CIGRE Study Committee C6

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG C6.43	**Name of Convenor:** Nikos Hatziargyriou (Greece) **E-mail address**: nh@power.ece.ntua.gr
Strategic Directions #[2]: 1, 2, 3	**Sustainable Development Goal #[3]: 9, 11**
The WG applies to distribution networks: Yes	
Potential Benefit of WG work #[4] : 1, 2, 3, 4	
Title of the Group: Aggregation of battery energy storage and distributed energy resources (DER), including solar PV	

Scope, deliverables and proposed time schedule of the Group:

Background:

Battery energy storage systems (BESS) are increasingly installed in distribution grids in conjunction with other distributed energy resources (DER). These resources are solar PV systems, and other distributed generation, including generation from renewable energy resources, such as wind and small hydro. One of the roles of BESS, in support of the wide deployment of renewable energy resources, is to meet the requirement for energy balancing to mitigate resource variability and intermittency and make the combination of BESS and renewable DER dispatchable. This balancing feature is applicable to smaller, roof-top PV installations (behind the meter) connected to the low voltage (LV) grid and to larger PV or wind farms connected to medium voltage (MV) distribution feeders. In the latter case, the combined installation feeds energy directly into the distribution system.

BESS are key enablers for the implementation of active distribution system functions and for providing a range of grid services at the distribution level. These include voltage support, feeder power flow control, load and hosting capacity management, local energy and capacity provision, and reliability and resilience services in the event of contingencies and exceptional atmospheric events. These services are provided to the distribution system. They can support the operation of the transmission grid.

BESS can be embedded in distribution systems in smaller units deployed in large numbers at low voltage levels in conjunction with solar PV systems, for example. In the case of a wide deployment of a large number of distributed BESS and solar PV systems, these need to be aggregated and controlled using DER management systems to fully exploit their potential to provide grid support and services.

Scope:

The working group addresses the issues associated with BESS deployment, configuration, design and management in the context of a high penetration of renewable energy resources in distribution systems, including solar PV systems. The scope covers BESS design and deployment considerations, and the interconnection and integration requirements. It addresses economic and business case considerations. Environmental impact, life expectancy and life cycle considerations are discussed in relation to the different types of applications. Findings of previous working groups on BESS and related issues in distribution systems will be included as appropriate. Issues related to safety, maintenance, and installation requirements are not addressed.

The following list of topics are addressed by the working group:

1. Distribution system operation and categorization of grid support and services required for a wide deployment of different types of DER, including solar PV. Characterization of the services enabled by the BESS and their inverter interfaces. Interconnection and integration requirements. Inverter capabilities for power and energy control and voltage support.
2. Implementation of BESS controllers for the provision of grid services – Intelligent inverter functions. Potential benefits of artificial intelligence and data driven systems in managing the BESS and its energy absorption and release capacity and availability. Managing discharging and recharging requirements.
3. Aggregation approaches for aggregating power and energy, and enabling grid services from a large number of distributed BESS.
4. BESS operating considerations – Relative cost of different battery technologies, capital and operating costs, volume, weight and installation requirements, reliability, availability and maintainability considerations. Life cycle considerations and life cycle expectancy as a function of the operating environment and conditions. Environmental impact, disposal and repurposing, as applicable.
5. Business cases for BESS stakeholders taking into account functions and services provided, and the operating considerations – Tools, use cases, stakeholders (single, multiple) interests, and implementation considerations. Experiences and case studies, regional considerations, ownership and operation.
6. Regulatory and legal framework, and jurisdictional constraints for grid service delivery – General considerations and impact on the BESS deployment.
7. Guidelines, recommendations and best practices

Liaison experts from SC C5 will be invited for the discussion of regulatory issues.

Deliverables:

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

Time Schedule: start: June 2021 **Final Report**: August 2023

Approval by Technical Council Chairman:

Date: May 4th, 2021

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.