CIGRE Study Committee C1

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG [1]N° C1.45	**Name of Convenor:** Pierluigi Vicini (ITALY) **E-mail address**: pierluigi.vicini@cesi.it
Strategic Directions #[2]: 1, 4	**Sustainable Development Goal #[3]: 7, 13**
The WG applies to distribution networks: ☐ Yes / ☒ No	
Potential Benefit of WG work #[4]: 1, 2, 3	
Title of the Group: Harmonised metrics and consistent methodology for benefits assessment in Cost-Benefit Analysis (CBA) of electric interconnection projects	

Scope, deliverables and proposed time schedule of the WG:

Background:

Interconnections between power systems are playing an increasingly important role not only to enhance security of supply or foster market integration among different regions, but also to favor the process of power sector decarbonization. In fact, thanks to interconnections it is possible to transfer surplus of power generated by Variable Renewable Energy Sources (V-RES) in one area to neighboring regions, avoiding so the need for curtailment. In contrast, periodic shortfall of power supply (e.g. lack of wind and solar generation) can be balanced by power imported through interconnections.
Thus, we are nowadays witnessing a substantial effort worldwide to deploy new interconnections, often relying on innovative technologies and solutions to mitigate the environmental impact, such as new design of electric towers, underground cables, HVDC to eliminate EMF risks, etc.

In Europe, 35 GW of cross-border capacity increase is in construction or planned until 2025, but the optimal expansion of the pan-European system until 2040 would require further 93 GW of capacity increase[1]. Similar trends are ongoing all over the world.

The new drivers for transmission investment decisions were investigated in WG C1.15 (see TB 701) and further by WG C1.22 "*New investment decision processes and regulatory practices required to deal with changing economic drivers*".

The WG will also build upon reference papers (on underground cables - overhead lines - gas insulated lines - UGC-OHL-GIL) and relevant B1 works (B1.19, B1.07, B1.10, B1.57, B1.54).

One of the suggested future works identified in the mentioned WGs is "cost-benefit analysis" (TB 701).

In fact, considering the high upfront investment costs required by the new interconnections or the reinforcements of the existing ones, it is increasingly more demanding to show to the stakeholders that benefits overweight costs. In particular, the evaluation of benefits is even more challenging for interconnections, since they are often located across different jurisdictions having different market and remuneration mechanisms. Furthermore, in many cases, it is very difficult to identify and monetize the benefits that a new interconnection could provide to the society (e.g. social and environmental benefits). The aspects related to allocation of benefits, costs and risks among countries and among grid operators, as well as allocation of asset ownership & responsibilities are explored by the ongoing WG C1.33.

[1] Source: "*Completing the map Power system needs in 2030 and 2040*", ENTSO-e, the European Network of TSO for electricity, August 2020 (draft version).

Nevertheless, WG C1.33 does not enter in detail on which benefit indicators shall be computed, what indicators can be monetized and how to consider and compare benefits having different metrics. In the past, benefits were mainly related to the decrease of the supply costs for the power system and to the enhancement of the security of supply that can be monetized base on VOLL[2] . Nowadays, benefits shall include the improvement of system technical performance against normal contingencies (e.g.: N-1 / N-2 contingency) and extreme events (resilience), as well as environmental indicators, such as reduction of greenhouse gases (GHG) emissions, impact on the landscape and, in general, on the territory.

A well-defined process to evaluate the benefits under consistent scenario assumptions is key to rank the various interconnection alternatives and better show to the stakeholders that benefits overweight costs. Indeed, one of the reasons of delays in interconnections construction is the lengthy discussions to reach an agreement on a shared solution among the concerned parties. This is caused also by the lack of solid international references on what benefit indicators to consider and how to evaluate them.

This WG aims to fill this gap.

Scope:

The scope of this WG is twofold:

- ✓ Identification of the benefits indicators (economic&social, technical, environmental) associated to an interconnection project. In identifying benefit indicators, we will consider the various market and regulatory frameworks worldwide
- ✓ Procedure to quantify the benefit indicators and how to combine them in consistent way when they have different metrics.

The focus is on interconnection reinforcements or on building new interconnections between isolated areas, but, in general, the suggested solution(s) can also be applied to inter-area transmission reinforcements within the same jurisdiction. Furthermore, the concept of "interconnections" does not necessary refer to a cross-border infrastructure.

The scope of the WG will be achieved through the following steps:

1. International review of the CBA practices in the different countries and identification of the main challenges: what benefit indicators are considered and how they are measured (indicator metrics) in the various regions of the world

2. Common strengths and weaknesses among the different approaches

3. Possible schemes to assess benefits indicators, quantify them and recommendations for comparing benefit indicators and ranking the various interconnection alternatives

4. Indicative case studies showing the application of proposed schemes for assessment of benefit indicators and ranking of the various alternatives. As far as possible, case studies will be applied to regions having different regulatory and market mechanisms

5. Summary and recommendations on good practices for quantifying benefits arising from interconnections based on a set of indicators with the final aim to help the investment promoters (TSOs or private investors) streamline the process of approval from National Regulatory Authorities / Energy Ministers and favors the discussions with stakeholders to reach the acceptance of the new infrastructures.

The Technical Brochure will be prepared in parallel to the various WG steps.

[2] VOLL: Value Of Lost Load

Deliverables:

☒ Technical Brochure and Executive Summary in Electra
☐ Electra Report
☐ Future Connections
☐ CSE
☒ Tutorial
☐ Webinar

Time Schedule: start: January2021 **Final Report**: Dec. 2022

Agreed ToR: December 2020
WG membership: January 2021

1st WG meeting: Feb 2021 (video conference)
2nd WG meeting: June 2021 (Slovenia)
3rd WG meeting to discuss draft report: Q4/2021
Presentation of WG preliminary outcomes to SC C1 at 2022 CIGRE Session, August 2022
Final report: Dec. 2022

Approval by Technical Council Chairman:

Date: November 28th, 2020

Notes: [1] Working Group (WG) or Joint WG (JWG), [2] See attached Table 1, [3] See attached Table 2 and CIGRE reference Paper: Sustainability – at the heart of CIGRE's work. [4] See attached Table 3

Table 1: Strategic directions of the Technical Council

1	The electrical power system of the future reinforcing the End-to-End nature of CIGRE: respond to speed of changes in the industry by preparing and disseminating state-of-the-art technological advances
2	Making the best use of the existing systems
3	Focus on the environment and sustainability (in case the WG shows a direct contribution to at least one SDG)
4	Preparation of material readable for non-technical audience

Table 2: Environmental requirements and sustainable development goals

	CIGRE selected the 7 SDGs that are the most relevant to CIGRE. In case the WG work refers to other SDGs or do not address any specific SDG, it will be quoted 0.
0	Other SDGs or not applied
7	**SDG 7: Affordable and clean energy** Increase share of renewable energy; e.g. expand infrastructure for supplying sustainable energy services; ensure universal access to affordable, reliable, and modern energy services; energy efficiency; facilitate access to clean energy research and technology
9	**SDG 9: Industry, innovation and infrastructure** Facilitate sustainable infrastructure development; facilitate technological and technical support
11	**SDG 11: Sustainable cities and communities** Increase attention on sustainable and resilient buildings utilizing local (raw) materials, power for electric vehicles, strengthening long-line transmission and distribution systems to import necessary power to cities, developing micro-grids to reinforce the sustainable nature of cities; protect and safeguard the world's cultural and natural heritage; reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and waste management
12	**SDG 12: Responsible consumption and production** E.g. Promote public procurement practices that are sustainable; address reducing use of SF6 and promote alternatives, encourage companies to adopt sustainable practices and to integrate sustainability information into their reporting cycle, address inefficient fossil-fuel subsidies that encourage wasteful consumption
13	**SDG 13: Climate action** E.g. Increase share of renewable or other CO_2-free energy; energy efficiency; expand infrastructure for supplying sustainable energy; strengthen resilience and adaptive capacity to climate-related hazards and natural disasters; integrate climate change measures into national policies, strategies and planning; improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
14	**SDG 14: Life below water** E.g. Effects of offshore windfarms; effects of submarine cables on sea-life
15	**SDG 15: Life on land** E.g. Attention for vegetation management; bird collisions; integration of substations and lines into the landscape

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.