CIGRE Study committe B2

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG B2.99

NAME OF THE CONVENOR
Steevens Stefan (GERMANY)

TITLE
Enhanced Calculation of Overhead Line (OHL) Conductor Temperature

THE WG APPLIES TO DISTRIBUTION NETWORKS: YES

ENERGY TRANSITION
4 / Sustainability and Climate Change
5 / Grids and Flexibility

POTENTIAL BENEFIT OF WG WORK
3 / likely to contribute to new or revised industry standards
4 / state-of-the-art or innovative solutions or directions
5 / Guide or survey on techniques, or updates on past work or brochures
6 / work likely to contribute to improve safety

STRATEGIC DIRECTION
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-ofthe-art technological advances
2 / Making the best use of the existing systems
3 / Focus of the environment and sustainability (in case the WG shows a direct contribution to at least one SDG)

SUSTAINABLE DEVELOPMENT GOAL
9 / Industry, innovation and infrastructure

BACKGROUND :

In recent years there have been innovations in research and technology that have improved our understanding of the thermal behaviour of overhead lines. The latest CIGRE model, presented in Technical Brochure 601, is now over 10 years old and can be improved to better account for the effects of low wind speeds, varying solar radiation and precipitation. Integrating these factors has the potential to enhance the reliability and efficiency of the grid.

PURPOSE / OBJECTIVE / BENEFIT OF THIS WORK :

The update of the thermal model aims to integrate these new scientific findings and technological developments, by considering real, varying environmental conditions. The enhanced model will provide more accurate predictions of overhead line performance and service life, including thermal aging effects such as annealing that can reduce conductor strength and reliability over time. The work will improve thermal efficiency and develop practical solutions for engineering applications. The analysis will include an evaluation of standard ACSR and HTLS conductors, as well as innovative conductor designs, including expanded conductors (with increased effective diameter) and covered conductors (e.g., with a 2.5 mm polymer coating). This includes in particular:

1. Extended modelling of resistance behaviour: Adjustments and extensions to the existing resistivity model for lines operating under climatic changes. The main focus should be on the changed climatic conditions and their consideration in the thermal behaviour. In addition, the variation of coefficient of thermal expansion for the various

conductor materials and constructions needs to be considered.
2. Improved thermal models considering variable weather conditions:
1. Incorporation of heat transfer calculation methods that specifically address the effects of low wind speeds (under 1 m/s) on conductor temperatures with particular emphasis on elevated operating temperatures and comprehensive wind tunnel testing for drag coefficient measurement and wind shielding evaluations. The temperature range of focus will be from 49 to 210°C.
2. Recent insights into the consideration of natural convection should be integrated accordingly.
3. Furthermore, the effect of decreased air density on convection and resulting heat transfer efficiency requires investigation.
4. Additionally, new findings related to the application of DLR systems, particularly under low wind speed conditions, should be considered.
5. Assessment of humidity levels in conjunction with precipitation effects and consideration of extreme weather (e.g. icing) conditions will be incorporated into the modelling approach.
6. Considering these aspects and the calculated conductor temperature, it is necessary to analyse the extent to which the surrounding air density decreases, which not only affects noise emissions but also alters convection. These changes in air density, which have been scarcely studied, could particularly influence natural convection and, consequently, the heat transfer from the conductor.
7. Additionally, the determination of conductor's emissivity and absorptivity should be investigated, as recent studies aim to optimize the thermal behaviour of conductors.
8. Finally, the extent to which modified outer layer/wire geometries, and hence modified drag coefficients, result in a change in cooling effects will be analysed. Furthermore, consideration should be given to lines operating at lower maximum temperatures (approximately 50°C), where absorptivity has a higher impact on sag behaviour compared to high temperature scenarios.

SCOPE :

The analysis will concentrate on thermal behaviour modelling. The methodological approach will emphasize model development rather than extensive input parameter refinement, ensuring practical applicability of the resulting tools. By implementing these improvements, we expect to see a significant increase in the accuracy of assessing the thermal capacity of overhead lines especially for low wind speeds and under precipitation, which can lead to improved design reliability and operational efficiency. The updated models will also provide engineers and operators with the necessary tools to maximise the performance of their systems while fully complying with safety standards, and the scope will explicitly include practical deliverables, such as case studies.

CIGRE References:

- WG B2.79: Enhancing OHL Rating Prediction by Improving Weather Parameters Measurements
- WG B2.95: Impact of extreme weather events under climate change on high voltage overhead line design standards
- TB 638: Guide to Overall Line Design, 2015
- TB 601: Guide for thermal rating calculations of overhead lines, 2014
- TB 299 Guide for selection of weather parameters for bare overhead conductor ratings, 2006
- TB 324: Sag tension calculation methods for overhead lines, 2007
- TB 425: Increasing Capacity of Overhead Transmission Lines: Needs and Solutions, 2010
- TB 498 Guide for application of direct real-time monitoring systems, 2012
- TB 643: Guide to the operation of conventional conductor systems above 100ºC, 2015
- TB 695: Experience with the mechanical performance of non-conventional conductors, 2017
- TB 763: Conductors for the uprating of existing overhead lines, 2019
- TB 969: Forecasting Dynamic Thermal Line Ratings, 2025

DELIVERABLES AND EVENTS

Deliverables Types

Annual progress and activity report to Study Committee
Technical Brochure and Executive Summary in Electra
Tutorial
Webinar

Deliverables schedule

Annual progress and activity report	Q3	2027

Enhanced Calculation of Overhead Line (OHL) Conductor Temperature

Annual progress and activity report	Q3	2028

Enhanced Calculation of Overhead Line (OHL) Conductor Temperature

Annual progress and activity report | Q3 | 2029
Enhanced Calculation of Overhead Line (OHL) Conductor Temperature

Technical Brochure | Q4 | 2029
Enhanced Calculation of Overhead Line (OHL) Conductor Temperature

Tutorial | Q2 | 2030 Enhanced Calculation of Overhead Line (OHL) Conductor Temperature

Webinar | Q2 | 2030 Enhanced Calculation of Overhead Line (OHL) Conductor Temperature

Time schedule

Q3 | 2026 Recruit members (National Committees, WiE, NGN)

Q4 | 2026 Develop final work plan

Q2 | 2029 Draft TB for Study Committee Review

APPROVAL BY TECHNICAL COUNCIL CHAIRMAN:
Rannveig S J Loken
August 04th, 2026