

*Annual Report 2025*

# HyValue

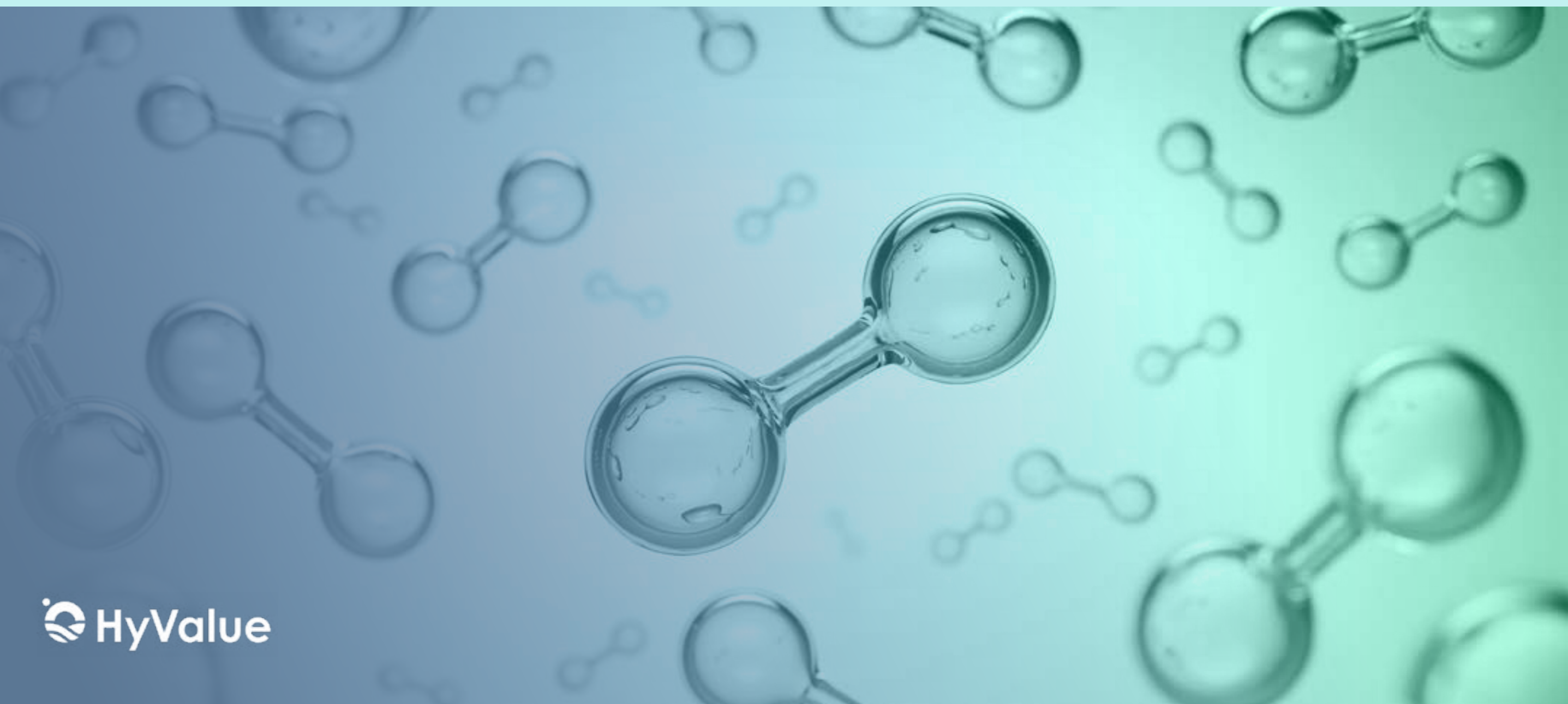
Norwegian Centre for Hydrogen  
Value Chain Research



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# Overview



# Overview



HyValue works to make sustainable hydrogen value chains possible through technology, knowledge and competence development.

The HyValue research centre brings together a broad cross-disciplinary consortium of national and international research partners with cutting-edge expertise in hydrogen related technical, economic, legal and societal fields of research. Our vision is “Achieving sustainable hydrogen value chains for a zero-emission economy”.

Our research spans from exploring new, energy-efficient methods for producing hydrogen and ammonia, to maturing the hydrogen sector as a technical system in society. HyValue provides new knowledge to assess and improve risk assessments for hydrogen transport systems and value chains. Equally important is our research on economic and regulatory barriers. The scientific work at the centre is organised in six work packages (WP1–WP6), where interdisciplinary collaboration is crucial to finding the right solutions.

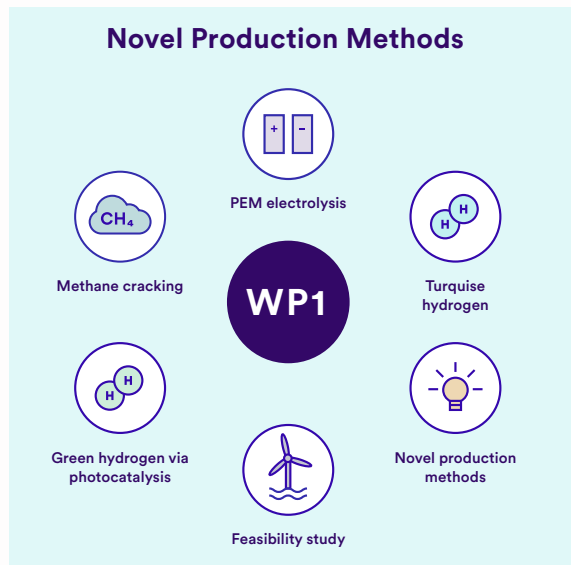
## HyValue shall

1. Significantly reduce energy loss, CO<sub>2</sub> emissions and cost of hydrogen and ammonia production.
2. Develop cost-efficient solutions for transport, storage and distribution of hydrogen and ammonia for export and at regional scale.
3. Solve technical challenges for transition to zero-emission economy, including maritime transport and operations and industrial production.
4. Develop novel frameworks for assessing and improving the strength of knowledge in risk assessments for hydrogen and ammonia systems.
5. Explore synergies and dilemmas between economically viable, socially inclusive, and environmentally sustainable socio-technical systems for hydrogen.
6. Identify economic and regulatory barriers and propose incentive structures to accelerate implementation of a hydrogen-based energy sector.
7. Maximise impact through communication, dissemination to stakeholders and education.

# WP1: Novel Production Methods

WP1 addresses the need for more **energy-efficient and low-emission production routes** for hydrogen and ammonia, targeting key cost and sustainability challenges in current production technologies.

WP1 has delivered important results in hydrogen production technologies and catalyst development. A series of novel metal-organic frameworks (MOFs) based on bifunctional ligands has been designed and synthesised for catalytic applications, with characterization underway and relevance for hydrogen purification and electrochemical processes. In Task 1.2, newly developed  $MS_2/TiO_2$  nanocomposite photocatalysts demonstrate significantly enhanced hydrogen production compared with bare  $TiO_2$ , and appear to be promising low-cost candidates for solar-to-hydrogen conversion from seawater. In Task 1.5, nickel-based catalysts for methane cracking have shown strong performance for hydrogen and carbon nanotube co-production, while carbon-based catalysts and uncatalyzed thermal processes were found to give low conversion below  $800^\circ C$ . Complementing experiments, quantum chemical calculations in the ammonia synthesis activity (Task 1.3) have produced a complete molecular-level reaction mechanism consistent with experiments, providing a foundation for rational catalyst and process design, while modelling of mass transport in rotating water electrolyzers (Task 1.4) informs reactor design and operation.



In Task 1.6, offshore hydrogen production is addressed through techno-economic analyses and system-level studies related to intermittency, storage, and transport, supported by multiple student projects. Progress has been strengthened by the recruitment of a postdoctoral researcher in 2025 and the establishment of an Industry Reference Group contributing to cross-WP collaboration and involvement of user partners in the WP.

## WP leaders:

Prof. Vidar Jensen, UiB

Prof. Dhayalan Velauthapillai, HVL

## WP2: Storage and Distribution

WP2 concluded as a standalone work package in 2025. From 2022 to 2025, WP2 addressed key technical and regulatory challenges related to the storage, transport and distribution of hydrogen and ammonia, with a particular emphasis on safety, reliability and system integration. The work package focused on four main areas: metering and measurement technologies, subsurface storage feasibility, pipeline flow behaviour, and regulatory frameworks for hydrogen infrastructure.

A central effort was the assessment of metering technologies for hydrogen-rich mixtures, focusing on accuracy, reliability and standardisation for custody transfer. This work laid the groundwork for the advanced gas-measurement infrastructure now hosted in WP3, which integrates acoustic, optical, electromagnetic and thermodynamic methods.



WP2 also analysed subsurface storage options, with a focus on injection-extraction behaviour and the effect of flow rates and cyclicity on storage efficiency. Establishing safety protocols for laboratory work was also central to this work. Moreover, a framework for a notional design study to assess requirements for subsurface storage as a buffer for Power-to-hydrogen has been established. Outputs from the task include identifying key factors affecting injectivity, trapping and deliverability. Research on hydrogen pipelines compared flow conditions with natural gas systems, highlighting differences in thermophysical properties, velocities, erosional limits and material constraints, and feeding into HyValue’s broader work on pipeline design and offshore transport.

In parallel, WP2 initiated reviews of regulatory and standardisation needs for hydrogen transport, identifying gaps in existing petroleum and gas frameworks. Salient was the contribution to the state of the art with one of the first publications linked to the EU ‘gas package’ of 2024 dealing with unbundling and third party access to hydrogen

transport networks. Further, research on transport of hydrogen in ships as well as the repurposing of oil and gas pipelines for hydrogen transport was studied from a regulatory perspective. Some of these activities now continue in WP6 (task 6.1 and 6.2).

Key results from WP2 have been actively carried forward in WP3 and WP6, ensuring continuity in research on metrology, infrastructure behaviour and regulatory frameworks despite the early closure of WP2 as a standalone work package. Despite its early closure, WP2 provided foundational insights into measurement needs, pipeline and storage behaviour and regulatory challenges related to transport infrastructure.

**WP leaders:**

Senior Researcher Nematollah Zamani, NORCE  
 Chief Scientist Kjetil Folgerø, NORCE

## WP3: End User Applications

WP3 addresses the challenge of expanding hydrogen and ammonia use beyond established industrial markets to new end-user sectors, particularly transport and heat. The work package focuses on identifying high-demand application segments that can support scaling of hydrogen and ammonia value chains and contribute to cost reduction through increased deployment.

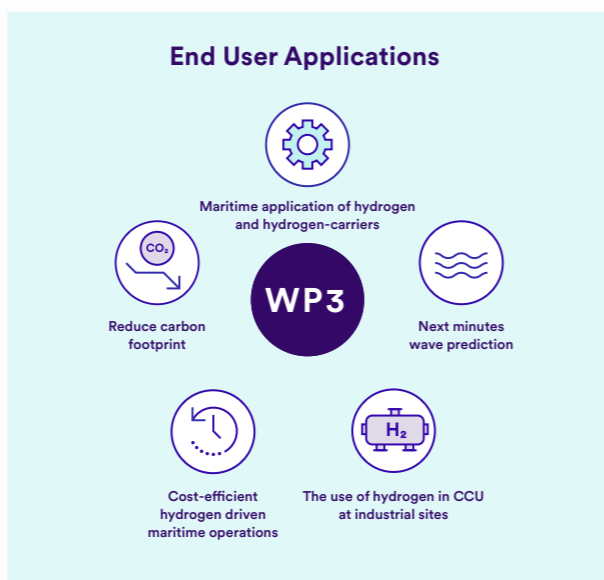
WP3 has established new experimental infrastructure and advanced modelling for hydrogen end-use, particularly in maritime and gas infrastructure contexts. A test station for low-temperature, membrane-based fuel cell testing has been developed at HVL in collaboration with NORCE, and used for fuel cell characterisation, including studies combining acoustic emission, fibre-optics and electrical impedance to monitor water content fluctuations. Results indicate that acoustic emission can be used to predict fuel cell flooding. A high-temperature test system for fuel and electrolysis cells has been delivered and is being installed, and will serve as a core instrument for an upcoming PhD project. In addition, a new gas measurement and analysis infrastructure, capable of measuring sound velocity, permittivity, near-infrared absorption, pressure and temperature under remote control, has been developed and is deployed in the HyMe project for advanced gas characterisation. Simulation studies in WP3 have evaluated offshore hydrogen production from future North Sea wind farms and found that onshore electrolysis supplied via subsea

electricity cables remains more cost-competitive than offshore green hydrogen production and blue hydrogen in the studied scenarios.

Further studies comparing hydrogen and natural gas pipeline flow highlight significant differences in thermophysical properties and resulting design constraints, particularly higher gas velocities and erosional limits when transporting hydrogen. Research on underground hydrogen storage through core-flooding experiments has documented channeling and unstable flow behaviour due to hydrogen's low density and viscosity, and shown that higher injection rates and initial saturations improve hydrogen trapping, with cyclic injection leading to increasing trapped hydrogen.

### WP leaders:

Senior Researcher Geir Nævdal, NORCE  
Assoc. Prof. Jonathan Økland Torstensen, HVL



## WP4: Safety Science and Risk

WP4 addresses safety-related challenges associated with increased use of hydrogen and ammonia, focusing on systems knowledge, risk assessment methodologies, emergency response, and regulatory aspects. The work package responds to the need for more consistent and robust approaches to safety analysis, as existing risk models are fragmented and characterised by high uncertainty.

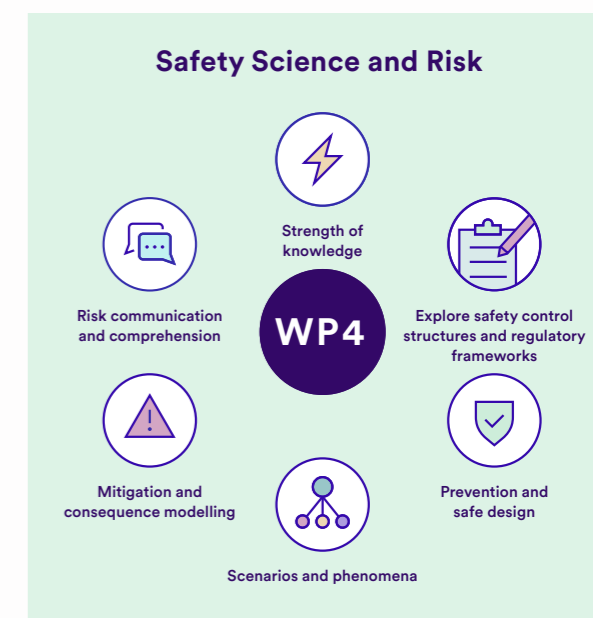
WP4 has produced several scientific contributions on risk assessment of hydrogen systems and large-scale energy concepts. Publications address the comparison of hydrogen risk assessment frameworks and regulatory guidelines in Norway, methodological developments in fault tree analysis to capture dynamic and multi-state aspects, applications of the precautionary principle in hydrogen contexts, and modelling of unavailability for large offshore energy systems. WP4 has focused on analysing and managing risk and safety in hydrogen systems and in upscaling for industrial applications, critically examining established methods (fault and event trees) and policies (the precautionary principle and safety equivalence principle) that originate from oil and gas activities. The work includes systemic perspectives and the application of “strength of knowledge” frameworks in risk assessments. An ongoing survey-based study

investigates risk communication and the role of incentives and policy communication between authorities, industry and society more broadly.

Beyond application-specific analyses, WP4 has contributed methodological advances in hydrogen risk assessment, including the development and application of ‘strength of knowledge’ perspectives, with relevance beyond the centre’s own case studies.

### WP leaders:

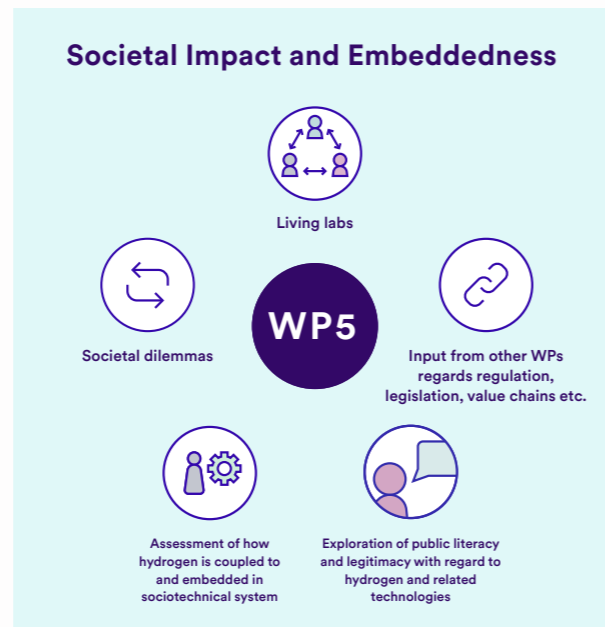
Prof. Jon Tømmerås Selvik, UiS  
Prof. Trygve Skjold, UiB



## WP5: Societal Impact and Embeddedness

WP5 addresses societal, political and institutional aspects of hydrogen energy systems, focusing on trust, legitimacy and resilience in an immature socio-technical system, where minor flaws and failures can undermine stakeholder confidence and slow system development.

WP5 has carried out research on socio-technical dynamics, public perception and policy design for hydrogen in Norway, with particular emphasis on the interaction between blue and green hydrogen pathways. Working papers analyse the socio-materiality of emerging green value chains and explore how actors coordinate and consolidate hydrogen industrial trajectories. Using Socio-Technical Configuration Analysis (STCA), one study examines actor alignment in the period 2020-2025, often presented as Norway’s “take-off” phase for hydrogen. It finds that actor alignment was high between 2020 and 2023 but fragmented significantly from 2023 onwards, as coalitions became more closed and less receptive to bridging narratives. This threatens coherent alignment between blue and green hydrogen actors, raising questions for blue hydrogen as a transitional technology towards green hydrogen in line with EU projections. Another study develops a dynamic systems model of blue and green Technology Innovation Systems (TIS), calibrating TIS functions such as financing, public legitimacy, R&D



and infrastructure for the two pathways, and simulating their development over different time horizons. This modelling is designed as a policy tool to explore the consequences of different policy choices.

Additional work analyses stakeholder narratives around hydrogen projects and shows that projects are interpreted as socially embedded processes shaped by local histories, expectations and perceived value creation, and that public resistance may centre on safety and local environmental impacts, as illustrated by a case study of an ammonia project in Sauda.

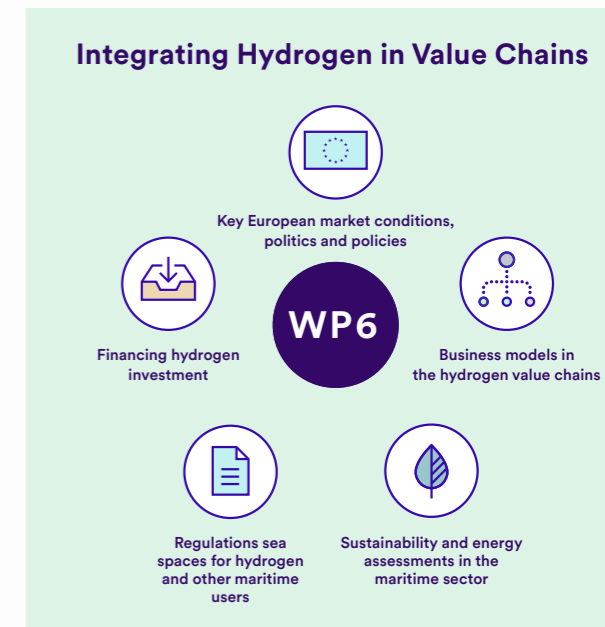
**WP leaders:**

Førsteamanuensis Svein Gunnar Sjøtun, HVL  
Senior Researcher Kari Kjestveit, NORCE

## WP6: Integrating Hydrogen in Value Chains

WP6 integrates results and insights from across the HyValue work packages to generate new legal, economic and policy-relevant knowledge supporting the development of coherent and viable hydrogen value chains. The work package focuses on the interaction between technological options, regulatory frameworks, market design and broader socio-economic conditions for hydrogen deployment.

WP6 has advanced knowledge about hydrogen’s role in energy-intensive industry, maritime applications and broader energy systems. One strand of work documents the gap between announced and realised green hydrogen projects, attributing this to cost disadvantages relative to fossil alternatives, offtake uncertainty, higher financing costs, supply-chain bottlenecks and incomplete policies. This “implementation gap” is analysed both conceptually and empirically. WP6 has developed techno-economic models and project-tracking tools that link electricity price heterogeneity, transport costs and industrial competitiveness, including analyses of green imports in primary industries and the role of location in making hydrogen-based value chains viable. Legal research within WP6 has addressed the regulatory integration of offshore wind, electrification and hydrogen production on repurposed oil and gas platforms, exploring issues such as ownership transfer,



decommissioning obligations and alignment between petroleum and renewable regimes. It has also initiated conceptual work on regulating hydrogen pipeline transport and third-party access, drawing on experience from gas and electricity.

WP6 plays a central integrative role in the centre by linking technological results with economic, legal and regulatory analysis of hydrogen value chains, thereby connecting research outputs across work packages to questions of implementation and governance.

**WP leaders:**

Prof. Gunnar S. Eskeland, NHH  
Prof. Ignacio Herrera Anchustegui, UiB

# Research Highlights 2025

## Gas quality measurements for custody transfer

A multimodal gas measurement and analysis infrastructure integrating acoustic, optical, electromagnetic and thermodynamic measurement methods has been applied in research activities. This infrastructure enables remotely controlled, safe and precise characterisation of hydrogen-rich gas mixtures and supports both research and innovation activities linked to metrology, custody transfer and system design. These facilities are made available to partners and linked projects, strengthening the centre's role as a provider of enabling research infrastructure.

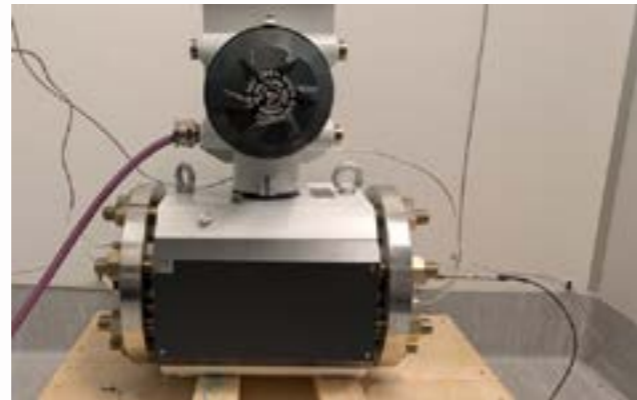


Photo: Experimental infrastructure for gas quality measurement.

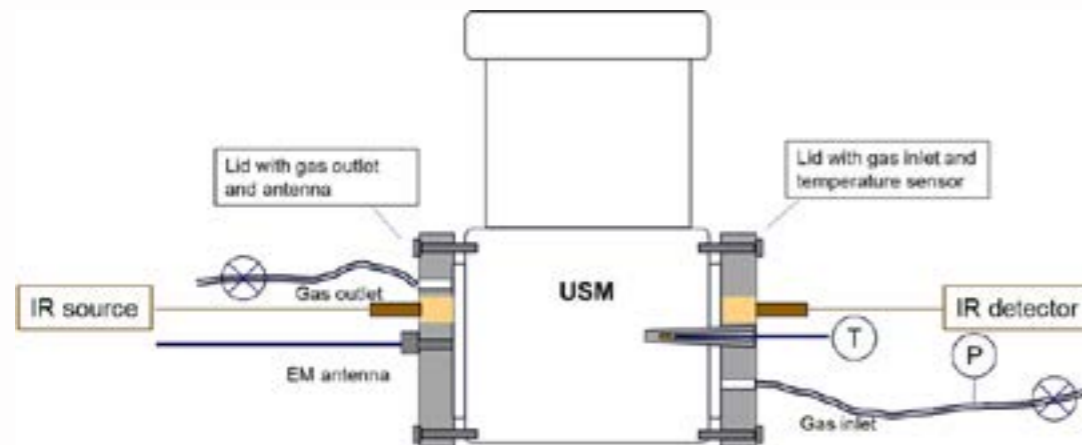


Figure: Gas quality measurement cell. Folgerø, 2026.

## Electrolytic hydrogen production developments

Experimental studies and model development has been performed related to electrocatalytic hydrogen production, including testing and further development of a centrifugal-enhanced electrolytic hydrogen production concept. Laboratory experiments and associated process models advanced the understanding of

gas removal and mass transport in electrolyzers, supporting pathway maturation at intermediate technology readiness levels (TRL 3–4). These activities are relevant for future upscaling and engineering of competitive hydrogen production solutions.

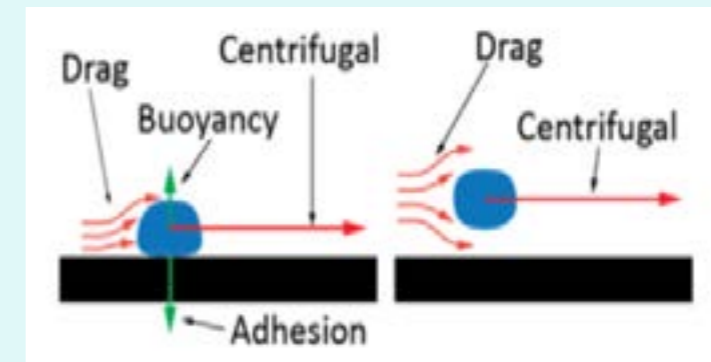
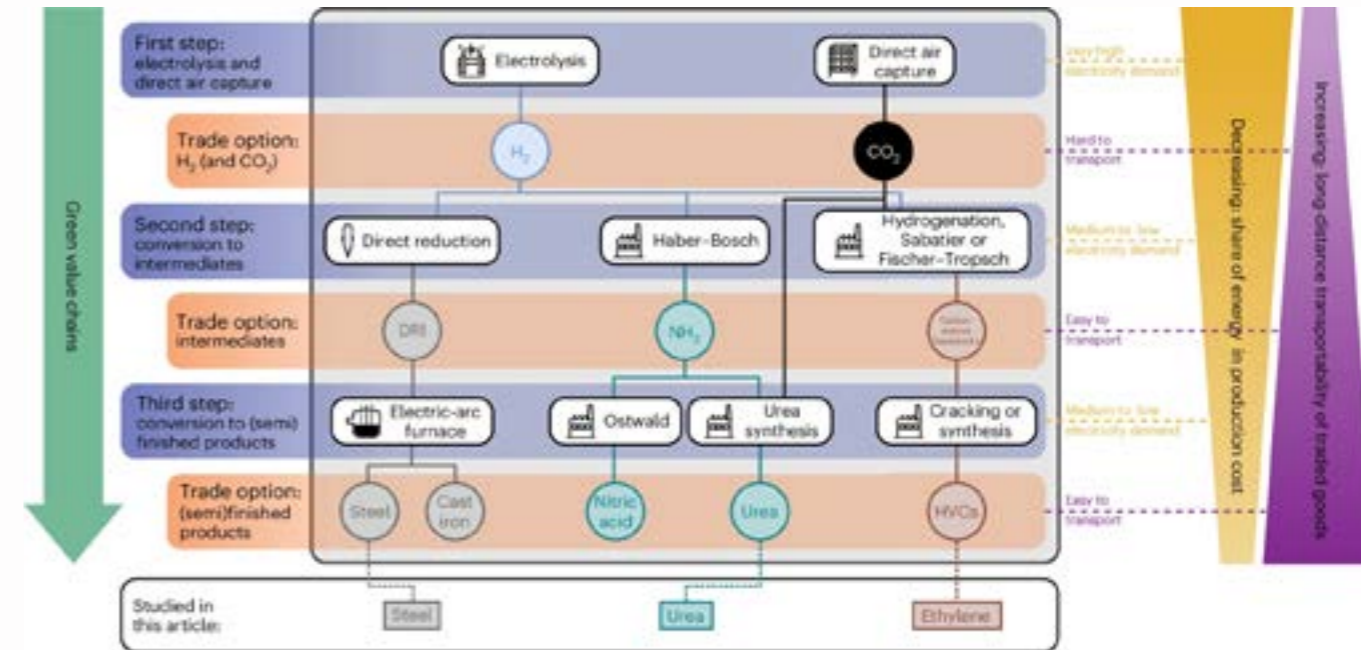


Figure: Gas removal from electrode by centrifugal forces.

# Contributions to an implementation framework

HyValue continues to generate innovation-relevant results in the form of regulatory, legal and governance frameworks that support implementation of hydrogen technologies and value chains. Research in advanced methodological approaches for assessing risk, uncertainty and “strength of knowledge” in hydrogen regulation and safety assessment enabling more robust and transparent decision-making in the presence of uncertainty.

Legal and economic research contributed to conceptual frameworks addressing integration of hydrogen into existing energy markets, transport networks and offshore infrastructure. Analyses of regulatory design, third-party access, and coordination of infrastructure investments support innovation at the level of work processes and governance models rather than technical artefacts, and are directly relevant for policymakers, regulators and industry actors.



**Figure:** Emerging green value chains and the associated production steps, feedstock flows and trade options. Verpoort, P.C. et al. (2024).

Bhandari D.; Selvik, J.T.; Glette-Iversen I.; Abrahamsen, E.B. 2025. On the Use of the Precautionary Principle in the Context of the Hydrogen Systems. In Proceedings of the 35th European Safety and Reliability Conference (ESREL2025) & The 33rd Society for Risk Analysis Europe Conference, SRA-E 2025 (2025).

Glette-Iversen, I.; Bhandari, D.; Selvik, J.T. Risk assessment of hydrogen systems: A review and comparison of frameworks and guidelines from Norwegian regulators. Safety Science, 198, 107163 (2026).

Njå, O.; Glette-Iversen, I.; Hisken, H.; Reinecke, E.-A.; Selvik, J.T.; Shibutani, T.; Skjold, T. Methodology and Analytical tool to Evaluate Risk Decision Processes of Large-scale Hydrogen Energy Systems. In Proceedings of the International Conference on Hydrogen Safety (ICHS2025), (2025)

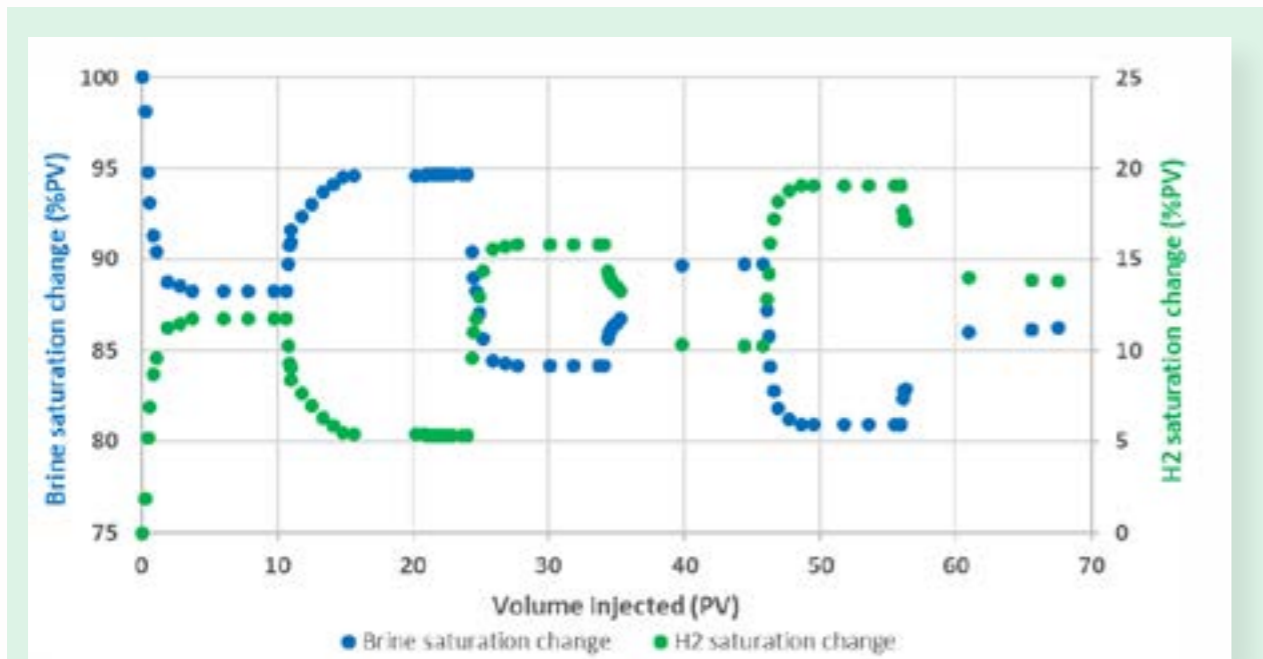
Njøs, R.; Sjøtun, S.G.; Jakobsen, S.-E.; Fløysand, A. (Re)Incorporating “the Tangible” in Industrial Path Development Analyses: The Role of Sociomaterial Contingencies in Explaining Potential Emergence of Hydrogen Production in Western Norway. Economic Geography, 100, 437–458 (2024).

Tselika, K.; Tselika, M.; Demetriades, E.; Eskeland, G.S. The cannibalization effect of intermittent renewables: Are wind and solar power in Germany still dependent on policy support? Journal of Environmental Management, 394, 127415 (2025).

Verpoort, P.C.; Gast, L.; Hofmann, A.; Ueckerdt, F. Impact of global heterogeneity of renewable energy supply on heavy industrial production and green value chains. Nature Energy, 9, 491–503 (2024).

# Hydrogen storage

Laboratory studies of injection of hydrogen in rock are helping pave the way for successful underground hydrogen storage. A core-flooding study in brine-saturated Berea sandstone shows low hydrogen saturation due to channeling and unstable flow caused by hydrogen’s lower density and viscosity. Higher injection rates improve saturation by increasing viscous displacement forces. Higher initial saturations also lead to greater residual trapping. Cyclic injection and withdrawal cause progressively more hydrogen to become trapped, indicating hysteresis or other effects (e.g., dissolution) that require further investigation.



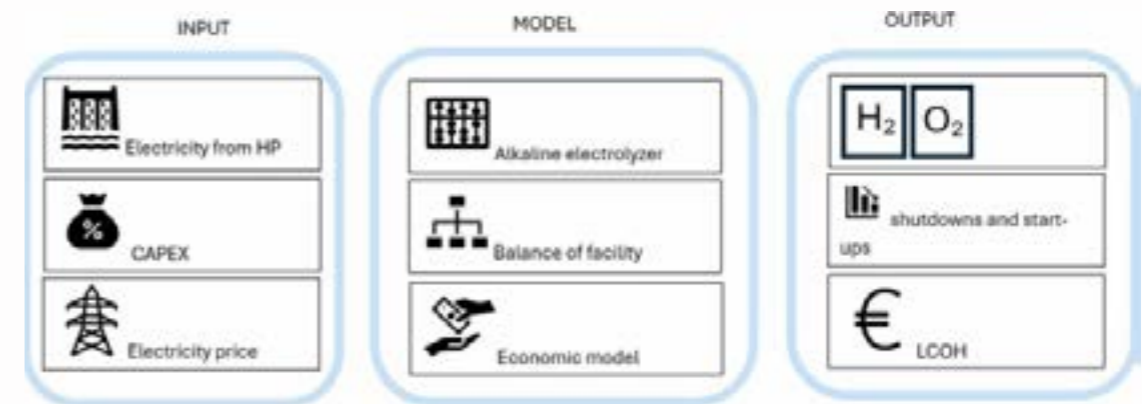
**Figure:** Effect of cyclic storage/production on trapped H<sub>2</sub> saturation (5cc/min flowrate). Aarra, M. & Shiran, B.S. (2025).

Aarra, M.; Shiran, B.S. Underground hydrogen storage: Main results from core flooding studies. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

# Modelling and analytical tools

HyValue continued to develop and apply modelling and analytical tools with direct relevance for innovation and decision-making in 2025. Techno-economic models for assessment of hydrogen value chains, transport solutions and production pathways were further refined and applied to concrete cases, including maritime and offshore applications. These tools support evaluation of cost drivers, system performance and trade-offs across competing pathways and are used by both research and user partners as decision-support instruments.

Advanced modelling approaches related to maritime applications were further developed, including dynamic models linking environmental conditions, vessel behaviour and energy system performance. Predictive models for wave conditions and ship load, combined with system-level modelling of fuel cell and battery operation, reached higher levels of maturity and contribute to process innovation aimed at reducing energy consumption and extending component lifetime in hydrogen-based maritime operations.



**Figure:** Schematic of the energy system model for hydropower-based electrolytic hydrogen production. Sangolt et al. (2025).

Bachorz, C.; Verpoort, P.C.; Luderer, G.; Ueckerdt, F. Exploring techno-economic landscapes of abatement options for hard-to-electrify sectors. *Nature Communications*, 16, 3984 (2025).

Verpoort, P.C.; Gast, L.; Hofmann, A.; Ueckerdt, F. Impact of global heterogeneity of renewable energy supply on heavy industrial production and green value chains. *Nature Energy*, 9, 491–503 (2024).

Sangolt, L.; Lopez, A.F.O.; Quayson, E.; Rognum, A.U.; Oltedal, V.M. Hydrogen production from a run-of-river hydropower plant: Modeling the economic viability. *Energy Reports*, 13 4985-4997. (2025)

Halstensen, S.O. Efficient operation of hydrogen-powered vessels by next-minutes wave prediction. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

## Related Projects

FME HyValue is closely linked to a broad portfolio of related projects that address complementary research topics across the hydrogen value chain. While these projects are not formally part of the centre, collaboration takes place through joint workshops, seminars, knowledge exchange, and participation of shared partners. Several projects operate at higher technology readiness levels (TRLs), thereby supporting validation, scaling, and potential uptake of HyValue research results and strengthening the overall impact of the centre’s activities.

PROJECT	FUNDING	TOPIC
<b>HySchool:</b> Norwegian research school on hydrogen and hydrogen-based fuels	RCN (332042)	Research school strengthening Norwegian PhD education on hydrogen and hydrogen-based fuels. Led by UiB.
<b>AmPep:</b> Ammonia Production via Electrocatalytic Processes	RCN, Equinor and TotalEnergies (336583)	Development of electrocatalytic ammonia production from water and di-nitrogen. Led by UiB.
<b>HyMe:</b> Reliable metering for the hydrogen supply chain	RCN; Gassco; Equinor; Shell; TotalEnergies (336565)	Development of knowledge, competence, and establishment of methodology to enable reliable, traceable, and accurate measurements of hydrogen-based energy carriers. Led by NORCE.
<b>HyLife:</b> Microbial risks associated with hydrogen underground storage in Europa	RCN; OMV; TotalEnergies; SLB; BP; Lanxess; Corrosion Alliance (347634)	Establish microbiological models for underground hydrogen storage with a focus on microbial effects from various locations in Europe. Led by NORCE.
<b>MOCHyS:</b> Microbiological Opportunities and Challenges of Hydrogen Underground Storage	RCN; Equinor; TotalEnergies (344183)	Study of microbiological opportunities and challenges related to underground hydrogen storage. Led by NORCE.
<b>Circularity in Decommissioning</b>	Offshore Norge; UiB (Faculty of Law)	Analysis of Norwegian regulations for the decommissioning of offshore infrastructure with the aim of identifying potential improvements. Led by UiB.
<b>HyEff:</b> Energy efficient operation of hydrogen powered vessels	RCN; Corvus Energy; SIN Oceanic; SEAM; Topeka (336527)	Research and develop technologies to facilitate the widespread, sustainable, and energy-efficient operation of hydrogen-powered vessels, thereby reducing greenhouse gas emissions from maritime transport. Led by NORCE.

PROJECT	FUNDING	TOPIC
<b>OptHyMob:</b> Optimized Hydrogen Powered Maritime Mobility	RCN; Corvus Energy; SEAM; SIN Oceanic; Topeka (337101)	Research and development of software to optimize the design and operation of hybrid systems consisting of batteries and hydrogen fuel cells on board vessels. Led by Corvus Energy with NORCE as partner.
<b>FME MarTrans:</b> Transition in maritime transport	RCN, user partners (FME scheme) (350371)	Accelerate the decarbonization of the maritime sector through cutting-edge research, innovation, and collaboration across the entire maritime energy value chain. Led by SINTEF with NHH and SNF as lead on RA4: Sustainable pathways.
<b>Tailored course development for green transition</b>	Vestland County Council	Education project within (maritime) hydrogen technology, led by Sustainable Energy Catapult with HVL and UiB as partners.
<b>Get Hydrogen:</b> Geo-politics of the Energy Transformation	German Federal Foreign Office	Analysis of opportunities and challenges related to the growth of hydrogen from a geopolitical perspective. Led by the Research Institute for Sustainability, Potsdam, Germany. FNI partner.
<b>SmartGasNet – Metrology for smart metering in gas networks</b>	Horizon Europe; Partnership on Metrology	Development of advanced metrology solutions for accurate, reliable and efficient smart metering in gas networks, supporting the transition to a green and digital Europe. Led by VSL. NORCE partner.
<b>Legal-By-Design:</b> Digital Disruption in the Circular Economy	EEA Grants	Interdisciplinary collaboration between Norway and Portugal with a particular focus on legal aspects related to the Digital Product Passport and hydrogen energy. Led by University of Minho. UiB partner.
<b>HERCHET:</b> Higher Education and Research Collaboration on Hydrogen and Enabling Technologies	HK-Dir	The partners collaborate on both higher education and research within hydrogen. Task 1.2 is linked to ongoing research in the project, and PhD candidates involved in the project also participate in HyValue. Led by HVL.
<b>INPANCEHA:</b> Indo-Norwegian Partnership on Advanced Nanomaterials	HK-Dir	Collaboration on new nanomaterials for clean energy technologies, including hydrogen. Led by HVL.
<b>H2CoVE - Hydrogen Centres of Vocational Excellence</b>	ERASMUS+	Equipping the European workforce with vocational skills required by industries in the emerging hydrogen economy, thereby supporting infrastructure for production, storage and use of hydrogen. Led by Vestland County Council. HVL partner. International partners Netherlands, Austria, Estonia and Ukraine.

PROJECT	FUNDING	TOPIC
<b>TriCHET</b> – Trilateral Consortium for Hydrogen Enabling Technologies	RCN (359789)	Exchanges and joint activities to promote research collaboration between Norway, India, and South Korea on advanced materials and technology for clean energy. Coordinated by HVL.
<b>GNTS:</b> Governance Frameworks for the Nordic Energy Transition at Sea	Nordic Energy Research	Collaboration network between law faculties in Copenhagen, Bergen, Turku and Gothenburg on offshore energy governance; synergies with HyValue WP6 in offshore regulation and ocean energy. Led by UiB.
<b>NorthCarb</b>	UiB-Equinor Academia Agreement	Governance and regulation of CCS (transport, storage, cross-border projects) in the North Sea; relevant parallels to blue hydrogen and offshore infrastructure in HyValue. Led by UiB.
<b>SAINT</b> – Sustainable Applied and Industrialised Nuclear Technology (SFI)	RCN, user partners (SFI scheme) (360130)	Research-based innovation centre for sustainable nuclear technology. Synergies with HyValue through a focus on maritime decarbonisation and regulatory issues (legal parallels for hydrogen versus nuclear power). Led by NTNU. UiB partner.
<b>ROZE</b> – Route to Zero-Emission Public Transport	RCN (358562)	Measures for the energy transition in public transport systems with high-speed passenger vessels; generated on the basis of HyValue work and applying insights from HyValue to new cases. Led by FNI.
<b>HyCarbon</b>	RCN, SIVA, Innovation Norway, user partners (Green Platform scheme)	Development of a value chain for turquoise hydrogen production; thematically linked to HyValue work on methane pyrolysis and value chains. Led by SEID. NORCE partner.
<b>COAST</b>	UiB strategic funding	Strategic centre on climate, energy, and sustainability law, providing institutional anchoring and long-term regulatory competence relevant to HyValue societal research. Led by UiB.
<b>Saltwater hydrogen production project</b>	HVL strategic funding	Develops novel hydrogen production methods based on direct use of sunlight and saltwater, strengthening HyValue’s research portfolio on sustainable hydrogen production. Led by HVL.
<b>H2-QUEST</b> – Exploration and Evaluation of European Natural Hydrogen Potential	Horizon Europe, Clean Hydrogen JU	Towards exploration and evaluation of European natural hydrogen potential. Led by IFE. NORCE partner.

# Innovation and value creation

# Innovation and value creation

## Overall approach to innovation in HyValue

Innovation in HyValue is understood broadly, encompassing technological, methodological, organisational and regulatory innovation across the hydrogen value chain. The centre’s innovation activities are closely integrated with its long-term research agenda and are guided by the objective of strengthening competitiveness among industry partners while enhancing the knowledge base for public-sector stakeholders.

In 2025, HyValue continued to develop and apply structured work processes to identify innovation-relevant results and support their further maturation. Research outputs are assessed with respect to innovation potential through complementary perspectives provided by scientific advisory functions and industry-oriented governance structures. Short-term industry projects and associated activities are used as targeted instruments to accelerate knowledge transfer and explore applied use of selected results alongside the core work packages.

In HyValue, technical innovation occurs through research efforts in production, storage, distribution, safety and use of hydrogen and hydrogen-based energy carriers. In addition, the centre focuses on innovation in relation to business and societal areas, including also regulatory aspects. HyValue further contributes to the innovation chain through research-based infrastructure, analytical tools and models, experimental platforms and conceptual frameworks that enable further development, uptake and implementation beyond the centre itself.

## Key innovation outputs and emerging results in 2025

In 2025, HyValue delivered a range of innovation-relevant results spanning technology development, modelling tools, experimental infrastructure and regulatory and governance frameworks. Selected examples are highlighted below to illustrate the breadth and maturity of the centre’s innovation activities.

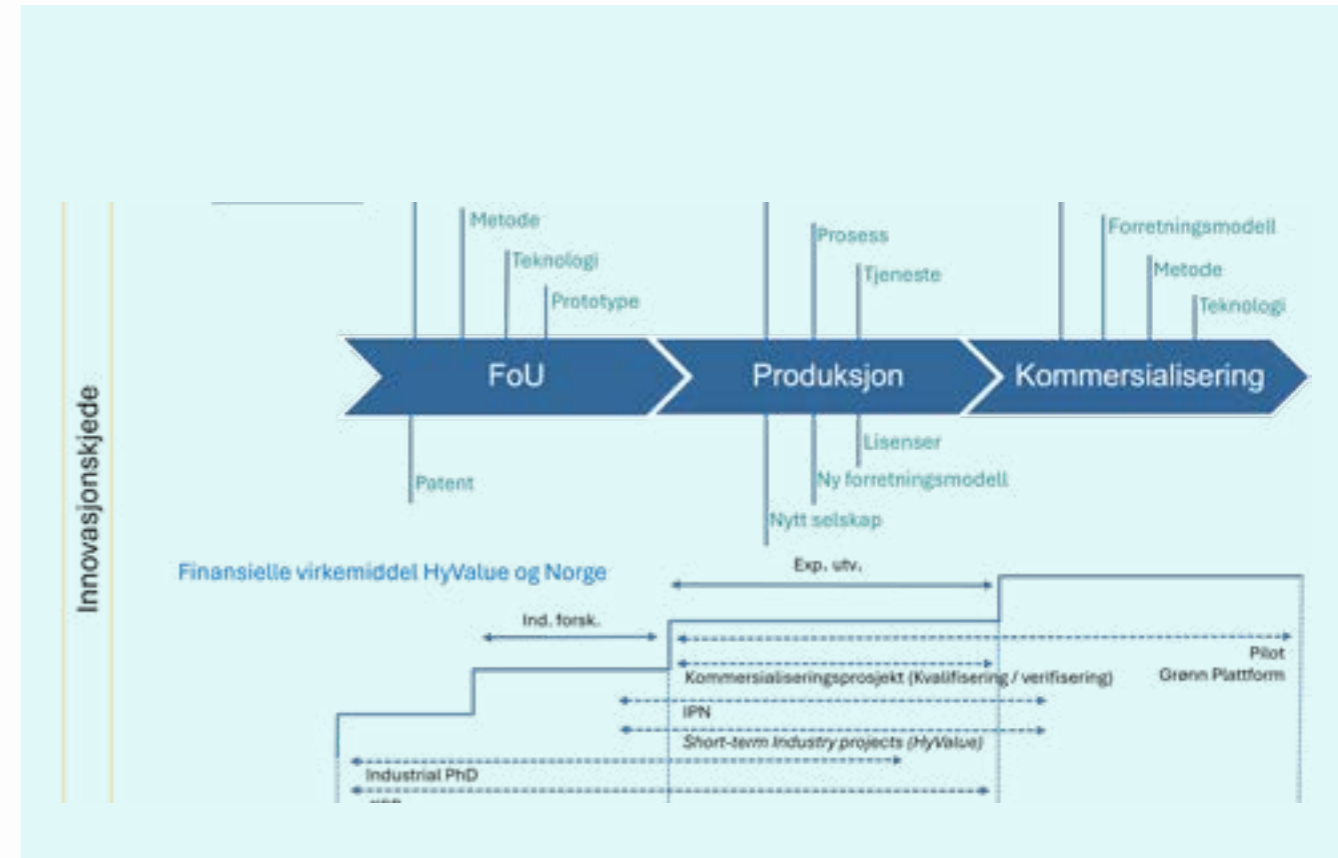


Illustration: Innovation chain

## Hydrogen production technologies and processes

### Process materials innovation

- A series of novel metal–organic frameworks (MOFs) based on bifunctional ligands have been designed and synthesized for catalysis applications in hydrogen purification and production, including photocatalysis and methane cracking. Difficulties in obtaining porous, rigid metal–organic frameworks (MOFs) from lanthanides, limited the feasibility of these systems for hydrogen purification. This prompted a strategic shift toward selected non-lanthanide metals better suited for forming robust frameworks. Characterisation of the synthesized materials for the various purification and production purposes is underway. TRL 3.
- For hydrogen production by photocatalysis, newly developed  $MS_2/TiO_2$  nanocomposite photocatalysts have demonstrated enhanced hydrogen production compared to bare  $TiO_2$ , the benchmark material for photocatalytic water splitting. These nanocomposites appear to be promising, low-cost candidates for solar-to-hydrogen conversion from seawater. TRL 4.
- Nickel-based catalysts have in the laboratory shown strong performance for low-temperature (below 800°C) methane cracking. Process optimization is ongoing to maximize  $H_2$  yield and bi-product carbon nanotube quality. TRL 4.

### Process innovation

- A central hurdle for photocatalysis has been the separation of oxygen and hydrogen during photocatalytic water splitting. As a result, the activity has pivoted toward developing scalable photoelectrode configurations employing optimized metal-chalcogenide/ $TiO_2$  composites, rather than relying solely on suspended-powder photocatalysis.

## Experimental infrastructure and testing platforms

Low-temperature fuel cell testing infrastructure has been used for experimental studies, while preparation and installation of high-temperature testing systems progressed, positioning the centre for advanced experimental work in subsequent years.

### Novel measurement results

- Results using the fuel cell test infrastructure show that acoustic emissions can be used to predict fuel cell flooding, important for the performance and longevity of the fuel cell.

## Modelling tools and analytical methods

### Novel models and applications

- Quantum chemical calculations within the ammonia synthesis project have produced a complete molecular-level reaction mechanism consistent with experiment, enabling rational catalyst and

process design. Standard density functional theory proved insufficiently accurate for key reaction steps, despite being the main computational tool for mechanistic studies in molecular catalysis. The need to adopt more computationally intensive electronic-structure methods has slowed progress but was necessary to reach reliable predictions

- Modeling of mass transport in rotating water electrolyzers for hydrogen production is now being used for practical reactor design.
- Socio Technical Configuration Analysis (STCA) has been used to study the alignment of commercial actors in relation to hydrogen as an energy carrier and enabler for the energy transition. Such modelling provides a better understanding of challenges in establishing a hydrogen value-chain and in alignment for a successful hydrogen-based energy transition.
- A dynamic systems model has been developed based on the functions of a Technology Innovation System to investigate requirements for such a system to succeed. The model has been applied for both blue and green hydrogen, taking into account both complementary and competitive elements, such as financing and public legitimacy. Such a tool may be used to simulate the impact of policy decisions and how they will play out.
- Software and data for techno-economic assessments:  
<https://philippverpoort.github.io/posted/>

## Regulatory, legal and governance-related innovation

### Measures supporting innovation and implementation

- Route-oriented analyses and sectoral studies for Norway and the North Sea highlight that credible rollout paths require synchronized decisions across assets and jurisdictions, which in turn calls for predictable regulation, targeted risk-sharing, and contractual solutions that allocate responsibilities and timing.
- Sustained, well-targeted demand- and supply-side policies—such as long-term contracts, carbon pricing, and investment support—are needed to bridge the cost gap, especially in hard-to-electrify sectors.
- The decline in industrial activity has mirrored the implementation gap identified, reinforcing that hydrogen deployment is highly sensitive to market conditions, cost structures, and policy stability. The challenges we face also reflect the coordination problems highlighted in our work on maritime and infrastructure value chains. These parallels have helped sharpen our understanding of where hydrogen applications are most robust and where policy and regulatory support is indispensable.

### Interaction with industry and public-sector stakeholders

Interaction with industry and public-sector partners is an integral element of HyValue's innovation activities. In 2025, user partners were involved through reference groups, workshops, joint supervision of students, provision of data and equipment, and participation in short-term projects and proposal development.

Although external factors such as policy uncertainty and reduced investment activity in the hydrogen sector continued to limit the scope of some industry-driven innovation activities, engagement with partners remained active and constructive. Research results and analytical tools developed in the centre were used as input to industrial assessments, policy discussions and further project development, demonstrating relevance beyond purely academic outputs.

Public-sector relevance is particularly evident for innovation related to safety science, regulation and governance. Methods and frameworks developed in HyValue contribute to improved administrative capacity and evidence-based policymaking related to hydrogen deployment, licensing and risk management.

### Societal relevance and pathways beyond the centre

HyValue's innovation-related outputs in 2025 contribute to value creation not only for direct partners but also for society more broadly. By strengthening the knowledge base for hydrogen production, transport, safety, regulation and value chain integration, the centre supports informed decision-making and more realistic expectations regarding hydrogen's role in the energy transition.

Many of the centre's innovation outputs are designed to be transferable and applicable beyond the immediate consortium, including open modelling tools, analytical frameworks and experimental methodologies. Linked and adjacent projects initiated or continued as a result of HyValue activities provide important pathways for further utilisation and maturation of results.

Overall, innovation in HyValue during 2025 is characterised by steady progress along the innovation chain, with emphasis on enabling technologies, methods and frameworks that reduce uncertainty, support implementation and lay the groundwork for future applied development and commercialisation.



**Photo:** Students and HyValue on a visit to Energy House and Sustainable Energy Catapult in November 2025. Guided by Geirmund Mæland (Wärtsilä), who gave an introduction to Energy House and Wärtsilä's ammonia engine. Photo: Velaug Myrseth Oltedal, HVL

# In the Spotlight

# Recruited fellows

## HyValue PhD students



**Ingrid Emilie Flesum Ringstad**

WP4 & WP6, NHH, 2021-2025  
Topic: Economics



**Jonas Himmelstrup**

WP1, UiB, 2020-2024  
Topic: Mechanistic insight and catalyst and process design.



**Marcello Costamagna**

WP1, UiB, 2022-2025  
Topic: De novo catalyst design



**Dikshya Bhandari**

WP4, UiS, 2024-2027  
Topic: Safety Science and Risk



**JKristoffer Skjelanger**

WP1, HVL, 2024-2027  
Topic: Green hydrogen from PEM electrolysis



**Buddhika Karunaratne**

WP1, HVL, 2024-2028  
Topic: Green hydrogen via photocatalysis



**Leif E. Hertwig**

WP1, UiB, 2023-2027  
Topic: Mechanistic insight and catalyst and process design



**Shuyi Pan**

WP4 & WP6, NHH, 2023-2027  
Topic: Economics



**Tomasz A. Skrzydlo**

WP1, UiS, 2024-2027  
Topic: Turquoise hydrogen from methane cracking



**Ashika Dilshani W. Gamage**

WP1, UiS, 2024-2027  
Topic: Advanced Materials for Hydrogen Purification



**Ruplekha Bordoloi**

WP1, UiB, 2025-2028  
Topic: Metal-organic framework for Hydrogen purification

## HyValue Postdoctoral fellows



**Torhild Nordtveit**

WP2 & WP6, UiB, 2023-2027  
Topic: Legal issues related to drafting and closing of contracts & Regulation of hydrogen transport at sea



**Roweno Heijmans**

WP6, NHH, finished in 2024  
Topic: Economics



**Niaz Bashiri Behmiri**

WP3, WP4, WP5 & WP6, NHH, 2024-2028  
Topics: Financing Hydrogen Investment; Key European market conditions



**Ingrid Glette-Iversen**

WP4, UiS, 2024-2028  
Topic: Hydrogen risk and safety



**Liina Sangolt**

PhD student at HVL, 2022-2026  
Topic: Offshore production of hydrogen  
Funding: Ulla-Førre Foundation



**Sivagowri Shanmugaratnam**

PhD student at HVL & UiB, 2023-2025  
Topic: Hydrogen production  
Funding: NORPART



**Ingrid Marie Stuen**

PhD student at UiB, 2023-2026  
Topic: Metering  
Funding: RCN (HyMe)



**Helene Hisken**

Postdoc, UiB  
Topic: Safety science and risk



**Faraimo Jay Vai**

WP5, HVL, 2024-2026  
Topic: Societal impact and embeddedness of Hydrogen in Norway



**Brynhild Stavland**

PhD student at UiS  
Topic: Safety Regulation of Hydrogen as an Energy Carrier  
Funding: HySociety



**Maren Holthe Hedne**

WP6, NHH, 2025-2029  
Topic: Economics / Green transition



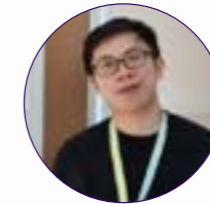
**Khusniddin Alikulov**

WP1, HVL, 2025-2027  
Topic: Offshore production of hydrogen, by use of techno-economic analysis



**Torbjørn Egeland-Eriksen**

PhD defended in 2024, UiO & NORCE  
Topic: Green hydrogen as energy storage and energy carrier in combination with offshore wind power



**Huy Nguyen**

PhD student, UiB, 2025-2028  
Topic: Separation of catalyst and chemical reductant  
Funding: RCN (AmPEP)



**Sanjay Gopaldas Chaudhri**

Postdoc, UiS  
Topic: Hydrogen separation and purification



**Anders Even Kvåle**

WP1, HVL/EonE, 2025-2028  
Funding: RCN & EonE (Industrial PhD)



**Andreas Breivik Ormevik**

WP6, NHH, 2025-2029  
Topic: Energy transitions under network externalities  
Funding: FME MarTrans



**Kristine Marie Halvorsen**

WP1, UiB, 2023-2027  
Topic: Development of new MOFs for the electrochemical reduction of CO<sub>2</sub>. Funding: UiB

# Events

## HyValue Days 2025

The annual HyValue Days were held on 7–8 May 2025, bringing together partners from industry, research organisations, and the public sector. The event served as an important arena for exchange of knowledge and discussion across the hydrogen value chain, including hydrogen production, storage, markets, regulatory frameworks, safety, and societal aspects.

The programme included contributions from European and regional initiatives, with representatives from Hydrogen Europe and the North Adriatic Hydrogen Valley providing external perspectives. HyValue Days continue to be a central meeting point for strengthening collaboration, fostering interdisciplinary dialogue, and ensuring alignment between research activities and partner needs within the centre.



**Photo:** Participants at the HyValue Days 2025. Photo: Andreas R. Graven, NORCE

## HyValue events

### Hydrogen and renewable energy: Global trends, grants, and incentives

A webinar in collaboration with EY was held in January 2025, focusing on global trends in hydrogen and renewable energy, with particular attention to funding instruments, grants, and incentives relevant for centre partners.



Photo: Webinar with Forschungszentrum Jülich

### Supporting the safe introduction of hydrogen technologies in the energy sector

In January 2025, HyValue co-organised a webinar with Forschungszentrum Jülich addressing safety considerations related to the introduction of hydrogen technologies in the energy system.

### New insights on EU competition law and offshore renewable energy projects

A webinar in March 2025 provided updates and discussion on EU competition law and its implications for offshore renewable energy projects.

### Hydrogen metering technologies

A webinar organised in collaboration with the HyMe project in September 2025 addressed developments and challenges related to hydrogen metering technologies.

### Societal aspects of hydrogen

HyValue organised a workshop series during the period 2023–2025 focusing on societal aspects of hydrogen, including narratives, legitimacy, and public acceptance.

### Annual workplan workshops with industry partners

In October 2025, HyValue conducted annual workplan workshops involving all industry partners to support alignment between research activities and partner needs.

### Joint HyValue–HYDROGENi webinars

HyValue and HYDROGENi jointly organised several webinars, including H<sub>2</sub> Flex – green hydrogen production as a source of flexibility in the power grid (2025) and Hydrogen is not a bubble (2025).



Photo: Fionn Iversen on stage at the FME Conference.

### FME Conference 2025

HyValue contributed to the FME Conference 2025, held in Trondheim in April 2025, a joint arena for all Norwegian FMEs. HyValue participated in a session titled Create competitive and green new industries, which focused on how research and innovation can support the development of competitive industrial value chains in Norway.

### International hydrogen symposia

HyValue has co-organised recurring international hydrogen symposia at AMCEHA, with responsibility for symposium organisation and leadership in India (2023), Sri Lanka (2025), and India (2026). HyValue researchers participated in the International Climate Summit 2024 in New Delhi, India. A delegation from HVL attended the summit and hosted a research delegation from India, organizing a seminar on academic and research collaboration between India and Norway.

Photo: HVL hosted an Indian research delegation, organizing a seminar on academic and research collaboration.



# International Collaboration

## International Collaboration

International cooperation in HyValue is embedded across work packages and spans technology development, safety science, social science, law and economics. The collaborations support joint research activities, exchange of methods and perspectives, and co-authorship of scientific publications. HyValue has also been successful in attracting international researchers to the centre and facilitating incoming and outgoing mobility of researchers and research fellows. The centre's researchers also participate actively in international strategic and advisory fora. Some examples are given below.

- **Research collaborations** are established with several prestigious international universities, including collaboration on electrocatalyst materials with Alagappa University (India), Anna University (India) and IIT Madras (India), and on photocatalyst materials with Korea University (South Korea), University of Jaffna (Sri Lanka) and Augustana University (USA). Also collaboration with Claude Bernard University Lyon 1 and Université ParisSaclay (France) targeting sustainable ammonia synthesis from water and dinitrogen, as a step toward a fully electrocatalytic process.
- **New EU-funded projects:** NORCE participation in two European Partnership on Metrology-projects on hydrogen (Met4H<sub>2</sub> and SmartGasNet) have been made possible through the engagement in HyValue. Building on the role in the HyValue Centre, HVL contributed to the successful

Erasmus+ H<sub>2</sub>CoVE – Centre of Vocational Excellence for Hydrogen (2024–2028), which brings together 19 partners across five European regions to develop vocational training systems for the hydrogen economy, emphasizing curriculum development, workforce upskilling, and crossregional knowledge exchange. UiS have received EU Horizon funding together with European and Indian partners for a project on boosting H<sub>2</sub> production from high water content biowaste with negative carbon emissions (BIOHAVEN).

- **International strategic fora:** The center's researchers participate actively in IEA Hydrogen Technology Collaboration Program Task 45, technical working groups in Hydrogen Europe Research, and in the Educational Board of the Association of International Energy Negotiators.

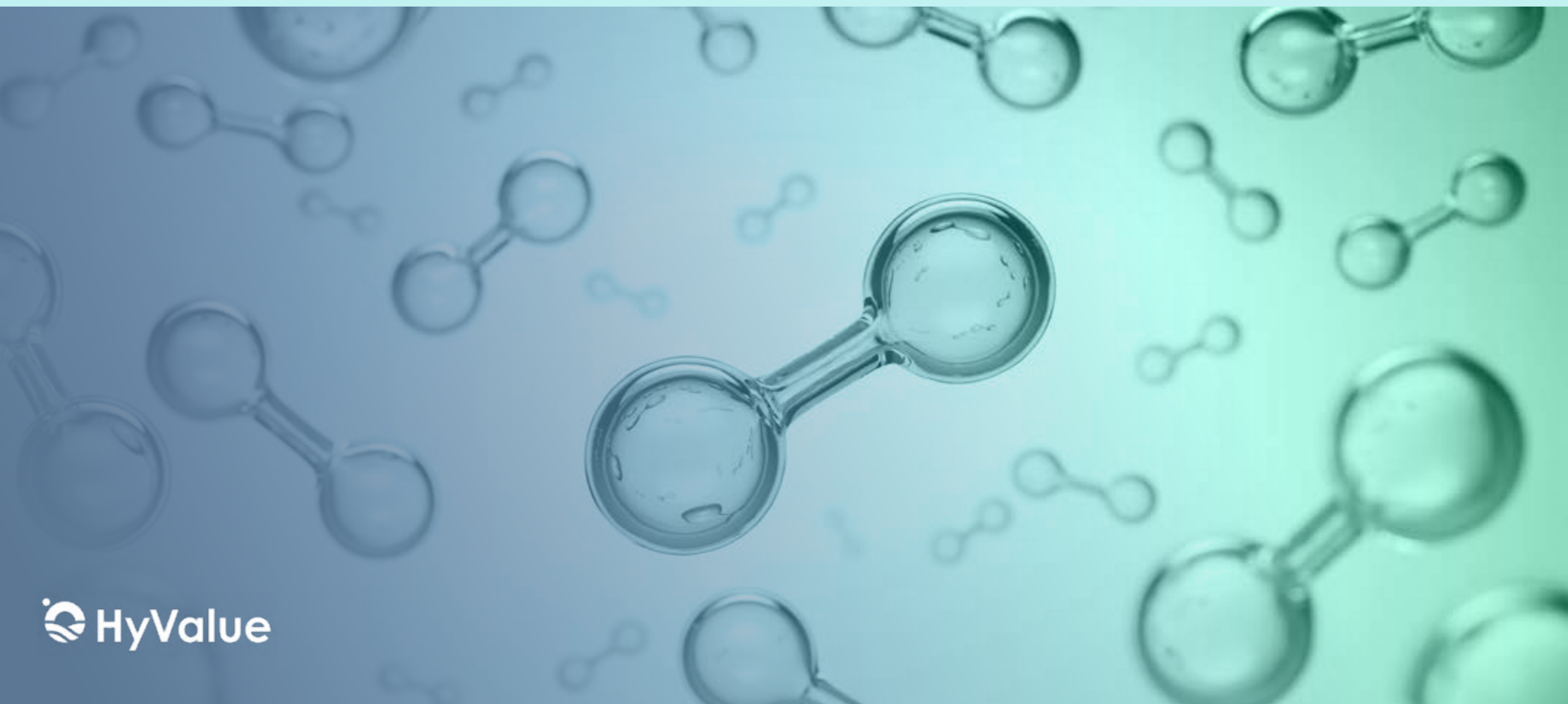
- **Norwegian delegation to Sri Lanka:** In March 2025, a delegation from HVL and UiB travelled to Jaffna, Sri Lanka, to coorganize the international conference AMCEHA- Advanced Materials for Clean Energy and Health Applications 2025. There, an MoU between Alagappa University, India, and HVL were signed. The two institutions agreed to collaborate on research on hydrogen enabling technologies.

- In december 25, HyValue Centre director Arvid Nøttveit participated in **delegation trip to visit the North Germany HY-5 cluster**. The trip was organized by the Norwegian-German Chamber of Commerce and included site visits to many North German hydrogen facilities, including production, conversion, transport and end-use of hydrogen. HY-5 is an impressive cluster and appears as a key driver in the European hydrogen energy transition.



Photo: HVL and UiB delegation visits University of Jaffna, Sri Lanka.

# HyValue Facts



# Governance Structure

HyValue uses a clear governance structure that secures user-partner input and coordinates work across research, innovation and industry projects.

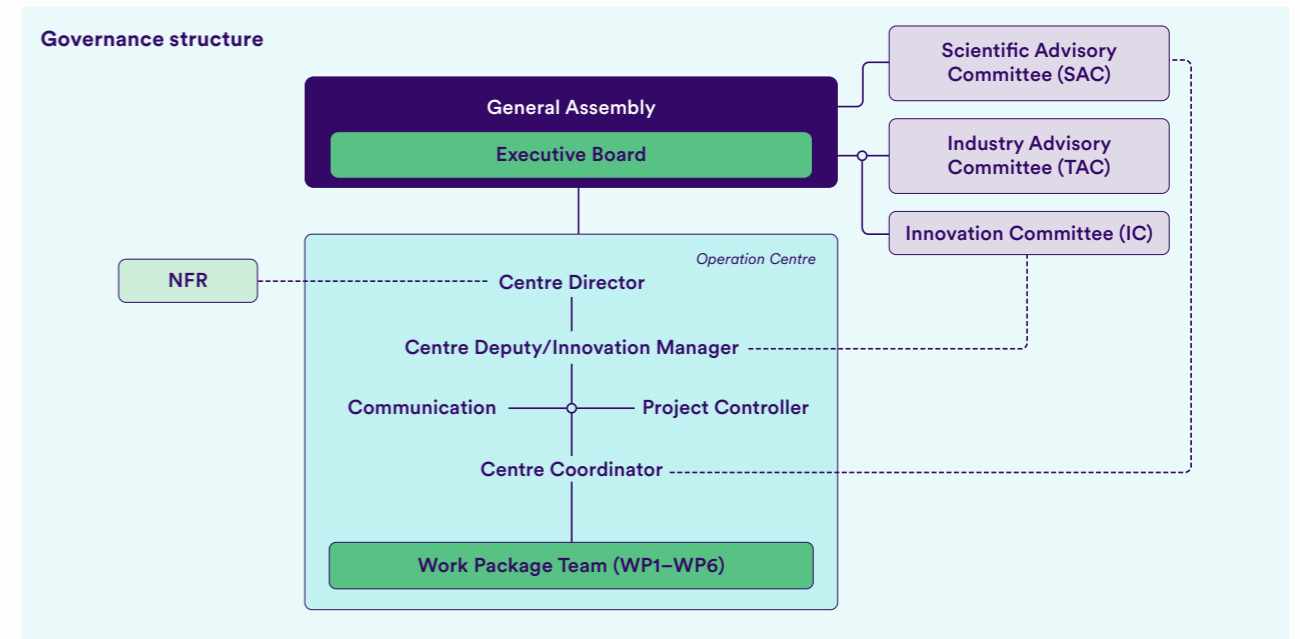
The **General Assembly** is HyValue’s ultimate decision-making body and consists of representatives from each partner. It provides overall strategic guidance and ensures that the consortium’s diverse partners maintain influence over the centre’s priorities and long-term trajectory. The General Assembly met once in 2025, and had one circular resolution in addition.

The **Executive Board** has a majority of its members, including the chairperson, from user partners. This structure ensures that industry perspectives have a strong influence on the centre’s priorities and that HyValue’s goals and activities remain well aligned with user needs.

The Executive Board met 5 times in 2025.

The **Centre Management Team (CMT)** is responsible for the day-to-day management of HyValue and consists of the Centre Director, Deputy Director, Centre Coordinator, and administrative support from NORCE. The CMT ensures operational continuity, coordinates activities across work packages, and prepares material for decision-making bodies. The CMT had weekly meetings in 2025.

**WP leaders** plan and oversee scientific activities, coordinate tasks, and ensure the delivery of results within their respective work packages. They serve as the primary link between the research teams, user partners, and the Centre Management, ensuring progress toward annual plans and milestone achievements. WP leader coordination meetings were held 5 times in 2025.



## HyValue Executive Board 2025

BOARD MEMBER	AFFILIATION
Aasgeir Valderhaug (Chair)	Elkem
Aina M. Berg	NORCE Research (NORCE)
Kristine Spildo	University of Bergen (UiB)
Anders Even Kvåle	Element One Energy AS
Leif Kristoffer Sandal	Norwegian School of Economics (NHH)
Helge Bøvik Larsen	University of Stavanger (UiS)
Elisabeth Kjøsberg	Corvus Energi AS
Jørn A. Uggerud	Advokatfirmaet Hjort AS
Kerstin Schemmann	Equinor Energy AS
Martin Hennem	Ocean Hyway Cluster
Stig Erik Jacobsen	Høgskulen på Vestlandet (HVL)

## Scientific Advisory Committee (SAC)

SAC MEMBER	AFFILIATION	COMPETENCE AREA
Kees van Wingerden (Chair)	Vysus group	Safety Science & Risk
Anna Stefanopoulou	University of Michigan	Mechanical Engineering
Kim Talus	University of Finland	Energy Law
Maartje Boon	University of Stuttgart	Subsurface storage
Ranjit Koodali	Western Kentucky University	Production Technologies

The Scientific Advisory Committee (SAC) consists of independent researchers who evaluate the centre’s scientific performance and recommend key activities and priorities. The SAC provides external quality assurance and supports the Executive Board by offering expert input on scientific direction. The SAC delivered one report in 2025.

In 2025, HyValue merged the Innovation Committee (IC) and the Industry Project Committee (IPC) into a single body: the Innovation and Industry Project Committee (IIPC). This change was introduced to better integrate innovation mapping with industry-driven project development. The IIPC shall:

- Map project results to assess innovation potential.
- Recommend further research activities that accelerate industry uptake, either within HyValue or through new initiatives.
- Proactively identify and select short-term industry projects for implementation.
- Propose and recommend budget allocations for these projects to the Executive Board.

Members represent both user and research partners. The committee plans to meet at least twice per year, and reports annually to the Executive Board.



**The Executive Board:** From upper left: Victoria Griffiths, Statkraft, Øyvind Midtbø Berge, HVL, Leif Kristoffer Sandal, NHH, Åse Slagtern, RCN, Per Ove Eikeland, FNI. From lower left: Kerstin Schemmann, Equinor, Kristine Spildo, UiB, Aina M. Berg, NORCE, Aasgeir Valderhaug, Elkem. Photo: Andreas R. Graven, NORCE.

## The HyValue Centre Management

The HyValue Centre Management Team (CMT) runs the day-to-day management of the centre. The CMT consists of the Centre Director, the Deputy Director, the Head of Innovation & Industry Affairs, the Centre Coordinator, as well as administrative support from the host institution NORCE.



**Arvid Nøttveit**

Centre Director  
arno@norceresearch.no  
+47 480 48 694



**Velaug Myrseth Oltedal**

Deputy Director  
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+47 55 58 57 26



**Fionn Iversen**

Head of Innovation &  
Industry Affairs  
fiiv@norceresearch.no  
+47 51 87 56 22



**Ellen Ingeborg Hætta**

Centre Coordinator  
ellh@norceresearch.no  
+47 56 10 70 77



**The Management Team:** From left: Velaug M. Oltedal, Fionn Iversen, Arvid Nøttveit and Ellen Ingeborg Hætta.  
Photo: Andreas R. Graven, NORCE

## HyValue Research Partners

The HyValue consortium is led by NORCE Research, with support from the Western Norway University of Applied Sciences (HVL) in centre management. HyValue comprises 12 leading R&D institutions in hydrogen-related research, including eight Norwegian and four international partners.

The research partners collectively provide world-leading competence across technical, economic, legal, and societal disciplines. Their capabilities span analytical modelling, simulation, and experimental research, and they are all strategically committed to HyValue's research agenda.

The consortium offers multidisciplinary expertise essential for delivering HyValue's ambitious programme, including:

- Materials science, catalysis, and chemical processes (UiB, UiS, HVL)
- Porous media, biogeochemistry, and underground storage (NORCE, UiS, TNO)
- Fluid dynamics, pipeline transport, measurement science, and metering research (NORCE, UiB, TNO)
- Optimisation and systems modelling (NORCE, MIT)
- Safety and risk assessment (UiB, UiS, FZJ)
- Societal research (NORCE, TNO)
- Economics, finance, LCA, value-chain analysis, political science, law, and energy systems (FNI, NHH/SNF, TØI, UiB, TNO, PIK)



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# HyValue User Partners 2025

HyValue collaborates with a broad range of national and international industry actors, alongside key public-sector partners. The centre conducts long-term, low-TRL research to support and enable the hydrogen energy transition. The user partners represent all segments of the hydrogen value chain, reflecting the diversity of stakeholders required to advance the sector.

They include engineering and consultancy firms, technology and sensor suppliers, and test facilities that contribute to technology development and maturation. Power companies and system operators, together with energy companies acting as investors and infrastructure owners, help drive the transition, while producers and distributors ensure hydrogen availability across emerging markets. Industrial

actors contribute to circular-economy solutions, and industrial parks, harbours, municipalities, and county councils play key roles in developing and anchoring use-cases. Ship agencies and maritime authorities ensure alignment with maritime operations, and cluster organisations strengthen connectivity across a wider network of stakeholders. Law firms contribute with regulatory and contractual expertise, supporting the framework conditions needed for the energy transition.

Although some user partners chose to conclude their participation in 2025, primarily due to shifts in internal priorities, the overall partner constellation remains broad and well aligned with the centre's long-term research activities.



# The research team

## Centre Management

Arvid Nøttveit,  
Centre Director, NORCE

Velaug Myrseth Oltedal,  
Deputy Director, HVL

Ellen Ingeborg Hætta,  
Centre Coordinator, NORCE

Fionn Iversen,  
Innovation & Industry Affairs, NORCE

## WP1 Novel Production Methods

### WP leaders:

Prof. Vidar Jensen, UiB

Prof. Dhayalan Velauthapillai, HVL

### Key researchers

Erwan Le Roux, UiB

Jonathan Økland Torstensen, HVL

Kristine Spildo, UiB

Pascal Dietzel, UiB

Sachin Chavan, UiS

Velaug Myrseth Oltedal, HVL

Zhixin Yu, UiS

Javier de Elio Medina, HVL

### Postdoc

Khusniddin Alikulov, HVL - Offshore production of hydrogen, by use of techno-economic analysis

### PhD students

Ashika Dilshani Wackwella Gamage, UiS - Advanced Materials for Hydrogen Purification

Buddhika Karunaratne, HVL - Green hydrogen via photocatalysis

Jonas Himmelstrup, UiB - Mechanistic insight and catalyst and process design

Kristoffer Skjelanger, HVL - Green hydrogen from innovative PEM electrolysis

Leif E. Hertwig, UiB - Mechanistic insight and catalyst and process design

Marcello Costamagna, UiB - De novo catalyst design

Ruplekha Bordoloi, UiB - Functional materials for hydrogen purification and utilization

Tomasz Adam Skrzydło, UiS - Turquoise hydrogen from methane cracking

Kristine Marie Halvorsen, UiB (associated) - Development of new MOFs for the electrochemical reduction of CO<sub>2</sub>

Liina Sangolt, HVL (associated) - Offshore production of hydrogen

Sivagowri Shanmugaratnam, HVL/UiB (associated) - Hydrogen production

Huy Nguyen, UiB (associated) - Separation of catalyst and chemical reductant

Anders Even Kvåle, EonE (associated) – industrial PhD

### Master students

Karine Strandos, HVL - Hydrogenproduksjon frå innestengt vasskraft

Kobika Venugopalavanithasan, HVL - Rare-Earth Tungstate as electrocatalysts for hydrogen evolution reaction in alkaline electrochemical water electrolysis

Malene Nordal Ulvestad, HVL - Investigating electrolytes for AEM / AEC electrolyzers

Maria Alice Svendsen, HVL - The role of hydrogen in getting large-scale offshore wind power to markets

Mark Ruben Chalupa, HVL/Leibniz U. - SnS/SrTiO<sub>3</sub> Nanocomposites for Solar-to-Hydrogen Conversion

Tina Eliassen Valøen, UiB - Catalysts for ammonia synthesis

### Bachelor student

Tina Nagy Lønning, UiB - Tin-based coordination polymers with bifunctional organic linkers 2,5-dihydroxyterephthalic acid and 2,5-dihydroxynaphthalene-1,4-dicarboxylic acid for electrochemical applications

## WP2 Storage and Distribution

### WP leaders:

Senior researcher Nematollah Zamani, NORCE

Chief scientist Kjetil Folgerø, NORCE

### Key researchers

Adam Funnell, NORCE

Antonie Oosterkamp, NORCE

Behruz Shaker Shiran, NORCE

Camilla Sætre, UiB

Daniel Lie Carlsen

Researcher Eivind Nag Mosland, NORCE

Hamid Yousefi, TNO

Ignacio Herrera Anchustegui, UiB

Ivar Wærnhus, NORCE

Morten Gunnar Aarra, NORCE

Petter Norli, NORCE

Remco Groenenberg, TNO

Rudiger Tscherning, UCalgary/UiB

Torbjørn Egeland-Eriksen, NORCE

### PhD students

Ingrid Marie Stuen, UiB (affiliated) - Metering

### Master students

Amalie Nordvik, UiB - Salt precipitation during gas storage in saline aquifers

Bishoy Sadaak, Upper Austria Univ. - Salt precipitation during gas storage in saline aquifers

Kjartan Yri, UiB - Metering

Suhayka Mohamed, UiB - Salt precipitation during gas storage in saline aquifers

## WP3 End User Applications

### WP leaders:

Research Professor Geir Nævdal, NORCE

Assoc. prof. Jonathan Økland Tøstensen, HVL

### Key researchers

Bjarte Gees Bokn Solheim, HVL

Ivar Wærnhus, HVL/NORCE

Leonid Vasilyev, NORCE

Pawel Jan Kosinski, UiB

Svein Olav Halstensen, NORCE

Ulrik Thisted, NORCE

Vetle Kjær Risinggård, NORCE

Victoria Zinchenko, NORCE

Yulia Skåtun, HVL

Yuming Liu, MIT

### Postdoc

Niaz Bashiri Behmiri, NHH (also in WP4, 5, 6) - Financing Hydrogen Investment; Key European market conditions: power, CO<sub>2</sub>, gas, hydrogen and energy intensive tradable products

### Master students

Henrik Abilgaard, HVL - Development of an AEM fuel cell test station

Tobias A. Slettemyr Jetmundsen, HVL - Modeling of a Solid Oxide Fuel Cell (SOFC) System for Marine Applications Using Aspen HYSYS

Tobias Spydberger, HVL/UiB - CFD modellering av metanpyrolyse

## WP4 Safety Science and Risk

### WP leaders

Prof. Jon Tømmerås Selvik, UiS – Risk communication and comprehension

Assoc. Prof. Trygve Skjold, UiB - Phenomena, modelling, and mitigation

### Key researchers

Armando José Garcia Pires, SNF

Bjørn Johan Arntzen, UiB

Ernst A. Reinecke, FZ Jülich

Leif Kristoffer Sandal, NHH

Margrethe Aanesen, SNF

Prof. Ove Njå, UiS

### PhD student

Dikshya Bhandari, UiS - Identifying and Mitigating Risks in Hydrogen Energy for Safer Integration

### Postdocs

Ingrid Glette-Iversen, UiS - Hydrogen risk and safety

Brynhild Stavland, UiS - Safety Regulation of Hydrogen as an Energy Carrier

Niaz Bashiri Behmri, NHH - Financing Hydrogen Investment; Key European market conditions: power, CO<sub>2</sub>, gas, hydrogen and energy intensive tradable products.

Helene Hisken, UiB (associated) - Safety science and risk

## WP5 Societal Impact and Embeddedness

### WP leaders

Assoc. prof. Svein Gunnar Sjøtun, HVL

Senior researcher Kari Kjestveit, NORCE

### Key researchers

Gilda Seddighi, NORCE

Henrik Litreré Bentsen, NORCE

Jon Kåre Skiple, NORCE

Rune Njøs, HVL

Simon Norheim Colclough, HVL

Sindre Aske Høyland, NORCE

Tone Njølstad Slotsvik, NORCE

### Postdocs

Faraimo Jay Vai, HVL, Societal impact and embeddedness of Hydrogen in Norway

Niaz Bashiri Behmri, NHH - Financing Hydrogen Investment; Key European market conditions: power, CO<sub>2</sub>, gas, hydrogen and energy intensive tradable products.

## WP6 Integrating Hydrogen in Value Chains

### WP leaders

Prof. Gunnar S. Eskeland, NHH - Economic analysis

Assoc. Prof. Ignacio Herrera Anchustegui, UiB - Governance frameworks

### Key researchers

Armando J. Garcia Pires, SNF

Babak Eslami Ebrahimi, TØI

Berte-Elen Konow, UiB

Christian Weber, TØI

Dires Hegen, TNO

Endre Kildal Iversen, SNF

Frants Gundersern, TØI - LCA

Frode Skjeret, SNF

Ingrid Sundvor, TØI - LCA

Jon Birger Skjærseth, FNI

Joris Koornneef, TNO

Kenneth Løvold Rødseth, TØI

Linda Ager-Wick Ellingsen, TØI

Malin Arve, SNF/NHH

Merel Laarhoven, TNO

Per Ove Eikeland, FNI

Rebecca Jayne Thorne, TØI

Rudiger Tscherning, Calgary/UiB

Sigrid Eskeland Schütz, UiB

Tor Håkon Jackson Inderberg, FNI

Vegard Heggelund Tørstad, FNI

Øyvind Thomassen, SNF

### PhD students

Ingrid Emilie Flesum Ringstad, NHH - Economics

Shuyi Pan, NHH – Economics

### Postdocs

Niaz Bashiri Behmri, NHH - Financing Hydrogen Investment; Key European market conditions: power, CO<sub>2</sub>, gas, hydrogen and energy intensive tradable products.

Torhild Nordtveit, UiB – Law

Maren Holthe Hedne, NHH – Economics / Green transition

Andreas Breivik Ormevik, NHH (associated) - Energy transitions under network externalities: Policies, firms, and finance.

### Master students

Andres Guillermo, NHH - Hydrogen contracts

Helene Just Rustad, NHH - Sustainable Aviation Fuels

Johannes Elgaaen, NHH - Sustainable Aviation Fuels

Kari Wiig UiB - Legal Challenges in Establishing Contracts for Difference for Hydrogen under the EEA State Aid framework

# Accounts

## Costs Per Project Partner 2025

COSTS PER PROJECT PARTNER (IN NOK 1000)	2025
<b>Research partners:</b>	
NORCE Research AS	10 517
Universitetet i Bergen	6 128
Universitetet i Stavanger	7 030
Norges Handelshøyskole	5 001
Høgskulen på Vestlandet	6 437
Fridtjof Nansens Institutt	1 466
Transportøkonomisk institutt	1 188
Samfunns- og næringslivsforskning AS	1 380
Potsdam-Institut für Klimafolgenforschung	893
Massachusetts Institute of Technology	321
Netherlands Organization for Applied Scientific Research (TNO)	428
Forschungszentrum Jülich GmbH	364
<b>User partners*</b>	3 555
<b>TOTAL COSTS</b>	<b>44 708</b>

## Funding Sources 2025

FUNDING SOURCES (IN NOK 1000)	2025
Own contribution (host)	2 898
Own contribution (national research partners)	15 390
Private funding	9 586
Public funding	610
International funding	1 061
The Research Council of Norway	15 165
<b>TOTAL FUNDING</b>	<b>44 708</b>

# Publications 2025

## Scientific publications and conference proceedings

Bachorz, C.; Verpoort, P.C.; Luderer, G.; Ueckerdt, F. [Exploring techno-economic landscapes of abatement options for hard-to-electrify sectors](#). *Nature Communications*, 16, 3984 (2025).

Bashiri Behmiri, N.; Fezzi, C.; Ravazzolo, F., [Renewable sources and short-to-mid-term electricity price forecasting](#). *Journal of Commodity Markets*, 41, 100541 (2026).

Bhandari D.; Selvik, J.T.; Glette-Iversen I.; Abrahamsen, E.B. 2025. [On the Use of the Precautionary Principle in the Context of the Hydrogen Systems](#). In Proceedings of the 35th European Safety and Reliability Conference (ESREL2025) & The 33rd Society for Risk Analysis Europe Conference, SRA-E 2025 (2025).

Bhandari, D.; Selvik, J.T. [On the Use of Fault Tree Analysis to Capture Dynamic and Multistate Aspects in the Analysis of Hydrogen Systems](#). *Chemical Engineering Transactions*, 116 (2025).

Cincotta, C.; Thomassen, Ø. [Evaluating Norway's electric vehicle incentives](#). *Energy Economics*, 146, 108490 (2025).

Costamagna, M.; Foscatto, M.; Grellscheid, D.; Jensen, V.R. [Hypershapes Recognition: A General Framework for Moment-Based Molecular Similarity](#). *Journal of Chemical Information and Modeling*, 65, 5960–5972 (2025).

Glette-Iversen, I.; Bhandari, D.; Selvik, J.T. [Risk assessment of hydrogen systems: A review and comparison of frameworks and guidelines from Norwegian regulators](#). *Safety Science*, 198, 107163 (2026).

Hasanefendic, S.; Hoogstraaten, M.; Bloemendal, M.; Boon, W.; Brezet, H.; Chappin, M.M.H.; Coenen, L.; Dai, Y.; Elzinga, R.; Femenias, P.; Frishammar, J.;

van der Grijp, N.; van Hal, A.; von Hauff, E.; Heller, R.; Hellsmark, H.; Hoppe, T.; Isabella, O.; Janssen, M.; Kaipainen, J.; Bossink, B. [Sustainable energy experiments and demonstrations: Reviewing research, market and societal trends](#). *Energy Research & Social Science*, 122, 104018 (2025).

Islam, M.H.; Pollet, B.G. [Perspective in the industrial applications of sonoelectrochemical hydrogen production](#). *Current Opinion in Chemical Engineering*, 48, 101122 (2025).

Jetmundsen, T.A.S.; Arinicheva Skåtun, Y.; Wærnhus I. [Simulation of a methanol-fueled SOFC system for maritime propulsion using Aspen HYSYS](#). In ECS Meeting Abstracts, MA2025-03, 202–202 (2025).

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Njå, O.; Glette-Iversen, I.; Hisken, H.; Reinecke, E.-A.; Selvik, J.T.; Shibutani, T.; Skjold, T. [Methodology and Analytical tool to Evaluate Risk Decision Processes of Large-scale Hydrogen Energy Systems](#). In Proceedings of the International Conference on Hydrogen Safety (ICH2025), (2025)

Njøs, R.; Sjøtun, S.G.; Jakobsen, S.-E.; Fløysand, A. (Re)Incorporating “the Tangible” in Industrial Path Development Analyses: The Role of Sociomaterial Contingencies in Explaining Potential Emergence of Hydrogen Production in Western Norway. *Economic Geography*, 100, 437–458 (2024).

Odenweller, A.; Ueckerdt, F. [An adjusted strategy is needed to ground green hydrogen expectations in reality](#). *Nature Energy*, 10, 19–20 (2025).

Odenweller, A.; Ueckerdt, F. [The green hydrogen ambition and implementation gap](#). *Nature Energy*, 10, 110–123 (2025).

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Shanmugaratnam, S.; Ravirajan, P.; Shivatharsiny, Y.; Velauthapillai, D. [Green hydrogen production through photocatalytic seawater splitting on MS<sub>2</sub>/TiO<sub>2</sub> \(M=Ni/Co/Sn\) nanocomposites over simulated solar irradiation](#). *International Journal of Hydrogen Energy*, 91, 673–682 (2024).

Shanmugaratnam, S.; Srinivasan, S.; Yuvakkumar, R.; Olteidal, V.M.; Ravirajan, P.; Shivatharsiny, Y.; Velauthapillai, D. [MS<sub>2</sub>/TiO<sub>2</sub> \(M = Co, Sn and Ni\) electrodes for electrocatalytic and photocatalytic water splitting](#). *Fuel*, 385, 134101 (2025).

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## Books or chapters in books

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## Reports and theses

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Tscherning, R. [Three Parts to the New Offshore Economy: Integrating Offshore Wind Energy with Hydrogen Electrolysis on Repurposed Oil and Gas Installations](#). In Herrera Anchustegui, I.; Taylor, M.; Pereira, E.; Wiffa, E. (eds.), *Offshore Energy Law*, Hart Bloomsbury Publishing, London, UK, 325-343 (2025).

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Aarra, M.; Shiran, B.S. Underground hydrogen storage: Main results from core flooding studies. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

Dietzel, P.D.C. Metal-organic frameworks: Materials for H<sub>2</sub> purification and catalytic transformations for hydrogen production and storage. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

Dorgeville, E. Fast track to ammonia in shipping – the Apollo Project. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

Eikeland, P.O. EUs håndtering av energikriser – drivere og utfordringer for koordinert politisk respons. Bachelor i beredskap og krisehåndtering (Lecture, Universitetet i Innlandet), Rena, Norway (2025).

Eikeland, P.O. The EU H<sub>2</sub>-strategy as framework for Nordic developments. Nordic Hydrogen Valleys Conference (Lecture, Nordic Energy Research / Technical University of Luleå), Luleå, Sweden (2025).

Eikeland, P.O. The future of hydrogen – challenges and opportunities ahead. Panel discussion. HyValue Days 2025 (Lecture, HyValue), Bergen, Norway (2025).

Eikeland, P.O.; Skjærseth, J.B.; Inderberg, T.H.J. The EU H<sub>2</sub>-strategy as framework for Arctic developments. Arctic Frontier Conference 2025 (Lecture, Arctic Frontiers / Universitetet i Tromsø), Tromsø, Norway (2025).

Eskeland, G. Environmental shipping: How does it start, and how does it build. Maritime CleanTech Annual Conference 2025: Chasing Zero, (Conference lecture, Maritime CleanTech), Os, Norway (2025).

Eskeland, G. Fiskarbonen og Norgesglaset. Energivalg for fremtiden, en helhetlig vei mot 2035 og videre, (Conference lecture, FME NTRANS), Trondheim, Norway (2025).

Eskeland, G. The impact in Norway of future EU laws and independent standards. RECS National GO Day – Norway, (Conference lecture, RECS Energy Certificate Association), Oslo, Norway (2025).

Gamage, A.D.W. Hydrogen purification by pressure swing adsorption. The 2025 HyValue Days (Conference poster, HyValue), HVL, Bergen, Norway (2025).

Glette-Iversen, I. Risk assessment of hydrogen systems: A review and comparison of frameworks and guidelines from Norwegian regulators. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

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Hennum, M. Public acceptance in the hydrogen value chain. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

Herrera Anchustegui, I. Hvordan får vi fart på hydrogen som klimaløsning? Klimafrokost, (Conference lecture, Energi og Klima), Bergen, Norway (2025).

Hertwig, L.E. Activity-determining factors in molybdenum-catalyzed ammonia synthesis – a computational study. The 2025 HyValue Days (Conference poster, HyValue), HVL, Bergen, Norway (2025).

Hisken, H.; Skjold, T. Large-Scale Hydrogen Storage in Offshore Salt Caverns: Critical Scenarios and Knowledge Gaps Related to Explosion Safety. International Conference on Hydrogen Safety, (Con-

ference lecture, The Korea Gas Safety Corporation and IA HySafe, with the Ministry of Trade, Industry and Energy), Seoul, South Korea (2025).

Jensen, V.R. Fremtidens utvikling av medisiner og materialer: KI og autonomi. NTVA/Tekna/AE Foredrag (Lecture, Norges Tekniske Vitenskapsakademi – NTVA Bergen; Tekna Bergen; Academia Europaea Bergen), Bergen, Norway (2025).

Jetmundsen, T.A.S. Simulation of a methanol-fueled SOFC system for maritime propulsion using Aspen HYSYS. The 2025 HyValue Days (Conference poster, HyValue), HVL, Bergen, Norway (2025).

Karunarathne, B. Oxynitrides- and MXenes-based photocatalytic hydrogen production and large-scale reactor fabrication. The 2025 HyValue Days (Conference poster, HyValue), HVL, Bergen, Norway (2025).

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Misund, T.M. The role of hydrogen in industrial symbiosis in Vestland. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

Motsa, N. Comparison of physico-chemical properties of Co/SiO<sub>2</sub> catalysts prepared using different synthesis methods. The 2025 HyValue Days (Conference poster, HyValue), HVL, Bergen, Norway (2025).

Reinecke, E.-A. Hydrogen safety research at FZJ – supporting the safe introduction of hydrogen technologies in the energy sector. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

Sangolt, L. Hydrogen production from fluctuating power. The 2025 HyValue Days (Conference poster, HyValue), HVL, Bergen, Norway (2025).

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Siegfried, M. Evolution of a solution – fiscal hydrogen flow measurement.

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Sinyage, R.M. Emergency and safety protocol for a green hydrogen alkaline electrolyser facility. The 2025 HyValue Days (Conference poster, HyValue), HVL, Bergen, Norway (2025).

Skiple, J.K. Democratic support for public hydrogen investments. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

Skjelanger, K. Modelling and simulation of a rotating electrolyser. The 2025 HyValue Days (Conference poster, HyValue), HVL, Bergen, Norway (2025).

Skjold, T.; Derempouka, E.; Perez Lucas, M.; Zheng, K.; Hisken, H. Strength of knowledge in risk assessments for hydrogen systems and implications for public discourse and governance. International Association for Hydrogen Safety (Conference report, ISBN 979-12-243-0274-2) (2025).

Skjold, T.; Hisken, H.; Hjertager, B.H.; Giljarhus, K.E.T.; Henriksen, M.; Vågsæther, K.; Narasimhamurthy, V.D.; Klein, T.S.; Vianna, S.S.V.; Johnson, D.M. PDR Alliance: Collaborative research on consequence modelling of accidental explosions in complex geometries. 30th International Colloquium on the Dynamics of Explo-

sions and Reactive Systems (Conference poster, University of Ottawa), Ottawa, Canada (2025).

Skrzydło, T.A.; Tucho, W.M.; Chavan, S.M.; Yu, Z. Ni/Fe hydrotalcite derived catalyst for catalytic cracking of methane. EuropaCat 2025, (Conference poster, Nordic Catalysis Societies under the auspices of EFCATS), Trondheim, Norway (2025).

Solheim, B.G.B. Characterization of PEM fuel cells by acoustic emission, impedance spectroscopy and fiber-optic cables. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

Strandos, K. A techno-economic study of hydrogen production from trapped hydropower. The 2025 HyValue Days (Conference poster, HyValue), HVL, Bergen, Norway (2025).

Stuen, I.M. Monitoring of hydrogen gas grids: Losses and uncertainty. The 2025 HyValue Days (Conference poster, HyValue), HVL, Bergen, Norway (2025).

Sydberger, T.F. A computational fluid dynamics study of methane pyrolysis. The 2025 HyValue Days (Conference poster, HyValue), HVL, Bergen, Norway (2025).

Talus, K. EU regulation of hydrogen: Unnecessary legal complications. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

Taylor, S. The North Adriatic Hydrogen Valley – origins, governance, implementation, and lessons learned. The 2025 HyValue Days (Keynote lecture, HyValue), HVL, Bergen, Norway (2025).

Thorne, R. Life cycle assessment of zero-emission high-speed passenger vessels. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

Ueckerdt, F. Green hydrogen – global status, challenges and prospects. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

van Wingerden, K. Questions still to be answered regarding safe handling of hydrogen. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

Velauthapillai, D. Modeling, synthesis, and future directions for novel materials in photocatalytic and electrocatalytic hydrogen production. The 2025 HyValue Days (Lecture, HyValue), HVL, Bergen, Norway (2025).

Venugopalavanithasan, K. Synthesis and characterization of samarium tungstate as an electrocatalyst for the hydrogen evolution reaction. The 2025 HyValue Days (Conference poster, HyValue), HVL, Bergen, Norway (2025).

Waciega, K. Shaping hydrogen market in Europe – a critical look at the European legal framework. The 2025 HyValue Days (Keynote lecture, HyValue), HVL, Bergen, Norway (2025).

Wilhelmsen, I.T. The Norwegian hydrogen landscape – current challenges and great opportunities. The 2025 HyValue Days (Invited lecture, HyValue), HVL, Bergen, Norway (2025).

Yri, K. Detecting impurities in hydrogen using a microwave resonator. The 2025 HyValue Days (Conference poster, HyValue), HVL, Bergen, Norway (2025).

## Other publications and dissemination activities

Bertram, L.; Eisl, A.; Jäger, P.; Verpoort, P.C. [Energy-intensive industry: How to stay competitive and avoid inefficient subsidy races](#). Table.Media (2025).

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Dietzel, P.D.C. Medisinsk mirakel og kjemisk magi: Dette er nobelprisvinnerne 2025. Aktuelt (Other presentation, Studentersamfunnet i Bergen), Bergen, Norway (2025).

Eskeland, G. [«Norgespris» og strømsløsning – fordi staten er blitt for mektig og selvtilfreds?](#) Dagens Næringsliv (2025).

Eskeland, G. [Elbilstøtten skal ned](#). Dagens Næringsliv (Letter to the editor) (2025).

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Eskeland, G. [Hva vil vi med de rike?](#) Dagens Næringsliv (Letter to the editor) (2025).

Eskeland, G. [Oljefondets integritet krever feighet](#). Dagens Næringsliv (Letter to the editor) (2025).

Eskeland, G. [Statlig rikdom kan svekke privat innsats](#). Dagens Næringsliv (2025).

Eskeland, G. [USAs selvskading gir Europa muligheter](#). Dagens Næringsliv (2025).

Eskeland, G. [Velgere og politikere er gullstandarden, ikke eksperimenter](#). Dagens Næringsliv (2025).

Herrera Anchustegui, I. (interviewee). [«Nøtteknekker» blåser liv i fornybar-draumen](#). NRK (2025).

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Oltedal, V.M. (interviewee). [Blått hydrogen: Snarvei eller unødig omvei?](#) Energi og Klima (2025).

Række, N.A.; Nøttveit, A. [Hydrogen er ingen boble](#). Dagens Næringsliv (2025).

Skiple, J.K.; Bentsen, H.L. Valg25: [Energipolitikken kan sprengte regjering-](#)

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Stratmann, K.; Verpoort, P.C. (interviewee) [Irrweg Wasserstoff-Import? Forscher zeigen Alternativen auf](#). Handelsblatt (2025).

Undheim, E.A.; Eikeland, P.O. (interviewee). [Landet som snudde kappa mot straumen](#). Dag og Tid (2025).

Ursin, L.; Herrera Anchustegui, I. (interviewee). [EU-etterslep bremser norsk hydrogensatsing](#). Energi og Klima (2025).

Verpoort, P.C. [Grundstoffindustrie: Wie grüne Importe die Wettbewerbsfähigkeit sichern könnten](#). Transforming Economics (2025).

Verpoort, P.C. [Zukunft Wasserstoff](#). VIK Mitteilungen (2025).

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