Operational cost
    - Expected life of asset.
    - Review of TB 638 “Guide to overall line design” as applied to HTLS and high temperature conductors.
    - Inclusion of HTLS and high temperature conductors in conductor selection process

The necessary actions to be addressed are:

- Questionnaire/s to collect data on
    - Reasons for using high temperature conductors on new lines
    - Reasons for not using high temperature conductors on new lines
    - Experiences with high temperature and high temperature conductors on new lines

- Detailed discussion on-line losses for both “radial” and “network embedded” lines
- Relative advantages & cost of high temperature conductor types in new line design
- Evaluate impact of thermal rating assumptions on use of high temperature conductors
- Table of pros and cons of use of high temperature conductors for new lines
- Prediction of power flow constraints (Input from System Planning SC C1)

Deliverables:

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

Time Schedule: start: March 2020 **Final Report**: December 2024

Approval by Technical Council Chairman:

Date: March 22nd, 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.