CIGRE Study Committee A1

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

(J)WG [1]N° A1.75	**Name of Convenor:** Vincent FERNAGUT (FRANCE)
Strategic Directions #[2]: 2	**Sustainable Development Goal #[3]:9**
The WG applies to distribution networks: ☐ Yes / ☒ No	
Potential Benefit of WG work #[4] : 4	
Title of the Group: Large air-cooled turbo-generator – state of the art, limits and perspectives for Small Modular Reactors	

Scope, deliverables and proposed time schedule of the WG:

Background:

Due to global warming, decarbonation, and the energy transition, the SMR (small modular reactors) will be a solution to produce CO2 free energy and with more and more flexible operation. A lot of SMR projects are now in development for new greenfield plants or to replace old thermal plants using coal or gas.
These types of small nuclear power plants will be equipped with air-cooled turbogenerators with strong requirements of reliability, life duration, modularity, and maintainability.
In addition, these generators shall be designed to operate in compliance with the latest operational and grid code requirements.

Purpose/Objective/Benefit of this work:

The goal of this WG is to establish a state of the art for larger air-cooled generators and give information on the possible evolutions with best efficiency in all grid-dependent operation conditions.

Scope:

The working group will investigate and report on:

- Basic approach to modern air-cooled generator design and state-of-the-art manufacturing processes
- Normative references
- Latest operational and grid code requirements impacting generator design
- Limits – stator insulation system technology, stator and rotor cooling …
- Technologies used for performance optimisation
- Description of auxiliary equipment
- Technologies used for standardisation or modularisation
- Principal degradation modes and defects – operational lifetime estimation of main components, e.g. windings
- Maintainability
- Standard / type tests
- Standard instrumentation and monitoring
- Main technical points to specify
- Future perspectives

Remarks:

Related CIGRE publications:

11-09: Design and operation on test bed of a 200MVA air cooled turbogenerator – 1984

11-202: Comparison of maximum-rated air-cooled turbogenerators with modern hydrogen-cooled generators - design and experience 1992

11-107: Air-cooled turbogenerator series for a changing market - 2002

A1-104: Air-cooled Generators Having Competitive Performances to Conventional H2-cooled Machines - 2006

A1-106: Large air cooled turbogenerators extending the boundaries – 2006

A1-104: At site test and service experience verification of the pincipally new turbogenerator type-asynchronized air cooled one – 2008

A1-103: Experimental study of the latest design of the powerful air-cooled turbogenerator stator – 2008

TB 772: Turbogenerator stator windings support system experience – 2019

A1-206: Features of the design and operating modes of the asynchronized turbogenerator T3FSU-320 – 2020

Documents with reference to a CIGRE paper:
S13/S14: KEMA specifications for hydrogen, liquid and air cooled synchronous a.c. generators with rated voltage 5 kV and above, KEMA Technical and Operation Service, Arnhem 2009

Non-Cigre papers:
IEEE PES-TR69 - REPORT ON COORDINATION OF GRID CODES AND GENERATOR STANDARDS: Consequences of Diverse Grid Code Requirements on Synchronous Machine Design and Standards

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) Q1 / 2023
- Develop final work plan Q2 / 2023
- Draft TB for Study Committee Review Q2 / 2024
- Final TB Q4 / 2024
- Tutorial 2025
- Webinar 2025

Approval by Technical Council Chairman:

Date: April 4th, 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.