CIGRE Study Committees C1 and C6

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP[1]

JWG C1.C6.42	**Name of JWG Convenor:** Charlotte Higgins (GB) **Name of JWG Secretary:** Jeff Palermo (US) **E-mail addresses**: charlotte.higgins@tneigroup.com, jeff@pjp-consulting.com
Strategic Directions #[2]: 1, 2	**Technical Issues #[3]: 7, 8**
The WG applies to distribution networks[4]: Yes	
Potential Benefit of WG work #2, 3, 4[6]:	
Title of the Group: Planning tools and methods for systems facing high levels of distributed energy resources	

Background:

Distribution and transmission utilities around the world are facing levels of renewable generation that were unanticipated only a few years ago. These renewable resources, often connected at distribution level but affecting all voltage levels, affect long-standing system characteristics and introduce new challenges to planning the entire power system. While increasing storage and customer flexibility may help with some of these challenges, they require new approaches to studies and use of data. Some of the challenges include:

- Changing overall customer load shape, affected by rooftop PV, more intensive use of electrification such as in heating and transport (e.g. EV fast-charging);
- Explicit and implicit demand response at all voltage levels, including potential strong increases in price elasticity of demand and customer interest in participating in such programs;
- Significantly different geospatial generation patterns during different times and seasons, and over the various voltage levels;
- Operational issues: lower system inertia; reduced and increasingly distributed frequency and voltage regulating capacity; lower fault-current levels; black-start capability and requirements.

Those utilities have developed a myriad of ways to perform planning studies to analyze these system changes and test potential solutions using existing tools and data and also additional new tools or data. These are also starting to consider:

- Increasing regulatory emphasis on holistic cost-benefit analysis for new transmission and also distribution infrastructure, combining technical, economic and reliability evaluations,
- New approaches to aggregating DER (microgrids, virtual power plants), DER management systems; and
- Availability of new control tools: information and communication technologies (ICT, internet of things), big data management and information extraction.

There is, however, limited sharing or publication of these methods. Findings from parallel JWG C1.C6.37 on investment decisions will be considered for the work of this JWG.

Scope:

1. Identify the impact of a large deployment of DER at the distribution level and repercussions on the transmission grid; identify the methods of aggregating DER; determine the benefits of aggregating DER at the distribution and transmission

levels.

2. Identify the tools required to analyse the impact of individual and aggregated DER on the distribution and the transmission systems; investigate the potential of co-simulation tools allowing the analysis of the impact of DER installed at the distribution level on the transmission grid; consider static and dynamic aspects
3. Identify and define the planning and operation tools required at the distribution and at the transmission levels to consider the impact of a wide deployment of DER; consider the impact on reliability and resilience, and the economic aspects associated with the generation of power and increased reliability and resilience.
4. Survey distribution and transmission Utilities for present practices and additional needs — parts of the survey focus on already known techniques, valuing DER and customer flexibility; practices and techniques in developing scenarios and the number of scenarios, both for transmission and for distribution (where e-mobility presents large uncertainties); how tools adapt to uncertainty; and probabilistic tools; review responses from utilities.
5. From the survey, identify commonly-used tools, methods and data; identify unique (non-common) methods and data that are proving useful; catalogue the range of methods and data in use; relate the results of the survey to the requirements defined in the previous sections; and identify gaps/needs for new tools or data, applied for distribution and transmission utilities.

Deliverables:

☒ Technical Brochure and Executive summary in Electra

☒ Electra report

☒ Tutorial[5]

☒ Webinar[5]

Time Schedule: start: January 2019

Final Report: August 2021
Tutorial: August 2021

Approval by Technical Committee Chairman:

Date: December 19th, 2018

Notes: [1] or Joint Working Group (JWG), [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