

POLICY BRIEF

*Towards a comprehensive hydrogen
infrastructure: assessing progress
and addressing gaps*

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1. Introduction

This paper aims to explore the critical role of hydrogen infrastructure in supporting the transition to a decarbonized and resilient energy system. It examines the need for dedicated hydrogen transport network and provides an overview of the current status of hydrogen infrastructure development in the EU, highlighting ongoing projects and regional initiatives. It also identifies the main uncertainties and technical, regulatory, and economic challenges that continue to hinder the deployment of hydrogen networks. Furthermore, the paper discusses the existing financial instruments and the current policy framework the EU has put in place so far. Drawing on key insights and perspectives gathered from stakeholders, industry participants, and hydrogen experts, the paper concludes with recommendations to guide policymakers, investors, and developers in advancing a coherent and resilient hydrogen infrastructure.

2. Why do we need hydrogen infrastructure?

The development of an EU-wide hydrogen infrastructure is becoming crucial as the European Union (EU) is accelerating its transition away from fossil fuels and is striving to scale up renewable and low-carbon hydrogen.

Today, most hydrogen consumed in Europe is still grey hydrogen, produced on-site at industrial facilities mainly through methane reforming. This situation is incompatible with the shift toward low-carbon fuels and renewable fuels of non-biological origin (RFNBOs), whose production will largely occur in regions with abundant and low-cost variable renewable energy sources. These areas, however, do not coincide with the major industrial demand centres/basins. Bridging this geographical mismatch requires a new, national and continent-wide hydrogen backbone capable of transporting clean hydrogen from optimal production zones to off-takers across the EU. Regional differences in renewable potential mean that some Member States and regions will have a structural competitive advantage in producing and exporting hydrogen, while others will inevitably rely on imports to meet current and future demand. A well-connected hydrogen network therefore becomes essential to facilitate cross-border flows, enable access to diversified sources, and ensure that all industrial consumers, regardless of location, can secure affordable, decarbonised hydrogen.

At the same time, it must be acknowledged that today, large-scale infrastructure development may not yet be justified by pure market logic. Hydrogen demand remains limited and concentrated. Most potential consumers are hesitant to switch to hydrogen due to uncertain volumes, limited supply chains, and the technical challenges associated with retrofitting existing processes. Additionally, the price gap between renewable hydrogen and fossil-based hydrogen is still significant. Even if an extensive hydrogen network were already in place, manufacturers, particularly in energy-intensive sectors operating on tight margins, would still struggle to switch to renewable or low-carbon hydrogen due to its cost premium. As a consequence, the economic case for building a fully developed hydrogen backbone cannot rely on short-term market signals alone. Instead, hydrogen infrastructure development must be seen as a medium-term or long-term strategic investment, essential to creating the future conditions under which a competitive low-carbon and renewable hydrogen market can emerge. This strategic perspective links hydrogen transport networks to several structural transitions: the progressive decarbonisation of the economy, the redesign of electricity markets to integrate high shares of variable renewables, the gradual repurposing and decommissioning of parts of the natural gas network, and the parallel development of CO₂ transport and storage infrastructure needed to support industrial decarbonisation and the scale-up of carbon capture and storage (CCS). Together, these transitions underpin the rationale for proactive, forward-looking infrastructure planning.

A dedicated hydrogen infrastructure also plays a critical role in managing system costs. The scale-up of renewables required to meet Europe's 2040 and 2050 climate objectives is set to place unprecedented pressure on electricity grids, which must integrate an estimated 1,292 GW of variable renewable capacity by 2040¹. Expanding transmission and distribution networks to connect remote offshore wind farms, distributed solar installations, and millions of new electrical loads, from electric vehicles to heat pumps and emerging electrified industrial processes, will require massive investment. Hydrogen infrastructure can offer a complementary pathway: by converting renewable electricity into hydrogen and transporting it through repurposed or newly built pipelines, the EU can alleviate part of the stress on electricity grids, reduce network tariffs, and optimise system-wide investments.

Finally, the deployment of a European hydrogen network reduces market fragmentation, strengthens energy security through diversification, and provides the long-term visibility needed to unlock private capital. By de-risking investments and creating a stable backbone for transport and storage, hydrogen infrastructure becomes a key enabler of industrial decarbonisation and a driver of a competitive, integrated, and resilient European hydrogen market.

However, its implementation must remain flexible and proportionate to national contexts: Member States differ significantly in their industrial base, renewable potential, existing gas infrastructure, and expected hydrogen demand profiles. Infrastructure planning must therefore balance national needs with EU-level coordination. In practice, this requires a dual approach: a bottom-up perspective, where countries define their hydrogen basins, production zones, and local infrastructure priorities, coupled with a pragmatic top-down vision that sets the rules and conditions to enhance cross-border exchange in order to have a clear, integrated, and standardized European regulatory framework covering essential aspects such as hydrogen purity thresholds, pressure levels and interoperability requirements, as well as network access and tariff rules, traceability of renewable and low-carbon hydrogen, and harmonized cross-border operational standards. Establishing these uniform rules is critical to ensuring that national networks evolve into a coherent European hydrogen backbone rather than a patchwork of incompatible systems, thereby enabling efficient cross-border flows and supporting a competitive, integrated single market for hydrogen.

3. EU Framework

3.1 Overview of EU hydrogen Policy framework relevant for hydrogen infrastructure

The EU hydrogen policy framework consists of a broad mix of strategies, regulations, and directives that collectively support the production, transport, and use of renewable and low-carbon hydrogen. However, the provisions relevant to hydrogen infrastructure are dispersed across numerous legislative files, creating complexity for project developers especially in a sector that is still emerging and requires clarity and predictability. The sheer number of overlapping regulations can make interpretation and implementation challenging. Moreover, Member States play a crucial role in translating this framework into practice and in delivering the EU's hydrogen targets. While EU regulations apply directly, directives require national transposition, meaning each country must adopt its own measures to achieve the objectives set at EU level. The pace and quality of this transposition significantly influence the rollout of hydrogen infrastructure across Europe.

¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52024SC0063>

Category	Policies	Description
High-level strategy & targets	EU Hydrogen Strategy²	Roadmap for scaling renewable H2 to 10 Mt by 2030, phased infrastructure rollout, possible gas network repurposing; coordinated planning via TEN-E/TYNDP. Update in 2026.
	REPowerEU³	Raises ambition to 10 Mt domestic + 10 Mt imported renewable H2 by 2030. Foresees three major import corridors.
Infrastructure planning, cross-border projects	TEN-E (Energy) Regulation⁴ - 2022 revision	Modernises EU energy infrastructure planning, makes H2 a dedicated infrastructure category eligible for PCIs, enables, repurposed pipelines, storage, and cross-border coordination.
	TEN-T (Transport) Regulation⁵	Supports EU hydrogen refuelling deployment. Aligns with AFIR targets and expands eligible urban nodes.
Gas/H2 network market rules	Hydrogen & Decarbonised Gas Market Package⁶	Updates market rules for renewable and low-carbon gases, creating ENNOH to coordinate hydrogen network planning and codes. Allows inter-temporal cost allocation, Addresses tariffs, consumer rights, smart meters, allows 2% H2 blending.
Transport & refuelling infrastructure	AFIR (Alternative Fuels Infrastructure Regulation)⁷	Requires hydrogen stations every 200 km on TEN-T by 2030, with ≥1 t/day capacity and 700-bar dispensing by 31 December 2030.
GHG emissions accounting methodology	Renewable Energy Directive (RED) + Delegated Acts^{8,9}	Provides criteria for renewable hydrogen (RFNBOs) and sets sectoral renewable hydrogen targets under RED III.
	Low-carbon Hydrogen Delegated Act	Establishes the GHG accounting methodology for low-carbon hydrogen.

A more detailed table is available in the Annex.

3.2 The European Grids Package

During the 2025 State of the Union Address, the President of the EU Commission Ursula von der Leyen mentioned a series of initiatives to address the persistent challenges of high energy prices and Europe's dependence on external energy suppliers¹⁰. Among these, the modernisation and expansion of energy infrastructure emerged as a central priority. To this end, the EU Commission committed to propose the European Grids Package to strengthen the EU's grid infrastructure and speed up permitting. The Package is positioned within the Competitiveness Compass and the Clean Industrial Deal, underscoring the understanding that energy infrastructure is inseparable from Europe's industrial strength and economic security. Moreover, the Package builds on the 2022 revision of the TEN-E Regulation, which already adapted the infrastructure framework to the European Green Deal by integrating hydrogen networks and reinforcing offshore grid development. Because the revised regulation is relatively recent,

² <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0301>

³ <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52022DC0230>

⁴ <https://eur-lex.europa.eu/eli/reg/2022/869/oj/eng>

⁵ https://publications.europa.eu/resource/cellar/cc3395a5-3516-11ef-b441-01aa75ed71a1.0006.03/DOC_1

⁶ <https://www.consilium.europa.eu/en/press/press-releases/2024/05/21/fit-for-55-council-signs-off-on-gas-and-hydrogen-market-package/>

⁷ <https://eur-lex.europa.eu/eli/reg/2023/1804/oj/eng>

⁸ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023R1184&qid=1704969010792>

⁹ https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2023.157.01.0011.01.ENG&toc=OJ%3AL%3A2023%3A157%3ATOC

¹⁰ https://ec.europa.eu/commission/presscorner/detail/ov/SPEECH_25_2053

the Commission will issue a proportionate implementation report rather than a full evaluation. This report will assess the functioning of the new rules on planning, permitting, cost sharing and simplification, and will review the early performance of Projects of Common Interest (PCIs) and Projects of Mutual Interest (PMIs).

Despite progress since 2013 (when TEN-E was first approved), the Commission has identified three main structural problems undermining the EU's ability to build a secure, affordable, and decarbonised energy system¹¹:

1. A growing mismatch between the scale of grid expansion required and the projects currently under development, affecting transmission and distribution levels.
2. Excessively slow implementation of renewable energy, storage, and grid projects, with lead times for major transmission infrastructure averaging 14 years. Consequences include rising redispatch costs, congested distribution grids, and long queues for connection of renewable capacity.
3. Insufficient security and resilience of cross-border energy infrastructure, which becomes increasingly critical under climate change and geopolitical stress.

As these problems exceed the capacity of national authorities acting alone, particularly due to the highly interconnected nature of the European grid. Therefore, this justifies EU-level intervention under Articles 170–172 and 194 TFEU.

In May 2025, the EU Commission launched a call for evidence and opened a public consultation¹² to gather input from stakeholders. The 'European Grids Package Communication' was published on December 10, 2025.

Despite the main focus of the European Grids Package is electricity, it also cover hydrogen and other infrastructure categories included in the framework for Trans-European Networks for Energy.

The package aims to¹³

- Propose measures to accelerate the upgrade, digitalisation and expansion of the European grid infrastructure.
- Streamline and shorten permitting and environmental assessment procedures to speed up the delivery of grids, renewables and storage projects.
- Strengthen cross-border and multi-level planning, ensuring fair cost and benefit sharing while improving the resilience of critical infrastructure against risks including climate change. To this end, the EU Commission will develop a comprehensive central EU scenario for cross-sector infrastructure planning.
- Support the development of hydrogen and CO2 infrastructure to facilitate decarbonisation of hard-to-abate sectors and enhance the competitiveness of European industry.
- Recognize the need for private investments (estimated at 240 billion euros for hydrogen networks) and future-proof network charges. The Commission will explore solutions such as contracts for difference and coordinated regulatory tools through regional high-level groups to help de-risk investments and close financing gaps for hydrogen projects.

Additionally, eight 'Energy Highways' have been identified, meaning key strategic interconnections that will support the completion of the Energy Union. Two flagship hydrogen corridors are included: the SouthH2 Corridor (connecting Tunisia, Italy, Austria, Germany) and the Southwest Hydrogen Corridor (Portugal, Spain, France, Germany). The Commission will fast-track the Energy Highways through reinforced political coordination, leveraging Regional High-Level Groups, and the Energy Union Task Force, including engagement with non-EU partners. All Highways will receive priority

¹¹ https://energy.ec.europa.eu/news/commission-collects-views-preparation-european-grids-package-2025-05-13_en

¹² https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/14672-European-grid-package_en

¹³ https://energy.ec.europa.eu/document/download/869c0537-3fcb-4d0a-bd05-e8b0c3696c12_en?filename=COM_2025_1005_1_EN_ACT_part1_v6.pdf

status at EU level, with the Commission supporting Member States in mirroring this prioritisation nationally. To improve cross-border permitting, the Commission will promote joint procedures, strengthen administrative and technical capacity and provide targeted support via targeted instruments. Certain corridors, including the Southwest Hydrogen Corridor, will be designated as pilots under the Competitiveness Coordination Tool, enabling coordinated action on horizontal challenges such as system flexibility, supply-chain constraints and financing¹⁴.

It is important to note that strengthening integrated network planning across electricity, gas and hydrogen is essential to prevent future bottlenecks and to ensure that infrastructure development reflects emerging industrial demand, including demand stimulated by new decarbonisation funding frameworks. Closer alignment between EU-level and national planning processes, greater transparency in modelling assumptions and the inclusion of robust climate safeguards would help deliver a more coherent and future-proof planning framework. At the same time, accelerating the expansion and digitalisation of the electricity grid, improving interconnections and streamlining permitting procedures remain fundamental, as limited access to affordable renewable and low-carbon electricity continues to constrain the scale-up of hydrogen production and use. In parallel, it should be noted that hydrogen storage plays a strategic role by providing system flexibility, helping to balance variable renewable generation and offering medium- to long-term security of supply.

Therefore, adopting a multi-vector approach becomes crucial to achieve EU energy goals. Additionally, embracing a technology neutral approach and coordinating the development of electricity, gas, hydrogen, CO₂ and heating networks ensures that infrastructure needs are assessed holistically rather than in isolation. Such an approach improves system-wide efficiency, reduces the risk of unnecessary or insufficient investment, and enables better anticipation of industrial demand and infrastructure interactions. It also supports the smooth integration of emerging technologies, ensuring that different energy carriers complement one another in delivering decarbonisation objectives. A multi-vector perspective aligns infrastructure decisions with whole-system needs, resulting in a more resilient, flexible and cost-effective energy system. The EU Grids Package represent an opportunity to integrate hydrogen into broader EU energy system planning, beyond electricity.

4. Financing instruments for hydrogen infrastructure

Financing hydrogen infrastructure in the EU remains a key challenge due to the early-stage nature of the hydrogen market, the need to oversize networks during the ramp-up phase, and persistent uncertainty over future demand. Hydrogen infrastructure requires significant upfront investment while utilisation rates are initially low, creating substantial bankability and revenue-recovery risks for project promoters and financiers. Ensuring that early users are not disproportionately burdened with grid development costs is essential for supporting a nascent market. This context necessitates targeted support for both capital expenditures (CapEx) and operational expenditures (OpEx), alongside a well-structured tariff system that enables phased infrastructure deployment and reflects the cross-border benefits of hydrogen corridors. Equally important is ensuring a fair distribution of costs among Member States, so that countries deriving limited advantage from a particular infrastructure do not bear a disproportionate financial burden¹⁵.

¹⁴ *ibidem*

¹⁵ European Clean Hydrogen Alliance. (September 2024). *Learnbook: financing of hydrogen infrastructure*
https://www.entsog.eu/sites/default/files/2024-09/European%20Clean%20Hydrogen%20Alliance%20T%26D%20RT_Learnbook%20on%20Financing%20of%20Hydrogen%20Infrastructure.pdf

The EU has developed a broad suite of financing instruments designed to de-risk early investments, promote cross-border coordination, and accelerate the deployment of hydrogen pipelines, terminals, and storage facilities needed to achieve the bloc's decarbonisation objectives. According to the 2023 REPowerEU Plan, total investment needs to meet EU 2030 hydrogen targets are estimated at EUR 28–38 billion for EU-internal pipelines and EUR 6-11 billion for storage¹⁶.

Instrument	Key Features
Connecting Europe Facility Energy (CEF-E)	EU funding instrument supporting TEN-E implementation
Connecting Europe Facility – Transport (CEF-T) Infrastructure Facility (AFIF) programme	CET-T funds transport infrastructure upgrades and deployment of hydrogen refuelling stations across road, rail, maritime, and inland waterways. The AFIF scheme requires each project to secure additional financing from national promotional banks, the EIB, or commercial lenders. This blended model leverages more capital and ensures broader stakeholder involvement in hydrogen infrastructure development.
Innovation Fund (IF)/ European Hydrogen Bank	The IF is one of the world's largest funds for demonstration of innovative low-carbon technologies. It Includes EU Hydrogen Bank auctions, offering fixed premiums (€/kg) for RFNBO hydrogen.
Horizon Europe / Clean Hydrogen Partnership	Horizon Europe funds hydrogen research, demonstration and large pilot projects. The Clean Hydrogen Partnership accelerates development of hydrogen technologies and infrastructure via coordinated calls and industry collaboration.
EU Regional Development Fund, Cohesion Fund, REACT-EU	Funds regional innovation, industrial transition and clean energy infrastructure, including hydrogen pilot and demonstration projects.
European Investment Bank	Provides loans, guarantees, and advisory support for sustainable projects.
InvestEU	Provides EU budget guarantee to mobilise high-risk investments via EIB Group and selected partners. refuelling infrastructure, hydrogen pipelines, and enabling infrastructure.
Modernisation Fund	Supports the modernisation of energy systems in 10 lower-income Member States. Can finance hydrogen-powered trains and vehicles, and hydrogen CHP.

A more detailed table is available in the Annex.

State Aid Instruments

Instrument	Key Features
State Aid/Clean Industrial State Aid Framework (CISAF)	EU's state-aid rules designed to accelerate the clean industrial transition up to 31/12/2030. Currently confined to project-specific investments for hydrogen infrastructure.
Important Projects of Common European Interest (IPCEI)	Supports strategic cross-border projects, allows higher state aid intensity. IPCEI Hy2Infra will support deploying 3.2 GW of electrolyzers, ~2,700 km of H2 pipelines, 370 GWh of storage capacity, and port terminals for LOHC handling.

5. Current status of hydrogen infrastructure development

The transportation of hydrogen primarily involves pipelines, and is divided into transmission and distribution levels:

- **TSOs** are responsible for the long-distance transport of hydrogen through high-pressure transmission pipelines. Their networks typically connect hydrogen production hubs (electrolysers,

¹⁶ <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52022DC0230>

imports), major industrial clusters and lead markets, hydrogen storage facilities, import/export terminals and cross-border interconnectors between Member States. TSO networks are designed for bulk transport and to support cross-border system integration. Some large industrial users may be directly connected to the TSOs when their volumes or pressure requirements justify it.

- **DSOs**, by contrast, operate local and regional hydrogen distribution networks that deliver hydrogen to end-users with smaller, more geographically dispersed demand profiles. These include small and medium industrial users, hydrogen refuelling stations, residential and tertiary buildings (where permitted), local energy systems and power-to-gas facilities and hydrogen valleys. Distribution pipelines operate at lower pressures and are tailored to supply consumers that are not directly connected to the transmission network. DSOs therefore play a critical role in ensuring that hydrogen reaches end-users dispersed across regions.

While major attention has focused on transmission pipelines, distribution networks will deliver a substantial share of future hydrogen demand. By 2040, at least half of Europe's hydrogen demand across sectors is expected to be located more than 3 kilometres away from the European Hydrogen Backbone (see section 5.2). In practice, this means that a large share of future consumers will not be directly reachable through transmission pipelines and will need to be connected through distribution networks¹⁷. This geographical structure signals that distribution grids will be essential to scale hydrogen in the EU¹⁸.

Despite the ambitions the infrastructure rollout is progressing slowly, and long permitting procedures and little financing are causing further delays. According to 2024 ACER's hydrogen monitoring report¹⁹ numerous storage projects and terminals are planned for the next decade (Table 1), but roughly 1% has reached final investment decision. Existing hydrogen pipelines mainly serve industry-specific needs but they are not yet integrated with EU-wide backbone²⁰.

Type of infrastructure projects	Total number of projects	Overview	Maturity status (number of projects)		
			FID	Advanced	Less-advanced
Transmission lines	107	42,425 km of which 15,507 km will be repurposed	2	60	45
Storage facilities	38	49 TWh working gas	2	16	20
Terminals	20	693 GWh/day import capacity	0	3	17
Electrolysers	29	17 GW total capacity	0	5	24

Table 1: Planned infrastructure projects in the EU and Norway based on the TYNDP-2024 project list²¹.

¹⁷ This trend is particularly evident in the case of small and medium industrial users, which are geographically dispersed and require hydrogen primarily for high-temperature process heat. Between 80 and 100 TWh of hydrogen demand from this segment alone will need to be supplied via DSOs, and this highlights the scale of the distribution challenge ahead. The structural characteristics of Europe's gas system reinforce this: 99% of current industrial and commercial gas consumers are already connected to distribution networks, which together extend over 1.6 million kilometres, representing more than half of Europe's gas pipeline infrastructure.

¹⁸ Ready4H2. (June 2025). *Report on research conducted in Phase 3*.

https://www.ready4h2.com/medien/r4h2/pdf/Ready4H2-Phase_3_Report.pdf

¹⁹ ACER. (November 2024). *European hydrogen markets, 2024 Market Monitoring Report*.

https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_2024_MMR_Hydrogen_Markets.pdf

²⁰ Possémé, B., et al. (April 2024). *Energy system infrastructures and investments in hydrogen, including an impact analysis of Ukraine's connection to the EU power grid*, Publication for the committee on Industry, Research and Energy (ITRE), Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament.

[https://www.europarl.europa.eu/RegData/etudes/STUD/2024/754207/IPOL_STU\(2024\)754207_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2024/754207/IPOL_STU(2024)754207_EN.pdf)

²¹ ACER. (November 2024). *European hydrogen markets, 2024 Market Monitoring Report*.

https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_2024_MMR_Hydrogen_Markets.pdf

5.1 Brief Overview of Projects of Common Interest (PCIs) and Projects of Mutual Interest (PMIs)

Projects of Common Interest (PCIs) are key trans-European energy infrastructure initiatives that advance the EU's energy objectives, including market integration, energy security, and the transition to low-carbon energy. They benefit from regulatory and financial backing through the Connecting Europe Facility (CEF) and benefit from accelerated permitting processes.

Projects of Mutual Interest (PMIs) are cross-border energy infrastructure projects involving the EU and partner countries outside the EU. They aim to support the EU's energy and climate objectives while contributing to the sustainability goals of non-EU countries, for example by facilitating the integration of renewable energy and enhancing energy security. PMIs are eligible for financial and regulatory support through the Connecting Europe Facility (CEF), including streamlined permitting procedures and measures to improve investor visibility.

Examples of hydrogen-related approved PCIs and PMIs²²:

Hydrogen-focused PCIs/PMIs were introduced for the first time in the EU's 6th PCI list¹⁷. The EU Commission accepted 65 hydrogen projects out of the 179 submitted. Hydrogen Transmission projects (29) represent the majority of all the hydrogen projects selected.²³ However, very few of these projects have currently reached the FID stage²⁴.

PCI/PMI	Description	Countries
CHE Pipeline	Offshore pipeline aiming to transporting renewable/low-carbon hydrogen from Norway to Germany; capacity up to ~4 Mt/year.	NO, DE
H2Med Project	Pipeline system (CelZa + BarMar) designed to transport up to 2 million tonnes of renewable hydrogen annually, accounting for 10% of Europe's projected consumption by 2030.	PT, ES, FR, with DE support
Baltic Sea H2 Collector	Cross-border infrastructure to collect and move green hydrogen across the Baltic region.	FI, SE, DE involvement
SouthH2 Corridor	~3,300 km network to import up to 4 Mt/year of hydrogen from North Africa into Europe.	IT, AT, DE + African partners
Czech-German H2 Interconnector	Interconnector aiming to link high-potential hydrogen supply areas in Northern Germany and the Baltics with anticipated high-demand clusters in the EU, particularly in Southern Germany and Northern Bohemia.	CZ, DE
Central European H2 Corridor	It explores the feasibility of establishing a hydrogen pipeline corridor in Central Europe to transport hydrogen from major supply areas in Ukraine through Slovakia and the Czech Republic to demand regions in Germany.	CZ, SK, DE + potential UA extension
Northern H2 Backbone	Aims to develop a hydrogen pipeline network connecting hydrogen production sites in Northern Europe with major consumption centers across the continent.	NL, DE, DK
H2 Baltic Pipeline	Aims to establish a hydrogen pipeline connecting the Baltic States with Central Europe, facilitating the integration of hydrogen markets and enhancing energy security in the region.	NL, DE, DK

Source: EU Commission ([link](#)), ERCST Paper 'Implementation and transposition of hydrogen regulations in the EU Member States' ([link](#)).

²² <https://ercst.org/implementation-and-transposition-of-hydrogen-regulations-in-the-eu-member-states/>

²³ <https://observatory.clean-hydrogen.europa.eu/media/news/european-commission-adopts-6th-list-projects-common-interest>

²⁴ ACER. (November 2024). *European hydrogen markets, 2024 Market Monitoring Report*. https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_2024_MMR_Hydrogen_Markets.pdf

5.2 European Hydrogen Backbone

The European Hydrogen Backbone is a plan for a pan-European, dedicated hydrogen transmission network emerging gradually from the mid-2020s and expanding to over 50,000 km by 2040²⁵. Such a dedicated Hydrogen Backbone (2040 layout) requires an estimated total investment of €27-64 billion²⁶. Building on Europe's extensive gas grid, around 60% of the backbone is foreseen to come from repurposed infrastructure and 40% new pipelines, enabling a cost-effective and rapid rollout²⁷. The Backbone aims to connect major hydrogen production centers and link them with industrial clusters, import terminals, and storage sites across the continent. This integrated network is essential for matching geographically uneven hydrogen supply and demand as it allows renewable hydrogen produced in resource-rich regions such as Spain, Italy, and Denmark to flow towards energy-intensive industrial centres in Germany, Belgium, the Netherlands, and Central Europe. By 2030, an initial 6,800 km of connected “hydrogen valleys” is expected to emerge, expanding to nearly 23,000 km by 2040 across the 10 countries²⁸, with further expansion into neighbouring regions. Ultimately, the Hydrogen Backbone has been conceived as the physical foundation of a European hydrogen market, enabling, security of supply, and large-scale decarbonisation across industry, power, and mobility sectors²⁹. However, as discussed in Section 5, actual progress fell significantly short of these ambitions³⁰.

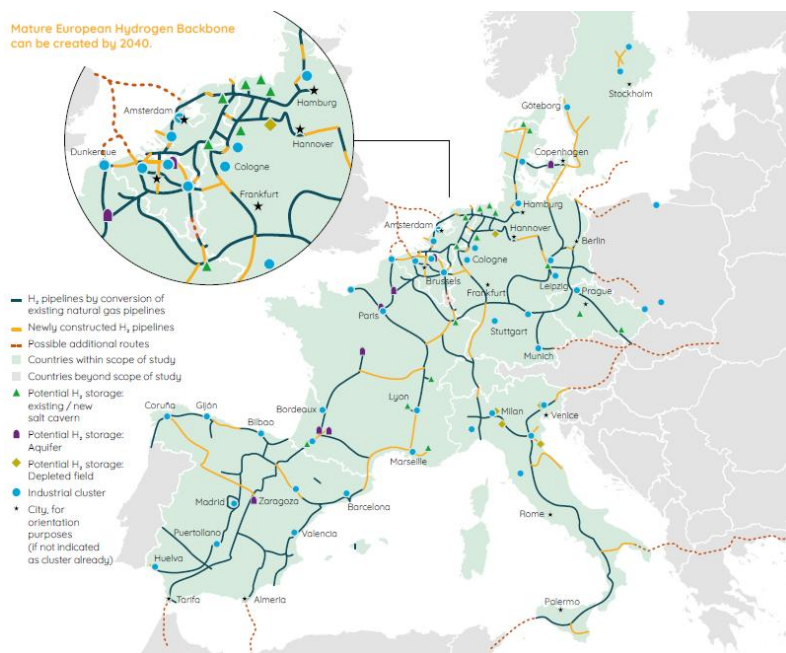


Figure 1: European Hydrogen Backbone initiative (2020)³¹

²⁵ Guidehouse. (July 2020). European Hydrogen Backbone - how a dedicated hydrogen infrastructure can be created https://ehb.eu/files/downloads/2020_European-Hydrogen-Backbone_Report.pdf

²⁶ *ibidem*

²⁷ Hydrogen Europe. (October 2024). *Hydrogen Infrastructure: the recipe for a hydrogen grid plan*. https://hydrogeneurope.eu/wp-content/uploads/2024/10/2024.10_HE_Hydrogen-Infrastructure-Report.pdf

²⁸ Germany, France, Italy, Spain, the Netherlands, Belgium, Czech Republic, Denmark, Sweden, Switzerland

²⁹ Guidehouse. (July 2020). European Hydrogen Backbone - how a dedicated hydrogen infrastructure can be created https://ehb.eu/files/downloads/2020_European-Hydrogen-Backbone_Report.pdf

³⁰ ACER. (November 2024). *European hydrogen markets, 2024 Market Monitoring Report*.

https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_2024_MMR_Hydrogen_Markets.pdf

³¹ *ibidem*

The European Climate law establishes the objective for the EU to achieve climate neutrality by 2050³². As Europe advances toward this goal, the consumption of fossil methane is projected to decline substantially, from 216 Mtoe in 2022 to roughly 105–155 Mtoe by 2040³³, equivalent to halving the role of natural gas in the EU’s final energy use. This downward trend is expected to progressively release sections of the gas grid that can be reassigned to hydrogen. Although the precise schedule for shifting pipelines from methane to hydrogen remains uncertain, stakeholders acknowledge that this transition will be central to building out the hydrogen network³⁴. This is also reflected in the revised TEN-E Regulation, which specifies that the future hydrogen system should draw heavily on converted natural gas assets, with new dedicated hydrogen pipelines developed only where required³⁵. Data provided by TSOs for the European Hydrogen Backbone initiative indicate that converting a 20-inch pipeline costs around one-third of building a new hydrogen pipeline of the same size, while compressor station investments remain broadly equivalent for both new and repurposed infrastructure, at around 4.0 M€/MWe³⁶. Maximising the use of Europe’s existing pipeline system offers economic and practical advantages: it lowers overall system costs, accelerates delivery by avoiding lengthy permitting procedures for entirely new corridors, and reduces the environmental footprint associated with new construction³⁷. However, retrofitting pipelines present technical issues in terms of pipeline’s pressure levels and components and that will be examined in Section 6.

5.2.1 Case Study: The Hydrogen Core Network - Germany

The German Hydrogen Core Network (HCN) has emerged as one of the main national initiatives for large-scale hydrogen transport in Europe, functioning as Germany’s backbone for long-distance hydrogen flows as well as a central corridor within the future EU-wide hydrogen market³⁸. Designed to address the long-debated “chicken-and-egg” problem of hydrogen infrastructure, Germany opted not to rely solely on localised hydrogen valleys but instead to establish a nationwide transmission network upfront, creating the conditions for production and demand to grow around guaranteed transport capacity. The plan, approved by the Bundesnetzagentur (BNetzA) in October 2024³⁹, foresees a 9,040 km system to be completed by 2032 with an overall investment of €18.9 billion. More than 60% of this network will consist of repurposed natural gas pipelines many located in regions previously supplied by major gas import corridors such as Lubmin or Lower Saxony, while the remainder part will be newly constructed. These corridors will connect renewable-rich areas on the North Sea and Baltic coasts with industrial centres in Brandenburg, Saxony, North Rhine-Westphalia and Bavaria, forming major north-south and east-west hydrogen routes. The HCN is therefore essential not only for domestic decarbonisation of heavy industry and energy systems, but also for cross-border flows toward the Netherlands, Belgium, Denmark, France and eventually Spain, positioning Germany as a central junction of the European hydrogen market.

³² <https://eur-lex.europa.eu/eli/reg/2021/1119/oj/eng>

³³ https://eur-lex.europa.eu/resource.html?uri=cellar:6c154426-c5a6-11ee-95d9-01aa75ed71a1.0001.02/DOC_1&format=PDF

³⁴ Hydrogen Europe. (October 2024). *Hydrogen Infrastructure: the recipe for a hydrogen grid plan*.

https://hydrogeneurope.eu/wp-content/uploads/2024/10/2024.10_HE_Hydrogen-Infrastructure-Report.pdf

³⁵ https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=urisrv%3AOJ.L_2022.152.01.0045.01.ENG&toc=OJ%3AL%3A2022%3A152%3ATOC

³⁶ <https://ehb.eu/files/downloads/EHB-2023-20-Nov-FINAL-design.pdf>

³⁷ https://op.europa.eu/en/publication-detail/-/publication/f5a15fd1-8f3b-11ee-8aa6-01aa75ed71a1/language-en?WT.mc_id=Searchresult&WT.ria_c=37085&WT.ria_f=3608&WT.ria_ev=search&WT.URL=https%3A%2F%2Fenergy.ec.europa.eu%2F

³⁸ <https://www.cleanenergywire.org/news/hydrogen-start-flow-pipelines-germany-2025>

³⁹ <https://www.bundesnetzagentur.de/DE/Fachthemen/ElektrizitaetundGas/Wasserstoff/Kernnetz/start.html>

To ensure that the scale of investment required for this network does not translate into disproportionate high tariffs for early users, Germany has introduced a sophisticated inter-temporal cost allocation mechanism⁴⁰ that spreads cost recovery across the entire market ramp-up. In the initial years, a uniform “ramp-up tariff” is intentionally set below the level needed to fully recover costs, allowing first movers to access the network at affordable levels despite low utilisation. Over time, as demand increases, tariffs gradually approach cost-reflective levels and eventually over-recover costs, enabling accumulated deficits to be paid down. The mechanism, which is designed to achieve full cost recovery by 2055, also includes structured risk sharing mechanisms between network operators and the State. If demand develops more slowly than expected, the government guarantees 76% of any remaining deficit at the end of the period, with operators assuming the remaining share. If demand fails to materialise by 2038, the State may step in fully and take over the network. This framework is complemented by the creation of a national amortisation account, which allows TSOs to collectively pre-finance the infrastructure through pooled loans backed by a State guarantee, making the initial investment phase feasible despite very low initial flow. BNetzA supervises the entire process, from approving investment scenarios and planning assumptions to evaluating tariffs every three years and adjusting parameters where necessary⁴¹.

At the system level, the HCN is intended as the structural element that links hydrogen production from coastal electrolyzers and import routes with Germany’s major industrial regions, while laying the foundation for a fully integrated European hydrogen backbone. Its development requires extensive coordination between TSOs, DOSs, industrial consumers and producers to ensure that major demand clusters and chemical parks are located close to the planned transmission corridors. During the planning phase, extensive surveys and consultations have been organized to ensure that the network directly reaches or closely approaches Germany’s largest industrial sites, particularly those in Bavaria, North Rhine-Westphalia and eastern Germany. As the market grows, connection of distribution networks will become essential, since the majority of German industrial consumers are connected at the distribution level rather than the transmission level⁴². Early users are expected to be directly linked to the transport network, while DSOs progressively build the short lateral connections needed to bring hydrogen to more dispersed industrial sites. Storage assets which are critical for balancing variable renewable hydrogen production will need to be integrated in future phases, as they currently fall outside the amortisation mechanism. The HCN thus illustrates how a large Member State seeks to use existing gas infrastructure, targeted public guarantees and phased regulatory support to rapidly establish a hydrogen transport system that solves early-stage market failures while remaining compatible with long-term EU-level integration.

However, the rapid advancement of the HCN has recently drawn scrutiny amid growing uncertainty about the pace of Germany’s hydrogen ramp-up. Concerns have been raised that the network may be oversized relative to foreseeable supply and demand, particularly toward 2030⁴³. Several indicators point in this direction: domestic electrolysis capacity is expected to remain well below the 10 GW target

⁴⁰ ACER. (November 2024). *European hydrogen markets, 2024 Market Monitoring Report*. https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_2024_MMR_Hydrogen_Markets.pdf

⁴¹ *ibidem*

⁴² *ibidem*

⁴³ Argus. (October 2025). *Oversized German H2 network a major risk: audit office*. https://www.argusmedia.com/en/news-and-insights/latest-market-news/2747217-oversized-german-h2-network-a-major-risk-audit-office?utm_source=marketo&utm_medium=newsletter&utm_campaign=glo-gmtc-gen-2025-08-19-hydrogen-newsletter&utm_content=newsstory-issue70lnk2&mkt_tok=NTg0LUJVVy02MDYAAAGd90LRMH9HIg1xdMo55ZP_pHlIG8OdxmCzNhWs_KtHpdeV25q61wmGVMgPrGG56npLs309d-6GJx-VT9GZ6TA03bg5RBPgORW6ayNiblhOmYzHF_Co

by 2030 established by the German National Hydrogen strategy⁴⁴, cross-border pipelines and maritime import terminals are unlikely to be operational as early as planned, and industrial off-takers such as future hydrogen-fired power plants⁴⁵ and parts of the steel sector⁴⁶ have postponed or revised their consumption timelines. This combination risks leaving a substantial share of the planned 6,000 km of operational pipelines underutilised by 2030, with entry and exit capacities significantly beyond realistic demand. Under such a scenario, the financing structure based on government-backed loans and tariff recovery could place a considerable burden on public finances if revenues fall short of expectations over an extended period. These emerging concerns underline the importance of aligning infrastructure expansion with credible supply and demand trajectories and coordinating domestic planning with European PCI-level developments⁴⁷.

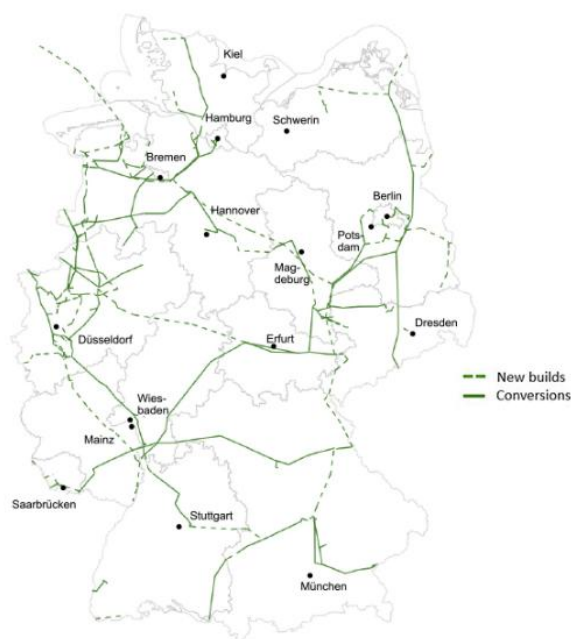


Figure 2: Hydrogen Core Network, Germany. Source ([link](#))

⁴⁴ https://www.bmwk.de/Redaktion/EN/Publikationen/Energie/national-hydrogen-strategy-update.pdf?__blob=publicationFile&v=2

⁴⁵ <https://fuelcellsworld.com/2025/06/27/energy-policy/leag-postpones-110-mw-green-hydrogen-project-in-boxberg-due-to-political-and-economic-challenges>

⁴⁶ <https://www.hydrogeninsight.com/industrial/salzgitter-postpones-future-investments-into-green-hydrogen-based-steel-programme-by-three-years/2-1-1875661>

⁴⁷ Argus. (October 2025). *Oversized German H2 network a major risk: audit office*. https://www.argusmedia.com/en/news-and-insights/latest-market-news/2747217-oversized-german-h2-network-a-major-risk-audit-office?utm_source=marketo&utm_medium=newsletter&utm_campaign=glo-gmtc-gen-2025-08-19-hydrogen-newsletter&utm_content=newsstory-issue70lnk2&mkt_tok=NTg0LUJVVy02MDYAAAGd90LRMH9HIg1xdMo55ZP_pHlIG8OdxmCzNhWs_KtHpdeV25q61wmGVMgPrGG56npLs309d-6GJx-VT9GZ6TA03bg5RBPgORW6ayNiblhOmYzHF_Co

6. Key uncertainties and challenges

a) Demand-side uncertainty

A central question is whether demand drives infrastructure or whether infrastructure enables demand. At present, the lack of long-term offtake agreements hinders investment confidence for transmission and storage assets. This demand-side uncertainty is reinforced by divergent national policies on hydrogen use in industry, mobility and power generation as well as structural volatility in the cost of renewable electricity, affecting the competitiveness of electrolytic hydrogen and finally uncertainty over future import volumes and prices⁴⁸.

b) Permitting

Permitting remains one of the most significant bottlenecks for hydrogen infrastructure, especially cross-border projects that require multi-jurisdictional approvals. Delays of several years⁴⁹ are common, undermining both investor certainty and alignment with 2030 climate targets. Additionally, a pressing ambiguity concerns Article 15e of the Renewable Energy Directive (RED III), which establishes accelerated permitting for “grid and storage infrastructure necessary to integrate renewable energy into the electricity system.”⁵⁰ Although designed for electricity assets, it should be noted that hydrogen infrastructure, particularly storage, performs an analogous system-integration function as it absorbs renewable generation peaks and supports flexibility, thereby reducing curtailment on the electricity side. Yet hydrogen assets are not explicitly covered, resulting in uneven or restrictive national interpretations.

c) Distributional gap and role of DSOs

While TSOs are heavily involved in planning hydrogen backbones, DSOs remain insufficiently integrated into EU-level planning and funding frameworks. Hydrogen demand in the 2030-2040 horizon is expected to be strongly industrial and local, situated close to clusters that may not be directly connected to national backbones. Despite this, distribution networks which are expected to serve a substantial share of future industrial hydrogen demand, currently remain largely overlooked in key EU instruments such as TEN-E, CEF and PCI/PMI criteria, that prioritise large cross-border transmission projects and give limited recognition to regional and local networks. The absence of clear regulation on hydrogen distribution networks, combined with limited incentives for DSOs to invest in repurposing or new pipeline segments, creates a structural “last-mile bottleneck.” This risks leaving end-users disconnected even where national backbones exist and reinforces the need for stronger coordination between TSOs and DSOs as well as between national and local planning processes to ensure that hydrogen can actually reach industrial clusters⁵¹.

⁴⁸ ERCST. (June 2024). 2024 State of the European Hydrogen Market Report. <https://ercst.org/2024-state-of-the-european-hydrogen-market-report/>

⁴⁹ <https://www.hydrogeninsight.com/policy/exclusive-european-hydrogen-banks-largest-winner-withdraws-from-subsidy-negotiations/2-1-1856561>

⁵⁰ <https://eur-lex.europa.eu/eli/dir/2023/2413/oj/eng>

⁵¹ Ready4H2. (June 2025). *Report on research conducted in Phase 3*. https://www.ready4h2.com/medien/r4h2/pdf/Ready4H2-Phase_3_Report.pdf

d) Technical challenges for repurposing and retrofitting pipelines and standardization need

Despite the potential readiness and the advantages that repurposing gas infrastructure brings about, there are several technical challenges that need to be considered due to the differences in design and materials between methane and hydrogen pipelines. For example, compatibility should be carefully assessed, and issues such as gas composition and purity should be evaluated. Valves may need to be replaced, pipelines continuously monitored for cracks, and internal coatings applied if the system will operate at higher pressures. Compressor stations must also be modified to handle hydrogen, which requires greater compression and larger volumes than natural gas due to its lower energy density and distinct physical properties. It is important to note that retrofit needs differ between transmission and distribution systems: high-pressure transmission pipelines, built from steel tailored to natural gas, must address challenges such as hydrogen embrittlement, while low-pressure distribution grids, often made of polyethylene, are generally more compatible and require fewer adjustments⁵². Additionally, hydrogen networks will only function efficiently if common standards are adopted when it comes to hydrogen purity requirements and allowable contaminants, blending parameters in repurposed natural gas pipelines as well as interoperability of compressors, valves and measurement systems. Currently, there is no EU-wide harmonisation for all the components mentioned above, and national practices vary significantly. This introduces technology and compatibility risk for early investors⁵³.

e) Lack of Financing and risk-sharing mechanisms

Hydrogen transmission, storage and import infrastructure involves high CAPEX and long lead times, with very limited initial tariffs due to low utilisation volumes. Current financing mechanisms such as IPCEI, CEF, national subsidies remain insufficient to fully mitigate the risks for first movers.

Key gaps include:

- **Lack of EU-level risk-sharing for hydrogen pipelines**, which leaves project developers exposed to significant demand-side uncertainty. Unlike mature regulated assets, early hydrogen pipelines cannot rely on predictable shipper revenues or stable utilisation rates. Therefore, the inter-temporal cost allocation mechanism should be better adapted to this landscape⁵⁴. Without EU-backed guarantees, contracts for difference, or risk-mitigation tools similar to those used in renewable electricity deployment, private promoters face disproportionate exposure to volume risk, potentially delaying investment decisions or reducing project scope.
- **Limited visibility of future tariff frameworks due to uncertain market evolution**, as regulators have not yet defined stable, long-term rules for hydrogen network tariffs, cost allocation, or allowed returns. Tariff methodologies are still under development in many Member States, and cross-border coordination remains incomplete. The absence of clarity on how costs will be recovered, especially in the early years of low utilisation, creates uncertainty for investors and future network users, undermining bankability and raising the cost of capital.
- **Absence of long-term capacity booking commitments comparable to the natural gas sector**, which historically provided predictable revenue streams for infrastructure operators. Hydrogen consumers and producers are reluctant to sign long-duration ship-or-pay or capacity-reservation

⁵² Hydrogen Europe. (October 2024). *Hydrogen Infrastructure: the recipe for a hydrogen grid plan*.

https://hydrogeneurope.eu/wp-content/uploads/2024/10/2024.10_HE_Hydrogen-Infrastructure-Report.pdf

⁵³ Guidehouse. (July 2020). *European Hydrogen Backbone - how a dedicated hydrogen infrastructure can be created*

https://ehb.eu/files/downloads/2020_European-Hydrogen-Backbone_Report.pdf

⁵⁴ <https://www.acer.europa.eu/news/acer-will-consult-inter-temporal-cost-allocation-mechanisms-financing-hydrogen-infrastructure>

contracts due to uncertainty about their own future operations, the competitiveness of hydrogen, and the evolution of alternative decarbonisation pathways. This lack of committed demand makes it difficult for infrastructure developers to demonstrate revenue security to financiers, resulting in higher financing costs and slower project advancement.

f) Technology neutrality and system integration challenge: need to align hydrogen with electricity and CO₂ infrastructure to avoid competing investments.

As discussed in section 3.2, decarbonisation requires a technology neutral approach and a coordinated build-out of electricity grids, hydrogen networks, and CO₂ transport and storage systems to maximize efficiency and cut costs. The lack of cross-sector planning risks creating underutilisation of hydrogen pipelines due to constrained renewable electricity availability, suboptimal deployment of electrolyzers due to local grid bottlenecks and ultimately competition rather than complementarity between hydrogen and direct electrification.

g) Regulatory complexity

The EU hydrogen policy landscape is made up of a diverse set of strategies, regulations, and directives that address the production, transport, and utilization of renewable and low-carbon hydrogen. Yet, the rules and requirements related to hydrogen infrastructure are scattered across multiple legislative instruments, representing a challenging landscape for project developers to navigate, particularly in a still-developing sector that depends on clear and predictable guidance. Additionally, the complexity of hydrogen definitions and GHG emissions accounting methodologies (Renewable Energy Directive delegated acts, Low-Carbon Hydrogen delegated act) and the almost exclusive focus on renewable hydrogen are hindering the possibility of making hydrogen a tradable commodity.

7. Conclusions/Recommendations

- **Accelerate regulatory transposition:** Member States should speed up the transposition of the Hydrogen & Decarbonised Gas Market Package. The fast-track permitting process established by Article 15e of the Renewable Energy Directive for grid and storage infrastructure should also be applied to hydrogen projects, as they participate in integrating more renewable electricity into the grid. Member States should consider similar fast-track permitting procedures for hydrogen. While consistent and uniform application of the EU policy framework across all Member States is essential, it should be noted that regulatory implementation alone will not be sufficient to create market demand.
- **Implement Member States Hydrogen Infrastructure roll-out:** when it comes to the EU hydrogen network, a dual approach is needed: a bottom-up perspective, where Member States identify their hydrogen basins, production zones, and local infrastructure priorities, combined with a pragmatic top-down EU coordination approach that establishes cross-border rules, harmonised technical standards (eg. Hydrogen purity), and interoperable certification systems which allows cross-border exchanges. The German example illustrates both progress and persistent gaps: while national implementation has advanced, the absence of common EU standards, cross-border rules, and interoperable certification systems risks fragmenting the market. To avoid purely national markets, the EU should ensure consistency and harmonisation across Member States.
- **Leverage the EU Grids Package:** The EU Grids Package may provide an opportunity to strengthen cross-border coordination, streamline infrastructure planning, and ensure that electricity and hydrogen networks are fully integrated to support decarbonisation goals. A central question is whether it will adequately cover the missing elements, particularly interoperability between energy carriers, technical standards, cross-border hydrogen infrastructure, and digital system integration. However, the Communication published on December 10, is falling short on expectations. Additionally, distribution operators should be systematically involved in network planning and be eligible for EU funding, as regional infrastructure will be essential to connect transmission grids with industrial clusters and end-users.
- **Ensure an integrated multi-vector approach:** The EU should adopt a coordinated, technology-neutral approach combining electricity, hydrogen, natural gas, heating, CO₂ and storage networks to reduce overall system costs and enhance security of supply. Together with hydrogen infrastructure, hydrogen storage is crucial to provide continuous 24-hour energy availability for industry. In addition, without a functioning CO₂ infrastructure, there can be no large-scale deployment of CCS, no production of low-carbon hydrogen via steam methane reforming (SMR) or autothermal reforming (ATR), and consequently no significant cost reduction or market development. The focus should therefore shift from silo-based planning to a cross-sectorial/holistic energy network approach.
- **Strengthen EU financing instruments:** Establish robust EU-level derisking and cost-sharing mechanisms for cross-border projects. Current TEN-E cost allocation tools are insufficient, as they fail to distribute costs equitably among Member States, offer limited incentives for investors, and are in practice rarely used due to uneven benefit allocation and high regulatory complexity.

8. ANNEX

EU hydrogen Policy framework relevant for hydrogen infrastructure

Policies	Description
EU Hydrogen Strategy⁵⁵	Sets the EU's roadmap for scaling renewable and low-carbon hydrogen, including an intermediate objective of producing up to 10 million tonnes of renewable hydrogen in the EU by 2030 as part of the pathway to climate neutrality by 2050. The Strategy outlines phased deployment objectives and 20 actions covering supply, demand, R&D, market rules, and international cooperation. It serves as the main reference for planning and sequencing hydrogen infrastructure. It foresees an initial phase of local or on-site production in industrial clusters and coastal areas, followed by the development of local networks and, over time, longer-distance transport infrastructure. This evolution is closely linked to updates of the Trans-European Networks for Energy (TEN-E) and revisions of gas market legislation to support competitive decarbonised gas markets. In the medium to long term, parts of the existing gas network may be repurposed for hydrogen transport, subject to technical suitability and regulatory adjustments. Coordinated system-wide planning, particularly through the Ten-Year Network Development Plans (TYNDPs), is highlighted as essential, including for optimal electrolyser deployment. The Strategy also notes that hydrogen blending into gas networks may serve as a transitional option, though it brings efficiency, quality, and interoperability challenges. An update is expected in 2026 to reflect evolving market, geopolitical, and infrastructure developments.
REPowerEU⁵⁶	Introduces enhanced hydrogen objectives, targeting 10 Mt of domestic renewable hydrogen production and 10 Mt of renewable hydrogen imports by 2030. Positions hydrogen as an essential component of the EU's broader strategy to strengthen energy resilience, diversify energy supplies, and accelerate the green transition. It mentions that the commission will support the development of three major hydrogen import corridors, via the Mediterranean, the North Sea, and potentially Ukraine, facilitated by Green Hydrogen Partnerships to promote renewable hydrogen imports while supporting decarbonisation in partner countries.
TEN-E (Energy) Regulation⁵⁷ - 2022 revision	Modernises EU energy infrastructure planning by recognising hydrogen as a dedicated network category. Enables both newly built hydrogen pipelines and repurposed gas assets to qualify as Projects of Common Interest (PCIs), which benefit from streamlined permitting, EU funding, and cross-border coordination. Establishes regional hydrogen corridors, supports storage, reception, compression, and electrolyzers as eligible infrastructure, and ensures interoperability, non-discriminatory access, and market integration across Member States. Requires cost-benefit analysis and system-wide planning to optimise investments and supports cross-border cooperation, including potential links with non-EU partners.
TEN-T (Transport) Regulation⁵⁸	Establishes the framework for a coherent, multimodal European transport network and provides the foundation for deploying hydrogen infrastructure across the EU. It integrates hydrogen refuelling stations along the core network and urban nodes, aligning with AFIR targets, and ensures eligibility for EU funding under the Connecting Europe Facility (CEF Transport and AFIF). The latest revision expands urban nodes from 82 to 430, significantly increasing the number of hydrogen refuelling points supported by EU financing. Ports identified as energy hubs, including smaller maritime ports, are eligible for funding to develop hydrogen import/export and production infrastructure, while railway exemptions allow hydrogen-powered trains where electrification is not feasible.

⁵⁵ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0301>

⁵⁶ <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52022DC0230>

⁵⁷ <https://eur-lex.europa.eu/eli/reg/2022/869/oj/eng>

⁵⁸ https://publications.europa.eu/resource/cellar/cc3395a5-3516-11ef-b441-01aa75ed71a1.0006.03/DOC_1

Hydrogen & Decarbonised Gas Market Package⁵⁹	The package updates EU gas market rules to support the uptake of renewable and low-carbon gases, including hydrogen, and adapts the regulatory framework to a future energy mix with less fossil gas. It establishes an entity for hydrogen transmission network operators, the European Network for Network Operators of Hydrogen (ENNOH), which will develop non-binding, ten-year network development plans and network codes for hydrogen. Ownership unbundling and regulated third-party access (TPA) rules from natural gas networks are largely maintained for hydrogen, with temporary exemptions to encourage network development. Member States may allow inter-temporal cost allocation for hydrogen network investments and, if needed, cross-subsidisation from existing networks, subject to regulatory approval. The package also allows limited hydrogen blending (2% by volume) into natural gas at cross-border points and provides tariff discounts for renewable and low-carbon gases. It covers consumer protection, including switching suppliers, billing information, and smart meters, and extends security-of-supply provisions to renewable and low-carbon gases ⁶⁰ .
AFIR (Alternative Fuels Infrastructure Regulation)⁶¹	AFIR mandates the deployment of publicly accessible hydrogen refuelling stations across the EU. By 31 December 2030, hydrogen stations must be installed along the core TEN-T network with at most 200 km between stations, and at least one station must be deployed in every defined urban node. These stations must have a minimum daily throughput capacity of 1 tonne per day and include a 700 bar dispenser to ensure compatibility with fuel-cell vehicles. The regulation also establishes user-friendly requirements: hydrogen refuelling points must support transparent pricing, common payment options, and clear customer information on availability and waiting times.
Renewable Energy Directive (RED) + Delegated Acts^{62,63}	Legal framework for the development of clean energy across all EU sectors. RED II Delegated Acts define the criteria for hydrogen to qualify as a Renewable Fuel of Non-Biological Origin (RFNBO) ⁶⁴ . RED III ⁶⁵ establishes renewable hydrogen targets in industry/transport ⁶⁶ . Article 15e enables Member States to designate dedicated infrastructure areas for grid and storage projects necessary to integrate renewable energy into the electricity system. Such areas are planned to avoid sensitive environmental sites, ensure synergies with renewables acceleration zones, and may allow certain environmental assessment exemptions to accelerate deployment. There is a discussion about whether hydrogen can be integrated/considered part of this category and whether Member States might choose to transpose similar accelerated permitting processes to hydrogen-related infrastructure.
Low-carbon Hydrogen Delegated Act	Establishes a methodology for GHG emissions accounting of low-carbon hydrogen production.

⁵⁹ <https://www.consilium.europa.eu/en/press/press-releases/2024/05/21/fit-for-55-council-signs-off-on-gas-and-hydrogen-market-package/>

⁶⁰ EUI. (May 2024). The EU Hydrogen and Decarbonised Gas Market Package <https://fsr.eui.eu/the-eu-hydrogen-and-decarbonised-gas-market-package/>

⁶¹ <https://eur-lex.europa.eu/eli/reg/2023/1804/oj/eng>

⁶² <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023R1184&qid=1704969010792>

⁶³ https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2023.157.01.0011.01.ENG&toc=OJ%3AL%3A2023%3A157%3ATOC

⁶⁴ (I) The **first Delegated Act** (namely ‘Delegated Act establishing a minimum threshold for greenhouse gas (GHG) emissions savings of recycled carbon fuels’) defines under which conditions hydrogen, hydrogen-based fuels or other energy carriers can be considered as Renewable Liquid and Gaseous Fuels of Non-Biological Origin (RFNBOs). In particular, the rules aim to ensure that RFNBOs are only sourced from “additional” renewable electricity⁶⁴ and comply with temporal and geographical correlation criteria. (II) The **second Delegated Act** (namely ‘Delegated Act on a methodology for renewable fuels on non-biological origin’) provides a methodology for calculating lifecycle GHG emissions for RFNBOs. This methodology considers the whole lifecycle of the fuels to calculate the emissions and the associated savings. In particular, using recycled-carbon fuels should lead to a minimum 70 per cent decrease in GHG emissions compared to the fuels they replace.

⁶⁵ <https://eur-lex.europa.eu/eli/dir/2023/2413/oj>

⁶⁶(I) Industry: RED III introduces a specific hydrogen target. It mandates that at least 42% of hydrogen used in industry must come from RFNBOs by 2030, increasing to 60% by 2035. This applies to both energy and non-energy uses. (II) Transport: No separate specific hydrogen target exists. Hydrogen is included under the broader RFNBO category within a combined 5.5% target for advanced biofuels and RFNBOs by 2030, with a minimum of 1% from RFNBOs. This allows hydrogen to contribute flexibly (e.g., in fuel cell vehicles or synthetic fuels) but without a separate mandate.).

Financing instruments for hydrogen infrastructure

Instrument	Key Features
Connecting Europe Facility – Energy (CEF-E)	EU funding instrument supporting TEN-E implementation which finances cross-border hydrogen transmission & distribution pipelines (including repurposed gas assets), storage infrastructure, and large-scale electrolyzers (>100 MW). Focus on Projects of Common Interest (PCIs). In 2024, the Connecting Europe Facility for Energy (CEF-E) allocated €250 million to support studies related to hydrogen infrastructure ⁶⁷ .
Connecting Europe Facility – Transport (CEF-T) Infrastructure Facility (AFIF) programme	CET-T funds transport infrastructure upgrades and deployment of hydrogen refuelling stations across road, rail, maritime, and inland waterways; supports removal of transport bottlenecks and shift to sustainable mobility. Since 2021, the (CEF-T) has allocated €352 million to 41 hydrogen initiatives under its Alternative Fuels Infrastructure Facility (AFIF). Nine of these projects have already been completed, delivering 41 functioning hydrogen refuelling stations (HRS) out of the 197 stations financed so far. On average, each HRS receives €2 million in EU support. Another 40 stations are expected to come online in 2025, with the remaining ones scheduled for 2026 and 2027. ⁶⁸ A major advantage of the AFIF scheme is its blended financing approach: every supported project must obtain co-funding from a national promotional bank, the European Investment Bank (EIB), or a commercial lender. This requirement brings in additional investment and ensures the active participation of a wider range of stakeholders in developing the infrastructure.
Innovation Fund (IF)/ European Hydrogen Bank	The IF is one of the world's largest funds for demonstration of innovative low-carbon technologies. Supports hydrogen production, storage, transport, and end-use deployment at pre-commercial and commercial scale. The IF Includes EU Hydrogen Bank auctions, offering fixed premiums (€/kg) for RFNBO hydrogen. The Auctions-as-a-Service scheme allows Member States to use the EU-wide auction platform for national support.
Horizon Europe / Clean Hydrogen Partnership	EU's main R&I programme (2021–2027). Funds hydrogen research, demonstration and large pilot projects under Pillars II and III. The Clean Hydrogen Partnership (public-private initiative) accelerates development of hydrogen technologies and infrastructure via coordinated calls and industry collaboration.
European Regional Development Fund (ERDF), Cohesion Fund (CF), REACT-EU	Part of the EU Cohesion Policy. Funds regional innovation, industrial transition and clean energy infrastructure, including hydrogen pilot and demonstration projects. Regions may allocate ERDF to hydrogen depending on national/regional strategies. REACT-EU provides additional resources to ERDF.
European Investment Bank (EIB)	Provides loans, guarantees, and advisory support for sustainable projects. Finances hydrogen infrastructure, production facilities, distribution networks, storage and refuelling infrastructure under its Energy Lending Policy. Often used in combination with EU guarantees (e.g., InvestEU).
InvestEU	Provides EU budget guarantee to mobilise high-risk investments via EIB Group and selected partners. Supports renewable hydrogen production, on-site storage, refuelling infrastructure, hydrogen pipelines, and enabling infrastructure. Priority window: "Sustainable Infrastructure."
Modernisation Fund	Supports the modernisation of energy systems in 10 lower-income Member States. Can finance renewable hydrogen production, hydrogen-powered trains and vehicles, and hydrogen CHP. Funded by auctioning 2% of EU ETS allowances.

⁶⁷ Hydrogen Europe. (September 2025) Clean Hydrogen Monitor 2025 <https://hydrogeneurope.eu/in-a-nutshell/reports/>

⁶⁸ Ibidem