Interreg
Baltic Sea Region

Co-funded by
the European Union

SMART GREEN MOBILITY
HyTruck

Policy Recommendations

for Strengthening the Regulatory Framework and Support Measures for Green Hydrogen Refuelling Stations in the Baltic Sea Region

VIDZEME
THE ONLY WAY IS UP!

October 2025

Imprint

Deliverable D3.2 Input for policy and funding programmes

The report was prepared by Vidzeme Planning Region in collaboration with Sustainability Cluster Latvia.

Cite:

Vidzeme Planning Region, 2025. Policy recommendations for Strengthening the Regulatory Framework and Support Measures for Green Hydrogen Refuelling Stations in the Baltic Sea Region.

This publication is a result of the Interreg Baltic Sea Region project HyTruck, financially supported by the European Union through the European Regional Development Fund within the Interreg Baltic Sea Region Programme

Table of Contents

Introduction

HyTruck is a 3-year-long Interreg project (2023-2025) aiming to support public authorities in steering the development of a network of hydrogen refuelling stations (HRS) suited for large trucks along the Baltic Sea Region (BSR) with harmonized standards across borders. Planning and deployment of a transnational HRS network is a complex process with a spatial, economic, environmental and technological dimension.

The development of HRS across various regions in Europe is being shaped by a mix of EU regulations, national policies, and financial support mechanisms aimed at transitioning to cleaner transport systems. The HyTruck project addresses the urgent need to establish a coordinated and future-proof hydrogen refuelling infrastructure for heavy-duty transport across the BSR, in line with the Alternative Fuels Infrastructure Regulation (AFIR), which requires HRS along the core Trans-European transport network (TEN-T) by 2030.

So far, the research institutions provided prototypes of tools that help finding suitable locations, estimate the effect of different technological and environmental scenarios, provide guidance on how to set-up HRS development processes and transparently inform about the evolution of technological standards. At a regional level, partners have tested the tools in five pilot regions: Rostock region in Germany, Wielkopolskie region in Poland, Kaunas and Panevezys regions in Lithuania, Vidzeme region in Latvia and Helsinki region in Finland. The project also takes into account Estonia's successful early-stage activities and Sweden's practical experience with hydrogen infrastructure.

EU regulations play a pivotal role in shaping hydrogen infrastructure development across the Baltic Sea Region and beyond. The AFIR, in particular, serves as the main regulatory driver for HRS deployment, setting binding requirements for station density, urban coverage, and refuelling capacity. In parallel, other legislative frameworks – such as Renewable Energy Directive (RED III), the Clean Vehicles Directive (CVD), EU Emission Trading System (ETS), and CO_2 standards for trucks – reinforce the policy landscape by linking infrastructure expansion with decarbonisation targets, renewable fuel obligations, and economic incentives. The HyTruck project aligns closely with this regulatory ecosystem, ensuring that pilot activities and tool development respond not only to technological and spatial challenges but also to the evolving legal obligations and strategic imperatives at EU and national levels.

AFIR should be the primary regulatory instrument guiding HRS deployment. AFIR mandates binding targets for HRS rollout along the TEN-T, ensuring HRS are located at maximum 200 km intervals and in all urban nodes, with a minimum refuelling capacity of 1 ton per day for heavy-duty vehicles. To comply, national authorities should develop national infrastructure roadmaps, ensuring strategic planning and integration with EU-wide technical standards.

RED III mandates increasing the share of renewable fuels of non-biological origin (RFNBO), such as green hydrogen, in transport. Other related EU legislation, including the CVD and EU ETS, directly or indirectly support hydrogen adoption by incentivizing zero-emission transport and discouraging fossil fuel use.

Multiple EU regulations, including CO_2 standards for trucks, the CVD, FuelEU Maritime, and the Energy Taxation Directive, collectively shape the policy landscape for hydrogen refuelling infrastructure development. These regulations reinforce the need for financial incentives, infrastructure expansion, and cross-border harmonization.

The following resources have been used in the preparation of the report:

- Guidelines from European, national and regional development planning documents currently in force.
- Regulatory acts applicable concerning the scope of the deliverable:
    - Report: HRS Spatial Development Concept Helsinki Region
    - Report: HRS Spatial Development Concept Kaunas and Panevėžys regions
    - Report: HRS Spatial Development Concept Rostock Region
    - Report: HRS Spatial Development Concept Vidzeme Planning Region
    - Report: HRS Spatial Development Concept Wielkopolskie Voivodeship
- A catalogue of technical standards and norms for HRS dedicated for heavy duty transportation.
- Regulation (EU) 2023/1804 of the European Parliament and the Council (13 September 2023) “On the deployment of alternative fuels infrastructure and repealing Directive 2014/94/EU.”
- Reports and guidelines developed within the framework of the HyTruck project.
- Relevant studies, plans, projects and other published materials related to the subject matter of the deliverable.

Terms and abbreviations

Abbreviation	Description
AFIR	Alternative Fuels Infrastructure Regulation
BEV	Battery electric vehicle
BSR	Baltic Sea Region
CapEx	Capital expenditure
CVD	Clean Vehicle Directive
EU	European Union
EUR	Euro
ETS	European Emissions Trading System
FCEV	Fuel-cell electric vehicle
GHG	Greenhouse gases
HRS	Hydrogen refuelling station/s
HVD	Heavy duty vehicle
ICE	Internal combustion engine
LEZ	Low emission zone
OpEx	Operational expenses
RED III	Renewable energy directive
RES	Renewable energy sources
RFNBO	Renewable fuels of non-biological origin
SAE	Society of Automative Engineers
TCO	Total cost of ownership
TEN-T	Trans-European Transport Network

1. Overview of the results of HyTruck regional HRS spatial development concepts

This overview highlights the current status and legal frameworks guiding the development of HRS in the Helsinki Region (Finland), Vidzeme Planning Region (Latvia), Wielkopolskie Voivodeship (Poland), Kaunas and Panevėžys regions (Lithuania), and the Rostock Region (Germany).

By performing regional analyses and organising a stakeholder dialogue, the status, development pathways as well as obstacles to overcome are explored. Each region showcases unique strategies for promoting hydrogen infrastructure for heavy-duty vehicles in alignment with the European Green Deal, sustainability goals, and national energy plans.

AFIR legislation defines minimum requirements for the HRS infrastructure serving heavy duty vehicles[1], listed below:

- HRS location should be on the TEN-T road network or within 10 km driving distance from the nearest exit, as well as deployed with a maximum distance of 200 km between them along the TEN-T core network. At least one publicly accessible HRS should be deployed in each urban node.
- The HRS along the TEN-T corridors should meet specific requirements for capacity (minimum cumulative capacity of 1 ton per day) and dispenser pressure (at least 700 bar).

RED III [2,3] outlines binding targets for renewable energy use across sectors, including transport. The directive directly supports the uptake of renewable hydrogen as a transport fuel and introduces mechanisms to incentivize its use:

- Member States must include hydrogen from renewable sources in their overall renewable transport fuel mix.
- RED III introduces sub-targets for renewable fuels of non-biological origin, including hydrogen, with defined shares of energy use in the transport sector.
- Guarantees of origin and sustainability criteria must be ensured to classify hydrogen as renewable under EU law.
- Member States are encouraged to provide support schemes for production, distribution, and consumption of renewable hydrogen in alignment with RED III targets.

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32023R1804
[2] https://ec.europa.eu/commission/presscorner/detail/en/ip_23_594
[3] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023L2413

TEN-T Regulation serves as the spatial framework[4] for Europe's core and comprehensive transport corridors and is directly linked to AFIR.

- HRS infrastructure planning must align with core TEN-T corridors, prioritising strategic freight and logistics routes.
- The TEN-T guidelines define urban nodes and multimodal hubs as focal points for infrastructure deployment.
- EU co-funding is prioritised for projects situated on or near the TEN-T network, reinforcing its strategic importance.
- The regulation also facilitates cross-border integration, making it a cornerstone for Baltic Sea Region (BSR)-level hydrogen corridor development.

The Clean Vehicles Directive (CVD) supports demand-side[5] measures by setting binding targets for public procurement of low- and zero-emission vehicles:

- Mandates minimum quotas for clean heavy-duty vehicles, including hydrogen-powered buses and trucks.
- National and local authorities must reflect these targets in procurement procedures, effectively stimulating hydrogen vehicle deployment.
- CVD complements AFIR by ensuring that the availability of vehicles is aligned with the roll-out of infrastructure.
- CVD indirectly affects the economic viability of HRS, by ensuring vehicle throughput and early user base.

1.1. Helsinki Region (Finland)

Legal and Policy Framework:

- National legislation, including the Act on Increasing the Usage of Renewable Fuels in Transport and its amendments, supports the integration of renewable fuels, including hydrogen, into the transport sector by mandating fuel suppliers.

[4] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R1315
[5] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019L1161

- The Act on the Distribution Infrastructure for Alternative Fuels Used in Transport further supports HRS development by setting out infrastructure requirements[6].

Financial Instruments:

- The Act on Support for the Infrastructure of Electric Traffic, Renewable Gas, and Renewable Hydrogen for Transportation Use – effective since 2022 – provides financial assistance for HRS infrastructure development.
- Funding for HRS projects is sourced from the EU Recovery and Resilience Facility[7].

1.2. Vidzeme Planning Region (Latvia)

Legal and Policy Framework:

- HRS development in Latvia is guided by national policy frameworks, including the Transport Development Guidelines 2021-2027 and Latvia's National Energy and Climate Plan 2021-2030[8].
- The Transport Development Guidelines 2021-2027 emphasize that infrastructure development for alternative fuels, including hydrogen, is a key priority within the guidelines' implementation plan.
- National Energy and Climate Plan 2021-2030 sets targets for renewable fuels, including hydrogen, with a goal of 1% RFNBO in transport by 2030, target scenario is 0.6%. This requirement is integrated9 in draft "Transport Energy Law".
- The draft Transport Energy Law mandates fuel suppliers to meet the RFNBO target and aligns with AFIR regulations, requiring the deployment of HRS along the TEN-T network and in multimodal transport hubs.
- The Strategy of Alternative Fuel Infrastructure Development in Latvia (2025) outlines criteria for the most suitable locations for 3 HRS and 1 urban node.

Financial Instruments:

- Currently, Latvia lacks dedicated financial support programmes for HRS development[10].
- There is one operational grey HRS in Riga. The project received EU cofounding.

[6] HRS Spatial Development Concept: Helsinki Region, Finland, 2024
[7] HRS Spatial Development Concept: Helsinki Region, Finland, 2024
[8] https://likumi.lv/ta/id/353615-aktualizetais-nacionalais-energetikas-un-klimata-plans-20212030gadam
[9] https://tapportals.mk.gov.lv/legal_acts/042cde65-37a0-4e35-a005-109648ea5037
[10] HRS Spatial Development Concept: Vidzeme Region, Latvia, 2024

- The state funding of EUR 10 million for at least two AFIR compliant HRS is indicated in the NECP.

1.3. Wielkopolskie Voivodeship (Poland)

Legal and Policy Framework:

- Polish Hydrogen Strategy until 2030 with a Perspective until 2040 sets strategic goals for the development of a hydrogen economy, prioritizing the deployment of HRS along major transport corridors, urban hubs, and logistics centres.
- The Act on Electromobility and Alternative Fuels establishes the legal framework for hydrogen-powered vehicles and HRS, defining safety and operational standards for their construction and use.
- The Act on Renewable Energy Sources (2023 amendment): Defines renewable hydrogen and emphasizes its production through electrolysis using renewable energy sources, aligning with Poland's broader decarbonization goals.
- Excise Duty Act (2008, updated 2023): Exempts hydrogen-powered vehicles from excise tax, making them more financially viable and accelerating their adoption across various transport sectors.
- Introduction of Green License Plates (2020): Poland implemented green license plates for battery electric vehicles and FCEVs, making it easier to identify zero-emission vehicles. Fuel stations offering hydrogen or other gaseous fuels can also include designated signage to improve accessibility for drivers.
- The Regulation of the Minister of Climate and Environment (26 February 2024): Establishes standardized procedures for measuring, recording, and calculating renewable hydrogen transported outside gas networks, ensuring transparency and regulatory compliance.
- Energy Law Amendments (May 2024): Proposed legislative changes aim to integrate hydrogen into the national energy framework, improve licensing processes, and facilitate infrastructure expansion to support the growing hydrogen economy[11].
- National Recovery and Resilience Plan (KPO): This plan includes structural reforms aimed at accelerating hydrogen adoption in transport. Key targets include the deployment of at least 25 publicly accessible HRS by 2026 and a zero-emission fleet obligation in cities with over 100,000 inhabitants by 2025.

[11] HRS Spatial Development Concept: Wielkopolskie Region, Poland, 2024.

- National Recovery and Resilience Plan (KPO): This plan includes structural reforms aimed at accelerating hydrogen adoption in transport. Key targets include the deployment of at least 25 publicly accessible HRS by 2026 and a zero-emission fleet obligation in cities with over 100,000 inhabitants by 2025.

Financial Instruments:

- Excise Duty Exemptions: Hydrogen-powered vehicles benefit from tax exemptions, reducing the total cost of ownership and enhancing competitiveness against traditional fossil-fuel vehicles.
- National Fund for Environmental Protection and Water Management: A programme has been announced to support zero-emission vehicle purchases, including hydrogen-powered transport options, with implementation expected in 2025.
- Investment in Hydrogen Infrastructure: Poland has previously allocated substantial funding for HRS development through initiatives such as the "Support for Charging Infrastructure for Electric Vehicles and Hydrogen Refuelling Infrastructure" programme, with PLN 100 million dedicated to hydrogen infrastructure expansion[12].
-

1.4. Kaunas and Panevėžys regions (Lithuania)

Legal and Policy Framework

- National Energy Independence Strategy – Aims to reduce reliance on imported energy by promoting renewable energy sources, including hydrogen.
- Transport Development Programme 2022 - 2030 – Sets out plans for developing alternative fuel infrastructure, including HRS, to support cleaner transport.
- Resolution of the Minister of Energy No. 1-81 (26 April 2024) – Establishes long-term guidelines for hydrogen development in Lithuania from 2024 to 2050.
- Law on Energy from Renewable Sources – Defines the regulatory framework for renewable energy production, including hydrogen, and sets specific targets for its use in transport.
- Law on Alternative Fuels – Provides the legal foundation for developing and promoting alternative fuels, including hydrogen.
- Law on Maintenance of Potentially Hazardous Installations – Classifies hydrogen station equipment as hazardous substances in categories 2, 3, and 4, ensuring strict safety regulations.

[12] HRS Spatial Development Concept: Wielkopolskie Region, Poland, 2024.

- Resolution of the Minister of Transport and Communications No. 3-105 (10 March 2023) – Approves guidelines for expanding hydrogen refuelling infrastructure and promoting hydrogen-powered vehicles.
- Order of the Minister of Environment No. D1-878 (12 December 2016) – States that HRS are subject to general construction regulations without additional specific requirements, simplifying the development process[13].

Financial Instruments:

Under the Order of the Minister of Transport and Communications (7 April 2023, No. 3-181), four HRS were planned for installation by 2026 partially supported by EU funds (the application deadline for financial support was July 2024). However, after the call for proposals was announced, only two applications were received for the installation of two stations: one in Vilnius and one in Klaipėda. Currently, a green hydrogen production and refuelling station is under development at Klaipeda Port. The project, valued at approximately €12 million, is co-financed by the EU's NextGenerationEU facility. Construction is set to commence in 2025, with operations expected to begin in 2026[14]. A Green Hydrogen Transit Hub is also being developed in Vilnius, plans are underway to establish a green hydrogen transit hub featuring a 3 MW PEM electrolyser. The project, with an estimated cost of €10 million, is supported by the EU's NextGenerationEU facility and the Vilnius City Municipality. Construction is scheduled to start in 2025, aiming for completion by mid-2026[15]

1.5. Rostock Region (Germany)

Legal and Policy Framework:

- The development of HRS infrastructure in the Rostock region is driven by compliance with EU policies such as the AFIR and the CVD. These set minimum requirements for HRS along the TEN-T network and public procurement mandates for low-emission vehicles.
- Germany's hydrogen import strategy focuses on securing diverse global suppliers, expanding infrastructure such as ports, pipelines, and storage, and prioritizing green hydrogen to meet

[13] HRS Spatial Development Concept: Kaunas and Panevezys Regions, Lithuania, 2024
[14] https://www.h2-view.com/story/klaipeda-port-to-begin-construction-of-lithuanias-first-green-hydrogen-hub/2127392.article/?utm_source=chatgpt.com
[15] https://www.hydrogenfuelnews.com/mt-group-to-deliver-lithuanias-first-green-hydrogen-transit-hub-in-vilnius/8570775/?utm_source=chatgpt.com

climate goals. It emphasizes trade agreements for stable supply chains, financial support through investments and subsidies, regulatory alignment with EU and international standards, and fostering technological innovation through research and development.

- The German Fuel Emissions Trading Act (BEHG) introduces CO_2 pricing for conventional fuels. Under the BEHG, companies that supply heating oil, natural gas, petrol or diesel to the market have been obligated to pay a CO_2 price per ton since 1 January 2021. In 2024, the price was at €45/t CO_2 and increased to €55/t CO_2 for 2025. A price corridor of between €55 and €65/t CO_2 is then set. From 2027 on, European emissions trading will also be extended to the transport and building sectors, thus replacing national CO_2 pricing. Emission-free fuels will become more attractive than fossil fuels by this measure, but the current hydrogen price is still too expensive to be competitive.
- Hydrogen-powered trucks benefit from toll exemptions until 2025, followed by a reduced rate from 2026 onwards, further incentivizing the transition[16] (Federal Highway Trunk Toll Act BFStrMG).
- GHG quota trading system (specified in Federal Emission Control Act BlmSchG) obliges the fuel traders to gradually increase the share of renewable fuels - is an effective market mechanism to prioritize gradual uptake of RFNBO.
- Until 2030, zero-emission vehicles are exempt from vehicle tax; partial tax reduction will continue onwards (Motor Vehicle Tax Act KraftStG). Further incentives for transitioning to fleets with lower CO_2 emission standards will take place according to national transposition of EU directives.

Financial Instruments:

- National Innovation Programme (NIP) Hydrogen & Fuel Cell Technology: The NIP II (2016–2026) is a key funding initiative supporting the commercialization of hydrogen and fuel cell technology in transport. It has provided €1.1 billion in funding, covering 3,444 hydrogen cars, 7 light commercial vehicles, 106 buses, and 146 refuse collection vehicles. Additionally, it has supported the establishment of 46 public HRS and 15 private HRS across Germany. NIP II was on hold since 2024 due to budgetary constraints, but additional calls may be reopened by 2026.
- Funding Programme for Climate-Friendly Commercial Vehicles and Infrastructure (KsNI): The KsNI initiative plays a crucial role in Germany's strategy for decarbonizing heavy-duty transport. Across multiple funding rounds, over €960 million has been allocated for commercial vehicles, HRS, and feasibility studies. This includes funding for 454 hydrogen-powered fuel cell vehicles and 18 HRS. Notably, KsNI-funded vehicles represent a significant share of new climate-friendly truck

[16] HRS Spatial Development Concept: Rostock Region, Germany, 2024

registrations in the >12t weight class. The KsNI programme has been also put on hold; however, activation of both NIP II and KsNI would be crucial for ramp-up of HRS network and zero-emission vehicle fleets.

- IKK – Sustainable Mobility: This programme provides KfW loans to support climate-friendly vehicle acquisition and infrastructure development, focusing on public transport and municipal fleets.
- Climate Protection Initiative for Companies: Businesses can access KfW loans for investments in sustainable, low-emission technologies, facilitating the transition to hydrogen-powered fleets and infrastructure[17].

1.6. Estonia

In Spring of 2025, there were no operational HRS for heavy-duty vehicles in Estonia. However, two stations were under construction in Tallinn, one of which - located in the Väo area - specifically designed to serve buses and trucks. Both are being developed by Alexela in cooperation with Utilitas and are expected to become operational in 2025.

Estonia is required to deploy at least three HRS along the TEN-T core network by 2030 in line with AFIR targets, with each station providing a minimum daily capacity of 2 tons at 700 bar pressure. Estonia's hydrogen development is guided by the national Hydrogen Roadmap, which outlines the country's strategic objectives for establishing a green hydrogen value chain and reducing dependency on fossil fuels18. In 2023, a national standardisation committee was established to begin integration of international technical norms, including ISO 19880-1, although national HRS-specific regulations are not yet in place. Permitting procedures currently rely on case-by-case safety assessments.

Financial support for hydrogen is available through Estonia's Recovery and Resilience Plan, which allocates €49.1 million for hydrogen-related initiatives, complemented by €67 million from national climate and energy instruments. While there are currently no targeted CapEx or OpEx instruments for HRS, funding is available for pilot projects and early deployment activities. The number of heavy-duty hydrogen vehicles in Estonia remains low, although pilot projects involving hydrogen-powered taxis and buses in Tallinn are planned. In parallel with infrastructure deployment, further work is ongoing to streamline permitting procedures and define technical and operational standards to support market readiness[19].

[17] HRS Spatial Development Concept: Rostock Region, Germany, 2024
[18] https://h2est.ee/en/hydrogen-economy/hydrogen-in-estonia/
[19] Estonian Hydrogen Roadmap. Tallinn: Ministry of Climate, 2023.

1.7. Sweden

In Spring of 2025, there were 8 HRS in operation[20]. In total, there are 55 HRS planned in Sweden. This number exceeds the general AFIR requirements for the core and comprehensive TEN-T networks, however, not all HRS planned will necessarily reach the implementation phase.

Following the tasks identified in Sweden's electrification strategy, the Swedish Energy Agency in collaboration with the Swedish Transport Administration prepared the Implementation programme for recharging and hydrogen refuelling infrastructure[21] (2023). In 2024, the agency also completed the national coordination framework for hydrogen which included an assessment of its role in the transportation sector[22].

The implementation programme listed 11 specific and several general measures for the HRS development, including national coordination, funding, monitoring, standardization and others.

The financial support for hydrogen was structured in three directions:

- innovation and development work dedicated to manufacture of fuel cell vehicles and related infrastructure,
- development of HRS,
- acquisition of clean energy vehicles.

The funding for HRS development was provided by two national programmes: 1. Climate Leap managed by the Nature Protection Agency[23] (SEK 700 million) and 2. Regional electrification pilots (SEK 224 million) managed by the Swedish Energy Agency. Some of the most recently commissioned HRS were developed by Hydri[24].

The number of heavy-duty fuel cell vehicles is still very low despite the availability of public co-funding. Along with further development of the HRS network cooperation with manufacturers and operators will continue to scale up the end use sector and the whole value chain. In parallel, regulative effort will be dedicated to optimizing permitting and standardization processes.

[20] https://www.energigas.se/fakta-om-gas/vatgas/tanka-vatgas/
[21] https://www.energimyndigheten.se/en/cooperation/charging-infrastructure-in-sweden/
[22] https://www.energimyndigheten.se/klimat/sveriges-elektrifiering/uppdrag-inom-elektrifieringen/nationell-samordning-vatgas/
[23] https://www.naturvardsverket.se/amnesomraden/klimatomstallningen/klimatklivet/vatgas/vatgastankstationer/
[24] https://hydri.energy

2. Comparison of HyTruck results with technology manufacturers and the transport industry positions

The deployment of HRS and fuel cell electric vehicles (FCEVs) within the HyTruck project regions reveals both alignment with and divergence from industry perspectives. This chapter outlines key findings from a comparative analysis between the HyTruck pilot results and the current positions and strategies of major stakeholders in the hydrogen mobility ecosystem, including technology manufacturers and transport operators.

2.1. Persistent Barriers to Hydrogen Truck Deployment

Despite policy momentum under the AFIR, the uptake of hydrogen trucks remains limited due to the following:

- High Total Cost of Ownership (TCO): Hydrogen-powered HDVs remain significantly more expensive than their diesel counterparts, both in terms of acquisition and operating costs. Hydrogen fuel prices for the mobility sector in the EU currently range between €9 and €12/kg, contributing to poor competitiveness[25].
- Limited Vehicle Availability: Truck manufacturers continue to pilot hydrogen models but have yet to commit to mass production. This hesitancy is largely due to perceived market immaturity and uncertainty regarding future demand.
- Delayed Industrial Commitment: Initiatives such as H2Accelerate (European collaboration platform of truck manufacturers, hydrogen producers and infrastructure operators) show promise, but without assured offtake volumes, manufacturers are unable to justify scaling up production lines or regional distribution networks.

2.2. Conservative Market-Readiness and Adoption Forecasts

Hydrogen vehicle adoption projections remain well below what is required for AFIR compliance. Major industry players have indicated that:

- Demand-side certainty is lacking. Without enforceable fleet targets or incentives, there is little incentive for hauliers to convert fleets.

[25] https://h2v.eu/analysis/statistics/financing/hydrogen-cost-and-sales-prices

- Regulatory mandates are necessary to create predictable market conditions that would enable investment in production and distribution capacity.
- Operational subsidies are a missing component that could help achieve TCO parity in the short to medium term.

2.3. Interdependence of Vehicle Demand and HRS Deployment

The hydrogen mobility ecosystem is caught in a circular dilemma:

- Underutilized HRS infrastructure is economically unviable in the absence of sufficient hydrogen vehicle uptake.
- Lack of reliable HRS coverage leads fleet operators to delay or cancel hydrogen vehicle investments.
- This interdependence creates a vicious cycle that cannot be resolved without coordinated public intervention in both infrastructure deployment and fleet transition.
-

2.4. Key Conditions for Market Breakthrough

Technology manufacturers and transport operators agree on several preconditions for hydrogen mobility to scale:

- Substantial public funding, covering both capital expenditures (CapEx) and operational expenditures (OpEx) for HRS and vehicles.
- Stable regulatory signals, including:
    - CO_2-based tolling (as implemented in Germany)
    - Clear fleet procurement mandates (e.g., for public and corporate fleets)
    - Predictable hydrogen pricing via mechanisms like Carbon Contracts for Difference and the Hydrogen Bank
- Capacity-based incentive models (e.g., Dutch SWiM programme https://business.gov.nl/subsidy/hydrogen-in-mobility/) to ensure demand-side alignment during the early deployment phases.

2.5. Technical standards

The core reference point is the ISO 19880 series, which serves as the master standard for HRS, supported by a range of related representatives from Society of Automotive Engineers (SAE) and ISO technical specifications. These standards cover critical aspects such as dispensing protocols, component testing,

safety distances, and emergency response requirements. In practice, compliance with this full suite of standards requires access to approximately 40 individual documents, each priced around €300, presenting a financial and operational burden - especially for SMEs and regional authorities. While certain elements of hydrogen infrastructure overlap with existing regulations for compressed natural gas, hydrogen has unique properties that introduce critical safety differences, such as pressure ratings, gas dispersion, and zone classifications.

2.6. Required Enhancements and Recommended Actions

- All national HRS planning and permitting processes should refer to the internationally recognised ISO 19880 series as the baseline for safety, technical performance, and risk management.
- National legislation should define specific safety and zoning requirements for HRS infrastructure in line with the general EU-level provisions. Regulations should include mandatory classification of explosion-risk zones, safety protocols, and technical equipment standards.
- State and Municipal institutions responsible for construction processes and environmental impact assessment should receive targeted training on hydrogen-related standards. As well as Emergency services and safety inspectors should be trained in hydrogen-specific risk management.
- All equipment must comply with internationally accepted certification schemes to ensure safe operation and public confidence, including defined minimum quality of HRS components, refuelling speed, load, pressure, and gas quality.
- Authorities should monitor the evolution of ISO/SAE standards, AFIR obligations, and lessons learned from pilot regions to maintain relevance and effectiveness.

3. Recommendations on improving regulation and funding programmes

The expansion of HRS is critical to advancing the EU's clean transport agenda. To support this, a series of horizontal recommendations are proposed to improve both regulatory frameworks and funding mechanisms for HRS development. These recommendations aim to ensure that national and EU-level policies are fully aligned, providing a clear roadmap for hydrogen infrastructure expansion. By streamlining regulatory processes and enhancing financial support, these recommendations seek to accelerate the transition to a zero-emission transport system, creating a cohesive and efficient hydrogen ecosystem across Europe.

These improvements focus on harmonizing national legislation with EU regulations, establishing clear policy roadmaps, and enhancing the strategic deployment of HRS. Governments are encouraged to adopt predictable, transparent regulations that align with the EU's broader decarbonization targets. Furthermore, targeted funding mechanisms, such as public-private partnerships and multi-level financial instruments, are essential to support HRS development. These measures will help create a stable and attractive investment environment, driving both the growth of hydrogen infrastructure and the broader hydrogen economy.

3.1. Regulatory improvements for HRS development

The development of HRS requires the establishment of clear, consistent, and harmonized regulatory frameworks that align with broader decarbonization goals. National and regional regulations must be structured to support the deployment of hydrogen infrastructure, ensuring that key obligations for developers and fuel suppliers are well-defined. It is essential for governments to create a regulatory environment that facilitates the gradual introduction of renewable hydrogen into transport systems, with a focus on long-term sustainability and the needs of the transport sector.

In addition, national governments should provide comprehensive and predictable policy roadmaps that offer clear guidance for hydrogen infrastructure development. These roadmaps should outline key milestones and targets for HRS deployment, offering security to investors, fuel suppliers, and transport operators. Simplifying and streamlining permitting processes for HRS projects, while ensuring high safety standards, is also essential to accelerate the rollout of infrastructure. By implementing these regulatory improvements, countries can create a supportive environment that drives innovation, investment, and the widespread adoption of hydrogen-powered transport.

3.1.1. Harmonization of National Legislation with EU Frameworks

- EU Member States should fully integrate key EU legislative acts into national policies, specifying obligations for HRS developers and fuel suppliers to facilitate the gradual increase of renewable fuels in transport by 2030. National policies should align with the AFIR and RED III to ensure regulatory consistency and avoid fragmented implementation.
- Strengthen compliance mechanisms to enforce HRS deployment along the TEN-T network and in urban nodes, ensuring strategic placement aligned with traffic patterns, logistics hubs, and industrial demand.

3.1.2. Clear and Predictable Policy Roadmaps

- National governments must translate EU policy objectives into structured implementation plans that ensure HRS accessibility, interoperability, and long-term investment security.
- Develop comprehensive hydrogen mobility strategies that provide certainty to investors, fuel suppliers, transport operators, and local governments, ensuring stable demand for hydrogen-powered transport.
- Implement mandatory hydrogen adoption targets for heavy-duty fleets, public procurement, and municipal transport systems to stimulate market growth.

3.1.3. Streamlining Permitting and Safety Regulations

- Simplify and expedite permitting procedures for HRS projects by implementing a single-window approval system at the national level.
- Establish standardized safety protocols for hydrogen storage, transport, and refuelling infrastructure to ensure uniform regulatory requirements across all EU Member States.

3.1.4. Integration of Hydrogen into Public Transport

- Update public procurement regulations to prioritize hydrogen-powered buses, municipal fleets, and regional transport services, ensuring stable demand for HRS infrastructure.
- Expand fiscal incentives, toll exemptions, and vehicle tax reductions to accelerate the transition of commercial and heavy-duty transport fleets to FCEVs.

3.1.5. Governance, KPIs, and Regular Monitoring

- Establish a dedicated hydrogen governance body at the national and EU level to coordinate policy implementation, funding allocation, and stakeholder engagement.
- Define KPIs to monitor HRS network expansion, infrastructure utilization rates, hydrogen availability, and economic viability.
- Implement real-time data monitoring systems to assess the impact of HRS deployment and make data-driven adjustments to policies and funding programmes.

3.2. Enhancing funding programmes for HRS development

The expansion of HRS infrastructure is a cornerstone of the EU's decarbonization strategy. To accelerate deployment, a multi-faceted financial approach is required, combining direct investment, public-private partnerships, and flexible funding mechanisms targeting both HRS subsidies and the market ramp-up of hydrogen vehicles. The tables below outline key financing instruments available at both the national and EU levels, ensuring targeted and effective funding allocation.

3.2.1. Strategic Investment in Hydrogen Infrastructure:

- **Enhanced Public Funding:** Governments should increase direct financial support for hydrogen projects, utilizing mechanisms such as Important Projects of Common European Interest and the Hydrogen Bank auctions to drive large-scale HRS deployment. Also, use of other available funding programmes, such as Clean Hydrogen Partnership[26] would be essential.
- **Support for SMEs and Emerging Innovators:** Dedicated grant programmes and tax incentives can empower small and SMEs to play a greater role in the hydrogen ecosystem, fostering localized innovation and competitiveness.

Table 1: National-Level Financing Mechanisms for Hydrogen[27]

Financing Mechanism	Description
State Aid Regulation	Provides national-level financial support while adhering to EU competition rules to avoid market distortions.
IPCEI State Aid Guidelines	Framework supporting large-scale hydrogen projects with cross-border benefits.
Hydrogen Bank Auctions	"Auctions-as-a-Service" scheme supporting market-based hydrogen deployment.
Contracts for Difference (CfDs) & Carbon CfDs	Price stabilization mechanism covering additional costs of green hydrogen production.

[26] https://h2v.eu

[27] Marcu, Andrei, Olivier Imbault, and Chiara Cavallera. Implementation and Transposition of Hydrogen Regulations in the EU Member States. European Roundtable on Climate Change and Sustainable Transition (ERCST), 2025.

General Block Exemption Regulation	Allows Member States to support hydrogen infrastructure without prior notification to the EU Commission.
National Recovery and Resilience Facility Plans	Country-specific funding programmes supporting hydrogen projects.
Temporary Crisis and Transition Framework	Supports hydrogen-related investments during energy crises or economic transitions.

3.2.2. Coordinated EU Investment and Cross-Border Integration:

- **Harmonized Funding Strategies:** A coordinated funding approach that integrates national budgets with EU-level financing—such as the Recovery and Resilience Facility and Horizon Europe—will optimize hydrogen infrastructure expansion.
- **Development of Hydrogen Corridors:** Cross-border hydrogen corridors should be prioritized, connecting industrial hubs and logistics centers across the EU to ensure market integration and supply security.

Table 2: EU-Level Financing Mechanisms for Hydrogen (2021-2027)[28]

EU Fund	Category	Description
Innovation Fund	Direct Grants	Supports large-scale innovative hydrogen projects.
Horizon Europe	Research & Development	Funds hydrogen research and pilot projects.
Connecting Europe Facility	Infrastructure	Supports hydrogen transport and storage infrastructure.
EU Recovery and Resilience Facility	Economic Recovery	Provides targeted funding for green hydrogen development.

[28] Marcu, Andrei, Olivier Imbault, and Chiara Cavallera. Implementation and Transposition of Hydrogen Regulations in the EU Member States. European Roundtable on Climate Change and Sustainable Transition (ERCST), 2025.

Just Transition Fund	Regional Development	Helps regions transition away from fossil fuels to clean hydrogen.
European Regional Development Fund	Structural Support	Finances hydrogen-related projects in less developed regions.
InvestEU	Loan Guarantees	Encourages private-sector investment in hydrogen infrastructure.

3.2.3. Advancing Hydrogen Production and Supply Chain Resilience

- **Scaling Up Green Hydrogen:** Investments should focus on electrolysis capacity expansion to meet the EU's target of 10 million tons of renewable hydrogen by 2030, as outlined in the RED III.
- **Building Robust Transport and Storage Infrastructure:** Funding should be directed toward dedicated hydrogen pipelines, repurposing existing gas infrastructure, and constructing large-scale storage facilities to enhance supply chain efficiency.

3.2.4. Public-Private Partnerships to Drive Market Growth

- **De-Risking Private Investments:** Collaborative models between governments, hydrogen producers, and transport operators should be encouraged to mitigate risks associated with large-scale infrastructure projects.
- **Fiscal Incentives for Private Sector Engagement:** Tax reliefs, co-financing mechanisms, and state-backed guarantees can stimulate private investments in hydrogen mobility solutions.

3.2.5. Flexible Financial Instruments for Sustainable Growth

- **Long-Term Loan Programmes:** Extending repayment terms for hydrogen-related infrastructure projects can enhance financial viability and attract investment.
- **Performance-Based Grants:** Linking funding to HRS utilization rates and hydrogen consumption can ensure efficient allocation of resources and measurable impact.

3.3. Recommendations for each HyTruck project region

This section outlines tailored recommendations for advancing HRS deployment in each HyTruck project region. The recommendations are informed by both HyTruck pilot results and comparative analysis with EU-wide best practices and policy instruments.

3.3.1. Helsinki Region (Finland)

- Expand early deployment through phased investment, focusing on key corridors (Helsinki–Turku, Helsinki–Kotka/Hamina).
- Leverage national support schemes alongside Hydrogen Bank funding and EU Recovery and Resilience Facility (RRF) allocations.
- Involve port authorities and logistics firms in site selection and demand aggregation.
- Promote cross-border coordination with Estonia and Sweden to support AFIR compliance.

3.3.2. Vidzeme Region (Latvia)

- Initiate HRS development through public investment, given the absence of private market interest.
- Start with modular infrastructure (e.g., 0.5 t/day) to minimize financial risk and allow for gradual scaling.
- Advocate for OpEx support mechanisms at the national level and ensure Latvia accesses EU-level operational funding tools.
- Strengthen regulatory certainty through expedited passage of the Transport Energy Law and full integration of RED III targets.

3.3.3. Wielkopolskie Voivodeship (Poland)

- Integrate dynamic planning tools with real-time transport data to improve station siting and scaling decisions.
- Align national funding (e.g., NFOŚiGW) with CO_2-based tolling and vehicle support incentives to stimulate dual market growth.
- Enhance public awareness and local industry engagement to foster early vehicle uptake.

3.3.4. Kaunas and Panevėžys Regions (Lithuania)

- Expand public-private partnerships to co-develop infrastructure, leveraging EU funding tools (e.g., CEF, Horizon Europe).
- Establish a centralized platform for monitoring station usage, planning infrastructure roll-out, and capturing demand signals.
- Collaborate with academic institutions to pilot emerging hydrogen technologies in mobility.

3.3.5. Rostock Region (Germany)

- Treat AFIR targets as minimum thresholds and expand based on commercial freight demand models.
- Revitalize Germany's KsNI and NIP programmes to co-fund HRS deployment and vehicle acquisition.
- Integrate national planning tools (e.g., StandortTOOL) to streamline location selection and support regional consistency.
- Monitor and publish toll savings for zero-emission vehicles to increase fleet *operator awareness.*

3.3.6. Sweden

- Strengthen national coordination by integrating HRS support into long-term freight decarbonisation frameworks (e.g. Klimatklivet, Swedish Transport Administration strategy).
- Target funding towards rural logistics hubs and high-throughput border areas (e.g. Malmö–Copenhagen corridor) to support full HDV corridor coverage.
- Facilitate dialogue between regional municipalities and private operators to streamline permitting and ensure spatial coherence.
- Advance alignment of safety and operational HRS standards with AFIR, and promote Swedish leadership in EU-level harmonisation of 700-bar HDV protocols.

3.3.7. Estonia

- Introduce regulatory fast-tracks and technical standards for HRS aligned with AFIR and ISO 19880 to improve investor confidence.
- In view of limited early market demand, the government should consider implementing operational support schemes (e.g., OpEx), road toll exemptions, or tax benefits for hydrogen-powered heavy-duty vehicles to stimulate uptake.
- The Hydrogen Roadmap outlines strategic goals and should be expanded further to include tangible policy instruments, deployment timelines, and private-sector engagement plans.

3.3.8. *Cross*-Cutting Recommendations

- Promote joint infrastructure planning across borders, especially in areas near TEN-T corridors.
- Ensure that each region develops a cohesive regulatory roadmap, aligning with EU regulations such as AFIR, RED III, and the Clean Vehicles Directive.

- Collect region-specific data on hydrogen demand, price sensitivity, and vehicle deployment to support adaptive policy making.

4. Coordinated Regulatory and Market-Based Measures

The deployment of hydrogen mobility infrastructure and technologies requires a cohesive policy framework that simultaneously discourages fossil fuel dependency and stimulates investment in hydrogen alternatives. The following section outlines essential regulatory and market-based instruments to unlock the full potential of hydrogen mobility within the HyTruck regions and beyond.

4.1. CO_2-Based Tolling and the Eurovignette Directive

The 2022 revision of the Eurovignette Directive empowers Member States to apply toll rates based on CO_2 emissions. This approach internalizes the environmental cost of diesel use and creates a strong economic incentive for zero-emission vehicle adoption.

- Best practice: Germany's implementation includes a surcharge of €200 per ton of CO_2, generating potential savings of nearly €30,000 annually per hydrogen-powered truck.
- Member States are encouraged to transition from time-based vignettes to distance-based tolling systems with CO_2 differentiation by 2030, as mandated by EU law.
- Revenue from such tolls should be earmarked for reinvestment in sustainable infrastructure, including HRS and multimodal hubs.

4.2. Low-Emission Zones (LEZs) and Urban Access Regulations

LEZs restrict access to high-emission vehicles in urban areas, indirectly promoting demand for clean mobility solutions such as hydrogen-powered vehicles.

- Regulatory unpredictability, such as the softening of LEZs in France, undermines investor and operator confidence.
- EU-level guidance is needed to harmonize LEZ implementation, with clear thresholds and long-term emission reduction trajectories.
- Member States should expand the number of LEZs and link them to public procurement and clean transport strategies.

4.3. Fleet Procurement and Corporate Transition Targets

Public and private fleet procurement has significant potential to drive hydrogen mobility adoption.

- The Clean Vehicles Directive (2019/1161) already mandates minimum quotas for ZEVs in public procurement.
- The upcoming revision of the Public Procurement Directive should introduce preferential treatment for hydrogen vehicles.
- Introduce mandatory fleet renewal targets for large corporate fleets (e.g., >100 vehicles), supported by tax incentives or penalties for non-compliance.

4.4. RED III and Credit Trading

RED III introduces binding targets for the use of RFNBO in the transport sector.

- Member States must implement robust credit trading systems to create market incentives for hydrogen adoption.
- Revenues from credit trading should be reinvested in HRS and hydrogen production infrastructure.
- Ensure that transport applications are prioritized in RFNBO allocation to maximize decarbonization impact.

4.5. Harmonization and Technical Standards

For hydrogen infrastructure to scale effectively across Europe, technical standardization and inclusion in regulatory frameworks are essential.

- The European Commission should publish technical norms for hydrogen, including pressure levels, dispensing protocols, and transport safety measures.
- Amend ISO 14083:2023 and related EU regulations to include hydrogen in transport GHG accounting methodologies, enabling better impact tracking.

4.6. Social Equity and the Just Transition

The shift to hydrogen mobility must be equitable and inclusive.

- Implement the Social Climate Fund in close consultation with local governments and civil society to ensure that vulnerable users are not disproportionately impacted by carbon pricing or regulatory changes.
- Fund clean transport access for low-income groups and SMEs through targeted support schemes linked to hydrogen adoption.

4.7. Integrated Policy Coordination

As hydrogen mobility infrastructure scales across Europe, it is essential to consider not only deployment and operational phases but also the end-of-life management of hydrogen-related technologies and systems. Circular economy principles should be integrated into policy frameworks to ensure long-term environmental sustainability and resource efficiency.

Recycling and End-of-Life Management: Decommissioning of HRS, as well as the disposal and recycling of FCEVs and their components, will become a growing concern as the first generation of assets reaches obsolescence in the 2030s. To address this challenge:

- EU-level policies should be developed to guide the safe, efficient, and environmentally sound dismantling and recycling of HRS infrastructure and hydrogen-powered vehicles.
- Member States should establish recycling targets for key components such as fuel cells, pressurized hydrogen tanks, and electrolysis systems.
- Public procurement and funding programmes should include criteria that favour recyclable, modular, and upgradable system designs.
- Develop and harmonize local know-how for maintenance and repair of FCEV.

Lifecycle Assessment Integration: Lifecycle assessment should become a standard component of HRS and hydrogen mobility projects, enabling a full accounting of environmental impacts from construction to decommissioning.

- Future updates to AFIR implementation guidelines should require LCA reporting for publicly funded hydrogen projects.
- LCA methodologies should be harmonized across Member States to ensure comparability and support EU-wide sustainability monitoring.
- LCA results can inform policy decisions on funding eligibility, siting criteria, and technology selection.

Research and Innovation Support: EU should allocate dedicated funding within Horizon Europe and related R&D programmes to support innovation in:

- Recyclable fuel-cell technologies
- Safe hydrogen storage reuse and recovery
- Automated HRS decommissioning tools and protocols

5. Input to national and transnational funding and policy programmes

5.1. Strategic Policy Recommendations for the Acceleration of Hydrogen Heavy-Duty Transport

- Facilitate the integrated deployment of HRS and hydrogen-powered heavy-duty vehicles through targeted, co-financed public-private investment schemes. A synchronized rollout is essential to mitigate the "chicken-and-egg" barrier to market uptake and to ensure that infrastructure availability supports vehicle adoption trajectories.
- Strategically coordinate the spatial distribution of hydrogen refueling and renewable hydrogen production infrastructure in consultation with national governments, regional authorities, and key industry stakeholders. Spatial planning should leverage real-time freight logistics data, anchor customer mapping, and the application of digital spatial planning tools, as demonstrated in the HyTruck project's methodological framework.
- Enhance market confidence in the availability of renewable hydrogen for the transport sector by operationalising the European Hydrogen Bank and ensuring enforceable implementation of the RED III mandates. These mechanisms must provide price and supply predictability to both investors and fleet operators, particularly in early-stage markets.
- Ensure that the total cost of ownership of hydrogen-powered heavy-duty vehicles achieves parity with diesel alternatives through a coherent and balanced mix of fiscal and regulatory instruments. This includes a progressive increase in carbon pricing under the EU ETS II, high-value RED credits for certified green hydrogen, and preferential fiscal treatment such as exemptions from road tolls and vehicle taxes for zero-emission trucks.
- Commit to the full and timely implementation of existing European legislative frameworks—including the AFIR, RED III, and the revised CO_2 Emissions Standards Regulation. To ensure regulatory coherence and effectiveness, a centralized and transparent monitoring system should be established to assess member state compliance and to inform corrective policy action where necessary.

5.2. Criteria for public co-funding

- **Functional rather than technical specification**: Design of terms of reference and other criteria for support programme calls or procurements is a complicated task. When developing specifications for co-funded HRS, experts representing public institutions should choose a functional rather than technical approach. “Functional” refers to the required services from the end user perspective (i.e. the transport operators), whereas “technical” rather focuses on prioritizing selected technological solutions and components. The functional approach mitigates the gaps of competence between officials, service providers and original equipment manufacturers and it has been successfully tested in recent HRS procurements, for example Groningen and Drenthe in the Netherlands.
- **Synergies of different zero emission technologies:** Adverse competition should be avoided between battery electric vehicles (BEV), FCEV and hydrogen internal combustion engine (ICE) technologies. Rather, their synergies and complimentary use cases should be exploited in specific contexts. Thus, we recommend adopting a technologically neutral approach to designing support schemes for electrification. Full life cycle costs and exploitation requirements should be compared, including availability of space for the charging/refueling infrastructure, local power distribution system, range and other use- and location-related criteria which should guide each decision.
- **Integrated solutions for hydrogen hubs and valleys**: Use of hydrogen in transportation has attracted a substantial part of EU funding. While support for RDI activities will continue, support for new piloting activities will not increase as technologies have reached their maturity. The focus is shifting to more complex value-chain projects and hydrogen valleys. Thus, EU funding for HRS development could be available as part of broader projects that tackle different aspects of production-distribution-use in key strategic locations.

5.3. Comparative Overview and Conclusion

To support evidence-based policymaking and strategic planning, a structured comparison of the regulatory frameworks, support instruments, and institutional readiness across HyTruck partner countries was conducted. The resulting matrix offers a cross-country perspective on key enablers and barriers affecting the development of HFR infrastructure for heavy-duty transport.

The Table 3 provides overview of hydrogen policy, regulatory, and financial support instruments in Germany, Finland, Poland, Lithuania, Latvia, Estonia, and Sweden. It covers both political (strategic and legal) and financial support frameworks relevant to the development of hydrogen energy and refueling infrastructure.

- **Hydrogen Strategy** status indicates whether the country has adopted a formal national hydrogen strategy.

- **National legislation (law)** refers to the presence of hydrogen-related laws or their development status.
- **National legislation (rules)** focuses on the implementation of EU's AFIR.
- **HRS National Regulation** addresses technical specifications at the national level for HRS.
- **ISO standard integration** refers to integration of ISO 19880 standards into national regulatory frameworks for HRS varies across countries.
- **Financial Incentives** includes subsidies, grants, or market support mechanisms.
- **CapEx Support** indicates whether public funding is available for infrastructure investment.
- **Buy-in Tariffs** refers to guaranteed prices or risk-mitigation tools for hydrogen producers, and
- **CO_2 Pricing** highlights whether a national carbon pricing mechanism is in place that affects the hydrogen market.

Table 3: HRS Political and Financial support instrument overview

Support instruments		Germany	Finland	Poland	Lithuania	Latvia	Estonia	Sweden
POLITICAL	Hydrogen strategy	Yes	Yes	Drafting phase	Yes	In development – strategy where green hydrogen is included	Yes	Yes
	National legislation (law)	Yes	Developing	Yes	Yes	Developing	Developing	Yes
	National legislation (rules)	Full AFIR compliance	Full AFIR compliance	Emerging AFIR compliance	Planned AFIR compliance	Planned AFIR compliance	Planned AFIR compliance	Full AFIR compliance
	HRS national regulation	AFIR compliant, 700 bar, 1t/day	Nordic standard, 350/700 bar)	No national technical standard	No national technical standard	No national technical standard	No national technical standard	Market-driven standards aligned with AFIR

	ISO standard integration	Integrated	Referenced regarding Hydrogen safety	Referenced regarding technical requirements	Not directly	Not directly	Not directly	Market-driven standards aligned with AFIR
FINANCIAL	Financial incentives	GHG quota, taxes, funding (on hold)	Tenders 2022–2025	Planned incentives	No direct support yet	None	Not evaluated	Strong industry-driven models
	CapEx support (HRS)	Yes[29]	Yes[30]	Yes[31]	Yes	No	No	No
	Buy-in tariffs	Indirect	Flexible policy mechanisms, no fixed tariffs	Subsidies cover production risk, no fixed tariffs	Indirect[32]	No	No	No
	CO_2 pricing	Yes (BEHG CO_2 price)	Yes (support via climate law)	Limited	No	No	Unknown	Carbon pricing in place

The analysis of HyTruck HRS Spatial Development Concept Reports revealed several strategic insights relevant to policymakers, planners, and operators engaged in HRS infrastructure deployment across the BSR. While technical specifications such as pressure levels and connector types are addressed in detail, broader systemic factors also emerge as decisive for implementation success.

A core insight relates to the role of transnational spatial planning. Despite the harmonising intent of AFIR (e.g., 200 km spacing on the TEN-T), several countries—particularly those in the eastern BSR—lack coordination mechanisms to ensure corridor continuity. Disjointed national planning processes risk creating infrastructure gaps or underused assets at cross-border nodes. The HyTruck methodology, combining AFIR-mandated requirements with bottom-up stakeholder input, offers a framework for addressing this, but remains inconsistently applied across regions.

[29] https://www.rabobank.com/knowledge/d011446925-germanys-core-hydrogen-network-and-regulatory-framework-explained
[30] https://gasgrid.fi/wp-content/uploads/Gasgrid_Study-on-the-Potential-of-Hydrogen-Economy-in-Finland_ENG-FINAL.pdf
[31] https://fuelcellsworks.com/news/poland-boosts-green-hydrogen-industry-with-substantial-subsidies
[32] https://ec.europa.eu/commission/presscorner/detail/da/ip_25_718

Another widely observed issue is the infrastructure-demand lock-in. In Latvia and Lithuania, neither green H_2 production nor HDV fleets currently exist at scale. This reinforces the investment risk and delays HRS construction. Reports recommend securing commitments from anchor customers (e.g., logistics operators, bus fleets) during early planning stages to stabilize demand and enable investment. In addition, public financial support is essential, as demonstrated by the German case study - Germany was frontrunning in ramping up HRS infrastructure but due to financial restrictions in subsidizing the market the pace slowed down significantly.

Stakeholder engagement is cited as a key enabler. Workshops in Finland, Germany, Poland, Lithuania and Latvia revealed major concerns: complex permitting procedures, insufficient funding clarity, and regulatory misalignment. By contrast, Sweden and Germany demonstrated effective coordination across governance levels, which has facilitated timelier and demand-responsive HRS development. The lesson is that engagement must be ongoing, not one-off.

Concerning site selection, the documents emphasize that distance-based placement alone is insufficient. Testing the HyTruck spatial planning toolkit provided valuable insights for further GIS integration in policy making. Effective HRS positioning requires access to hydrogen sources, multimodal terminals, and high HDV throughput zones. However, many national plans lack data-driven freight corridor analysis, missing opportunities to align HRS locations with actual use cases.

Persistent regulatory fragmentation also poses challenges. Lithuania and Latvia lack codified safety, inspection, and operational standards for HRS. In several cases, permitting procedures extend over 12 months, discouraging private investment. The reports recommend establishing streamlined permitting pathways and legal clarity to accelerate timelines.

And lastly, HR and training constraints were noted, especially in Poland and Lithuania. A lack of specialized workforce capacity—engineers, technicians, and inspectors—hampers the readiness of HRS deployment ecosystems. The reports suggest forming targeted collaborations with technical education institutions to fill this gap.

Ultimately, the HyTruck project demonstrates that spatial development of HRS is not merely a technical exercise but a systems-level challenge involving policy, finance, governance, and capacity-building. Addressing these dimensions holistically will be key to ensuring that the BSR becomes a frontrunner in the transition to zero-emission heavy-duty transport.