CIGRE Study Committee A2/D1

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

JWG [1]N° A2/D1.72	**Name of Convenor:** Roberto ASANO (BRAZIL) **E-mail address**: roberto.asano@yahoo.com
Strategic Directions #[2]: 2, 3	**Sustainable Development Goal #[3]:** 9
The WG applies to distribution networks: ☒ **Yes /** ☐ **No**	
Potential Benefit of WG work #[4]: 1, 3, 6	
Title of the Group: Retrofill of Mineral Oil in Transformers – Motivations, Considerations and Guidance	

Scope, deliverables and proposed time schedule of the WG:

Background:

Transformer retrofilling is the practice of removing from a transformer one liquid dielectric, typically mineral oil, and replacing it with an alternative to achieve one or more specific aims, such as improved fire performance, enhanced environmental safety or increased rating. Replacement of mineral oil by natural and synthetic esters is an activity that has been reported for 20 years or more and there may be other fluids that could be considered for retrofill purposes. A distinction should be made between retrofilling and simple replacement of the fluid so that the user understands that, when mineral oil is aimed to be replaced by an alternative fluid, a more detailed understanding of how the new fluid (and its mix with the remaining oil) may affect performance is needed.

The benefits provided may be attractive but are not available to all transformers as limitations apply based on voltage or other aspects of transformer design. The condition of the transformer may also be a factor the owner wishes to consider when considered whether the benefits are of sufficient value to justify the work.

Purpose/Objective/Benefit of this work:

The technical feasibility of retrofilling with an alternative fluid depends on a multitude of design and operational factors. If the properties of the fluid may differ, transformer design must be re-evaluated to ensure it meets users' minimal operational requirements (which may be different from original nameplate values). This re-evaluation may necessitate the recalculation of certain design parameters, in order to evaluate its effect on the dielectric and thermal performance. Bushings, tap changers and other components shall also be re-evaluated to access its compatibility and performance with the new fluid.

Once the performance aspects above have been clarified, the work has to be carried out such that the benefits are actually achieved by ensuring that the original fluid is replaced appropriately, and other risk factors are properly identified and controlled. Transformer owners additionally need to understand what the inspection regime should be following retrofill both to ensure the retrofill has been successful and to demonstrate the desired benefits have been achieved.

Scope:

The proposed scope of work will be as follows:

1. Define where replacement of liquid insulation in transformer is considered replacement or retrofill based on whether the fluid is considered equivalent or if a form of design review is required.
2. Describe the benefits and trade-offs that may arise as a result of retrofilling with reference to case studies.
3. Identify the necessary considerations, information and analysis that must be undertaken to determine whether retrofill is technically feasible and therefore likely to achieve the intended benefits.
4. Provide guidance on the steps to be taken in carrying out retrofill activities successfully.
5. Identify any changes in maintenance and testing activities arising from the retrofill process for example: flash point testing to show that the mixed fluid (new fluid with residual oil) maintains the flash point above 300°C to accomplish with the requirements for K class fluids.
6. Review test methods for testing the fluid (mix) and its compatibility with transformer's materials. Collect experiences on test methods and their adequacy as well as the criteria to evaluate the fluid and transformer health.

The removal and replacement of PCBs for environmental/legislative purposes is out of scope for this working group.

As many of these aspects are also the same for mineral oil-filled cable terminations, SC B1 may indicate a liaison representative for this Working Group.

Remarks:

TB436 Experiences in Service with New Insulating Liquids

TB537 Transformer Fire Safety Practices

TB856 Dielectric Performance of Insulating Liquids for Transformers

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)	Q4 2023
• Develop final work plan	Q2 2024
• Draft TB for Study Committee Review	Q4 2025
• Final TB	Q3 2026
• Tutorial	Q3 2026

Approval by Technical Council Chairman:

Date: October 23rd, 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

WG Membership: refer Comments at end of document

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.