CIGRE Study Committee C1

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG [1]C1.44	**Name of Convenor:** Gerald Sanchis (France) **E-mail address**: gerald.sanchis@rte-france.com
Technical Issues #[2]: 3, 4, 7, 10	**Strategic Directions #[3]: 1, 3, 4**
The WG applies to distribution networks[4]: No	
Potential Benefit of WG work #[5]: 2, 5, 7	
Title of the Group: Global interconnected and sustainable electricity system: Effects of storage, demand response and trading rules	

Scope, deliverables and proposed time schedule of the WG:

Background:

CIGRE WG C1.35 has performed the first known quantitative feasibility study for the concept of a global electricity network. Although based on several strong assumptions, its Technical Brochure of Summer 2019 has derived a possible geographical and technical configuration, and described preconditions for its feasibility, considering technology and economic aspects.

This feasibility study has explored the economic costs and benefits of interconnections between the different continents as one key enabler of the development of clean energy worldwide. Among other advantages, interconnections help the 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.

In order to produce results within less than three years, WG C1.35 focused on joint modelling and optimization of intercontinental transmission and clean generation options, without addressing longer-term storage options (only sensitivities on batteries), demand response, transmission within continental regions or some of the trading rule and governance questions of a global grid. These factors can affect the need for interconnections on the cost and benefit side, e.g. because they solve part of the variability problem of wind and solar energy.

Building directly on the data, modelling and tools which WG C1.35 developed, WG C1.44 will modify assumptions and data to run the optimization tools for transmission and generation options while taking into account different storage options, demand response, transmission within continental regions, and trading rule and governance questions of a global grid.

Scope:

The objective of WG C1.44 is to extend the results of WG C1.35 and make them more robust, by considering different storage options, demand response, transmission within continental regions, and trading rule and governance questions of a global grid.

The main steps are:

1. To select the 2050 study case of C1.35, used as reference for the present study and to gather and where needed update the relevant data (generation, load patterns, generation and transmission costs etc…). For this, parallel work in IEC ACTAD may be relevant.

2. To define relevant characteristics and cost forecasts of different energy storage technologies (seasonal, weekly, daily use).
3. To develop and apply a methodology for the assessment of the potential of storage for each region. As part of the first three steps, check the assumptions on hydro energy in the reference study case and determine how the potential of energy storage in hydro reservoirs can best be assessed.
4. To define the profile and the potential of demand response for each region (different e.g. for cooling vs. heating needs and different kinds of electrified transport scenarios).
5. To develop and apply a method for accounting for different energy storage technologies and demand response in the joint transmission and generation optimization approach. This could include methodological developments to include storage and/or demand response as decision variables, or adjusting the load pattern of each region, taking into account the impact of storage and of demand response in different scenarios.
6. To identify the costs and benefits of interconnections, after consideration of the implementation of storage and demand response in the 13 different regions selected by WG C1.35.
7. To describe in two separate chapters the need and effects of continental-scale electricity trading rules and governance issues, and potential effects of the status of transmission system development within a continent on the costs and benefits of a global grid. For this part of the work the WG will liaise with SC C5.
8. To summarize results of WGs C1.44 and C1.35 in conjunction, and make recommendations for how and where the most important obstacles to the development of inter-continental electricity transmission 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: October 2019 **Final Report**: March 2021

Approval by Technical Council Chairman:

Date: August 26th, 2019

Notes: [1] Working Group (WG) or Joint WG (JWG), [2] See attached Table 1, [3]See attached Table 2, [4] Delete as appropriate, [5] See attached Table 3,
[6] Presentation of the work done by the WG

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.