CIGRE Study Committee D1

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG[1] D1.82	**Name of Convenor:** Thomas ANDRITSCH (UK)
Strategic Directions #[2]: 1, 3	**Sustainable Development Goal #[3]: 9, 12**

This Working Group addresses these Energy Transition topics:

☐	**Storage**	☐ **None of them**
☐	**Hydrogen**	
☐	**Digitalization**	
X	**Sustainability and Climate Change**	
☐	**Grids and Flexibility**	
☐	**Solar PV and Wind**	
☐	**Consumers, Prosumers and Electrical Vehicles**	
☐	**Sector Integration**	

Potential Benefit of WG work #[4] : 3, 4

Title of the Group: Additive Manufacturing/3D Printing in Service of the Electrical Power Industry

Scope, deliverables and proposed time schedule of the WG:

Background:

Additive manufacturing (AM), also known as Additive Layer Manufacturing (ALM) is the industrial name for 3D printing technology. This is a computer-controlled manufacturing process, which creates 3D objects by subsequent deposition of layers. AM has developed rapidly over the past decade, but there is a lack of relevant work in the field of electrical power engineering, as much of the published work focuses on mechanical, thermal and chemical properties.

This WG proposes to review the state of the art of AM and highlight existing work focussing on dielectric and electrical properties. It will further highlight some of the potential of AM as technology for the power industry. AM allows for complex geometries which would be difficult or impossible to achieve by conventional means. The layer-by-layer deposition also allows for insulators with a controlled variation of the permittivity or conductivity across the dielectric, which could revolutionise the area of field grading materials. Along with 3D scanning techniques, AM could simplify maintenance of older assets in the network, as it could allow for creating of replacement parts that would otherwise be difficult to acquire/procure for a variety of reasons.

Subject to relevant experience on the WG, it is proposed to include experimental work on materials created by AM that will be compared with conventionally prepared materials and compare their properties with a variety of methods.

The brochure will also report on foreseeable challenges in terms of standardisation, intellectual property and highlight the current limits of AM technology, but the focus is predominantly on the material properties and identifying what role AM can have in the electrical power industry.

Purpose/Objective/Benefit of this work:

The brochure aims to summarise the potential for 3D printing for the electrical power industry and informs on the opportunities and limitations of the technology. This work should also include experimental work on comparison between materials that have been prepared by conventional means and by 3D printing.

Scope:

The working group would investigate and report on:

1. Review of the state of the art of additive manufacturing.
2. Highlight existing work on additive manufacturing in the field of electrical (power) engineering.
3. Provide an overview of potential benefits for the power industry.
4. Report on challenges in terms of standardisation and limits of the technology.

Experimental work on material properties of 3D printed dielectrics and comparison with conventional methods (e.g. extrusion, conventional moulding).

Remarks:

This is the first relevant work within CIGRE that would cover the area of AM.

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, WiE, NGN)	Qtr 3 2024
• Develop final work plan	Qtr 3 2025
• Draft TB for Study Committee Review	Qtr 3 2026
• Final TB	Qtr 3 2027
• Webinar	Qtr 3 2027

Approval by Technical Council Chair:

Date: July 1st, 2024

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, WiE and NGN nominees.

b. WG nominees by NCs 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.