Interreg
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H2ignite

Activity 1.7:

Hydrogen innovation ecosystem evaluation concept for the heavy-duty transport sector

Final Report

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Abstract:
This evaluation concept provides a conceptual framework and guidelines for the continuous evaluation of nascent local green hydrogen innovation ecosystems in the heavy-duty transport sector. The evaluation aims at regularly monitoring and supporting the efforts of establishing the innovation ecosystem, and drawing valuable lessons for other nascent green hydrogen innovation ecosystems. Conceptually, we identify two key challenges for the establishment of a sustainable regional hydrogen value chain for green hydrogen-powered heavy-duty vehicles (HDV), the cost disadvantages compared to conventional diesel-powered HDV and the "chicken-and-egg" dilemma in nascent networks. The evaluation should pay particular attention to the stage of HDV operation in which these two challenges are particularly evident

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1 Introduction

This evaluation concept provides a generic framework for the continuous assessment of nascent local green hydrogen innovation ecosystems in the heavy-duty transport sector. It specifically applies to the four pilots of the H2ignite project.[1]

The evaluation serves two main purposes. It shall (i) monitor and support a publicly funded project aimed at contributing to establish a local green hydrogen innovation ecosystem for heavy-duty transport, and (ii) draw valuable lessons from the activities taken in this project for other nascent green hydrogen innovation ecosystems that may help them overcome the obstacles they face. On the backdrop of the objectives of the project to be evaluated, the monitoring shall identify the major obstacles to the establishment of a fully operational value chain in the project region and determine to what extent, and how, the project has been contributing to overcoming these obstacles. One challenge faced by many nascent local green hydrogen value chains is the need of coordination among stakeholders and the development of innovative solutions to overcome the enormous uncertainty among key stakeholders at the different stages of the value chain. One goal of the project to be evaluated must therefore be to bring together relevant actors from all stages of the value chain as well as supportive stakeholders from businesses, public authorities and academia ("triple helix") to jointly figure out how to reduce their uncertainties. The evaluation will support the project by systematically and continuously reviewing its objectives and activities on the backdrop of theoretical insights and good practices established by other, comparable projects, and feeding the insights from these reviews back to the project management or relevant stakeholders. The lessons drawn from these monitoring and review processes will be published and disseminated to other projects to facilitate learning from the project and its evaluation on a global scale.

While this evaluation concept focuses on innovation ecosystems that envision hydrogen-powered heavy-duty vehicles with fuel cell (HFC-HDV) or retrofitted internal combustion engines (HICE-HDV), it could be modified or extended to cover ecosystems that target other low-emission alternatives such as battery-electric (BE) HDV.[2] The evaluation concept also focuses on ecosystems that target green hydrogen but could be used for ecosystems that target other sources of hydrogen such as purple (nuclear energy) or grey hydrogen (fossil). Hydrogen

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[1] The four pilots shall (i) assess the feasibility and readiness of hydrogen technologies for inland waterway transport on the Seine-North Europe Canal in the French region of Hauts-de-France, (ii) connect hydrogen suppliers, filling stations and end-users to bring hydrogen-powered heavy-duty vehicles (HDVs) to market in the Dutch Province of Drenthe, (iii) contribute to establishing a business environment for hydrogen-powered HDV deployment in the Danish region of Zealand, and (iv) advance hydrogen-powered logistics through demonstration projects in West Sweden.
See https://www.interregnorthsea.eu/h2ignite/pilots for more details (last access June 27, 2025).

[2] There is still great uncertainty about the current and future economic viability of the different zero-emission alternatives relative to diesel internal combustion engines (DICE) and relative to each other, depending on the prices of the vehicles as well as of diesel, green electricity and hydrogen, charging technology, public support schemes and the specific use cases, among others (e.g., Rout et al. 2022, Danielis et al. 2024, 2025).

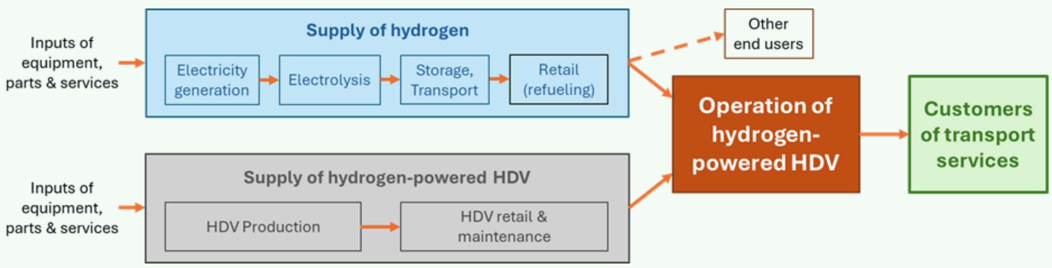
produced from non-renewable sources could play an important role in the ramp-up of a hydrogen ecosystem in some regions because it is currently still cheaper than green hydrogen.

The next section lays the conceptual foundation of the project evaluation by describing the stages of a prototypical green hydrogen value chain and the main challenges often faced in establishing such a value chain at the regional level. Section 3 defines the objectives and the scope of the project evaluation, and Section 4 describes a benchmarking exercise that aims at complementing the evaluation through learning from good practices from other, more advanced projects.

2 Conceptual background

Figure 1 outlines the stages of a prototypical green hydrogen value chain in a stylized way. This chain consists of three interconnected systems: the supply of hydrogen fuel (blue color), the manufacture and delivery of hydrogen-powered vehicles to end users (grey), and the provision of green hydrogen-powered transport services (red and green). The fuel supply system spans the process from renewable electricity generation and electrolysis through the storage and the distribution of hydrogen to refueling stations. The vehicle manufacture and delivery system consists of hydrogen-powered HDV manufacturers (original equipment manufacturers, OEMs) and HDV retail services. The retail services include not only vehicle sales but also complementary repair, maintenance, insurance, financing, leasing and resale services. These two systems provide essential inputs for the operation of HDVs (red), which are at the center of the value chain. HDV operators purchase hydrogen fuel from refueling stations and hydrogen-powered HDVs and related services from dealers, garages, or financial service providers. In turn, the HDV operators provide transport services for their customers (green).[3]

Figure 1: Green hydrogen value chain for hydrogen-powered heavy-duty vehicle (HDV)



Each red arrow in the value chain represents a distinct trade relationship where an upstream operator supplies a product or service to the next stage at an agreed price. The price is acceptable to the respective supplier if her expected revenues (discounted over the lifespan of equipment) cover all discounted costs—net of any third-party subsidies and other financial or non-financial benefits. The costs include a reasonable profit margin. The price is acceptable to the respective

[3] For simplicity, the customers of transport services are considered the final stage of the hydrogen value chain, though many are likely to be in manufacturing, construction, or service industries.

customer if she can fully pass it on to her customers, ensuring that her discounted revenues—net of any applicable subsidies and other benefits—cover all her discounted costs (including upstream input costs) plus a reasonable profit margin.[4]

The key challenges for the establishment of a sustainable regional hydrogen value chain for green hydrogen-powered HDV are twofold. One challenge is the cost disadvantages of hydrogen-powered HDV vis-a-vis comparable DICE- or BE-HDV, which is still significant and originates from both higher fuel costs and higher investment costs for the HDV.[5] The other challenge is the fundamental "chicken-and-egg" dilemma in nascent networks (e.g., Royer and Wirth 2024). The value chain is subject to indirect network externalities that require the simultaneous emergence of a critical mass of both supply of and demand for hydrogen and hydrogen-fueled HDV. Hydrogen-fueled HDV cannot be operated without sufficient supply of hydrogen from refueling stations, and hydrogen refueling stations cannot be operated sustainably without sufficient demand by operators. These two challenges currently create enormous uncertainties among potential investors at the different stages of the value chain regarding the commercial viability of their investments (e.g., Korbee 2024). As a result, many potential investors remain hesitant, adopting a wait-and-see approach rather than committing in advance. Overcoming the chicken-and-egg dilemma and the cost disadvantage requires creating favorable conditions that reduce the uncertainty of potential operators at all stages of the value chain and motivate them to simultaneously invest in production capacities and begin operations.

Even though uncertainties hamper investments and operations at several stages of the value chain, there are good reasons for projects that seek to establish an innovation ecosystem for such a chain—and consequently the evaluations of these projects—to put particular emphasis on the HDV operation stage because the two challenges, the chicken-and-egg dilemma and the cost disadvantage, are particularly evident at this stage. The entire value chain will operate sustainably only if there is a critical mass of transport companies that have the opportunity, and are willing, (i) to purchase hydrogen-powered HDV and related services from local retailers resp. garages at acceptable prices, (ii) to purchase hydrogen from local refueling stations at an acceptable price,[6] and (iii) to sell their transport

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[4] While we treat the individual stages of the value chain to be operated separately from each other in this stylized concept for the sake of simplicity, adjacent stages may be vertically integrated in practice for technical, economic or organizational reasons. For example, electricity generation, electrolysis and storage could be provided by a single company to exploit synergies between these stages and reduce coordination costs. OEMs can offer repair and maintenance services to compensate for the lack of expertise of traditional local suppliers. Or the customers of transport services could themselves operate hydrogen-fueled HDV to provide in-house distribution or delivery services. Although such vertical integration enables a certain degree of cross-subsidization across the integrated stages, it does not invalidate the general principle that each operator's revenues must cover her costs in the long term.

[5] For example, Gray (2022) estimates that the total cost of ownership for a HFC-HDV vehicle exceeds those for a comparable DICE-HDV vehicle by 18%-109%. Taking into account local conditions in Antwerp/Belgium and Helmond/The Netherlands, estimates by REVIVE (2025) are at the upper bound of this range. The cost of green hydrogen as a fuel vary widely, depending on the prices of electricity, electrolysis and transport (e.g., ESMAP et al. 2023). Model calculations by Noll et al. (2022) and Rebel Group yield comparable results (https://tcovrachtwagen.org/simulation, last access: May 9, 2025).

[6] Long-haul transportation additionally requires that refueling stations are available along

services to customers at an acceptable freight rate. In addition to this, this stage faces, like many other stages, safety issues and other challenges that require the involvement of public authorities or of scientific of business consultancy services. The HDV operation stage is also a good point of departure because it reveals the cost disadvantage of hydrogen-powered HDV vis-a-vis comparable DICE- or BE-HDV particularly clearly. Prices are comparatively easy to observe at this stage, which makes it possible not only to quantify the magnitude of the cost disadvantage of hydrogen-powered HDV operation but also to identify its major causes, be it high vehicle prices, high fuel cost or low freight rates (see Section 4).

While both challenges need to be addressed and overcome simultaneously to establish a sustainable regional hydrogen value chain, they will frequently require different measures. Overcoming the cost disadvantage primarily requires strategies that either reduce effective vehicle operation costs or exploit pecuniary or non-pecuniary benefits of vehicle operation. Such strategies could include:[7]

- HDV operators might view the cost differential as an investment in acquiring practical experience with HFC-HDV operations through learning-by-doing or learning-by-using.
- Customers of HDV operators may voluntarily choose to pay a higher price for the more environmentally friendly transport services offered by hydrogen-powered HDV. This willingness could come from their own motivation to contribute to CO_2 emissions reduction, or they may pass on the additional cost to their own customers who are highly willing to pay for lower-emission services.
- Customers of HDV operators may be forced to purchase environmentally friendly transport services offered by hydrogen-powered HDV by public regulatory measures like access restrictions to specific areas or other obligations to reduce their CO2 footprints.
- OEMs or hydrogen producers could align their investments in production capacity with research and development (R&D) efforts—potentially in collaboration with operators, research institutions, or consultants—that aim to achieve future cost reductions through technological or organizational innovations, learning effects, or economies of scale.
- Hydrogen fuel costs could be reduced by sourcing it from non-renewable feedstocks or importing it from other regions or countries, assuming the necessary hydrogen transport infrastructure is in place.
- Rising demand for hydrogen from other sectors, such as manufacturing, may reduce the price of hydrogen through economies of scale along the hydrogen fuel value chain (sector coupling).
- Regulatory changes could also help lower costs at specific stages of the value chain. Measures that promote trust-building between stakeholders along the

the main routes the transport company serves.

[7] Another option would be postponing the establishment of the value chain until technological innovations have offset the cost disadvantage, of course. This option is not considered relevant in the present context, however.

value chain reduce uncertainty sufficiently to encourage participation and investment. Such arrangements could take the form of long-term contracts or other binding agreements that define the terms of bilateral supply and demand relationships. These agreements might be further supported by commitments from other stakeholders—such as consultancy services or financial incentives—that help reduce perceived risks and further strengthen mutual confidence.

- Some segments of the value chain may receive public subsidies sufficient to offset the current cost disadvantages of hydrogen-powered HDV transport services.

Overcoming the chicken-and-egg dilemma additionally requires bringing together relevant, potentially interested stakeholders along the entire value chain to help them coordinate their interests and activities and establish trustful, preferably long-term stable business relationships. Including complementary expertise by additional stakeholders from industry, public administration, academia and interest groups will provide helpful in many cases to help key stakeholders' align their interests to each other, contribute possibly innovative technical, organizational or business solutions, or reduce administrative or regulatory barriers ("triple" or "quadruple helix" approach).

3 Objectives and scope of the evaluation

Based on the conceptual framework outline in the previous section, and subject to the overall objectives of the project, the evaluation will continuously monitor and assess

- The activities taken within the project to identify the major obstacles to the effective operation of the value chain;
- The activities planned in the course of the project to contribute to overcoming these obstacles at the HDV operation stage or other stages of the value chain;
- The current state of the value chain as a whole in the project region with respect to the maturity of the hydrogen-powered HDV operation stage and the other stages, the stakeholders involved and the linkages with actors from adjacent stages;
- The main remaining obstacles that prevent the gaps in the value chain from being closed, i.e., prevent potential operators at those stages that are not yet in operation from investing, starting production and trading with adjacent stages.

The main source of information for the evaluation will be repeated interviews with the project management and core stakeholders of the nascent value chain in question in the course of the project.[8] An interview with the project management at the beginning of the project shall identify the objectives and planned activities as well as the status quo ante of the nascent value chain, including the main obstacles the project needs to overcome. Subsequent regular consultations with

[8] The Appendix provides guidelines for semi-structured interviews with relevant stakeholders on the project's objectives activities as well as on the state of the value chain.

the project management or stakeholders during the project period shall update this information and identify progress (or setbacks) in achieving the project's objectives and the establishment of the value chain. The final evaluation of the project and the value chain, which will take place at the end of the project period, shall determine the extent to which the project has achieved its objectives, the extent to which the activities taken during the project contributed to achieving these objectives, and the obstacles that prevented the value chain from becoming operational and the project from achieving its objectives or carrying out its planned activities. It shall also determine the extent to which the value chain has been completed and become operational. This final evaluation will identify good practices for other nascent value chains and for projects to implement them. The insights from the evaluation of the project and from benchmark cases will be shared with the project management or the stakeholders in regular consultations.

One recognized way to identify the potential (and pitfalls) of a sustainable value chain for hydrogen-powered HDV is to look across industry and observe situations where such value chains are already in place and creating value. For this reason, in a supplementary benchmarking exercise (see below), the evaluation will spread the net more widely, searching for good practices across a range of other, more established value chains. The purpose is to investigate whether these value chains faced similar obstacles in the past, and how their stakeholders went about overcoming them.

4 Benchmarking

Established, fully functional regional green hydrogen value chains for hydrogen-powered HDV have obviously succeeded in overcoming the lack of cost competitiveness. They could provide valuable information on how obstacles can be overcome in the nascent value chain under evaluation. As part of the evaluation, core stakeholders from selected of these value chains will be interviewed to identify, as far as possible, good practices. This is expected to substantiate the monitoring process and provide additional support to the project.

This benchmarking could prove challenging for several reasons, however. One reason is that there are so few established value chains in this industry, making it difficult to come to any empirically sound conclusions on the effectiveness of examples taken from practice. Another reason is that stakeholders from these value chains may be reluctant to provide sufficiently detailed information on how the cost disadvantage of hydrogen transport services was overcome in their cases. This reticence to share information may be owing to confidentiality concerns or a lack of willingness to cooperate.

To meet these challenges as far as possible, the interviews will be complemented by desktop research that uses publicly available information about established value chains to gain preliminary, tentative insights on how the cost disadvantage of hydrogen-powered HDV against DICE-HDV transport services has been overcome. To reduce complexity, this research aims to focus on the comparison between hydrogen-powered HDV against DICE-HDV transport services. In addition to scientific and popular publications, this publicly available information also supplies important data, helping to shed light on the sustainability of using green hydrogen to power the haulage industry. One key piece of data is published information of hydrogen “pump prices”, available from refueling stations within the regions under study. Another key piece of data is the retail prices of vehicles used in the haulage industry.[9] A comparison of fuel and vehicles prices will provide a rough indication not only of the magnitude of the cost disadvantage of hydrogen-powered HDV but also the relative contributions of the two systems of the value chain, the fuel supply and the HDV supply system.

More specifically, to identify the cost disadvantage of using hydrogen fuel vis-à-vis conventional diesel fuel, we apply the following formula:[10]

$$\Delta_{fuel} = \frac{P_{H2}}{\frac{3.1}{0.826} * P_{diesel}} = \frac{P_{H2}}{3.75 * P_{diesel}}$$

P_{H2} and P_{diesel} are, respectively, the prices of 1 kg of hydrogen and 1 liter of diesel at the refueling station. If Δ_{fuel} is larger than one, there is a cost disadvantage of hydrogen. A higher value of Δ_{fuel} implies a higher cost disadvantage. If Δ_{fuel} is only slightly above one, most of the cost disadvantage of hydrogen has already been overcome at the upstream stages of the value chain for hydrogen production. By contrast, if Δ_{fuel} is significantly above 1, the price disadvantage of hydrogen must be carried by the downstream stages, i.e., the HFC-HDV operators or their customers.

The investment cost disadvantage of HFC-HDV vis-à-vis DICE-HDV (resp. BE- or HICE-HDV) can be similarly determined. For the sake of simplicity, the evaluation can be based on observed or estimated sales prices of an HFC-HDV ($P_{HFC-HDV}$) relative to the observed price of a comparable DICE-HDV ($P_{DICE-HDV}$) as

$$\Delta_{HDV} = (P_{HFC-HDV} - \mathrm{S})/P_{DICE-HDV}$$

where S denotes public capital expenditure (CAPEX) subsidies for HFC-HDV. This formula rests on the assumption that all other cost components, including the costs of insurance, the operation and maintenance as well as ownership duration and mileage, are roughly the same for hydrogen and diesel-powered HDV (e.g., Basma and Rodriguez 2023, REVIVE 2025). Again, a Δ_{HDV} only slightly above one indicates that most of the cost disadvantage of HFC-HDV has already been overcome at the upstream stages of the corresponding value chain while a higher Δ_{HDV} implies that this disadvantage must be borne by downstream stages, i.e., the HDV operators or their customers.[11]

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[9] Information on prices of hydrogen at the refueling stations is available from https://h2.live, among others. Estimates of the retail prices of vehicles are available from a number of published studies (e.g., Danielis et al. 2024).

[10] This formula assumes that the energy content of hydrogen (142 MJ/kg) is 3.1 time higher than that of diesel (45.8 MJ/kg; e.g., Sarker et al. 2023), and that the diesel density is 0,826 kg per liter. The formula suggests that, at a diesel price of 1,6 EUR/liter, hydrogen will break even at a price of 6 EUR/kg, which is roughly in line with estimates suggesting that hydrogen will be competitive with diesel at around 5 EUR/kg (e.g., Bampaou and Panopoulos 2025). By comparison, the current price of hydrogen, which ranges between roughly 10 and 20 EUR/kg, depending on the refueling station (https://h2.live/, June 11, 2025), Δ_{fuel} amounts to 1.7 to 3.3. A similar approach can be used to quantify the cost gap between hydrogen and electricity.

[11] According to a recent internal evaluation by Voigt Logistik, a German logistics company

As an additional tool for determining the cost disadvantage of HFC-HDV compared to DICE-HDV, BE-HDV, and HICE-HDV in a more specific context, the evaluation will liberally use online cost simulation tools.[12] Calculating the total cost of ownership for trucks with several propulsion systems under different cost operating parameters, these tools could also account for other cost components such as road toll exemptions for low-emission HDV.

This analysis of the cost differences at the downstream level of HFC-HDV operators will help to guide the interviews, allowing us to identify–for the benchmark cases—those stages of the value chains that contributed most towards overcoming the cost disadvantage. At the same time, this cost exercise serves as a fallback position if the interviews turn out to be less informative.

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based in Neumünster, Δ_{HDV} amounts to about 3.6 (500,000 / 140,000 EUR) for HFC-HDV and 3.2 for BE-HDV (450,000 / 140,000 EUR). See https://de.linkedin.com/posts/voigt logistik_elektrifizierungsstrategie-voigt-logistik-activity-7331247853131980802-uerO; last access: June 11, 2025).

[12] See, e.g., https://tcovrachtwagen.org/simulation.

References

Basma, H., and Rodríguez, F. A. (2023), Total Cost of Ownership Comparison of Truck Decarbonization Pathways in Europe. Working Paper 2023-28, International Council on Clean Transportation, Washington, DC, USA. https://theicct.org/wp-content/uploads/2023/11/ID-54-%E2%80%93-EU-HDV-TCO_paper_final2.pdf.

Bampaou, M., and Panopoulos, K.D. (2025), An Overview of Hydrogen Valleys: Current Status, Challenges and their Role in Increased Renewable Energy Penetration. *Renewable and Sustainable Energy Reviews* 207: 114923. https://doi.org/10.1016/j.rser.2024.114923.

Danielis, R., Niazi, A.M.K., Scorrano, M., Masutti, M., and Awan, A.M. (2025), The Economic Feasibility of Battery Electric Trucks: A Review of the Total Cost of Ownership Estimates. *Energies* 18(2): 429. https://doi.org/10.3390/en18020429.

Danielis, R., Scorrano, M., Masutti, M., Awan, A.M., and Niazi, A.M.K. (2024), The Economic Competitiveness of Hydrogen Fuel Cell-Powered Trucks: A Review of Total Cost of Ownership Estimates. *Energies* 17(11): 2509. https://doi.org/10.3390/en17112509.

ESMAP, OECD, Global Infrastructure Facility and Hydrogen Council (2023), Scaling Hydrogen Financing for Development. Energy Sector Management Assistance Program (ESMAP) Paper. World Bank, Washington, DC. http://hdl.handle.net/10986/41125.

Gray, N., O'Shea, R., Wall, D., Smyth, B., Lens, P.N.L., and Murphy, J.D. (2022), Batteries, Fuel Cells, or Engines? A Probabilistic Economic and Environmental Assessment of Electricity and Electrofuels for Heavy Goods Vehicles. *Advances in Applied Energy* 8: 100110. https://doi.org/10.1016/j.adapen.2022.100110.

Korbee, J. (2024), The Development of Ecosystem Strategies The Case of the Emerging Green Hydrogen Ecosystem in the Netherlands. Master thesis, University of Twente and Technische Universität Berlin.

Noll, B., del Val, S., Schmidt, T.S., and Steffen, B. (2022), Analyzing the Competitiveness of Low-Carbon Drive-Technologies in Road-Freight: A Total Cost of Ownership Analysis in Europe. *Applied Energy* 306 Part B: 118079. https://doi.org/10.1016/j.apenergy.2021.118079.

REVIVE (2025), Life Cycle Cost Analysis Report. Deliverable 4.5. Refuse Vehicle Innovation and Validation in Europe (REVIVE). Project co-funded by the European Union. https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e517762c3f&appId=PPGMS.

Rout, C., Li, H., Dupont, V., and Wadud, Z. (2022), A Comparative Total Cost of Ownership Analysis of Heavy Duty On-Road and off-Road Vehicles Powered by Hydrogen, Electricity, and Diesel. *Heliyon* 8(12): e12417. https://doi.org/10.1016/j.heliyon.2022.e12417.

Royer, S., and Wirth, S. (2024), Geschäftsmodelle mit grünem Wasserstoff zur Defossilisierung des Schwerlastverkehrs in der EU. In: Landeskompetenzzentrum für Wasserstoffforschung Schleswig-Holstein (HY.SH) (Hrsg.), *Wasserstoff-Forschung SH KOMPAKT*. Beiträge zum HY.SH Forschungssymposium 2024, Kiel, pp. 22-25. https://www.hysh.de/artikel/wasserstoff-forschung-sh-kompakt.

Sarker, A.K., Azad, A.K., Rasul, M.G., and Doppalapudi, A.T. (2023), Prospect of Green Hydrogen Generation from Hybrid Renewable Energy Sources: A Review. *Energies* 16(3): 1556. https://doi.org/10.3390/en16031556.

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Appendix: Interview Guidelines

Objectives of the project and planned activities

1. Main objectives of the project

	Objective	Success criterion	To be achieved by
A			
B			
C			

2. Planned activities to achieve these objectives

Objective A

Activity	Success criterion	To be achieved by

Objective B

Activity	Success criterion	To be achieved by

Objective C

Activity	Success criterion	To be achieved by

1. Foreseeable major challenges of the project

Challenge	Possible solution

Status quo of the regional hydrogen value chain

1. Production or supply of hydrogen: Origins, operators and funding

   a. Within the region

	Actual/ Planned	Operator	Funding/Supporters
Green electricity generation			
Green (renewable, electrolysis)			
Purple (nuclear, electrolysis)			
Blue (fossil, CCS)			
Grey (fossil)			
Other			

CCS: Carbon capture and storage

   b. Outside the region

	Actual/ Planned	Operator	Funding/Supporters
Green (renewable, electrolysis)			
Purple (nuclear, electrolysis)			
Blue (fossil, CCS)			
Grey (fossil)			
Transport infrastructure for imports			
Other			

2. Local storage and distribution

	Actual/ Planned	Operator	Funding/Supporters
Storage			
Distribution via pipeline			
Distribution via truck			
Other means of distribution			
Safety issues?			

3. Local retail and prices

	Actual/ Planned	Price (€/kg)	Operator	Funding/Supporters
Refueling stations 700 bar				
Refueling stations 350 bar				
Other				
Safety issues?				

4. Hydrogen end users

	Actual/ Planned	Operators	Funding/Supporters
Private-sector transport company (trucks, vessels)			
Public-sector transport company (buses)			
Private-sector cars			
Public-sector cars			
Manufacturing			
Heating: Private/commercial buildings			
Heating: Public buildings			
Other			

(Manufacturing includes hard to abate sectors such as chemicals, refineries, steel, cement)

5. Customers of private-sector hydrogen-powered logistics services

Name	Actual/ Planned	Funding/Supporters

6. Supply of HDV

	Actual/ Planned	Within the region	Operator	Funding/Supporters
OEM				
Retailer				
Repair & Maintenance				
Trader of used HDV				

7. Other main obstacles (please specify)

Staffing shortages	
Regulatory barriers	
Bureaucratic hurdles, long approvals	
Lack of standards and norms	
Other	

8. Complementary hydrogen projects

a. Within the region

Name	Funding/Supporters

a. Outside the region

Name	Funding/Supporters

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List of figures

Project Title:	Igniting H2 Transport Innovation Ecosystems in the North Sea Region
Acronym:	H2ignite
Call:	Call 4C (FA)
Priority:	Priority 1. Robust and smart economies in the North Sea Region
Priority specific objective:	Developing and enhancing research and innovation capacities and the uptake of advanced technologies
Start date:	01/09/2024
Duration:	36 Months
Website:	www.interregnorthsea.eu/h2ignite
Consortium:	Ministerium für Landwirtschaft, ländliche Räume, Europa und Verbraucherschutz (MLLEV) – Germany Kiel Institut für Weltwirtschaft – Leibniz Zentrum zur Erforschung globaler ökonomischer Heraus-forderungen (IfW) – Germany Europa-Universität Flensburg (EUF) – Germany Hafen Hamburg Marketing e.V. (HHM) – Germany Region Sjælland (STRING) – Denmark DFDS A/S (DFDS) – Denmark Københavns Universitet (UCPH) – Denmark Pôlénergie (POL) – France Provincie Drenthe (Drenthe) – Netherlands Lindholmen Science Park AB (LSP) – Sweden Volvo Technology Corp. (VTEC) – Sweden