

READY DC

**Conclusions of
Ready4DC WG2:**

**Whitepaper: Legal
and Regulatory
Aspects of a Multi-
Vendor Multi-
Terminal HVDC Grid**

Deliverable 2.3



ABOUT READY4DC

The future electricity network envisioned by READY₄DC will be characterized by a growing role of multi-terminal multi-vendor (MVMT) 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.

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EXECUTIVE SUMMARY

A multi-vendor, multi-terminal (MVMT) HVDC grid requires coordination and governance, standards, and protection of IP – issues that are regulated by law. A stable and enabling legal framework forms an essential basis for investment in HVDC technology. This Whitepaper describes the main legal and regulatory framework on several topics relevant for an interoperable HVDC network, namely the governance of a MVMT grid, cooperation between undertakings in the light of competition law, issues of IP law and standardisation, and finally the division of risks and liability in a MVMT situation.

GOVERNANCE - COORDINATION WITHIN A LARGER STRUCTURE

The roll-out of a MVMT HVDC grid requires a solid governance structure. This is based on a combination of public law, private law, and standardisation (which is in the middle between public and private law). From a public law perspective, the law applicable to the governance of existing (AC) grids is also applicable to HVDC grids. This Whitepaper signals provisions in current legislation that may need to be amended, related to coordination, financial regulation of TSOs (linked to the added risks for MVMT HVDC projects), and the network codes. Next to public law, private law can also assist in creating a stable governance structure: an umbrella agreement between all parties to set the targets, means, and principles of the cooperation can serve as a backbone, while a model agreement, to be attached to bilateral contracts for the procurement of new additions to the HVDC grid, can help to make sure companies operate under the same conditions and contribute to standardisation.

GOVERNANCE – DIVISION OF ROLES AND RESPONSIBILITIES

It is discussed whether there needs to be a clear division of roles and responsibilities in the roll-out of HVDC systems. It is not necessary to wait before the final division is clear: first, there may be a hybrid form, with multiple divisions existing alongside each other. If main issues are well coordinated, a hybrid division will also work. Second, the infrastructure is gradually developed and should remain in place for several decades. In that timespan, the ideas on public/private investment in essential infrastructure are likely to evolve, as they have done in the past. Although no definite division can or must be made at this moment, it is important that the roles and responsibilities in the development of the next few projects are well defined and allocated. This Whitepaper gives the principles for the division of roles and responsibilities and proposes a specific division of roles and responsibilities in the near future (the first pilot projects). It is important to start with several pilots and to evaluate these pilots well, as they may contribute to the decision-making on larger parts of the grid.

COORDINATION BETWEEN COMPANIES AND STANDARDISATION

Companies (competitors and companies dependent on each other) will have to cooperate (or at least make certain agreements on interfaces and interoperability) to get a MVMT HVDC grid off the ground. The cooperation between companies is regulated by EU competition law. Anti-competitive agreements should be avoided; there are guidelines on how to make sure agreements are aligned with EU competition law. Standardisation is a process in which competitors, or their umbrella organisations, may need to cooperate and reach an agreement. Transparency and non-discrimination are important to make sure this process is in line with competition law. There are specific rules on Fair, Reasonable, and Non-Discriminatory (FRAND) terms for licensing that need to be considered. The sector needs to decide whether a standard should be static or dynamic and whether it should be technology/IP neutral or not. Finally, licensing can take place bilaterally or be pool-based.

IP LAW AND HVDC GRID DEVELOPMENT

Vendors of HVDC technology protect their ideas, inventions, and products through intellectual property rights, for example, patents and trade secrets. It may be that a company relies both on patents and on trade secrets for the development of its technology. In the standardisation process, it is not exactly clear how trade secrets should be treated. On the other hand, there are also some limits to patents. It may be that companies have to switch trade secrets to patents or change their IP strategy, as black boxing (and the preservation of the secrets inside the black box) may not work anymore in an MVMT HVDC grid.

RISKS AND LIABILITY

The shift from HVDC turn-key point-to-point systems to multi-terminal and multi-vendor systems that grow organically and that at some points can be treated similar as the existing AC grid (plug & play) entails certain risks, which are, for example, related to the interoperability between a new addition and the existing system. With these new risks, it is important to decide how the risks should be allocated and when liability should shift from one company to another. To minimize risks and associated liabilities in MVMT HVDC systems, it is important to clearly define roles and responsibilities in procurement contracts and establish clear guidelines for system integration and testing. Additionally, thorough testing of interoperability can help identify and address potential faults or damages before they become major issues. Finally, having a clear plan for allocating liability in the event of a fault or damage is essential to minimize disputes and ensure that the responsible party is held accountable.

All conclusions and recommendations are listed in the conclusion.

1. INTRODUCTION

A multi-vendor, multi-terminal (MVMT) HVDC¹ grid requires coordination and governance, standards, and protection of IP – issues that are regulated by law. A stable and enabling legal framework forms an essential basis for investment in HVDC technology. This Whitepaper describes the main legal and regulatory framework on several topics relevant for an interoperable HVDC network, namely:

- Governance of a MVMT grid
- Cooperation between Undertakings and Competition Law
- IP law and standardisation
- Risks and Liability

It must be noted that there is an interdependence between these topics, for example, because an industry standard may rely on many licenses and patents or because the division of risks and liability is connected to the division of roles and responsibilities. The next important issue in the legal framework is the division of risks and liability between different companies. When too much risk is concentrated within one company, this will make that company reluctant to invest.

For each topic, the legislative status quo is identified and applied to the development of HVDC grids. Recommendations are made where relevant and remaining questions and legal barriers are flagged. In some instances, there is no legal barrier but rather a choice to be made (for example: bilateral licensing or licensing pools). In such cases, the Whitepaper shows the consequences of the two options.

It must be noted that the development of a legal/regulatory framework for the cooperation between vendors and project developers in a meshed HVDC system is a complex and long-term process. This Whitepaper should therefore not be considered as a final result but rather as input for policymakers and future research projects. Moreover, this Whitepaper focuses on the legal and regulatory aspects, but there are other aspects to consider. First, WG₃ has produced a Whitepaper on the interoperability process from a more technical perspective, and WG₄ broadens the horizon with whitepapers on 'Framing the Future European Energy System' and 'The Future of HVDC'.

This Whitepaper contains the final results of Ready₄DC WG₂. It is based on a preliminary version (D2.2), which appeared in April 2023, and a period of stakeholder interaction and review.

¹ High Voltage Direct Current as defined in e.g., IEC 60633, IEC 62747, IEC TS 63291-1 and -2 ED1.

2. GOVERNANCE

Governance is a wide concept. In this context, it entails the process of governing the roll-out of MVMT HVDC grids. This chapter focuses on two issues:

- Coordination within a larger framework
 - o Based on public law
 - o Based on private law
 - o The role of standardisation

- Division of roles and responsibilities
 - o Principles for division of roles and responsibilities
 - o Concrete division in pilot projects

Governance does not lie with one actor, but instead is a process in which many different actors play a role. One important issue identified is that coordination now usually takes place on a bilateral basis between vendor and TSO/developer,² whereas coordination within a larger structure is necessary to reach interoperability between different sub-systems/vendors and across multiple TSOs/developers. A main question in this regard is how to manage the transition from single vendor to multi-vendor. Another dimension is the multinational dimension: regular point-to-point projects usually require two countries (TSOs; regulators; permitting agencies) to cooperate, but in a future grid, multiple countries and actors may be involved. The legal basis for larger HVDC structures is not completely clear yet: which parties should take the initiative? Who decides on expansions? How is the responsibility (and following from that, liability) allocated when two systems are coupled on the DC side? Who pays if there are extra costs for modification of the systems in order to have everything interoperable? In Section 2.1, the legal sides of coordination within a larger structure are treated in detail. The specifics of risk allocation and liability are covered in chapter 5.

Another crucial element in governance is the division of roles and responsibilities between these different actors. It was identified that as the roles and responsibilities of the different parties in a multi-vendor situation are not entirely clear yet, customers are locked in single-vendor systems, even though multi-vendor systems could lead to several (mid-long term) benefits in terms of easy extendibility, speed of implementation, enhanced competition, and lower costs (on the short run, costs may be higher due to intensive coordination and preparation). The division of roles and responsibilities is partially laid down in legislation,³ but not everything is clear. Whereas it is not necessary to develop a definitive division of roles and responsibilities now (the division may change over the years), it is important that the roles and responsibilities are clear for the coming few projects. The division of roles and responsibilities is treated in further detail in Section 2.2.

² An exception is cross-border links which do involve 2 TSOs instead of one. There is one multi-vendor project in Europe, connecting offshore oil and gas production sites in Norway (Johan Sverdrup).

³ For example, the current roles of TSOs are laid down in Directive 2019/944 on common rules for the internal market for electricity, OJ L 158, 14.6.2019, art. 40. The roles of ENTSO-E and ACER are also laid down in EU legislation.

Finally, the issue of governance is not limited to WG2, as it is a central theme of the entire READY4DC project. The gaps identified with regard to governance are not necessarily legal by nature, but legislation and regulation is one of the ways to clarify the roles and responsibilities of different actors and to increase certainty for all. The specific process of reaching interoperability (and which party has which role in this process) is treated in further detail in Ready4DC Work Package 3.⁴

2.1 Coordination within a Larger Structure

Coordination and cooperation within a larger structure requires a legal basis, both in the system of public law, such as European energy law, which describes the powers and roles of different actors *vis-a-vis* each other (and the national implementation thereof), and in private law, in the form of agreements directly between these different actors. Finally, standardisation, a process with both public law and private law elements, plays a specific role in coordination of large networks. These three aspects will be treated in this section.

First, it is important to specify the term 'coordination'. The development of a multi-vendor HVDC grid shall be coordinated in the sense that parties shall consult each other about their technical designs. We should distinguish the era of operation of the TSO (= before the connection point) and the connected party (= behind the connection point). Coordination should take place between the TSOs operating a MVMT grid. Then, the interface between the TSO and the connected party two should be regulated with regard to the non-discriminatory connection requirements (including operational capabilities) and agreed regarding the specific details of the site. The specific location of the connection point as such is also a matter of agreement between the TSO and the connected party and it would be possible to agree on several connection points (primary, secondary and tertiary). Also metering can be subjected to agreement. Finally, agreement is necessary between the TSOs and the vendors of specific technology that is procured.

2.1.1 Coordination through Public Law

From a public law perspective, the European Electricity Market Directive and Electricity Market Regulation are essential pieces of legislation. They set the principles and organisation of the energy sector and define main roles for different entities. Next to the Directive and Regulation, network codes are also public law, adopted as binding Commission Regulations. It needs to be further investigated (1) whether the current provisions are also relevant for HVDC networks and (2) whether the current provisions provide sufficient legal basis for coordination within a larger structure, based on the questions below.

As a general remark, following the recent adoption of the recast Energy Efficiency Directive,⁵ EU Member States must ensure that the Energy Efficiency First Principle (EEFP) is assessed in planning, policy and

⁴ Nico Klotzl (et al), Ready4DC, Deliverable D3.2: Multi-vendor Interoperability Process and Demonstration Definition (2023).

⁵ Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast), OJ L 231, 20.9.2023, art. 3.

major investment decisions of energy systems with a value of more than €100,000,000 (Article 3). The EEFPP is defined by the EU Governance of the Energy Union Regulation.⁶

2.1.1.1 General

In practice, there is a differentiation in the definition of a TSO and its responsibilities under the law based on TSO certification. The “full-fledged TSOs” are to be distinguished from other TSOs, like single-interconnector TSOs or co-investors in offshore systems. In the UK these are not considered system operators and labelled “Transmission Operators”) through their TSO-designation. In the Netherlands, the TSO designation (in based on a ministerial decision referring to the mandatory tasks stipulated in the national Electricity Act), not the formal certification which only sees to unbundling, defines the role of the designated entity. In the EU only the “full-fledged TSO” are provided with the system balancing task and are therefore also indicated as “balancing TSOs”. All other certified TSOs have only a very limited mandate, they are not even balancing their own system but are (only) to be included as a TSO in market coupling (which means that they need to provide transmission capacity to the market and cannot obtain it for trade - they are not supposed to act as a market participant). **It should be decided which functions and tasks are allocated to owners of HVDC systems.**

The Directive and Regulation are formulated in a way that does not differentiate between AC and DC. For example, the term ‘Transmission’, the basis for other terms such as Transmission System Operator (TSO),⁷ is defined as “the transport of electricity on the extra high-voltage and high-voltage interconnected system.”⁸ ‘Transmission system operator’ means a natural or legal person who is responsible for operating, ensuring the maintenance of, and, if necessary, developing the transmission system in a given area and, where applicable, its interconnections with other systems, and for ensuring the long-term ability of the system to meet reasonable demands for the transmission of electricity.⁹ **This means that, unless otherwise specified, provisions aimed at TSOs are applicable regardless of whether the network is based on AC, HVDC or another form of high power transmission.**

⁶ Article 2 (18) of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: “‘energy efficiency first’ means taking utmost account in energy planning, and in policy and investment decisions, of alternative cost-efficient energy efficiency measures to make energy demand and energy supply more efficient, in particular by means of cost-effective end-use energy savings, demand response initiatives and more efficient conversion, transmission and distribution of energy, whilst still achieving the objectives of those decisions”.

⁷ It must be noted that there is a legal reality and a technical reality. In the legal reality, transmission cables are owned by transmission system operators (although their mandate differs, as per the paragraph above, for example interconnector-only, OFTO or fully-fledged TSO). There are other lines that transmit power, such as direct lines (the connection from OWFs to oil or gas platforms in Norway is a good example), but that are not classified as transmission system, even though from a technical perspective, the cables make use of the same technology.

⁸ Electricity Directive, art. 2(34).

⁹ Electricity Directive, art. 2(35). There are some deviations, for example: the UK, although not an EU member-state has so-called ‘Offshore Transmission Owners’ (OFTOs) that are third-party investors in transmission infrastructure.

Also in other instances, there is no separation between AC and HVDC in the general legal framework for electricity networks. For example, in the description of the Ten-Year Network Development Plan process (Regulation, art. 48), Regional Cooperation of TSOs (Directive, art. 34), and tasks of Transmission System Operators (Directive, art. 40), no mention is made of the technology used. However, these legislative provisions were mainly written with AC networks (and point-to-point HVDC interconnectors) in mind. Therefore, the following should be investigated:

- Directive art. 40(1)e provides that TSOs shall be responsible for: “providing to the operator of other systems with which its system is interconnected sufficient information to ensure the secure and efficient operation, coordinated development and interoperability of the interconnected system.” Is this article sufficient to be the legal basis for interconnection of HVDC systems? Is it necessary to formulate (not in the E-Directive but in underlying documents) which information is needed specifically for HVDC systems in the context of this article?
- Similarly, Electricity Market Regulation art. 40(1)g makes TSOs responsible for “providing system users with the information they need for efficient access to the system.” What information do system users need when connected to the HVDC grid? Should this be laid down in underlying documents?
- In the TEN-E Regulation, an offshore network development plan is foreseen for 2024 (and regularly updated).¹⁰ Is this ONDP sufficient basis for the future offshore grid? Or should the pledges, that are now non-binding, become binding for the Member-States? A difficulty with binding pledges is that it will make states and TSOs more reluctant to incorporate plans that are not fully developed yet, which may lead to an incomplete picture. On the other hand, with non-binding agreements, it may be more difficult for neighbouring states and TSOs to do anticipatory investments, based on the expected OWF output in a certain area.
- Is the system of Regional Coordination Centres (RCCs), as laid down in art. 34-47 of the Regulation, fit for regional coordination of HVDC systems? The current staff of RCCs comes from the current TSOs; if the ownership situation of offshore grids is different, should this also be reflected in the current RCCs? Or should there be a “North Sea RCC” for the HVDC grid?
- How will regulatory supervision be organised? Regulatory supervision currently takes place on a national level, with ACER as a monitoring umbrella organisation. ACER is a forum of National Regulatory Authorities (NRAs) managing cross-border flows. What is the relationship between RCCs and ACER? Do we need a separate North Sea Regulator or a regional ACER body to regulate an offshore grid?¹¹

¹⁰ Regulation (EU) 2022/869 of the European Parliament and of the Council of 30 May 2022 on guidelines for trans-European energy infrastructure, amending Regulations (EC) No 715/2009, (EU) 2019/942 and (EU) 2019/943 and Directives 2009/73/EC and (EU) 2019/944, and repealing Regulation (EU) No 347/2013, OJ L 152, 3.6.2022, art. 14.

¹¹ Nieuwenhout, C. T. (2020). Regulating Offshore Electricity Infrastructure in the North Sea: Towards a New Legal Framework. [Thesis fully internal (DIV), University of Groningen, 2020]. University of Groningen, para 7.3.5 on different proposals for regulatory supervision.

2.1.1.2 Governance of TSOs' Risks and Income

Fully-fledged TSOs have a regulated income.¹² Their behaviour towards investment risks is based on the way regulation takes place. The primary legal basis for this is in EU law, where it is stated in Regulation 2019/943 that: “*Tariff methodologies shall reflect the fixed costs of transmission system operators and distribution system operators and shall provide appropriate incentives to transmission system operators and distribution system operators over both the short and long run, in order to increase efficiencies, including energy efficiency, to foster market integration and security of supply, to support efficient investments, to support related research activities, and to facilitate innovation in interest of consumers in areas such as digitalisation, flexibility services and interconnection.*”¹³ (emphasis added by authors)

It is a task of NRAs to determine the tariff methodology based on this general rule (and the characteristics of the country). As will be discussed in more detail later (see chapter 5), the different strategy—from turn-key point-to-point systems to distributed, multi-vendor systems—will entail several new risks, from the project development stage to the operation and maintenance stage. The risks TSOs are willing to take depend on whether they will be able to recoup the investment via their regulated income. When the risks are increasing, they should be covered by different means, depending on the risk. However, this entails extra costs for the project developers, often the TSOs. **Therefore, it is important that the tariff methodology is adapted to the development of MVMT HVDC grids, both regarding the added risks for TSOs and the cross-border influences an offshore grid will have.**

The task of setting tariff methodologies currently lies with the NRAs, which generally develop the tariff methodologies for TSOs every few years (regulatory periods last a few years). Other than the article quoted above, EU law does not prescribe how tariff regulation should take place. Interestingly, in the previous Electricity Regulation, it was a specific mandate for TSOs to develop “rules regarding harmonised transmission tariff structures including locational signals and inter-transmission system operator compensation rules”.¹⁴ However, this article has been removed with the revised Regulation in the clean energy package. An interesting role could be played by ACER, as ACER is an institution with the specific aim to act within the interests of the Union rather than national interests, and it deals with cross-border

¹² To the contrary, some interconnector-only TSOs have been exempted from the regulated income requirements. Instead, they receive their income from congestion rents. Such interconnectors are called ‘merchant’. The exemption is based on Regulation No 714/2009 of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003, OJ L-211/15, 14.08.2009 (hereinafter Electricity Regulation), art. 63 combined with article 19. The European Commission concludes that exemptions for interconnectors may only be used in exceptional cases; “It will be difficult if hybrid projects need to rely on exemptions or derogations under EU law.” European Commission, Staff Working Document accompanying the document Communication ‘An EU strategy to harness the potential of offshore renewable energy for a climate neutral future’ SWD/2020/273 final, under section 2.a.

¹³ Regulation (EU) 2019/943 on the internal market for electricity, OJ L 158, 14.6.2019 (hereinafter Electricity Regulation), art. 18(2).

¹⁴ Electricity Regulation, art. 8(6)k.

issues that NRAs encounter.¹⁵ The specific tasks of ACER regarding tariff methodologies are currently limited to making a 'best practices report'.¹⁶ **In a truly cross-border offshore grid, the tasks of ACER regarding tariff setting could possibly be expanded.** However, this requires political support from the Member-States.

2.1.1.3 Network Codes

Next to the general provisions on all electricity systems in the EU, the HVDC grid code (Commission Regulation (EU) 2016/1447 of 26 August 2016 establishing a network code on requirements for grid connection of high voltage direct current systems and direct current-connected power park modules) is of specific relevance as it details HVDC-related issues. It was written mainly with interactions between AC and HVDC systems in mind and also governs some specific applications such as DC-connected offshore windfarms. However, the development of an MVMT HVDC grid requires more coordination. For example:

- There should be more specific guidelines on the interface of systems connected on the DC side
- This grid code often states "the relevant TSO shall specify". This means that many specifications are decided per project or per TSO. This works for point-to-point systems but not for MVMT HVDC systems, as there are multiple TSOs and other stakeholders involved. The HVDC Grid code should state how these parameters are specified for a larger grid, where multiple TSOs are involved.
- The interoperability of HVDC systems requires the controls and system operation to be interoperable. Article 51-53 of the HVDC Grid code should include the provisions necessary to enforce interoperability.
- The sharing of simulation models is regulated in article 54. Currently, this is about sharing simulation models between the relevant TSO and the HVDC system owner. However, sharing between HVDC system owners is currently not provided for.¹⁷
- The definitions may need to be amended to reflect the reality, as an "HVDC system" currently is defined as a system between two or more AC buses (...). This would mean that a MVMT system is considered as one system, regardless of the size, with one owner (as the grid code refers to "the HVDC system owner". In practice, current HVDC links are often structured in limited liability companies with multiple owners (the underlying TSOs) or even private ownership. References to "the HVDC owner" in current network codes are therefore to this interconnector company and indirectly the owners of that company. In a MVMT situation, multiple HVDC systems can be connected to each other on the DC side. The definition "HVDC system" would then entail the entire system connected on the DC side, which currently implies that there is one owner. In reality,

¹⁵ Regulation (EU) 2019/942 of the European Parliament and of the Council of 5 June 2019 establishing a European Union Agency for the Cooperation of Energy Regulators, OJ L 158, 14.6.2019, art. 1(2) and (3).

¹⁶ Ibid., art. 15(4). See also Regulation 2019/943, art. 18(9).

¹⁷ The only multi-vendor project in Europe so far, Johan Sverdrup, is governed by bilateral contracts between the TSO and one vendor, and between the TSO and the second vendor. The TSO is the only entity with access to all interfaces. The technical process is described in S. Denetière, P. Rault, H. Saad, et al., "Technical solutions to predict and mitigate inadvertent interaction of two parallel connected VSCHVDC schemes feeding an islanded offshore Oil and Gas grid," in Proc. CIGRE Session, online, 24 Aug.–3 Sept. 2020.

the MVMT HVDC grid should not necessarily be considered as one system, especially when this has legal consequences for “the HVDC system owner”.

Next to the HVDC Network Code, other network codes may also have to be adjusted to reflect MVMT HVDC grids. For example, the System Operation Network Code (Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation) also contains provisions on HVDC grids, directed to HVDC system owners and relevant TSOs.

It goes beyond the scope of this Work Package to identify all issues and gaps in the existing Network Codes regarding the implementation of a multi-terminal HVDC network, (further analysis is done in the Ready4DC WG3 Whitepaper, figure 61),¹⁸ but **it is important that the Network Codes are ready for multi-terminal HVDC systems when the technology is ready to be implemented. This requires the relevant actors (European Commission, ENTSO-E, and ACER, based on the Electricity Market Regulation art. 58/59) to start in time with the drafting process.**

2.1.2 Coordination through Private Law

Next to public law, coordination also can take place through agreements in private law. This topic is addressed in detail in the Horizon Europe project InterOPERA, the purpose of which is to unlock MVMT HVDC electricity grids. InterOPERA proposes a coordinated approach between a diverse, high-level group of industries at the forefront of renewable energy sources (RES) development and grid management. Four HVDC vendors, eight transmission system operators (TSOs), two wind turbine vendors, and three wind park developers intend to bring their industrial knowledge and practical abilities to make future HVDC systems mutually compatible and interoperable by design and to improve the grid forming capabilities of offshore and onshore converters. As can be seen from the parties involved in InterOPERA, commercial interests and thus private law becomes relevant. Although sustainability considerations are gaining in priority in business transactions, it remains a reality in our market economy that private entities have a fiduciary responsibility to their shareholders to generate monetary profits from their activities.

In InterOPERA, the development of a multi-vendor cooperation framework in Work Package 4.2 is the primary deliverable. Early thoughts on the legal layout of a coordination framework are developed here.

Such a cooperation framework could be a combination of two legal instruments: first, a general umbrella agreement signed by all parties relevant for the development of a MVMT grid can provide the basis for cooperation and lay down the goals and rules of this cooperation to the extent necessary between relevant stakeholders. These rules could relate to shared objectives and timelines, but also to IP law and especially shared IP. Within InterOpera, a Multi Party Cooperation Framework (MPCF), a private law instrument to set a cooperation framework for the entities willing to develop an MVMT HVDC grid, is drafted. This would lay down the goals and rules for the cooperation necessary for interoperability. This framework facilitates cooperation in and during the project, but post-project the umbrella is intended to be open for anyone.

As the interoperability in multi-party HVDC systems might require cooperation among the vendors (horizontal cooperation), and between vendors and grid developers or wind turbine manufacturers

¹⁸ Nico Klotzl (et al), Ready4DC, Deliverable D3.2: Multi-vendor Interoperability Process and Demonstration Definition (2023).

(vertical cooperation), this cooperation could entail effects on competition. It will be vital to ensure strict compliance with EU competition law. This cooperation will also entail the sharing of technology and thus will activate intellectual property rights issues. The process of achieving a certain amount of standardisation must therefore find the appropriate balance between transparent participation, broad industry participation, and the granting of relevant IP rights and licenses. There will also need to be agreement on the ownership and use of any results that were jointly generated through the entities cooperating to form the meshed grids. Liability must be apportioned in a way that is reasonable and rewards the entities according to the level of risk they are taking, and the MPCF must provide a way for “late comers” coming to the field to participate on an equal footing with the founding members.

As a second step, a model agreement, to be attached to procurement documents for new projects, can be developed to ensure interoperability each time an addition to the existing grid is. This model agreement might then be an addition to the bilateral contract between the owner of the existing grid and the vendor of the new part. If this second goal is accomplished, it may streamline and make more efficient the tender process for HVDC projects, as the TSOs and the governments that own them have clearly signalled that interoperability is a *sine qua non* to their net-zero carbon goals. In this way, private law can help reach an interoperable MVMT HVDC grid.

2.1.3 The Role of Standardisation Processes

Next to public and private law, there is a specific role for standardisation. It is necessary to align the products, software, and processes of the different vendors with each other to reach interoperability. Standardisation is a process that, from a legal perspective, lies between public and private law. This is because standardisation is about producing a document (the standard, also sometimes referred to as a “guideline”) which is agreed upon by the stakeholders in a specified process. It is not compulsory to adhere to a standard, but it may be *de facto* necessary to acquire access to the relevant markets, as adherence to certain standards may be included in tender criteria. Moreover, specifications that were not binding as part of a standard may become compulsory when they are adopted as legally binding documents, for example via the EU Network Codes. Standardisation is a process that can start from a bottom-up initiative, but it can also be stimulated by top-down pressure, for example by including a requirement for interoperability in tender conditions.

Standardisation as a process, including the conditions for access and the voting rights in standardisation processes, is described further in section 3.2. Specific choices such as how to determine the price of a licensing fee in a standard; whether to use static or dynamic standards; and whether to use technology/IPR neutral specifications or not in a standard are also included in chapter 3. The specific considerations about intellectual property (IP) law and standardisation are analysed in chapter 4.

2.2 Division of Roles and Responsibilities

One hurdle identified regarding the deployment of MVMT HVDC systems is that, as the roles and responsibilities of the different parties in a multi-vendor situation are not entirely clear yet, customers are locked into single-vendor systems, even though multi-vendor systems could lead to several benefits in terms of easy extendibility, speed of implementation, enhanced competition, and lower costs.

2.2.1 Principles for the Division of Roles and Responsibilities

Different roles and responsibilities can be discerned. In a recent position paper,¹⁹ ENTSO-E discerns 'network planning', 'asset design and building', 'ownership', 'maintenance,' and 'operation'.²⁰ The ENTSO-E paper lists the considerations for five models that divide the abovementioned tasks, namely between 'onshore TSOs', 'offshore TSO', and three degrees of competitiveness. Other splits of tasks could also be possible, and other ways of dividing the tasks are also possible. Two important considerations in this regard are:

First, the division of roles and responsibilities does not have to be the same for the entire interconnected grid, there may be different roles and responsibilities in different grid elements: it is possible to have a combination of different systems, as long as certain topics—such as grid planning/development, the interoperability of different parts of the grid, and operation/maintenance—are well coordinated. Moreover, grid planning/development can be organised by a combination of actors (for example, onshore and offshore TSOs and a Regional Coordination Centre (RCC)), and interoperability can be reached by a standardisation process and a clear division of liability in case of malfunctioning when a new asset is added to the grid (see chapter 5 below). A regional coordination centre could coordinate routing and availability (for example related to routine maintenance). Which entity performs the maintenance can also vary throughout the network. Hybrid options are also possible, such as special purpose vehicles with ownership shares of both TSOs and market investors.

Second, it is possible to develop the model of ownership, roles, and responsibilities over time. This can happen on a long-term basis, for example what happened in the phase of unbundling, liberalisation and privatisation, when the grids were transferred to specific companies that did not engage in commercial activities such as production or supply of energy. It can also happen on a short-term basis per project. For example, a (part of a) grid can be transferred from one party to another. This happens for example in the UK, where the grid connection of OWFs is often developed by the OWF developer, and then transferred to a third party, such as an institutional investor, who will maintain the asset over its lifetime. Also in the development phase of other projects, such as point-to-point interconnectors that are developed on a turn-key basis, a sort of transfer happens: although TSOs are the initiators of a project, the theoretical ownership of a new grid element is transferred to the TSOs only once it is proven that the system functions well. Before that time, the risks and liabilities lie with the vendor of the system. Afterwards, they lie with the TSOs.

¹⁹ ENTSO-E, 'Assessment of Roles and Responsibilities for Future Offshore Systems', Brussels, Nov 2022, available at https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/Publications/2022/entso-e_pp_Offshore_Development_Assessment_roles_responsibilities_221118.pdf.

²⁰ End of life: Refurbishment, Dismantling and removal are not explicitly mentioned as a role or responsibility in the ENTSO-E paper. However, it is wise to discuss dismantling and removal sufficiently early to give upfront clarity on this topic to grid developers, OWF owners, and vendors of the HVDC technology. See also Ready4DC WG4 Whitepaper on the long-term view HVDC technology, forthcoming (2023).

The offshore grid will not be built in one night, and insights into which model of ownership and construction are best suited in terms of costs, risks, implementation time, and coordination may change over time. The lifetime of offshore electricity cables is several decades, and experience from the previous decades teaches that the political vision on the degree of competition, the benefits and disadvantages of vertical integration, and the ownership of essential infrastructure in public or private hands can change over such a time span. Here, again, it remains important that coordination is guaranteed when the model changes.

For these two reasons, it is **not necessary to wait for a clear division of roles and responsibilities for the entire MVMT grid**. Instead, it is **important to start with several pilots and to evaluate these pilots well, as they may contribute to the decision-making on larger parts of the grid**. For these first steps in the development of a MVMT grid, it is important that certain roles and responsibilities are clear to avoid a circle of waiting for each other.

Finally, the responsibilities (and the liability stemming from responsibility) should be divided in such a way that **they lie with those best placed to manage them**, as this reduces the total societal costs of HVDC systems. Grey areas of shared responsibility or unattributed responsibility should be avoided. If the attribution of risks and responsibilities comes without adequate remuneration, this reduces the willingness to invest in HVDC.

VISION OF THE EUROPEAN COMMISSION

The governance framework is likely to develop and change beyond the first pilot projects. The European Commission concluded in its Staff Working Document accompanying its EU Strategy on Offshore Renewables²: "Looking further ahead and beyond the deployment of the first hybrid projects, to complex meshed grids, the delegation of TSO tasks to one lead TSO (including bidding zone management and operational security) or the creation of an ISO [Independent System Operator] could be an efficient and strategic regional initiative to ensure optimal planning and operation of the offshore grid."

The European Commission points to ISO models commonly used in the United States. An example is the Midcontinental Independent System Operator (MISO), a privately driven independent non-profit that delivers power across 15 US states and Manitoba in Canada. Since 2009, MISO claims have accrued over \$30 billion in total benefits and \$3.5 bn in annual benefits in 2020, e.g. in the form of more efficient dispatch, regulation, spinning reserves and wind integration.¹

The European Commission writes that an ISO model with commercial parties owning the infrastructure and receiving a regulated return, as also used for gas infrastructure in the North Sea region, could be used on a multi-lateral basis in the electricity sector, in a way that fully complies with the unbundling requirements. Such an ISO, the European Commission writes, "could function as a system architect to develop the long-term master plan for offshore meshed grid development, map locations for offshore wind, as well as undertake the required grid investments needed for Europe-wide grid optimisation. It would provide scope for the relevant NRAs to assess in a neutral and coordinated way the best type of incentive regime and tariff design for a variable renewables-based electricity system. It would also have the advantage of solving coordination challenges and could help de-risk anticipatory investments."

2.2.2 Preliminary Division of Roles and Responsibilities

Considering the development above (the distinction between pilots and final framework), it is important to discuss the division of roles and responsibilities in the coming years, in the pilot phase. As a subtopic of this, Ready4DC WG1 has made a division of roles and responsibilities of different actors in interaction studies for pilot projects.²¹ The following is a proposal of roles and responsibilities in the pilot phase, based on the more general roles next to the specific division of roles in WG1 (interaction studies) and WG3.²²

²¹ Louis Filliot, William Leon Garcia (Ready4DC WG1) "Modelling, Simulation Framework and Data Sharing for Multi-Terminal Multi-Vendor HVDC Interaction Studies and Large-Scale EMT Simulations (2023), chapter 3.

²² Nico Klotzl (et al), Ready4DC, Deliverable D3.2: Multi-vendor Interoperability Process and Demonstration Definition (2023), chapter 6.3.3.

Task	Grid developers, TSOs	ENTSO-E	Wind Developers, WindEurope	Vendors and T&D Europe	NRAs, ACER
Determine the system needs, within the given policy context of EU targets of decarbonisation, renewable energy, energy efficiency and energy independence	Main Developer	Bundles and clusters system needs			
Coordinate requirements and targets (align national targets, EU targets, ENTSO-E requirements)	Assisting	Main Developer			Assisting
Identify projects that match these system needs	Either TSOs or new ISO	Assisting			
Describe the functional requirements for the infrastructure needed for these projects ²³	Main role	Assisting	Assisting	Assisting	
Further develop and fulfil System Integrator role (see WG3)	Possible	Possible			Possible
Develop wind assets that can be connected to an HVDC network	Assisting		Essential owner	Assisting	
Review the functional requirements for OWFs			Essential owner	Assisting	
Develop assets that answer the functional requirements referred to above				Essential owner	
Contribute to Standardisation	All actors except regulators, main role for standardisation body				
Determine extent to which development of MVMT grid differs from regular grid investments and consequences for the (income) regulation model	Assisting				Main role: ACER
Provide clarity to project developers on income regulation					Main role: NRAs
Reach a fair division of liability between developers and vendors	All actors				
Develop a model agreement to this end, to ensure interoperability and to de-risk the investment	All actors except regulators, done in the context of InterOpera.				

²³ Nico Klotzl (et al), Ready4DC, Deliverable D3.2: Multi-vendor Interoperability Process and Demonstration Definition (2023), chapter 4.2.2.

As mentioned above, in the longer term (beyond the pilot projects), roles and responsibilities may change. The process to identify projects is currently bottom-up based on the input from the various TSOs, based on the identification of system needs (so called IoSN, performed by ENTSO-E). This is based on various input data which are clustered in scenarios (national RES development targets, technological assumptions, assumptions of generators on costs and yield, TSO assumption on system development). At the same time, ENTSO-E also delivered a system vision for 2050 (carbon neutral Europe), in cooperation with ENTSG.²⁴

An important point of attention is that this grid planning process mainly supports TSO in connecting nationally planned generator projects (especially offshore wind), rather than starting with which grid configuration serves the European society as a whole best. Therefore, the coordination of where OWFs should be located and what grid configuration fits with these ambitions, should be done on a more regional level. This role can be taken up by ENTSO-E or by an Independent System Operator (ISO). Wind developers and other stakeholders may have conflicting interests that are better served by another grid configuration or governance structure, for example with more connections to different markets than planned by the TSOs. It is important that the needs from third parties are made clear and that it is clear how third-party needs are incorporated in grid planning and selection of projects for the coming decades.

3. COOPERATION BETWEEN COMPANIES

Developing an MVMT HVDC grid requires companies to cooperate (both between client and supplier (vertical) and between competing suppliers (horizontal)). Cooperation between companies is allowed but regulated by competition law, to make sure that the cooperation does not negatively affect consumers or the market as a whole. The cooperation needed to reach an interoperable HVDC grid includes the development of standards, projects, and possibly joint R&D investments.

Two main rules are that companies may not cooperate in a way that disturbs or distorts the market (101 TFEU) and that companies in a dominant position may not abuse that position (102 TFEU).²⁵ Both main rules are relevant in the development of a MVMT grid. For example, when multiple companies decide to use a certain technology rather than another technology, this decision needs to be transparent and beneficial to consumers and the market. Abuse of a dominant position can take place when a company that holds a certain patent that is essential to a standard asks a price that is not fair and reasonable for sharing it. Infringement of the rules can come with high fines.²⁶

This section explains how cooperation can take place without infringement of competition law. The section also highlights what is still unclear or what seems inefficient in the current legal framework.

²⁴ ENTSO-E, 'Vision: A Power System for a Carbon Neutral Europe' 10 October 2022.

²⁵ Treaty on the Functioning of the European Union, Lisbon 2009, art. 101 and 102.

²⁶ It can be difficult, however, to determine in practice what unfair prices for patents are. This will be explored in more detail in section 3.4.

3.1 Agreements between Companies

Cooperation between companies, and the underlying agreements, are regulated by EU competition law. Vendors and TSOs will only agree to cooperate as long as they are allowed. Therefore, it is important that they have a degree of certainty on whether the envisaged cooperation is allowed. Without that certainty, companies may not want to participate in the creation of a MVMT HVDC standard. There are several relevant rules and guidelines, but there are grey areas too, where companies may be uncertain about the degree of cooperation.

The general rule regarding cooperation between undertakings can be found in art. 101 TFEU. The article prohibits “all agreements between undertakings, decisions by associations of undertakings and concerted practices which may affect trade between Member States and which have as their object or effect the prevention, restriction or distortion of competition”. This general rule has been applied in cases before the European Court of Justice (ECJ) and has been elaborated in guidelines from the European Commission.²⁷ Agreements and decisions are explicit arrangements between firms, while concerted practices are a more implicit form of coordination.²⁸ Traditionally, coordination between *direct* competitors is reviewed more strictly than other forms of coordination. In practice, it is not always easy to determine when cooperation between companies crosses the threshold into restricting competition.

Based on the existing legislation and application in practice, three options are possible to obtain certainty on whether cooperation is allowed.

1. AGREEMENT DOES NOT AFFECT COMPETITION

If an agreement or form of cooperation does not negatively affect competition, there is no violation of competition law. There are guidelines from the European Commission that explain when this is the case. As an example: on standardisation agreements, the guidelines provide: “*Where participation in standard development is unrestricted and the procedure for adopting the standard in question is transparent, standardisation agreements which contain no obligation to comply with the standard and which provide effective access to the standard on FRAND [Fair, Reasonable and Non-Discriminatory] terms will generally not restrict competition within the meaning of Article 101(1).*”²⁹ In practice, this means that all competitors in a market should have unrestricted access to the standardisation process and that the procedures should be objective and non-discriminatory. This is elaborated in more detail in section 3.2. The concept FRAND is explained in more detail in section 3.4.

2. SAFE HARBOUR

²⁷ Note that a violation of competition law does not automatically constitute a violation of IP law or vice versa. Other than a few well-defined circumstances, such as FRAND licensing for standard-essential patents, competition law does not influence the use of IP law. See sections 3.3-3.4

²⁸ All forms of coordination, provided competition law is restricted, can violate competition law. The main difference between these forms of coordination lies in the legal proof required in court.

²⁹ COMMUNICATION FROM THE COMMISSION Guidelines on the applicability of Article 101 of the Treaty on the Functioning of the European Union to horizontal co-operation agreements (2023/C 259/01), para 451.

When the combined market shares of the undertakings cooperating in a certain market are relatively low, an agreement is unlikely to restrict competition. Thus, agreements below this threshold are in a “Safe Harbour”. The percentage of market share considered a safe harbour differs per type of cooperation, so for commercialisation agreements, it is only 15%, whereas for R&D agreements it is 25%. However, the agreements required to achieve interoperability should aim for cooperation with a sufficiently high percentage of the market—especially where the ultimate goal is standardisation. Therefore, it is unlikely that the safe harbour percentages will be met. It must be noted that agreements that are anticompetitive by nature (such as hardcore cartels and price fixing) are not allowed, even if they are below a certain market share.

3. EFFICIENCY GAINS: ARTICLE 101(3) OF THE TFEU

If a form of cooperation covers a large percentage of the market and restricts competition, it can still be allowed when it leads to efficiency gains. An individual exemption is possible if the following four (cumulative) criteria are met:

- The cooperation contributes to the improvement of production or distribution of goods, or to the advancement of technical or economic progress within the EU.
- A fair share of the resulting benefits reaches the consumers.
- The restriction of competition must be indispensable to the attainment of the objectives in the first criterion.
- The cooperation does not result in the elimination of competition in respect of a substantial part of the products or services in question.

The case law of the ECJ contains few references to this article, leaving much room for the Commission to interpret these rules. In order to clarify when these rules are applicable in different situations, the European Commission has drafted Guidelines and Block Exemption Regulations. The Block Exemption Regulations will be discussed in sections 3.1.3-3.1.6. The Guidelines of the commission will be discussed in section 3.1.2 and sporadically in subsequent sections.

It is important that the burden of proof shifts from the Commission to the companies when this exception is used. It is up to the European Commission to demonstrate that a certain agreement or cooperation is anti-competitive, but if undertakings wish to defend their cooperation based on its positive effects (efficiency gains), it is up to the undertakings to show that the cumulative criteria listed above are met. There are also guidelines on this topic.³⁰

The current state of competition law thus leaves a lot to be desired when determining the relevant burden of proof for either a violation or justification of EU competition law. If a company finds itself exceeding the threshold of art. 101 (1) TFEU, the burden of proof will shift, and the standard of proof will rise. A company will then also have to prove the other three criteria of art. 101 (3) TFEU, which are not found in any of the other thresholds. The Commission’s Guidelines therefore lack clarity when determining whether a standard is in compliance with competition law.

³⁰ Communication from the Commission — Notice — Guidelines on the application of Article 81(3) of the Treaty (Text with EEA relevance), OJ C 101, 27.4.2004

3.1.1 Block Exemption Regulations

A high degree of certainty about whether a form of cooperation is allowed can be obtained when the cooperation falls under one of the so-called “Block Exemption Regulations”. There are three block exemptions within the scope of competition law and IP licensing that are relevant for the cooperation necessary to achieve an interoperable MVMT HVDC system. These are related to R&D agreements, specialisation agreements, and technology transfer agreements:

- Regulation No 2023/1066 of 14 December 2010 on the application of Article 101(3) of the Treaty on the functioning of the European Union to categories of **research and development** agreements;
- Regulation No 2023/1067 of 14 December 2010 on the application of Article 101(3) of the Treaty to categories of **specialisation agreements**;
- Regulation No 316/2014 of 21 March 2014 on the application of Article 101(3) of the Treaty on the Functioning of the European Union to categories of **technology transfer agreements**.

If any activities are caught within the scope of these Regulations, they will not be considered a violation of any substantive obligation under EU competition law.

However, these block exemptions are only applicable when it concerns a limited part of the market. For example, Article 6 of Regulation 2023/1066 on R&D agreements restricts the application of the exemption to 25% as the combined market share of all competing parties in the agreement. This can be measured from both the relevant technology market and the relevant product market where that technology will be used. In the context of HVDC standards, a product and technology market can be any product or process that fulfils a necessary function within a relevant standard. If any market share is higher than 25% for these markets, at any point during the research or **seven years after the first exploitation**, the exemption no longer applies. In practice, this 25% threshold will almost certainly block participating companies from using this exemption in the case of HVDC R&D. For specialisation agreements, the threshold is 20%, and for technology transfer agreements, competing undertakings must not exceed a combined market share of 20%. For non-competing companies this market share threshold is 30% for each individual company.

Considering the market structure regarding vendors for HVDC components, not even the most favourable interpretation of the Block Exemption Regulations could result in some manner of exemption from art. 101(1) TFEU. Companies are therefore advised not to rely on these block exemption regulations, but to make sure that the cooperation is not anti-competitive (by following the guidelines and not engaging in anti-competitive behaviour) or otherwise that the cooperation can be justified under 101(3) TFEU.

3.2 The Process of Standardisation and Competition Law

Interoperability in HVDC systems asks for a certain degree of standardisation. Relevant companies must agree on specifications that ensure interoperability of future HVDC standards, which will require significant cooperation. Standardisation is a process that can take different forms, and the legal consequences of standardisation depend on the way the process is organised. The process of standardisation requires undertakings to engage in agreements with each other, which makes the rules on competition law relevant for this topic. The clearest available law on this issue can be found in the Guidelines for the assessment of horizontal cooperation agreements. This law is not binding per se, but still holds significant influence over the interpretation of otherwise opaque law.

3.2.1 Participation in Standardisation

It is important to facilitate participation by a variety of industry actors in standardisation. EU competition law, particularly the Commission's guidelines, stresses that standardisation should be open and transparent. The Commission generally stresses that the efficiency improvements that standards can provide have the potential to be significant. Even so, the Commission remains wary of standardisation as a cover for commercial cooperation that is less desirable. It is for this reason that the Commission prefers to emphasise two principles of standardisation: openness and transparency. If all relevant companies that wish to participate can do so and the standardisation process is transparent, the Commission is not likely to take issue with the standardisation process. These rules, however, are general in nature. Companies will have to decide for themselves how these rules will be implemented, requiring a careful application of these general rules by the companies themselves.

Of equal importance is the allocation of voting rights within the standardisation process: this should be objective and non-discriminatory and should contain objective criteria for selecting technology or specifications. If the allocation of voting rights is not done properly, a few undertakings could gain significantly more influence than would ordinarily be justified. The criteria used by the Commission are general in nature and are not further elaborated upon. Just as with the principles of openness and transparency, the standardising companies must formulate these rules themselves. The Commission only clarifies that possible exclusions could be justified, if:

1. the would-be participant demonstrates or is likely to demonstrate significant inefficiencies (i.e., technical or organisational);
2. the standardisation process already sufficiently covers the collective interest of that particular would-be participant.

Regarding the first exemption, it is relevant that such a determination is made through objective criteria, with preferably an independent body making the final decision. The wording of the Commission does not allow for a clear separation between "mere" inefficiencies and inefficiencies that are of such significance that they warrant exclusion from the standardisation process. The last exemption can be used to avoid unnecessary organisational difficulties. Unfortunately, the Commission does not adequately explain when the collective interest is already sufficiently covered or when mere inconvenience evolves into organisational difficulties.

3.2.2 Broad Participation and Binding Commitments

As previously mentioned, standardisation allows for efficiency gains within the market that is standardised. For the greatest possible efficiency gains to occur, it is necessary that the standardisation process has broad industry participation. Through this broad base of industry support, the best available technology can influence the chosen specification and be integrated into the standard at an early stage. This aligns with the Commission's stance on open and transparent participation in the standard-setting process. Any rules, regulations, or organisational decisions should therefore facilitate broad participation.

The need for broad participation is counter-balanced by the related need to acquire a binding licensing commitment from participating companies. Any technology that participating companies possess that is useful for a standard nearly always has intellectual property rights (IPRs) attached to it, as far as technology is not kept secret (blackboxed). It is therefore in the interest of the standard that these companies provide irrevocable licensing commitments under fair, reasonable, and non-discriminatory

terms (also known as 'FRAND terms'). That way, a standard can develop specifications in line with state-of-the-art technology, with the knowledge that the standard will not be hindered by companies invoking their IPR. This is also required by the Commission: without it, a standard cannot make use of the "safe harbour" found within the Commission's Guidelines.

Such a binding licensing commitment, however, has the potential of reducing participation by companies, depending on the terms of the licensing commitment. Unclear or early binding commitments may otherwise force companies to license IPR, without them being entirely aware of the IPR that they possess and the value that this IPR could have in the future. The ECJ's case law dictates that, once a binding commitment has been made by companies to license their IP for use in a standard, competition law significantly restricts their freedom to licensing their IP.³¹ The goal of open and transparent participation and the need for binding licensing commitments therefore cause tension within the standardisation process. If the timing of the binding commitment is early, participation by companies may be hindered. If the binding commitment is required late into the standardisation process, this may delay the development of the specification or force sub-optimal choices in the specifications. The standard-setting process should therefore find an appropriate balance between transparent participation, fostering broad industry participation, and securing relevant IP licenses. It remains up to private parties or industry bodies to do so.

3.2.3 Good Faith

An issue associated with broad industry participation concerns the obligation of participating companies to disclose which IP they possess. It is necessary for the standardisation process that all relevant IPR is disclosed ahead of time. If a specification has been set without knowledge of existing IPR, that could hinder the effective development of the standard or force other companies to pay a large licensing fee for the usage of that technology. For the benefit of a standard, companies are required to disclose what IPR they have. To that end, the Commission requires companies to perform a good faith disclosure of all IP that "might be essential for the implementation of the standard under development".³²

This requirement does not require companies to compare their available technology to the standard and positively conclude that they have no related IPR. Neither do companies have to disclose exactly what type of IPR they possess regarding a particular development stage of a standard. All that is necessary is that the company, as the standard develops, makes a good faith effort to locate its relevant technology and associated IPR. If any relevant IPR is found, the company in question must then merely inform the other parties that they have IPR on technology of theirs that could fulfil a particular specification.

This test seeks to balance two factors: a need to disclose IPR so that a "patent ambush" can be avoided, and the need to foster participation in the standardisation process. If no disclosure requirements are implemented, the Commission may consider the standardisation process as suspect. The exact way the good faith requirement should be implemented, however, is left unclear by the Commission's Guidelines. The easiest way for a firm to comply with the requirement of good faith would be to regularly review the current state of the standard. Ideally, staff with technical expertise and staff with knowledge of the firm's intellectual property would be involved in this process. By regularly reviewing the state of the standard, a

³¹ CJEU 16 July 2015, EU C-170/13 ECLI:EU:C:2015:477 (Huawei Technologies).

³² See the next section for the issue of essentiality in standardisation.

firm will be able to discover at an early stage whether it has IP that is relevant for the standard. The relevant firm(s) could then determine whether to provide a license, and the standardising body will be made aware of IP hindering certain specification(s).

Standard Essential Patents

A technological standard for HVDC grid components may be based on a large amount of patents. Some patents are essential to a standard: these are called “standard-essential patents” (SEP). An SEP is defined as a patent that a standard must use, without which a particular standard cannot function. Depending on the nature of the standard and the market in question, a standard may contain thousands of such patents. For purposes of standardisation, it is relevant to know what constitutes such a patent. The definition of SEPs influences which patents should be prioritised, how they should be determined, and ultimately the legal risk under EU competition law that a standard incurs when selecting or using the patent in question.

A patent can be essential for a particular standard if the equipment or methods used in that standard cannot be carried out without violating that patent. This presupposes that a standard has been set independently of existing patents or cooperation from partners of industry, which often is not true. The process of selecting a patent requires the relevant standard-setting organisation or partners of industry to determine the best solution for a particular technical problem. If only one patented solution exists that can meet the selected specifications, then there is no issue. That patented solution can be selected. If, however, multiple solutions exist that can meet the relevant specification, it becomes more difficult to determine which of these solutions is the essential patent. A safe solution in that context would be to include all relevant patents into a standard, so that concerns of discrimination against particular patents cannot occur. Such an approach, however, might run contrary to the Commission’s view.

In its Guidelines on the applicability of art. 101, the Commission prefers only one set of essential patents.³³ The Commission tends to holistically consider the interoperability efficiencies gained through standardisation and the efficiency lost through excessive licensing costs. If multiple patents are unnecessarily included in the standard, the concomitant costs of licensing for those patents will also rise unnecessarily.³⁴ The initially gained interoperability efficiencies could then be undermined by the extra licensing costs. Including all suitable patents into the standard is therefore not a solution to multiple patents meeting the chosen specification. In order for multi-terminal multi-vendor HVDC standardisation to safely select specifications and patented technology, it is necessary to gain clarity on this issue.

A possible solution for the issue of multiple patents meeting the relevant specification, with no discernible difference in performance, would be the addition of a commercial context. In the Guidelines on the

³³ C 89/03 2014, Communication from the Commission, Guidelines on the Application of Article 101 of the Treaty on the Functioning of the European Union to Technology Transfer Agreements, para. 253-254 & 262.

³⁴ This presumes that users of the standards must pay for all SEPs that exist. That is not the case if all vendors have their own set of patents for all or most specifications. A user would then have to pay for one set of relevant patents and nothing else. Both options (users of standards pay for all SEPs, or for none of them) are extremes, and unlikely to materialise. It is more likely that a middle road is taken: vendors pay for certain licenses, while they can rely on their own IP for other standardised processes. This will depend on the standard facilitating multiple solutions.

applicability of article 101, the Commission makes no mention of commercial criteria, but in its Guideline on technology transfers, such a mention is made in reference to technology pools. Technology pools are arrangements whereby two or more parties assemble a package of technology, which is licensed not only to contributors of the pool but also to third parties. The comparison is not perfect, as technical standards result in interoperability, which technology pools do not necessarily provide. The licensing component of IPR, whereby multiple companies in a horizontal setting bundle their IPR and provide other parties access, can nevertheless be necessary to achieve standardisation. This justifies the comparison between technology pools and technical standards.³⁵ In the technology transfer Guideline, the Commission defines technologies as essential if “no viable substitutes (both from a commercial and technical point of view) for that technology inside or outside the pool and the technology in question” exist and if it “constitutes a necessary part of the package of technologies for the purposes of producing the product(s) or carrying out the process(-es) to which the pool relates”.³⁶ In the context of pool-based licensing, which may be related for future HVDC standards, commercial feasibility can give a relevant patent an edge in the case of multiple technically comparable technologies. It remains unclear, however, to what extent this soft law is applicable to standardisation. The Commission considers technology pools related to standards, but does not consider them “inherently linked”.³⁷ It is therefore unclear to what extent commercial consideration can help break a deadlock between multiple technically comparable patents.

The Guidelines on horizontal coordination of art. 101 TFEU and the Guidelines on technology transfers both describe activities which are applicable to standardisation. The possibility of overlap between these two guidelines is largely left unaddressed. The first guideline covers standardisation; the second technology pools and licensing. This makes it difficult to determine to what extent the aforementioned commercial context can help determine the essentiality of patents. It also makes it difficult to determine if other factors in the technology transfer Guidelines, such as the need for independent expert panels to determine the essentiality of certain patents, are applicable to standards.³⁸ Additionally, it leaves unaddressed the possible complementary nature of patents in technology pools, which is allowed in the technology transfer Guidelines. As the Guidelines on horizontal coordination seem to only allow essential patents, it is difficult to determine which interpretation should be applicable when the scope of both Guidelines overlap.

³⁵ See the Commission’s own assessment of tech pools and standards: Communication from the Commission — Guidelines on the application of Article 101 of the Treaty on the Functioning of the European Union to technology transfer agreements, para 244-249, para . 252 et seq. See also: “C. Shapiro, Navigation the patent Thicket: Cross Licenses, Patent Pools, and Standard Setting.

³⁶ Guidelines on the application of Article 101 of the Treaty on the Functioning of the European Union to technology transfer agreements, para . 252.

³⁷ *ibid*, para. 245.

³⁸ The Commission has recently proposed a new Regulation that deals extensively with a procedure that is meant to ease the determination of essentiality. See: COM(2023)232 - Proposal for a regulation of the European Parliament and of the Council on standard essential patents and amending Regulation (EU) 2017/1001. At time of writing, it is unclear if and in what form that Regulation will be implemented. Should the proposal be accepted in its current form, there will be a requirement to assist an independent expert when determining the essentiality of standard-essential patents.

3.3 FRAND Licensing & Excessive Pricing

An important obligation pertaining to standards is the requirement of all participating companies to license their relevant IP. This licensing needs to comply with the criteria of Fair, Reasonable, and Non-Discriminatory (FRAND) licensing, as determined by the ECJ and the Commission.

A large part of the rules pertaining to FRAND licensing refers to the determination of the price. Excessively high prices are not allowed. Should a particular licensing regime be classified as producing such prices, there will likely be a violation of competition law. However, it is difficult to determine when a licensing fee is excessive, especially in a developing sector like HVDC. A high licensing cost may be explained and justified by high costs of R&D, including the costs made in research that yielded no commercially useful technology. The Commission and the ECJ furthermore lack relevant information to determine *ex ante* what the price for a license should be. It is therefore established practice that competition law, in principle, does not interfere with the prices set for licences. Intervention is more likely:

1. in a market where barriers to entry make it difficult for competitive forces to reduce licensing fees;
2. in situations where excessive fees are the result of anti-competitive behaviour, rather than a reward for expensive and risky R&D.

The first situation is inherent in standards, as parts of the (technology) markets are restricted through use of the standard. HVDC standardisation will therefore likely be subject to enhanced scrutiny by the Commission.

3.3.1 How to Know if a Fee is Excessive?

The Commission has intervened with license fees at several instances. In doing so, it has made use of a variety of tests for whether a fee was excessive or not. The first test relates to prices that, on an absolute level, are too high. This test likely is not relevant for standardisation in the HVDC sector. The second test attempts to establish relatively excessive prices, by comparing the license fees of comparable technologies used by other companies. The Commission might also attempt to compare the licensing fees of technology before its integration into a standard and after this has occurred. If no comparable technology or companies exist, this test has little practical value. Even if there are comparisons, the Commission would have to determine that the license fees in question are not already excessive for the test to work.

A third possible method attempts to account for the R&D costs and bases the excessive pricing on those costs. However, this method requires significant investigation into those costs and does not account for the R&D costs incurred for other technology that lacks commercial value. For companies that focus on R&D this is an even bigger issue, as they must earn all their costs back from IP use and then earn a profit. The lack of the Commission's ability to determine objective value for technology hinders its ability to determine appropriate license fees. As long as participating companies do not require licensing prices that are substantially above those of a competitor, it is unlikely that competition law will be violated.

A relatively recent case before the ECJ shows the possibility of a fourth test to determine excessive pricing.³⁹ This test attempts to separate the strategic value of information and might be used in the future to determine excessive licensing costs in standards. The test assumes that only value borne out of innovation is worthwhile in licensing. Value originating from the strategic placement of a patent within a license—which market participants have to acquire due to the nature of a standard—ought to be excluded. This test still struggles with the issue of comparability mentioned previously. It therefore remains difficult for the Commission and the ECJ to determine when an excessive price for a license has been applied. Companies should be wary of charging prices for licenses that are substantially higher than their competitors and should prepare justifications for any fees that are substantially higher.

3.4 Static and Dynamic Standards

Standardisation aims to achieve interoperability and increase general efficiency within particular markets. This requires a standard that all relevant market participants can adhere to. The greater the reach of the standard, the greater the potential interoperability and efficiency gains. A standard may evolve to such an extent that, while there is no legal obligation to use it, there will be a *de facto* commercial obligation to adhere to it. In static markets with little innovation, this has few downsides, as the standard can generally not be greatly improved. The chosen specification does not require change over time in such contexts.

In still evolving environments, such as HVDC grids and grid components, the context changes. A standard's justification for existing, from a competition law point of view, is the interoperability and efficiency gains it can provide. The requirement of interoperability presumes, to an extent, that certain standards will be "locked in" to allow all relevant market participants to build on those standards. In innovative environments, this presumption may be challenged by continual improvement. As technology improves, it is possible that the technology integrated into a standard becomes increasingly outdated. The specifications of a standard ideally allow for continual adaptation to new and improved technology.

If a standard locks in its specifications and excludes the possibility of integrating more innovative technology later, that might be taken as a point of critique by the Commission. Relevant considerations in that context are: if the standard can be formulated in such a way as to allow the relevant specifications to be changed and whether this may be done without disrupting the work other market participants have performed in complying with these specifications. Other relevant concerns are whether the relevant market can support continual improvement of the standard or if there are other good technical reasons for excluding the technology. The Commission seems to prefer an approach of continuous competition regarding relevant technology.

Of particular interest is whether the appearance of better technology at a later date may be classified as essential in the sense of section 5. It is not immediately clear if EU competition law considers it possible for new technology—introduced at a time when the standard has already been set—to be essential for a standard. Neither the ECJ's case law nor the Commission's soft law explicitly state this possibility. This lack of clarity does not, however, suggest that new technology can never be considered as essential. Much depends on the technical possibilities within a future HVDC standard.⁴⁰

³⁹ Case T-167-08 ECLI:EU:T:2012:323 27 June 2012, Microsoft Corp v Commission

⁴⁰ Relevant also is the likelihood that specifications can be designed in an IPR neutral manner. See section 3.6

3.4.1 Consequences of the Choice

The choice between a dynamic or static standard may influence the licensing arrangements that are necessary to support the standard. In a static standard, the choice of technology and IP does not undergo (significant) change. The IPR associated with that technology will also not change. But in a dynamic standard, with the (possible) inclusion of future technology, the licensing arrangements must take that future technology into consideration. Licensing arrangements that do not consider this will create the possibility that the improved technology is licensed at higher prices than before or does not get licensed at all. Licensing agreements regarding dynamic standards, which only cover the initial integrated technology, will likely not comply with the obligation to provide a FRAND license to all potential users of the standard.

Failing to comply with FRAND licensing terms will increase the risk from a competition law perspective. To what extent the competition law risk increases may depend on a number of factors, such as the increase in licensing fees, the potential to reduce interoperability, or other restrictions in competition. The issue remains largely unaddressed in EU case law or in the Commission's guidelines. It is consequently difficult to give clear pronouncements. To avoid the issue, it would be prudent to require all participating companies in standards to provide binding licensing commitments pertaining to current and future IPR. Such a commitment may cause concern for the requirement of open and transparent participation in standardisation, as explained in section 3.3.

3.5 Technology/IPR Neutral Specifications

The specifications of a given standard are not the object of competition law per se. EU competition law does not, in principle, concern itself with considerations of a technical nature, unless these considerations have some influence or overlap with other areas. One topic that fits this description concerns technology or IPR neutral specifications. Technology or IPR neutral specifications refer to specifications that are designed in such a manner as to encompass a variety of technical solutions. These specifications are therefore not bound by a particular technology and, as a result, not bound by a particular IPR. Competition law generally has no opinion on the design of such specifications, provided that the efficiency gains of interoperability are reached and that the process of selecting these specifications has complied with the requirements mentioned in section 3.2.

The relative neutrality of a standard does influence the potential ease with which new technologies can be integrated into a standard. The previous section explained the concept of dynamic standards. A technology neutral specification may better facilitate the creation of a dynamic standard. Technology neutral specifications do not require constant updating to integrate new technology, as these specifications were not originally bound to a particular technology. It will still be necessary to make proper licensing arrangements pertaining to future technology, as the previous section explained.

The neutrality of the licensing arrangement may also influence the licensing arrangements that participating companies are likely to use. If the specifications of a standard are highly neutral, there is less need for participating companies to cross-license with other participating companies. Companies with IPR will be more able to license their IP individually with standard users. This allows participating companies to avoid complex licensing arrangements like technology pools (see section 3.7). It may additionally allow companies to make better use of intellectual property that is not classified as a patent (see section 10). Finally, licensing under neutral specification may enable competition in the relevant technology markets.

If multiple technologies exist to meet the demands of a given specification, a potential standard user may benefit from having more than one option to choose from because, for example, competition between different options drives down prices for the relevant technology. A downside to technology neutral specifications is that they may reduce the performance and efficiency gains that a standard may provide. The potential licensing downsides coincide with the potential downsides of bilateral licensing (see section 3.7).

An important development in this regard is whether voltage is the right measure for capacity. Some parties argue that using voltage as a parameter (in High Voltage DC) is not technology neutral, as it excludes other technologies that are capable of transferring high volumes of power at medium or low voltage, as voltage is not a goal in itself: the transfer of electrical power is.⁴¹

3.6 Bilateral Licensing and Licensing Pools

Standards require large volumes of technology to fulfil its purpose of interoperability. Any company that has offered a binding licensing commitment must offer its associated IPR to would-be standard users on FRAND terms. These terms have been clarified to an extent, but the licensing arrangements have not been. Of note for standardisation and competition law is the way the required licensing is carried out. There are two main variants worthy of discussion: bilateral licensing and pool-based licensing.

With bilateral licensing, the IPR holder will provide FRAND licenses at the request of third-party standard users. Through bilateral licensing, none of the parties holding IPR engage in any coordination pertaining to joint licensing agreements. This may be considered beneficial for competition, as coordination between direct competitors is limited to the standardisation phase. Once the standard is in place, no further coordination is necessary. This lack of coordination, which is an essential element of pool-based licensing, can more easily allow competition between IPR holders and increase competitive pressure. Bilateral licensing can synergise quite well with IPR neutral specifications, provided that multiple patented solutions exist. Bilateral licensing can, however, increase transactions costs for third-party standard users. It may also make upgrading the standard more complex, at least if IP neutral specifications cannot be effectively realized. Without one centralised “hub” for relevant patents, new standard essential patents may require separate licensing arrangements to be negotiated with third-party standard users.

Pool-based licensing allows multiple standardising companies to integrate their relevant IPR into a single “pool” of technology. The technology pool has several advantages over bilateral licensing. While initially more complex to arrange, the technology pool offers third-party standard users one single license for all necessary IPR. This can reduce the transaction costs associated with standard-related licensing. A technology pool becomes more relevant the greater the number of participants and associated IP. If the specifications of a standard cannot achieve sufficient IP neutrality, a pool-based licensing model becomes even more useful. Bilateral licensing in a large standard without IP neutral specifications requires a third-party standard user—if all relevant IP is not held by a few companies—to expend considerable effort to acquire all relevant licenses. It may also be easier to update the standard through usage of a technology pool, as one license can be connected to one continuously updatable pool. The downsides of a pool-based system largely revolve around its difficulty to set up and the remuneration formula employed for each

⁴¹ Ready4DC WG4, ‘Whitepaper Long-Term View for HVDC Technology’ (2023), chapter 5.

participant. Pool-based licensing also complicates the issue of trade secrets and other valuable know-how related to patented technology. Finally, pool-based licensing may provide competing companies more means to coordinate with respect to commercially sensitive information. EU competition law usually prefers to avoid such coordination.

3.7 Conclusion and Recommendations

This section highlighted how companies can cooperate in a way that does not infringe competition law and how the standardisation process is influenced by this. A first conclusion is that the process of developing an interoperable HVDC grid requires companies to cooperate and to make agreements, for example, standardisation agreements. In doing so, they should follow the guidelines of the European Commission in order to make sure they do not infringe competition law. This means that participation in the cooperation should be transparent, participation should be open to all interested parties, voting rights should be allocated in an objective manner, and access to licenses should be on FRAND terms.

The main take-away of the legal side of standardisation is that the process should be as open and transparent as possible, but that there are several specific issues to take into account in the context of developing interoperable HVDC grids. These are:

On standardisation procedures:

There are limited concrete *ex ante* rules and procedures on open and transparent participation in standardisation that industry participants can follow.

The lack of legal guidelines does not mean there are no relevant guidelines from which a standard-setting body of companies can take inspiration. Even if not specifically empowered under EU law, the guidelines and practice of standard-setting organisations within the EU remain authoritative.⁴² For the purposes of an MVMT HVDC grid, the authoritative standard-setting organisations are CEN and CENELEC. The usage of existing guidelines or the involvement of standard-setting organisations is to be encouraged.

There are no concrete *ex ante* rules and procedures dictating when exclusion of undertakings from standardisation is justified, nor how the allocation of the voting rights within the standardisation process should take place.

Competition law tends to review standard-setting in hindsight: if there are certain red flags or dubious practices in the process of standard-setting, competition authorities may review the process and start enforcement proceedings. This necessitates a careful consideration of which companies vote on the specifications within a standard and how strong their voting rights are. Within the development of standards for MVMT HVDC grids, there is the added complexity that the nature of the standard might result in an overrepresentation of vendors. As vendors are the responsible parties for creating the components that must comply with a standard, it is natural that their voice is represented as one of the most knowledgeable parties. Simultaneously, an overrepresentation of vendors could potentially be seen, retroactively, as a form of unwanted commercial coordination. The inclusion of multiple types of

⁴² A lot of the described competition law is general. For instance: what is a reasonable price for a patent or to what extent are patents essential in a standard. The knowledge of industry bodies can be of great value for interpreting competition law.

companies with adequate representation is useful in reducing that risk, such as research institutes or TSOs. Absent any guidance from the Commission, the use of guidelines from CEN or CENELEC could prove valuable in determining what an appropriate balance of standardising companies is.

On licensing of patents

FRAND licensing terms require binding commitments from participating firms. This needs to be aligned with the need to foster broad industry participation.

The standard-setting phase should focus on broad, active participation over an early, binding licensing commitment. Instead of potentially reducing participation with binding commitments at an early stage, it is advisable that standardisation efforts focus on crafting specifications that all relevant companies can fulfil. The participation of a sufficiently large group of vendors, research institutes, and other IP holders can help achieve that. Throughout the process of choosing the relevant specifications, companies should continue to provide information on whether certain inventions or solutions are likely to be covered by one of their patents. This can allow the engineers choosing the specifications to consider to what extent particular solutions might be dependent on patents from a single company and potentially steer the specifications away from solutions only one patented solution can provide.

A standard-setting organisation should consider combining an obligation to provide relevant information to the standard setting organisation with a policy of good faith efforts from the participating companies to continuously reveal relevant IP. Such a combination will allow all parties to make informed decisions during the standardisation process. If the standard setting organisation does not wish to take a risk with an IP-heavy specification, it could potentially choose alternatives. IP holders could determine with each specification or set of specifications whether or not they would be willing to license the relevant patents. Proper communication between parties can prevent unexpected licensing requirements. If a company is willing to provide a voluntary binding licensing commitment, that would be the safest option, as participation will not be threatened in that scenario. But companies are not required to do so to ensure compatibility with competition law.

EU law requires a good faith effort on the part of undertakings to disclose relevant IPR. The scope and duration of that good faith effort, however, are not specified.

The development of a standard requires input from relevant parties to set the specification in a manner that can achieve interoperability, as well as several lesser objectives. When crafting these specifications, the engineers might not be fully aware of any potential patents their company possesses that could (partially) overlap with these specifications. If specifications are chosen whilst a company is unaware of relevant patents, a binding licensing commitment could force vendors to license IP they might otherwise have kept for themselves. It is advisable that relevant experts on both the contents of company patents and the development of the standard regularly take stock on the progress of the standard. This would allow a company to be more aware of what IP it might have to license, which as a result would give the standard setting organisation information on the necessary patents for the standard.

The Commission prefers one set of standard essential patents (SEPs) per specification. What if multiple patented solutions exist in a standard, which can all perform the specified function equally well?

If multiple patents exist for each relevant standard user, then patents for that function will not have to be licensed in unison. If, however, one or more companies lacks access to a relevant patented solution, at

least one patent should be licensed. From a competition law perspective, it is desirable that one patent is not declared as the standard essential patent without good cause. Should multiple solutions remain possible, it would likely be optimal that the companies possessing the patents compete for licenses. If the number of patents required becomes too large or the overview of who has what patent becomes too complex, it might become necessary to employ a technology pool. The patent that gains entry into the patent pool could then compete for its position based on price.⁴³ That way, interoperability will remain possible, and competition for licenses can continue without SEP's getting in the way unnecessarily.

The Commission's preference for one set of technology — and therefore one set of patents — leaves unaddressed the possibility of non-essential but complementary technology.

Complementary technology might refer to a reduction in the complexity of a particular standard or might otherwise reduce the price of that standard. Whilst the status of complementary technology is uncertain, its inclusion within a standard could be justified with proper motivation. If a standard setting organisation wishes to include complementary technology, the Commission requires that the organisation at least addresses the following: what aspect of the standard would be aided by complementary technology and how the overall price of the standard would be reduced by its inclusion. The onus, if a choice must be made, should be on potential price reductions over reductions in complexity within the standard. This is advisable due to qualitative improvements of a standard being more difficult to analyse from a competition law perspective.

The Guidelines on the applicability of article 101 do not mention commercial factors in determining essential patents. The Guidelines on technology transfer do and specifically mention standards. It is unclear if, and to what extent, commercial factors can influence the essentiality of patents.

The previous issue largely dealt with commercial factors. Interoperability is the main goal of standards and should be its primary goal. If, however, clearly favourable price reduction can be achieved by favouring one set of essential patents, it is defensible that this set of patents is chosen. Such a choice should also consider which technology allows for more flexible standard development, which could result in price reductions in the future. The Commission should revise its soft law to accommodate such choices.

On licensing and excessive prices

There are multiple methods available to determine excessive pricing. It is unclear when each method will be used and in what combination.

If relative comparisons are chosen to determine an excessive licensing price, it will be difficult for the Commission to determine if all companies involved are not already charging excessive prices. Nevertheless, properly motivated licensing policy, particularly if reference can be made to common commercial practice, will reduce the chance that the Commission will declare licensing fees as excessive. It is unlikely that the research and development costs of a particular patent will be used to determine an appropriate licensing fee, as:

⁴³ This is not binding law per se, but the soft law of the Commission seems to at least require this. C 89/03 2014, Communication from the Commission, Guidelines on the Application of Article 101 of the Treaty on the Functioning of the European Union to Technology Transfer Agreements, para. 253-254 & 262.

- that is usually not the role of an executive or judicial entity in market capitalism, but that of commercial parties;
- executive and judicial authorities will not have access to the necessary information to determine what the relevant costs are.

Recent attempts to reduce strategic value from licensing fees may cause future issues, if the commercial practice of participating companies does include strategic value. It is unclear to what extent that is likely to occur.

The Commission has recently attempted to define excessive prices as any price that includes strategic value.⁴⁴ It remains unclear if the Commission and the ECJ are likely to employ strategic value in determining the value of a patent. With no indication forthcoming, companies should, at least, refrain from stating that the value of a particular patent relies on its strategic position. If some form of patent pool is used, companies should not differentiate between the value of individual patents and, instead, determine remuneration of patents in a pool in unison. If the value of patents for a company is determined purely on the number of patents in the patent pool, with the total licensing income of the pool portioned out based on each company's share of patents, it seems unlikely that competition law will be violated.

Static or dynamic standards?

It may be beneficial for standards to be dynamic instead of static. The current regulations and soft law do not provide adequate clarity on several issues:

- the extent to which interoperability and general efficiency, gained by continuously integrating innovative technology into the standard, reduce competition law risk;
- the status of innovative technology as essential to an already developed or nearly completed standard;⁴⁵
- the grounds under which innovative technology, at a later date, may or must be integrated into a standard;
- the appropriate licensing regime pertaining to dynamic standards.

Large parts of the legislative gaps and subsequent solutions to these gaps depend on the uncertain future development of the specifications. Should makers of a standard wish to keep their legal options open, standardising companies should take the possibility of future IPR having relevancy for a standard into consideration when making FRAND commitments. The use of a patent pool could facilitate in making such commitments.⁴⁶ The need for a patent pool, however, also depends on the future development of a standard.

IP Neutral Specifications?

Technology or IP neutral specifications within a standard may influence the ease with which standards can be updated and the licensing arrangements of the standard. Competition law has no rules pertaining to these specifications. If these specifications are used, the following issues are relevant:

⁴⁴ Case T-167-08 ECLI:EU:T:2012:323 27 June 2012, Microsoft Corp v Commission

⁴⁵ Regulation may not be able to be specific for innovative technology. The current law, however, also does not provide general guidelines on this issue.

⁴⁶ For more information on patent pools, see section 3.7.

If a group of companies setting a standard-setting body wish to develop an HVDC standard that is IPR neutral, that body would in principle not risk violating competition law. This group could pursue the development of such a standard, insofar as the basic requirements of standardisation elaborated in subsections 3.2–3.3 are followed. Competition law, at the moment, has no specific law on IPR neutral standards. The real difficulty for IPR neutral standards lies in designing specifications that can avoid all IP protected processes. This is a technical challenge, not a legal one.

Technology neutral specifications may allow for the utilisation of trade secrets. The law leaves unclear to what extent that possibility is positive or negative from a competition law perspective.

This Whitepaper explains the difficulty of aligning trade secrets with standardisation. IPR neutral specifications may aid in the usage of trade secrets, by removing the necessity for all relevant competitors to share sensitive information to achieve interoperability. Competition law may be neutral on efficiencies gained in this manner, but it would judge harshly any standard that required trade secrets for its interoperability. Any standard that cannot achieve the required interoperability without trade secret information could still comply with competition law, by designing IPR neutral specifications.

Bilateral or pool-based licensing?

Licensing is key in facilitating the smooth development and usage of a standard. The parties developing HVDC technology (and their standards) need to decide whether to use bilateral or pool-based licensing. There is a general lack of clarity between favourability of bilateral licenses and technology pools, as well as on issues of overlap between technology pool licensing and its usage in standardisation.

Furthermore, it is not clear to what extent the possibility of increased coordination influences the legal risk pertaining to technology pools and whether/to what extent a possible reduction in transaction costs with technology pools influences the legal risk pertaining to technology pools.

The legislative gaps of this section are not addressed here, but all in section 4.3

4. IP LAW AND HVDC GRID DEVELOPMENT

Developers of technology protect their IP through various means. In the context of HVDC, the most important are patents and trade secrets. The way IP is protected may influence the ease with which interoperability may be reached. This chapter will explain further the role of IP law in HVDC grid development and will make recommendations.

4.1 Patents and Trade Secrets in HVDC Standards

Before delving into the specifics of patents and trade secrets, the difference between the two is explained.

Patents are publicly registered technical information that grants the owner of a patent a legal monopoly on a particular process or invention. However, not all technical information can be patented, and not all patentable information is patented.

Trade secrets are defined as:

- Secret, thus not, as a body or in the precise configuration and assembly of its components, generally known among or readily accessible to persons within the circles that normally deal with the kind of information in question;
- having commercial value because it is secret;
- subject to reasonable steps, under the circumstances, by the person lawfully in control of the information, to keep the information secret.

4.1.1 The Limits of Patents

While software and algorithms can be patented, if they solve a specific technical problem, patenting a particular invention can have downsides.

First, the process of filing for a patent, together with potential lawsuits from competitors challenging the validity of the patent, can consume an extensive amount of time and resources. Even after a patent has been granted, its precise scope may still be challenged later in infringement proceedings. If good prior art research has been conducted prior to filing, substantiated with a good research report from patent offices, the risk of a challenge will be minimal. But if that has not been done or if conducting that research was infeasible, a competitor may successfully challenge filed patents. In these circumstances, it can take quite a few years before the patent holder knows with certainty the extent of protection that the patent offers.

Secondly, the patented invention must be described sufficiently clear in the patent filing and in potential subsequent proceedings to offer sufficient information to third parties on the scope of protection the patent offers. That requires publishing that information in public registers that are available to its competitors. As a result and depending on the scope of the protection of the invention, competitors can find alternative solutions to the patented invention that are not covered by the patent.⁴⁷ The patent holder can prevent that by filing an opposition procedure during the filing of such an alternative patent, thus imposing costs on the competitor. Depending on the overlap between the novelty and inventiveness of the patent, deny a competitor their patent.⁴⁸ Filing a great many patents in terms that are as neutral as possible can thus reduce the likelihood that another company can utilise inventions that are covered under these patents or at least impose costs on the competitor should they try. But there is no way to prevent entirely the efforts of a competitor to gain a patent that achieves something similar, provided the new invention is novel and inventive enough on its own.

⁴⁷ Ideally, if company A wishes to compete with company B, company A will file a patent with a large scope that company B has difficulty avoiding. A broad scope implies that the patent filing only limits its invention to certain technical features if it must, thus keeping the scope of the patent as broad and neutral as possible. Concurrently or alternatively, company A could file many patent applications covering a variety of solutions in order to protect strategic technology. A single invention could result in many patents that describe a variety of different technical features. Even if not all possible solutions can be covered, such patents can still impose costs on company B to such an extent that it becomes more difficult for it to acquire a similar invention.

⁴⁸ Art. 94 EPC. The discussion becomes more complicated when the doctrine of equivalence is factored into the discussion. Through equivalence, the patent gains indirect protection, which depends to a large extent on the inventiveness and novelty of the patent. The scope and juridical value of a patent can be increased.

Finally, the ability to be novel or inventive in innovative markets is usually limited. Inventiveness implies that the invention has managed to expand on the prior art. In innovative, competitive markets, the room for a particular invention to expand on the prior art will usually be limited.⁴⁹ The closer competitors are to one another in terms of innovation, the closer inventions from these competitors are likely to be to one another. The time it takes to patent an invention in innovative environments and the speed with which new inventions are created can reduce the usefulness of a patent.⁵⁰

4.1.2 Patents or Trade Secrets?

A possible solution to the issues with patents could be to not patent an invention at all and instead rely on trade secrets.

Trade secrets can be protected from a variety of unlawful methods of acquisition. A trade secret may furthermore be commercially exploited in a variety of ways, often with a variety of safeguards in place. For example, companies can use black-boxing, whereby the use of the trade secret may be possible but all knowledge pertaining to the trade secret is kept in the hands its holder. Another example can be the use of an extensive confidentiality agreement, with large sanctions in place for violations. This information protected by trade secrets cannot be licensed in a similar manner as with patent law. This leaves a lot of commercially sensitive information that exists outside the scope of an ordinary license. From a licensing perspective, this is an issue, as the value of this information relies on its relative secrecy. Depending on the nature and scope of technically important and commercially sensitive information, it may become difficult to effectively standardise. If companies either have or develop technology that is only partly patented or patentable, the mere use of the patented information may not be sufficient to achieve interoperability. Nor may a company be willing to share that information broadly because its protection relies on relative secrecy.

Depending on the amount of trade secrets and their necessity to make patented solutions work (optimally), the licensing framework needs to shift. Pool-based licensing seems unfeasible, considering the requirement that the information must not generally be known by the relevant industry. Bilateral licensing could better facilitate some sharing or utilisation of trade secrets or other relevant know-how.⁵¹ Even if relevant legal arrangements can be made, the trade secret cannot be fully integrated into the standard. The required secrecy prevents it. It can only be an attachment to a bilateral license related to patented technology that has been adopted into the standard.

⁴⁹ R. Cappelli, M. Corsino, K. Laursen, S. Torrisi, Technological competition and patent strategy: Protecting innovation, pre-empting rivals and defending the freedom to operate, *Research Policy* 2023/52/6

⁵⁰ It is important to mention here that the granting of the patent does not immediately allow a company to commercialise that patent. It can take additional years before a company can industrialise, utilise, and then appropriately market its invention. Until then, a company cannot begin to recoup its investment.

⁵¹ Other know-how refers to information that cannot fulfil the definition of trade secrets or patents, but can still have use for a company.

For MVMT HVDC components — with the applicable software being appropriately black-boxed — trade secrets can be a viable alternative to patent protection.⁵² The input or the output of the black-box can be measured, but the technical invention within the black-box cannot. For dynamic markets, the use of trade secrets, so long as it remains feasible to black-box these secrets, constitutes a valid alternative to patents.

Within the context of standardisation, however, trade secrets have some distinct drawbacks. Standardisation, as elaborated on previously, requires voluntary technical or quality specifications with which current or future products, processes, or services comply. Standardisation requires extensive deliberation by relevant experts to set the specifications in such a manner that interoperability can be reached. The specifications within a standard and the relevant IP must be provided or licensed under FRAND terms, the exclusion of which constitutes a violation of competition law.⁵³ Under the current law, there is no impediment to companies providing the full extent of their knowledge to all third parties wishing to access a standard, but doing so would likely cause trade secrets to lose their *de facto* protection.⁵⁴ Simultaneously, the requirement for FRAND licensing under ordinary licenses cannot allow companies to protect trade secrets in such a manner that restricts effective competition, both within the standard and with possible competing standards. If it were otherwise, a single vendor could monopolise a solution that is necessary to allow other third parties to gain access to the standard.⁵⁵

As a result, there is currently no clearly laid out path in the regulatory framework that aligns all of the following aspects: standardising, providing trade secrets to third parties in a FRAND manner, multilateral setting (if that is required to use the standard) and retaining the *de facto* monopoly that trade secrets provide. To determine if the legal risks associated with trade secrets in a standardised context prevent their use, this Whitepaper will explore the perceived tensions from an IP law and a competition law perspective. The focus will be on FRAND access, interoperability, and the enforcement of trade secrets.

4.2 FRAND Access and Trade Secrets

A hypothetical scenario: If a standard-setting organisation for MVMT HVDC systems were to agree to specifications that only include specifications covered by trade secrets, what options would remain to ensure FRAND access?⁵⁶ The available options regarding the need for FRAND access depend on technical aspects within a standard. If the specifications of a standard are sufficiently open to multiple technical

⁵² Black-boxing refers to keeping relevant information technology—through a variety of technical means—contained. Such technical approaches prevent third parties from acquiring information, even if they were to attempt it.

⁵³ It is only a violation if the firm holding the patent made a binding licensing commitment during the course of standardisation. Third-party IP can be withheld, even if that were to ruin the standard. See paragraph 6.

⁵⁴ The requirement for open access to a standard seems incompatible with the requirements of relative secrecy necessary for the definition of trade secrets.

⁵⁵ With patents, there is a mature legal system in place for multi-lateral licensing that is recognised by the Commission as in principle compatible with competition law. See paragraph 9. For trade secrets, no such recognition exists. The extent to which EU competition law allows IP holders to use trade secrets to monopolise or monetise their solutions in a standard-based setting is therefore uncertain.

⁵⁶ It is not likely that such a standard can feasibly exist, but using it as an example can be useful for clarification's sake.

solutions and if multiple companies participating in the standardisation signal that they are capable of achieving these specifications, the need for FRAND access of trade secrets to direct competitors will be removed. The open specification would allow companies to compete within the standard and against other standards, which is positive from a competition law perspective. Neither will companies lose trade secret protection, as all relevant components can remain black-boxed. But this hypothetical rests on two conditions: that the specifications are sufficiently open to multiple solutions and that multiple companies can provide those solutions. If only one firm has the solution for a specification in the form of a trade secret, FRAND access remains necessary for that particular solution. If such a situation occurs multiple times — such as multiple firms having the solution for a given specification within a standard that ensures interoperability — then all relevant undertakings must provide FRAND access for these specific solutions.⁵⁷ To do otherwise would likely constitute a violation of EU competition law.⁵⁸ The safest way of employing trade secrets within a standard that still complies with EU competition law rests on the specifications being sufficiently open in order to allow companies to each create their own solutions for the specifications. If that cannot be done, FRAND access by the participating standardising firm will be necessary to ensure an open standard.⁵⁹

It is unclear to what extent EU competition law allows trade secrets to be monetised when granting FRAND access. The nature of a trade secret allows bilateral licensing, which implies that monetisation is a right of the trade secret holder.⁶⁰ In a standardised context, however, EU competition law leaves uncertain whether that is possible. Case law from the European Court of Justice implies that information which is strategically valuable must be.⁶¹ The definitions of a “trade secret” and “strategic value” somewhat overlap. A future interpretation of FRAND access regarding trade secrets might therefore require a vendor to provide valuable information to third parties, potentially without (significant) compensation. The requirement of FRAND access for trade secrets within a standardised context brings with it significant organisational difficulties. Firms would have to be aware of the trade secrets necessary to use the standard, insofar as they possess solutions to specifications others lack, and would have to sign appropriate non-disclosure agreements (NDAs) with each firm that holds a relevant trade secret.⁶²

⁵⁷ The larger the number of specifications that can only be fulfilled by one single firm, the greater the difficulty in arranging appropriate contracts and NDAs for all relevant parties.

⁵⁸ See gap analysis paragraph 3.3-3.4 on FRAND access. Only if every firm has independently acquired the solution to all specifications can a violation of competition law be avoided.

⁵⁹ Unlike with patents, there is not a clear reference to FRAND requirements under the EC guidelines to horizontal cooperation with trade secrets. But given the similarity of a firm participating in standardisation not allowing other companies to use their solution in a patent context, it seems reasonable that the same requirements for FRAND access are applied to trade secrets.

⁶⁰ Both Directive 2016/943 and the art. 39 Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIP) consider licensing or sharing as an option, which in a commercial setting will usually require some form of compensation.

⁶¹ See section 3.3.

⁶² If the firm sharing information wishes to be remunerated for its knowledge, the problem of valuing this information within a standardised context comes into play. In paragraph 6.2, the gap analysis mentions a

A risk of sharing (sufficiently large amounts of) information contained within a particular trade secret with direct competitors lies in the loss of commercial value of that information. Even with appropriate NDAs in place, sharing trade secreted products still discloses that information. If the specifications within a standard do not require sharing information or only limited amounts of it—thus keeping the most important information within a black box—there is most likely no issue. The secrecy is maintained and thus the value is maintained. But if enough information is shared to the point where a competitor can determine the contents of the black box, the commercial value of the trade secret may be lost.⁶³ Much will depend on the future interpretation of commercial value within trade secrets by the ECJ.⁶⁴ Specifications with multiple approaches to technical problems may not be able to prevent that loss of commercial value. If MVMT HVDC systems cannot be interoperable without sufficiently large amounts of shared information between different components, FRAND access must be granted to ensure compliance with competition law. If technical reasons compel information to be shared to maintain interoperability—with trade secrets becoming known to direct competitors as a result—it may not be possible to align FRAND requirements with trade secret protection. Vendors would do well to regularly take stock of the specifications of a developing standard and consider whether these specifications force them to divulge trade secrets to retain interoperability. If so, then these specifications should be altered, if at all possible. Declining to do so is not a violation of competition law, but it would make it infeasible to both reach interoperability and retain trade secrets. Attempting to integrate trade secrets into a standard – whilst attempting to maintain trade secret protection – likely would violate competition law.

If the information contained within trade secrets must be shared with actors who are not in direct competition are not lost if sharing the trade secret does little to affect its commercial value. Within innovative markets, the value of trade secrets lies in direct competitors not knowing the trade secret.⁶⁵ Thus, if direct competitors gain knowledge of the trade secret—even under an NDA—the value of the

recent ECJ case forbidding the remuneration within a standard for information that is strategically valuable. It is possible that this ruling applies to trade secrets, though it cannot be said with any degree of certainty. For more on NDAs see section 4.5 on enforcement.

⁶³ Recall that the definition of a trade secret requires that the information within the trade secret has commercial value through its secrecy (art. 2 (1b) Directive 2016/943). If the commercial value of a trade secret relies on it being kept secret from direct competitors, such value might be lost if, through standardisation, direct competitors learn the trade secret.

⁶⁴ The lack of case-law makes this difficult to confirm. But, depending on the interpretation the ECJ follows, commercial value within the directive could be interpreted negatively or positively for the trade secret holder. If (enough) direct competitors learn a trade secret, that could be interpreted as losing the trade secret. A different reading, one reliant on recital 14 of directive 2016/943, puts the emphasis on the unlawfulness of the trade secret use. The recital might be interpreted to mean that lawful use of the trade secret cannot damage the commercial value as defined under art. 2 (1b). With such an interpretation, knowledge of the secret may be allowed by direct competitors without fear of losing the trade secret. The recital may also be interpreted, however, to aid understanding of when unlawful disclosure of the trade secret is protected.

⁶⁵ In Recital 14 of Directive 2016/943, the directive refers to commercial value: "Such know-how or information should be considered to have a commercial value, for example, where its unlawful acquisition, use or disclosure is likely to harm the interests of the person lawfully controlling it, in that it undermines that person's scientific and technical potential, business or financial interests, strategic positions or ability to compete".

trade secret may be lost. In the context of access to the trade secret for third parties, however, the value is not lost. For MVMT HVDC systems, for instance, vendors or research institutes hold trade secrets to compete with one another, not with TSOs. Sharing trade secrets with TSOs therefore does not reduce the commercial value pertaining to a firm's ability to compete.⁶⁶

A complicating factor for using trade secrets to fulfil specifications within standards concerns the lack of an established way to share trade secrets in a manner similar to technology pools.⁶⁷ Technology pools allow for licensing to any number of standard users through one patent pool. While potentially difficult to set up, technology pools provide easy access to the relevant IP to all potential standard users. Currently, there is no established regulation, case law, or soft law providing for pools of trade secrets, nor any law on the impact of such multilateral agreement on competition law. Existing commercial practice would require a significant shift to accommodate such sharing agreements. Should the specifications or the requirement for interoperability not allow for sufficient technical secrecy, the FRAND requirement of EU competition law would remain. The lack of a clearly defined multilateral legal arrangement for sharing trade secrets will require substantial effort from the participating companies to solve, if it can be done at all. Without such a regime, all prospective users of a standard require bilateral contracts and NDAs from each party in possession of relevant trade secrets.

To what extent do the practical requirements of non-disclosure agreements coincide with the requirement of FRAND licensing terms?

In principle, FRAND licensing terms and non-disclosure agreements are compatible. The main issue of trade secrets lies in their integration within a standard as a replacement of patents, which competition law would likely sanction.⁶⁸ If these issues are avoided, a vendor could use a non-disclosure agreement in unison with FRAND licensing terms.

Trade secrets are not part of a standard. Does competition law allow the standardisation process and the selection of specifications to be influenced by trade secrets?

Neither the ECJ nor the Commission has dealt with this issue before. Even so, it seems very unlikely that competition law would look favourably on trade secrets influencing specifications. For HVDC standards to

⁶⁶ Ibid. If commercial value must be read as a vendor's ability to compete on financial, technical, or strategic grounds, competition would occur for third parties, not with them. Nevertheless, NDAs remain advisable.

⁶⁷ In theory, such an agreement may be concluded by multiple companies. The effort to do so would likely be difficult and time-consuming due to the need to locate all relevant information, agree on the terms for sharing, and then effectively enforce the agreement with several competitors. In the meantime, the risk regarding the loss of the trade secret due to over-sharing would remain in place. The trade secret directive allows companies to share information without losing the trade secret (art. 4 (3) Directive 2016/943). But due to the directive containing a fair amount of references to highly contextual norms and the lack of EU case-law, it is difficult to say when the sharing of a trade secret causes it to lose its status.

⁶⁸ This issue will be described in more detail in the next sections.

avoid unwanted attention from competition authorities, it is advised that all specifications are designed so to avoid making trade secrets necessary.⁶⁹

The Commission might frown upon licensing fees that depend on strategic value. Does the secret nature of a trade secret constitute strategic value in terms of excessive licensing fees?

Considering the state of the ECJ's case law and the Commission's guidelines, there is no way to know for certain whether trade secrets fall under the scope of strategic value. Possible solutions to this problem of strategic value rely on avoiding the issue altogether. See section 4.3.

Before this Whitepaper delves further into what separates trade secrets and patents, a brief overview will be presented on the factors that justify the legal monopoly of patents. Afterwards, the difficulty of relying on trade secrets from an intellectual property perspective is explained. Algorithms—and, more broadly, software and mathematical formulae—cannot be patented directly. But an invention solving a particular technical problem can. In accordance with article 52 of the European Patent Convention (EPC), European patents shall be granted to any inventions, in all fields of technology, if they are new, involve an inventive step, and are susceptible to industrial application.

Novelty, in accordance with the article 54 of the EPC, requires an invention to not form part of the prior art, otherwise known as the state of the art. Article 54(2) of the EPC considers the prior art to comprise everything made available to the public by means of a written or oral description, by its use, or in any other way, before the date of filing of the European patent application. The examiner of the European patent office establishes the prior art pertaining to the technical field wherein the invention is used. If the invention cannot be found within the currently available prior art, novelty will be present.

Novelty determines whether a particular invention is new. To determine the scope—i.e., the power to enforce that patent against others—it is furthermore necessary that the invention is inventive. Inventiveness means nothing more than the following: Is the way the invention reaches a technical solution non-obvious to the relevant expert, i.e., surprising to them. There are a variety of ways to determine, without the benefit of hindsight, when an invention is inventive. One method is the problem-solution approach, whereby the closest prior art is first established (usually elucidated through the prior art investigation conducted by the European patent office) and compared to the technical solution the patent claims. Then, the innovation between the prior art and the new invention is compared to see whether the technical solution of the invention is non-obvious. The greater the inventiveness of the patent, the stronger its juridical value will be. The greater the novelty is, the greater the scope of protection the patent provides. The novelty and inventiveness of an invention together determine the usefulness of a patent.

4.3 Interoperability and Trade Secrets

⁶⁹ Some trade secrets may remain in use when vendors use the standard. So long as these are not necessary for the standard to achieve interoperability or if all vendors possess their own suitable trade secrets, there is no competition law issue. There may be issues of trade secret protection, however. These issues will be analysed in greater detail below.

The second difficulty regarding the use of trade secrets within a standard concerns interoperability. Interoperability mostly raises technical problems, but some issues on interoperability and sharing information might be solvable with legal solutions. Without interoperability, standards would serve no purpose. Within the context of MVMT HVDC systems, all the technical components and software that were once provided by a single vendor will have to work in a system where all components (can) come from different vendors. The system, in more technical terms, must change from a point-to-point system to a MVMT system. To allow all the relevant components and software to operate within one single system, a standard must create specifications that take the interoperability within a MVMT HVDC system into account. If different components must “communicate” with other components or software, the specifications must be appropriately adjusted for that task. That is not a legal but a technical issue. The legal issue here lies in the type of information that is being shared. If the information being shared is a patent, the legal regime is well suited to facilitate its sharing.⁷⁰ For trade secrets, as previously mentioned, the legal framework is less developed. Previously, the lack of a developed IP law framework for trade secrets was not an issue for HVDC firms. Rather than using legal solutions, firms rely on technical solutions to black-box trade secrets. Any systems that interact with the black box cannot see what processes are at work within the black box.⁷¹ In a MVMT HVDC context, it is an ongoing process to determine to what extent it is possible to keep the relevant information in a black box, whilst still facilitating interoperability.

If assumed that all the relevant components and software can remain appropriately black-boxed, then the objective of interoperability can be aligned with the objective of trade secret protection. If, however, interoperability cannot be achieved with the level of secrecy vendors require to secure their trade secrets, legal measures are required. The use of NDAs with all parties that a firm shares a trade secret with can make the disclosure of the trade secret unlawful. A vendor sharing trade secrets with third parties via appropriately constructed NDAs may not lose its trade secrets due to the required interoperability.⁷² Having said that, the lack of case-law does mean that there can be no certainty on this issue. NDAs do not automatically prevent a competitor or third-party from learning from the trade secret of the competitor.⁷³

⁷⁰ Section 3.6.

⁷¹ It may also be possible to design the relevant software through a collaborative effort, with an agreement in place allowing participating companies to use the developed software.

⁷² Per art. 2 (1c) & 3 (1b) Directive 2016/943, trade secrets that have entered the public domain or have not been subject to reasonable steps to keep them secret can be used by anyone. The precise scope of when something enters the public domain or when a firm has not expended enough effort in keeping the secret is difficult to determine in general. The text does not provide clear answers, and there is a lack of case-law at the EU level that specifies it. The recital in the directive provides some interpretative aid. In recital 1-4 & 8, the need to realise innovation and usage of trade secrets is mentioned. If (certain aspects of) trade secrets are shared with other parties under strict NDAs, it seems plausible that future European Court of Justice case-law will take the need to innovate into consideration when interpreting certain law. For instance: when has a secret entered the public domain or the reasonable effort required to keep something secret.

⁷³ Though the lack of case-law makes it difficult to determine, the protection of a trade secret may depend on what was done with the information. If the trade secret is copied, there is no room for doubt regarding the protection a trade secret holder is due. But if a competitor merely learns from a trade secret to produce new technology, whether the protection is due will depend on the terms of the NDA and the differences between the technology. Reverse engineering clauses are essential here, though it will remain difficult to determine when a competitor has used reverse engineering on a trade secret to improve its own technology.

The lack of clear law at the EU level necessitates considering the application of trade secret law—including unfair competition law in general—in each Member State to determine the precise protection a trade secret can offer and the usability of these secrets in commercial transactions.

4.4 Trade Secrets and Enforcement

A favourable interpretation of trade secret protection does not necessarily result in adequate enforcement of that protection, especially at the national level. The trade secrets directive provides for legal remedies in general terms. The enforcement of trade secrets must be fair and equitable, occur within a reasonable timeframe without unnecessary complexity, and be effective and dissuasive.⁷⁴ A large body of literature describes what effective enforcement of EU law at the national level ought to look like.⁷⁵ But EU law has not harmonised national procedural law in this area. With enforcement being a part of procedural law, the trade secrets directive limits itself to proscribing certain goals, without dictating how these goals must be met.⁷⁶ As a result, the precise enforcement of trade secrets within the EU largely depends on national procedural law, which will be different for each Member State. The ability of trade secret holders to request evidence, the burden of proof for violations, and the legal remedies a trade secret holder can request will therefore vary. The legal uncertainty associated with the differences in enforcement may hamper the ability of a trade secret holder to adequately enforce its trade secrets or to investigate possible violations. Companies wishing to enter into agreements and NDAs to facilitate trade secret protection should be aware of these enforcement differences and which EU jurisdiction has the most favourable protection of trade secrets and should ensure that the trade secret holder has the right to request or gather evidence necessary to determine whether a violation of the NDA has occurred.

The enforcement of trade secrets in the EU is complicated due to the requirement of having unlawfully gained the trade secret from its holder. With patents, the information behind an invention must be described in sufficient detail. The information behind the invention will therefore be public knowledge. A license for the patent does not grant the ownership of that information to a third party, but simply allows its use. It does not matter if another company used that same process previously because the patent grants a legal monopoly to whomever files for the relevant patent first. In enforcement proceedings, a patent holder will thus only have to prove the encroaching invention is similar enough to its patent.⁷⁷ Unlike with patents, the information behind a trade secret invention is not public knowledge. The protection of the right relies on relative secrecy, with disclosure being protected via NDAs and other reasonable efforts to maintain secrecy. In enforcement proceedings, the trade secret holder will have to

⁷⁴ Art. 6 Directive 2016/943.

⁷⁵ See, e.g., G Bacharis & S. Osmola, “Rethinking the Instrumentality of European Private Law”, ERPL 2022/3. P. Gliker, “European Tort Law: Five Key Questions for Debate”, ERPL 2009/3 & H.W. Micklitz, “The Transformation of Enforcement in European Private Law: Preliminary Considerations”, ERPL 2015/23.

⁷⁶ The relation between the trade secrets directive and the general enforcement directive of IP law (Directive 2004/48 on the enforcement of intellectual property rights) is still unclear.

⁷⁷ There is a limited right for a firm to continue to use the process described in the patent in some Member States (see art. 55 Rijksoctrooiwet for a Dutch example). The burden of proof, however, is high, and that firm can only use the process for itself. It cannot be licensed to others. The practical relevance of the right is limited.

prove that another firm acquired relevant information from one of its trade secrets.⁷⁸ A complicating factor for that legal proof is that the other firm may have been unaware of the status of the information of the trade secret or that this other firm may have independently discovered the information contained in the trade secret. Extensive NDAs with precise details on how a trade secret can be used — with sufficient detail for the opposing firm to determine what the scope of trade secrets is — may help with that legal proof.⁷⁹ Special attention should be given to clauses forbidding reverse engineering.

4.5 Trade Secrets & Patents in a Standard

All relevant current or future processes that can facilitate MVMT HVDC systems will likely not all fit neatly into the definition of either patents or trade secrets. A firm may be limited in filing for a patent. As explained previously, patents on software that do not provide a solution to specific technical problem cannot be patented. Should such software have a use for MVMT HVDC systems, a firm will only have the protection afforded through trade secret law. A firm may also not want to patent an invention. It may make more commercial sense to forgo a legal monopoly—and the required publication of the invention—and choose *de facto* protection through trade secrets.⁸⁰ Different commercial considerations may move a firm to file a patent. A particular invention might require active enforcement against its competitors, which trade secrets cannot facilitate if a competitor independently develops its own similar invention. Or a firm may consider that the enforcement of trade secret protection for a particular invention it wishes to license is inadequate, thus necessitating the status of a patent for proper commercial use. Depending on the precise legal limitations or commercial considerations a firm has, the processes necessary to make MVMT HVDC systems function can be split between two forms of IP: patents and trade secrets.

Companies in innovative industries will typically have a combination of patents and trade secrets covering their commercially valuable information.⁸¹ Through a combination of trade secrets and patents, it is possible to protect valuable information beyond the period for which a patent is granted. A firm usually achieves this either by not filing a patent for all the inventive technical solutions necessary to solve a particular problem or by only claiming a limited protection scope covered by the patent. This results in a series of patents, which do not contain all the necessary information to solve a particular technical problem. The legal monopoly of a firm will prevent the use of the patented solution, which will remain useful until another firm has invented a sufficiently different solution.⁸² The remaining information contained within a trade secret can then be of use to extend the *de facto* monopoly a firm has on a

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⁷⁹ A firm will then also have more difficulty claiming ignorance.

⁸⁰ There is some literature on what might motivate companies in a commercial context to choose either patents or trade secrets. For an overview, see K. Sim, “optimal use of patents and trade secrets for complex innovations”, IJIO 2021/79 & Belleflamme, Paul & Bloch, Francis & Bloch, “Dynamic Protection of Innovations Through Patents and Trade Secrets” Center for Operations Research and Econometrics 2013.

⁸¹ K. Sim, “Optimal use of patents and trade secrets for complex innovations”, IJIO 2021/79.

⁸² The length of a patent in the EU is ostensibly 20 years, but in innovative markets the actual protection will be much shorter. The specific patented solution to a problem becomes outdated significantly before the 20-year period expires. That of course implies that other patents cannot block the invention. Continuously filing a large number of patents can cause an opposing firm difficulty in overcoming all of them.

particular solution. Should innovation be sufficiently rapid within a market, this combination of trade secrets and patents can safeguard the most recent—and therefore most valuable—information a firm has.

A mixture of patents and trade secrets within a standard allows for a more flexible standardisation approach. Depending on either a lack of openness regarding a specification to multiple solutions or the inability of sharing information whilst retaining appropriate black box secrecy, it may be infeasible to rely on trade secret protection.⁸³ If the trade secret is patentable, a firm can avoid legal uncertainty associated with trade secrets and instead rely on the more developed licensing regime available to patents.⁸⁴ If, however, interoperability can be secured without sharing (sufficiently large parts of) a trade secret or if the ability to black-box can be maintained, a firm may instead opt for indefinite trade secret protection. Splitting inventions up into patents and trade secrets may, additionally, grant a firm higher protection than having one form of IP for one particular invention.⁸⁵ Companies participating in HVDC standardisation can take advantage of the option described here, provided the firm is sufficiently aware of its IP portfolio.

The use of both trade secrets and patents within a standard can require bilateral or multi-lateral agreements. For patents, it is possible for a standard-setting organisation to require the use of a technology pool.⁸⁶ If the specifications do not allow for vendors to create their own solutions to particular problems or if the specifications are not sufficiently IP neutral, the large-scale deployment of the standard may require the use of technology pools.⁸⁷ Trade secrets, as shown in the previous sections, may face a variety of legal risks if they are shared in a multilateral context. To avoid potential risk, it may be prudent to only use bilateral contracts when divulging trade secrets necessary for ensuring FRAND access and interoperability. The use of two different information-sharing models—bilateral or multilateral—will require additional coordination from IP holding parties. They must first determine the technology pools for patents and all relevant issues that come with it.⁸⁸ IP holders must subsequently consider the bilateral divulging of trade secrets to standard users, if that is necessary for interoperability or FRAND access. The greater the success of the standard and the greater the number of participants requesting to use the standard, the more cumbersome this arrangement may become.

4.6 Conclusion and Recommendations

⁸³ See the previous sections.

⁸⁴ This does of course imply that the trade secret is patentable. Only inventions that solve a particular technical problem are patentable.

⁸⁵ Note that this option must still comply with the requirement of FRAND access and interoperability mentioned above.

⁸⁶ For greater detail, see Communication from the Commission — Guidelines on the application of Article 101 of the Treaty on the Functioning of the European Union to technology transfer agreements, para. 244 et seq.

⁸⁷ With IP neutrality, this Whitepaper refers to specifications that largely avoid patented inventions. See section 3.6.

⁸⁸ Think of the following: profit-sharing, obligation to include new patents, determining the value of patents, determining inclusion of new participants, etc. See also A. Ishihara, N. Yanagawa, “Dark sides of patent pools with independent licensing” IJIO 2018/57.

In HVDC grid development and standardisation, it is relevant to understand which inventions, information, and algorithms are patented and which are part of a trade secret, as this choice has consequences. Especially when we move from turn-key systems of one vendor to a multi-vendor situation in which not everything can remain secret, it may be necessary to change the approach to IP protection. There are some remaining issues and recommendations.

Switching between trade secrets and standards

At time of writing, it is unknown to what extent future specifications will allow software processes contained within trade secrets to remain appropriately black-boxed within a standard. If black-boxing does not offer suitable protection within a future standard and sharing information through the standard is required to ensure interoperability, **vendors should consider to what extent the relevant trade secrets can be turned into patents.**

The ability of a vendor to convert a trade secret into a patent can be a useful tool to avoid the legal risks associated with relying on trade secret protection. The specifications within a standard and the perceived commercial risk play a role in determining when a vendor should consider that. The previous sections on FRAND access and interoperability show that **this decision should be taken on a case-by-case basis, with the vendor being aware of the scope of the trade secret, the need to enforce it against competitors, and the specifications of the standard.**

EU competition law and trade secrets

EU competition law's relation to licensing patents is well-defined, allowing companies to provide licenses in multilateral contexts without concern for losing their IPRs. EU competition law's relation to the licensing of trade secrets is not well-defined. Both the question of monetisation and FRAND access within standards are unclear, resulting in a large legal grey area. If information must be shared in a FRAND manner and if a vendor has the ability to do so, a vendor should therefore consider changing an essential trade secret into a patent to allow for more secure licensing. **It would be useful for this sector if the status of trade secrets in standardisation is, from a competition law perspective, further clarified by the European Commission.**

Sharing trade Secrets and NDAs

Trade secrets must only be shared if the specifications within a standard choose a specific solution that only one vendor has, which is then contained in a trade secrets.⁸⁹ To avoid the legal uncertainty associated with FRAND access, **a standard-setting organisation should choose specifications that are sufficiently open to multiple approaches.** Input from vendors could allow a standard-setting organisation to know which specifications are to be avoided.

⁸⁹ If only one vendor has the solution to a particular specification, then other vendors require that solution if they are to use the standard. If that solution is patented, then vendors can acquire (the right to use) the solution through a license. Trade secrets, however, likely cannot be integrated into a standard without losing legal status. A vendor will thus be unable to integrate trade secrets into a standard without protection. That lack of protection makes it unlikely that a vendor will choose to integrate information into a standard. It is therefore better that no specification is chosen that can only be fulfilled by one company's trade secret.

If sharing trade secrets cannot be avoided (for example if black-boxing does not work), it is necessary to compel each party that requires access to a trade secret to **sign appropriate NDAs**. Clauses forbidding reverse-engineering, experimenting, or any other use than what is strictly required for the standard are highly encouraged.

Licensing can occur in a pool-based model or through bilateral licensing. Bilateral licensing has some basis in EU intellectual property law, though none in EU competition law concerning standards. Sharing trade secrets in a standardised context through a pool-based model currently has no basis in either EU competition law or intellectual property law. **If sharing trade secrets cannot be avoided, the safest option for licensing trade secrets is the more established bilateral licensing option.**

The lack of an established pool-based licensing option for trade secrets complicates licensing arrangements, particularly if a standard becomes popular. It is possible to license patents in a pool-based system, with trade secrets being licensed on a bilateral basis. A solution covered by both patents and trade secrets may increase the difficulty of licensing under FRAND terms whilst retaining trade secrets. **A standard-setting organisation should either set specifications in such a manner that there is limited overlap between solutions covered by trade secrets or patents, or otherwise inform vendors of the risk of combining solutions between two forms of IP.**

The role of national law

The definition of trade secrets is harmonised in Directive 2016/943,⁹⁰ but that harmonisation largely remains confined to a general definition and a few articles that expand or restrict the scope of trade secret protection.⁹¹ The procedural law that determines the enforcement of trade secrets largely is not harmonised in EU law. Aspects — such as a trade secret holder’s ability to request evidence, the burden of proof for violations, and the legal remedies available to a trade secret holder — are all dependent on national procedural law. **Vendors should inquire about the procedural law of Member States pertaining to trade secret enforcement and choose appropriate national law for enforcing their trade secrets when entering into commercial contracts for specific projects.**

The lack of available case-law at the EU level leaves much uncertainty about the definition of trade secrets and the use of trade secrets in a standard. National unfair competition law may be able to provide protection within the gaps EU law leaves national law. **Vendors should inquire about the state of national unfair competition law and the definition of trade secrets at the national level when entering into commercial contracts for specific projects.**

⁹⁰ Directive (EU) 2016/943 on the protection of undisclosed know-how and business information (trade secrets) against their unlawful acquisition, use and disclosure, OJ L 157, 15.6.2016.

⁹¹ See for instance art. 3 (1a) Directive 2016/943, which determines the rights of workers to information and consultation cannot be hindered by trade secrets. See also art. 4 (2) Directive 2016/943, which describes in general when trade secret acquisition is unlawful.

5. RISKS AND LIABILITY

The change in roles, duties, and responsibilities in HVDC projects with multiple vendors and multiple owners has a significant impact on liability and warranty in the overall system.

5.1 System Design – Impact on Liabilities

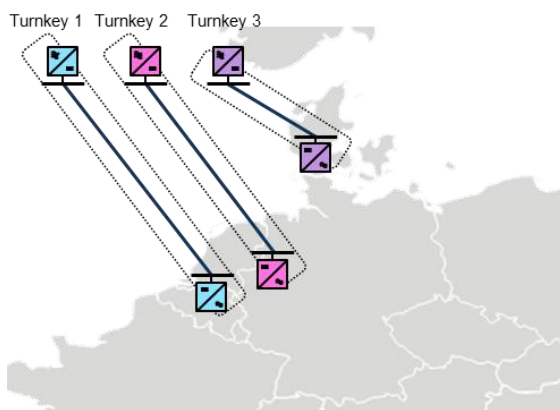
5.1.1 Independent Turn-key HVDC Projects

Today, point-to-point and a few multi-terminal HVDC transmission systems are built or under construction as single-vendor turn-key projects. The system owners (TSOs or others) specify the system as a whole. Interfaces at the AC grid connection or access points are defined in harmonised network codes for the AC grid connection for HVDC systems, providing a clear legal framework.

In such turn-key projects, as shown in Figure 1 (left), the contractor (e.g., an HVDC vendor) is responsible for the design and execution within the boundaries that are set by the system owner. The contracts typically include engineering, procurement, and construction and even installation (EPCI).

Consequently, the contractor is liable for defects in design as well as for installation and commissioning. If during this or a later phase, the system is not providing the guaranteed performance according to the contract, the owner can recover costs related to damages or downtimes from the contractor as dictated by the specific project contract conditions.

INDEPENDENT TURN-KEY POINT-TO-POINT HVDC SYSTEMS



DISTRIBUTED MVMT HVDC SYSTEMS

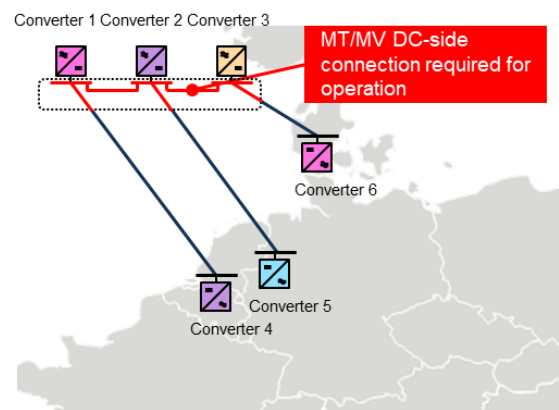


Figure 1 From independent turn-key point-to-point (left) to distributed (right) MVMT HVDC systems

5.1.2 Distributed Multi-Terminal HVDC Systems

Moving from single-vendor turn-key HVDC systems to MVMT systems will shift part of the design and execution responsibility from the manufacturer to the owner and operator of the DC grid. Owners and

operators will need to individually specify each module (e.g., converter stations), as indicated in Figure 1 (right), while being liable for the performance and the security of the overall system. Figure 1 is only meant only for illustration. When interconnected systems span across different synchronous zones on the AC side, the issue of liability for potential interactions in onshore AC systems must also be considered. This includes assessing and defining the extended liability boundaries and potential consequences that may arise due to these interactions. In case of design errors — in particular related to the interoperability of different modules — the entire system might not be able to operate.

To derive liabilities, the roles and responsibilities of all involved parties need to be clearly assigned and mutually respected. Procurement process and contracts that adequately allocate liability and warranty risks within this new context need to be formulated. Therefore, TSOs and manufacturers are needed to derive the risks—especially liability risks—arising from MTMV connection for all phases of a project. This includes:

- design and procurement
- engineering and commissioning
- operation and maintenance
- refurbishment and decommissioning

5.1.3 DC-side Connection of Turn-key P2P HVDC Systems

As the roles and responsibilities of the different parties and accordingly risks and liabilities in fully distributed multi-vendor systems are not defined yet, owners might be locked into realising single-vendor systems, regardless of the benefits of multi-vendor systems.

Moreover, despite the benefits of MTMV HVDC system, their development must not endanger other core tasks related to the energy transition:

- Offshore HVDC systems must reliably transmit wind energy to shore;
- Onshore HVDC corridors and interconnectors must transmit bulk power between new (renewable) generation and load centres;
- HVDC projects need to be realised in time and the execution times shall not be extended.

A feasible way to reduce the risk associated with MVMT HVDC systems is to interconnect turn-key systems, as shown in Figure 2. In case problems should occur with the connection of systems from different vendors, the system can be separated and fall back into turn-key subsystems. Thus, the risk of outages of the entire system can be reduced and possible interoperability issues can be solved with the exercise of the appropriate amount of diligence.

Such a setup might result in the allocation of roles, risks and liability, which needs to be taken into consideration in the overall legal framework.

DC-SIDE CONNECTION OF TURN-KEY POINT-TO-POINT HVDC SYSTEMS

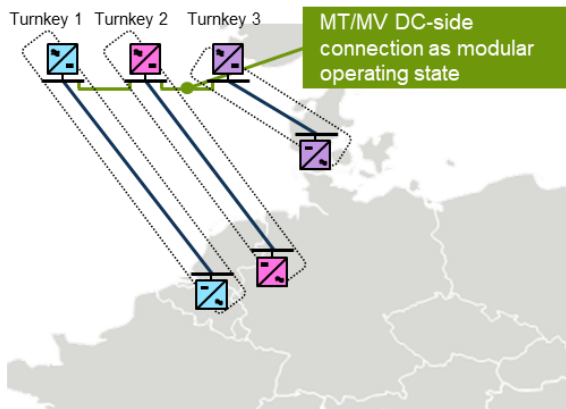


Figure 2 Step in between: DC-side connection of turn-key point-to-point HVDC systems

5.2 Risk allocation and Shift of Liability

In Deliverable 2.1 of Ready4DC, several gaps were identified that needed to be addressed in order to pave the way from turn-key to distributed MVMT systems. Within this document, the following steps are discussed in more detail:

- To define and allocate liabilities and warranties, risk allocation and system responsibilities need to be defined for the different scenarios outlined in the deliverable for all relevant project phases.
- Principles determining liability and warranty assignment in the event of malfunctioning and interoperability issues must be derived.

5.2.1 Project Preparation

5.2.1.1 System Design

In multi-terminal multi-vendor HVDC systems, the responsibility for design may shift from the manufacturer to the owner and operator of the DC grid, increasing the design risk for the latter. In turn-key HVDC systems, the manufacturer has full control over technical aspects, such as the converter control systems, and has design freedom over the HVDC system, while considering standards, regulatory aspects, customer specifications, and patents. However, the shift from turn-key to multi-vendor systems fundamentally changes the design principles of the HVDC system.⁹² Moreover, owners and operators may require more extensive knowledge and information disclosure by vendors than what is currently standard, as all parties need to take more collaborative roles in multi-vendor projects.

The system developers, i.e., the TSOs, will have increased responsibility for the high-level design of the system due to the increase of contractual interfaces on the DC side of the system. Thus, the TSOs and other developers will take on the role of the system designer. Until the interfaces at the DC grid connection

⁹² Louis Filliot, William Leon Garcia (Ready4DC) "Modelling, Simulation Framework and Data Sharing for Multi-Terminal Multi-Vendor HVDC Interaction Studies and Large-Scale EMT Simulations (2023), chapter 3.

or access points are defined in harmonised network codes that provide a clear legal framework and there is sufficient experience with the operation of HVDC converter stations from different vendors within one HVDC system, designers of multi-vendor systems have a new design and interface risk to bear. This includes the definition of functional and specific requirements at the DC point of connection to ensure harmonious operation of the system's components. A major challenge for the owner is limited insight into the control system of individual subsystems, which adds risks. If the requirements at the interfaces are not correctly designed, but all HVDCs still meet the specified requirements, the system owner will be liable for the malfunction and potential consequential power losses. This must be taken into consideration in the assignment of liabilities in future contracts for multi-vendor projects.

The design of components, such as converter stations, will remain the responsibility of the HVDC vendors. They will have to design individual stations without full knowledge of the system and other sub-systems, such as converter stations or fault separation devices from other vendors, as well as grid controllers. This may create an opportunity for testing agencies to test equipment and confirm that this equipment adheres to the proposed standards. As a result, vendors will have to rely on the functional and specific requirements of the system designer and may be liable for malfunctions against these requirements. Nonetheless, HVDC vendors may have to meet new requirements to ensure stable, secure, and robust operation of the multi-vendor HVDC system. Therefore, vendors may need to agree to comply with requirements that they have never tested before in a commercial context subject to acceptable terms and conditions while gradually improving Software-in-the-Loop (SiL) and Hardware-in-the-Loop (HiL) simulations to assess how equipment works together at reasonable cost and under acceptable terms and conditions.

An intermediate step in allocating risks and corresponding liabilities is to connect turn-key systems. In this case, the TSO or developer is responsible for the interface between the turn-key systems. In case of design mistakes, the system can be split into turn-key subsystems that function similarly to today's HVDC system. For offshore HVDC systems used to transmit wind energy to shore, it may be possible to reduce the risk of significant financial losses due to the inability to generate electricity (since it cannot be transmitted) and penalties for not fulfilling transmission obligations. One question that needs to be discussed is how the shift in liabilities to the TSO will impact the cost of potential projects. The Vendor has a shift in liabilities to the TSO, and the TSO needs to insure or cover these liabilities, potentially leveraging a larger asset base. While this shift may be beneficial from an insurance perspective, the split in liabilities may lead to an increase for both parties, sparking a different and new discussion.

5.2.1.2 Procurement

The change from turn-key to distributed MVMT HVDC systems will fundamentally change the procurement phase of HVDC projects. In today's HVDC systems, the core part of the system is purchased within one lot. Even systems that are extended in a second phase, e.g., the extension of the Ultranet

Project with corridor A north⁹³ or the Caithness-Moray link⁹⁴ extended by the Shetland link⁹⁵, are procured as fully working turn-key systems for the first phase.

Warranty Risks (Components and system behaviour): Warranty risks can arise if the warranties provided by different vendors do not align or cover the entire system, leaving some components unprotected. The owner is responsible for the entire system behaviour and for specifying sub-systems correctly. Since the malfunction of a single subsystem, i.e., a converter station, could cause a significant part (or even the entire system) not to fulfil its core functions, i.e., to transport offshore wind energy to shore, the warranties of the sub-systems might need to be higher than the price of the sub-system itself.

Contracts must also include warranties for the extension of an HVDC system subject to acceptable terms and conditions.

Liability Assignment Risks: The allocation of liability risks in multi-terminal multi-vendor HVDC systems may not be clear and may need to be established during the procurement phase. This can create uncertainty, especially when procuring multiple subsystems from different vendors at the same time. Moreover, an unclear assignment of liabilities due to the lack of experience with the project execution and operation of multi-vendor systems may increase the risk of disputes and legal action.

Closing all required contracts: Ensuring the closure of all essential contracts is crucial to fulfilling the core functions of the project, namely, bringing offshore wind energy to shore. If these core contracts cannot be closed and the core parts of the grid (i.e., connection from offshore to shore) cannot be realised, it could result in significant financial losses and project delays for the owner (and involved parties). If not, all contracts can be closed, alternative solutions would need to be found or the project might need to be cancelled or postponed. Even though this risk already exists in today's system, i.e., when converter stations and cables are procured via separate EPC contracts, the risk increases as the number of lots and interfaces increases.

Inadequate specifications: If the functional specifications provided by the owner are not clear or sufficient, it could lead to misunderstandings between the owner and the contractor(s) (e.g., HVDC vendors), leading to a mismatch between the actual requirements and the offer submitted. The need to solve that would put an unpredictable resource and financial burden on the vendors, such as additional workforce and postponement of already planned workforce.

5.2.2 Project Execution

5.2.2.1 Engineering and Construction

During the engineering phase of a multi-vendor HVDC system, there are specific risks that need to be addressed, including:

- The system owner bears the risk of new testing and interface challenges, such as interoperability tests between different vendors. The experience and knowledge about these tests, specific procedures,

⁹³ Ultranet and A-Nord project: <https://www.amprion.net/Grid-expansion/Our-Projects/A-North/>

⁹⁴ Caithness-Moray project: <https://www.ssen-transmission.co.uk/projects/project-map/caithness---moray/>

⁹⁵ Shetland project: [Shetland HVDC Link - SSEN Transmission \(ssen-transmission.co.uk\)](https://www.ssen-transmission.co.uk/projects/project-map/shetland-hvdc-link/)

and mitigation methods are limited, and problems with the tests may delay the overall project. Thus, the system owner might be liable for such delays.

- Delays in completing a subsystem, such as the control of a converter station, could impact the overall integration and interoperability test, causing delays and additional efforts that affect the schedules of other subsystems from different manufacturers. In such cases, it must be clarified who is liable for the costs resulting from such delays or additional efforts. To reduce such risks, it is important to develop test methods that allow subsystems to be developed and tested independently of each other. Whether common interoperability tests, which have effort and time implications for all parties in a network project, are necessary is an issue that needs to be investigated in R&D projects like InterOPERA and early multi-vendor HVDC projects. While this transition may introduce complexity, it is worth noting that similar challenges and corresponding solutions exist in closed systems today. Multiple parties are often involved in various aspects, such as substations, cables, substructures, and superstructures. As such, there may already be contractual clauses in place to address delays or unforeseen issues with specific components. It may be valuable to review contracts from existing installations, even though they are relatively compact (about 2-3 volumes) compared to future MTMV projects, to glean insights into managing these known risks.
- Reliable methods are needed to determine which party is responsible for malfunctions of the overall system. If this cannot be clearly assigned, it can lead to complex and expensive legal disputes.
- In the first multi-vendor projects, the owner's requirements may not be precise enough to ensure interoperability. In such cases, the cause must first be clarified, and then adaptation of subsystems from individual manufacturers may be necessary, leading to additional efforts and delays. It is important to have a clear assignment of responsibilities so that there is no ambiguity as to who is liable in such a case. Additionally, it should be clarified in advance which party is liable for any resulting damages in specific cases.

As already introduced in the system design section, the risks and financial implications concerning these risks might be reduced by starting with the connection of turn-key projects before moving to a fully distributed MVMT system.

5.2.2.2 Commissioning

Interdependency of different projects: In turn-key HVDC systems, one contractor is responsible for ensuring that the requirements for commissioning are fulfilled for the entire system. On the other hand, in distributed multi-vendor systems, the owner or developer of the system bears these responsibilities.

Due to the split of the grid into separate lots, there may be interdependencies during the commissioning phase of the individual projects. For example, the commissioning of an offshore converter station may depend on the commissioning of the onshore station. Since delays in commissioning can lead to considerable costs, it must be clearly regulated in such cases which party is responsible for the costs incurred.

In a distributed MVMT system, individual HVDC stations (and contractors) may face potential impact if another HVDC subsystem cannot be commissioned and put into operation on time. In such case, the owner of the grid may be liable towards the parts of the grid that face impact from the delay in commissioning, while the delayed project's developers are liable towards the grid owner. Thus, the corresponding warranties and penalties must be aligned to ensure that the party causing the delay is liable for the resulting costs subject to acceptable terms and conditions.

To reduce the risks associated with interdependencies, it might be a feasible solution to start with a moderate increase of interface in multi-vendor projects, i.e., the interconnection of turn-key subsystems.

Integration Risks: Integration risks can arise if different modules from different vendors do not seamlessly integrate into the overall system, leading to potential system failure and increased downtime.

5.2.3 Operation

5.2.3.1 Malfunction / Performance related

Interoperability risk: If separate HVDC stations are not interoperable, it could lead to the failure of the entire HVDC transmission system. This, in turn, could result in power outages, reduced energy transmission and distribution, and other operational problems. This may cause significant financial losses and delays in projects, as well as damage to the reputation of the involved parties. Moreover, identifying and fixing the root cause of the interoperability issue may require redesigning and recommissioning the HVDC stations. If the issue remains unresolved, it could affect the feasibility and overall success of the project, as well as the energy market as a whole. Moreover, it could potentially lead to increased energy prices for end-users, which might have implications for competition law.

Moving from single-vendor turn-key HVDC systems to multi-vendor systems shifts the risk of interoperability from the vendor to the owner of the system. With a single vendor, the contractor is responsible for the design and execution of the entire system and is liable for any design, installation, or commissioning defects. However, with a multi-vendor system, the owner and operator of the DC grid must specify each module individually and are liable for the performance and security of the entire system. This increases the risk of design errors and interoperability issues, as each vendor's equipment may not be compatible with the equipment provided by other vendors.

To mitigate this risk, the responsibilities and liabilities of all parties involved should be clearly defined and mutually respected. Procurement processes and contracts also need to be formulated to allocate liability and warranty risks. This can ensure that all parties are aware of their responsibilities and can take the necessary steps to prevent interoperability issues from arising.

Performance Risks: Performance risks may arise if the performance of the different modules does not meet the required specifications. This can lead to reduced system efficiency and increased costs. Moreover, hidden features or control methods might not be exchanged between the vendor and the owner or operator of the system. Thus, performance reduction and damages caused by inadequate knowledge transfer to the operator can lead to damages in multi-vendor projects for which the vendor might be liable subject to acceptable terms and conditions.

5.2.3.2 Faults causing damages

Liability for damages to system components resulting from faults can vary depending on the specific procurement contract and the roles and responsibilities assigned to each party involved. Generally, the party responsible for designing, installing, and commissioning the components may be liable for resulting damages. This is often the contractor or manufacturer, but in a MTMV HVDC system might shift from the manufacturer to the owner.

Thorough Interoperability testing during the execution phases to ensure that all components and systems are compatible with each other is an essential strategy for reducing this risk of damage or faults that may result from incompatible components or control systems. Nonetheless, interoperability testing based on real-time simulation cannot mitigate all interoperability risks.

To minimise the risk of disputes over liability, it is important to have a clear allocation of roles and responsibilities in the relevant procurement contracts, as well as clear procedures for investigating and allocating liability in the event of a fault or damage to the system components. Moreover, it must be clearly defined who is responsible for the investigation, i.e., the owner or operator of the system or a third-party investigator. The investigation should include a review of the system design, installation, and commissioning processes, as well as any relevant maintenance or operation procedures. The investigation should also include a detailed analysis of the data collected from the system.

Therefore, adequate sensors, control systems, and other monitoring equipment must be foreseen. Once the root cause of the fault has been identified, the liability can be allocated based on the roles and responsibilities outlined in the procurement contract. If the fault was caused by a failure in the design or installation of the sub-system, i.e., the converter station, the contractor or manufacturer may be liable for resulting damages subject to acceptable terms and conditions. If the fault was caused by improper design, operation, or maintenance, the owner or operator of the system may be liable.

5.2.4 Maintenance

No additional risks that cause a shift of liabilities are identified.

5.2.5 End of Lifetime

5.2.5.1 Refurbishment

No additional risks that cause a shift of liabilities are identified.

5.2.5.2 Decommissioning

No additional risks that cause a shift of liabilities are identified.

5.2.6 Summary

The shift from turn-key HVDC systems to distributed MVMT HVDC systems can impact risks and associated liabilities in several ways.

- In turn-key systems, a single vendor assumes responsibility for the entire project, including design, installation, and commissioning.
- Therefore, the liability for faults or damages or malfunction resulting from the system falls on the turn-key vendor.
- In contrast, in multi-vendor systems, responsibility is divided among several vendors, potentially increasing the risk of interoperability issues and making it difficult to allocate liability in the event of faults or damages.

The connection of turn-key point-to-point systems from different vendors for early multi-terminal multi-vendor HVDC systems can limit risks by allowing for easier management and operation of the system. If interoperability issues occur, the system can be separated and operated as individual turn-key systems. Thus, such systems can be an adequate intermediate step to multi-vendor interoperability with less drastic change of risk allocation and liabilities.

To minimise risks and associated liabilities in multi-vendor HVDC systems, it is important to clearly define roles and responsibilities in procurement contracts and establish clear guidelines for system integration and testing. Additionally, thorough testing of interoperability can help identify and address potential faults or damages before they become major issues.

Finally, having a clear plan for allocating liability in the event of a fault or damages is essential to minimise disputes and ensure that the appropriate party is held responsible.

6. CONCLUSION AND RECOMMENDATIONS

This Whitepaper has analysed legal and regulatory issues that play a role in the development of an MVMT HVDC grid: the governance, cooperation between undertakings and the required standardisation, IP law aspects, and risks and liability. The most important conclusions and recommendations are the following:

GOVERNANCE

With respect to public law, the governance of an MVMT HVDC grid is best served by a clear legal and regulatory framework. The current framework is based on AC networks and on point-to-point connections when HVDC technology is used. The application to HVDC networks of specific provisions in EU energy law needs to be made clear. The regulated income for TSOs in an HVDC situation should also be clarified further: as risks and liabilities shift in MVMT HVDC systems, it is important that NRAs adapt the tariff methodology for TSOs to the development of MVMT HVDC grids. Moreover, network codes need to be adapted to HVDC grids. It is important that the Network Codes are ready for multi-terminal HVDC systems when the technology is implemented. This requires the relevant actors (European Commission, ENTSO-E, ACER, based on the Electricity Market Regulation art. 58/59) to start in time with the drafting process.

With respect to private law, there is also need for certainty in the form of commercial agreements. This certainty can be achieved in the form of an umbrella agreement between all involved parties with the aim of codifying general rules on the cooperation needed to development an HVDC grid. Standardised bilateral agreements would also serve this aim and could be used by grid owners and vendors during the procurement process each time the HVDC grid is extended. The contents of such agreements are discussed further in another Horizon Europe project: InterOPERA.

One of the topics to be adopted in the legal framework is the division of roles and responsibilities. It is sometimes said that the ownership and other roles regarding an HVDC grid should be decided before the development starts. However, the conclusion of WG2 is that the ownership of the grid can very well vary between different parts, as long as these parts are interoperable. Moreover, it is important that the grid planning and operation are coherent. However, these aspects can be decoupled from ownership. Furthermore, over the lifetime of the grid (multiple decades), the ideas on ownership, development, roles, and responsibilities will probably change several times. We should therefore not aim to clarify every detail prior to starting development but must instead ensure that the MVMT HVDC grid works regardless of the exact ownership division. Nonetheless, it is important to know how the roles and responsibilities are divided in the next phase. This Whitepaper includes a list of roles per (type of) entity. It is important to start with several pilots and to evaluate these pilots well, as they may contribute to the decision-making on larger parts of the grid.

COOPERATION BETWEEN COMPANIES AND STANDARDISATION

Companies (competitors and companies dependent on each other) will have to cooperate in order to develop an MVMT HVDC grid. The cooperation between companies is regulated by EU competition law. Anti-competitive agreements should be avoided; there are guidelines on how to make sure agreements are aligned with EU competition law. Standardisation is a process in which competitors must cooperate to reach an agreement. Transparency and non-discrimination are important to make sure this process is in line with competition law.

In a situation with multiple vendors who have different IP and trade secrets, there are various options in standardisation. This Whitepaper highlights different options, such as bilateral or multilateral information

sharing and the (dis)advantages of the use of technology pools. Depending on the precise options that are chosen in standardisation, the risk of inadvertently violating competition law or the ill-suited use of intellectual property rights will increase or decrease. This is of particular concern for trade secrets, which lack a clearly defined legal framework and thus entail risks. Despite the option that is chosen, it is always important that there is access on FRAND terms (fair, reasonable, and non-discriminatory) to ensure that competition law is respected. A standard-setting organisation could help to create the standard, but here again it is important that the specifications are based on open and reasonable criteria. An important question is to what extent interoperability can be reached without sharing IP (or how the amount of IP to be shared can be limited as far as possible)—presupposing that IP needs to be shared in the first place. Depending on the ability of all relevant stakeholders to reach a shared approach for MVMT grid operations and the precise specifications required for interoperability, it may not be necessary to share (large amounts of) IP. This depends on the clearness of the interface regarding the roles and responsibilities of all relevant parties. An important question in MVMT HVDC standardisation is therefore: to what extent is it feasible to expect stakeholders to reach a shared design philosophy and to what extent can the specifications accommodate that?

IP LAW AND HVDC STANDARDISATION

HVDC vendors can use different types of IP rights to protect their inventions, technologies, and ideas. Patents and trade secrets are the most relevant ones here. Regarding trade secrets, vendors should inquire about the procedural law of Member States pertaining to trade secret enforcement and choose to apply the national law that is the most appropriate for protecting their trade secrets. Moreover, NDAs are helpful in making sure that commercially sensitive information remains secret.

If technical reasons compel information to be shared to maintain interoperability—with trade secrets becoming known to direct competitors as a result—it may not be possible to align FRAND requirements with trade secret protection. Vendors would do well to regularly take stock of the specifications of a developing standard and consider whether these specifications force them to divulge trade secrets to retain interoperability, which is something all vendors will try to avoid. If this is the case, it is important that vendors take appropriate action to notify the standard setting organisation.

The lack of available case-law at the EU level leaves much uncertainty about the definition of trade secrets and the use of trade secrets in a standard. National rules on unfair competition may be able to fill in the gaps in EU law. Vendors should, if feasible, inquire about the definition of trade secrets at the national level. Moreover, it remains unclear if the Commission and the ECJ are likely to employ strategic value in determining the value of a patent. Finally, if a patent pool is used, it is advisable to not differentiate between the value of individual patents and select remuneration on the total value of the patents in the pool. As some industries know ‘patent forests’ with many patents around a specific technology, the amount of patents does not say anything about the value of the patents.

The lack of the Commission’s ability to determine objective value for technology hinders its ability to determine appropriate license fees. As long as participating companies do not require licensing prices that are substantially above those of a competitor, it is unlikely that competition law will be violated. It is advised that companies use their knowledge of the industry, whilst not coordinating with other companies if a patent pool is used, to choose license fees that are not substantially higher than the fees of direct competitors.

If specifications are chosen whilst a company is unaware of relevant patents, a binding licensing commitment could force vendors to license IP they might otherwise have kept for themselves. It is

advisable that relevant experts on both the contents of company patents and the development of the standard regularly take stock on the progress of the standard. This would allow a company to be aware of what IP it might have to license, which as a result would give the standard setting organisation, CENELEC or IEC, information on the necessary patents for the standard.

RISKS AND LIABILITY

The division (and shift) of liability is an important issue dealt with in this Whitepaper. The shift from turn-key HVDC systems to MVMT HVDC systems can impact risks and associated liabilities in several ways. In turn-key systems, a single vendor assumes responsibility for the entire project, including design, installation, and commissioning. In these systems, the liability for damages resulting from system failures falls on the turn-key vendor. In contrast, in multi-vendor systems, responsibility may be divided among several vendors and the party that determines how they interoperate, potentially increasing the risk of interoperability issues and making it difficult to allocate liability.

In an early development phase of MVMT HVDC systems, risks can potentially be limited by connecting several turn-key systems to each other. If interoperability issues occur, the system can be separated and operated as individual turn-key systems. Thus, such systems can be an adequate intermediate step to multi-vendor interoperability with less drastic change of risk allocation and liabilities. To minimise risks and associated liabilities in MVMT HVDC systems, it is important to clearly define roles and responsibilities in procurement contracts and establish clear guidelines for system integration and testing. Additionally, thorough testing of interoperability can help identify and address potential faults or damages before they become major issues. Finally, having a clear plan for allocating liability in the event of a fault or damage is essential to minimise disputes and ensure that the appropriate party is held responsible.

ABBREVIATIONS AND ACRONYMS

AC	Alternating Current
DC	Direct Current
EC	European Commission
ENTSO-E	European Network of Transmission System Operators for Electricity
EPC	European Patent Convention
EPCI	engineering, procurement, construction and installation
ECJ	European Court of Justice
FRAND	Fair, Reasonable, and Non-Discriminatory
HVDC	High Voltage Direct Current as defined in e.g., IEC 60633, IEC 62747, IEC TS 63291-1 and -2 ED1
IP	Intellectual Property
IPRs	Intellectual Property Rights
MPCF	Multi-Party Cooperation Framework
MVMT	Multi-Vendor Multi-Terminal
NRA	National Regulatory Authority
RCC	Regional Coordination Centre
R&D	Research and Development
TFEU	Treaty on the Function of the European Union
TSO	Transmission System Operator
TYNDP	Ten Year Network Development Plan

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