Haskoning
Enhancing Society Together

Business briefing:

Ports at the heart of Europe's energy transition: those who adapt will thrive

For decades, European ports have been shaped by an energy supply chain centred on fossil fuel imports. But as Europe aims to increase its share of renewable electricity to over 90% by 2050 and geopolitical tensions adding layers of volatility and uncertainty, one thing is for sure – energy demand is set to radically change.

With energy from oil and coal projected to decline by more than half by 2050, ports must adapt to thrive.

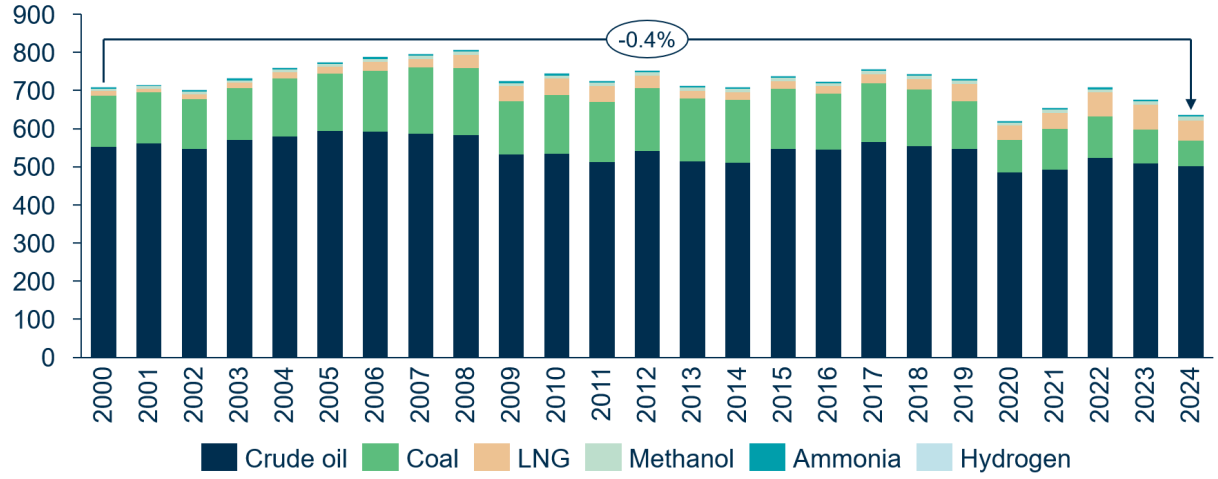
The good news is that ports have adapted before. The transition from coal to oil redefined the global energy trade market – creating winners among ports that could swiftly adapt to emerging geographies and evolving demand. In the same way, the future shift toward a low-carbon energy system driven by domestically produced renewable electricity, presents significant opportunities for those who understand and respond to the influences that will shape it.

The history of Europe's energy dependence: import-reliant and fossil-focused

To understand the future though, you must first look to the past. Europe's energy landscape has long been shaped by a strong dependence on external sources. Today, nearly 60% of the EU's energy demand is met through imports. Crude oil remains the most dominant imported energy source, followed by coal and liquefied natural gas (LNG). In contrast, imports of alternative carriers such as methanol, ammonia, and hydrogen remain marginal.

Between 2000 and 2024, Europe's total energy imports declined slightly (see chart below). This trend was largely driven by a sharp reduction in coal imports, as many European countries committed to phasing out coal from their energy mix by 2030. Crude oil remained relatively stable, while LNG imports surged to 54 million tonnes in 2024. This increase reflects Europe's strategic pivot toward LNG as a more adaptable and geopolitically diversified energy source, particularly in response to reduced pipeline gas flows from Russia.

European[1] Energy Imports, million tonnes (Eurostat)



[1] *Austria, Belgium, Bulgaria, Cyprus, Czechia, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Croatia, Hungary, Ireland, Italy, Lithuania, Luxembourg, Latvia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Sweden, Slovenia, Slovakia & United Kingdom*

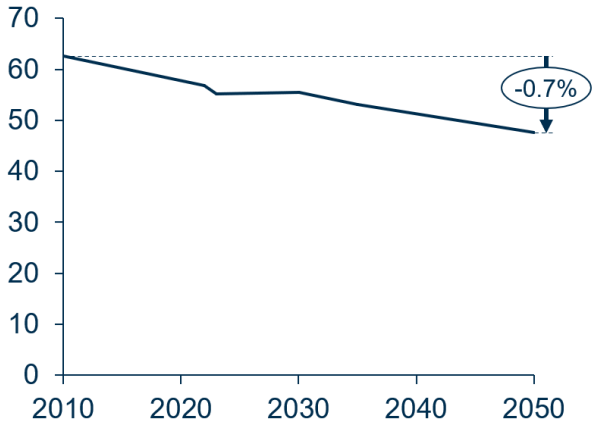
From 2025 onward, Europe's energy demand will radically change, and efficiency and electrification will lead the transition

Europe's current energy strategy is shaped by the dual imperatives of achieving climate neutrality by 2050 and strengthening energy security amid geopolitical uncertainties. Meanwhile, energy policy focuses on ensuring affordability for citizens and competitiveness for industry. These objectives, embedded in EU strategies such as *REPowerEU* and the *Fit for 55* package, have been translated into concrete policy targets: increasing the share of renewable electricity to over 90% by 2050, reducing collective energy consumption by 11.7% by 2030, and eliminating emissions from cars and vans by 2045, to name a few.

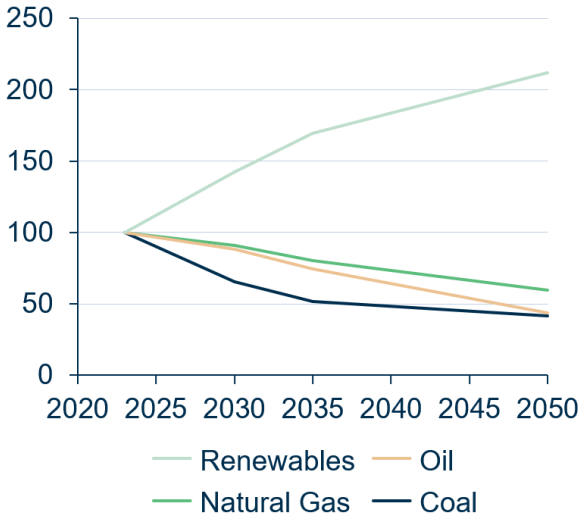
Aligning with these policy targets, recent global projections suggest that energy-related CO_2 emissions will peak around 2024-2025, marking a historic tipping point in the transition towards more renewable energy systems. Energy from renewable sources is expected to more than double by 2050 compared to 2025, while oil and coal are projected to decline by more than half, and natural gas by nearly 50%.

These shifts mean a radical change for Europe's energy demand, and for its ports, as increased energy efficiency, electrification, local energy sourcing, and a more diversified energy mix define a new landscape. Energy efficiency will come in the form of developments in building standards and energy-efficient industrial technologies, which, according to data from the *World Energy Outlook 2024*, published by the International Energy Agency (IEA), will result in a decline in European final energy consumption.

Europe's total final energy consumption, EJ[2]



Europe's total energy supply index (2023=100)



[2] *Stated policies scenario, Source: IEA, World Energy Outlook 2024*

Elsewhere, the growing share of electricity in the energy mix will be a crucial element in the energy transition. In Europe, electricity demand is expected to increase by 81% from 2023 to 2050, driven largely by the electrification of transport, heating, industry, and the production of green hydrogen via electrolysis.

Additionally, technological advancements are allowing more regions to produce their own energy. Driven further by the pursuit of energy security and resilience, countries are increasingly investing in local renewable sources like wind, solar, and hydrogen. As electrification accelerates, the demand for locally sourced energy will rise, enhancing regional energy independence and reducing transmission losses. Reflecting this shift, the EU aims to generate nearly 90% of its electricity from renewables by 2050, which will largely be domestically produced.

Lastly, the spikes in energy prices and market disruptions caused by Russia's invasion of Ukraine have accelerated Europe's energy diversification efforts. This includes reducing reliance on single suppliers, which enhances energy security. This shift is reshaping trade flows, potentially elevating the role of emerging energy-exporting nations while diminishing the influence of traditional suppliers.

Global shipping is deeply tied to fossil fuels, with ports having evolved as key hubs for energy trade and having shaped Europe's port geography

Out of all global maritime cargo – that is 11 billion tonnes shipped annually – about 40% is energy-related[3]. However, this energy cargo consists of fossil fuels like coal, oil, gas, and petrochemicals. The shipping industry and the fossil fuel sector are still deeply intertwined. Maritime transport relies heavily on bunker fuel, a by-product of oil refining, and simultaneously acts as a crucial facilitator of the fossil fuel trade by transporting crude oil, refined products, coal, gas and other energy carriers across the globe. This interdependence has shaped the development of ports into multifunctional trade hubs, with energy logistics being a significant part of their operations.

Ports have historically evolved alongside major energy transitions. The move from coal to oil transformed shipping routes and infrastructure, reducing the importance of coaling stations while elevating ports that embraced the oil economy. Today, ports continue to derive much of their significance from their capacity to handle, process, and distribute energy, a role that will shape their competitiveness in the context of future energy transitions.

This interdependence is clearly mirrored in Europe's port geography, where energy trade shapes the role and prominence of major hubs. The map on the right indicates Europe's largest energy ports in 2023[4]. The Hamburg–Le Havre range stands out, comprising five of the continent's major energy ports. Another significant concentration of large energy ports, although smaller in volume, can be observed in the Western Mediterranean, stretching from Sines to Marseille.

As Europe transitions toward a low-carbon energy system, the role of ports is once again being redefined from gateways for fossil fuel imports to strategic energy hubs. They enable electrification, support handling of new energy carriers, and are strongly integrated with industrial clusters. Yet, the future remains uncertain. Many alternative fuels are still in early stages of development, and the transition is shaped by a complex interplay of regulatory, technological, investment, and geopolitical factors.

[3] *Theo Notteboom, Athanasios Pallis and Jean-Paul Rodrigue (2022) Port Economics, Management and Policy*
[4] *By liquid bulk throughput*

From fossil fuel gateways to strategic clean energy hubs: opportunities and uncertainties for ports

The energy transition presents conditional opportunities for ports, dependent on how certain key drivers unfold:

Regulation and policy

Policy is a primary driver of how quickly and effectively ports can respond to the energy transition. While strategies such as the Green Deal Industrial Plan and REPowerEU set ambitious targets at EU-level, the actual impact on ports also depends on how these strategies are implemented locally and nationally as policies.

Speed of permitting for deploying new energy infrastructure

According to the European Sea Ports Organisation (ESPO), delays in permitting for renewable energy infrastructure, such as hydrogen terminals and offshore wind connections, are among the most significant barriers for ports aiming to support the energy transition. Ports in regions with streamlined procedures will move faster than those facing bureaucratic hurdles.

Carbon pricing and subsidy schemes

These shape the economic viability of clean energy imports. The competitiveness of clean fuels hinges on carbon pricing under the EU Emissions Trading System (ETS) and financial support mechanisms at both EU and national levels.

Technology

Another decisive drive, the energy transition is not a single trajectory but a convergence of multiple technological pathways. Ports will need to accommodate a mix of energy carriers, such as electricity, hydrogen, ammonia, methanol, and captured CO_2, each with distinct infrastructure needs.

Grid connection capacity

This is a critical enabler. Ports with strong grid connections or plans to expand these, can support electrified industrial clusters and offshore wind integration. Projects like Zeevonk II in Rotterdam illustrate how ports are already hosting electrolysers and renewable energy conversion facilities.

Zeevonk II is a major energy integration project spearheaded by a joint venture between Swedish energy firm Vattenfall and Copenhagen Infrastructure Partners (CIP). It centres around the IJmuiden Ver Beta offshore wind zone in the North Sea, which it won in a government tender.

The project aims to establish a fully integrated energy system consisting of:

- A 2 GW offshore wind farm—one of the largest in Dutch waters
- A 50 MWp floating offshore solar park, enhancing renewable diversity and grid-efficiency
- A 1 GW electrolyser located on the Maasvlakte, capable of producing green hydrogen by converting locally generated electricity

This energy hub is scheduled for commissioning by 2029.

Hydrogen and ammonia infrastructure

While the Ports of Bilbao and Sines are forming international hydrogen corridors with the Ports of Amsterdam and Rotterdam respectively, production and demand are still nascent. Infrastructure gaps and high production, transport, and storage costs continue to delay large-scale deployment.

Investment and industrial strategy

According to ESPO, European port managing bodies will require around €80 billion in investments by 2034. Within this, sustainability and energy transition projects rank as the second-highest priority, reflecting the shift towards greener operations. Yet, the economic viability of clean energy imports remains uncertain.

Without long-term demand certainty, clear regulatory frameworks, and targeted financial support, many projects will remain commercially risky. Funding instruments are thus essential for de-risking early investments and enabling first-mover projects. While start-ups and pilot projects are vital for testing new technologies, the bulk of the transition will hinge on large-scale investments by established firms with the financial capacity and operational scale to drive systemic change. Ports that can support both ends of this spectrum will be more adaptable.

Industrial clusters

Where industry actors have clear roadmaps for electrification, fuel switching, or carbon capture, the case for infrastructure investment is stronger. HAROPA, for example, is actively developing low-carbon fuel projects for aviation, shipping, and industrial use.

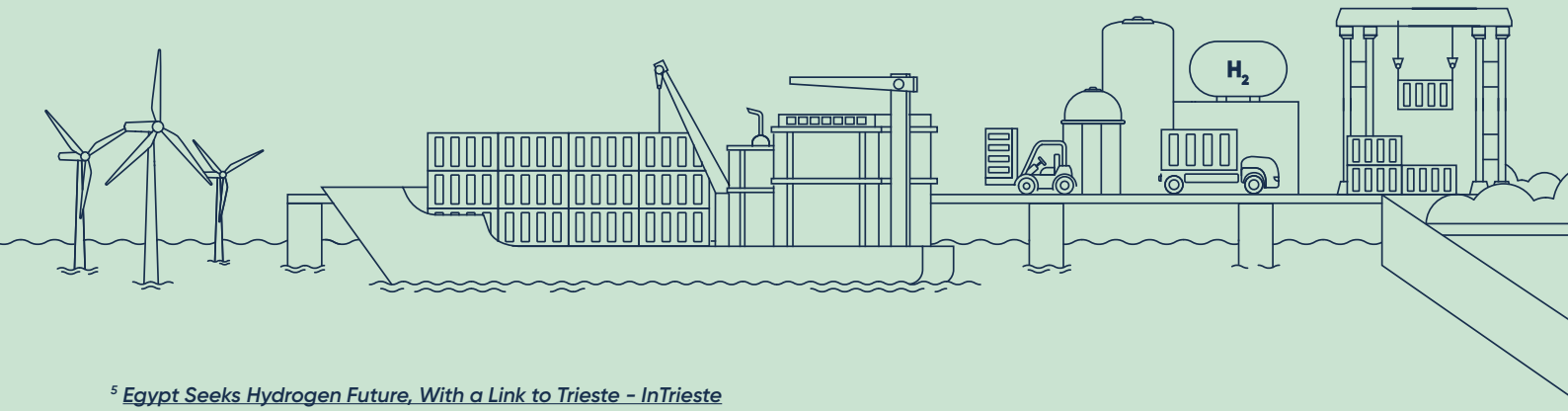
Macroeconomic and geopolitical factors

These will continue to reshape the strategic landscape for ports. Energy security concerns are prompting Europe to retain strategic industries, such as steel and chemicals, even if production costs are higher, to reduce dependency on external suppliers. This shift could reinforce the role of ports as critical supply chain nodes.

Trade route realignment

As Europe diversifies away from Russian energy, new routes are emerging in North Africa or Latin America. For instance, the port of Trieste and the port of Damietta have established a direct Ro-Ro route, positioning themselves to become an important supplier in Europe's future needs for import of green hydrogen (derivatives)[5].

Europe's ports stand at a crossroads. Their legacy as fossil fuel gateways is undeniable, but their future will be defined by adaptability. Those able to balance uncertainty with long-term vision, invest in flexible infrastructure, and align with evolving industrial and policy priorities will remain indispensable nodes in Europe's future energy landscape.



[5] *Egypt Seeks Hydrogen Future, With a Link to Trieste - InTrieste*

Meet our experts:

Michiel Nijboer

Senior Investment Consultant

linkedin.com/in/michielnijboer

Jonas Hendriksen

Maritime Economist

linkedin.com/in/jonas-hendriksen-a1a827121