



Norwegian
Hydrogen Forum

The Norwegian Hydrogen Guide

2024 | 01



Minister of Trade and Industry Jan Christian Vestre and Knut Førland at the opening of the new facility for HYDS, Dalane Energi, and Eigersund Næring and Havn KF at Kaupanes outside Egersund. The facility has a capacity of 1 MW and will produce 388 kg of hydrogen per day.

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The Secretariat of Norwegian Hydrogen Forum. From left: Tor Kristian Haldorsen, Marika Nilsen, Ingebjørg Telnes Wilhelmsen, Lin April Løstegård, Jan Carsten Gjerløw.



Norwegian Hydrogen Forum (NHF) was founded in 1996 as a non-profit member organisation which promotes the advantages of hydrogen and ammonia as energy carriers. As of 2023, our approximately 100 members include Norwegian producers, distributors, industry, universities, research institutes, companies in the transportation sector, consulting firms and other organisations related to hydrogen.

NHF works actively to disseminate key information in Norway on hydrogen and ammonia research and technology commercialisation, market trends and international policy making. Moreover, NHF organises conferences, seminars, and workshops, some in collaboration with our Nordic sister-organisations, projects, or other national and international stakeholders. Updates are provided by publishing newsletters and posting news on www.hydrogen.no.

NHF is convinced that one of the best ways to serve our members is to contribute to establish a substantial market for hydrogen technologies both in Norway and internationally. To fulfil this ambition NHF actively promotes our members' interests towards public authorities and decision makers.

NHF has succeeded in getting substantial political attention and support for the introduction of hydrogen technologies at national as well as regional levels, ensuring strong financial support schemes in the years to come.

NHF was founded to promote hydrogen as an important solution in the green transition. Norway has been a frontrunner in hydropower for more than a century. Now, we must show the world that we are still a force to reckon with when it comes to renewable energy and take a leading role in the hydrogen and ammonia industry.

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Hydrogen is an energy carrier that can be produced from all energy sources, including natural gas and renewable energy, both of which Norway has in abundance. Due to a rapidly increasing share of intermittent energy sources in the energy system, like solar and wind power, there has been a substantial increase in the interest in hydrogen, both to decarbonise and to enhance the flexibility in the energy system. To accommodate and facilitate for the needed growth, the Norwegian government must take an active part. It is NHF's ambition to be a constructive partner for the authorities on this matter.

The first National hydrogen strategy was launched in 2005 by the Ministries of Petroleum and Energy, and the Ministry of Transport and Communications. In June 2020, the government presented a new Norwegian Hydrogen Strategy, and in June 2021 they followed up with a roadmap. The roadmap was part of the White Paper "Value creation from Norwegian Energy Resources". The White Paper states that Norway's position as an energy nation will be further developed through new initiatives such as hydrogen, offshore wind, strengthening of the grid and low emission oil and gas sector.

The current government has stated that it will contribute to developing a coherent value chain for hydrogen produced with low or no emissions, where production, distribution and use are developed in parallel.

Norway and the EU have ratified the international Paris Agreement on climate change, and, like the EU, Norway has committed to a target of at least a 55 percent reduction in greenhouse gas emissions by 2030 compared to 1990 levels.

The use of hydrogen and ammonia is important to reach the goals. But we must act now, there is no time to lose. That is why NHF is working hard to facilitate the development of the Norwegian hydrogen and ammonia industries, together with our members and international partners. Together we must ensure a sustainable development where hydrogen and ammonia will give a significant contribution to the reduction of CO₂ emissions.

The County Network

The County Network is a cooperation between counties and municipalities in Norway. The main goal is to develop well-functioning value chains for hydrogen throughout the country. NHF is the secretariat for the network.

Regional authorities play an important role in the work of phasing out fossil fuels and facilitating the deployment of low- and zero-emission solutions. Over the past few years, the authorities and the industry have significantly increased their attention towards hydrogen, and several projects and initiatives have been initiated all over the country. This provides both challenges and opportunities for counties and municipalities, both on a political and administrative level. Local authorities play an important role in facilitating this development, utilising energy resources, creating green jobs, and reducing greenhouse gas emissions.

The County Network aims to:

1. Increase hydrogen competence in counties and municipalities
2. Provide input to regional and local action plans and strategies
3. Act as a discussion partner for NHF's preparation of input for public consultations
4. Work for improved national framework conditions that are of particular importance to municipalities and counties
5. Increase the cooperation between the participants by sharing experiences and coordinating activities



AGDER
fylkeskommune



AKERSHUS
FYLKESKOMMUNE



Finnmark fylkeskommune
Finnmárkku fylkkagiielda
Finmarkun fylkinkomuuni



Møre og Romsdal
fylkeskommune



Nordland
FYLKESKOMMUNE



Rogaland
fylkeskommune



Telemark
FYLKESKOMMUNE



Troms fylkeskommune
Romssa fylkkasuohkan
Tromssan fylkinkomuuni



Trøndelag
fylkeskommune



ØSTFOLD
FYLKESKOMMUNE



Berlevåg kommune



bodø
KOMMUNE



Hitra
kommune



Kristiansand
kommune



Kvinesdal
KOMMUNE



Oslo



PORSGRUNN
KOMMUNE



TRONDHEIM
KOMMUNE

Figure: Participants of the County Network



Herøya in Telemark is one of the largest industry areas in Norway, and has established a local hydrogen network.



The city of Trondheim aims to play a vital role in the hydrogen value chain and intends to enhance the establishment of a robust regional infrastructure for renewable and fossil-free fuels including hydrogen. Europe's first hydrogen trucks are operated by ASKO Midt-Norge, located in Trondheim.





Finnmark County has adopted a hydrogen strategy and intend to utilise the natural advantages for the production of hydrogen, both from natural gas and wind power.

The EU project Haeoulus operates a new-generation electrolyser integrated within a state-of-the-art wind farm in a remote area with access to a weak power grid, located at Raggovidda in Finnmark.



The Vestfjorden Ferries operating the route between Bodø and the Lofoten islands will use hydrogen from 2025. The city of Bodø is the regional capital of Nordland county and a center for logistics and transports. The goal is to realize zero-emission transport systems within the next decades. Hydrogen is expected to play a key role in this ambition.

The Nordic Hydrogen Partnership

Nordic Hydrogen Partnership (NHP) is a collaboration between the Nordic hydrogen associations. The partners are Norsk Hydrogenforum in Norway, Vätgass Sverige in Sweden, Brintbranchen in Denmark, VTT Technical Research Center of Finland and Icelandic New Energy on Iceland. NHP is a communication platform for the Nordic countries and boosts cross-sector implementation of hydrogen and fuel cell technologies in the Nordics, in close cooperation with several industry representatives.

The Nordic Hydrogen Partnership was established in 2006, when the different Nordic hydrogen organisations joined forces to coordinate the market introduction of hydrogen cars and HRSs to the Nordic market. The Nordic Hydrogen Partnership was originally called Scandinavian Hydrogen Highway Partnership (SHHP), but this name was changed by the end of 2020 to accommodate the broadened scope of the organisation.

Next Wave (2019 –) is an initiative established through the Nordic Hydrogen Partnership. The goal of the project is to encourage the globally leading hydrogen technology companies in the Nordic region to establish the world's first expansion of hydrogen infrastructure for large vehicles, and to accelerate a greater roll-out of hydrogen trucks and buses. In phase III, the project will also look into Zero Emission Tradelines and how this can be achieved. The other partners in the project, together with NHP, are EvigGrønn, GreenH and Vireon as well as the associated partners Fortescue, Hy2Gen, Linde and Samskip. The project receives funding from Nordic Innovation.

VÄTGAS
SVERIGE

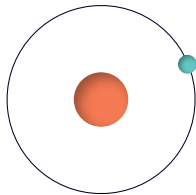
Brintbranchen
Hydrogen Denmark





What is hydrogen?

The name hydrogen is derived from the Greek words for 'water' (hydro) and 'forming' (genes). Hydrogen (H) has atomic number 1 and is the lightest element in the periodic table. The most common isotope of hydrogen consists of one proton and one electron. Estimates show that hydrogen is the most common element in the universe and, despite its lightness, makes up three quarters of the mass of the universe.



On earth, the hydrogen atom mostly appears as part of the water molecule, H_2O . Hydrogen is also a part of many other substances, for instance in hydrocarbons, carbohydrates, and ammonia (NH_3). Hydrogen is an energy carrier and must therefore be produced from energy resources. The most used production methods are electrolysis and reforming of fossil energy e.g., natural gas. When hydrogen is produced from renewable energy, it is categorised as renewable hydrogen, and when generated from gas reforming with Carbon Capture and Storage (CCS) or Carbon Capture Usage and Storage (CCUS) it is known as low carbon hydrogen. Both are categorised as clean energy carriers and when utilised in a Fuel Cell, the only emissions are clean water and heat.



SINTEF is a leading R&D and innovation actor in Europe within hydrogen technologies, with more than 30 years' experience and significant activities.

Almost a hundred years of large-scale hydrogen production

In Norway, Norsk Hydro has produced and utilised hydrogen in large-scale fertiliser production since 1927. Their electrolysis technology is being further developed and supplied by Nel Hydrogen. Norsk Hydro, Statkraft and Statoil (now Equinor), together with Raufoss Fuel Systems (now Hexagon Purus) and Norwegian research institutions, brought hydrogen from the industrial and research stage to the public refueling arena in the beginning of 2000 when the HyNor-project was established to demonstrate hydrogen as an alternative fuel for passenger cars. Some hydrogen refueling stations were established through public and private investments.

Norwegian companies, research institutes, and universities have over the last decades developed strong competence and long experience within hydrogen technologies. New companies along the entire value chain from hydrogen production and distribution to end use and system integration are being established, developing competence, experience, products and solutions. Today, both new and established companies are heavily engaged in hydrogen, either as a segment of their business or as their core business. New initiatives and projects have increased tremendously over the past few years, leading to increased public awareness that is likely to boost a nationwide deployment of hydrogen solutions in the coming years.

With a 98 percent of renewables share in Norwegian power production and an increasing exploitation of small-scale run of river hydropower, as well as solar and wind power, the need for grid balancing and energy buffering is increasing. The growing hydrogen infrastructure could play a crucial role in meeting these challenges and contribute to meeting the ambitious climate targets. Regional authorities and public financial support agencies have for many years supported the development of hydrogen technologies. Lately, large industrial players are investing substantially in scaling up and deploying hydrogen for emission reductions in industry as well as in road and maritime transport.

The Norwegian Hydrogen Forum (NHF) is facilitating further development of these skills and capabilities so that Norwegian stakeholders can maintain their pioneering role and take an adequate share in the growing global market for hydrogen and ammonia technologies. NHF aims to be a visible actor in the hydrogen community in Norway and abroad and has an important coordinator and facilitating role in fostering this growing industry.

Meråker Smelteverk, 1957





Members

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Aibel AS

Aibel builds, modifies, and maintains critical infrastructure for the energy industry. As an established service company in the energy sector, we design, engineer, construct and deliver quality projects for the renewable energy transition, with a strong position and key offerings within Offshore Wind and onshore / offshore Hydrogen.

Through concept studies and Front End engineering studies, Aibel reveals opportunities and works closely with customers to find the optimum solution for their hydrogen project, and develops a plan for safe execution and delivery of Hydrogen process plants. We are a system integrator, focused on technical safety, selection of technologies to optimize the process design, construction, installation, and commissioning.

Aibel has a competent and experienced team that has developed Hydrogen projects. Through a technology agnostic approach, we are able to work closely with a range of different technologies for onshore and offshore Hydrogen production, including large volume storage.

Aibel has a track record delivering cost effective projects safely and on time.



aibel.com

HYDROGEN CHAIN	APPLICATION	ACTIVITIES
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	Storage	
	System Integration	

Air Liquide Norway AS

Air Liquide (AL) is the world leader in gases, technologies and services for Industry and Health, Air Liquide is present in 80 countries with approximately 65,000 employees and serves more than 3.5 million customers and patients. Oxygen, nitrogen and hydrogen are essential small molecules for life, matter and energy. They embody Air Liquide's scientific territory and have been at the core of the company's activities since its creation in 1902.

Regarding hydrogen, the company is present in the entire hydrogen production chain from hydrogen production, storage, transportation and delivery to end users. AL currently produces more than 1 million tons of H₂ per year for steel, glass, chemical, food industries and mainly for refineries. The Group operates a large distribution network, which includes gaseous tube trailers, liquid trailers, cylinders and bundles but also the largest European hydrogen pipeline network. Air Liquide also designs and operates hydrogen fuelling stations in Europe, North America and Asia and has been actively involved in R&D projects aiming to strengthen the safe usage of hydrogen in a hydrogen based economy.

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Aker Horizons

Aker Horizons develops green energy and green industry to accelerate the transition to net zero. The company is active in renewable energy, carbon capture and hydrogen, and develops industrial-scale decarbonization projects. As part of the Aker group, Aker Horizons applies industrial, technological and capital markets expertise with a planet-positive purpose to drive decarbonization globally.

Aker Horizons is listed on the Oslo Stock Exchange and headquartered in Fornebu, Norway. Across its portfolio, the company employs approximately 1,200 people in 18 countries on five continents. The company develops, builds, owns and operates clean hydrogen at industrial scale globally, continuously working on making hydrogen affordable, safe and easy.

Aker Horizons' approach is to leverage standardization, digitalization and partnerships across the value chain, applying HSSE culture, toolbox and solutions from more than 180 years of industrial heritage from the Aker Group, and understanding the end-users' technical and commercial hurdles. Targeted end-use markets are hard-to-abate sectors such as ammonia, methanol shipping and refineries.

A K E R

H O R I Z O N S

akerhorizons.com

Commercialization
Components
R&D
Services

Portable
Stationary
Transportation

Control systems
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FC/ICE
Production
Storage
System Integration

Aker Solutions ASA

Aker Solution offer engineering and construction services for the renewable energy transition with key focus on hydrogen and derivatives. Utilize its strong project execution experience and methodology and a strong culture of solving problems, we deliver complex energy projects in a safe, predictable, and sustainable way.

The offering ranges from early phase studies and design to EPC for both onshore and offshore. It covers the value chain from production to storage and transportation to end use of hydrogen and hydrogen derivatives like ammonia, e-fuel and methanol. Aker Solution work in an integrated and collaborative way to ensure cost efficient execution with world class quality.



HYDROGEN CHAIN	ACTIVITIES	Commercialization
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Akershus Energi Infrastruktur AS

Akershus Energi is an energy company for renewable energy and green infrastructure. We are invested in renewable sources such as hydro-power, district heating, solar and wind.

Our ambition in hydrogen is to contribute to the decarbonization of transport sector in our region through industrial scale hydrogen production. We aim for integration of hydrogen production in the energy system for utilization of flexibility and waste heat to increase competitiveness of hydrogen.

Akershus Energi mainly do development and business together with partners. We do our development of industrial project within the hydrogen business through our partnership in Viken Hydrogen AS.

Commercialization

Components

R&D

Services

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FC/ICE

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Storage

System Integration

Aneo AS

Aneo is looking into possibilities to produce green hydrogen for use in transport on land and at sea.

Together with Statkraft we are engaged into the hydrogen hub at Hitra as one the five which Enova support.

We like to mention that Aneo has completed EU-project REMOTE with success which was a off-grid electricity project where hydrogen was the main energy storage. Hydrogen was produced by electricity from renewable sources as windpower and PV. The project was led by POLITO – Polytechnical University of Turin. The project has given us knowledge for how we could commercialize this kind of solution.

ANEEO

aneo.com

HYDROGEN CHAIN	ACTIVITIES	Commercialization
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Applied Hydrogen AS

Enabling emission free construction sites. We provide conversion kits for excavators to replace diesel engines with Fuel Cell based Hydrogen Power sources.

We also build portable hydrogen filling units for off-grid filling in construction sites.

A cloud-based fleet management system is used to control the hydrogen value chain for production site to delivery to excavators.



appliedhydrogen.no



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ASKO

ASKO is a family-owned company established in 1866. As Norway's largest grocery retailer, our core business is to supply customers all over Norway with food. With our 800 trucks on the road every day, we have a very strong focus on sustainable solutions. Our ambition is to be zero emission in all transport within 2026, and we see hydrogen as an important ingredient to reach that. ASKO already has our own hydrogen production, hydrogen forklifts and heavy-duty hydrogen trucks in operation.



ASKO

asko.no

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Bilimportørenes Landsforening

Bilimportørenes Landsforening (BIL) is the Norwegian Association of Car Importers representing the international car industry in Norway.

BIL is a member of NHF (The Norwegian Hydrogen Forum) as we recognize their important role in this growing industry. The process of commercializing the hydrogen technology for vehicles is in progress, and we see huge possibilities in joining forces working for a cleaner global environment.

There are already several vehicles containing this technology on Norwegian roads, and we expect the number to grow for the years to come.

BIL is continuously working towards the authorities. We are glad to see that the Norwegian government now is quite ambitious to provide infrastructure for hydrogen road and sea transportation.

bilimportorene.no

Commercialization

Components

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Stationary

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FC/ICE

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Storage

System Integration

Bürkert Norway AS**MEASURING, CONTROLLING, REGULATING****Hydrogen applications with BÜRKERT**

- We are here for you from development to large-scale production- for a rapid time-to-market for your systems
- With our products and customized components, you will optimize the efficiency of your hydrogen application and lay the foundations for low maintenance operation.
- Approved, application-compliant products ensure maximum safety, today and in the future.



HYDROGEN CHAIN	ACTIVITIES	Commercialization
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Ceramic Powder Technology AS

Cerpotech (Ceramic Powder Technology AS) is developing and manufacturing high quality advanced ceramic oxides for a broad range of applications. Application areas are within environmental technologies, energy and electro ceramics. Powder for lead free piezo, membranes for various technology areas, solid oxide fuel or electrolyzes cells and batteries by use of spray pyrolysis. The manufacturing method spray pyrolysis is very flexible and robust and are also very reproducible and easy to scale up as it semi continuous. Cerpotech specializes in the manufacturing of multicomponent oxide powders according to the customers' specifications regarding composition and powder morphology. In addition to commercial sales to industry and R&D-purposes, Cerpotech is partner in national and EU funded R&D projects.

Cerpotech as a spin off from NTNU from 2007 have in 2013 established an industrial size manufacturing line located at Tiller, just outside the city center of Trondheim. The company have customers worldwide within a broad range of market areas from basic R&D to commercial products.

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Clara

Clara Venture Labs AS

Clara is a venture platform backed by Aker to develop disruptive technologies and solutions within Clean Energy Solutions, New space, Advanced materials, Resource Scarcity, Circular Economy, and Biochemistry.

Clara – former Prototech – has been involved in fuel cell development since 1990, and develops fuel cell systems for different applications using commercially available components. Clara has competence within design, analysis, manufacturing and testing of stack components, stacks, balance-of-plant and complete systems. Clara has participated in a number of national as well as EU projects related to fuel cells and fuel cell systems. In 2021, Clara launched the venture Alma Clean Power for further development and commercialization of high-temperature fuel cell systems for ocean industries. Clara has also carried out projects for the European Space Agency related to hydrogen storage and compression systems as well as regenerative fuel cell systems for satellites and spacecraft.

Clara supplies balance-of-plant components and complete systems for test and demonstration. Testing and demonstration are carried out in our own fuel cell and hydrogen laboratories.

claraventurelabs.com

Corvus Energy

Corvus Energy is the world's leading supplier of safe, innovative and reliable zero-emission solutions for all segments in the maritime industry.

We design and manufacture marine approved fuel cell and energy storage systems. Corvus have a close collaboration with Toyota, a global leader in the production of PEM fuel cells for the land based industry. Leveraging our extensive marine expertise, we seamlessly integrate Toyota's cutting-edge technology to produce the inherently gas-safe marine Corvus Pelican fuel cell system.

Corvus was founded in 2009 and are today the largest supplier of marine energy storage systems worldwide, supporting the decarbonization of the marine industry with fuel savings equivalent to millions of kg of CO₂ every year.

On top of our fuel cell and battery system offerings we deliver advanced digital services to support the ship owners, crew, ship designers and integrators to implement and use the combination of our fuel cell and batteries in the most efficient way.

In 2024 the Corvus Pelican will be receiving marine Type Approval from DNV and the first installation starts its operation onboard the fishing training vessel MS Skulebas.

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DNV AS

DNV is a leading, independent advisor and verifier covering “all colors” of hydrogen and full value chains with a global operation. Core industries that DNV serve are maritime, offshore, pipeline, as well as land-based industrial hydrogen (smelters and ammonia production) and hydrogen for land-based transport.

Core services within advisory is safety assessments, HAZID’s, experiments, Joint Industry Projects, and R&D related to hydrogen safety with a world leading large scale explosion test facility at Spadeadam, UK. Analyses also includes new technologies and value chains for renewables and hydrogen carriers, life cycle analysis and GHG footprint including forecasting and advisory regarding long-term hydrogen development.

DNV Maritime Class is pioneering developments with hydrogen and ammonia as fuel for ships and on carriers, including rule developments, handbooks, guidelines and standardization.



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Equinor ASA

Equinor is an international energy company present in more than 30 countries worldwide, including several of the world's most important oil and gas provinces. Founded in 1972 under the name Den Norske Stats Oljeselskap AS – Statoil (the Norwegian State Oil company), we changed our name to Equinor in 2018.

Our headquarters are in Stavanger, Norway, and we have over 21,000 employees committed to providing affordable energy for societies worldwide and taking a leading role in the energy transition. We're on a journey to net zero emissions through optimising our oil and gas portfolio, accelerating growth in renewables and pioneering developments in carbon capture and hydrogen.

equinor.com

European Energy Norge AS

European Energy aims to be a major global force in driving the green transition, develop green energy solutions and encourage the world to join the movement towards a fossil-free society.

European Energy develop, build and operate projects mainly in solar, wind and Power-to-X, where we currently develop projects in 29 countries. In 2022, our project portfolio was 31 GW, and a total of 1.3 GW was under construction.

In 2023, European Energy started the construction of the world's first commercial e-methanol plant in Kassø, Denmark. The plant is expected to be commissioned in 2024, and will deliver green fuel to Maersk, as well as e-methanol to Novo Nordisk and Lego, which will use the e-methanol in the production of green plastic.

European Energy has a green hydrogen plant under construction in Måde, Denmark. At this plant we intend to test various electrolysis units, as well as gather knowledge about the flexibility of the electrolysis unit towards the power grid.

In addition, European Energy has a portfolio of Power-to-X projects in over 8 countries. Power-to-X in European Energy includes the entire value chain from power generation, project development, EPC to distribution of the final product.

europeanenergy.com

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The Norwegian Defence Research Establishment (FFI)

FFI is the prime institution responsible for defence-related research in Norway and is the chief adviser on defence-related science and technology to the Ministry of Defence and the Norwegian Armed Forces' military organization.

Hydrogen and fuel cell activities at FFI have mainly focused on power systems for underwater applications, especially for the autonomous underwater vehicle HUGIN. FFI has developed a sea water battery, an aluminium/hydrogen peroxide semi-fuel cell and a PEM fuel cell system for this purpose. Fuel cells and hydrogen are also a relevant technology for Norway's new submarines, which will be delivered from 2029 and onward. On this basis, FFI is investigating fuel cell systems used for air-independent propulsion on submarines, including hydrogen storage in metal hydride containers. Production and storage of hydrogen is also a relevant technology segment due to this application.

Reforming of liquid fuels to hydrogen is an important field for FFI due to the military community's interest in power generation from military fuel (kerosene/JP-8). FFI has investigated available auxiliary power units based on diesel reforming and fuel cells for use on military vehicles. FFI also tests commercially available fuel cell systems for soldiers.



FFI Forsvarets
forskningsinstitutt

ffi.no

Commercialization

Components

R&D

Services

Portable

Stationary

Transportation

Control systems

Distribution

FC/ICE

Production

Storage

System Integration

Flowtec AS

- Norwegian company within instrumentation, pumps and solutions
- Target areas in new development, maintenance & modification, and after market activities within the oil & gas and Hydrogen industry
- Stockist and distributor for internationally leading instrumentation and pump manufacturers (valves, fittings, tubing, regulators, pumps, level, enclosures, etc.)
- Technical Department covering engineering, design, performance, testing, documentation and delivery of control systems and cabinets
- Typical control systems; high pressure system, filling systems, local control panels, valve actuation, sampling, distribution, chemical injection, testing, boosters, HPU, pump systems, etc.
- Commissioning, service and maintenance, onshore / offshore
- Offshore expertise with deliveries of products and systems in hazardous areas to land-based systems
- Our suppliers develop products especially for the Hydrogen market
- Located with office, inventory stock and workshop at Sola, Stavanger
- High level of knowledge and experience within all level of company product segments
- Great emphasis on quality at all levels, and have implemented quality system according to the requirements of ISO 9001:2015, EPIM JQS and Achilles

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
HYDROGEN CHAIN		Storage
		System Integration

Fortescue Future Industries

Fortescue Future Industries (FFI) is a global green energy company committed to producing green hydrogen, containing zero carbon, from 100 per cent renewable sources. FFI is a subsidiary of the Australian company Fortescue Metals Group (one of the world's largest iron ore companies). We are decarbonising heavy industry and creating jobs globally. FFI is developing technology solutions for hard-to-decarbonise industries, while building a global portfolio of renewable energy, green hydrogen and green ammonia projects. FFI is also leading the world effort to decarbonise hard-to-abate sectors and is responsible for the proposed decarbonisation of one of the biggest resources companies in the world by 2030 – our parent company Fortescue Metals Group.

FFI has offices in all continents are developing some key regions of focus. Norway is an important location for FFI as we see an attractive potential to develop large scale green hydrogen projects. FFI recently announced the green ammonia project in Holmaneset in Bremanger municipality where we shall production in 2027 based on 300 MW capacity. FFI will continue to develop more projects and opportunities in Norway and look to become an integrated part of the industry.



ffi.com.au

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Fuella AS

Fuella is an independent development company of green ammonia projects in Norway.

At our facilities, we will produce green hydrogen through electrolysis and immediately convert it to ammonia by means of the Haber-Bosch process. This green ammonia is an excellent hydrogen carrier, as it has favorable storage and safety properties compared to pure hydrogen. Furthermore, Ammonia is already today a globally traded and transported good. The technologies for transportation and storage, as well as the regulations for handling and safety, are available and well proven.

We are committed to significantly reduce production cost of green ammonia and thereby facilitate an increasing decarbonization in different industrial sectors such as shipping, fertilizer and offshore power generation.

Our projects are scheduled to deliver increasing quantities of green ammonia over time. Starting with 100'000 t in 2025 and subsequently expand production by 100'000 t/year in 2026 and 2027 respectively, with further expansion potential at each of our locations.

HYDROGEN CHAIN	ACTIVITIES
	Commercialization
	Components
	R&D
	Services
APPLICATION	Portable
	Stationary
	Transportation
HYDROGEN CHAIN	Control systems
	Distribution
	FC/ICE
	Production
	Storage
	System Integration

Gen2 Energy

Gen2 Energy (G2E) is planning and preparing for large-scale production, sale and distribution of green H_2 produced in Norway from hydro power. The H_2 will be produced on locations near the power production and with access to deep seaports for exports. G2E is developing production sites in Mosjøen and Suldal. G2E work for using the by-products of hydrogen production (heat and oxygen) in fish farming and agricultural industries.

In the first phase, 70–80% of the H_2 produced will be exported to Northwest Europe using hydrogen container vessels. Agreements with clients in Germany, UK and Scotland give clear indications of strong offtake interest of green H_2 in Europe.

G2E is developing an intelligent “plug and play” concept that will reduce costs for the consumer and make the switch easier for the clients. To ensure safety and efficiency in the supply chain, the containers will use IOT and other instrumentations to track and survey the H_2 in the containers, and monitor the end-user’s H_2 -consumption. G2E plans to have a zero-emission seaborne transportation of the containers to markets in Europe.

G2E have 14 employees. The staff is highly competent, mainly PhD and master-level. A NOK 70 million capital raise carried out in March 2021 brought in strategic owners such as Vitol, the world’s largest energy trading company, Høegh LNG and TS Invest, and gave the company a solid financial platform. G2E has no debt.

gen2energy.com



HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Glomfjord Hydrogen AS

In January 2024, the company Glomfjord Hydrogen AS was split into two new companies. Glomfjord Hydrogen AS continues from now on as a development company. The other company, Glomfjord Green Ammonia AS, is planning and preparing to build a green ammonia plant located in Glomfjord.

As a development company, Glomfjord Hydrogen will search for hydrogen-related projects where the company can take positions in new companies and contribute to developing of infrastructure for production and distribution of hydrogen.



glomfjordhydrogen.no

HYDROGEN CHAIN	APPLICATION	ACTIVITIES
		Commercialization
		Components
		R&D
		Services
	Portable	
	Stationary	
	Transportation	
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

GreenH AS

GreenH AS is a Norwegian company dedicated to the development of infrastructure for production and distribution of green hydrogen. GreenH develops projects and will build, own and operate hydrogen production facilities. We aim to establish a network of hydrogen hubs with medium sized hydrogen production facilities strategically located in direct proximity of regional end-users. As such, we supply green hydrogen with no, or minimal, transportation costs and emissions.

Our customers are the maritime sector, heavy road transport and industrial buyers. GreenH is a subsidiary of Infranordic AS. Infranordic origins from transactions and capital markets and 25 years of business development, financing, construction and operating renewable energy plants.



greenh.no

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
APPLICATION		Portable
		Stationary
		Transportation
HYDROGEN CHAIN		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Greenstat ASA

Greenstat ASA is a company that develops, operates, and owns green hydrogen plants and industrial wind- and solar plants, primarily through its subsidiaries. Furthermore, Greenstat delivers analysis and insights into the green energy markets and develops and operates concepts for energy distribution through energy stations. Greenstat was established by Christian Michelsen Research (now a part of NORCE) in Bergen in 2015 and has since evolved to become independent with more than 1800 unique shareholders (2021).

Greenstat's purpose is to find, develop and operate hydrogen-related projects to create green growth and profitability. At the time, these include Glomfjord Hydrogen AS, Meraker Hydrogen AS, Viken Hydrogen AS, Stord Hydrogen AS and more.

Greenstat has, after working dedicated towards the hydrogen market for several years, seen an increase in inquiries related to hydrogen as an energy carrier in various sectors. Greenstat is currently in dialogue with dozens of different initiatives, all of which can result in commercial projects for green hydrogen production and supply. This applies to projects in the transport, maritime and industrial sectors.

GREENSTAT

greenstat.no

Commercialization

Components

R&D

Services

Portable

Stationary

Transportation

Control systems

Distribution

FC/ICE

Production

Storage

System Integration



H2CARRIER AS

H2Carrier is the designer and owner of a proprietary floating energy production and storage system, the P2XFloater™, an industrial-scale floating green hydrogen and green ammonia facility. The concept is based on proven floating production, storage and off-take technologies from the oil & gas industry. The design has a fully integrated electrolyser and Haber–Bosch system. H2Carrier will build, own/lease and operate a fleet of P2XFloaters™. The company has developed the P2XFloater™ concept in close co-operation with leading maritime and process engineering companies in Norway, thus building on decades of experience and competence from the oil & gas sector, the maritime industry, and the offshore wind installation industry.

h2carrier.com

Commercialization

Components

R&D

Services

Portable

Stationary

Transportation

Control systems

Distribution

FC/ICE

Production

Storage

System Integration



Pushing Performance
Since 1945

HARTING

HARTING is a family-owned German company and a world leader of manufacturing Industrial connectivity solutions. More than 75 years of experience with a great engineering innovation strength.

We deliver efficient energy saving connectivity solutions for hydrogen market. Standard components as well as custom made cable harnesses for power, signal, and data communication.

High power pcb connectivity and high-speed data transmission solutions for indoor and rugged environments.

We are engaged in various hydrogen projects including projects for ferries and coastal cargo carriers, hydrogen trucks and buses as well for stationary backup power solutions.



harting.no

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
	APPLICATION	Portable
		Stationary
		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration



Hexagon Purus ASA

Hexagon Purus is a global leader of zero emission mobility solutions. We produce high-pressure Type 4 composite cylinders, hydrogen fuel systems and hydrogen distribution systems. Our offering also includes the complete vehicle systems and battery packs for fuel cell electric and battery electric vehicles.

Our type 4 composite cylinders' lightweight, corrosion resistance and long lifetime, reduce operational costs and total cost of ownership – and in sum makes them ideal for storing hydrogen.

Hexagon Purus has pioneered hydrogen fuel systems in the automotive industry and our solutions are in operation across a wide range of mobility applications, such as heavy-duty trucks, transit buses, trains, light-duty vehicles and even on a snow groomer. We are now taking our experience from the automotive industry to accelerate and develop hydrogen fuel solutions in the maritime industry. In order to serve this market, we have established an own company – Hexagon Purus Maritime AS – which purpose is to apply already existing technology into maritime use applications, either being as hydrogen fuel storage or sea transport of hydrogen.

hexagonpurus.com

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Hoerbiger Service Nordic AS

HOERBIGER – a global leader in performance defining components for reciprocating compressors. Our products, services and solutions enable our customers and partners from various industries to improve the performance and safety of their products and operations, save energy, and reduce emissions. This is how HOERBIGER enables change. For a better tomorrow.

Together with our partners, HOERBIGER is on a mission to deliver the most cost-efficient and flexible hydrogen compression package available. To allow wide use of hydrogen for mobility applications and trailer filling, equipment must be able to evolve from small demonstration projects into industrialized and efficient solutions, enabling you to meet your total cost of ownership expectations. Reciprocating compressors play a key role in reaching this goal. Together with Ariel, we have the technology to enable the most economic and reliable package for high pressure hydrogen compression.

HOERBIGER – advancing sustainability together.



[hoerbiger.com](https://www.hoerbiger.com)

Commercialization

Components

R&D

Services

Portable

Stationary

Transportation

Control systems

Distribution

FC/ICE

Production

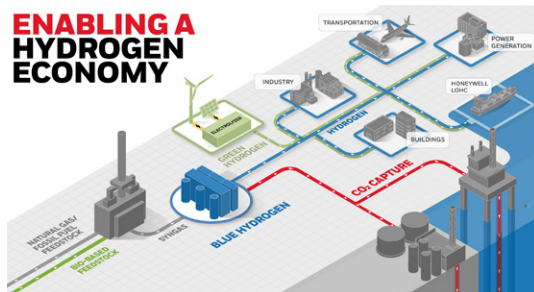
Storage

System Integration

Honeywell AS

Honeywell is very well known world wide for our automation and control capabilities, particularly with large and complex projects and as the hydrogen supply chain matures, the ability to deliver these new large and green hydrogen related projects will be key.

Honeywell has established a significant presence in the hydrogen industry, leveraging its extensive expertise in advanced materials and technologies. Ready now, Honeywell offers many paths to consider across the Hydrogen economy, no matter where you are in your carbon neutral journey. We have been providing innovative hydrogen processing solutions for more than 50 years.



Honeywell

honeywell.com

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Horisont Energi AS

Horisont Energi (EURONEXT: HRGI) is a Norwegian clean energy company that will provide clean energy and carbon transport and storage services. Horisont Energi will transform water, renewable electricity and gas into clean ammonia and hydrogen and offer CO₂ transportation and storage solutions using proprietary technology, paving the way for a low carbon economy. The company was founded in 2019 and is headquartered in Sandnes, Norway.

Our mission is to accelerate the transition to carbon neutrality through pioneering projects.

Barents Blue project will be Europe's first world scale clean ammonia plant with best-in-class life-cycle carbon footprint, achieved through carbon capture in excess of 99% and other measures. We have signed a joint development agreement with the Spanish ammonia specialist Fertiberia for the realization of Barents Blue.

Managing Director and founder in Horisont Energi:
Björgulf Haukelidsæter Eidesen



horisontenergi.no

HYDROGEN CHAIN	ACTIVITIES
	Commercialization
	Components
	R&D
	Services
	APPLICATION
	Portable
	Stationary
	Transportation
	Control systems
	Distribution
	FC/ICE
	Production
	Storage
	System Integration



H Y 2 G E N

Hy2gen

Hy2gen develops, finances, builds, and operates plants to produce green hydrogen, green ammonia, and hydrogen-based e-fuels worldwide. Currently, the company has activities in France, Germany, Norway and Canada, and the first green hydrogen will be produced later this year.

A \$200 mln funding round was completed last year, which was the world's largest private investment in green hydrogen. The investors included both strategic partners and financial investors, setting the company up for further growth and capability to develop large projects. Hy2gen has a team with deep technical knowledge and has strategic access to a global network of leading commodity traders and industries for offtake.

Norway is a key country for Hy2gen, and the company sees a large potential to decarbonize maritime and industrial sectors and export to the European market. The company is currently developing a large-scale green ammonia project in Sauda together with partners CIP and Trafigura and will continue to pursue more opportunities in Norway.

hy2gen.com

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

HydePoint AS

HydePoint is providing a solution to optimize the value of offshore wind farms by allowing for large scale hydrogen production from wind power.

Offshore wind resources will become a significant source of renewable energy. However, the current onshore grids are not prepared to receive neither the large amounts of power nor the peaks expected from renewable energy sources. It will require significant and long-term infrastructure investments to allow full utilization of power from new wind resources without curtailment limiting full wind farm production.

HydePoint is an **offshore hydrogen producing substation** which can utilize wind resources efficiently and allow new wind farms to be located where the wind resources are strongest, even though the grid infrastructure is poor or missing. It is an unmanned, modularized, and industrialized platform which can be delivered both to floating or bottom fixed wind farms, and it can convert wind power fully or partly to hydrogen. If a HydePoint is connected to an onshore grid, it can also help balancing the overall power systems, and improve the total energy system utilization.



Commercialization

Components

R&D

Services

Portable

Stationary

Transportation

Control systems

Distribution

FC/ICE

Production

Storage

System Integration

HydraServ AS

Supplier of High-Quality Regulators, Fittings, Valves tubing and other process and instrumentation parts for Hydrogen applications.

Hydrogen Fuel Cell Pressure Regulators from ultra-lightweight regulators (down to 200g) and onboard vehicle regulators, to high-pressure refuelling solutions and self-closing cylinder valves, the product portfolio covers a wide range of applications on Hydrogen service. This includes the EC79 approved AUTO438 for hydrogen powered buses and trucks.

The extensive approval process put the AUTO438 through over 100,000 cycles – this equates to 10 years lifetime on a typical installation.

HydraServ

hydraserv.no

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Hydro Havrand

Hydro Havrand offers green hydrogen made from renewable energy to help bring the world to net-zero emissions. We develop, operate and own green hydrogen facilities, and provide our industry and energy expertise to customers within heavy industries, maritime sector and heavy transport to enable them to transition to renewable energy.

Hydro Havrand has partnership agreements in place with Hydro and with Speira, previously Hydro Rolling, which gives us access to a global network of sites with large predictable offtake and competitive power sourcing agreements. This also gives us a significant offtake platform to scale from so that we can offer green hydrogen to industries beyond these two companies' international footprint. To achieve this, we will often work with partners so that we can build projects at scale, bring together experience and capabilities to enable new value chains and drive down costs.

Hydro Havrand is an industrial venture with global ambitions, building on our owner company Hydro's 115 years of experience within renewable energy and industrial development.

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
APPLICATION		Portable
		Stationary
		Transportation
HYDROGEN CHAIN		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

HydrogenPro AS

HydrogenPro designs and supplies customized hydrogen plants in cooperation with global partners and suppliers, all ISO 9001 certified. Hydrogenpro are being ISO 9001:2015 (QMS), 14001:2015 (EMS) and 45001:2018 (HS) Certified.

The Company was founded in 2013 by individuals with background from the electrolysis industry which was established in Telemark, Norway by Norsk Hydro in 1927. We are an experienced engineering team of leading industry experts, drawing upon unparalleled experience and expertise in the hydrogen and renewable energy industry.

Our core product is the alkaline high-pressure electrolyser. With our new electrode technology, we are able to increase the efficiency of each unit by 14 % to reach 93 % of the theoretical maximum. This is a significant step forward as the cost of electric power, depending on market prices, amounts to 70–90 % of the cost of producing hydrogen, the value of such increased efficiency equals approximately the investment cost for the entire plant in a Total Cost of Operation perspective.

The Company is targeting a production cost for green hydrogen of USD 1.2 per kg in 2022.

Hydrogen pro

hydrogen-pro.com

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
	APPLICATION	Portable
		Stationary
		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration



Hydrogen Solutions AS (HYDS)

The aim of reducing emissions and ensuring access to clean green energy, is an essential part of HYDS' business model. HYDS covers all the essential stages in production of green hydrogen, such as research and development, project execution, plant ownership and plant operation.

HYDS designs and develops hydrogen production plants with an emphasis on safety, standardisation, and scalability. The approach primarily involves utilising prefabricated container modules containing sub-components of the production plants. Stord Hydrogen is HYDS' first hydrogen plant in operation, producing compressed green hydrogen to costumers in transport, construction, industry, and the maritime sector.

HYDS has been responsible for development, engineering, procurement, construction, and installation including design and control of the green hydrogen plant at Kaupanes. The plant opened 8 February 2024 and HYDS is managing the day-to-day operations, asset management and customer agreements.

HYDS manages customer experiences and utilises our unique hydrogen plant control system including the nominations module for customers to book and organise hydrogen offtake. HYDS' plants are remotely monitored 24/7 through the operation centre.

HYDS has secured a range of production sites and is actively participating in several tenders and project possibilities within green hydrogen and hydrogen derivatives.

hyds.no

HYDROGEN CHAIN	ACTIVITIES
	Commercialization
	Components
	R&D
	Services
	APPLICATION
	Portable
	Stationary
	Transportation
	HYDROGEN CHAIN
	Control systems
	Distribution
	FC/ICE
	Production
	Storage
	System Integration



Hynion AS

Hynion AS is an experienced Hydrogen fuel provider and possesses and has Know-How in hydrogen production and purification, as well as in design, building, certification, and operation of hydrogen refuelling stations. The company builds on experiences from the last 20 years, including world-leading projects such as HyNor, CUTE, Utsira wind/hydrogen, CEP Berlin, SHHP, NewBusFuel and H2ME. The company's management also has extensive experience establishing and operating start-up companies and years of experience in the automotive industry.

Hynion operates hydrogen stations in Sweden and Norway, where the Oslo station at Høvik outside Oslo is among the busiest hydrogen stations in Europe. The company has an ambitious plan to establish more stations for trucks and cars in the next few years.

Hynion is listed at the Oslo Stock Exchange, Euronext Growth with the ticker HYN.



hynion.com

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
APPLICATION		Portable
		Stationary
		Transportation
HYDROGEN CHAIN		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Hyrex AS

Hyrex is revolutionizing the boating industry with cutting-edge hydrogen technology that will change the way boats are powered. Our mission is to provide boat owners with a superior boating experience that's environmentally sustainable, without compromising on performance or reliability.

With our hydrogen fuel cell range extender, boats can integrate a battery pack for short trips, providing a zero-emission, electric boating experience. Our modular setup, the HyBoost range extender, can be scaled to different sizes of boats and vessels, making our technology accessible to boat owners worldwide.

We are not just another company, we are a movement towards a cleaner, more sustainable future. At Hyrex, we are passionate about offering a way to experience the sea that's both luxurious and eco-friendly. Join us on this journey towards a brighter, more environmentally conscious future, and experience the thrill of boating with a clear conscience.

Our commitment to innovation and growth means that we are always developing new boat models and technology that take full advantage of our revolutionary system. With Hyrex, you are not just buying a boat, you are investing in a sustainable future.



hyrex.no

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Hystar

Hystar makes highly efficient PEM electrolyzers for the large-scale production of green hydrogen. Hystar's patented technology has a key role to play in decarbonizing hard-to-abate sectors and Hystar is scaling quickly to meet demand. With its game-changing technology, Hystar is a leader in achieving a greener, more sustainable future.

Located in Høvik, Norway, Hystar has an Innovation Centre, supporting its R&D and manufacturing capabilities. And by 2026, Hystar's first automated GW manufacturing facility will be fully operational at this site. As a spin-off from SINTEF, a leading European research organization, Hystar has 15+ years of research into PEM technology. Hystar's technology has been proven to use significantly less energy than conventional PEM electrolyzers, enabling a substantial increase in hydrogen production output.

Hystar is backed by significant global investment bodies, including AP Ventures, a major investor in breakthrough hydrogen technologies, SINTEF Ventures, the investment fund of the SINTEF research institute, Firda, a pioneering early-stage investor in Norway, as well as other notable names including Mitsubishi, Nippon Steel, Finindus, Trustbridge, and Hillhouse.



hystar.com

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
	APPLICATION	Portable
		Stationary
		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Hystorsys AS

Hystorsys AS develops and manufactures hydrogen storage and compression systems based on metal hydrides (MH).

The company is based on the long-term research expertise of Institute for Energy technology (IFE), and thus possesses experience on the complete hydrogen chain from fundamental understanding of hydrogen-metal interactions to their use in hydride-based energy systems.

MH-compression:

MH-compressors enable compression of ultra-clean hydrogen without the need of a high-quality energy carrier such as electricity, exploiting heat (e.g. industrial waste-heat) for compression. Furthermore, thermal MH-compressors have a minimum of moving parts giving long maintenance intervals.

MH-storage:

One of the main advantages of MH-storage is high hydrogen density at low pressures. Some metal hydrides have volumetric storage densities higher than liquid hydrogen, without the need of maintaining a low (20 K) temperature. In the MH-system hydrogen is chemically bound – thus, not volatile or mortgaged with boil-off. The MH-system eliminates the need for expensive high-pressure compression, and has the property of an intrinsic safe system.

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
HYDROGEN CHAIN		Storage
		System Integration

Haakon Ellingsen AS

Haakon Ellingsen AS delivers a wide range of quality products within valves, actuation, filtration, and instrumentation. We supply fully assembled and tested solutions for pneumatic, electric, and hydraulic systems. We perform installation, maintenance, and service of all our products.

Haakon Ellingsen AS has offices and workshop facilities in Oslo, Bergen and Stavanger and our main markets are oil & gas, marine and general industry. Our product portfolio consists of a combination of self-produced products and products produced by our international partners.

Hydrogen is one important part of Haakon Ellingsen AS future strategy to expand our business into green energy and we are working close with our partners to develop products along the complete value chain. Filtration, level indication and valve systems are important products needed for different type of applications in the hydrogen chain. Our products are used for in production as well as utility systems.

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
	APPLICATION	Services
		Portable
		Stationary
	HYDROGEN CHAIN	Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Håland Instrumentering AS

Håland Instrumentering AS was established in 1999 by Terje Håland. And a large part of the colleagues in Håland Instrumentering has worked in the same team for more than 30 years.

The employees are the main value of the company. All employees are trained and experienced within their field. These are among others engineers with years of experience in sales and product responsibility in field instrumentation, fire & gas detection and valves. And we would like to share our product competence and market knowledge within disciplines piping, process, instrumentation, technical safety and mechanical with you as a customer. Several of our manufacturers have long experience for their products in the Hydrogen market.

Rheonik have a long history deliver mass flowmeters for H2 into the marked, MSA deliver several principles of gas detection for H2, and we also have control valves for the same purpose.

We also doing sales and service with Distran ultrasonic instrument for detection leakage of any gasses, including Hydrogen. In addition, Håland Instrumenting supply a lot of other instrumentation needed for process plants.



HYDROGEN CHAIN	APPLICATION	ACTIVITIES
	Commercialization	Components R&D Services
	Components	
	R&D	
	Services	Portable Stationary Transportation
	Portable	
	Stationary	
	Transportation	
	Control systems	Distribution FC/ICE Production Storage System Integration
	Distribution	
	FC/ICE	
	Production	
	Storage	
	System Integration	

IFE – Institute for Energy Technology

IFE is an independent research foundation that has been involved in research on hydrogen for more than 70 years. The research at IFE is based on experimental activities and supported by advanced modelling. The main research focus is on hydrogen production by sorption enhanced reforming and water electrolysis (alkaline and PEM), hydrogen storage in metal hydrides, fuel cells (PEM) and hydrogen energy system analysis. IFE also specialize in other areas relevant for hydrogen: Multiphase flow, liquefaction and cooling technology, material integrity, hydrogen embrittlement, instrumentation and level monitoring, man-machine, risk and safety.

IFE also do research related to ammonia production and cracking and large-scale underground storage of hydrogen. As a leading research institutes in Norway on batteries, wind and solar power IFE also has have in depth competence on renewable energy and hydrogen system integration and optimization. IFE work in depth on the material side to increase safety, sustainability, energy efficiency and to reduce investments and operation cost of within the hydrogen value chain. IFE is the host for FME MoZEES, a national research on environment-friendly research with focus on zero emission energy systems for transport using battery and hydrogen technology (mozees.no). Using several relevant national research infrastructures.

ife.no

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
APPLICATION		Portable
		Stationary
		Transportation
HYDROGEN CHAIN		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Industri Energi

Industri Energi is a national union under the trade union confederacy LO. We have 56000 members within the oil and gas industry, pharmaceutical industry, aluminium and other chemical and metal producing industries. Industri Energi is the largest union in some of the largest Norwegian companies like Equinor, Hydro, Yara, and Ekornes.

Norsk Hydro started hydrogen production in Norway in 1927, we have organised the workers in hydrogen production in Norway from the very start. Industri Energi organises the operators working in present-day hydrogen companies. Our policy is that hydrogen and ammonia is critical to make the necessary steps towards a green future. Both to transform the petroleum sector and to reach the next milestones in making our other sectors climate neutral and carbon negative.

Industri Energi is working actively towards policymakers and the government to ensure that hydrogen gets the necessary framework to be competitive in Norway on a global scale. We do this in the culture for collaboration and teamwork that we call «The Norwegian model». Where the government, the representatives of the workers and of the companies working together.



industrienergi.no

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
HYDROGEN CHAIN		Storage
		System Integration

Jarotech AS

Jarotech AS have more than 40 years' experience in oil and gas combustion engineering. From heavy fuel oil in 1984 to the first hydrogen burner in 2006. In between, and still, we supply burners, combustion chambers, boilers, flares for all type of gas like hydrogen, natural gas, propane, CO, syngas and other. Our experienced engineering team can supply burner for hydrogen and combustion air as well as 100% hydrogen and oxygen. Especially for the melting industry we have supplied oxy-fuel burner system for rotating kilns and ladles. In our control system we use combination of safety PLC and TÜV/PED/CE approved equipment.

We design and supply complete system from piping, airducts, burners, FMS/control system and flame scanner like UV-IR-Ionisation. Furthermore, hydrogen approved gas train with burner shut-off and control valves, SAV/SBV (Safety shut off valve and Safety Blow off valve). We supply components from acknowledge and recognized Europe and US suppliers.



jarotech.no

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
	APPLICATION	Portable
		Stationary
		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration



J.S.Cock AS

J.S.Cock has been supplying valves, actuators and instrumentation to the Norwegian offshore industry since the early 1970s and valves in general since 1897. Our vision for the future is to provide the same range of products to the hydrogen industry and become a preferred supplier.

Our company already represents several manufacturers who have been heavily investing in developing products for the hydrogen industry for many years. Based on our own experience in supplying products and knowledge to a demanding industry with high expectations to quality, we are confident that we will also become a first-class supplier to the fast-growing hydrogen industry.

Currently, we can supply a wide range of control valves and on/off valves in all types of materials and pressure classes. Our valves are fire-tested and certified, and cryogenic performance and functionality are type-approved by well-known certifying bodies. Cryogenic testing can be performed in-house without any size limitation and down to -196°C.

We can also offer a wide range of instrumentation to the hydrogen industry. This includes everything from flow, pressure, level and temperature to pH, oxygen, conductivity, viscosity and turbidity measurements.

jsc.no

Commercialization

Components

R&D

Services

Portable

Stationary

Transportation

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Distribution

FC/ICE

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System Integration



JUMO AS

Your partner for components, systems and solutions "from sensor to cloud".

JUMO is a leading system and solution provider in industrial sensor and automation technology. Components for the measuring ranges temperature, liquid analysis, pressure, level, flow, and humidity, as well as products for registration, monitoring, control, and automation, are used to create complete systems for a wide range of industries.



jumo.no

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
APPLICATION		Portable
		Stationary
		Transportation
HYDROGEN CHAIN		Control systems
		Distribution
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		Production
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		System Integration

Justervesenet – Norwegian Metrology Service

Justervesenet is the National Metrology Institute of Norway, ensuring global acceptance of Norwegian measurements, providing metrology services and R&D. Justervesenet is also the national regulator for metrology and a notified body for MID and NAWI directives in Norway. Justervesenet works to ensure sufficient traceability and accuracy of hydrogen measurements in the Norwegian industry and society. This traceability is ensured by new metrological solutions, including a newly developed gravimetric primary standard for verifying light-duty hydrogen refueling stations.

Justervesenet continues to be an active participant in two ongoing and one approved research projects aiming to increase the Norwegian measurement capabilities within hydrogen. The projects are financed through EURAMET – the European Association of National Metrology Institutes and their associated research programs, including the current European Partnership on Metrology. The projects are aimed at specific hydrogen applications (light and heavy-duty hydrogen vehicles), new technologies for hydrogen measurements (sonic nozzle technology) and in ensuring traceability for the entire European hydrogen value chain.

Justervesenet is a leading expert in hydrogen measurement in Northern Europe, and is an independent source of metrological expertise available to all interested parties in both Norway and elsewhere.

Justervesenet



justervesenet.no

Kunnskapsbyen Centre of Innovation

Kunnskapsbyen Centre of Innovation connects cutting edge research from local research institutions, visionary energy companies and progressive local environmental policies, and facilitates public-private projects – which are locally beneficial, but also an integral part of both national and international hydrogen projects.

Kunnskapsbyen Centre of Innovation is co-located with the secretariat of The Norwegian Hydrogen Forum. We are also a partner with the Nordic national hydrogens associations in the Next Wave project on Hydrogen infrastructure for trucks and busses, financed by the Nordic Council of Ministers through Nordic Innovation. Kunnskapsbyen Centre of Innovation is the Norwegian lead partner of the Interreg project Cleancon – Clean Construction Machinery.



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Lhyfe

A Sustainable company – Lhyfe is an innovative company founded in 2017 with its headquarters in Nantes, France. The vision behind the company is to change things today, not tomorrow for the future of our children and grandchildren.

Lhyfe invests in, develops, constructs and operates innovative hydrogen production plants using renewable electricity to produce at industrial scale with a positive impact. The first onshore plant was inaugurated Sept-2021 and the first offshore plant will be in operation Sept-2022. Lhyfe is active in many European countries with a team of 80 people, with a growth to 160 people by the end of 2022.

Lhyfe is developing a unique hydrogen production know-how:

- **Renewable and sustainable Solution:** designed to be directly connected to renewable and intermittent energy sources.
- **Modular Solution:** plants designed in a modular way integrating the best technologies on the market.
- **Flexible Solution:** architecture and control system designed for flexible and intermittent operation of the entire system for optimal efficiency.
- **Intelligent Solution:** Our unique control system integrates flexible production, logistics/offtake. The system is data-based and is continuously improving.
- **Optimized financial solution:** internalized competences in project financing as well as optimizing support, to propose the lowest renewable hydrogen cost.

lhyfe.com



HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
APPLICATION		Portable
		Stationary
		Transportation
HYDROGEN CHAIN		Control systems
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		Production
		Storage
		System Integration



Making our world more productive

Linde Gas AS

At Linde, we have been harnessing the power of hydrogen for over 100 years, and clean hydrogen is a cornerstone of our clean energy strategy. Hydrogen has been one of our fastest growing molecules for the past 10 years, and today we generate around USD 3 billion per year of global revenue through our hydrogen activities.

Linde offers technology and expertise throughout the whole hydrogen value chain; Electrolysis for green hydrogen production, cutting-edge fueling technologies for the mobility and marine sector, carbon capture technology for use and storage, hydrogen liquefaction technology for storage and transport, hydrogen pipeline services and storage of hydrogen in underground salt caverns as examples.

To continue our growth, we will use our integrated asset network, execute locally driven and focused strategies, and continue to advance and grow our technology leadership across the value chain. In addition, we are actively identifying and developing collaborations to accelerate opportunities.

linde.com

HYDROGEN CHAIN	ACTIVITIES
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Litra AS

Established in 1917, and with over 100 years experience, Litra group still reach for the best of quality and security in the transport market.

We operate primarily in the Scandinavian market, and offer the market transport of food / thermo goods , energy and industrial gases, and dry/wet bulk products, and we are specialized in dangerous goods.

In the Litra Group there are several high recognized daughter companies, and our strength is high quality, high safety level, large volumes, specially adapted solutions, and finding sustainable solutions.

We currently have over 320 heavy trucks with a total weight of 50–60 tonnes, of which 40 of these trucks use biogas as fuel.

Our activity generate over 38 mill km every year, and our goal is to strongly reduce our emissions, and we are absolutely certain that hydrogen will be an important part of achieving this goal.



litra.no

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
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HYDROGEN CHAIN		Storage
		System Integration

MANA Group AS

MANA is part of the NG Group, one of the leading companies within waste management in the Nordics. Established in 1926, NG Group today handles more than 2.3 million tons of waste annually, from over 40,000 customers.

MANA was created to increase the value of different waste streams and are currently working on four various projects representing different high value products from waste. MANA is uniquely positioned to disrupt the waste sector and pioneer waste valorization solutions together with partners. We have access to feedstock at scale, in-depth competence on sorting, a strong combination of engineering, waste management experience, and business competence, and we have robust and patient financing.

One of the four projects explores the possibility to produce high quality hydrogen gas based on un-recyclable waste with the use of waste gasification. The result will be increased value of the residual waste as well as produce an attractive product such as hydrogen. MANA is currently working on establishing such production plants in Norway and further expansion to the rest of the Nordics and Europe.

MANA

PART OF THE NG GROUP

managroup.no

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
APPLICATION		Portable
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HYDROGEN CHAIN		Control systems
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Meraker Hydrogen

Meraker Hydrogen is a private company based in Kopperå, Norway. The core business is the production of green hydrogen from available local hydropower. The hydrogen production will be produced, on the formerly known microsilica plant Elkem Meraker, which has a history back to 1898. The planned hydrogen plant is located close to the Swedish border and 1hr east by car of Trondheim. The plant's location can utilize the largely available hydropower and reduce the transmission losses related to the power lines to end-market.

Meraker Hydrogen is owned by large industrial owners such as NTE, Greenstat, Gen2 Energy, Aker Clean Hydrogen, and local investors. All owners are active players in hydrogen projects and bring valuable expertise to Meraker Hydrogen.

The main market for Meraker Hydrogen is the regional market in both Norway and Sweden in market segments such as transport, industry, railway, and maritime. In addition, Meraker Hydrogen is active in helping businesses accelerate their zero-emission initiatives and taking an active role in the region in facilitating the green shift.



merakerhydrogen.no

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NAPOP AS

We are Not A Part Of the Problem – rather a part of the solution – being your roadmap to fossil freedom!

NAPOP provide technologies for producing grid independent electricity by means of the fuel-cell based Energy Station (ES) as well as heat, using NAPOP's catalytic combustion technology (CTC) – targeting mobile and temporary requirements, e.g. the building and construction sector. Ours catalytic combustion technology (CTC) is also available for serving larger heat/ thermal requirements in industries in general.

All by the use of Hydrogen – the wonderful future energy carrier.

Through our daughter company, VIRIDIH2 AS – we will supply green Hydrogen and establish Hydrogen infrastructures catering for Hydrogen requirements and associated services in our focused markets; production, intermediate storage, transportation, supply (pressure/ volume management) and conformity.

NAPOP is involved in several Hydrogen projects aiming to demonstrate the maturity of Hydrogen technologies, breaking down any barriers obstructing its wider use with particular emphasis on Hydrogen safety.

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		Components
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APPLICATION		Services
		Portable
		Stationary
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		Distribution
		FC/ICE
		Production
HYDROGEN CHAIN		Storage
		System Integration

Nel Hydrogen

Nel has a history tracing back to 1927 and is today a leading pure play hydrogen technology company with a global presence. The company specialises in electrolyser technology for production of renewable hydrogen, and hydrogen fueling equipment for road-going vehicles. Nel's product offerings are key enablers for a green hydrogen economy, making it possible to decarbonise various industries such as transportation, refining, steel, and ammonia.



nelhydrogen.com

HYDROGEN CHAIN	APPLICATION	ACTIVITIES
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		Components
		R&D
		Services
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NORCE Norwegian Research Centre AS

NORCE is one of Norway's leading research institutes. We are present along the entire Norwegian coast, and conduct interdisciplinary research for both public and private sectors. Our researchers focus on how to enable and speed up the green energy transition with hydrogen as one of the key components. We help stakeholders with the insight, modelling and monitoring needed to understand, validate and make informed decisions on viable developments and investments within hydrogen.

NORCE hosts a centre for hydrogen value chain research called HyValue. The centre is a collaboration between more than 50 partners from research, industry and public sector. HyValue are looking at hydrogen production, distribution, use, regulations, safety, and commercialization. We aim for safer, greener and more efficient hydrogen production that both industry and society can trust. NORCE core hydrogen business is applied research in the following topical areas:

- Microbial hydrogen production
- Geological storage of hydrogen
- Distribution and metering of hydrogen
- Hydrogen for maritime transport
- Industrial use of hydrogen
- Hydrogen in the energy system
- Microbial use of hydrogen and fermentation
- Public acceptance and social embeddedness of hydrogen technologies

norceresearch.no



Commercialization

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Nordkraft

Nordkraft is developing sites for power intensive industries in Northern Norway, including sites suitable for hydrogen production. Our aim is to offer ready-to-build sites and to be a facilitating partner within regional, power and site specific matters. Several of our sites are well suited for hydrogen (or ammonia production), offering good logistics with closeness to harbour facilities and process water.

All of our sites are situated next to strong grid connection points with available power capacity. The sites are located in Northern Norway, which has the lowest estimated power prices in addition to the lowest grid fees in Norway.



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Norwegian Hydrogen AS

Norwegian Hydrogen AS builds and operates a comprehensive network of production sites and distribution systems for green hydrogen throughout the Nordics, tailored to meet the future requirements for zero-emission energy in a wide range of mobility sectors and industrial segments.

The company is supported by strong industrial owners, such as Flakk Group, Mitsui & Co., Fortescue, Ltd, Hexagon Purus, aquaculture major Hofseth International and hydropower company Tafjord.

Norwegian Hydrogen's head office is in Ålesund, Norway, and they also have offices in Oslo, Helsinki, Copenhagen and Stockholm.

Norwegian Hydrogen manages a substantial pipeline of projects and activities, with two projects ready for production start in 2024: Grøn Brint in Hjørring, Denmark, with innovative technology using hydrogen in liquid biogas production, and Hellesylt Hydrogen Hub by the UNESCO World Heritage Geirangerfjord in Norway.

Their fully owned subsidiary Vireon is a hydrogen refueler for heavy-duty transportation in the Nordics, currently developing and building infrastructure across Norway, Sweden, Denmark, and Finland.



norwegianhydrogen.com

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NTE Hydrogen AS

NTE Hydrogen, a subsidiary of Nord Trøndelag Elektrisitetsverk (NTE), stands as Norway's first green hydrogen provider for the maritime industry. Strategically located at industrial locations along the Norwegian coastline, our development locations holds the potential of 250MW production capacity.

As a participant in the EU Hydrogen Valley Mid Norway initiative, we are committed to building comprehensive value chains for green hydrogen in Norway. Our partnerships ensure product sales, distribution, transformation of hydrogen into derivatives like ammonia, and peak HSEQ in every link of our value chain.



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		Components
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APPLICATION		Services
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NTNU – Team Hydrogen

NTNU Team Hydrogen, founded by Professor Bruno G. Pollet and now led by Professor Nicola Paltrinieri, is a team of world experts on Hydrogen energy. The team consists of professors and researchers from different disciplines, departments and faculties across NTNU that works within the Hydrogen R&D value chain, from the development of materials and systems (mobility and stationary), to hydrogen health & safety, life cycle analysis and technico-economic assessments. NTNU has excellent state-of-the-art hydrogen, fuel cell and electrochemical laboratories as well as cleanrooms for micro- and nanofabrication and ex-situ physical characterization techniques.

We are also educating and training research leaders, innovating, providing solutions and stimulating the industry. NTNU Team Hydrogen works in line with NTNU's vision: Knowledge for a better world, the Norwegian and European Hydrogen Strategies and the United Nation's 17 Sustainable Development Goals.



ntnu.edu/energy/hydrogen

Norwegian Maritime Authority

The Norwegian Maritime Authority (NMA) is the administrative and supervisory authority in matters related to safety of life, health, material values and the environment on vessels flying the Norwegian flag and foreign ships in Norwegian waters. The NMA is subordinate to the Ministry of Trade, Industry and Fisheries and the Ministry of Climate and Environment. Our activities are governed by national and international legislation, agreements and political decisions.

Hydrogen could play an important role in the green shift. It is important for the NMA to be involved when new technology is developed, in order to ensure that the technology is safe, reliable and ready for marine use. Hydrogen challenges existing prescriptive regulations, and vessels fuelled by hydrogen will therefore need approval through a risk based design approval process.

The NMA is a visible and recognised participant in the international maritime regulatory work. The NMA will, together with the industry, contribute to making Norwegian innovation and solutions the standard in the international maritime regulatory work.

Norwegian Small Hydropower Association

The Norwegian Small Hydropower Association is the national organization for companies who build and operate small hydropower stations. Since year 2000 there has been built 750 such plants scattered all over the country where you will also find good potential for H₂-consumption and customers. Each of these new plants have an installed effect beneath 10 MW and all together they represent a yearly production of 5 TWh.

The small hydro industry consists mainly of entrepreneurs who are searching for new business opportunities. That's probably why our association is the first player among Norwegian organizations for electricity producers who has started to work systematically with exploring H₂ production as a new business area for its members. Among other projects we also have a R&D-project running over three years with the The Norwegian Water Resources and Energy Directorate.

Our main focus is how hydrogen can play a role in improving the Norwegian power system. We are looking into how the grids problems with peaks in consumption, capacity constraints and production can be reduced and thereby also downsize the need for grid investments. From the electricity producers point of view hydrogen production can generate added values in periods with low prices and high production.

OTECHOS AS

OTECHOS is an experienced company with roots back in industrial engineering and commercialization of new products within the energy sectors. We follow our innovative and environmentally friendly products from the early stage of idea to their specific markets. The company draws benefits from long experience and from being a small and flexible environment for creativity and knowhow.

OTECHOS CR-Technology is especially well suited for H2 compression as the compressor is oil-free, no contact of surfaces in compressor chamber, no inlet valves and no discharge valves. The main features of our H2 compressor are listed below:

Efficient

- Water sealing fluid provides sufficient cooling for nearly isothermal compression process
- Extended precision boundary zone with water sealing minimizes reverse flow even with small molecule gases
- Low internal friction due to non-contact compression chamber sealing
- High output per revolution
- 8 compression cycles per revolution

Reliable / low-maintenance

- No contact of surfaces in compression chamber
- No inlet valves and no discharge valves

- Low temperatures maintained for all components (isothermal compression)

Clean

- Process is not contaminated by oil or particulates

Liquid tolerant

- The compressor tolerates several volume percent liquid in the gas

Allows for system simplification

- The special features of the CRCP compressor allows for various system simplifications

Commercialization

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Parker Hannifin AB NUF

Parker is your global partner and key component supplier of technologies for applications throughout the hydrogen value chain.

With decades of experience in hydrogen including the Apollo 11 Mission we deliver many key components including a vast range of filtration solutions, water production/separation, sealing/shielding, nitrogen generation, dryers, sensors, coolers, piping & fluid connectors, instrumentation and more besides.



parker.com

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
APPLICATION		Portable
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HYDROGEN CHAIN		Control systems
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PowerCell Group

PowerCell Group develops and produces fuel cell stacks and systems with a uniquely high power density for aviation, marine, power generation, off- and on-road applications. Our products run on pure or reformed hydrogen and generate electricity and heat without any emissions other than water vapor. We have an extensive IP portfolio based on more than 25 years of innovation and are dedicated to supporting our customers in their transition to zero-emission operations. As a leader in hydrogen electric solutions, we contribute to an emission-free, more sustainable world. For more information about the company and our hydrogen electric solutions, please visit our website.



PowerCell Group

powercellgroup.com

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
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	APPLICATION	Services
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Provaris Norway AS

Provaris Energy is a developer of integrated green hydrogen projects for export to regional markets through the simplicity and efficiency of compressed hydrogen. Compression is a proven, safe and reliable method of storing and transporting hydrogen and is already used in the upstream and downstream hydrogen applications.

Energy efficiency should be the goal of all carriers of renewable energy. The energy efficiency of compression is supported by project feasibility level studies which demonstrate compression can improve the conversion efficiency by a factor of 8–10 when compared to liquid or chemical carriers. The outcome being we use less renewable energy when transported and sold as gaseous hydrogen.

Our proprietary Class approved hydrogen carriers store, transport, and deliver hydrogen in a gaseous form. Compressed hydrogen is a modular solution, that can accelerate the development of greenfield export projects due to the minimal technical barriers, small environmental footprint and flexibility to load follow the renewable energy profile. Simplicity of the Provaris approach eliminates the need for capital and energy intensive processes to convert and reconvert hydrogen gas to a higher density carrier in liquid or chemical form.

Provaris Energy established Provaris Norway AS in 2022 in order to cover the European market.

HYDROGEN CHAIN	ACTIVITIES	Commercialization
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APPLICATION		Services
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Renewables Norway

Renewables Norway is a non-profit industry organization representing 400 companies involved in the production, distribution and trading of renewable electricity and heat in Norway. Norwegian power production is almost 100% renewable and emission-free. 95% of the power production stems from the 1600 hydropower plants, and 3.5% is generated from wind power.

Renewables Norway is working actively to improve the regulatory framework in which our member companies operate, both in Norway and in Europe. We are a member of Nordenergi, Eurelectric and Wind Europe. We aim to increase competence and promote the competitiveness of the Norwegian renewable industry for green value creation.

Renewables Norway values hydrogen as an important energy carrier for the renewable and all electric society. Several of our member companies are involved in ongoing and planned projects for production of green hydrogen for industrial applications, maritime transport and as an alternative to power grid investments.

Renewables Norway coordinates and manages R&D projects funded by power- and network companies and by The Research Council of Norway.

HYDROGEN CHAIN	ACTIVITIES	Commercialization
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		System Integration

SINTEF AS

SINTEF is Scandinavia's largest independent contract research organization. SINTEF develops and implements technological solutions in society and thereby creates value through knowledge generation, research and innovation.

SINTEF is a leading R&D and innovation actor in Europe within hydrogen technologies, with more than 30 years' experience and significant activities. Through participation in European projects with total budget of 300 M€ over the last decade, SINTEF has built leading competence in key hydrogen areas.

SINTEF's hydrogen projects include:

- Hydrogen production from natural gas & renewable energy sources
- Membrane technologies for hydrogen separation
- Hydrogen quality analysis and standards
- Hydrogen liquefaction and storage
- Fuel cell & electrolyser materials development
- System and component testing and validation
- Hydrogen combustion (gas turbines)
- Modelling from micro to macro level
- Well-to-wheel analyses, LCA and feasibility studies
- Safety, societal and political aspects
- Techno-economic and value chain analysis
- Business models and decision support services

Commercialization
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A/S Norske Shell

Shell is a global energy company with a 110 year long history in Norway. Looking back at many decades of experience with complex developments, technology projects and safe and reliable operations, Norske Shell now powers progress towards a better energy future. As a stable and reliable energy provider to Europe we are producing our natural gas in the safest, cleanest and most efficient way. We are also using our competence from oil and gas to realise more carbon capture and storage and create new opportunities in renewables and cleaner energy solutions.

Shell aims to help build a global hydrogen economy by developing opportunities to produce, store, transport, and deliver hydrogen to end customers. Currently, Shell owns and operates around 10 per cent of the global capacity of installed hydrogen electrolyzers and have started building Holland Hydrogen I, which will be Europe's largest renewable hydrogen plant when it enters operation in 2025. Shell sees a potential in hydrogen production in Norway with export to a growing European market, and we are currently pursuing several large-scale opportunities both in green and blue hydrogen.

shell.no

HYDROGEN CHAIN	APPLICATION	ACTIVITIES
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Skagerak Energi AS

Skagerak Energi is entering into the hydrogen area as a natural step for evolving the renewable Energy Group with today's core activities of hydropower, grid connection and district heating. Skagerak Energi is also heavily involved in the biomethane industry with Air Liquide Skagerak.

Skagerak Energi is involved in several hydrogen activities for industrial, maritime and land transport applications. The primary goal is to develop a market for hydrogen as part of a greener future.

With Skagerak Energi's position next to some of the largest industrial sites in Norway (Grenland) consisting of Herøya Industripark, Rafnes and Frier Vest, the placing is ideal to develop a hydrogen market related to these sites. Grenland is the area with the largest consume of hydrogen in Norway today.

Grenland Havn is the third busiest harbour in Norway with a lot of international and national maritime traffic to its several terminals.

Production, storage, and distribution will be the primary goal in the hydrogen value chain for Skagerak Energi.

Skagerak Energi also developing Mobile Energy solutions for various applications and hydrogen is a part of this development.

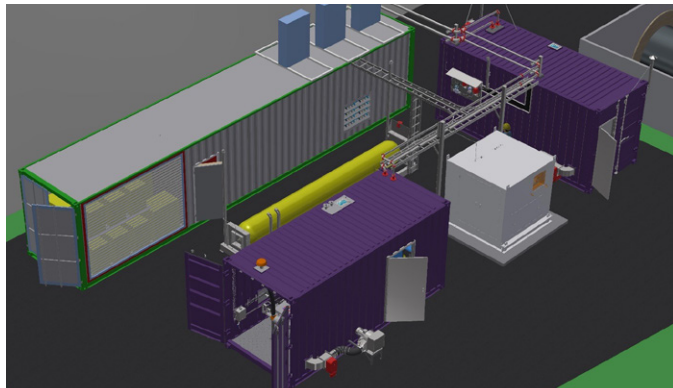


skagerakenergi.no

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
APPLICATION		Portable
		Stationary
		Transportation
HYDROGEN CHAIN		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Slåttland Group AS

Engineering and fabrication of different mechanical process solutions. Member of Deep Purple hydrogen consortium for development and engineering of mechanical concept.



HYDROGEN CHAIN	ACTIVITIES
	Commercialization
	Components
	R&D
	Services
	APPLICATION
	Portable
	Stationary
	Transportation
	Control systems
	Distribution
	FC/ICE
	Production
	Storage
	System Integration

Statkraft AS

Statkraft, the largest producer and trader of renewable power in Europe, have a strategy to be a producer and supplier of green hydrogen to industry and transport.

Green hydrogen will be an integrated part of the new energy market and support the hydro-, wind-, and solar- power development.

Statkraft will also be involved in other energy products like ammonia and methanol as long as renewable power and green hydrogen is the basis. In most projects Statkraft will seek partners to strengthen the business case.

Commercialization

Components

R&D

Services

Portable

Stationary

Transportation

Control systems

Distribution

FC/ICE

Production

Storage

System Integration

Swagelok Norway

Swagelok Norway (SVAFAS Stavanger Valve & Fitting AS) has been an authorized Swagelok sales and service center since 1975, providing solutions for all fluid systems within Norwegian industry.

Systems for applications involving the storage, transfer, and use of hydrogen requires components with advanced performance capabilities. It also requires a strong understanding of materials science, fluid system design best practices, and industry certifications, standards, and approval processes.

Swagelok Norway actively supports companies developing hydrogen technologies by providing the fluid system expertise and deep understanding of application requirements they need to compete effectively in a performance-driven, safety-focused market. Our stainless-steel components are designed to deliver the seal tightness, grip strength, thermal performance, corrosion resistance, ductility, and ease of assembly needed to make hydrogen vehicles and infrastructure viable.

Swagelok Norway can also provide the support needed to overcome design challenges, select components, and troubleshoot issues while developing fuel storage, transportation, and delivery systems. We also design and assemble subsystems and assemblies built to customers exact specifications, ready to be installed. Furthermore, we offer training on fluid system best practices, trends and technology, installation, and safety.

stavanger.swagelok.com/en



Swagelok Norway

Commercialization
Components
R&D
Services

Portable
Stationary
Transportation

Control systems
Distribution
FC/ICE
Production
Storage
System Integration



TECO 2030 ASA

TECO 2030 is building up Europe's first Giga production facility of hydrogen PEM fuel cell stacks and modules in Narvik, Norway. The production capacity will be built up through 2024 and 2025, targeting an output capacity of up to 200 MW of fuel cells in 2025, increasing to 1.6 GW in 2030.

TECO 2030 is a Norwegian based clean tech company developing zero-emission technology for the maritime and heavy industry. We are developing PEM hydrogen fuel cell stacks and PEM hydrogen fuel cell modules, that enable ships and other heavy-duty applications to become emissions-free. The company is listed on Euronext Growth on Oslo Stock Exchange under the ticker TECO and in New York, OTCQX under the ticker TECFF. TECO 2030 is a spinoff from TECO Maritime Group, a group that has provided technology and services to the global shipping industry since 1994. For more information, please visit our website.



teco2030.no

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
		Transportation
HYDROGEN CHAIN		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

THEMA Consulting Group

THEMA has established itself as a sought-after group of expert advisors for the renewable energy sector. We deliver a range of services, from forecasts and models, strategical and socioeconomic analysis as well as management consultancy both in the Nordic market and in Europe. From the start, the core of our expertise has been an in-depth knowledge of, and long experience with the challenges and issues facing the power industry. Along the way, our knowledge of how the renewable energy sector and power markets work has become increasingly valuable in a variety of other areas.

We actively monitor hydrogen developments, both those related to the market and the associated technology. Using our power market model, we can simulate the market value and consequences of hydrogen's use in the future power system. In our technology report, we map the past, current and future status of hydrogen technology across the entire value chain, covering production, transport, storage and distribution.

We build on this foundation of knowledge to aid actors in facing a variety of challenges. With a strong and versatile team, we are ready to assist our clients with in-depth analysis and sound strategic advice spanning the entire hydrogen value chain.



thema.no

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
	APPLICATION	Portable
		Stationary
		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration



Tolcon AS

For 30 years, Tolcon has been market leader as supplier of all energy gas solutions from component level to larger turnkey system solutions. Hydrogen is one of the major players in the energy transition with clean energy mixtures, and Tolcon intends to make its experience through participation and development of new projects in Norway.

Our knowledge and established network with partners open up great opportunities for the development of more sustainable energy solutions, where our set of available solutions spans from hydrogen generation through electrolysis up to the end users metering, passing through storage, pressure control and blending with natural gas.

tolcon.no

Commercialization

Components

R&D

Services

Portable

Stationary

Transportation

Control systems

Distribution

FC/ICE

Production

Storage

System Integration



Toyota Norge AS

Toyota Norge is a subsidiary of Toyota Motor Europe, and is responsible for the marketing and sales of their second generation Mirai Fuel Cell Electric vehicle and promotion of the hydrogen society. Toyota Fuel cells are also used in buses, trucks, ships, trains and generators, and Toyota intends to offer their components to third-parties in building hydrogen ecosystems.

toyota.no/mirai

Umo Advanced Composites AS

Umo Advanced Composites (UAC) is the leading global supplier of large fibre glass type IV pressure vessels and modules for containment, storage and transportation of Hydrogen on land-based and maritime applications. We are breaking new ground by offering safe and price-competitive solutions for optimal containment, storage and transportation of larger volumes of Hydrogen, challenging traditional steel and carbon fibre alternatives.

Competitive advantage developed from 15 years of know-how in glass fibre vessel manufacturing, R&D and close collaboration with global customers and suppliers. UAC products are in daily use world wide by our top tier customers.

UAC deliver plug&play ready modules in different sizes, highly customized, ensuring high-performance utilization with excellent fatigue properties and durable lifetime. Enabling optimized balance between product performance, CAPEX and OPEX.

Ultimate safety is granted both by the material properties of the fibre glass pressure vessels and by the structural design of our modules. We subject our products to stringent fire, fatigue, stress rupture, burst, impact and proof tests. The composite materials in the Type IV pressure vessels have lightweight, very robust, non-toxic and non-corrosive properties, elimination risk of galvanic oxidation and wide temperature tolerances.

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

The University of Oslo (UiO)

The University of Oslo (UiO) offers studies at Bachelor, Masters and PhD levels in disciplines relevant to hydrogen technology; physics, chemistry, materials science, and technology systems, as well as supporting areas like mathematics, informatics, statistics/risk analysis, law, and social sciences. The materials science programs provide knowledge and training within renewable energy technologies, among these hydrogen. There are several strong and relevant activities at UiO for hydrogen technologies organized within Centre for Materials Science and Nanotechnology (SMN) with participating groups from the Departments of Physics and Chemistry. Topics include petroleum chemistry and catalysis; solid electrolytes and materials for gas separation membranes, fuel cells and electrolyzers; hydrogen storage materials; semiconductors for solar energy conversion; high temperature sensors; and fundamental research in materials science and nanotechnology. UiO partakes in a number of national and international projects within or related to hydrogen technology.

The University of Oslo commercializes its research and has founded spin-off companies through its technology transfer partner Inven2.

Commercialization

Components

R&D

Services

Portable

Stationary

Transportation

Control systems

Distribution

FC/ICE

Production

Storage

System Integration

University of South-Eastern Norway (USN)

University of South-Eastern Norway (USN-TNM-PEM) does research and education on hydrogen technology (BSc. / MSc. / Ph.D.) within hydrogen safety and process technology. We focus on physical effects, pre-normative research, and the safe design of hydrogen systems. USNs research is theoretical and experimental, with laboratory and field facilities for studying the impact of explosions and hydrogen behavior. We are developing tools for predicting physical effects based on experimental results. We are a member of HySafe, IEA Hydrogen Safety, IDERS – The Institute for Dynamics of Explosions and Reactive Systems.

Projects:

- FME MoZEES (NFR, 2017-2025)
- FME HYDROGENi (NFR, 2022-2030)
- HyTunnel-CS (EU, 2018-2022)
- Pre-normative Hydrogen safety in tunnels and confined spaces
- HyRESPONDER (EU, 2020-2023)
- H2Konstabel (NFR, 2022-2024)
- HySchool (Researcher school, 2022-2030)
- Gen2Energy (RFF, 2021-2022)
- H2Maritime (NFR, 2018-2022)
- Maritime hydrogen
- H2NOR (IN, 2021-2024)
- Safe maritime FCs
- HyLOCD (NFR, 2021-2024)
- SH2ift2 (NFR, 2021-2025)
- Safe use of hydrogen
- Green Platform (Technip Norge) Subsea storage
- Green Platform (Wärtsilä Gas Solutions) Ammonia



University of
South-Eastern Norway

usn.no

Commercialization

Components

R&D

Services

Portable

Stationary

Transportation

Control systems

Distribution

FC/ICE

Production

Storage

System Integration

Varanger KraftHydrogen AS

Producer of Green Hydrogen. Established H₂ plant in Berlevåg. From Q1 2024 delivery of compressed hydrogen to end-user.



HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Viken Hydrogen AS

Viken Hydrogen aims to be the most competitive supplier of green hydrogen in our region. Our core competence is to develop, construct and operate hydrogen plants. The company is owned by Akershus Energi, Greenstat, and Østfold Energi.

Our ambition is to increase the pace of the hydrogen value chain development and by that contributing to the decarbonisation of fossil-based industry, heavy duty and maritime transport, construction sites, etc. in our region.

We aim to develop our business through industrial long-term partnerships and welcome you to contact us to explore opportunities Viken Hydrogen AS for cooperation.



vikenhydrogen.no

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Vireon AS

Vireon is a Nordic hydrogen refueling company. Vireon's core business is to develop, own and operate hydrogen refueling stations targeted at the heavy-duty transportation sector.

Founded in 2023 as a subsidiary of Norwegian Hydrogen AS, the company is already present and engaged in building heavy-duty hydrogen refueling stations across Norway, Sweden, Denmark, and Finland.

Backed by strong owners with high ambitions, and with a worldwide partner network, Vireon works to enable zero emissions for trucks and other heavy-duty vehicles.

Active projects span across the Nordics, and Vireon is continually exploring opportunities to expand its refueling network even further.

In 2023 Enova granted support to Vireon for four hydrogen refueling stations across Norway, marking a significant leap in establishing Norway's first comprehensive hydrogen refueling corridor for heavy-duty transport.



vireon.com

Western Norway University of Applied Sciences (HVL)

At HVL we have a strong focus on education and continual education in hydrogen technology, covering technical, environmental and economical aspects of the entire hydrogen value chain. We also do applied and fundamental research on selected hydrogen technology topics such as hydrogen production, and are currently establishing HVL HydrogenLab.



Western Norway
University of
Applied Sciences

hvl.no

Westgass Hydrogen AS

Westgass Hydrogen is a green energy company focused on accelerating the transition from fossil fuels in Europe and emerging markets. We will enable customers to run carbon neutral businesses by 2030.

Our purpose is to supply affordable and easily accessible green hydrogen and green ammonia, leveraging our experience, expertise and network in the energy sector.

We are fuelling the energy transition with green hydrogen by

- Building a distribution and sales network of green hydrogen across Norway
- Providing clients in the mobility sector high pressure refilling and off-grid fast charging
- Delivering off-grid power to replace high capacity diesel generators

We are safeguarding our climate with green ammonia by

- Developing green ammonia facilities in emerging markets for local fertilizer production
- Delivering zero carbon electricity to rural communities through green hydrogen fuel cells
- Supplying industries in Europe with clean feedstock

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration



Worley Origo Process AS

Worley Origo Process consists of 16 process engineers with broad experience that spans from basic research and technology development to practical challenges, engineering, process safety and process simulations. Since 2002, quality and job satisfaction have been central values to establish a strong in-house professional environment.

Process competence is supplied to hydrogen companies with a high degree of flexibility. Examples of deliverables are listed below.

- Facilitate hazard and operability studies (HAZOP) and design reviews.
- Assist in the development of hydrogen production plants, i.e., mass and energy balances, process simulations, process safety evaluations and engineering.
- Assist with technology development and research.

Process engineers working with Worley Origo Process have PhD or MSc degrees within the fields of chemical engineering or chemistry. Projects are performed in own offices in Stavanger, or by working full or part-time as consultants in the customers' office.

The Australian Worley concern consists of 48,000 of the world's brightest minds in energy, chemicals and resources, all working to deliver a more sustainable world.

origo-process.no

Commercialization

Components

R&D

Services

Portable

Stationary

Transportation

Control systems

Distribution

FC/ICE

Production

Storage

System Integration



Yara Clean Ammonia

Yara Clean Ammonia

Building on its long experience and leading position within global ammonia production, logistics and trade, Yara has recently established the Yara Clean Ammonia (YCA) unit. Yara Clean Ammonia will enable climate smart agriculture, based on "green fertilizers" and Yara's farming solutions, capture growth opportunities in emission-free fuel for shipping and power, and deliver clean ammonia for industrial applications.

Yara is uniquely positioned to enable the hydrogen economy in a market expected to grow by 60 percent over the next two decades.

Yara Clean Ammonia is supported by 17 production units, operates 11 ships and 18 ammonia terminals across the world. Yara Clean Ammonia is headquartered in Oslo, Norway.

[yaracleanammonia.com](https://www.yaracleanammonia.com)

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
	APPLICATION	Portable
		Stationary
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		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

ZEG Power AS

ZEG delivers solutions for clean hydrogen production using the novel ZEG ICC™ Technology. The uniqueness of the technology:

- Captures the CO₂ inside the reformer where the CO₂ concentration is the highest
- Enables high CO₂ capture rate, increased hydrogen yield, and high thermal efficiency

ZEG delivers turnkey clean hydrogen production plants together with partner and owner SLB (Schlumberger).

ZEG – an answer to the energy trilemma

- **Affordable**
Leading on Levelized Cost of hydrogen
- **Reliable**
Enabling clean utilization of base load natural gas
- **Sustainable**
Clean hydrogen below EU Taxonomy threshold

Z • E • G

zegpower.com

Zero Emission Resource Organisation		
HYDROGEN CHAIN	APPLICATION	ACTIVITIES
		Commercialization
		Components
		R&D
		Services
		Portable
		Stationary
		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

ZERO is a non-profit environmental organization working for zero emissions solutions. In our view, emission-free alternatives exist for all energy use, and ZERO works continuously for their realization. We are not consultants, but participate in partnerships financed by third parties. ZERO has been working with hydrogen since 2002.

The key priorities have been to get sufficient incentives for hydrogen production and infrastructure, and to establish a domestic market with large-scale users in industry and the transport sector.



zero.no

Å Energi

Å Energi is Norway's largest renewable energy group with operations throughout the value chain from production to end customer. The cornerstone of our business is hydroelectric power, with around 11.3 TWh generated annually at 73 wholly-owned and part-owned power plants.

To serve an emerging market within transportation, maritime and construction, we are establishing green hydrogen production plants adjacent to new and existing power plants, minimizing the need for grid upgrades and land use, utilizing existing infrastructure. We are establishing our first hydrogen production plant at Pikerfoss hydro power plant in Kongsberg, with expected production start by the end of 2025. Å Energi aim to serve a hydrogen market in the south and eastern Norway.

Å Energi are also involved in ammonia-related projects. We are developing a project in Kvinesdal related to a large scale green ammonia plant. Through the company Ammonia AS (partly owned by Å Energi) we are developing an underground ammonia storage system eliminating safety distances.



Swagelok (SVAFAS Stavanger Valve & Fitting AS) offer training on fluid system best practices, trends and technology, installation, and safety.

HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
		Services
APPLICATION		Portable
		Stationary
		Transportation
		Control systems
		Distribution
		FC/ICE
		Production
		Storage
		System Integration

Enova SF

Enova SF is a public enterprise owned by the Norwegian Ministry of Climate and Environment. Enova SF's goal is to contribute to reduced greenhouse gas emissions and in the development of climate technologies necessary for bringing Norway to the low emission society in 2050. Enova supports projects mainly through the granting of investment aid with an aim to reducing barriers and stimulating lasting market development. Enova's support instruments are mainly aimed at the potential users of new climate technology, who have climate gas emissions today. Both industry and transport are prioritized sectors for Enova, in which hydrogen may become an important solution for reduction of climate gas emissions.



enova.no

HYDROGEN CHAIN	ACTIVITIES
	Commercialization
	Components
APPLICATION	R&D
	Services
HYDROGEN CHAIN	Portable
	Stationary
	Transportation
	Control systems
	Distribution
	FC/ICE
	Production
	Storage
	System Integration

Innovation Norway

Innovation Norway is part of the Norwegian governments public support system, and we contribute to sustainable growth and exports for Norwegian businesses through capital, expertise and networks. Hydrogen is a prioritized area for Innovation Norway, and our most relevant funding schemes are the environmental technology grants and innovation loan.



HYDROGEN CHAIN	ACTIVITIES	Commercialization
		Components
		R&D
APPLICATION		Services
		Portable
		Stationary
HYDROGEN CHAIN		Transportation
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		Distribution
		FC/ICE
		Production
		Storage
		System Integration

The Research Council of Norway

The Research Council of Norway provides funding for fundamental, strategic and applied research within the hydrogen area. This is both in terms of technologies for production, storage, distribution / transport and the use of hydrogen. The Research Council of Norway is pivotal in relation to Norwegian participation in international cooperation agreements. Projects related to hydrogen and hydrogen based solutions will mainly be funded through the Research Council's Portfolio for energy, transport and low emission

The Research Council supports both Researcher Projects, Competence projects with research organisations as contracting parties, and Innovation projects, where industry companies are contracting parties. Through Pilot-E, The Research Council is collaborating with Enova and Innovation Norway to accelerate the projects from research to demonstration and market introduction. The Research Council also supports Centers for Environmentally Friendly Energy Research (FME). FME MoZEES and FME NCCS are covering environmentally friendly transport based on hydrogen and batteries and CCS including blue hydrogen production respectively. A new Center for Environmentally Friendly Energy Research dedicated to only hydrogen activities will be launched March 2022. For an overview of public funding allocated to hydrogenrelated projects, see HEILO.



Litra have a goal to strongly reduce their emissions, and they are absolutely certain that hydrogen will be an important part of achieving this goal.

Notes

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Norwegian
Hydrogen Forum

Contact us

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