CIGRE Study Committee C1

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

WG N° C1.40	**Name of Convenor:** CHRISTOPHER REALI (Canada) **E-mail address**: christopher.reali@ieso.ca
Strategic Directions #[2]: #1, #2	**Technical Issues #[3]:** #1, #5, #7
The WG applies to distribution networks[4]: Yes	
Potential Benefit of WG work #[6]: #2, #3, #5	
Title of the Group: Planning Coordination between System Operators, Transmitters and Distributors: Frameworks, Methods, and Allocation of Costs and Benefits	

Scope, deliverables and proposed time schedule of the Group:

Background:

Need:

As distributed energy resources ("DER") continue to be incorporated into distribution systems, "active distribution systems" as well as variable renewable generation connected to the bulk power system have created a growing need for greater planning coordination between independent system operators ("ISO"), transmission service operators ("TSO"), and distribution service operators ("DSO"). The need for greater planning coordination between TSOs and DSOs was also a key theme identified in the 46th CIGRÉ Session outlined in the keynote address.

When considering the complexity of the integration between TSO and DSO systems and planning activities, it is clear that there is a need to develop more optimal planning solutions to enable more accurate TSO and DSO planning. With ever-changing economic conditions, evolving technology, and renewable integration, among other factors influencing TSO and DSO planning, integrated solutions and greater defined processes will significantly contribute to benefitting of the customer. This will in turn lead to increased economic benefits for both electricity service providers and customers. Given complexities in system and customer benefit functions, a comparable framework for allocating costs to various system and customer benefits are required in addition to planning process improvements.

There is little information available about planning coordination between TSOs and DSOs in different jurisdictions. The level of planning coordination will depend greatly on the planning models employed, how DERs are considered within the planning model, how benefits arising from coordination can incentivize meaningful TSO-DSO collaboration, and improved planning for future infrastructure investment decisions.

Best practices will be gathered from current integration initiatives and applied to the target networks as appropriate. It is important to note that different countries have different needs towards planning functions. One main distinction can be made between developed countries vs. developing countries of which the planning and integration needs might vary vastly. Developed countries need to include technological drivers and their implications on TSO-DSO network integration, whereas developing countries need to implement regulation and structures proactively in order to plan for robust networks to accommodate future growth and development.

The need for addressing interface issues in the coordination of planning is a priority for SCC1 as it is a preferential subject and key work stream for the study committee:

PS3 – Coordinated Planning Between Grid Operators Across All Voltage Levels:

- Methodologies for planning multiple interconnected transmission grids and for transmission-distribution interaction.

- How cost sharing and/or company organization and strategy can improve or impact coordinated planning principles.
- The evolution of planning methods to account for smart grids, distributed generation, demand response and technological innovation.

Past Works:

Past works will be leveraged to help the working group meet the identified scope. Specifically, work conducted by WGC1.33 and JWGC1.29 will be used by this proposed working group's investigation as they are recent works and very much related.

WGC1.33 explores interface issues associated with interconnections between two transmitters ("TSO-TSO interconnections" or "horizontal interconnections"). Similar challenges can exist between a transmitter and distributor ("TSO-DSO interconnections" or "vertical interconnections") but of a different dynamic. The emergence of active distribution systems will further complicate vertical interconnections.

WGC1.33 has identified further work to identify interface issues of vertical interconnections.

JWC1.29 explored planning criteria for future transmission networks in light of greater variability of power exchange with distribution systems, largely due to DERs. In particular, JWGC1.29 explored the level of information-sharing between transmitters and distributors and has identified the need for further investigation in planning coordination challenges.

JWGC1.29 recommended the following:

- Additional research into generation mix of DER
- Commercial aspects for Active Network Management
- Forecasting of DER
- Regulatory accountabilities for the TSO-DSO interface

WGC6.19 explored Planning and optimization methods for active distribution systems. This WG identified a new framework and methodologies for models of active distribution planning.

WGC6.19 recommended that modern distribution planning methodologies have to be explicitly risk oriented, and planning and operations must be more tightly coordinated.

The work of this proposed working group will dovetail well with these past works done by WGC1.33, JWGC1.29 and WGC6.19.

Scope:

The scope of this working group has been informed by the discussions of SCC1, specifically the following questions:

1. How are plans coordinated between different network owners?
2. Do different rules at network ownership boundaries lead to sub-optimal connection locations and network investment?
3. How are the costs of network development allocated when there are different shares of benefits between different parties across network ownership boundaries? E.g., connection of generation to a distribution network triggers (or saves) transmission reinforcement – how does this affect the generator's grid charges?
4. What new data exchanges are needed to facilitate coordination? Do these lead to changes to grid codes or new types of connection conditions?

5. Do re-dispatch costs of distributed resources reveal price signals which can inform optimal network development?
6. How are bottom-up and top-down approaches integrated in forecasting (e.g. DSO on lower voltages and TSO on higher voltages)?
7. How are Renewable Energy Systems and DER forecasts in line with rapidly changing technology, and how is this integrated into current forecasting for capacity planning of maintaining or expanding network infrastructure?
8. In growing networks such as those in developing countries where network expansion is still of high priority, how are future regulatory changes optimized to positively influence planning decisions.

Methods

The scope of this working group will investigate, through a jurisdictional survey, the established practices for planning coordination, the challenges and successes seen in each jurisdiction, and based on responses, recommend best practices for planning coordination.

The survey will consider the following information:

1. What is the established regulatory framework in the surveyed jurisdiction? (i.e. national versus state level, regulated asset types: transmission, sub-transmission, distribution, any regulated or codified requirements for operators, transmitters, and distributors information sharing and collaboration).
2. Are utilities publically owned, privately owned, mixed ownership?
3. Is the transmission planning process formalized or ad hoc?
4. Is the distribution planning process formalized or ad hoc?
5. Are there any touch-points in the transmission planning process with the distribution planning process? Are these touch-points formalized requirements or ad hoc?
6. What entities are involved in the transmission and distribution planning processes?
7. What is the data required by each entity involved in the transmission and distribution planning processes?
8. What is the length of time that the planning process is performed over?
9. What gaps in data exist in the current planning process?
10. What would the requested data enable each entity to achieve?
11. How are system investments decided? – board of directors, regulatory body; by transmission or distribution company, by government, by independent system operator, in collaboration with multiple parties (if so, who)
12. How are system investments funded and costs allocated? – by type of facility, by function of facility; uniform tariff, customer-dependent tariff, other
13. How is system investment funding related to, or incorporated in the planning process?

The above information will be distilled into the following themes:

1. Different models of transmission planning
2. Models which account for the paradigm shift of increased distributed resources
3. Models which allocate costs based on type of investment or function of investment
4. Components of planning models which the working group believes are positive characteristics for future integrated TSO-DSO planning challenges

The above themes will be used to recommend future planning process models which the working group believes will benefit system operators, transmitters, and distributors. The above themes may also be of benefit to regulatory and political bodies.

Membership for this working group will span both TSO and DSO initiatives. Therefore, recruitment of at least one liaison from C6 will be completed, with preference to active member(s) from C6.19.

Deliverables:

☒ Technical Brochure and Executive summary in Electra - Yes

☐ Electra report - No

☐ Tutorial5 - To be determined upon receipt of survey responses

Time Schedule: start: May 2017 **Final Report**: August 2019

Approval by Technical Committee Chairman:

Date:17/03/2017

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