WHEN TRUST MATTERS

An Integrated and Resilient North Sea

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A global assurance and risk management company

16,000+	162	100+	6%+
employees	years	countries	of revenue to R&D

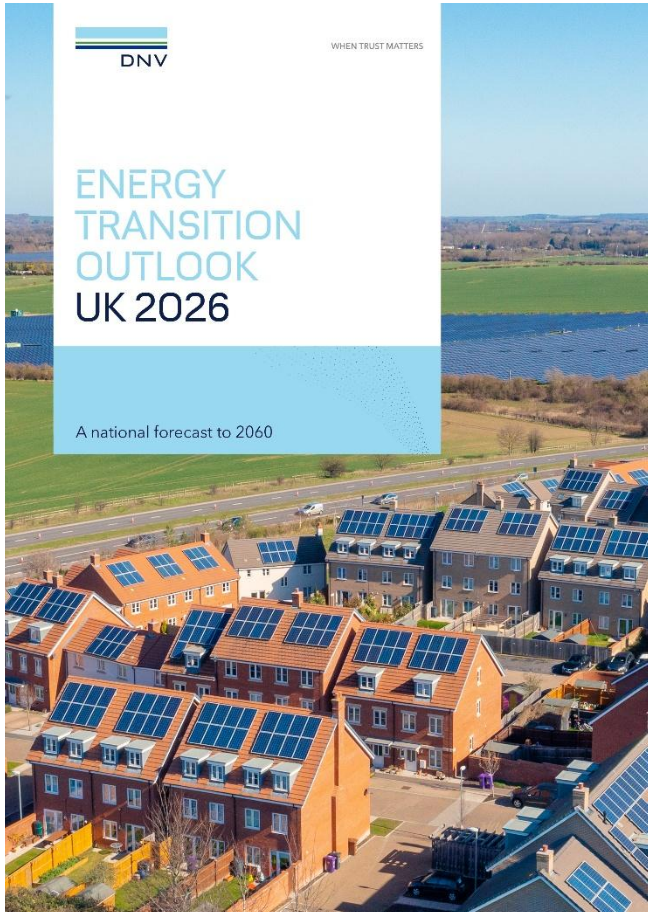
Ship and offshore classification and advisory

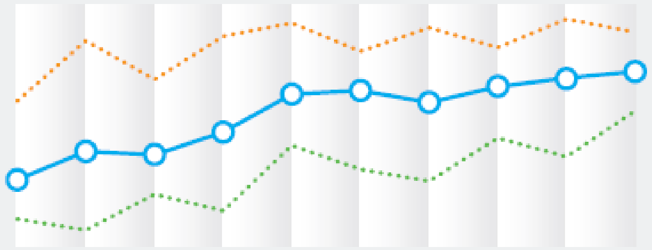
Energy advisory, certification, verification, inspection and monitoring

Software, cyber security, data platforms and digital assurance

Certification and assurance across industry sectors, including healthcare and ocean health

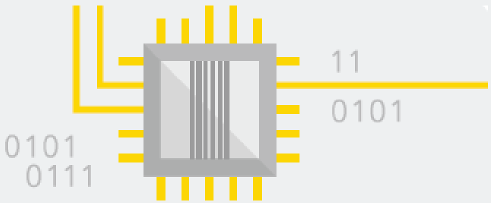
DNV ETO forecast





Our **best estimate**, not the future we want a **single forecast**, not scenarios

UK as part of the **global energy system** – through technology, economy, energy resources



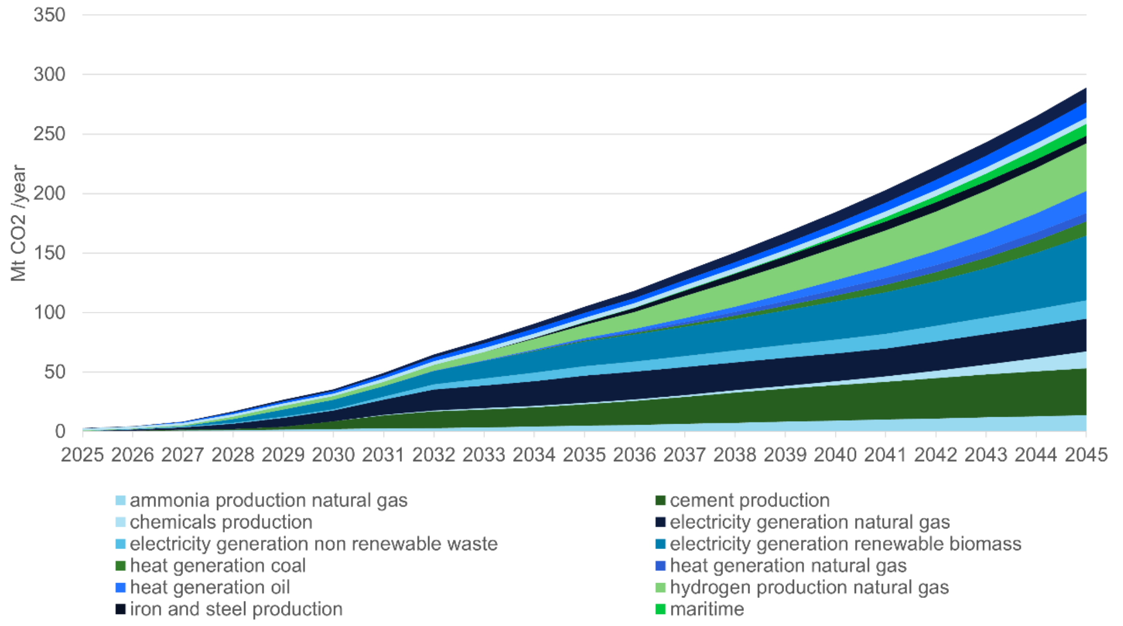
Technology uptake is mainly cost driven – reflecting global trends and learning curves

Key confirmed **policy** trends included: e.g. phase out of ICE, commitment to industrial clusters

The North Sea is central to Europe’s low-carbon energy system

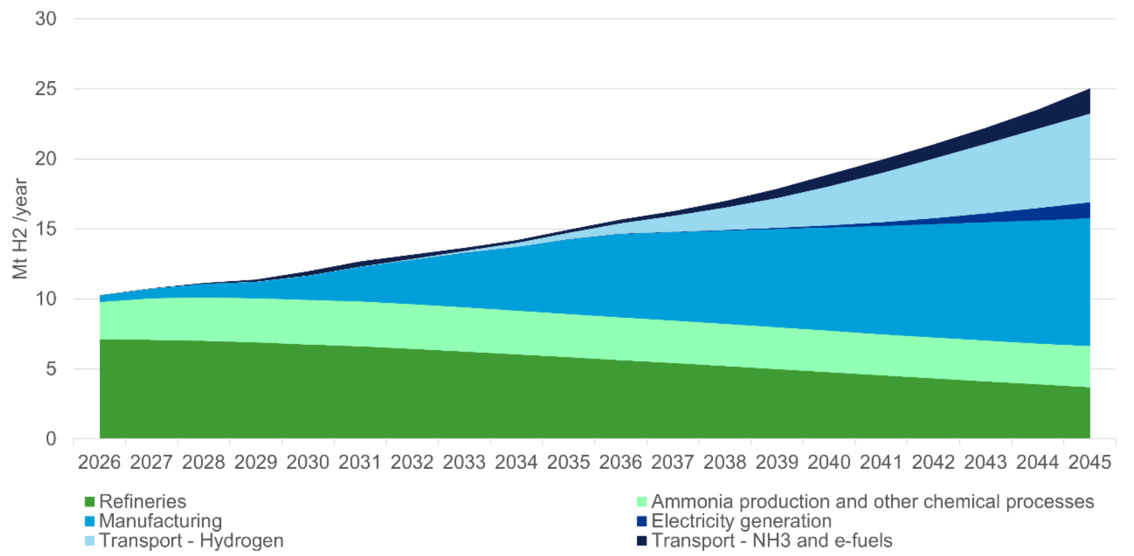
EU Capture Capacity by Sector, DNV ETO 2025

- EU CO_2 capture demand is scaling rapidly across sectors
- Industrial sectors drive long-term demand
- Requires large-scale transport and storage
- Creates dependence on North Sea CO_2 stores



EU Hydrogen Demand, by Sector, DNV ETO 2025

- Hydrogen demand is growing across multiple end-uses
- Strong growth in industry and transport
- Supply and demand are geographically misaligned
- Requires large-scale cross-border connectivity



How we approach resilience in this study

Approach

- System-level focus – not individual projects
- Overlapping CCS and hydrogen themes
- Designed for uncertainty – not fixed scenarios

What we mean by “resilience”

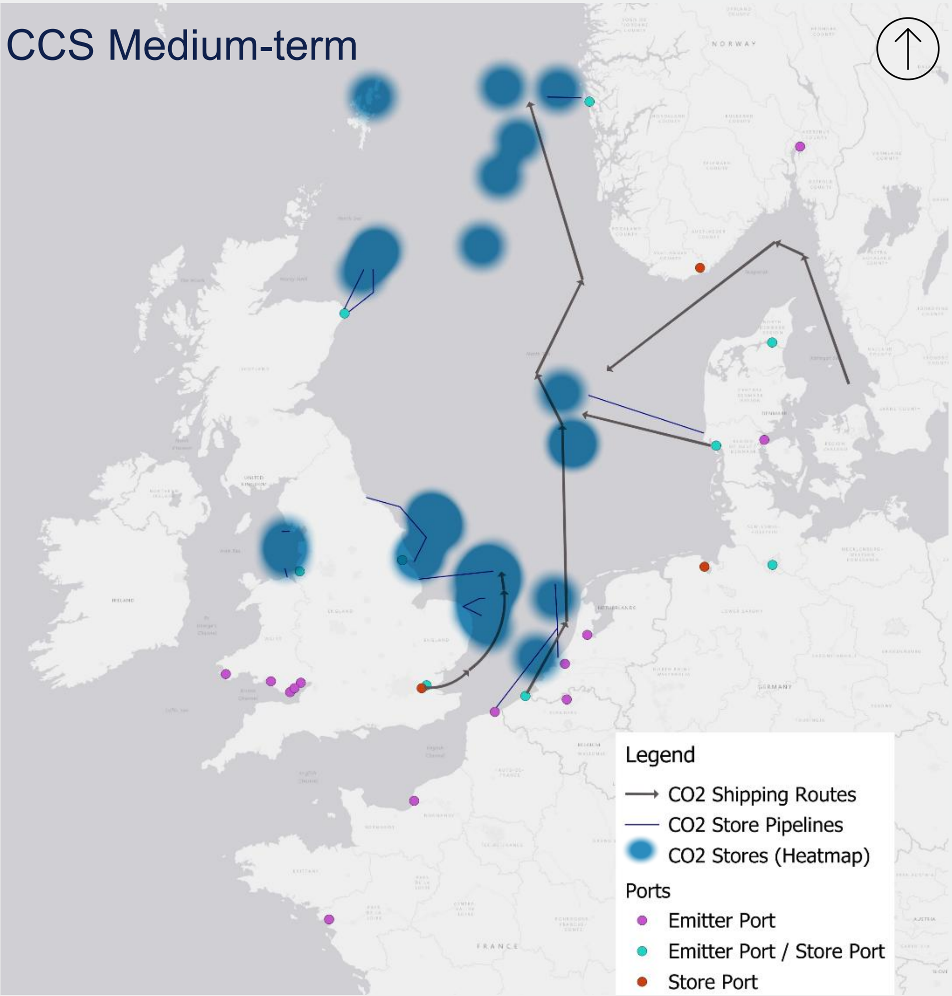
Technical resilience = how the system is built

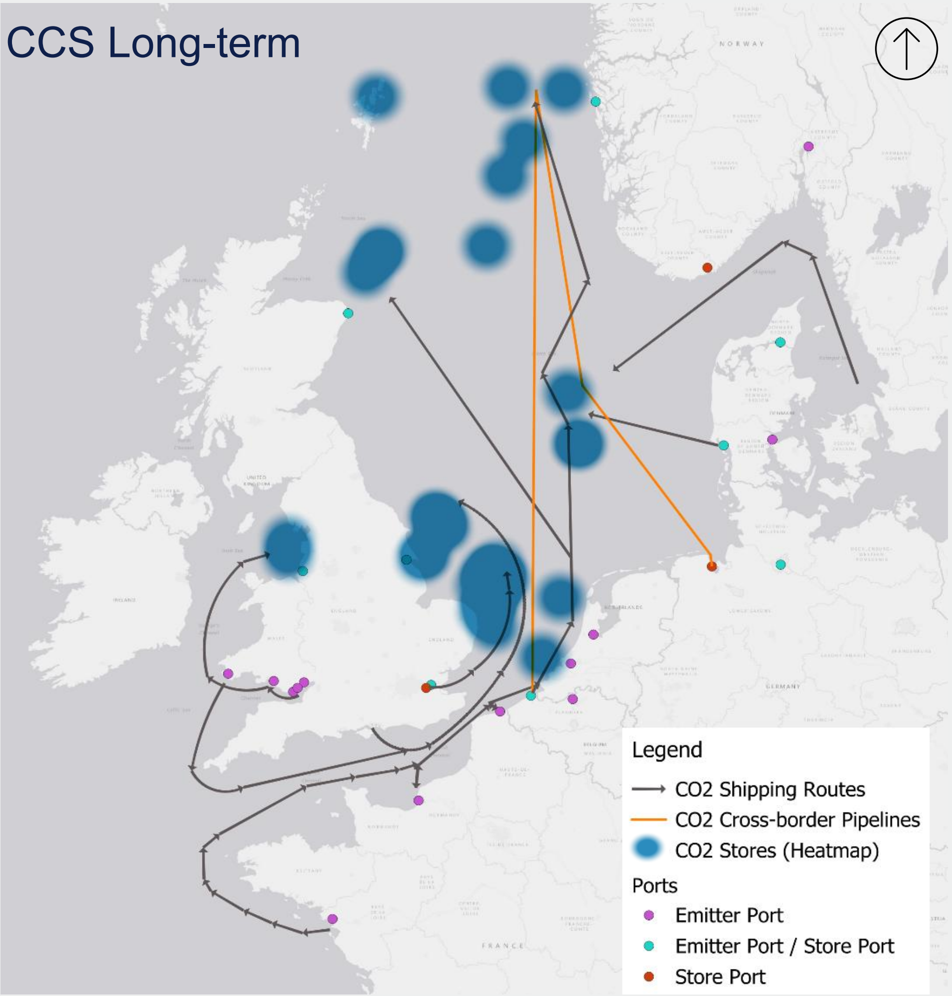
Operational resilience = how the system is operated

Regulatory resilience = how the system is governed

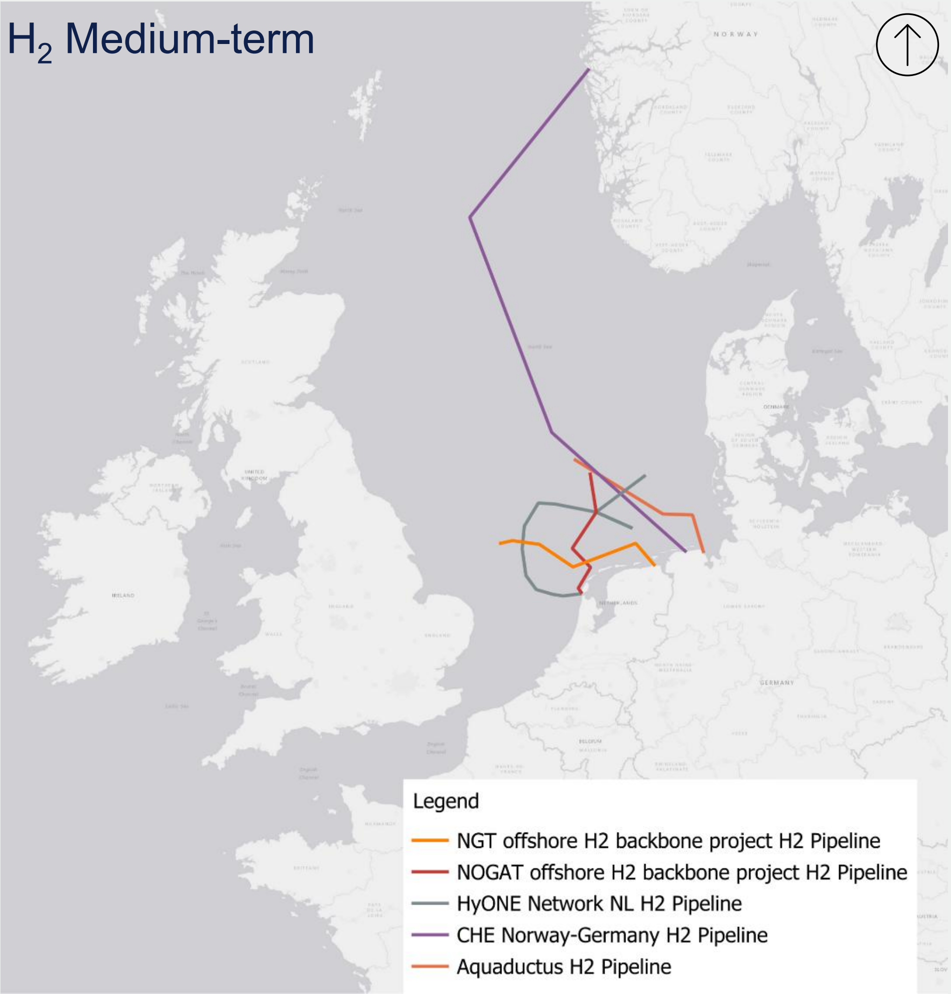
Economic resilience = how the system sustains itself economically

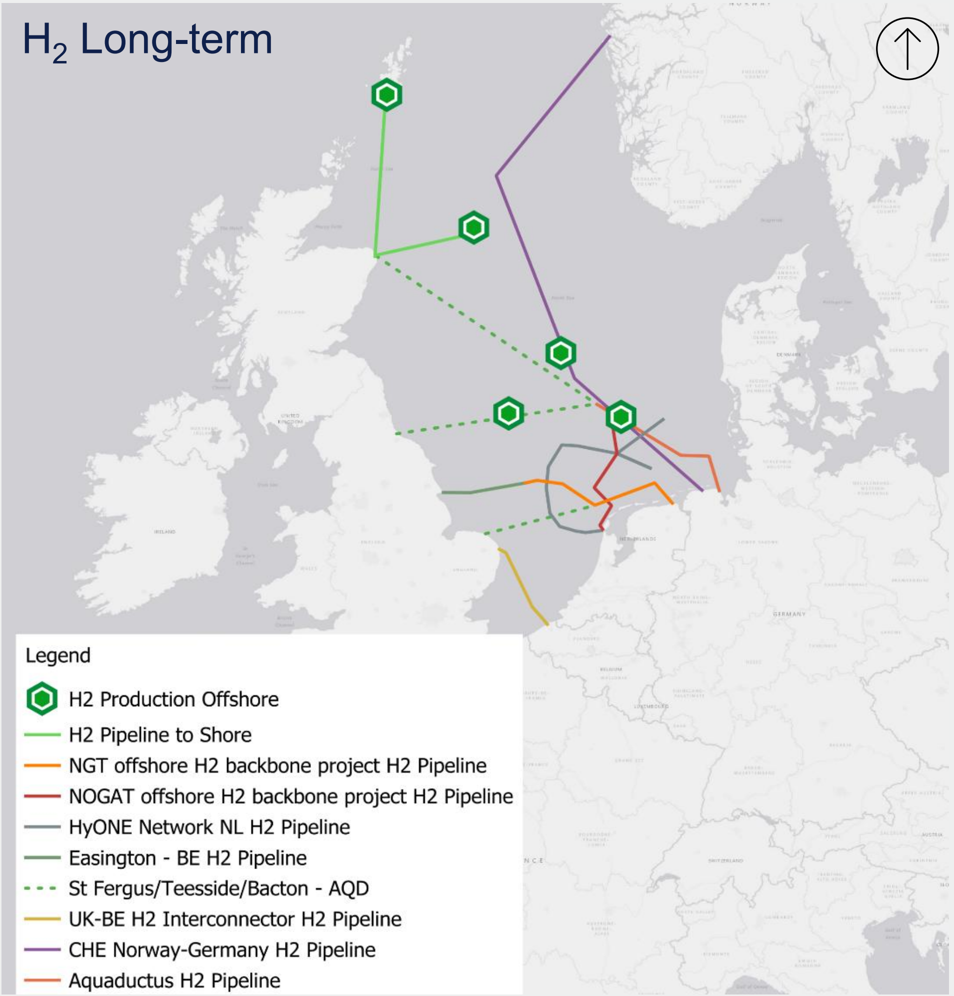
CCS infrastructure evolves from individual projects to integrated networks



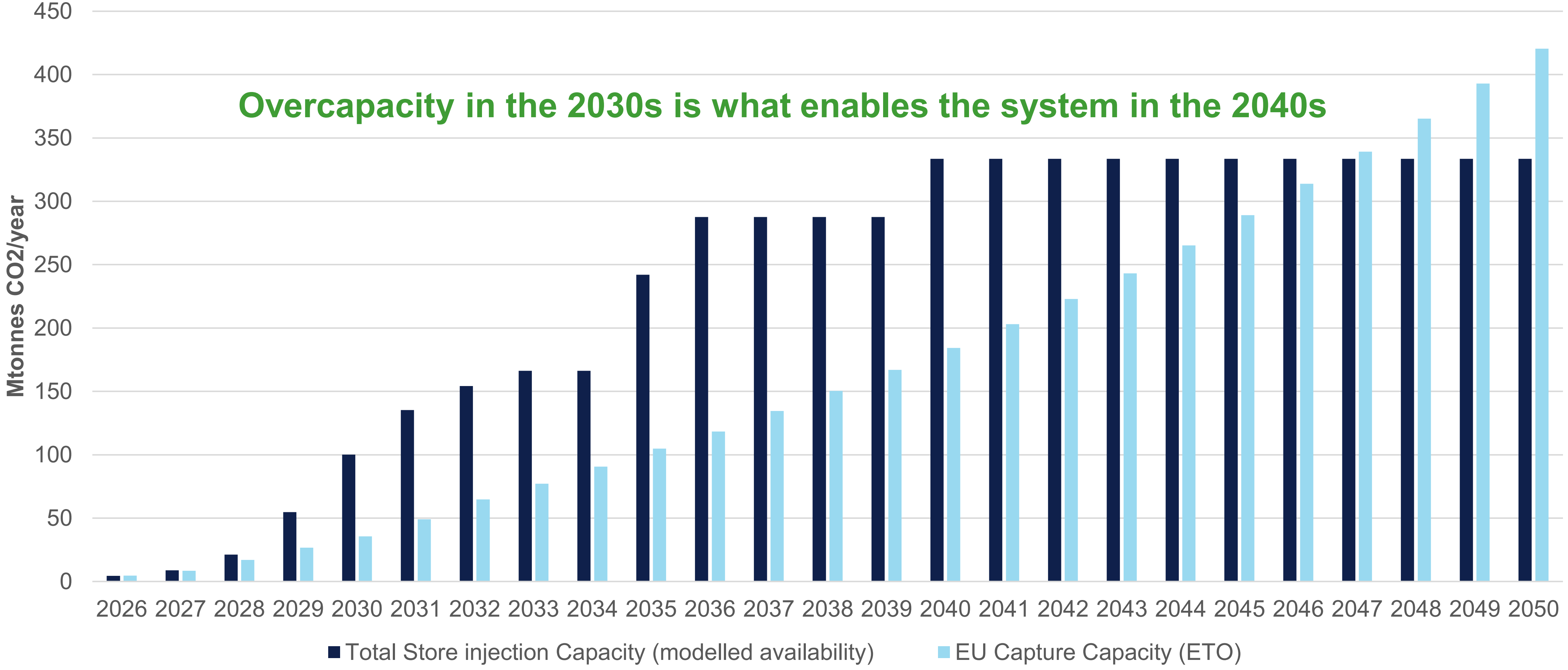


Hydrogen infrastructure evolves from backbone corridors to integrated networks



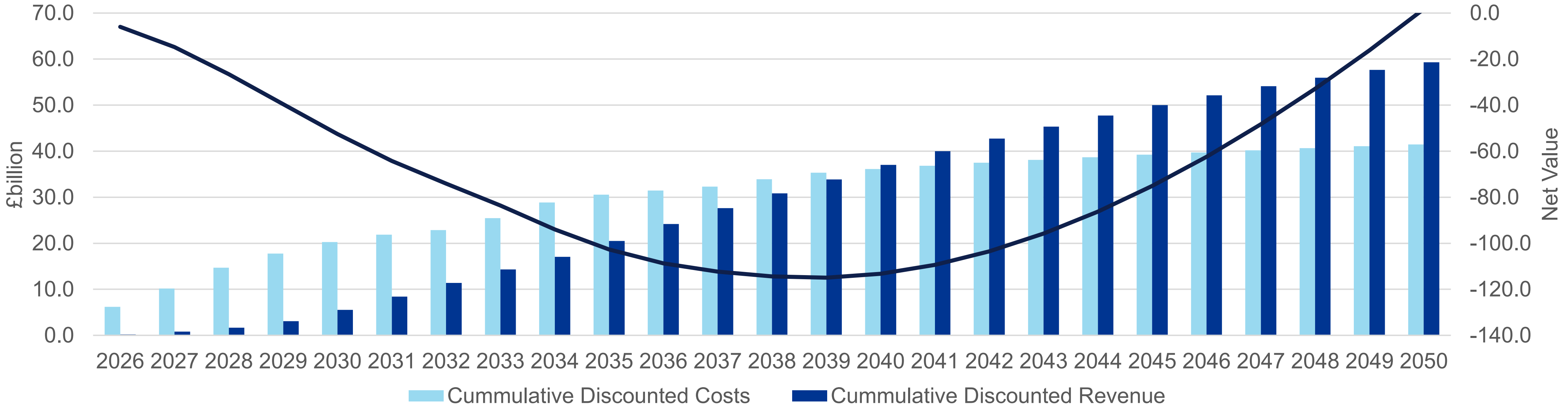


Early capacity is required for CCS system development



Injection Capacity vs ETO Capture Capacity

CCS infrastructure economics require early capacity ahead of demand



1. Capacity strategy

Early overcapacity

Capacity built ahead of demand

2. Investment profile

~ 25-year payback

Returns depend on utilisation over time

3. System dependency

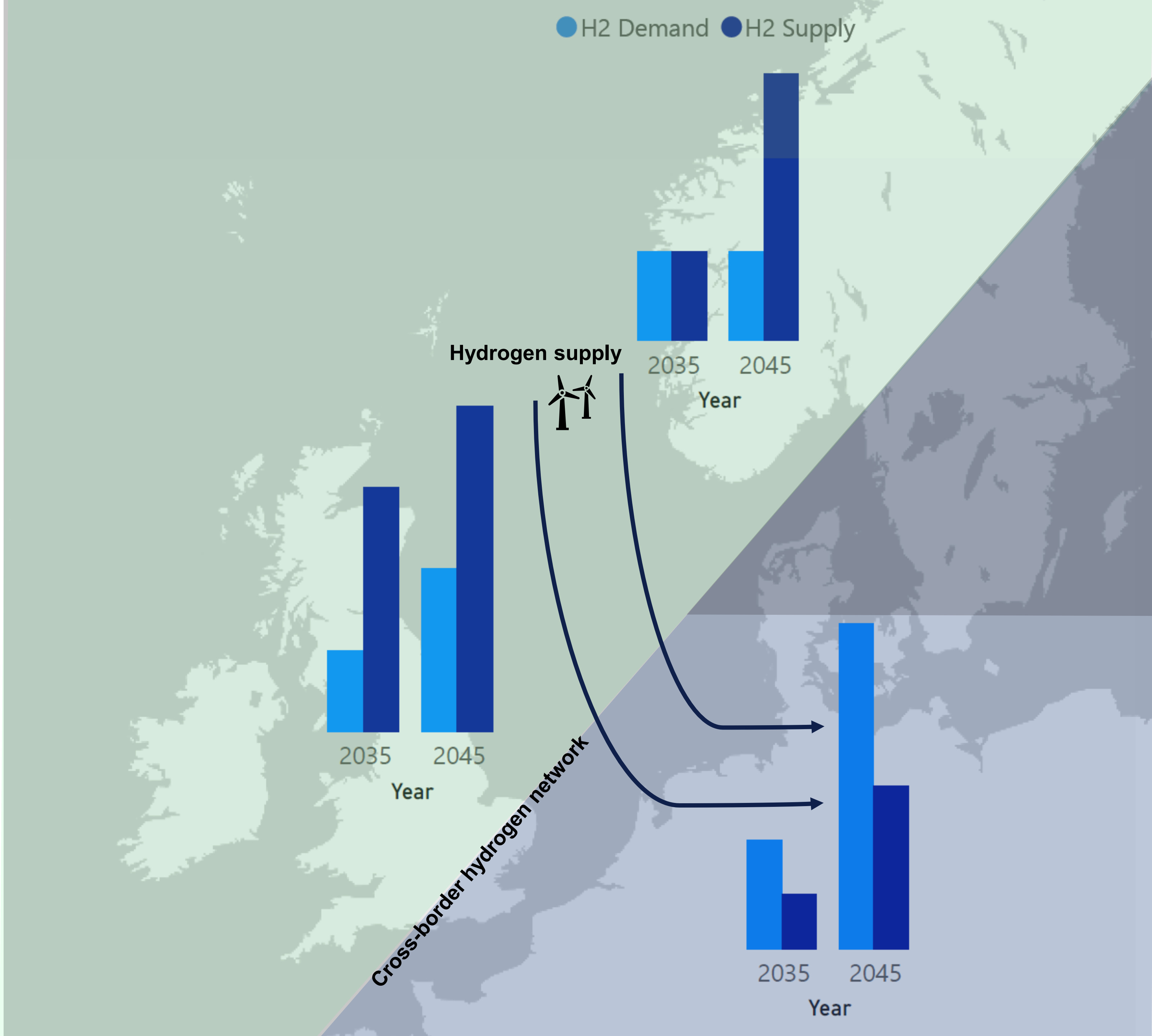
Multi-operator value chain

Requires coordinated capture, transport, and storage

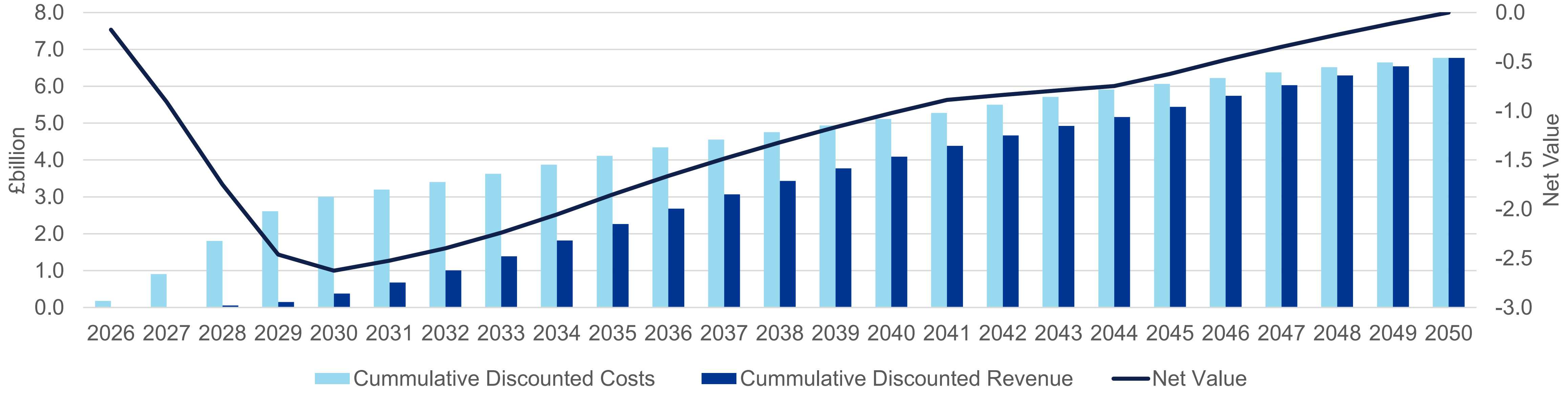
Early capacity enables long-term system growth

Hydrogen supply and demand are geographically misaligned

- **Potential surplus supply** from the North Sea region
- **Demand exceeds supply** in countries in central Europe (e.g. Germany)
- **Connectivity** enables system integration



Economic viability of hydrogen infrastructure depends on scale, utilisation, and system confidence



1. Cost competitiveness

~ £0.15/ tonne-km

Depends on utilisation and scale

2. Investment profile

~ 25-year payback

Inherent to large infrastructure systems

3. System scale

~34 Mt/year throughput

Requires coordinated system development

Early investment is required to enable long-term system value

Resilience dimensions are interdependent, but realised at different stages over time

Regulatory:
Defines rules, access, and investor confidence

Technical:
Builds capacity, flexibility, and optionality

Operational:
Delivers system performance in practice

Economic:
Creates value over time as the system scales

Resilience is built into the system, not added later

Structural Elements

Backbone: cross-border pipelines, shared trunklines, interconnected hubs

Redundancy: diversified routing and ‘oversized’ design

Flexibility: bidirectional flows

Enabling Actions

Strategy: Long-term, system-level approach and cross-border alignment

Coordination: harmonised regulation and coordinated investment

Integration: interoperability between systems

Together, these enable a resilient, flexible, and scalable system

Key Takeaways

Unlock North Sea Potential

The North Sea has significant capacity to support the growth of both CCS and hydrogen at scale.

Shift to system-level coordination

Move from project-by-project optimisation to integrated, system-level infrastructure to unlock full North Sea potential.

Accept early inefficiencies

Building ahead of demand means temporary underutilisation and overcapacity - a necessary part of scaling.

Build investor confidence

CCS and hydrogen require long-term confidence in demand, policy stability, and system coordination.

4 priorities to unlock an Integrated and Resilient North Sea system

Align standards and enable interoperability

- Maintain early flexibility, move toward harmonisation
- Use joint industry projects (JIPs) and standard-setting forums
- Align cross-border specifications, access, and rules

Plan infrastructure for the long-term

- Base decisions on system-level demand scenarios
- Improve coordination and visibility across project pipelines
- Use phased, modular development

Build for scale, flexibility, and resilience

- Design for expandability, redundancy, and multiple routes
- Enable inter-modality and buffering capacity
- Address delivery, cost, and coordination challenges

Strengthen coordination and investment

- Improve cross-border planning and system coordination
- Provide stable policy frameworks, demand visibility, and clear risk allocation

Thank you

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www.dnv.com