

WORKSHOP: Horizon 2050 power system and the role of HVDC technologies in a highly decentralised RES generation

04 February 2020

Directorate General for Energy – Rue de Mot 24, Brussels

I. CONTEXT

The Commission's scenarios, as presented in the 'Clean Planet for All' Communication, indicate that offshore wind will become increasingly important in the future energy mix – as a key contributor to a climate neutral Europe that is the goal of the Green Deal.

Due to the lower capacity factor of wind generation, the RES power to be installed offshore will be much higher than the equivalent fossil fuel-based generation to phase-out. Once generated far away from shore, this huge amount of green energy needs to be transmitted efficiently to the loads in the mainland. Presently, this is accomplished by point-to-point HVDC technologies. Due to the increasing number of interconnections, of windfarms and of other offshore RES (e.g. tidal), this type of connection is evolving to more complex, but efficient systems such as hybrid interconnections, meshed grids, DC hubs, etc.

In these types of configurations, the Multi Terminal High Voltage Direct Current (MT HVDC) converter as well as the grid forming converter technologies are acquiring a key role. Whatever the architecture, the solution needs to address the increasing - to 100% - replacement of inertia rotating machines with PEID (Power Electronic Interfaced Devices).

In this wide context, some key challenges need to be addressed such as the interoperability among different vendors' converters, the regulatory framework, etc.

The modularity of DC systems integrated in the current AC grid may provide a gradual implementation for offshore as well as for onshore applications, hence a programmable and affordable way forward.

The main objectives of the workshop were to identify the barriers and the corresponding actions needed to facilitate the development and implementation of HVDC technologies for offshore as well as for onshore applications and their interconnection with the current AC system.

II. MAIN FINDINGS

Different aspects of HVDC were addressed and from the discussion, the following main conclusions can be drawn:

- HVDC has acquired a growing important role for the transmission system, in particular for connecting markets and bringing to the mainland increasing shares of offshore wind and other RES generation;
- China has taken a leading position for multivendor MT HVDC projects, the related experience and market;

- MT HVDC and the grid forming converter technologies are today key enablers for implementing offshore grid as well as for grid transformation on land;
- HVDC and HVAC systems are not in competition, but they complement each other;
- The growing mix of HVDC and HVAC interconnections requests knowing beforehand their interaction to be ready to master all the aspects of such hybrid system;
- Multiple architecture development options are available (e.g. hybrid connection, meshed). The multi-terminal HVDC and the grid-forming converter will play a key role in these assets. There is the need to test and demonstrate these technologies beyond the laboratory scale to pave the way for deployment;
- For such scaling up, it is crucial that:
 - o The converters from different technology suppliers are interoperable (Multi-Vendor Multi Terminal HVDC);
 - o The solution addresses the increasing – to 100% - penetration of PEID in the electricity network;
 - o Grid code requirements for HVDC systems are defined;
 - o There is certainty on regulation, conflict resolution, planning and permitting processes, etc.

Other aspects / areas for follow-up

- To further improve and make the HVDC technologies more compact / efficient / economic, the basic component of the converter station, the PE (Power Electronics) and its value chain such as WBG (Wide Band Gap) components will play an important role;
- The concentration of high power transfer could consider new technologies such as superconductors;
- Besides efficiency, also a green electrical system is tackled. Eco efficient switchgears can play an important role in reducing the GWP (Global Warming Potential);
- Based on REACH (European Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals), the European Chemicals Agency (ECHA) added lead metal in its list of SVHC (Substance of Very High Concern) due to reprotoxic properties, which, if confirmed, would hinder the subsea cable manufacture.

III. CONCLUSIONS - ACTION POINTS

- To identify how these issues can be addressed through Horizon2020 (the upcoming Green Deal Call) or Horizon Europe;
- A study to analyse the interactions of a future hybrid HVAC and HVDC electricity system, how it can be operated and what are the operational challenges;
- Further studies and dialogues to address non-technological barriers, such as between NRAs and TSOs to finance (joint) investments in HVDC, joint planning, permitting, etc. to support and accelerate the development of offshore assets;
- Development of grid code requirements for HVDC systems;
- Remove the interoperability barriers among HVDC converters of different manufacturers to allow further development and implementation of such DC systems;

