

North Sea Energy

offshore system integration

The North Sea Energy System

Pioneering Europe's secure clean energy future

The North Sea holds the key to Europe's energy transition, but only if we act now. We are at a turning point. The technical solutions are within reach, but the transition depends on integrated thinking, shared choices, and a mindset shift across all levels. From policy and politics to industry and society. The NSE research program outlines realistic pathways toward a secure, independent and sustainable offshore energy system.

Integrated grids

Within an integrated approach, NSE developed designs for three clusters (North, West, East). As spatially explicit blueprints they show the infrastructure for production, transport and storage of the four energy functions (Wind, Hydrogen, CO₂, Natural Gas). From a national grid to European grids with strong international connections to balance supply and demand.

Shared Vision for a Green Energy cluster

With a shared European ambition, working across borders and sectors we can shape the North Sea as a sustainable energy powerhouse that contributes to climate goals, strengthens ecosystems, and secures energy for generations to come.

Electricity

- Extend European (HVDC) interconnectors and develop HVDC circuit breakers
- Develop a European supply chain and critical material plan
- Develop an offshore market design (bidding zones)
- Develop cost-sharing and financing guidelines for interconnectors

Hydrogen

- Create a long-term EU H₂ grid and storage plan
- Develop legal, regulatory and market frameworks on offshore H₂
- Standardize and harmonize H₂ interoperability

CO₂

- Expand cross-border infra with pan-North Sea body to coordinate efforts
- Develop regulatory frameworks and standards for transport and monitoring
- Develop trade and cooperation agreements (EU-UK)

Hydrocarbons

- Create a joint strategy on decommissioning efforts and timelines
- Improve data sharing on decommissioning
- Enable certification of pipeline re-use for CO₂ & H₂

Integrated grid compass

Integrated grid actions:

- 1 Integrated energy vision and infrastructure plan for the North Sea
- 2 Supply chain bottleneck strategy across the four commodities
- 3 Standardization working groups under NSEC

The North Sea is filling up fast

The map shows that a wide range of activities are planned across countries for energy, nature, and shipping. Mapping them all reveals the urgent need for smart, integrated planning to make it all fit.

Next steps: Four main building blocks

1. European collaboration. Harmonized standards, shared infrastructure and joint planning
2. Cost & Socioeconomic balance. Creating viable business models, smart incentives and workforce planning
3. Space & Nature. Efficient use of space and robust nature restoration
4. Security. System resilience, supply security and strategic autonomy

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