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Empowering Europe

Delivering the security and economic benefits of clean energy in the North Seas

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Cover image: Wind turbines at the Afsluitdijk, the Netherlands. Photo by Sepia100 via Adobe.

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OUR SPONSOR

EnBW is one of Europe's largest energy suppliers, investing €40 billion by 2030 to accelerate the transition to clean energy. With over a century of operation and majority public ownership, the company is a leading force in driving offshore wind development across multiple projects in the North Seas. EnBW Generation UK and EnBW AG were pleased to sponsor and collaborate on this independent research by E3G as part of their commitment to supporting a successful and ambitious deployment of offshore wind in the region.

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Summary

Offshore wind in the North Seas has the potential to be a major geostrategic and economic asset for Europe. In the face of new security challenges, the North Seas grid can be planned as a security asset, and to be resilient in the face of attack. Stable project pipelines can support the development of strong supply chains, ready to capitalise on global market growth. A North Seas grid can provide households and industry with reliable energy supply at stable prices, benefitting the whole economy.

Leaders need to show that Europe will grasp this opportunity. This requires leaders of North Seas adjacent countries to inject a step change in the pace of deployment, and in the depth and the scope of cooperation between countries.

An ambitious offshore wind agenda can be a defence asset in the North Seas

Leaders already recognise that North Seas wind is a valuable opportunity to reduce exposure to the price shocks and supply squeezes that come with fossil fuel dependency. The North Seas Energy Cooperation (NSEC) was established to grasp the opportunity, and leaders have set a target to deploy at least 300 GW of offshore wind in the North Seas by 2050.[1]

Building out renewable energy in the North Seas can do even more for Europe's security. The infrastructure itself can be designed as a security asset to improve defence capabilities in the North Seas through the inclusion of surveillance and monitoring equipment. Furthermore, in case of sabotage or attack, decentralised systems can make it easier to restore energy supply, compared to oil and gas infrastructure. These are important considerations since the North Seas is already identified as a potential future security flashpoint.[2]

[1] European Commission, **The North Seas Energy Cooperation** (webpage, accessed January 2026)

[2] Atlas Institute for International Affairs, January 2025, **A North Sea defence alliance: challenges and opportunities for the UK**

The existing close energy security cooperation between North Seas adjacent countries does not yet link the energy and security dimensions. Countries need to work together to ensure that security requirements – and opportunities – are integrated into the design of the system. These discussions should also consider the growing risk from new threats such as hybrid and cyberattacks, as well as increasing extreme weather events. Better integration of energy and security governance at national level is a prerequisite to enable countries to align national priorities with the regionally coordinated security requirements.

In 2025, NATO agreed that parties may allocate up to 1.5% of GDP to broader security-related spending.[3] Given the potential for the North Seas offshore grid to be a defence asset, leaders should agree to use a proportion of this funding to finance security aspects of the design.

North Seas wind can help Europe be a global shaper and leader on offshore wind

Europe has technological leadership in offshore wind, and manufacturers Siemens Energy and Vestas held nearly 40% of the global market for complete offshore wind turbines in 2024.[4] Europe is in a strong position to be a leader in this growing market in the face of global competition, boosting local economies and the competitiveness of European manufacturers and supply chains.

Scaling domestic markets is essential for the European wind industry to maintain its global status. Again, cooperation between countries is vital. Integrating regional demand to create a larger market will encourage supply chain investment, while harmonising tendering requirements and standardising components can improve efficiency in the supply chain.

Creating efficiencies of scale can result in lower costs and benefits for electricity consumers. By providing large volumes of renewable energy at competitive prices, the key economic benefits of North Seas wind would ultimately lie across the economy, creating the confidence for European industries to invest and grow.

[3] NATO, June 2025, **The Hague Summit Declaration**

[4] European Commission Joint Research Centre, 2025, **Clean Energy Technology Observatory: Wind Energy in the European Union - 2025 Status Report on Technology Development, Trends, Value Chains and Markets**

An action plan for the North Sea Summit in 2026 and beyond

While North Seas leaders agreed to bold deployment targets for offshore wind, delivery is off track.[5] There is also insufficient cooperation, as deployment remains largely driven by independent national agendas. Significantly, the UK – which may represent around one-third of North Seas wind capacity by 2030 – currently only has observer status in the NSEC.

Capturing the benefits of North Seas wind requires a new approach. The North Seas must be viewed as a European project with energy, economic and security dividends arising through close cooperation. Given the political nature of the decisions to be made, technical coordination is not enough.

The heads of government summit planned for 26th January 2026 is a crucial moment to start making that change. Starting this year, and carrying the momentum into future summits, the North Sea Summit must set up the structures to embed a security by design approach for the North Seas grid, strengthen Europe's economic resilience, and deliver at pace. We propose that the following actions are agreed by leaders at the summit.

Embed a security by design approach

- Agree to dedicate part of the NATO-agreed 1.5% of GDP for security-related spending to cover the potential additional cost of aligning grid development with a security by design approach.
- Establish a platform for sharing security information among key North Seas energy and security stakeholders.
- Define the governance arrangements to monitor the realisation of security benefits from speedy delivery and set network design and system security criteria.

Strengthen economic resilience

- Commit to harmonise tender requirements, including timelines, and explore standardisation of components and equipment.
- Identify critical components that require European production for security and resilience alongside those that will deliver an industrial dividend.
- Agree coordinated action to build and scale regional supply chain capacities in critical sectors.
- Define an international partnership agenda to shape and build global influence and export opportunities.

[5] Baringa, on behalf of Breakthrough Energy, December 2024, **Beyond Borders: Unlocking the power of UK–EU offshore wind coordination**

Accelerate delivery

- Accelerate current projects by resolving the cross-border cost-sharing and electricity trading framework, including by clarifying the basis for future UK–EU trading.
- Define the governance for North Seas wind spatial planning, network design and system operation, including through establishing when the UK will become a full member of the North Seas Energy Cooperation.
- Set the timeline to produce an integrated spatial energy plan for the North Seas and to design the grid that will meet these energy needs.

Above all, leaders must take control of the agenda to ensure it proceeds at pace given the geostrategic value.

- Establish a leader-level sherpa group to drive decision making at pace, monitor progress, and quickly escalate issues for resolution.

Chapter 1: The importance of cooperation on North Seas energy

Against new geopolitical threats, Europe must make the most of domestic renewable resources that can be produced at scale. Developing North Seas renewable energy resources as a security and economic asset is a European project of increasing political significance. European leaders must respond to the current security environment and trigger a step change in the rate of deployment of renewable energy resources in the North Seas.

The security imperative

Energy security

One of the primary roles of governments is to keep citizens safe and the country secure. The ability to access reliable energy at affordable prices is a central component of the overall security package.

Russia's weaponisation of fossil fuel supplies since its full-scale invasion of Ukraine has highlighted the shortcomings associated with energy supplies dependent on fossil fuel imports. The gas supply crunch that followed led to a surge in energy prices, affecting the cost of living,[6] business competitiveness[7] and leading to socio-economic and political destabilisation.[8] The EU and UK had to introduce emergency measures to limit the impact of high prices on energy consumers and increase deployment of renewables.[9] European governments also recognised the need to reduce and ultimately eliminate imports from Russia.[10]

[6] SUERF, March 2024, **How gas prices affect inflation: lessons from the European energy crisis** (PDF)
[7] Financial Times, 17 November 2022, **Europe's energy crisis increases risk of deindustrialisation**
[8] EU Reporter, 23 June 2024, **The rise of energy prices in the EU and the populist surge**
[9] European Council, Council of the EU, **Energy prices and security of supply** (webpage, last reviewed 5 December 2025); UK government, 8 June 2023, **£40 billion spent protecting families and businesses from energy costs**
[10] Council of the EU, 20 October 2025, **Council agrees its position on rules to phase out Russian gas imports under REPowerEU**

However, without reducing overall consumption of fossil fuels, prices will remain susceptible to supply squeezes, and Europe remains open to geopolitical pressures. The EU still meets 58% of its energy demand with fossil fuels[11] and 16% of electricity is produced by gas-fired power stations.[12] This demand cannot be met through domestic fossil fuel production. Alternatives to Russian gas supplies involve deals with suppliers that are willing to pressure Europe on its policy direction and leave Europe exposed to external shocks.[13]

Instead, Europe can reduce its vulnerabilities by investing in renewable energy and electrifying the economy. Europe is fortunate to have access to regions rich in homegrown and reliable renewable energy which can replace fossil fuels and meet the needs of a modern, electrified economy. The North Seas is one such region with the potential to provide vast amounts of offshore wind energy.

The North Seas regional energy cooperation (NSEC) process was established to grasp this opportunity and member countries (Belgium, Denmark, France, Germany, Ireland, Luxembourg, Netherlands, and Norway, plus the European Commission) have set ambitious offshore wind deployment targets. At the Ostend North Sea Summit on 24 April 2023, leaders of the North Seas countries agreed in a joint declaration to reach at least 300 GW of offshore wind energy by 2050, with an intermediate target of 120 GW by 2030.[14] However, a recently published "status quo" forecast suggests we are only on track to deliver 82 GW by 2030 and 171 GW by 2040[15] unless there is a significant change in approach.

> *"[I]n response to Russia's aggression against Ukraine and attempts of energy blackmail against Europe we will accelerate our efforts to reduce fossil fuel consumption as well as dependence on fossil fuel imports and promote the rapid upscaling and deployment of renewable energy for an energy resilient Europe and guarantee the resilience of our offshore infrastructure"*
>
> **Ostend political declaration by Leaders of North Seas countries[16]**
> **April 2023**

[11] Eurostat, March 2025, **Shedding light on energy in Europe – 2025 edition**

[12] Ember, January 2025, **European Electricity Review 2025**

[13] Forbes, 6 August 2025, **Europe isolated: Qatar threatens Natural Gas embargo against the EU**

[14] European Commission, **The North Seas Energy Cooperation** (webpage, accessed January 2026)

[15] Baringa, on behalf of Breakthrough Energy, December 2024, **Beyond Borders: Unlocking the power of UK–EU offshore wind coordination**

[16] Leaders of Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Norway, United Kingdom, 24 April 2023, **Ostend Declaration on the North Seas as Europe's Green Power Plant**

Defence security

We are living in increasingly unstable times. Defence security is – traditionally – linked with energy security through the potential for sabotage or even direct military attack on critical infrastructure. The invasion of Ukraine by Russia, as well as recent attempts to sabotage Baltic cables, highlight this risk. The Baltics are most likely to be the new security flashpoint, but the North Seas are also vulnerable.[17] They are home to critical energy (and telecoms) infrastructure which must be defended. Against this context, the greater decentralisation of renewable energy offers benefits to hard security. Decentralisation presents a greater potential for resilience against sabotage than heavily centralised and vulnerable oil and gas infrastructure.

Moreover, offshore renewables infrastructure can serve defence needs. Dual-use (that is, civilian and military) port infrastructure or the addition of surveillance and monitoring equipment to cables and wind farms can enhance the North Seas defence capabilities if designed correctly. This supports the efficient use of offshore spatial resources while achieving military and civilian objectives at a time when Europe is scaling and resetting its own defence capabilities in the context of waning support from the United States and an enduring threat from Russia.

This degree of energy/defence synergy requires North Seas countries to establish new common approaches to surveillance and protection, and to coordinate on identifying security requirements relating to network adequacy and redundancy, infrastructure engineering and equipment procurement. The recent EU–UK Security and Defence pact shows that both the EU and the UK recognise the need for deeper cooperation. This cooperation should not be restricted to North Seas countries: all European regions must work together to share best practice delivering integrated offshore renewable systems that improve both direct and economic security.

In Chapter 2 we discuss in more detail how energy and defence security go hand in hand, and the steps North Seas adjacent countries need to take to realise these joint benefits through the North Seas grid.

Managing risks

There are security risks relating to North Seas wind as well as benefits. Elements of the offshore wind supply chain are currently dominated by China, creating both direct and economic security concerns. These issues need to be addressed through security requirements in the context of equipment procurement or tenders, alongside a strategic approach to supply chain diversification and, where necessary, domestic production.

[17] Atlas Institute for International Affairs, January 2025, **A North Sea defence alliance: challenges and opportunities for the UK**

The European Commission recently published proposals to increase the economic security of the EU which called for "an integrated whole-of-government and business approach, improved governance as well as even closer cooperation with like-minded partners and, where appropriate, joint action".[18] This includes cooperation with trusted partners on critical technologies to balance dependency risks with efficiency and speed of delivery. In this sense, deeper EU–UK cooperation on clean technologies, trade, and innovation can address some of the economic security concerns that may result from the supply chain risks.

We discuss these issues in more detail in Chapter 3, as part of a broader discussion of the economic relevance of offshore wind value chains to North Seas countries.

Economic strength

Competitive energy costs for an electrified economy

Europe, along with major international competitors, is in the middle of a transformation to a more modern, digital and electrified economy. Europe cannot compete based on low input costs alone, for example of labour or energy. Instead, Europe's competitive edge has always been, and can continue to be: well-run, interconnected systems creating integrated networks and stable prices; a highly qualified labour force; innovation and technology ecosystems; and an effective and predictable business environment.

The North Seas, as part of an interconnected European grid, can leverage these advantages and deliver both reliable energy supply and stable prices to industrial end consumers. This will be reinforced by trading resources across the continent and developing system backup options such as hydrogen produced with surplus renewable electricity. North Seas renewable energy resources could, therefore, reverse the trend of industrial decline and be the foundation of European economic renewal.

Against a backdrop of geopolitical turmoil that makes fossil fuel prices increasingly volatile, the North Seas transition can be the launchpad for a next generation European energy system that makes sure Europe retains its advantage and remains attractive to investment. An agenda to electrify strategic end uses – such as clean technology manufacturing or low-grade process heat[19] – could create a virtuous cycle of investment in, and modernisation of, European industry while creating demand certainty that would reduce the costs of offshore wind.

[18] European Union, 20 June 2023, **Joint communication to the European Parliament, the European Council and the Council on "European economic security strategy"**

[19] Eurelectric, Accenture, 2025, **The New Industrial Age: Tailored pathways for Europe's industrial competitiveness**

Building and defending technology leadership

Developing the North Seas can maintain European leadership on offshore wind and grid technology.[20] Action now to drive renewable deployment in the North Seas will instil confidence in the supporting industrial ecosystem (turbines, grid manufacturing, associated services, infrastructure). It will also create new jobs and growth, increasing Europe's chances to compete for a fast-growing global offshore wind market, including by shaping the industrial and security standards of systems elsewhere. This requires a laser focus on where Europe can scale supply chains domestically through better cooperation among North Seas countries and where it should seek strategic partnerships with other suppliers.

In short, the North Seas can be central to the creation of a new, highly energy efficient European economy when combined with the build-out of renewables across the continent in other rich pockets of wind or solar resource. In Chapter 3 we discuss in depth the strength of the European offshore wind industry and the opportunities – and challenges – for building resilient supply chains.

Delivering success

Tapping the full North Seas potential through cooperation

To successfully capture the benefits that the North Seas offer, the countries involved must step up their political commitments, and the scope and depth of their cooperation. They must move beyond agreements on renewable capacity targets, to focus on overcoming the barriers to delivery. The new security paradigm requires an integrated approach to security and energy infrastructure cooperation. Security, supply chain capacity, and enabling infrastructure must be considered as part of a shared European project, building scale and enabling rapid and complementary build-out to meet the demands of an electrified economy.

Amid international competition, it is in the interests of the EU, Norway and the UK to work together. The UK holds a major share of North Seas renewable resources and may represent around 36% of North Seas capacity by 2030,[21] [22] and the EU–UK security and defence partnership shows that the need for cooperation on security issues has already been recognised. Mutual access to wind resources in the UK, Norwegian, and EU Economic Exclusive Zones (EEZ) will generate significant energy cost benefits for consumers across the region (€44bn until 2040[23]), while combining UK, Norwegian, and EU production and demand will deliver significant scale benefits and a strong domestic market to support globally competitive offshore wind supply chains. Cooperation on areas like network design

[20] E3G, October 2024, **An Electrification Action Plan to Secure EU Industry's Future**

[21] UK government, March 2023, **Offshore wind net zero investment roadmap**

[22] European Commission, **Offshore renewable energy** (webpage, accessed January 2026)

[23] Baringa, on behalf of Breakthrough Energy, December 2024, **Beyond Borders: Unlocking the power of UK–EU offshore wind coordination**

and spatial planning, markets, system operation and technical interoperability, security and procurement requirements, and pipeline visibility can deliver huge efficiency dividends.

The UK should therefore be fully integrated into NSEC policy and planning activities to help deliver these many benefits to all parties. The North Sea Summit scheduled for January 2026 should set out how this will be achieved.

Leaders must remain engaged

Leaders cannot delegate delivery to technical bodies and review progress every one or two years; this approach has so far proved inadequate. The North Seas opportunities, as well as the barriers to delivery, cut across sectors – energy, economy, industry and security – and require cross-ministerial coordination. There are also important issues such as infrastructure cost allocation which need to be agreed between countries, requiring delicate inter-governmental negotiation.

Setting up a permanent leaders-level "sherpa group" to drive the pace of decision making, monitor progress, and quickly escalate issues could help to navigate delivery within and between governments. This should be supported by governance structures – eventually within NSEC or the Offshore Transmission System Operator Collaboration (OTC) – that enable deeper coordination on areas that will drive quicker offshore wind development, like network design and spatial planning, financing, electricity trading and system operation, or supply chains. The North Sea Summit should mark the start of this new delivery governance.

In Chapter 4 we propose a "Summit Action Plan", detailing the measures needed from the North Sea Summit to deliver a step change in North Seas renewable deployment.

Chapter 2: Energy and security in tandem: designing the North Seas grid

The North Seas Summit is a pivotal moment to act in the face of a new European security reality. Rapid delivery of a North Seas grid can help to address the energy and defence security threats that Europe faces. Managing these risks requires deeper cooperation at both regional and national levels to improve coordination on energy and security. Countries and institutions will also need to be prepared for the new forms of security threats that modern energy systems bring.

The security–energy nexus

The synergies between energy security and defence are such that the NSEC must go beyond its original objective to "[facilitate] the further cost-effective development of offshore renewable energy, in particular wind"[24] and include a stronger focus on security.

A particular advantage of offshore wind is the potential for improved resilience against physical security threats, like sabotage. Redundancy requirements in network design can be raised or specific engineering approaches can be adopted. As a decentralised system, offshore wind can be designed to be more easily restored following damage or attack. In contrast, attacks on oil and gas infrastructure are more disruptive, as seen with the NordStream sabotage[25] and Russian attacks on energy systems in Ukraine. Lessons can be taken from the efforts to restore energy supplies in Ukraine (see box on next page).

Going further, a North Seas grid can itself become a security asset through the possibility of **dual use**: incorporating security equipment into the infrastructure to strengthen defence capabilities in surveillance, detection and protection.[26] This could, for example, involve integrating sensors and drones into the offshore wind infrastructure.[27]

[24] CIRCABC (European Commission), 2016, **Political Declaration on energy cooperation between the North Seas Countries**

[25] MIT Technology Review, 3 October 2022, **Here's how the Nord Stream gas pipelines could be fixed**

[26] Liga.net, 16 May 2025, **Finland plans thousands of wind turbines along Russian border for defense**

[27] European Union, 21 February 2025, **Joint communication to the European Parliament and the Council: EU Action Plan on Cable Security**

At the same time, cooperation is necessary to anticipate and mitigate new security challenges arising from the development of North Seas wind infrastructure. Increased hybrid threats need to be addressed with more rigour, and climate resilience and preparedness are becoming increasingly important for energy system reliability. These risks need to be reflected in updated system design requirements and reinforced information exchange. New security responses will be needed to deal with cybersecurity risks, an inherent feature of new energy infrastructure embedded in economy-wide digitalisation. Table 1 provides an overview of the interlinked security risks that must be considered in the design and delivery of North Seas wind.

Energy infrastructure resilience: lessons from Ukraine[28]

Enhance system preparedness for system restoration

- Pre-developed system restoration schemes.
- Deployment of distributed storage and local backup generation resources.
- Repair capabilities in place, including rapid response repair teams, spare parts, and reserve equipment.

Comprehensive approach to critical infrastructure protection.

This requires a reliable defence system, anti-sabotage protection, system engineering protection and cybersecurity preparedness.

- **System design and generation capacity need to consider disruptive events**. Overcapacity in transmission and generation meant the system had sufficient redundancy and reserve capacity. At the start of the war, the capacity of Ukraine's power system was twice the maximum peak demand.
- **Decentralised energy systems can be critical** to ensure energy supply to vital services is maintained.
- **Regular exercises** allow energy stakeholders to simulate scenarios, identifying vulnerabilities and opportunities for improved collaboration.
- **Restoring gas supplies appears to be much more difficult than restoring electricity supply.** Destruction of Gas Compressor Stations (GCS) or surface assets of underground gas storage facilities (UGSF) requires new construction of installations, making it more complex than restoring centralised electricity supply (let alone decentralised systems).

[28] Centre for Global Studies, July 2024, **Russian tactics targeting Ukrainian critical energy infrastructure**

Table 1: Priority areas for cooperation according to threats in the new security context and relating to the development of North Seas wind.

Security risk	Major risks	Priority areas for regional cooperation
Geopolitical risk	▸ Weaponisation of supply chains, including fossil fuels and critical raw materials ▸ International market fluctuations and socio-economic instability ▸ Resilience of fossil fuel supply logistics ▸ Enabling the electrification of key industrial sectors	Faster North Seas wind delivery through cooperation on: ▸ **Network design and planning**, accelerating permitting and investment decisions ▸ **Supply chains**, to strengthen European manufacturing capacity and build resilience through diversification. ▸ **Electricity trade and system operation**, for accurate business case modelling. ▸ **Financing**, to unlock infrastructure investment decisions and de-risk bidding by developers.
Physical security	▸ Espionage and sabotage of maritime infrastructure ▸ Climate risks ▸ Military presence ▸ Shipping lanes	▸ **Network design and planning** for a more resilient grid. ▸ **Security requirements**: capabilities for prevention, surveillance and repair.
Cyber security	▸ Cyberattacks ▸ Espionage ▸ Drone threats ▸ Hybrid threats	▸ **Security requirements**, including procurement and tender criteria and information sharing.
Operational reliability	▸ Adequacy for periods of low wind ▸ Resilience of a new hybrid/meshed grid system	▸ **Network design and planning**: adequacy and system stability assumptions in line with the security context, including technological choices for resilient operation and quick system restoration. ▸ **Electricity trade and system operation** for efficiency and to unlock investment in grid management capacity.

Security by design

A well-designed North Seas grid needs to integrate security requirements into system design by applying a **security by design** principle. The traditional design criteria for infrastructure development risk leaving critical energy infrastructure exposed to emerging threats by focusing purely on surveillance and, ultimately, repair.

Security by design has key benefits in the context of the security risks introduced in Table 1.

Geopolitical risks

- Network design and planning processes leading to faster permitting and investment decisions and, therefore, more rapid build-out of renewable capacity.
- Supply-chain diversification requirements that strengthen energy security and resilience without undermining cost-effectiveness or the pace of renewable deployment.

Physical threats

- Engineering design and tender requirements to minimise sabotage and climate risks.
- Dual use requirements for offshore wind assets to improve monitoring and surveillance capabilities.
- Updated network design and planning requirements that minimise the impact of disruption on offshore wind infrastructure.

Cybersecurity threats

- Setting security requirements for sensitive North Seas wind and grid infrastructure to reduce cybersecurity vulnerabilities.
- Exchange of information on security assessments of equipment at the regional level to allow identification and mitigation of weak points in the North Seas wind system.

Operational reliability

- Network planning and resilience built on requirements that reflect the latest views on the security context and the outcomes of joint exercises by North Seas stakeholders leading to enhanced system adequacy and stability.
- Selection of technologies for reliable and resilient grid operation in line with system recovery scenarios ensuring resilience to the eventuality of disruptive actions or extreme weather events.
- Regional alignment on technological choices leading to enhanced system resilience.

Mainstreaming security by design across the North Seas wind development process should give decision makers more confidence to progress the investments required. It will help balance the need to accelerate delivery with making sure infrastructure is resilient against emerging security risks. The areas that need to be considered in relation to security requirements include: system engineering and design; procurement and tender criteria: protection, detection and repair capabilities; and the need for streamlined information exchange.

Effective cooperation between countries and institutions

The increasing connections between North Seas energy, and Europe's overall security and climate security means there is a strong case to improve regional cooperation that ensures risks are co-managed and defended by non-EU and EU countries.[29] This cooperation should establish a formal link between energy and security, which in practice should involve:

- Definition of security requirements for infrastructure design and planning, tender, engineering and procurement criteria and eventual integration of dual-use capabilities.
- Collaborative efforts to strengthen repair and surveillance capabilities.
- Information exchange on security assessments and threats.
- Mechanisms to monitor progress in reducing fossil fuel demand.

However, current institutional structures and decision-making governance have not linked the energy and security dimensions. The EU–UK defence and security partnership,[30] for example, shows that the value of cooperation is recognised, but it falls short as it does not identify energy security as a formal area of cooperation.

Similarly, existing technical-level regional cooperation platforms (e.g. NSEC support groups) or committees are focused on technical matters and don't have the mandate to address security related trade-offs. This could be addressed by including a critical energy infrastructure protection group with a cross-thematic mandate in the NSEC Support Group Structure.[31] Also, North Seas energy security could be integrated into the EU–UK security and defence partnership,[32] making it a pillar of the regional security dialogue and linking it at technical level with the EU–UK Trade and Cooperation Agreement committee structures and working groups (this should also guarantee Norway's participation). The box on the next page describes how these issues are being progressed in the Baltic Sea region.

[29] European Policy Centre, November 2025, **Europe's security begins at sea: It's time to counter Russia's shadow fleet**

[30] European Union and UK government, May 2025, **Security and defence partnership between the European Union and the United Kingdom of Great Britain and Northern Ireland** (PDF)

[31] NSEC, 2024, **North Seas Energy Cooperation (NSEC) Work Programme 2025–2027**

[32] European Union and UK government, May 2025, **Security and defence partnership between the European Union and the United Kingdom of Great Britain and Northern Ireland** (PDF)

Energy security cooperation in the Baltic Sea

The Baltics are Europe's new security flashpoint, with a series of sabotage actions damaging critical infrastructure in the region since 2022. In face of the escalating security threat, regional cooperation has been deepened and expanded, including through the following mechanisms:

- **Memorandum of Understanding on Critical Infrastructure Protection**:[33] Includes stronger cooperation on information exchange, best practice sharing and access to finance for critical infrastructure protection.
- **Baltic Sentry**: A NATO-coordinated deterrence mechanism that entails reinforced patrolling actions around critical energy infrastructure.[34]
- **Baltic Offshore Grid Initiative**: Includes a set of coordinated actions among Baltic Sea transmission system operators (TSOs), such as exercises, information exchange, repair capabilities and implementation of surveillance technologies.[35]

More intense regional coordination has been complemented with national initiatives. As an example, Poland has strengthened its military capabilities to surveil and protect critical maritime infrastructure.[36] It has also updated the security requirements for the development and operation of its offshore wind capacity, including the integration of deterrence capabilities.

Establishing a strong energy–security nexus at national level will help align national priorities with the regionally identified security requirements (Figure 1). However, currently there is a disconnect here too: national organisations are generally focused on either security or energy issues, not both. New governance architectures are required to address coordination gaps covering overall progress in reducing reliance of fossil fuels, information and data exchange, maritime monitoring, and implementation of security requirements or crisis management. Institutions must be built on a cross-thematic mandate, involving critical stakeholders from defence, energy infrastructure, cybersecurity, climate and industry (including developers and manufacturers of critical equipment). North Sea countries need to adapt decision-making structures and processes to the current geopolitical context, integrating the latest views on security risks. The box on page 22 describes such an approach in the Netherlands.

[33] Governments of Denmark, Estonia, Finland, Germany, Iceland, Latvia, Lithuania, Norway, Poland, Sweden and the European Union, 16 May 2025, **Memorandum of understanding on the protection of critical undersea infrastructure in the Baltic Sea** (PDF)

[34] NATO, January 2025, **Baltic Sentry to Enhance NATO's Presence in the Baltic Sea**

[35] 50Hertz, AST, Elering, Energinet, Fingrid, Litgrid, PSE, Svenska Kraftnät, 2025, **Baltic Offshore Grid Initiative – Expert paper 2025** (PDF)

[36] Polish government, 22 May 2025, **The Baltic on high alert: Poland takes action against "shadow fleet"**

Energy security cooperation in the North Seas

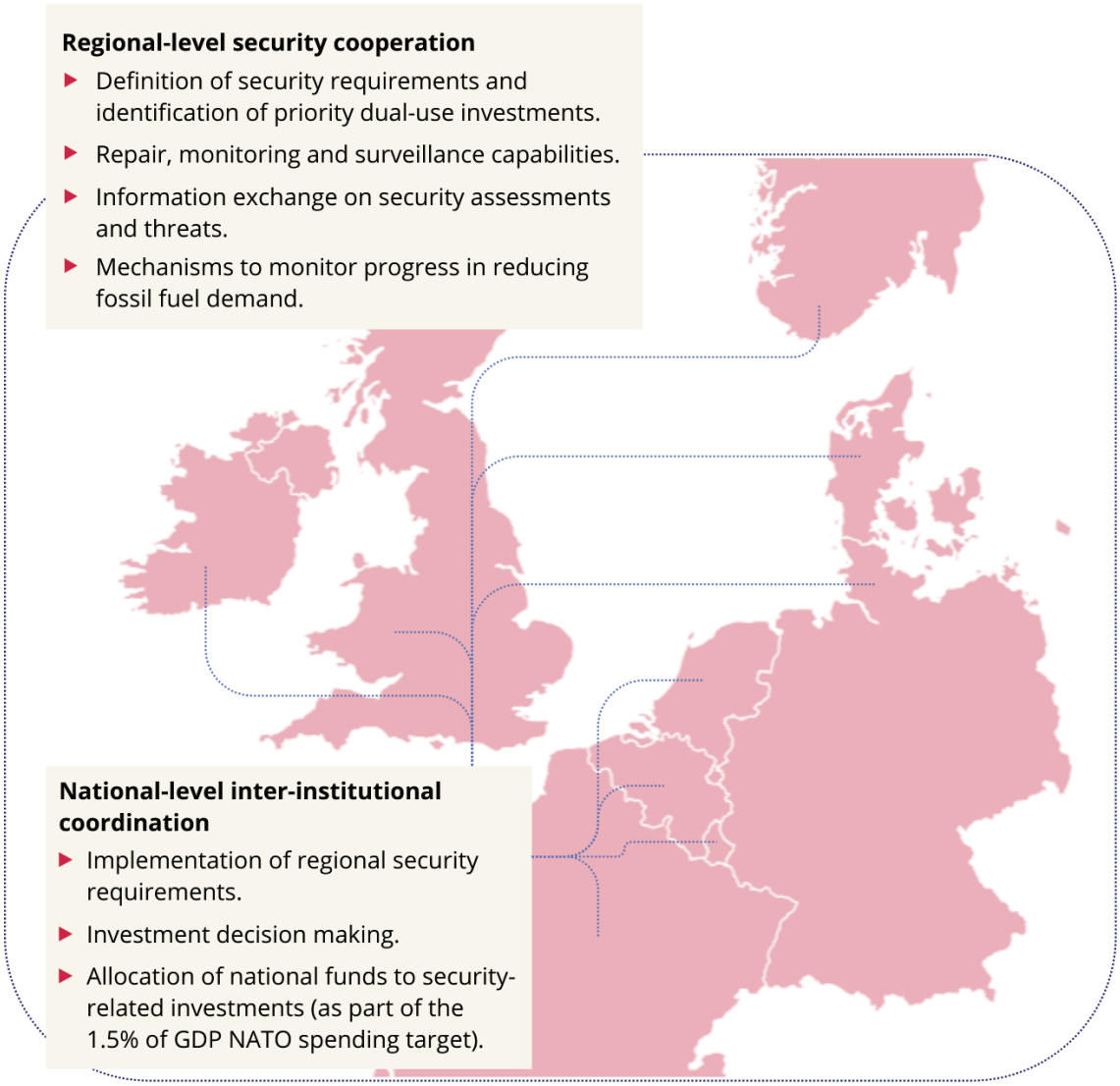

Figure 1: Cooperation between countries and between institutions within countries must establish a formal link between energy and security considerations.

The Dutch "North Sea Infrastructure Protection Programme" as a case of national cross-institutional collaboration[37]

The sabotage of NordStream 2 and the increased threat level to maritime infrastructure led to the creation in 2023 of the Dutch "North Sea Infrastructure Protection Programme" (PBNI).

The programme facilitates coordination and cooperation across the government departments of defence, economic affairs, climate, justice and security, and foreign affairs, while also involving energy and telecom stakeholders, including network operators.

The PBNI entails five action pillars: i) governance; ii) surveillance capabilities; iii) infrastructure resilience; iv) crisis management; and v) international cooperation.

Investing in security

Political-level regional coordination will additionally be vital in managing the trade-off between security and cost. NATO spending targets could offer a solution here. Within the overall target to spend 5% of GDP on defence, 1.5% of GDP can be spent on defence-related investments in areas including critical infrastructure protection, cybersecurity or crisis preparedness. Targeting such investments at relevant aspects of North Seas grid deployment could deliver:

- Higher adequacy standards.
- Stricter redundancy requirements.
- Updated engineering approaches.
- Equipment procurement aligned with security criteria and delivering dual-use capabilities, including adaptation of existing assets.
- Regional security cooperation governance

While decisions on the allocation of the 1.5% of GDP investments are made at the national level, this will be most effective if aligned with regionally coordinated security requirements.

[37] Government of the Netherlands, **Programma Bescherming Noordzee Infrastructuur** (webpage, accessed January 2026)

Recommendations for the North Sea Summit

- **Agree on an energy security governance structure tasked with:**
  - **Creating the trust-based conditions for sharing security information among key North Seas stakeholders.** This would help to bridge the defence and energy coordination gap and could be managed through either NSEC or expanding the scope of the EU–UK security and defence pact.
  - **Coordinating security requirements and grid design and engineering approaches needed to address new security threats.** Leaders should immediately define the governance arrangements to monitor delivery of security benefits and to set network design and system security criteria (adequacy and stability) with a view to this being agreed at the next summit in 2027.
- **Agree to dedicate part of the NATO-agreed 1.5% of GDP for security-related spending to cover the additional investments** associated with a "security by design" approach to the development of the North Seas grid. This would recognise the enhanced value for the region's defence capabilities and overall security.

Accelerating deployment

A step up in political commitment is needed to increase the pace of deployment of North Seas wind, moving from ambition to delivery. Evidence shows that deployment is falling behind the rate needed. The recent Baringa report for Breakthrough Energy shows that the current approach will likely deliver 87GW by 2030 and 257GW by 2050, failing to meet the respective goals of 120GW and 300GW set by leaders.[38] [39] Delay in delivery prolongs Europe's exposure to volatile gas prices, including through maintaining the coupling between gas and electricity prices,[40] and will extend the geopolitical vulnerabilities.

Delivery-focused cooperation must rethink and deepen existing work areas, and expand in scope. A "whole of North Seas approach" is required to tap into the available wind resource potential by reducing investment costs, developing an integrated and coherent approach to spatial planning and network design, and clarifying regional trade and system operation arrangements.

[38] Baringa, on behalf of Breakthrough Energy, December 2024, **Beyond Borders: Unlocking the power of UK–EU offshore wind coordination**

[39] Leaders of Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Norway, United Kingdom, 24 April 2023, **Ostend Declaration on the North Seas as Europe's Green Power Plant**

[40] Ember, October 2025, **Decoupled: How Spain cut the link between gas and power prices using renewables**

This is not helped by the current participation status of the UK. While its National Energy System Operator (NESO) has full membership of and participation in the North Seas Offshore TSO Collaboration (OTC),[41] the UK engages with NSEC as an observer,[42] albeit with intense cooperation taking place bilaterally or multilaterally with NSEC members in the context of specific (hybrid) projects. The UK's absence from the internal electricity market is also unhelpful and the process to rejoin should be accelerated.

Accelerating delivery – and reducing network costs – relies on effective regional energy spatial planning, to enable design of the lowest-cost network that is ready to support industrial growth in a modern electrified economy. A spatial plan should identify the location of future energy demands, thereby providing the European economy with the benefit of reliable energy supplies, while ensuring an appropriate balance between wind energy potential, biodiversity and other North Seas activity such as fisheries and shipping. It also offers the possibility of integrating new, updated security requirements. An optimised grid connecting new industrial demands is illustrated schematically in Figure 2.

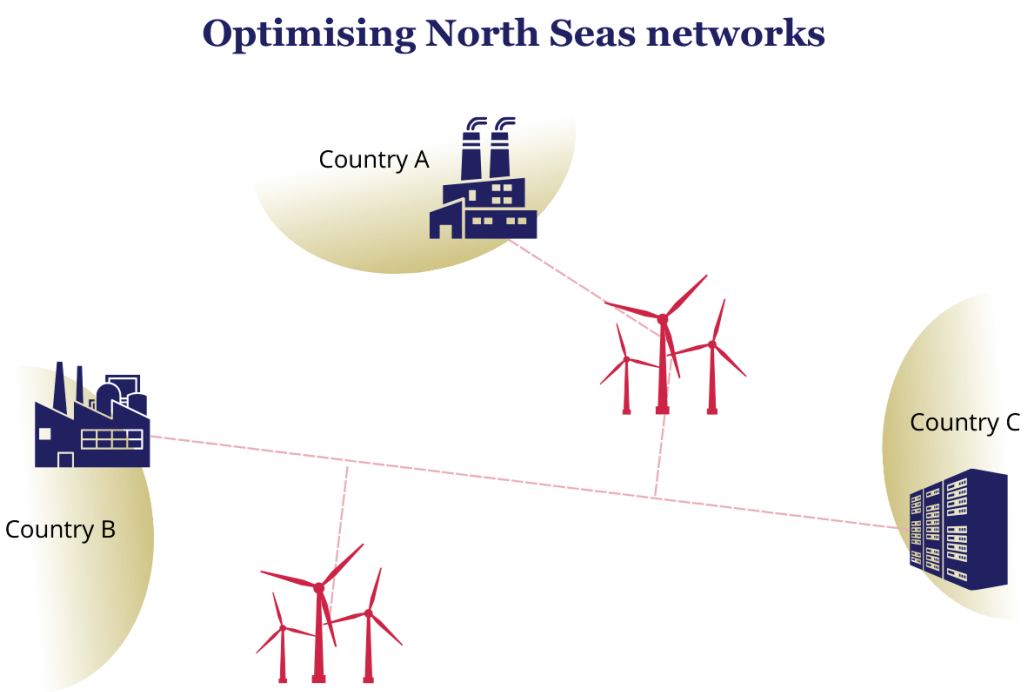

Figure 2: Regional spatial planning is essential to ensure North Seas energy networks are built to the lowest possible cost, are well placed to support a growing electrified economy, and consider other activities and biodiversity in the North Seas.

[41] Tennet, **Offshore TSO Collaboration - Supporting Europe's energy security and competitive growth through a regional approach to offshore grid development** (webpage, accessed January 2026)

[42] European Commission, 18 December 2022, **North Seas Energy Cooperation and UK establish cooperation framework to facilitate the development of offshore renewable energy**

Other issues that need to be resolved to accelerate delivery include:

- **Interoperability uncertainties** need to be addressed to support network design and improve asset business cases.
- **Trading arrangements** need to be clarified for developers to model their business cases and develop competitive bids to increase wind capacity.
- **A cost-sharing model** is needed to increase governments' confidence to commit to cross-border project investments. There are many potential grid projects, but without government-level commitments, investment decisions are unlikely.
- **Harmonising offtake and support arrangements for renewable projects** (Contracts for Difference – CfDs) connecting to multipurpose interconnectors will help improve predictability for developers, create a standard for managing financial flows, and give confidence for government-level decision making.

Recommendations for the North Sea Summit

- **Rapidly progress those projects that can be delivered quickly** by: (i) Committing to a timetable for allocating investment support; (ii) Confirming the basis for efficient electricity trading: either through the EU–UK Trade and Cooperation Agreement framework (setting bilateral agreements for each cross-border project), or ideally with the UK joining the internal electricity market as quickly as possible; (iii) Asking NSEC to propose interoperability standards, reducing uncertainties about future power flows and the type of equipment to be used.
- **Commit to a steady buildout of offshore wind** to achieve the 300GW goal in 2050. The Offshore TSOs Collaboration (OTC) should be asked to work with relevant authorities, including with governments regarding their industrial strategy plans, to propose a spatial plan that includes the optimal locations for these wind resources in line with this trajectory. Leaders should endorse this spatial plan at the next summit in 2027. In parallel, leaders should commit to agree cost sharing, harmonised CfD schemes and renewable offtake arrangements that ensure no country is unfairly advantaged or disadvantaged from where the windfarms are located.
- **Ask the OTC to produce a plan for the North Seas grid** that minimises the costs of connecting resources in the spatial plan and adheres to the security by design criteria by the summit in 2028. This should include any offshore hydrogen infrastructure that would improve system efficiency and meet any industrial needs. Leaders should endorse this plan at the summit in 2028.
- **Confirm immediately when the UK will gain full membership of NSEC.** Leaders should commit to defining the enduring institutions responsible for planning, building, and operating the North Seas Grid at the summit in 2028. They should also set out the process for allocating connection capacity and offtake arrangements for future offshore wind projects.

Chapter 3: The economic opportunity: capitalising on Europe's offshore wind expertise

Offshore wind is an area in which Europe has technological leadership: the EU still holds a significant position in global wind turbine manufacturing, while the UK has expertise in floating offshore wind. With global interest in developing offshore wind on the rise, the international market opportunity is big. However, Europe's ability to compete in global markets depends on achieving scale and cost reductions via deployment and collaboration in the North Seas and by positioning itself as a partner that can offer system solutions.

While we are focusing here on opportunities for the wind sector, it is important to remember that the key economic benefits lie elsewhere in the economy. Producing large volumes of renewable electricity at stable and competitive prices will create the confidence for European industries to invest and grow. It will create the bedrock of a thriving, clean, and modern European economy.

Supply chain opportunities and challenges

Europe's strength in offshore wind

In 2024, European manufacturers Siemens Energy and Vestas together held nearly 40% of the global market for complete offshore wind turbines.[43] Europe is also a significant producer of wind turbine components, accounting for almost a third of global manufacturing capacity for foundations, and almost a quarter for towers between 2022 and 2025.[44] European countries also lead in high-value wind inventions: Denmark and

[43] European Commission Joint Research Centre, 2025, **Clean Energy Technology Observatory: Wind Energy in the European Union - 2025 Status Report on Technology Development, Trends, Value Chains and Markets**

[44] European Commission Joint Research Centre, 2025, **The manufacturing landscape of wind turbine components**

Germany together filed nearly three times as many high-value inventions as China over 2019–2021.[45]

Europe's wind industry in numbers

- In 2024, each GW of offshore wind installed in Europe generated €4.4bn of value added to the European economy. The wider European wind industry generated €87bn in revenues, including €14bn from exports, and contributed nearly €55bn to Europe's GDP.[46]
- In 2024, the industry sustained 442,800 jobs in Europe, and this is forecast to reach 607,000 by 2030.[47]
- The UK offshore wind supply chain could add over £90bn of gross value to the UK economy by 2040.[48]
- It is estimated that global offshore wind development can create a £1,000bn serviceable export market to the UK industry by 2035.[49]

China dominates the global market for wind turbine components and onshore wind turbines given their lower manufacturing costs. However, in 2024 European manufacturers still accounted for 88% of the EU onshore wind market and 96% of the offshore wind market.[50] Between 2022 and 2025, European manufacturers sourced 59% of their components from EU-based companies.[51] The same report suggests that in 2024, EU manufacturing capacity was enough to meet the deployment needs for nacelles, blades and towers.

EU companies contribute to the global supply chain as well as meeting European demand.[52] In 2023, the EU recorded a positive trade balance of €1.7bn in complete wind turbines, while other green energy technologies such as solar panels and biofuels saw a

[45] European Commission Joint Research Centre, 2025, **Clean Energy Technology Observatory: Wind Energy in the European Union - 2025 Status Report on Technology Development, Trends, Value Chains and Markets**
[46] European Technology & Innovation Platform on Wind Energy (ETIPWind), June 2025, **European Wind Energy Competitiveness Report** (PDF)
[47] WindEurope, 2025, **Europe's Wind Energy Workforce Report**
[48] Offshore Wind Industry Council and Offshore Wind Growth Partnership, 2023, **UK Supply Chain Capability Analysis: Summary Report** (PDF)
[49] RenewableUK, Offshore Wind Industry Council, The Crown Estate, Crown Estate Scotland, 2024, **2024 Offshore Wind Industrial Growth Plan**
[50] European Commission Joint Research Centre, 2025, **Clean Energy Technology Observatory: Wind Energy in the European Union - 2025 Status Report on Technology Development, Trends, Value Chains and Markets**
[51] This figure is based on the number of manufacturing locations not on manufacturing capacity. See European Commission Joint Research Centre, 2025, **The manufacturing landscape of wind turbine components**.
[52] Ibid.

negative trade balance.[53] Between 2014 and 2024, the EU's average trade balance in complete wind turbines averaged around €2bn.[54] This suggests that the EU wind energy industry is robust and well established, with a strong foundation for future growth and development at a global scale.[55]

In addition, many countries, including those in Europe, may be concerned about potential security risks associated with buying Chinese equipment. While there is no comprehensive data available to compare performance of Chinese and European turbines, there are some safety and reliability concerns reported on Chinese turbines.[56] There are also some challenges conducting due diligence at Chinese turbine manufacturing plants – covering technical quality, production standards and labour conditions, among other factors.[57] Therefore, despite the cost disadvantages, European manufacturers do have some significant advantages in many markets.

Europe is especially strong in floating offshore wind. While the Asia-Pacific region has overtaken Europe in terms of the total installed offshore wind capacity, primarily due to China, Europe remains the market leader for floating offshore wind installation.[58] At the end of 2024, a total of 278 MW of floating wind was installed globally, 84% of which was installed in Europe and 14% in China.[59]

The UK was the first country to develop wind farms on floating foundations, and has the largest pipeline of floating offshore wind projects in the world.[60] This could give the country advantages in areas such as moorings and anchor designs, supply and installation, concrete platform designs, steel platform supply and manufacturing, and operations and maintenance.[61] Nearly 60% of floating wind project spending can be addressed by oil and gas supply chain companies through current capabilities, providing a major transition opportunity for firms.[62] Analysis of the UK's existing industrial capability suggests that the UK and global floating wind farms could contribute up to £47bn worth of gross value added (GVA) to the UK economy by 2050.[63]

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[53] Dell'Anna, A., 24 October 2024, **EU green energy exports grow on all fronts but trade-off remains negative**, Euronews

[54] European Commission Joint Research Centre, 2025**, Clean Energy Technology Observatory: Wind Energy in the European Union - 2025 Status Report on Technology Development, Trends, Value Chains and Markets**

[55] European Commission Joint Research Centre, 2025, **The manufacturing landscape of wind turbine components**

[56] Oxford Institute for Energy Studies (OIES), 2025, **Chinese participation in Europe's offshore wind sector: the good, the bad and the unknown**

[57] Ibid.

[58] Norton Rose Fulbright, August 2025, **International offshore wind: Floating offshore wind**

[59] Global Wind Energy Council (GWEC), 2025, **Offshore wind installed capacity reaches 83 GW as new report finds 2024 a record year for construction and auctions**

[60] RenewableUK, Offshore Wind, **https://www.renewableuk.com/our-work/offshore-wind**, accessed December 2025

[61] UK Floating Offshore Wind Task Force, 2024, **Floating Wind: Anchoring the Next Generation Offshore**

[62] RystadEnergy, 2024, **UK oil and gas supply chain and opportunities in the energy transition**, commissioned by Offshore Energies UK(OEUK)

[63] UK Floating Offshore Wind Task Force, 2024, **Floating Wind: Anchoring the Next Generation Offshore**

Global market opportunities

Governments and industry around the world are showing strong interest in developing their offshore wind potential. The Global Wind Energy Council (GWEC) forecasts a compound average growth rate of 21% for the offshore wind industry, which means another 350GW of offshore wind energy capacity could be added over the next decade, bringing total offshore wind capacity to 441GW by the end of 2034.[64] While China and Europe will continue to dominate offshore wind growth, their global market share in cumulative installations is expected to drop to 89% in 2029 and 84% in 2034, because of growth in other markets such as Asia-Pacific, North America and Latin America.[65]

Significant growth is expected in floating offshore wind. Around 80% of the world's exploitable offshore wind resources are located in deep waters,[66] and operational floating wind capacity is expected to grow nearly tenfold to 2.5GW by 2030.[67] This creates big opportunities for European manufacturers since early deployment in deeper North Seas waters has created a first-mover advantage. The total potential capacity for floating offshore wind is estimated to exceed 13TW worldwide, potentially creating a global market worth £1 trillion by 2050.[68] [69]

Supply chain challenges

While the sector is strong, the European wind industry faces some challenges in scaling to enable the deployment of projects expected in the North Seas and to take advantage of growing international markets.

- **Supply chain capacity in Europe must expand rapidly to meet the growing demand.** Recent analyses suggest a need for investments to meet growing demand beyond 2030. Up to that point, existing EU manufacturing capacity should be able to cover a large share of deployment needs. This is thanks to more than €13bn in new investments in factories, ports and vessels since 2022 – most of which are in the offshore wind supply chain. However, there is the potential for constraints in ports and vessels.[70] [71]

- **The wind industry continues to face high cost pressures** driven by substantial price inflation for key components, in turn due to sharp increases in energy costs and raw-material prices in 2021 and 2022.[72] For example, prices of base and industrial metals

[64] Global Wind Energy Council (GWEC), 2025, **Offshore wind installed capacity reaches 83 GW as new report finds 2024 a record year for construction and auctions**
[65] Ibid.
[66] Offshore Wind Academy, September 2025, **Floating Offshore Wind: Pilot Projects Around the World**
[67] RenewableUK, November 2025, **Floating offshore wind pipeline report - November 2025**
[68] International Renewable Energy Agency (IRENA), 2024, **Floating Offshore Wind Outlook** (PDF)
[69] UK Floating Offshore Wind Task Force, 2024, **Floating Wind: Anchoring the Next Generation Offshore**
[70] WindEurope, June 2025, **How much can Europe manufacture and install?**, WindEurope Market Intelligence
[71] European Commission Joint Research Centre, 2025**, Clean Energy Technology Observatory: Wind Energy in the European Union - 2025 Status Report on Technology Development, Trends, Value Chains and Markets**
[72] Rystad Energy, in cooperation with WindEurope, 2023,

such as aluminium and copper increased significantly, and despite the prices easing in 2023 subsequent rises mean they remain well above pre-pandemic levels.[73]

- **Europe needs to diversify supply chains** to avoid dependence on a single supplier and the risk of supply chains being weaponised in case of geopolitical tensions and potential security issues for critical infrastructure. It will also help reduce the risk of material inflation driven by a single supplier.

Need for collaboration

Offshore wind supply chains are inherently cross-border and planning cannot stop at national borders. Individual wind farms commonly rely on components manufactured and ports located in multiple countries.[74] Investments in manufacturing capacity, ports and supporting infrastructure therefore need to be coordinated at a European and sea-basin level to ensure scale and cost reductions, efficiency, resilience and timely delivery.

European countries can meet these challenges and seize the economic and industrial opportunities offered by the growing offshore wind sector – both within Europe and globally. However, this will require greater coordination and collaboration between countries. The following sections sets out measures that can be taken.

Creating predictability of demand

The lack of pipeline visibility is a key challenge hindering longer-term investment across supply chains. Despite ambitious national and European deployment targets, there is still no coordinated long-term schedule of tender rollouts. This creates uncertainty in a sector where investment decisions must be made years in advance. Offshore wind is a long-cycle business where suppliers and developers need to commit capital well before steel hits the water. Ørsted has warned that the uneven build-out plan (Figure 3) hampers the supply chain's ability to invest, deliver, and scale up.[75]

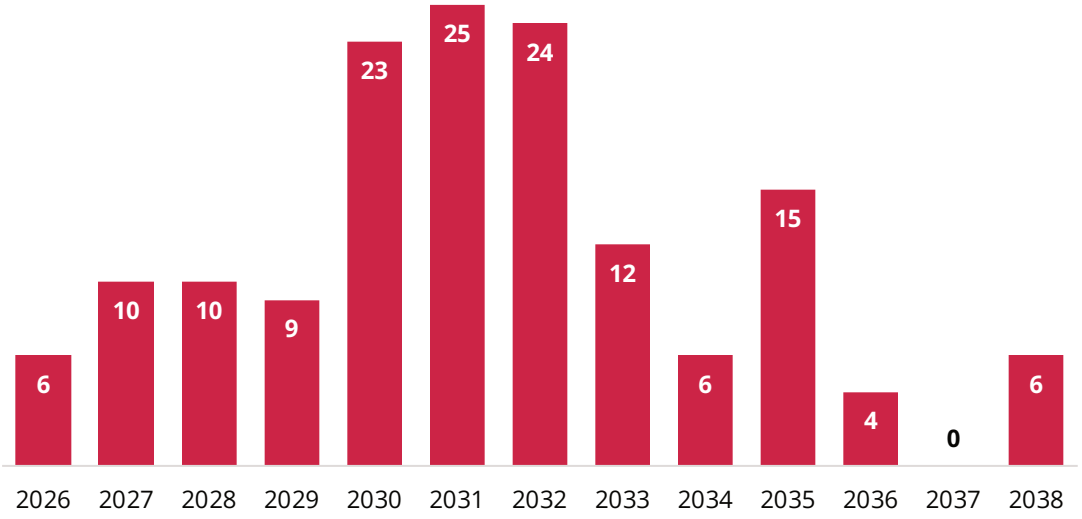
> *"The supply chain is going through major expansion. We currently have enough capacity, and supply chain actors are ready to keep investing. However, for the longer term, clear and consistent volumes are needed, to give supply chain clarity for their business case."*
>
> **Lizet Ramirez, Senior Analyst, Wind Energy Supply Chain, WindEurope**

[73] International Energy Agency (IEA), 2025, **Global Critical Minerals Outlook 2025**

[74] WindEurope, August 2025, **Offshore wind energy 2025 mid-year statistics**, WindEurope Market Intelligence

[75] Ørsted, 2025, **Offshore wind at a crossroads: Reviving the industry to secure Europe's energy future**

Planned offshore wind capacity additions in Europe (GW)



Note: *Numbers include capacity additions to be commissioned in the near term (pre-2029), already tendered CfD projects and other announced projects.*

Source: *Ørsted, 2025,* ***Offshore wind at a crossroads: Reviving the industry to secure Europe's energy future***

Figure 3: Planned European offshore wind additions in 2030–2032 exceed current supply chain capacity, but the subsequent fall in announced projects creates uncertainty for investment decisions.

Ministers of NSEC members acknowledged in November 2025 that one of the immediate challenges for the industry is transparency and predictability of demand, and called for a more coordinated and stable pipeline of projects.[76] The existing NSEC Tendering Tool, which collates national tender processes, can contribute to transparency and improve the visibility of existing and planned tenders.[77] This tool was launched in November 2023 to collate the schedule of offshore wind tenders across NSEC countries, including estimated timing out to 2030.[78] Information on the UK tenders is currently not included in the NSEC Tendering Tool since the UK is not a member of NSEC.

Clear, long-term build-out plans are essential to unlock investment in enabling infrastructure as well as manufacturing capacity. Port infrastructure is a major bottleneck with lead times up to 10 years. Under current auction designs – which prioritise the lowest costs and are largely agnostic about project locations – investors have limited confidence to commit to large-scale port upgrades years in advance of knowing whether projects will win a contract. WindEurope analysis points out that there is a mismatch between available port infrastructure and wind farm locations.[79]

[76] **The 2025 Joint Statement of Ostend on the North Seas Energy Cooperation 'Stronger together in the North Seas', Ostend, 6 November 2025 (PDF)**

[77] Ibid.

[78] European Commission, **The North Seas Energy Cooperation** (webpage, accessed January 2026)

[79] WindEurope, June 2025, **How much can Europe manufacture and install?**

However, coordination needs to go beyond visibility on ambitions and include commitments to support future investment that will ensure a stable pipeline. Increasing visibility and predictability of the project pipeline, alongside targeted public funding to de-risk early investment, would help attract the anticipatory investment needed to expand and modernise ports in time to meet future demand.

An additional option to smooth potential boom-and-bust cycles is to introduce greater flexibility in project delivery timelines within contracts, allowing developers to adjust schedules and ease pressure on the supply chain where bottlenecks emerge. Moving contract signing earlier in the process would give developers earlier project certainty, and therefore provide clearer signals for manufacturers and investors, which can enable timely investment across the supply chain. A common approach to auction design across the North Seas would avoid unhelpful competition between countries to attract resources and provide additional impetus to agreeing a cost allocation methodology.

Recommendation for the North Sea Summit

Improve predictability by coordinating tender timelines and volumes across North Seas countries. An immediate step could be to integrate UK tender schedules into the NSEC tendering transparency tool, improving visibility of the regional pipeline.

Improving efficiency

Improving efficiency across the offshore wind supply chain will be essential to accelerate deployment and help bring down costs, especially given the inflationary pressures faced by the industry. A strategic approach to harmonising processes and standardising certain components and tools can reduce unnecessary complexity, improve delivery timelines, and support the scale-up needed to meet Europe's offshore wind ambitions.

Harmonising tendering requirements

The NSEC work programme for 2025–2027 tasks Support Group 4 to "assess supply chain challenges as regards standardisation (technical standards)".[80] Current attempts at coordination around technical requirements in tenders can be significantly improved. For example, TSOs often require different qualifications or requirements. Mapping these differences, and identifying which could be aligned, would increase efficiency.

There is very little coordination across North Seas countries on security and resilience requirements. While more complex than harmonising technical standards, aligning these requirements would deliver substantial benefits, reducing the administrative burden for developers and manufacturers operating in multiple jurisdictions and creating a more predictable investment environment. It could be helpful to add this topic to the longer-term agenda for UK–EU cooperation at annual leader-level summits.

[80] NSEC, 2024, **North Seas Energy Cooperation (NSEC) Work Programme 2025–2027**

Standardising components and tools

Standardisation can further support efficiency, particularly where it unlocks economies of scale without constraining innovation. A first step is to identify which components or equipment are suitable for standardisation, and where this could meaningfully reduce costs by avoiding unnecessary custom designs. In some cases, standardisation can also help improve compatibility and therefore system resilience.[81] However, standardisation processes can take time and resources, so these costs should be weighed against the expected benefits. Standardisation may also be inappropriate if it risks locking in outdated technologies, or where bespoke solutions are a source of competitive advantage for suppliers.

Optimising human resources

Skills shortages in supply chains slow deployment and raise costs. Between 2024 and 2030, the number of jobs employed both directly and indirectly by the European wind industry is forecast to increase by 36%, from 442,800 to 607,000.[82] While this shows the important role of the wind industry as a source of employment, it also means that the workforce needs to expand rapidly to meet this gap to prevent skills shortages being a barrier to scaling up deployment. Blade technicians, field engineers, pre-assembly support technicians, and commissioning technicians have been identified as critical roles where the existing workforce cannot meet anticipated demand.[83]

Countries are currently addressing this at the national level, focused on strengthening the domestic workforce to maximise local benefits, for example by attracting new entrants, retraining oil and gas or other offshore workers, and retaining existing workforce. While this might eventually meet increasing demand, it will take time. There is no supply-side analysis of where resource gaps might be resolved nationally and where staff will be needed from other countries.

This is especially relevant for very specialist roles, where developing a domestic workforce is likely to take the longest. For example, the UK wind industry has called for more flexible immigration rules for vessel workers, as there are not enough UK workers available and it is not possible to close the gap domestically in the short term.[84] Restricting mobility in such roles could delay project delivery without clear benefits. Therefore, North Seas countries should identify roles where facilitating cross-border mobility can effectively address skills shortages without undermining domestic job opportunities and consider measures such as more flexible visa arrangements and mutual recognition of certifications.

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[81] European Initiative for Energy Security (EIES), October 2025, **REpower Europe's Energy and Grid Security: Key Takeaways for Policymakers and Industry**

[82] WindEurope, 2025, **Europe's Wind Energy Workforce Report**

[83] Ibid.

[84] Renewable UK, Offshore Energies UK, Scottish Renewables, Workboat Association, Global Underwater Hub, NOF, International Marine Contractors Association, May 2024, **White Paper: Impacts of visas for Offshore Workers on industry members and offshore energy development, operation and costs**

Recommendations for the North Sea Summit

Improve efficiency by harmonising tender requirements and considering standardisation of components and/or equipment. As a first step, countries could jointly assess where harmonised tender criteria and standardised components or equipment would deliver the greatest benefits for costs and supply-chain efficiency. They should also consider facilitating cross-border mobility for certain roles, through more flexible visa arrangements and mutual recognition of certifications.

A European approach to maximise economic opportunities and resilience

Scaling markets

Scaling domestic markets is essential for the European wind industry to maintain manufacturing capacity and status in the global supply chains, given the inherent cost disadvantages compared to China. This requires the European market to grow and regional demand to be integrated, creating a larger market to encourage supply chain investment. Disaggregated national markets risk inefficiencies, higher production costs, and lost competitiveness.

The UK is a small market where domestic demand alone cannot support scaled manufacturing.[85] While the EU provides larger markets, it has a more complex regulatory landscape than other countries such as the US.[86] Without stronger coordination between the EU, Norway and the UK to harmonise regulations and standards, companies may find it more viable to scale production outside Europe.[87]

Both the UK and the EU see offshore wind as an opportunity to reap industrial dividends and have developed plans to grow the industry domestically. In 2024, the UK developed the Offshore Wind Growth Plan, including a "make or buy" assessment for the supply chain based on market opportunities, UK's current capability, and added value to the economy.[88] The EU produced an offshore renewable energy strategy in 2020 with a follow-up communication in 2023. It has set out its offshore wind ambition and plans to strengthen manufacturing capacities and supply chains in the wind industry, through the 2023 EU Wind Power Package and as a part of the Net Zero Industry Act. The EU Wind Power Package includes financial support through the European Investment Bank (EIB) to boost investments in manufacturing, such as the recently increased €6.5bn counter-guarantee scheme.[89]

[85] Cleantech Group, 2024, **Stronger Together: Opportunities for UK-EU Collaboration in Clean Technologies**
[86] Ibid.
[87] Ibid.
[88] RenewableUK, Offshore Wind Industry Council, The Crown Estate, Crown Estate Scotland, 2024, **2024 Offshore Wind Industrial Growth Plan**
[89] WindEurope, June 2025, **EIB expands financing for wind manufacturing, grids and electrification**

> *"To grow and maintain competitive wind supply chains in Europe, we need a regional approach – modelled on how companies enhance competitiveness through consolidation. That means aggregating the market across the North Seas and encouraging certain countries to specialise so efforts are complimentary and more focused, strengthening Europe's overall position."*
>
> **Peter Giddings, Chief Engineer, NCC (UK)**[90]

There is now an opportunity to build on existing national-level analyses and develop a regional approach that identifies how Europe can compete and where it needs to nurture capacity across the offshore wind supply chain. This would map the region's collective capabilities and areas of comparative advantage, identify where countries can specialise, and where closer coordination and joint action is needed. This could also include a joint assessment of supply-chain vulnerabilities, particularly where heavy dependence on a single supplier creates security risks, as well as consideration of targeted measures to protect or shape markets for European components or materials that can deliver economic benefits or strengthen resilience.

However, developing domestic capacity is not always aligned with lowest costs. Therefore, such a regional approach would need to strike a careful balance between cost efficiency, accelerated deployment, industrial growth and security. It should enable Europe to optimise resources and maximise economic benefits while strengthening the resilience of its offshore wind supply chain.

Strengthening supply chain resilience through collaboration

A more collaborative approach to building resilient supply chains could help diversify Europe's sources of critical components, materials and services. Overreliance on a single supplier creates the risk of supply chains being weaponised in times of geopolitical tension; for example, China's expanded export control regime on rare earth elements (REEs) and permanent magnets, introduced in October 2025, demonstrated the risks of dependence on a single source. Moreover, dependence on external sources may pose security threats to critical infrastructure,[91] leaving wind farms vulnerable to cyberattacks, espionage and sabotage over the lifetimes of these components. This relates to complex systems that require ongoing maintenance, software updates, and spare parts.[92]

[90] **NCC** is a world-leading innovation organisation that transforms cutting-edge research and technology into industrial impact.

[91] Council of the European Union General Secretariat, 2024, **Harnessing Wind Power: Navigating the EU energy transition and its challenges** (PDF)

[92] European Union Institute for Security Studies, June 2024, **Here is how to protect the EU against Chinese electric vehicles and wind energy**

The EU and the UK have both recognised diversification of critical materials as a strategic priority in their respective critical mineral strategies and have introduced ambitious targets for domestic production, recycling, and limits on reliance on any single supplier country (see box below). Close collaboration would increase the chance of meeting these objectives. The EU and the UK can also further align their targets, including by recognising each other's contributions in achieving them.

▶ EU and UK diversification strategies for critical raw materials

Both the EU and the UK are nearly fully reliant on Chinese rare earth elements (REEs), and Chinese-produced permanent magnets. [93] [94] Permanent magnets are key components of wind turbine generators, and their production uses 4 out of the 17 classified REEs.[95] China is dominant in the global supply chain of REEs and permanent magnets: it supplies over 60% of REEs, refines 91% of them and produces 94% of permanent magnets.[96]

Given their importance for the wind industry, the UK's new Critical Minerals strategy lists the REEs used in permanent magnets among the minerals vital to the UK economy's growth sectors.[97] The strategy adopts benchmarks for diversification of supply of these minerals by 2035. At least 10% of annual demand must be met through domestic extraction, processing and refining, 20% through recycling, and no more than 60% can be imported from any one country.[98]

The more ambitious EU Critical Raw Minerals Act sets similar targets for as soon as 2030, requiring at least 10% of critical minerals to be extracted and 40% to be processed within the EU, 25% to come through recycling, and no more than 65% to come from any one third country.[99]

[93] Council of the European Union General Secretariat, 2024, **Harnessing Wind Power: Navigating the EU energy transition and its challenges** (PDF)
[94] UK Critical Minerals Intelligence Centre, 2024, **A UK foresight study of materials in decarbonisation technologies: the case of wind turbines**
[95] Jenns, C., 24 April 2025, **The supply chain limitations facing the wind turbine market**, Power Technology
[96] International Energy Agency (IEA), October 2025, **With new export controls on critical minerals, supply concentration risks become reality**
[97] UK government, 2025, **Vision 2035: Critical Minerals Strategy**
[98] Ibid.
[99] European Commission, **Critical Raw Materials Act** (webpage, accessed January 2026)

The potential for recycling is large. Decommissioning of wind turbines is set to increase as around 80GW of European wind energy capacity will theoretically reach the end of their operational lifetime by 2030. Annually decommissioned blade material is expected to reach 55,000 tonnes by 2030, more than double the amount in 2025.[100] By 2050, recycling of the most widely used rare-earth permanent magnets – based on neodymium–iron–boron (NdFeB) – could meet close to 50% of total EU demand across sectors in the most optimistic scenario.[101] Potential economic benefits from establishing a recycling and remanufacturing industry include the ability to refurbish ten wind turbine components across ten European countries, which could generate £9.6bn gross value added in the UK between 2025 and 2035.[102]

EU–UK collaboration could help to join up collection of end-of-life products and other stages of the recycling process across countries, creating a consistent flow of materials for recycling companies, while also achieving the scale needed for commercial viability across the value chain. The EU has already introduced measures to incentivise large-scale recycling,[103] and the example of UK rare earth company Less Common Metals building a permanent-magnet recycling plant in France shows that EU and UK capabilities are already interlinked.[104] Coordinated regulation, shared standards, and even pooled financing tools could boost recycling across the region. For instance, the EU's RESourceEU Action Plan, announced on 3 December 2025, includes plans to introduce export restrictions on permanent magnet scrap and waste from early 2026,[105] which would be more effective if coordinated with the UK.

In addition, the EU and the UK can pursue joint trade partnerships to develop alternative mining and refining capacity with external partners. Acting separately risks unnecessary competition to secure supplies from the same sources, whereas a joint approach would allow them to pool demand, strengthening their purchasing power, and supporting investment at scale in partner countries. While certain countries like Australia and Canada have capacity to extract critical minerals, alternative midstream refining capacity remains limited, meaning there is room for cooperation to develop midstream refining capacity in those countries.[106] In addition, the EU and the UK could establish diversified supply chains through joint partnership that also meet their shared sustainability and responsible-mining standards.

North Seas countries can begin by jointly identifying critical materials and components that require European production for security and resilience and coordinating on regional

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[100] WindEurope, November 2025, **Where do wind turbine blades go when they are decommissioned?**

[101] CEPS, 2022, **Developing a supply chain for recycled rare earth permanent magnets in the EU**

[102] BVG Associates, 2023, **Circularity market analysis: Assessing the potential market size and economic benefits in the UK of moving toward a circular model for operational wind turbine components** (PDF)

[103] European Commission, **Critical Raw Materials Act** (webpage, accessed December 2025)

[104] Onstad, E., 29 May 2025, **UK rare earths company to build plant in France**, Reuters

[105] European Commission, 3 December 2025, **Commission adopts RESourceEU to secure raw materials, reduce dependencies and boost competitiveness**

[106] Frazer-Nash Consultancy, 2025, **UK Critical Minerals Recycling and Midstream Processing Capability Assessment**

security requirements (see Chapter 2). They can also identify those value chains that will deliver highest economic benefit. For example, copper and aluminium are important for the wind industry but they are less vulnerable to geopolitical supply risks than REEs.[107] However, there could be a significant industrial dividend to ensuring they are produced in Europe. Alternatively, REEs used in magnets are strategically vulnerable and domestic sourcing would help supply chain resilience while the global market opportunity and industrial dividend is limited.

This assessment could lead to a shared strategy to increase supply chain resilience through regional production and recycling of critical materials and components and external sourcing from alternative suppliers, including coordinating tools such as local content requirements. This strategy should also cover digital systems with cybersecurity implications, to avoid long-term reliance on foreign technologies in critical infrastructure.

The EU has been rolling out "buy European" requirements, and the Industrial Accelerator Act – scheduled to be unveiled on 29 January 2026 – is expected to introduce further "Made in the EU" requirements for strategic materials and technologies.[108] Yet when it comes to critical materials, components, and digital systems for the offshore wind industry, the EU needs to engage with other North Seas countries such as the UK and Norway to strategically coordinate potential use of local content requirements. This can include the EU, Norway and UK mutually recognising each other's production and digital supplies in local content calculations.

Alongside a "Made in Europe" approach, a more flexible "Made with Europe" approach – encompassing free trade agreement (FTA) partner countries and other like-minded parters – could also be considered where appropriate to ensure more competition.[109] A coordinated European preference approach rather than fragmented domestic-only targets would create a larger market and encourage overall regional production, and ultimately strengthen Europe's ability to compete globally.

Recommendations for the North Sea Summit

Develop a coordinated European approach to maximise economic opportunities and enhance supply chain resilience, aligned with regionally coordinated security requirements of critical components. Agree coordinated action to build and scale regional supply chain capacities in critical sectors for industrial dividends and/or resilience.

[107] Baron, R., Kowol, D., Matusiak, P., Lutyński, M., Nowińska, K., 2024, **Assessment of the Risk of the Loss of Supply, the Recycling Rate and the Degree of Substitutability of Elements in the NdFeB Magnets of a Small Wind Farm Generator**, *Energies* 17 (3), 671

[108] Euronews, 09 December 2025, **EU's 'Buy European' strategy delayed by division among member states**,

[109] Dahl, J., 11 December 2025, **Document: Germany lays out a cautious 'Buy European' approach for the EU**, Politico Pro

Strengthening Europe's global strategic partnerships

Wind, onshore and offshore, and associated grid technology is a sector in which Europe remains the preferred partner for many countries and where a large part of the global value pool is accessible to global competition.[110] Other countries will, like Europe, want to manage over-reliance on Chinese materials and components. Europe can offer a credible alternative, built on fair, balanced, rules-based and mutually beneficial trade and investment partnerships that also support local value creation.

Offshore wind capacity is forecast to grow by 350 GW by 2035, adding to the currently installed global total of 83 GW. In addition to the current main markets of Europe and China, growth is expected in Latin America and the Asia-Pacific region. Australia, Philippines, Viet Nam, Japan, South Korea, Brazil and Mexico are all working on new policies and regulations to develop offshore wind.[111]

The opportunity goes beyond exporting manufactured goods. By providing an attractive market at home combined with a complementary trade agenda, Europe can develop partnerships which support the diversification of its own supply chain. Türkiye, in its immediate neighbourhood, is well positioned to become integral to its supply chain for glass fibres and for rare earths used in permanent magnets.[112]

Sharing best practices and providing technical and diplomatic support around market, grid and security design, North Seas countries can shape systems and norms elsewhere – positioning themselves as trusted partners on energy and security. This will help deepen and diversify diplomatic partnerships against a fast-changing geopolitical context.

The development of other high-level regional energy collaborations in the EU and beyond will continue to support Europe's interest in a faster climate transition – a cornerstone of Europe's agenda to safeguard multilateralism and to limit climate risks for its own population and economy.

The North Seas cooperation is moving from proof-of-concept to full-scale delivery and now needs a global partnership component that shapes diplomatic agendas across climate, energy, trade and security. North Seas countries can help identify global opportunities to develop offshore resources, improve access to public and private finance and create a "global offshore wind troubleshooting hub". Working with existing diplomatic platforms and alliances such as the Global Offshore Wind Alliance (GOWA), the Global Energy Transition Forum (GETF), the Global Coalition for Energy Planning (GCEP) and the Global Clean Power Alliance (GCPA) can be a first step which can ultimately broaden into engagement across security and trade dialogues.

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[110] McKinsey, November 2025, **Bold moves, fast scale-up: Europe's path to cleantech competitiveness**

[111] GWEC, 2025, **Global Offshore Wind Report 2025**

[112] WindEurope, November 2023, **The Turkish wind supply chain keeps getting stronger**

Recommendations for the North Sea Summit

Set out an international partnership agenda to build strong collaboration with developing offshore wind markets (both within and outside of the EU) to seize the opportunity to shape market rules, maximise EU–UK co-investment abroad, increase supply chain diversification, and shape security specifications.

Chapter 4: Powering ahead – a proposed summit action plan

The North Sea Summit is a key moment to power up action. It needs to move beyond ambition to delivery which enhances security, stabilises energy costs, and creates an economic dividend.

This is a long-term project for Europe. The greatest benefits will arise when governments remain committed to achieving shared goals over decades. The best way to ensure that all countries remain committed is to deliver benefits that are apparent, arise quickly, and are sustained. The North Sea Summit must set out a roadmap that is focused on this goal. We recommend the following steps, summarised in Figure 4.

Immediately appoint a leaders sherpa group

This action plan involves addressing a complex set of technical and political issues. These cannot be left to annual summits to resolve: leaders must remain engaged. We propose appointing a sherpa group responsible for ensuring the timeline set out in our proposed actions is achieved. This group must be able to act with leader-level authority to resolve any issues and forge the necessary agreements.

Ensure security by design

- **Make bold financial commitments for Europe's security.** Immediately agree to dedicate part of the NATO-agreed security-related spending (1.5% of GDP) to cover the additional cost of aligning grid development with the security by design approach.
- **Establish the energy security governance structure(s) for:**
  - **Sharing security information among key North Seas energy and security stakeholders.** This should be implemented as soon as possible and would help bridge the defence and energy coordination gap. It could be implemented through either NSEC or scope expansion of the EU–UK security and defence pact.
  - **Coordinating security requirements and grid design and engineering approaches needed to address new security threats.** Leaders should immediately define the governance arrangements to monitor delivery of security benefits and to coordinate on network design and system security criteria (adequacy and stability) with a view to this being agreed at the next summit in 2027.

A delivery schedule for security and prosperity through North Seas wind

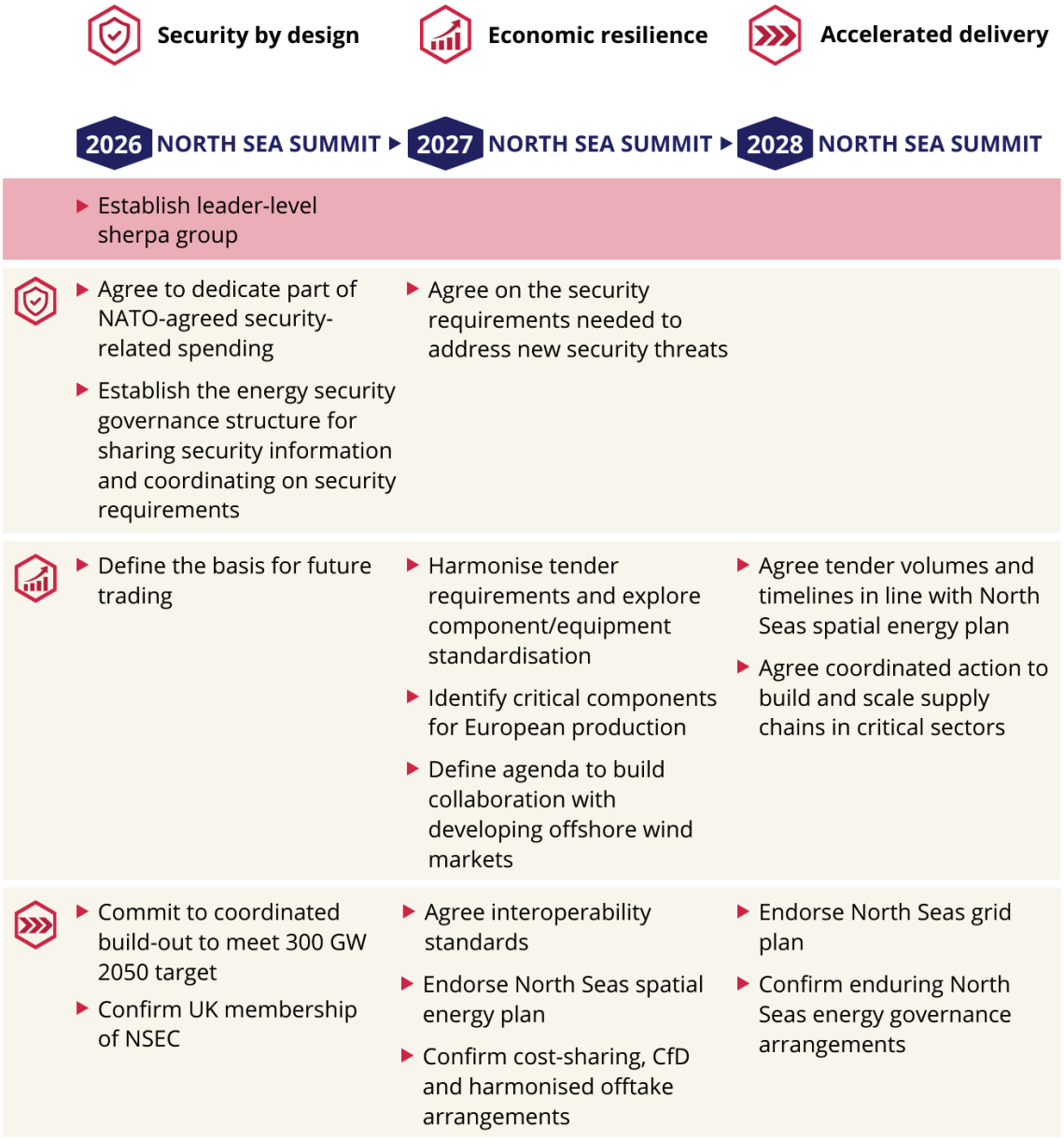

Figure 4: E3G's proposed action plan to move North Seas wind from ambition to delivery.

Strengthen economic resilience

- **Create predictability.** Commit to coordinate tender volumes and timelines across North Seas countries in line with the regional spatial energy plan for agreement at the summit in 2028. An immediate step could be to integrate UK tender schedules into the NSEC tendering transparency tool, improving visibility of the regional pipeline.
- **Improve efficiency.** Commit to harmonise tender requirements and explore component/equipment standardisation by the summit in 2027. This should include proposals to facilitate cross-border mobility for key roles. As a first step, countries could jointly assess where harmonised tender criteria and standardised components or equipment would deliver the greatest benefits for costs and supply-chain efficiency.
- **Increase supply chain resilience.** Identify critical components that require European production for security and resilience alongside those that will deliver an industrial dividend before the next summit in 2027. Countries should commit to agreeing coordinated action to build and scale regional supply chain capacities in those critical sectors at the summit in 2028.
- **Strengthen global partnerships.** Commit to define an international partnership agenda by the next summit in 2027 to build strong collaboration with developing offshore wind markets. This should seize the opportunity to shape market rules, maximise EU–UK co-investment, increase supply chain diversification, and shape security specifications.

Accelerate delivery

- **Hit the ground running.** The Offshore TSOs Collaboration (OTC) should be asked to immediately confirm those multi-purpose interconnector projects that are currently sufficiently advanced in planning that they can be delivered this decade. Governments should commit to ensuring prompt investment decisions so that these projects can form the baseline for the future offshore grid. They should also immediately set out the basis for efficient trading (e.g. timetable for UK to join internal electricity market) and instruct national regulatory authorities to ensure that the regulatory framework is in place to allow early delivery of these projects. The OTC should also be asked to propose technical interoperability standards that will reduce uncertainties around future power flows and the type of equipment to be used, for leaders to approve at the 2027 summit.
- **Build a spatial energy plan for the North Seas.** Leaders should commit to a steady build-out of offshore wind to achieve the 300GW goal in 2050. The OTC should be asked to work with relevant authorities, including with governments regarding their industrial strategy plans, to propose the optimal locations for these wind resources in line with this build-out trajectory by the summit in 2027. In parallel, leaders should commit to agree cost sharing, harmonised CfD schemes and renewable offtake arrangements that ensure no country is unfairly advantaged or disadvantaged by where the windfarms are located. Leaders should endorse this spatial plan at the 2027 summit.

- **Plan the North Seas Grid.** The OTC should be asked to produce a plan for the North Seas grid that minimises the costs of connecting resources in the spatial plan and adheres to the security design criteria by the summit in 2028. This should include any offshore hydrogen infrastructure that would improve system efficiency and meet any industrial needs. Leaders should endorse this plan at the summit in 2028.
- **Implement delivery governance.** Leaders should immediately confirm when the UK will gain full membership of NSEC. They should commit to define the enduring institutions responsible for planning, building and operating the North Seas Grid at their summit in 2028. They should also set out the process for allocating connection capacity and offtake arrangements for future offshore wind projects.

ABOUT E3G

E3G's mission: A safe climate for all

A safe climate for all underpins a future where humans and the natural environment can survive and thrive, where the most vulnerable are protected from climate impacts and economic systems prioritise people and the planet.

To achieve our mission, we build the policy solutions and political conditions for systemic action on climate. We:

- Work to win the politics and geopolitics of climate.
- Build the political conditions and policy solutions to drive the phase-out of coal, oil and gas from the global economy.
- Promote reforms to financial systems to secure the investment needed for mitigation and adaptation.

We are strategic thinkers

We combine deep strategic understanding with policy expertise. We analyse the political economy of climate and develop scenarios of how the future may evolve and what can be done to manage risks and exploit opportunities for action.

We are architects of climate action

We bring diverse stakeholders together to align action and foster dialogue. Through our collaborative approach we build connections and bridges, open windows of opportunity and create coalitions for change.

We are trusted brokers

We work closely with those driving climate politics forward, supporting them to tackle challenges behind the scenes. Governments rely on our knowledge of how to get things done in climate policymaking.

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