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Dear Members of the Northeast States Collaborative on Interregional Transmission,

We are writing to request that state policy makers move forward with planning and solicitations for planned offshore transmission systems utilizing the *de facto* global hardware standards that have emerged through collaborative work between European utilities and the electric equipment supply chain. While recent analyses by the Brattle Group,[1] the U.S. Department of Energy (DOE),[2] and others in 2023 and early 2024 have all pointed to the need for high voltage direct current (HVDC) standards to allow for development of an expandible offshore transmission system, the advanced work described in this letter has already resulted in significant 525kV HVDC equipment orders, now totaling over $36 billion, to multiple vendors – both for converter platforms and transmission cables. This market activity around a standardized hardware design for both transmission cables and offshore voltage source converters (VSCs) is resulting in a scaling of the global supply chain that the U.S. can cost-effectively utilize. We encourage policy makers to avoid needless go-slow approaches that may operate under the false impression that years of work are still needed before multi-vendor cable and platform voltages can be specified in no-regrets, scalable transmission solicitations. The long lead time nature of transmission equipment, the schedule for both on and offshore permitting, and the consumer cost benefits of interconnection certainty in offshore wind pricing provide further counsel for near term action relying on developed supply chain equipment standards so that states can realize their energy policy goals.

The Development of Standardized Hardware Designs

As noted in a recent report by The Brattle Group, European grid operators have made extensive use of modern VSC HVDC over the past decade, with around 50 gigawatts (GWs) of those systems in service today and another 130 GWs in planning and deployment stages through 2030.[3] The U.S. is well-positioned to benefit from that current on-going work. Prior to 2020, TenneT, which operates part of the German transmission system, recognized the need to move HVDC systems to a repeatable model that could be produced by multiple vendors. The utility convened a group of five major suppliers to work on a standardized 525kV VSC HVDC platform design.[4] The design for European installation is also multi-terminal ready, meaning that it could be networked to other HVDC equipment and standardized around a 2 GW transmission

[1] *The Benefit and Urgency of Planned Offshore Transmission: Reducing the Costs and Barriers to Achieving U.S. Clean Energy Goals*, https://www.brattle.com/wp-content/uploads/2023/01/EXECSUM_Brattle-OSW-Transmission-Report_Jan-24-2023.pdf at 13-14 ("Planned Offshore Transmission Benefit Study").

[2] *An Action Plan for Offshore Wind Transmission Development in the U.S. Atlantic Region, Interim Draft – September 2023.* https://www.energy.gov/sites/default/files/2023-10/Atlantic-Offshore-Wind-Transmission-Plan-Report_October-2023.pdf at 56.

[3] *The Operational and Market Benefits of HVDC to System Operators*, https://www.brattle.com/wp-content/uploads/2023/09/The-Operational-and-Market-Benefits-of-HVDC-to-System-Operators-Full-Report.pdf at 3.

[4] https://www.modernpowersystems.com/features/featuretennet-opts-for-525-kv-hvdc-onshore-and-offshore-8019642/

cable capacity.[5] The 525kV system also utilizes a single cable package, limiting environmental impacts.[6] Eight transmission cable suppliers were engaged by TenneT to develop a new standard for submarine 525kV HVDC cable systems.[7]

The result of the 2 GW standardized program is that TenneT is forecasting that 14 2 GW 525kV HVDC systems will be in service within the TenneT system by 2031 with the addition of two systems *per year* thereafter.[8] The standardization at scale will allow for the same amount of energy being delivered to families and businesses utilizing "less than half as many systems compared to previous offshore grid systems."[9]

Industry Adoption and Supply Chain Orders

With the move towards industrializing a 525kV HVDC standard in lieu of 320kV systems, which will continue to be the preferred option for HVDC installations in the US for near-term deployment over the next five to eight years,[10] several companies have now placed significant orders that will build the 525kV HVDC manufacturing infrastructure needed. Among these is a 23 billion euro order for converter systems by TenneT from both Hitachi and GE, which also has placed a 5.5 billion euro order for at least 10 525 kV HVDC cable systems – 7,000 km – from NKT, Nexans, and a consortium of Jan De Nul, LS Cable, and Denys with submarine installation slated to begin in 2026.[11] Over this last year, 50Hertz, the transmission system operator for parts of Germany and Belgium also placed orders for 525kV HVDC cables, awarding a 3.5 billion euro contract to NKT[12] and a 1.1 billion euro contract to Nexans.[13] National Grid, the transmission system operator for the United Kingdom, and SP Transmission plc have also placed an 850

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[5] https://tennet-drupal.s3.eu-central-1.amazonaws.com/default/2023-04/TenneT_offshore_2GW-Program_Folder_en.pdf at 6.

[6] *See* https://www.tennet.eu/news/tennet-accelerates-grid-expansion-and-energy-transition "A cable system will consist of four cables, a 'plus' and 'minus' pole cable, a metallic return cable and a fibre optic cable." While accepted in Europe, installation in the US may require a separate trench for each pole of a 2 GW system. This has yet to be determined.

[7] https://www.modernpowersystems.com/features/featuretennet-opts-for-525-kv-hvdc-onshore-and-offshore-8019642/; *see also*, https://www.witteveenbos.com/news/energy-islands-the-next-step-for-offshore-wind-growth/ The engineering firm commented: "In designing the new DC platform standard, TenneT is scaling up to 2 GW. IJmuiden Ver will be the first wind farm to use these HVDC platforms. As only one platform instead of the usual three is needed to connect a 2 GW wind farm, much less steel is required to build the platforms and fewer cables need to be laid, resulting in substantial savings."

[8] https://tennet-drupal.s3.eu-central-1.amazonaws.com/default/2023-04/TenneT_offshore_2GW-Program_Folder_en.pdf at 2.

[9] *Ibid*.

[10] "With the introduction of the 2 GW direct current platform, the switch from 320 kV HVDC to 525 kV HVDC is already being made." https://www.witteveenbos.com/news/energy-islands-the-next-step-for-offshore-wind-growth/

[11] *See* fn. 6.

[12] https://www.nkt.com/news-press-releases/nkt-secures-framework-agreement-and-record-order-for-five-power-cable-projects-supporting-the-german-energiewende

[13] https://www.prysmiangroup.com/en/media/press-releases/prysmian-signed-an-agreement-worth-around-1-1-bn-with-50hertz-for-the-submarine-cable-project-nor-11-1-and-the-underground-cable-project-dc31-in-germany

million euro order for a joint venture project that will see the majority of a route between England and Scotland, 176 km, installed offshore with a commissioning date of 2028.[14] Most recently, Prysmian signed a series of 525 kV HVDC contracts with Germany's Amprion totaling 5.4 billion euros, including orders for 1,000 km of submarine cable and 3,400 km of overland 525 kV HVDC,[15] and NKT received a 2 billion euro order for three 525kV HVDC systems for Dutch wind farms in the North Sea that are slated to be commissioned between 2028 and 2030.[16]

Atlantic Coast states can and should move forward with planning and procurement of offshore transmission systems based on the work that has led to the developing supply chain and a significant order book; further, state policy makers should avoid alternatives that are either bespoke or - while possibly more available for near-term use - are not likely to be delivered in a window materially ahead of the ability to specify 525kV use in solicitations. Emmanuel Martin-Lauzer of Nexans summarized the timing of the use of 525kV systems in the United States in the following manner: "For project needs *before* 2032 or 2033, the availability of installation vessels and product maturity point to 320kV HVDC systems. However, near term projects in the United States are already committed to technology choices and larger systems are likely to have installation dates that extend beyond 2032. Where installation is targeted for more than eight to ten years out from now, 525kV will likely be the global standard backed by production capacities and interoperability solutions for the highest power requirements. Policy makers should examine global supply chain orders and avoid bespoke solutions that will add delay and costs. Furthermore, they need to work across system operators and reliability organizations to provide consistent and forward-looking grid reliability policies, and coordinate with industry OEMs to incorporate future HVDC technology development in their modernization of the transmission policies."[17] In a recent comment regarding the wisdom of selecting present day equipment that may appear more available on paper, Dr. Morgan Putnam of DNV has noted: "States should undertake a high-level mapping of the HVDC converter, cable, and installation vessel supply chains. Absent such an analysis, states run the risk of running solicitations for which commercially viable equipment does not exist within their desired timeframes."[18]

This note of caution also applies to taking a realistic view of the likely availability of transmission system components and installation vessels. Given current order books, states should anticipate that orders placed today will likely arrive for installation in the 2031-time frame, seven years out. This is all the more reason why planning and procurements should start as soon as possible so that orders can be placed, permitting can commence, and the supply

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[14] https://www.prysmiangroup.com/en/media/press-release/prysmian-first-525-kv-submarine-cable-system-in-the-uk

[15] https://www.reuters.com/markets/deals/prysmian-signs-record-5-billion-euro-deal-with-germanys-amprion-2024-02-15/

[16] https://www.nkt.com/news-press-releases/nkt-awarded-record-orders-for-worlds-first-525-kv-xlpe-hvdc-submarine-cable-projects-for-offshore-wind

[17] Comment provided to ACORE regarding the timing of 525kV deployment.

[18] Comment provided to ACORE regarding the timing of 525 kV deployment and the need to avoid bespoke solutions.

chain will have further certainty as to the scope and scale of U.S. offshore wind ambitions. This certainty will benefit not only the global and U.S. transmission supply chain, but also developers of offshore generation who will be able to factor into their planning and bids the design and location of planned transmission systems to connect to.

Planning and Procurement Efforts Need Not Wait for Additional Standards Work

While various studies have set out the benefits of coordinated transmission planning for offshore wind, these documents have also discussed the need for additional standards development work. While standards work will need to be done to ensure compatibility with US grid code, for example, a clarity around the voltage for HVDC has already been provided by earlier European standardization work, significant orders, and resulting supply chain development. Other issues that require standards development, such as multi-vendor interoperability of networked systems also exist. However, significant work on that topic is already underway and is geared towards establishing additional guidance to allow for modular, multi-vendor HVDC networked systems based on the 525kV VSC HVDC currently being procured.

For example, InterOPERA is the collaborative effort underway in Europe. The work is a joint initiative involving "eight TSOs, three offshore wind developers, four HVDC equipment manufacturers, two wind turbine manufacturers, two sector associations, and two universities under the coordination of a research and innovation institute."[19] With 69 million euros in project funding, this work was launched in January 2023[20] and has a 52-month project timeline. Given the several years' lead that Europe has in the HVDC space and the participation by global vendors that will also supply U.S. projects, this technical work is likely to be directly applicable to standards utilized in the U.S., especially if there is a goal to avoid bespoke specialization and the risk of further delay for market variations. Where additional standards work will be needed to adopt these HVDC systems for US installation, that work can proceed in parallel with the advancement of transmission planning and procurement.

Conclusion

The signatories to this letter appreciate the focus on, and proactive steps taken by the Atlantic coastal states to convene and collaborate both together and with the U.S. DOE to identify paths forward for coordinated transmission planning and procurement. Given the development of *de facto* transmission hardware standards discussed in this letter, we ask that

[19] https://cinea.ec.europa.eu/news-events/news/successful-kick-interopera-horizon-europe-offshore-electricity-grids-project-2023-01-20_en

[20] https://windeurope.org/newsroom/news/eu-and-industry-launching-new-project-charting-the-way-for-interconnected-offshore-wind-farms-and-energy-islands/ "InterOPERA's main objective is to make future HVDC systems mutually compatible and interoperable by design, and to improve grid forming capabilities of offshore and onshore converters. Future HVDC systems will be modular. Thanks to common functional specifications and standard interfaces, modules based on different technologies and modules supplied by different manufacturers will be able to interact seamlessly and operate together."

you now move forward with transmission planning and procurement with the assurance that global supply chain and cooperative efforts have resulted in uniform cable and converters designs that are both being produced by multiple vendors and utilized by multiple transmission entities to support the long-term growth of Atlantic offshore wind. Given the lead times and supply chain orders already in place, beginning transmission solicitations for Atlantic-based offshore transmission as expeditiously as possible will help ensure that systems that allow offshore wind energy to increase in scale and benefits can be in place by the 2032-2033 time frame.

Sincerely,

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