

Response to ENTSO-E's RDI Implementation Report 2021- 2025

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Introduction

SuperNode Ltd is a cutting-edge global technology company that develops terrestrial and subsea superconducting power transmission systems to connect offshore renewable energy generation and facilitate grid interconnection.

SuperNode Ltd. has responded to ENTSO-E's research & Development & Implementation Report 2021-2025 by submitting an online survey. This is a summary of the official response and does not provide answers to all questions in the consultation.

SuperNode has previously responded to ENTSO-E's Research & Development & Innovation Roadmap 2020-2030 (10 August 2020).

Question 5: Which is your opinion on ENTSO-E approach to base RDI Implementation Report (2021-2025) on a limited number (twelve) of project concepts?

It is well focused and it may seem better suited for collaborative research between TSOs in different jurisdictions, thus providing the foundation for collaborative European research. However, it is not clear from the Implementation Report which "key stakeholders" beyond TSO's will be involved and how ENTSO-E intends to include non-TSO's such as research institutions and private sector companies in the RDI projects. Moreover, there seems to be little recognition of the need for grid technology innovation beyond HVDC grids, such as grid enhancing technologies and technology based on High Temperature Superconductors (TRL 5-8 according to ENTSO-E's Technopedia). The latter would certainly be relevant for the P8 project, scheduled to commence in 2025 and should also be referenced in P7.

Question 27: In the context of Flagship 4 (Enable large-scale offshore wind energy into the grid), do you agree that the two suggested project concepts (P7 and P8) will contribute to the aims set for the period 2021-2025?

As P8 is planned to commence in 2025, it will not have an impact within the 2021-2025 timeframe. It's impact will, to a large degree, be determined by the success of P7, which certainly contributes to the aims set for the period. The point-to-point approach to offshore

infrastructure based on current (HVDC) grid technology will not deliver the Green Deal. Without innovation in network technology (including a fundamental review of physical materials within the design scope), Europe will fail to deliver on its Paris Agreement commitment and its climate neutrality objectives. Flagship 4 presupposes that offshore infrastructure will be based on HVDC grids and makes little mention of other innovative technologies, such as new grid enabling technologies and cable technology based on high-temperature superconductors (TRL 5 to 8 according to ENTSO-E's Technopedia), which have the potential to unlock large efficiency gains at a system level, e.g. in the form of fewer losses and reduced material use.

Question 28: In the context of Flagship 4, do you find that the scope and expected impact of each project concept are well defined?

The presumption of the proposal is that only HVDC technology has a role to play in the future development of offshore grid infrastructure, to tap into Europe's vast offshore renewables resources. The Flagship should ensure that other, innovative technologies such as sub-sea superconducting cables systems (SSCS) and other MVDC technologies are allowed access. Access to multi-terminal DC pilot projects (or electrolyser projects) are needed by SSCS to access risk-free testing as part of their TRL progression. Without access, alternative technologies, and their qualification programmes, may be heavily impacted at the expense of innovation linked to global climate ambitions. The European technology lead will be lost to other nations without inclusion of all grid technologies.

Question 31: In the context of Flagship 4, do you find that the proposed timeline, estimated budget and funding schemes of each project concept are well identified?

This information is clear. Of particular note is that FS4 and FS5 account for more than 50% of total project budget, approx. €100 million. With a proposed budget of this size, all technology options should be explored for greatest value to European citizens as well as achieving global climate targets.

Question 32 In the context of Flagship 4, do you have any further suggestions regarding proposed project concepts (P7 or/and P8)?

It is vital that P7 and P8 make it possible for SMEs and new innovative entrants to contribute to network innovation.

Question 33: In the context of Flagship 4, do you find specific project concept(s) missing?

Transmission systems based on sub-sea superconductors are missing. Prototypes are expected to be available by mid-decade and would fit well into P8, hence they must also be taken into account in P7.

Question 34: In the context of Flagship 5, do you agree that the two suggested project concepts (P9 and P10) will contribute to the aims set for the period 2021-2025?

The techno-economic benefits of a widespread hybrid AC/DC system under its current scoping structure will only account for HVDC technologies in the DC space. Medium voltage DC (superconducting) technologies should be included within the scope of the wider projects and, as a result, ensure that an all-encompassing techno-economic and societal analysis is produced.

Question 36: In the context of Flagship 5, do you find that the barriers and policy context of each project concept are well identified?

A barrier that needs addressing is how to ensure an open door for the private sector to participate in the Projects, thereby providing innovation and policy support for TSOs to facilitate development of new technologies from TRL6 to TRL9, e.g. by establishing sand boxes and / or other incentives. For that to happen, incentives must be established for TSOs to engage in external R&D partnerships to facilitate the demonstration and deployment of new, innovative grid technologies.

Question 38: In the context of Flagship 5, do you find that the proposed timeline, estimated budget and funding schemes of each project concept are well identified?

FS5 is suggested to start in 2022. SuperNode proposes that alternative technologies should be considered alongside HVDC. Therefore, sufficient time must be allowed to scope in innovative technologies providing alternative technical solutions under this Flagship and related Flagships, the results of which may have a material impact on Flagship 5.

Question 39: In the context of Flagship 5, do you have any further suggestions regarding proposed project concepts (P9 or/and P10)?

Yes. Where alternative technologies (e.g. MVDC, Superconductors, etc) could have material impacts on the outcomes of P9 and P10, these must be considered within this Flagship and related Flagships.

Question 40: In the context of Flagship 5, do you find specific project concept(s) missing?

Yes. Where alternative technologies (e.g. MVDC, Superconductors, etc) could have material impacts on the outcomes of P9 and P10, these must be considered within this Flagship and related Flagships.

Question 48: Please rank the importance of each project concept for the realisation of the European Green Deal

P1/ Smart charging for large-scale electromobility optimal integration:
Relevant but not key

P2/ Innovative tools for coordinated multi-sector system operation and planning:

Relevant but not key

P3/ Design of a pan-European cross-sector data model:

Relevant but not key

P4/ Integrating a coordinated flexibility potential into the future energy system of systems:

Relevant but not key

P5/ SF6-free alternatives in high-voltage equipment:

Relevant but not key

P6/ Smart asset management for a circular economy:

Relevant but not key

P7/ Development of multi-vendor HVDC systems and other power electronics interfaced devices:

Indispensable

P8/ Real commercial offshore full-scale multi-vendor & multi-terminal HVDC demonstrator:

Indispensable

P9/ Stability management in power electronics dominated systems:

Indispensable

P10/ Assessment of a widespread hybrid AC/DC system: |

Indispensable

P11/ Cyber resilience in the future control centre:

Relevant but not key

P12/ Secure, robust, AI-enabled and open IT solutions for the future control centres:

Relevant but not key

Question 49: Which project concept(s) should ENTSO-E and TSOs focus their efforts most?

1. P7/ Development of multi-vendor HVDC systems and other power electronics interfaced devices.
2. P8/ Real commercial offshore full-scale multi-vendor & multi-terminal HVDC demonstrator.
3. P10/ Assessment of a widespread hybrid AC/DC system.

Question 50: Please indicate for each project concept your level of interest to work with ENTSO-E and TSOs

P1/ Smart charging for large-scale electromobility optimal integration:

No interest

P2/ Innovative tools for coordinated multi-sector system operation and planning:

Some interest

P3/ Design of a pan-European cross-sector data model:

Some interest

P4/ Integrating a coordinated flexibility potential into the future energy system of systems:

Some interest

P5/ SF6-free alternatives in high-voltage equipment:

Some interest

P6/ Smart asset management for a circular economy:

No interest

P7/ Development of multi-vendor HVDC systems and other power electronics interfaced devices:

Strong interest

P8/ Real commercial offshore full-scale multi-vendor & multi-terminal HVDC demonstrator:

Strong interest

P9/ Stability management in power electronics dominated systems:

Strong interest

P10/ Assessment of a widespread hybrid AC/DC system:

Strong interest

P11/ Cyber resilience in the future control centre:|

Some interest

P12/ Secure, robust, AI-enabled and open IT solutions for the future control centres:

Some interest

Contact:

Christian Kjaer

Chief Public Affairs Officer

SuperNode Ltd

Christian.Kjaer@Supernode.energy

Mob: +45 9360 2023

