# Deliverable 5.6

# Report on final dissemination event

WindEurope

November 2023

READY4DC

## ABOUT READY4DC

The future electricity network envisioned by READY4DC will be characterized by a growing role of multi-terminal multi-vendor (MTMV) HVDC solutions within the current AC transmission networks both onshore and offshore. READY4DC is contributing to this synergistic process by enabling commonly agreed definitions of interoperable modelling tools, model sharing platforms, clear processes for ensuring interoperability, and an appropriate legal and political framework.


DISCLAIMER:

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PROJECT DETAILS:

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# Deliverable 5.6
# Report on final dissemination event

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READY4DC

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# 1. CONTEXT

On 13 September 2023 the READY4DC project consortium organised the final dissemination event of the project. It took place in Vienna, during the CIGRE B4 Colloquium and online to maximise the participation of stakeholders. The event was jointly organised with InterOPERA's first dissemination event given the relevance of the two projects and in order to show how the results and activities of READY4DC feed the activities of InterOPERA.

The objective of the event was to present the main findings of the whitepapers of each Working Group (WG) within the project to a wide audience of relevant stakeholders and to create awareness about the overall work and activities performed during the project lifetime. Furthermore, the event aimed to steer the discussion on the challenges of an interoperable, multi-vendor HVDC system and to facilitate the creation of a community of experts that will develop recommendations for an interoperable and expandable Direct Current (DC) grid in Europe. Participants had the opportunity to exchange views on the findings of the whitepapers and provide feedback before the finalisation of the reports.

The specific objectives of the event were to:

- Update participants on the progress achieved by each WG;
- Engage experts from various sectors e.g. High Voltage Direct Current (HVDC) technology manufacturers, Transmission System Operators, the wind energy industry, policymakers, system integrators, other relevant technology providers and academia further in the discussion on interoperability, DC technology and the future of the European grid; and
- Present the findings of the four whitepapers published by the project Working Groups (WGs).

This report on the final dissemination event is the deliverable D5.6 described in Work Package 5, Task 5.3. It summarises the discussion that took place during the event, to comment on the engagement of relevant stakeholders, to reflect comments and questions posed by the audience and to recommend how the outcomes of the discussion can be used by the READY4DC consortium and its WGs.

## 1.1 AGENDA OF THE EVENT

***Figure 1*** *Agenda of the final READY4DC dissemination event*

# READY4DC – InterOPERA
## JOINT EVENT (in-person & online)

When one thing ends, something else begins!

READY4DC will come to an end this autumn. As we turn the page on READY4DC, it's time to look ahead - to InterOPERA!

The READY4DC final event and the InterOPERA first dissemination event will take place on 13 September, in Vienna during the CIGRE B4-Colloquium.

Join us in-person or online to hear more about the main findings of the READY4DC whitepapers and InterOPERA's work towards interoperable, multi-vendor HVDC grids.

When: 13 September 2023, 8.00 – 12.30 CEST

Where: Austria Trend Hotel Savoyen Vienna, Rooms Paris & Wien (1st floor).

### Agenda

| | |
|---|---|
| 08:00 – 08:15 | **Registration & welcome coffee** |
| 08:15 – 08:20 | **Opening**<br>John Moore, SuperGrid Institute |
| 08:20 – 08:35 | **READY4DC project overview**<br>Ilka Jahn, RWTH Aachen University |
| 08:35 – 09:25 | **Framing the future European Energy System: presentation of main findings**<br>Ilka Jahn, RWTH Aachen University<br>Jaqueline Cabanas Ramos, RWTH Aachen University<br>Marc Moritz, RWTH Aachen University<br>**Every presentation will be followed by a short Q&A.** |
| 09:25 – 09:40 | **Coffee break** |
| 09:40 – 10:30 | **READY4DC: main findings of the final whitepapers of Working Groups 1, 2 and 3**<br>• ***Modelling and Simulation framework and data sharing for HVDC interaction studies and large scale EMT simulation,*** William Leon Garcia, SuperGrid Institute<br>• ***Multi-vendor Interoperability Process and Demonstration Definition,*** Nico Klötzl, TenneT<br>• ***Legal Framework for the Realization of a Multi-Vendor HVDC Network,*** Ceciel Nieuwenhout, University of Groningen<br>**Every presentation will be followed by a short Q&A.** |
| 10:30 – 10:45 | **Coffee break** |
| 10.45 – 11:00 | **InterOPERA project overview**<br>John Moore, SuperGrid Institute |
| 11:00 – 12:25 | **InterOPERA: the European way for Multi-Vendor Multi-Terminal HVDC grids**<br>• ***Development of standardised interaction study processes and interfaces,*** Sébastien Dennetiere, RTE<br>• ***Requirements and assessment of interoperability for multi-vendor multi-terminal HVDC systems,*** Mario Ndreko, TenneT<br>• ***Multi-vendor multi-terminal demonstrator project,*** Carlo Degli Esposti, T&D Europe<br>• ***Cooperation framework and governance,*** Syed Hamza Kazmi, Ørsted - online<br>**Every presentation will be followed by a short Q&A.** |
| 12:25 – 12:30 | **Closing remarks**<br>John Moore, SuperGrid Institute |

## 1.2 STAKEHOLDERS PARTICIPATION

The final dissemination event took place in-person, in Vienna and online. It was open for participation to all interested stakeholders including the very relevant HVDC audience of the CIGRE B4 Colloquium. The 2023 CIGRE B4 Colloquium is part of the international power electronics conference CIGRE and its aim is to provide a forum for latest research results and system operations experience related to how HVDC, DC Grids and flexible alternating current transmission systems (FACTS), dealing with challenges imposed on electrical distribution and transmission grids by integrating the necessary amount of RES.

Project partners communicated about the event on social media and announced it on the project's website, social media accounts and their networks of experts.

***Figure 2** LinkedIn post promoting the final dissemination event*


To be able to participate, interested stakeholders had to register either for the in-person or online event. The invitation was also sent to the project's dissemination list which currently counts for 546 experts. This list includes experts that represent the transmission system operator (TSO) industry, High Voltage Direct Current (HVDC) and other grid technology suppliers, wind turbine manufacturers and wind farm developers and operators, policymakers, academia, consultants from the EU, the UK, the United States, Canada and other regions globally. Additionally, to this list of experts, all the experts currently participating in the READY4DC WGs and all partners of the InterOPERA EU project were invited.

In total around 100 participants joined the event in-person and online with a very active engagement throughout its duration.

The presentations shared during the event and the recording of the event have been uploaded in the project's website and are publicly available here.

***Figure 3** Image from the READY4DC final dissemination event*

# 2. SUMMARY OF THE DISCUSSION

**Dr Ilka Jahn** (RWTH Aachen) and Mr **John Moore** (the SuperGrid Institute) opened and moderated the event. The event lasted 4.30 hours and it was divided in two equal parts: READY4DC presentations and InterOPERA presentations.

## 2.1 READY4DC PROJECT OVERVIEW

**Dr Ilka Jahn** presented the basic facts about the READY4DC project, highlighting that the work of READY4DC is indeed being incorporated by InterOPERA.

Dr Ilka Jahn stated that READY4DC supports all the preparatory phases that will lead to a demonstration project to de-risk the technology for the first MTMV HVDC system with grid forming capabilities in Europe. She reminded participants that READY4DC has a budget of €1 million and a duration of 18 months. Its partners include technology providers, transmission system operators (TSOs), and potential users of such novel MTMV HVDC systems.

The project scope is to facilitate agreement among stakeholders, through creating a platform for discussion. Topics being discussed in the Working Groups (WGs) include compatibility of modelling tools towards interoperability, the legal framework for model sharing between TSOs, roles, financing and responsibilities etc.

Dr Ilka Jahn presented the long-term impact of the project and the structure (concept) of the project, depicted below and available in the presentation slides on the website.

***Figure 4*** *READY4DC long-term impact*

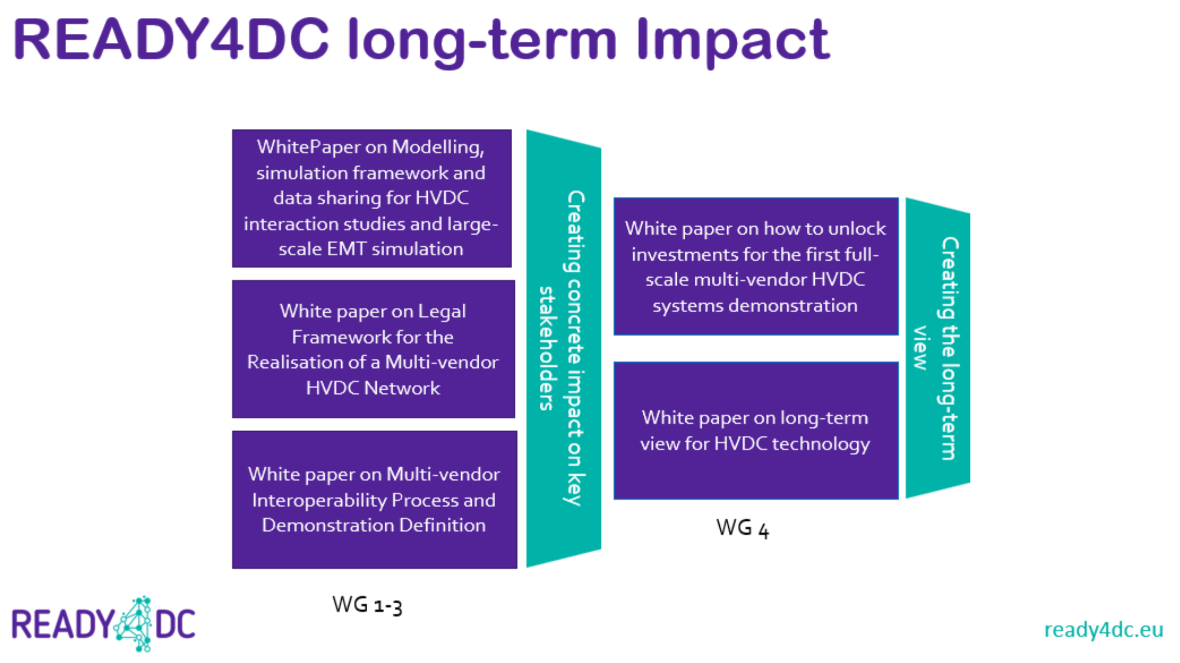
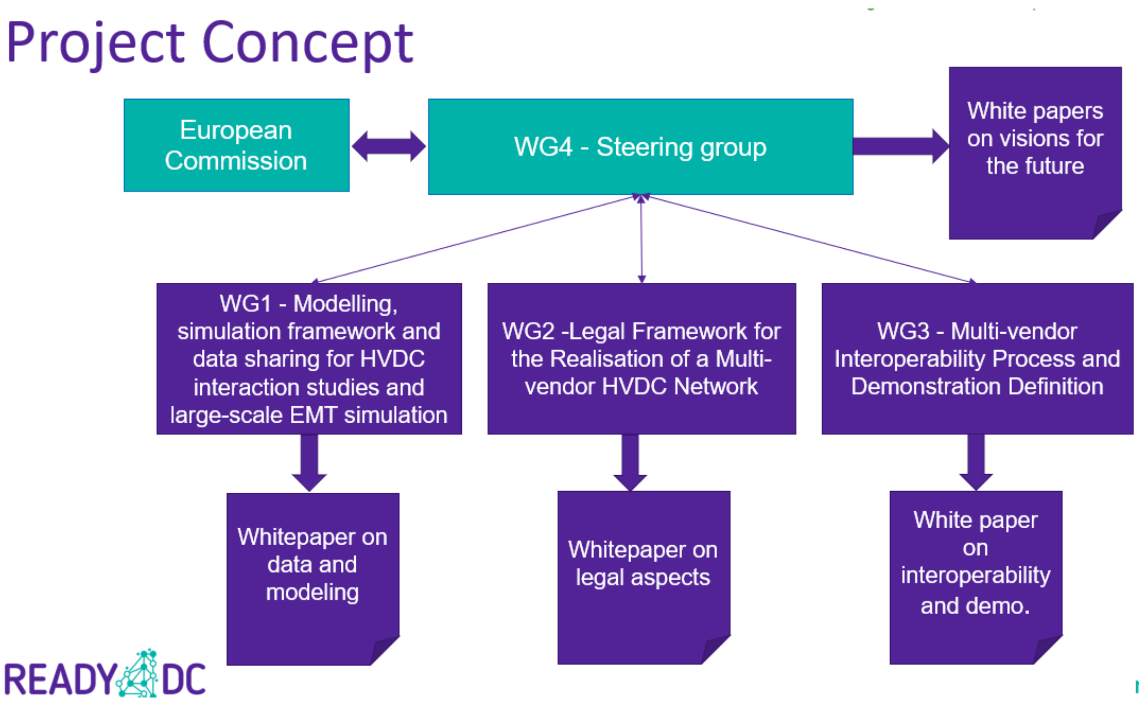


*Figure 5 READY4DC project concept*




She briefly described the specific activities of the four WGs and the decision-making process in the project. She encouraged participation from the event participants in the WGs, and through the communication channels of the project (e.g. LinkedIn, X (formerly Twitter), etc).

She also said that the project was about to release the final updated whitepapers in autumn 2023. She also highlighted the work of other research initiatives on MTMV HVDC, including the work from CIGRE (workstreams B4.81 and B4.85), the IEC standard 63471 and the InterOPERA project.

## 2.2 WORKING GROUP 4: FRAMING THE FUTURE EUROPEAN ENERGY SYSTEM

The first session was opened by Dr Ilka Jahn (RWTH Aachen University), who presented the structure of Working Group 4 (WG4); WG4 extracts information from the other WGs to shape a vision for the future HVDC system in Europe and provides a framework for the exploitation of the project outcomes. Based on the output of the other WGs, WP4 addresses two main topics. The first one is about how to unlock investments (published). The second is about Framing the European Energy System.

Dr. Jahn presented the statistics of participation in WG4. By the time of the event, it has 49 people with meeting attendance between 6 and 21. Main countries represented are Germany, United Kingdom, Belgium, the Netherlands.

On the first whitepaper on unlocking investments, five topics are covered:

- investment options;
- investment volume and sustainability of supply;
- blocks for investing into the first MTMV HVDC demonstrator;
- financial decision-maker experience; and
- plan to unlock investments.

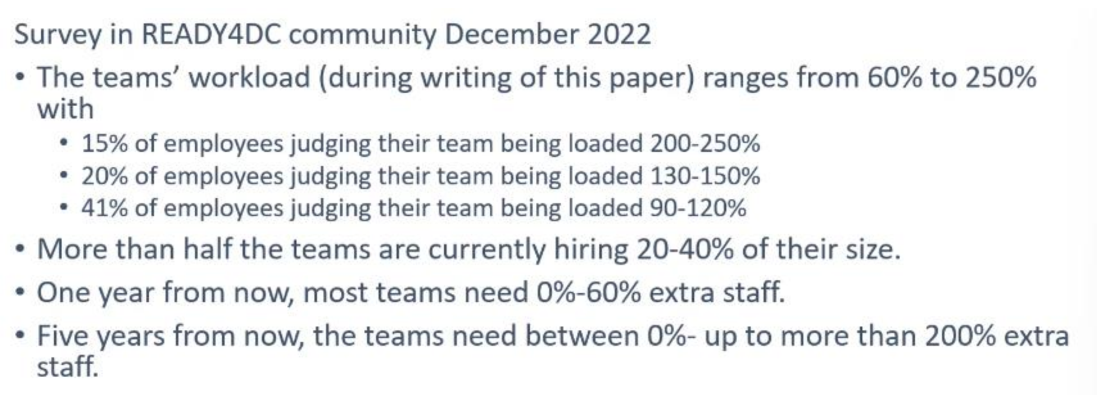
She explained that the size of initial first-of-a-kind projects may be high and outside national or international support schemes. Dr Jahn gave a specific example of a DC circuit breaker bypass, a case study from the PROMOTioN project – the only publicly available cost-benefit analysis. And while this is not fully representative, it provides an idea of the magnitude of the investments. The case study was a simple project, onshore, connecting two single vendor pole-to-pole HVDC links. The costs were estimated from €17 to 38 million. This was a single piece of equipment. Despite the positive cost benefit ratio, the risk was considered too high.

Dr Jahn explained that the most likely funding source for first-of-a-kind projects would be the EU funding Connecting Europe Facility/ Projects of Common Interest, but there are still open questions around anticipatory investments. WP4 discussed about the possibility of "first-of-a-kind Europe" for technology with strategic importance and that could consider technology integration aspects that can be different outside Europe, also with regards to intellectual property. Public-private partnership could be a good option for financing and sharing risk.

The WP4 first whitepaper also performs a back-of-envelope estimation of the investment needs. Dr Jahn described the process followed and the assumptions the authors made to arrive at the €520 billion needed. She clarified that – with this simplified back-of-the-envelope calculation – HVDC grids would need €20 billion per year until 2050. While obviously scaling effects etc. would apply in reality, This raises questions about costs to TSOs against their revenues. The paper suggests that public-private partnerships and private initiatives could play a role in such an endeavour.

Finally, Dr Jahn mentioned that in December 2022, READY4DC WG4 surveyed the workload needed to carry out such projects based on the effort used in the WG. The results are depicted below.

***Figure 6*** *Results of the survey in READY4DC community*




Then**, Ms Jaqueline Cabañas Ramos** (RWTH Aachen University) presented the whitepaper "Long-term view for HVDC technology". The information is sourced from experts in the working group, including vendors, wind developers, and TSOs (Transmission System Operators).

On the socio-economic aspects, Ms Cabañas Ramos highlighted that HVDC technology is highlighted as a key solution for connecting large-scale offshore wind farms, such as those in the German North Sea. HVDC is effective in connecting distant locations from offshore wind farms, easing congestion, enabling offshore wind farms to link multiple grids, and interconnecting previously isolated grids. It impacts the energy market, enhancing grid stability and reducing curtailment, as seen in projects like the Caithness-Moray link. Infrastructure investments and job creation are significant, with cross-border and national initiatives playing a vital role. Studies suggest that a national 64 GW of cross-border reform is cost-efficient, and national investments like Germany's initiatives are crucial. By 2050, four times the current electricity generation and three times the transmission capacity will be needed. The integration of HVDC into energy policies and investments, like the NeuConnect project, is essential. Private investments and operating under Ofgem's "Cap and Floor" regulations in the UK market are sources of funding. Social and public acceptance and stakeholder opinions are vital for the successful deployment of HVDC. Circular economy principles are important, considering raw materials and recycling.

Ms Cabañas Ramos continued on the topic of raw materials and stressed that that grid expansion requires key minerals, including aluminium and copper. Discussions regarding the removal of copper cables from the seabed and the use of more environmentally friendly insulation materials are ongoing. Aluminium production and recycling remain costly.

Moving to the Circular Economy Challenges and Opportunities in HVDC Technology, she mentioned that manufacturing and refurbishment considerations include the transition from Submarine Cable Connection to Voltage Source Converter. Industry design considerations aim to facilitate the quick replacement of subassemblies and parts, leading to maintenance benefits. Environmental limitations exist in the replacement of materials. Circular design includes replacing conventional oils with renewables, modular components, SF6 switchgear challenges, and waste management, recycling, and decommissioning.

Then, on R&D priorities, Ms Cabañas Ramos explained that the whitepaper examined different R&D priorities identified by other projects and overall, the HVDC community. Given the increased targets READY4DC wants to put emphasis on three priorities: right infrastructure (interoperability across vendors and technical specification and standards), grid extension and training.

Finally, Ms Cabañas Ramos talked about End of Life which is a concern for HVDC owners and utilities interconnected to HVDC converter station. On this topic the whitepaper highlights the developed structures for end-of-life assets and sustains that life extension is more logical than removal. In addition, the whitepaper discusses challenges stemming from international law regarding removal obligations; currently under international law there is a removal obligation but for wind turbines and converted station but not for cables. Finally, the whitepaper touches upon the End-of-life legislation and contracts. End-of-life management should be an integral component of the initial Cost-Benefit Analysis (CBA) and be subject to legislative and government contract considerations, ultimately shaped by governmental policies. Typically, environmental permits required for construction already include this aspect, although it needs special attention.

In the last presentation of WP4**, Mr Marc Moritz** (RWTH Aachen University) presented the findings from the whitepaper “Framing the European Energy System”.

The whitepaper encompasses several key areas, including the role of High Voltage Direct Current (HVDC) both onshore and offshore. It explores the position of HVDC transmission in the broader infrastructure, the sustainability of DC grids, and the future possibilities of DC systems, referred to as "Beyond HVDC."

Achieving the goals of the European Green Deal and the FIT for 55 legislation packages necessitates substantial growth in renewable energy capacity and electrical grid development. Currently, 30 GW of offshore wind capacity are installed the EU and the UK combined, covering just 3% of the electricity demand. The EU has ambitious targets: 60 GW of offshore wind by 2030 and 300 GW by 2050. The Ostend declaration of the North Sea countries in 2023 has even more ambitious targets, envisioning over 120 GW of offshore capacity by 2030 and over 300 GW by 2050. HVDC offshore projects aim to facilitate cross-country interconnection and wind power transmission. Onshore HVDC is crucial for long-distance transmission to inland sites and cross-country interconnection. It also serves to replace functionalities of existing AC assets. HVDC projects contribute to Unified Power Market (UPM) transmission grids. In the TYNDP 2022, around 58% of potentially considered additional cables and lines are DC. Currently, approximately 30 operational HVDC projects are in Europe, and a trend estimation of the total HVDC-based installed capacity results in about 1 Terawatt by 2050.

Mr Moritz then talked about the two visions for HVDC development: the European Supergrid and the Incremental Approach. Challenges include regulatory hurdles, a shortage of engineering skills, staff scarcity, and supply challenges. An alternative to a supergrid is proposed, which involves incorporating multi-terminal HVDC power corridors into the transmission grid, resulting in a hybrid AC-DC grid. Questions are raised regarding how HVDC connections can contribute to AC grid stability and how to manage HVDC faults in a hybrid grid.

Moving to the vision for sustainability of DC Grids, Mr Moritz highlighted the importance of UN Sustainable Development Goals, particularly SDG7 (reduction of emissions and increasing energy efficiency) and SDG9 (DC transmission as reliable, resilient infrastructure). Building sustainable DC grids necessitates considerations of grid extensibility, interoperability, modularity, and repurposing of existing infrastructure.

Lastly, Mr Moritz referred to aspects going beyond HVDC technology, such as strategies for attracting more engineers to the HVDC industry to tackle the problem of staff scarcity. Further, Medium Voltage DC (MVDC) and Low Voltage DC (LVDC) were identified as technologies that are related to HVDC and can contribute to the energy transition but have distinct technical details.

## 2.3 WORKING GROUP 1: MODELLING, SIMULATION FRAMEWORK AND DATA SHARING FOR MULTI-TERMINAL MULTI-VENDOR HVDC INTERACTION STUDIES AND LARGE-SCALE EMT SIMULATION

**Mr William León García** (SuperGrid Institute) gave a presentation on the modelling, simulation framework, and data sharing in the context of multi-terminal, multi-vendor High Power Direct Current (HPDC) networks, as well as large-scale Electromagnetic Transient (EMT) simulations.

He started with an introduction comprising the context, motivation, and structure of the WG1 whitepaper. Mr. León García said that the EU ambition to develop a multi-terminal meshed grid on- and offshore in the future will lead to a system where components by different vendors will need to interact on the alternate current (AC) and DC parts of such system. With the whitepaper, Working Group 1 (WG1) tried to provide answers to some important questions on these topics:

- What are the interaction studies considered necessary?
- Why are these studies needed?
- How these should be performed?
- When and who should make each study?

Mr León García talked about the vision for a European multiterminal DC network and emphasized the need for smooth technology integration and addressing interaction studies. The AC network currently employs power electronic technologies to integrate renewables and flexibility systems. Point-to-point HVDC technologies are already in use for interconnecting wind and solar farms, offshore and onshore. The perspective is to develop a multi-terminal DC system that connects all wind farms and AC networks, anticipating more interactions in the future, requiring adaptations to new tools and methods.

In the DC domain, interactions will increase, and the risk needs assessment. Unlike the AC network, the DC network lacks mathematical rules for defining interaction parameters. Interactions occur between converters, and DC protection can affect the control system, especially when integrated with DC breakers.

Mr. León García explained that the paper also outlines the workflow that interaction studies should follow six steps: specifying the studies, conducting interaction tests, analysing the causes, proposing solutions for possible interactions, approving the solutions, and implementing the solutions. Deep documentation from all stakeholders is essential for every model and test.

Interaction studies in a point-to-point scenario involve vendors adhering to clear guidelines or specifications to validate no interactions in their systems. As more HVDC systems emerge, a second scenario involves Transmission System Operators (TSOs) being supported by third parties, such as integration labs, to perform independent interaction studies. Vendors can have various roles in interaction studies.

The architecture of the functions on the Multi-Node Control (MNC) and protection and how the integrator views these functions affect the interaction studies workflow. Different degrees of openness impact the autonomy of integrators in analysing and solving interaction studies.

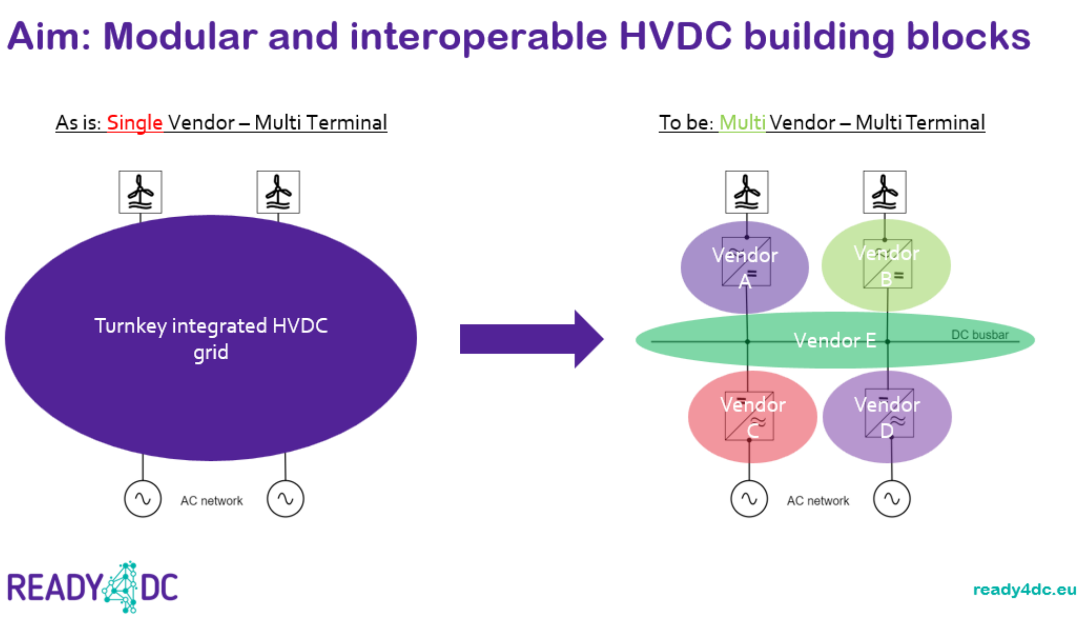
About the EMT simulation tools discussed in the paper, he mentioned that they are used for interaction studies. Software in the loop of line simulations involves simulating the electrical system and control and protection algorithms on a workstation. System equations can be solved faster than the time constant of the phenomena studied in real time. Hardware-in-the-loop (HIL) testing uses real hardware and is suitable for large EMT simulations. Offline simulations are more cost-effective, while HIL tests are common but more complex to set up.

Finally, Mr. León García stressed that the overall ACDC system will face the risk of new and more interactions that the network codes should anticipate by integrating new methodologies and tools for interaction studies. The focus should remain on the practical implementation after Multi-Terminal Multi-Vendor (MTMV) projects are awarded.

## 2.4 WORKING GROUP 3: MULTI-VENDOR INTEROPERABILITY PROCESS AND DEMONSTRATION DEFINITION

**Mr Nico Klötzl** (TenneT) presented the main findings of the whitepaper of Working Group 3 which aims in the evolving transition from a single-vendor multi-terminal plan to a more advanced multi-vendor multi-terminal grid.

**Figure 7** From a Single vendor multi-terminal to multi-vendor MT HVDC system

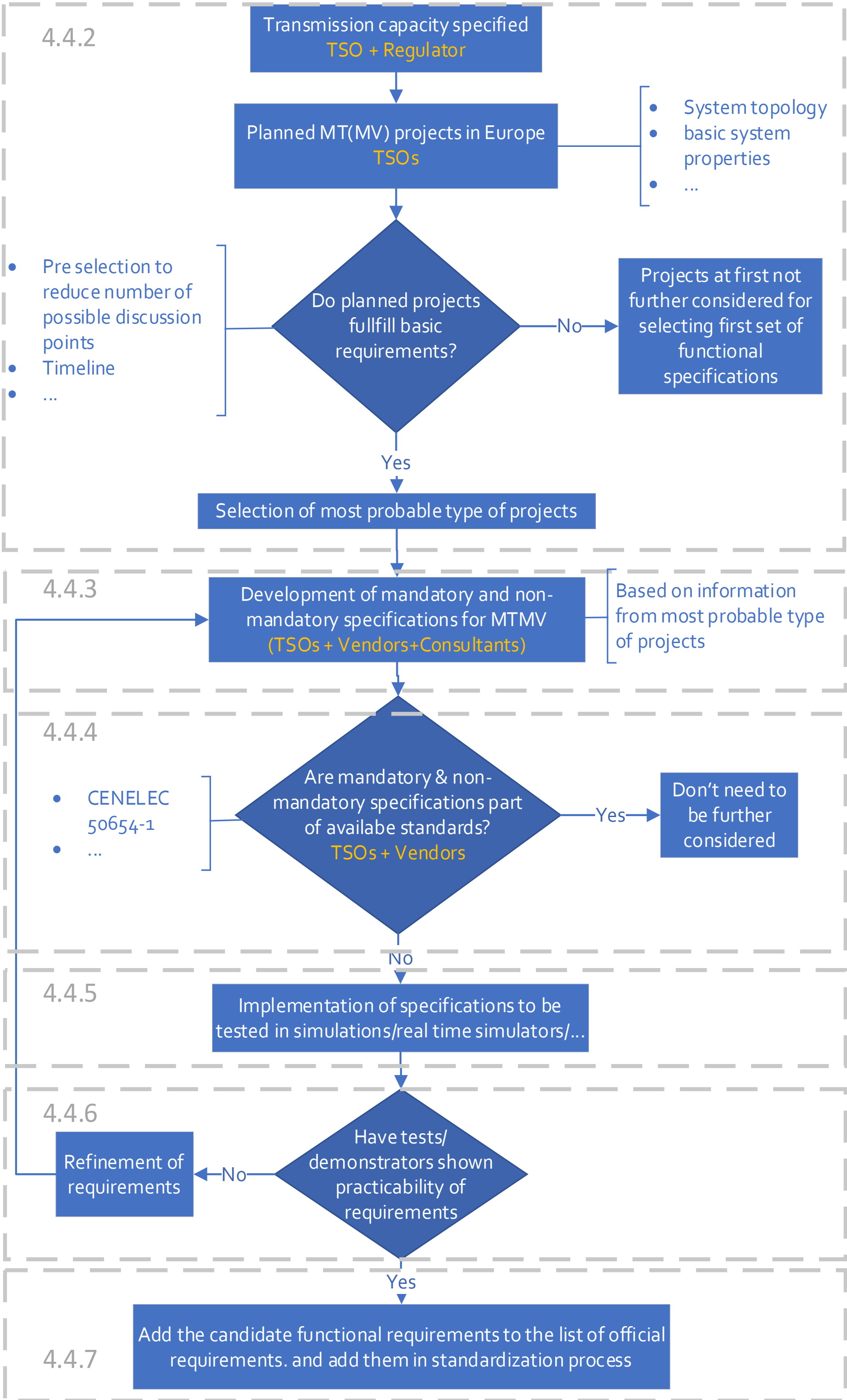



He explained the objective of WG3 as to provide the guidelines for the demonstration project. This includes the selection criteria and the proposal of up to three potential candidate projects. It also covers the procedure for selecting functional specifications, key milestones in implementing a first MTMV demonstrator, and a roadmap for future expandability.

Mr Klötzl presented the findings of the WG3 whitepaper that describes the selection criteria for the first MTMV demonstrator that revolve around functional requirements and design impacts. He illustrated this with practical examples, showing how specific functional requirements can significantly influence the design process as for example the importance of the DC fault protection and DC control on the compliance to the system operations guideline (SOGL)..

Moving forward to the findings regarding the selection of potential candidate projects, WG3 identified four projects so far: Bornholm Energy Island, North Sea Energy Island, Project Aquilla and a generic MTMV system hub. Additionally, Mr Klötzl explained the detailed procedure for selecting functional specifications based on a stepwise and iterative approach, that can be seen in the whitepaper (available here) and the Figure below.

**Figure 8** Procedure for selecting functional specifications




Mr Klötzl also presented the key milestones in implementing a first MTMV demonstrator, beginning with pre-conditions and assumptions before the planning phase. These include clarifying key roles and implementing a legal and regulatory framework, which ensures that the demonstrator is included as a project of common interest. He highlighted the significance of achieving a standard language regarding MTMV and addresses the differences in approaches between TSOs and vendors for model sharing and implementation. Furthermore, Mr Klötzl elaborated on the development towards detailed MTMV functional requirements and specifications, the pre-qualification of vendors, the integration tests, and the steps from construction to the end of the life cycle.

Mr Klötzl presented the roadmap for future expansion beyond the demonstration project. The roadmap is divided into three phases. He discussed the importance of gaining experience from the first MTMV HVDC demonstrator in Phase 1, focusing on that interoperability is proven and adjustments can be made to enable future linking of hub projects. Phase 2 involves the development of an overall system design, with various priorities and options being considered. Phase 3 focuses on standardization of modular sub-systems. This includes standardizing technical and regulatory requirements, ensuring compatibility of converter stations and separate DC switchgear, and designing modular protection mechanisms. The ultimate goal is to create modular HVDC building blocks with compatible input/output interfaces that promote interoperability by design.

Finally, Mr Klötzl underscored the various technical requirements such as system rating, power flow control, dynamic stability, protections, and equipment. He also touches upon the role of regulatory bodies, including connection, operations, market, and cybersecurity, and how they influence different aspects of HVDC systems.

## 2.5 WORKING GROUP 2: LEGAL AND REGULATORY FRAMEWORK PRELIMINARY RESULTS

**Dr. Ceciel Nieuwenhout (University of Groningen)** presented the whitepaper prepared by Working Group 2, highlighting key aspects that need addressing. The focus includes governance of HVDC, multiterminal HVDC, cooperation, standardization, IP, risks, and liability.

Coordination on a larger system level is crucial for an HVDC grid in regions like the North Sea. Dr. Nieuwenhout identified challenges in public and private law, emphasizing that existing regulations were crafted with AC grids in mind, necessitating potential amendments for HVDC systems.

She raised specific concerns regarding the tariff model for TSOs. As liabilities shift from vendors to system designers, TSOs might face increased risks. Network codes, initially designed for point-to-point HVDC connections, may need amending for broader HVDC cooperations.

Standardization agreements are considered vital for interoperability. Dr. Nieuwenhout highlighted the ongoing debate about offshore grid ownership, suggesting a flexible approach to accommodate various solutions. The whitepaper advocates for clear roles and responsibilities, particularly in the short term, acknowledging the ongoing debate on offshore grid ownership. Cooperation between companies, both horizontally and vertically, must adhere to competition guidelines.

Standardization procedures, particularly for patents, are discussed. Dr. Nieuwenhout mentioned the exploration of the choice between static and dynamic standards, considering the influence of vendors on the process.

Risks and liability discussions revolve around the shift from point-to-point to more complex systems. Dr. Nieuwenhout outlined principles for defining liabilities and risks, emphasizing the need for a robust system design. The role of system designers becomes crucial in this context.

In conclusion. Dr. Nieuwenhout highlighted the importance of the InterOPERA project, which will implement pilot projects based on the outlined principles in the whitepaper.

# 3. CONCLUSIONS

The participants in the final dissemination event of the READY4DC project engaged in a very interesting and helpful discussion before the closure of the project. During the event, in-person and online participants exchange views and asked their questions to the project experts. Project partners took into consideration the useful feedback and comments before finalising the whitepapers.

The event was followed by the first dissemination event of InterOPERA, the project that paves the way towards the first multi-vendor multi-terminal real life projects in Europe using as foundations the work and results of READY4DC.

The final READY4DC whitepapers are available on the project website:

- Whitepaper WG1: Modelling, Simulation Framework and Data Sharing for Multi-Terminal Multi-Vendor HVDC Interaction Studies
- Whitepaper WG2: Legal and Regulatory Aspects of a Multi-Vendor Multi-Terminal HVDC Grid
- Whitepaper WP3: Multi-vendor Interoperability Process and Demonstration Definition
- Whitepapers WP4
    - How to unlock investments for the first full-scale multivendor HVDC systems demonstration
    - Long-term view for HVDC technology
    - Framing the European energy system

In addition, the CIGRE B4 colloquium in Vienna provided a platform for networking of the EU projects READY4DC and InterOPERA with the CIGRE community. A result of this networking are early plans for a combined “HVDC Interoperability” session between CIGRE B4 and InterOPERA during the CIGRE Session Paris in 2024 with several thousand guests expected. Such an event would further broaden the InterOPERA outreach and embed the project with the international HVDC community.