CIGRE Study Committee A3

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG [1]N° A3.47	**Name of Convenor: Ankur Maheshwari** (Australia)
Strategic Directions #[2]: 2, 3, 4	**Sustainable Development Goal #[3]: 9, 12**
The WG applies to distribution networks: ☒ Yes / ☐ No	
Potential Benefit of WG work #[4] : 1, 5, 6	
Title of the Group: Lifetime Management of Medium Voltage Indoor Switchgear	

Scope, deliverables and proposed time schedule of the WG:

Background:

Reliability of the electricity supply system is largely influenced by the reliability of high voltage equipment. Amongst these, reliability of medium voltage equipment has a key influence on power system reliability, particularly so as they are at the lower end of the electricity supply chain and close to the consumers.

Since the reliability of modern high voltage equipment has increased considerably, some utilities are used to order equipment off the shelf without paying much attention to the precise application and international specifications. Knowhow about the technical aspects of specification, procurement, application assessment, judgement of type test reports, quality control, installing and commissioning seems to leak away.

At the same time, the medium voltage indoor switchgear installed two to three decades ago do not necessarily present the same levels of reliability as the more modern switchgear. Many users (utilities and other applications) have older air insulated oil switchgear and the SF_6/ Vacuum switchgear of the 1980's that do not provide the level of internal arc fault protection that has come to be expected from the industry standards to allow safe ease of access, maintenance and operation from indoor switchgear. In addition, some of these installations have employed bus insulation systems such as epoxy resin that have shown deterioration and present a safety hazard due to the consequences from their failure. The older switchgear installations were built based on standards of the day and present safety hazard risks to the operators and visitors to substations. Refurbishment, retrofitting and other similar measures may be more practical over the replacement of the switchgear. Consolidated literature on possible options to extend the life of medium voltage switchgear is not available.

Some of the topics associated with lifetime management of transmission and distribution high voltage equipment are addressed in present publications, however most of the literature has focussed on outdoor high voltage equipment. Medium voltage indoor equipment hasn't been a focus of these publications. Whilst addressing the topic of lifetime management of medium voltage switchgear, the working group will leverage on existing technical brochures and current working groups related to switchgear condition assessment such including: -

- TB165 – Life management of circuit breakers
- TB422 – Transmission Asset Risk Management
- TB725 – Aging High Voltage Substation Equipment and possible Mitigation Techniques
- TB 734 – Management of Risk in substations – check relevance
- TB737 – Non-Intrusive Methods for condition assessment of Distribution and Transmission switchgear
- TB816 – Substation Equipment Overstress Management

- JWG A3.43 – Tools for lifecycle Management of T&D Switchgear based on data from condition monitoring systems
- WG B3.48 – Asset Health Indices for equipment in existing substations

Scope:

The working group will deliver a technical brochure on lifetime management of indoor medium voltage switchgear. The brochure will take into consideration the environmental, safety, equipment reliability, equipment changes of use and logistical factors and recommend options for increasing in-service life of the switchgear. Options will include various factors such as retrofitting of components, replacement, and other measures such as work practices.

The technical brochure of the working group will include:

- Document key challenges faced by medium voltage switchgear users in management of their equipment including safety, reliability and maintainability
- Study the impact of industry standards in respect to safety, environmental requirements on the operability of installed switchgear that were designed based on standards of the day
- Survey approaches that are used to manage the challenges with respect to lack of manufacturer support, obsolescence and lost technical knowledge (maintainability)
- Methods for qualitative and quantitative risk assessment on existing switchgear of old designs including approaches for testing, condition analysis and monitoring. This includes the assessment of risks to Health and Safety, Reliability, Environmental, Legal Requirements, Operational and Maintenance, and Manufacturer support.
- Provide viable alternatives to address these risks including retrofit, upgrade and others including the techno-commercial considerations applied for decision making. Discussion will include financial assessments over the equipment life cycle. The working group will provide options that could be included for consideration for existing equipment. Example of options could include maintain status quo (do nothing), minimal replacements to extend life, retrofitting switchgear, installing arc-fault protection or extensions.
- Practical considerations for lifecycle options including Safety considerations, access to previous standards, financial constraints, operational and load constraints, spare parts management, supplier constraints, diminished knowledge of plant and maintenance practices, end of life management, and changes to corporate paradigms.
- Some real-life case studies and examples of:
    - Risk assessment
    - Financial assessment of different options
    - Replacement like for like (e.g. CB and VT retrofits)
    - Upgrades to bring up to better spec (e.g. arc flash retrofit, protection upgrades)
    - Switchgear replacement (either in-situ or new building)

The working group will utilise industry experience and expertise and apply asset management techniques to present options that medium voltage switchgear can use to undertake risk assessment and decide optimal methods for life extension.

Remarks:

Deliverables:

The working group will produce some papers during Cigré sessions and colloquia. Final outcome will be published in a technical brochure. Tutorials will be arranged as well.

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

Time Schedule: start: November 2021 **Final Report**: November 2024

Approval by Technical Council Chairman:

Date: December, 7th, 2021

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.