CIGRE Study Committees C6 and C1

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

JWG C6/C1.33	**Name of Convenor:** Birgitte Bak-Jensen (Denmark) **E-mail address**: bbj@et.aau.dk
Strategic Directions #[2]: 1, 3	**Technical Issues #: 4, 5, 7, 8**
The WG applies to distribution networks[4]: Yes	
Potential Benefit of WG work #[6]: 1, 2, 4, 6	
Title of the Group: Multi-energy system interactions in distribution grids	

Scope, deliverables and proposed time schedule of the Group:

Background:

Multi-energy systems are integrated schemes from different energy vectors, sectors and networks such as electricity, gas, heating, cooling, transport, etc. These systems are key to generating new types of energy flexibility as well as techno-economic and environmental opportunities for reliable operation and least-cost planning of future smart electricity grids. There is a significant potential to be exploited from the synergies between the electricity grids and different sectors of energy. An example is the storage of electricity generated from renewable energy units during low electricity price periods in other forms of energy (heat/gas systems) for later use. These in turn can generate techno-economic solutions for flexible demand, energy storage provisions and system services that can enhance the hosting capacity of electricity grids and distributed generation resources, without requiring the implementation of expensive grid reinforcements. It is therefore essential to understand the close interaction at the energy level between the electricity and other energy sector technologies, infrastructures and functions in order to develop smarter electricity networks and communities.

Scope:

Multi-energy systems, sometimes called sector coupling, is a large field with many aspects, affecting both distribution and transmission grids strongly. CIGRE addresses this relatively recent topic of interest with several coordinated new WGs, primarily within SC C6 but partly also in JWGs with SCs C1 and C2. Whereas the parallel JWG C6-C2.34 examines drivers and requirements for flexibility as well as flexibility contributions from distributed energy resources, the scope of this WG C6/C1.33 is to study the configurations, impacts and prospects of multi-energy systems that enable enhanced solutions for intelligent electricity systems, energy storages and demand side management in the electricity grids with an increasing share of distributed energy resources (DER). The following are topics which will be explored and elaborated within the JWG:

1. Opportunities and impacts of multi-energy systems in future electric power systems – Role in increasing the penetration of distributed generation (storage and use of excess electricity).
2. Review of technologies and systems that integrate multiple sources of energy systems: Power-to-Gas (P2G), including electrolyzers, fuels cells, hydrogen storage, injection into gas networks; Combined Heat and Power (CHP); Combined Cooling, Heat and Power (CCHP); Power-to-Heat (P2H), including electric boilers, heat pumps, thermal storage; Power-to-Vehicle (P2V) including vehicle to grid (V2G) services; pumped and compressed air storages.

3. Building, district and city modelling as part of multi-energy systems. Architecture, use cases and tools for multi-energy system operation, planning and design.
4. System modelling, planning, control and operation of electric distribution grids as part of multi-energy systems and networks.
5. Business cases for multi-energy systems. Experiences and case studies of active multi-energy systems.
6. Guidelines and existing practices, techno-economic challenges and solutions to adopt multi-energy systems.

Joint work with other SCs:

Liaison experts from SC C2 for aspects concerning the operational interface between this system and the network will be invited.

Deliverables:

☒ Technical Brochure and Executive summary in Electra

☒ Electra report

☒ Tutorial[5]

Time Schedule: start: August 2018 **Final Report**: October 2020

Approval by Technical Council Chairman:

Date: 30/07/2018

Notes: [2] See attached Table 2, [3]See attached Table 1,
[4] Delete as appropriate, [5] Presentation of the work done by the WG, [6] See attached table 3

Table 1: Technical Issues of the TC project "Network of the Future" (cf. Electra 256 June 2011)

1	Active Distribution Networks resulting in bidirectional flows
2	The application of advanced metering and resulting massive need for exchange of information.
3	The growth in the application of HVDC and power electronics at all voltage levels and its impact on power quality, system control, and system security, and standardisation.
4	The need for the development and massive installation of energy storage systems, and the impact this can have on the power system development and operation.
5	New concepts for system operation and control to take account of active customer interactions and different generation types.
6	New concepts for protection to respond to the developing grid and different characteristics of generation.
7	New concepts in planning to take into account increasing environmental constraints, and new technology solutions for active and reactive power flow control.
8	New tools for system technical performance assessment, because of new Customer, Generator and Network characteristics.
9	Increase of right of way capacity and use of overhead, underground and subsea infrastructure, and its consequence on the technical performance and reliability of the network.
10	An increasing need for keeping Stakeholders aware of the technical and commercial consequences and keeping them engaged during the development of the network of the future.

Table 2: Strategic directions of the TC (ref. Electra 249 April 2010)

1	The electrical power system of the future
2	Making the best use of the existing system
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 or economic benefit 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 direction
5	Guide or survey related to existing techniques. Or an update on past work or previous Technical Brochures
6	Work likely to have a safety or environmental benefit