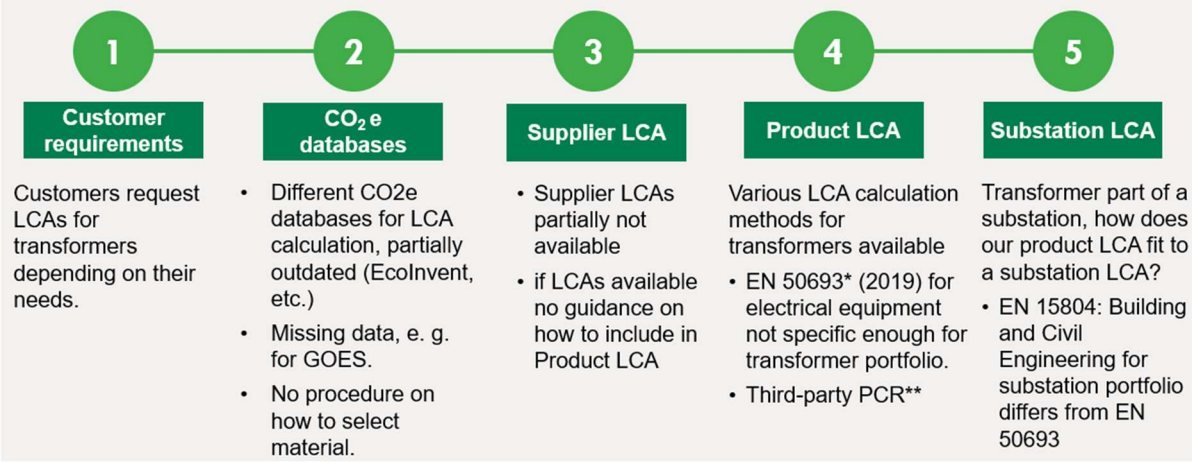


CIGRE Study Committee A2

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

JWG¹ N° A2/C3.70	Name of Convenor: Myles Margot (Germany)																		
Strategic Directions #²: 3		Sustainable Development Goal #³: 9, 12																	
The WG applies to distribution networks: <input checked="" type="checkbox"/> Yes / <input type="checkbox"/> No																			
Potential Benefit of WG work #⁴ : 1, 3																			
Title of the Group: Life Cycle Assessment (LCA) of Transformers																			
Scope, deliverables, and proposed time schedule of the WG:																			
Background:																			
<p>There is an increasing demand for Life Cycle Assessments (LCA) of Transformers. This need is driven by various stakeholders (Regulatory, Governmental, Customers, Original Equipment Manufacturers – OEM’s, Suppliers and others) to address environmental and sustainability measures or targets.</p> <p>To enable the transition to flexible green energy, we need to understand and unpack the entire life cycle (cradle to grave) and establish standardized evaluations, scoring systems and Key Performance Indicators (KPI’s) of the transformers’ environmental impact.</p> <p>Figure 1 below, illustrates the current process and various sub-elements which contribute to the requirement to further define LCA of Transformers:</p>																			
<div style="background-color: #f0f0f0; padding: 10px;"> <h3 style="margin: 0;">Background</h3>  <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%; text-align: center;">1</th> <th style="width: 20%; text-align: center;">2</th> <th style="width: 20%; text-align: center;">3</th> <th style="width: 20%; text-align: center;">4</th> <th style="width: 20%; text-align: center;">5</th> </tr> <tr> <th style="background-color: #008000; color: white; text-align: center;">Customer requirements</th> <th style="background-color: #008000; color: white; text-align: center;">CO₂e databases</th> <th style="background-color: #008000; color: white; text-align: center;">Supplier LCA</th> <th style="background-color: #008000; color: white; text-align: center;">Product LCA</th> <th style="background-color: #008000; color: white; text-align: center;">Substation LCA</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top; padding: 5px;"> <p>Customers request LCAs for transformers depending on their needs.</p> </td> <td style="vertical-align: top; padding: 5px;"> <ul style="list-style-type: none"> Different CO₂e databases for LCA calculation, partially outdated (EcoInvent, etc.) Missing data, e. g. for GOES. No procedure on how to select material. </td> <td style="vertical-align: top; padding: 5px;"> <ul style="list-style-type: none"> Supplier LCAs partially not available if LCAs available no guidance on how to include in Product LCA </td> <td style="vertical-align: top; padding: 5px;"> <p>Various LCA calculation methods for transformers available</p> <ul style="list-style-type: none"> EN 50693* (2019) for electrical equipment not specific enough for transformer portfolio. Third-party PCR** </td> <td style="vertical-align: top; padding: 5px;"> <p>Transformer part of a substation, how does our product LCA fit to a substation LCA?</p> <ul style="list-style-type: none"> EN 15804: Building and Civil Engineering for substation portfolio differs from EN 50693 </td> </tr> </tbody> </table> </div>					1	2	3	4	5	Customer requirements	CO ₂ e databases	Supplier LCA	Product LCA	Substation LCA	<p>Customers request LCAs for transformers depending on their needs.</p>	<ul style="list-style-type: none"> Different CO₂e databases for LCA calculation, partially outdated (EcoInvent, etc.) Missing data, e. g. for GOES. No procedure on how to select material. 	<ul style="list-style-type: none"> Supplier LCAs partially not available if LCAs available no guidance on how to include in Product LCA 	<p>Various LCA calculation methods for transformers available</p> <ul style="list-style-type: none"> EN 50693* (2019) for electrical equipment not specific enough for transformer portfolio. Third-party PCR** 	<p>Transformer part of a substation, how does our product LCA fit to a substation LCA?</p> <ul style="list-style-type: none"> EN 15804: Building and Civil Engineering for substation portfolio differs from EN 50693
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<p>Figure 1. Background problem statement of Transformer LCA</p>																			
<p>In addition to the various sub-elements, there is also a need to establish and define the methodology or parameters during each phase of the transformer’s life cycle, Figure 2 below illustrates the complexity:</p>																			

*EN 50693: Product category rules for life cycle assessments of electronic and electrical products and systems

** third-party PCR: Product Category Rules for products available by third-parties, e. g. Environdec, EPDItaly

LCA Calculation current methodology

Parameters that are based on assumptions (from OEM, supplier & customer)

Materials
<ul style="list-style-type: none"> Emission factors for materials: $e_{m,i}$ <ul style="list-style-type: none"> - Based on e. g. Ecolnvent database, no industry standard established yet - Emission factors simplified Transport emissions can only be approximated → applies to Manufacturing & End of Life (EoL) as well
Manufacturing
<ul style="list-style-type: none"> Calculation of energy use for manufactured Tx Impact of Renewable Energy Certificates (REC's) for the actual carbon intensity of bought electricity: $e_{Man,electricity}$ How can waste management be considered?
Operation
<ul style="list-style-type: none"> Load factor, cooling factor & years of operation (lifetime) are defined by SE or customer: f_{load}, $f_{cooling}$, a <ul style="list-style-type: none"> - no industry standards established yet Carbon intensity based on current value of factory location (e. g. country): e_{net} <ul style="list-style-type: none"> - Static or dynamic value to be discussed
End of Life
<ul style="list-style-type: none"> Methodology under discussion (circularity / end of life credits / end of life burden)

Figure 2. Elements to be addressed during Transformers Life Cycle.

Currently, there is little to no comparability of the results or statements which makes the evaluation, scoring and KPI setting complex. Unified framework and recommended best practices are required to further enhance the transformers' role in environmental and sustainability actions.

Purpose/Objective/Benefit of this work:

- Alignment of the various guidelines/procedures/standards (including the influence or integration from product to system level)
- Comparability and evaluation basis for manufacturers, customers and other regulatory entities.
- Investigate and establish the influence of different technologies, manufacturing techniques, operational influence and end of life (Circularity).
- Best practices and/or framework for CO2 reduction.

Scope:

The working group will investigate, report, and recommend on:

- Define emission-baselines for materials and energy usage.
- Define a valid Product Category Rule (PCR) for transformers (either based on existing or new).
- Agree on standard parameters (lifetime, load-factor, etc.) for above mentioned PCR and methodology for End of Life (EoL).
- Impact and influence the energy mix has on the parameters or baseline.
- Environmental impact of transport of materials and transformer (distance, type of transport)
- Evaluation of sustainability measures linked to Transformers (Lifetime).

Deliverables:

- Annual Progress and Activity Report to Study Committee
- Technical Brochure and Executive Summary in Electra
- Electra Report
- Future Connections
- CIGRE Science & Engineering (CSE) Journal
- Tutorial
- Webinar

Time Schedule:

- | | |
|---|-----------|
| • Recruit members (National Committees) | Q2/3 2023 |
| • Develop final work plan | Q3/4 2023 |
| • Draft TB for Study Committee Review | Q2/3 2024 |
| • Final TB | Q3/4 2024 |
| • Tutorial | Q3/4 2024 |

Approval by Technical Council Chairman:**Date:** June 15th, 2023**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.

Comments:

1) CIGRE Official Study Committee Rules: WG Membership

<https://www.cigre.org/GB/about/official-documents>

- a. Only one member per country (by exception of SC Chair)
- b. WG nominees must first be supported by their National Committee (or local SC Member) as an appropriate representative of their country.
- c. Acceptance of the nomination is granted by the SC Chair and advised to the WG Convener

2) Collaboration Space

<https://www.cigre.org/article/GB/collaborative-tools-2>

CIGRE will provision the WG with a dedicated Knowledge Management System Space.

The WG will use the KMS for drafting collaboration, capture and retention of discussion and meeting records.

Official country WG Members will be sent registration instructions by the Convener.

Official country WG Members may request the WG Convener to allow additional access for an extra national subject matter specialist to aid in the work at the national level, including NGN members.