CIGRE Study Committee C1

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG N° C1.47	**Name of Convenor: Ning Zhang (China)**
Strategic Directions #[2]: 1, 2, 3	**Sustainable Development Goal #[3]: 7, 9, 11, 12**
The WG applies to distribution networks: ☐ Yes / ☒ No	
Potential Benefit of WG work #[4] : 1, 2, 3, 4	
Title of the Group: Energy Sectors Integration and impact on power grids	

Scope, deliverables and proposed time schedule of the WG:

Background:

Energy Sectors Integration (ESI) denote the system that coordinates the generation, transmission, conversion, and utilization of energy across different energy sectors, pathways, and time scales. Compared with "classical" energy system in which energy sectors are treated independently, ESI has four main advantages: 1) accommodating higher penetration of renewable energy using the flexibility from energy conversion and energy storage; 2) increasing the efficiency of whole system by cascade utilization of energy including renewable energy; 3) promoting the optimal deployment of both centralized and decentralized energy resources at a system level through market interaction; and 4) enhancing the reliability and resilience of energy supply through the complementation of different energy infrastructures. The couplings and interactions among multiple energy networks, for example, power, gas, hydrogen, heat/cooling networks, as well as electro mobility, are becoming more and more complex. For example, there are increasing concerns on the coupling of the gas market and power market in US and Europe. The output gas fired generators are more often limited by the security constraint of gas network and further affecting the safety operation of power system.

ESI can be categorized into two levels, that is, local level energy systems and multi-region level energy networks. The local level energy systems mainly focus on the energy coupling in distribution or consumer level (e.g., school, hospital, or a community). It includes electricity distribution systems, gas distribution stations, gas pipes, heat exchange stations, and district heat networks. The multi-region level energy networks mainly denote the energy transmission networks connecting source side and demand side, including long-distance power, gas, hydrogen transmission networks. Some networks usually do not have a large scale, but their operation also has impact on the planning and operation of other systems. The large scale water resources/river basins also affect the energy networks. With the increasing trend of energy sectors coupling, the challenges opportunities should be investigated from the infrastructure planning and operational optimization points of view.

There have been two working groups on energy system coupling in CIGRE. JWG C6-C2.34 examined drivers and requirements for flexibility as well as flexibility contributions from distributed energy resources. JWG C6-C1.33 studied the configurations, impacts and prospects of multi-energy systems from demand and distribution side. To face the development of ESI, more work should be done from the perspective of transmission network.

The aim of this WG is to address both the technical, business, economic and regulatory issues for the developing of concrete use cases of energy systems coupling and assess state-of-the-art research in different countries around the world. The WG will also bridge the gap between academy research and industry on the ESI to reveal the key issues that should be addressed in the future.

Scope:

The Scope of this WG is to

1. Identify technical / business / institutional challenges and benefits from energy sectors integration at transmission grids level.
2. Review the methodology and technologies on the modeling, operation, market analysis and planning towards multi-region level ESI.
3. Summarize lessons learned and introducing best practice of energy sectors integration.
4. Analyse issues about market and regulatory differences between sectors — and the need to minimise the differences in the emerging green gas sectors; on this basis, propose suggestions for policies and market regulations towards the energy sectors integration at transmission grids level.
5. Promote technical papers, technical panel sessions, and workshops for the dissemination of academic research and real-world applications of energy sectors integration.
6. Coordinate such activities where appropriate with other CIGRE committees, subcommittees, and working groups.

For the above topics, a survey of state-of-the-art, technical advances and typical cases shall be done, analyzing the drivers and solutions for the selected planning and operation towards energy sectors coupling at transmission level, with scope to infer some general principles as useful guidelines for the design of future integrated multi-energy systems.

Joint work with other SCs:
Liaison experts from SC C6, B1 and C5 will be invited.

Deliverables:

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

Time Schedule: start: Januaryr 2021 **Final Report**: December 2022

Agreed ToR: December 2020
Regular WG webmeetings as needed

Physical WG meeting: Q3/2022 in Paris General Sessions
Design and distribute questionnaires Q1/2021
Collection of survey results: Q3/2021
Compile and analyze data Q4/2021

Best practice of sectors coupling chosen: Q1/2022
Draft report: Q2/2022
Milestone report to C1: Q3/2022

Presentation to C1 at the 2022 CIGRE Session
Final report: Dec 2022

Approval by Technical Council Chairman:

Date: November 28th, 2020

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.