CIGRE Study Committee C6

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

JWG C6/C2.34	**Name of Convenor: Pierluigi Mancarella (Australia)** **E-mail address**: pierluigi.mancarella@unimelb.edu.au
Strategic Directions #[2]: 1, 3	**Technical Issues #[3]: 2, 3, 4, 5, 7, 8**
The WG applies to distribution networks (4): Yes	
Potential Benefit of WG work #[6]: 1, 2, 3, 4, 6	
Title of the Group: Flexibility provision from distributed energy resources	

Scope, deliverables and proposed time schedule of the Group:

Background:

With the growing penetration of volatile renewable energy sources, flexibility requirements are becoming more demanding. New ancillary services may be required, including inertial response in lower inertia systems, ramping services, reactive power support and provision of fault current. Traditional sources of flexibility and system control such as conventional thermal power plants are increasingly being displaced, and new providers of flexibility and ancillary services are needed. Distributed energy resources (DER) based on emerging technologies, including dispersed generation, energy storage, and demand response, are the more promising options for providing ancillary services, while avoiding potential over-rated system development. Multi-energy technologies that exploit the increasing interactions between electricity and other energy sectors (e.g., heat, transport, and chemical industry) and which exhibit intrinsically high degrees of complementarity can also be used. Given the competitive environment, these grid services are procured and delivered in the form of varying market products, for which relevant technical, regulatory and economic integration approaches and market mechanisms are needed at different levels of the value chain. The transition from passive distribution networks to active distribution systems managed by distribution system operators (DSOs), which also manage the integration of local DER on their grid, opens up increased interaction between DSOs and TSOs to enable the participation of distributed resources as service providers in congestion management in both the TSO and the DSO grid and on load-frequency control. Finally, new opportunities to enhance the business cases for DER will emerge, facilitated by new actors, such as prosumers, aggregators, energy service companies, microgrid operators, and community energy system operators. Increased flexibility is key in supporting the transition towards low carbon energy systems.

Scope:

The scope of this working group is to take stock of, analyze, assess and promote the role and potential of distributed energy resources (DER) in providing ancillary services, particularly flexibility, and participating in balancing market and whole-system operation.
The following topics will be explored and discussed in detail within the WG.

1. Review drivers and new requirements for flexibility at different stages of power system planning and operation at different levels of the power system, from the whole-system to the local network, with a focus on DER based on intermittent renewables.
2. Compile information on the potential of DER and multi-energy coupling to provide flexibility over different time scales, and in different forms, including generation (inverter interfaced), energy storage (batteries, thermal storage, e-vehicles, gas

infrastructure), demand response (industrial installations, individual buildings or district energy systems), and flexible assets (transformer tap changers and voltage regulators, dynamic thermal rating) and operations (active power control of renewable energy, TSO-DSOs coordination).

3. Analyze the contribution of DER to operational and planning flexibility in transmission and distribution networks in current and future power systems, taking into account market structures, in providing multiple services of their choice to TSOs or DSOs, facilitated by new actors (aggregators) and grid architectures (interconnections, microgrids, virtual power plants, and energy hubs interlinkage – among which Vehicle to Grid (V2G) and Power to Gas (P2G)).
4. Identify methodologies to estimate the benefits accrued to different stakeholders in the value chain arising from the provision of flexibility by DER. Explore new business cases for emerging technologies and new market models and actors.
5. Identify and discuss experiences and case studies from existing and future power grids, with a focus on applications, methodologies, projects and practices on the TSO-DSO interface.
6. Provide recommendations and guidelines regarding commercial, regulatory and policy changes required to exploit the flexibility provided by DER.

Joint work with other SCs:

Results from JWG C2.C6.36 on TSO-DSO interaction will be taken into account for further work of this WG. A liaison expert from SC C1 will be invited.

Deliverables:

☒ Technical Brochure and Executive summary in Electra

☒ Electra report

☒ Tutorial[5]

Time Schedule: start: August 2018 **Final report**: December 2020

Approval by Technical Council Chairman: M. Waldron

Date: 26/07/2018

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