CIGRE Study Committee C1

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

<table>
<tr><td>WG C1.50</td><td colspan="2">Name of Convenor: Nicolas CHAMOLLET (France)
E-mail address: nicolas.chamollet@edf.fr</td></tr>
<tr><td colspan="2">Technical Issues #[2]: 4, 5, 7 and 8</td><td>Strategic Directions #[3]: 1, 2, 3, 4</td></tr>
<tr><td colspan="3">The WG applies to distribution networks[4]: No</td></tr>
<tr><td colspan="3">Potential Benefit of WG work #[5]: 1, 2, 3, 7</td></tr>
<tr><td colspan="3">Title of the Group: Global sustainable energy system coupling electricity and hydrogen</td></tr>
<tr><td colspan="3">Scope, deliverables, and proposed time schedule of the WG:

Background:

Sustainability is a key driver of many developments world-wide, and quite notably for power systems, thanks to the December 2015 Paris Agreement on climate protection with its actionable worldwide consensus.

CIGRE, as the ‘global expert community for electric power systems’, must and wants to support is engaged in supporting the Paris Agreement, and sustainability in general, and pursues sustainable electricity for all.

In this context, CIGRE WG C1.44 (“Global interconnected and sustainable electricity system: Effects of storage, demand response and trading rules”) has performed the first known quantitative feasibility study for the concept of a global electricity network including impact of storage and demand response. This feasibility study has explored the economic costs and benefits of interconnections, storage, and demand response as key enablers of the development of clean energy worldwide by 2050. It has been demonstrated that among the different solutions to reduce the cost of the global power system with less CO2 emissions, the most cost-effective is the development of interconnections. Storage alone also decreases CO2 emissions but has limited impact on cost. Demand Response has little impact and should be more efficient for short-term needs. Among other advantages, interconnections and storage help the global power system to take advantage of diversity from different time zones, seasons, load patterns and renewable energy availability, thus supporting a balanced coordination of power supply of all interconnected countries.

Meanwhile, CIGRE WG C1.48 is performing a deep assessment on the “Role of green hydrogen in energy transition: opportunities and challenges from technical and economic perspectives”, including:

• The collect and analyse of numerous studies related to technical and economic aspects of hydrogen supply chain and use, as well as supporting national policies and implementation strategies;

• The presentation of different use cases in industry, transport, heating sectors and as energy storage and other system services including renewable electric energy supply needs, land, and water requirements, and

• The recommendation for technology solutions for grid code compliance and to enable market-based provision of various local and system wide flexibility services by large scale electrolyser plants.</td></tr>
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Scope:

Based on the deep analysis of the C1.44 and C1.48, the main objective of the WG C1.50 is to perform a quantitative pre-feasibility study of a global power system including electricity and green hydrogen by 2050.

This pre-feasibility study shall explore the economic costs and benefits:

- of interactions between electricity and hydrogen supply chain including production, conversion, transport, and storage
- of electricity and H2 storages and transport between the continents

The main steps are:

- To forecast and map hydrogen demands in each region and corresponding amount of renewable electric energy supply and installed capacity.
- To develop and apply a methodology for modelling hydrogen layer on a global scale including potentials of production, conversion, transport, and storage.
- Based on C1.44 model, to build a higher granularity global power model including interactive green hydrogen layer.
- To define pertinent cases studies for a broad analysis based on various options such as equipment's cost, technology options, RES potentials, etc.
- To run the model and to identify the costs and benefits of synergies between electricity and hydrogen in a global power mix system.
- To summarize results and make recommendations for how and where the most important obstacles to the development of inter-continental electricity hydrogen mix power system could be addressed.

Deliverables: Technical Brochure, summary in Electra, Tutorials, Webinar, Conference presentations.

☒ Technical Brochure and Executive Summary in Electra

☒ Electra Report

☒ Tutorial[6]

☒ Webinar[6]

Time Schedule: start: January 2024 **Final Report**: June 2026

Approval by Technical Council Chairman:

Date: January 5th, 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: Technical Issues for creation of a new WG

1	Active Distribution Networks resulting in bidirectional power and data flows within distribution levels up to higher voltage networks
2	Digitalization of the Electric Power Units (EPU): Real-time data acquisition includes advanced metering, processing large data sets (Big Data), emerging technologies such as Internet of Things (IoT), 3D, virtual and augmented reality, secure and efficient telecommunication network
3	The growth of direct current (DC) and power electronics (PE) at all voltage levels and its impact on power quality, system control, system operation, system security, and standardisation
4	The need for the development and significant installation of energy storage systems, and electric transportation, considering the impact they can have on the power system development, operation and performance
5	New concepts for system operation, control and planning to take account of active customer interactions, and different generation types, and new technology solutions for active and reactive power flow control
6	New concepts for protection to respond to the developing grid and different generation characteristics
7	New concepts in all aspects of power systems to take into account increasing environmental constraints and to address relevant sustainable development goals.
8	New tools for system technical performance assessment, because of new Customer, Generator and Network characteristics
9	Increase of right of way capacity through the use of overhead, underground and submarine infrastructure, and its consequence on the technical performance and reliability of the network
10	An increasing need for keeping Stakeholders and Regulators aware of the technical and commercial consequences and keeping them engaged during the development of their future network

Table 2: Strategic directions of the Technical Council

1	The electrical power system of the future: respond to speed of changes in the industry
2	Making the best use of the existing systems
3	Focus on the environment and sustainability
4	Preparation of material readable for non-technical audience

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.
7	Work addressing environmental requirements and sustainable development goals.

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.