CIGRE Study Committee B3

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG [1]N° B3.64	**Name of Convenor:** Atsushi Eto (JAPAN) **E-mail address**: eto.atsushi@tepco.co.jp
Strategic Directions #[2]: 2, 3	**Sustainable Development Goal #[3]: 9, 13**
The WG applies to distribution networks: ☒ Yes / ☐ No	
Potential Benefit of WG work #[4] : 1, 3, 6	
Title of the Group: Guidelines on Optimising Seismic Design of Substations for Power Resiliency	

Scope, deliverables and proposed time schedule of the WG:

Background:

In recent years, demands for reliability in power supply have been increasing with the promotion of electrification and digitalisation. At the same time there are concerns that natural disasters have become more severe due to Climate Change. The need to harden substation facilities against natural disasters and improve the speed of recovery has attracted attention due to increased customer expectation and need of resilience. from the perspective of resilience.

In Study Committee B3, the technical brochure (TB) 614 "Air Integrated Substation Design for Severe Climate Conditions" was published in 2015. The TB summarises the concept of short- and medium-term maintenance and design of future equipment replace for AIS and GIS against Severe Heat, Drought and Dust, Severe Flooding, Severe Rain and Humidity, Severe Cold, Snow and Ice, Severe Wind. In addition, measures using mobile substations are also described as countermeasures. However, the phenomena of earthquakes are out of scope in TB 614.

In many countries, including the neighbourhood of border of the continental plate in the world (such as United States, Canada, Japan, Southeast Asian Philippines and Indonesia, South American Chile, China, New Zealand, Italy, Greece, Turkey, etc.), string earthquakes are frequent, historically, and severe damage has occasionally occurred.

Presently, large-scale blackouts of the power grid from natural disasters such as a powerful earthquake, require quick restoration of electric power to meet the needs and expectations of customers. Therefore, seismic/resilience design, proactive disaster management studies and disaster mitigation measures for all substations are necessary.
A powerful earthquake is rare but may be destructive. It is helpful to share the experiences and practices of earthquake disasters and develop a list of best practises.

Scope:

The activity will focus on the seismic design of substations. Specifically, the working group will:

1. Gather and summarise the actual data of recent noteworthy earthquake damage in substation and experiences of restoration efforts
2. Compare international design standards (IEC, IEEE, etc.) related to earthquake disasters and unique standards for each country. In addition, how to evaluate the seismic strength

for design criteria, the reasons and backgrounds for establishing the standards will be summarised.

3. Compare the practical measures of substation equipment against earthquake disasters from the following points of view.
   - Difference of substation type; indoor/outdoor, AIS/GIS.
   - Influence of configuration of apparatus such as basements/building types, supports structures and interconnection methods between equipment to the resonance frequency as a whole system for the earthquake.

   Also, details of engineering methods about design, analytical technique and evaluation of performance will be studied.
4. Gather and summarise what kind of maintenance method and condition monitoring technique are applied to prevent a catastrophic damage caused by earthquake.
5. Summarise good initiatives and best practices of each country/utility's fast restoration from substation equipment damages caused by earthquake disasters, such as deploying a mobile substation, temporally equipment, and preparing spare parts and restoration training.
6. Finally, propose a User's Guide for the seismic design of substations and recommended countermeasures to prepare for earthquake disasters.

Deliverables:

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

Time Schedule: start: April 2022 **Final Report**: December 2024

Approval by Technical Council Chairman:

Date: March 23rd, 2022

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 sutilising 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.