



Niedersächsisches
Wasserstoff-Netzwerk

THE GREEN HYDROGEN ECONOMY



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THE HYDROGEN NETWORK

 The Hydrogen Network of Lower Saxony (NWN) is the number one contact for hydrogen in Lower Saxony. The NWN supports and advises various players from politics, business and science in order to speed up the development of the green hydrogen economy. Ecological, economic and social aspects are considered in order to build up a sustainable hydrogen economy.



H₂

Power of the Future

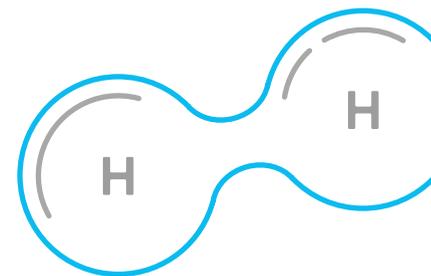
Hydrogen is the most common chemical element in the universe. Due to its chemical and physical properties, it is suitable as an energy carrier and complements renewable electricity in the energy grid of the future.

The German state of Lower Saxony focuses on green hydrogen, which does not release any CO₂ during production and thus is climate friendly. Green hydrogen is produced by the separation of water into oxygen and hydrogen through electricity. This process is called electrolysis. In order for the hydrogen to be climate-friendly, renewable electricity is required. The green hydrogen can then, for example, be used in industrial processes that cannot be electrified. In contrast to electricity, hydrogen can also be stored in the long-term at a low cost and will therefore be an important building block for the security of supply with clean energy.

The EU is also supporting the ramp up of the hydrogen economy. Within the framework of the IPCEI program (Important Projects of Common European Interest), major projects are being implemented throughout Europe. The IPCEI projects in Lower Saxony will be jointly supported by the state and the federal government.

HYDROGEN IN LOWER SAXONY

We need clean energy for a successful energy transition. While Lower Saxony has ideal prerequisites to produce clean electricity, many energy-intensive processes cannot be electrified. The steel or chemical industry, for example, need to undertake a profound transformation process to replace fossil fuels. This is where hydrogen as a CO₂-free alternative comes into play.



€ All projects marked with this sign are being funded by the state of Lower Saxony.

2045

GERMANY ON ITS WAY TO NET ZERO

Germany has declared it wants to achieve net zero by 2045. Lower Saxony in the north of Germany, with more than 300km of North Sea coast and lots of space and wind, will make a significant contribution in achieving climate neutrality throughout Germany. It is where vast amounts of renewable electricity are already being produced, having an impact on the overall energy mix. To complement green electricity, Lower Saxony is now focusing on green hydrogen to transition industrial processes that cannot be electrified.



PRODUCTION

Hydrogen can be produced in several ways. To produce climate-neutral hydrogen, renewable power is required. In the process of electrolysis water is separated into oxygen and hydrogen by the use of renewable electricity. In addition, green hydrogen needs to be imported to meet the energy demand in Lower Saxony, but also in Germany and the EU.



STORAGE

The storage of renewable energy is of central importance for the security of supply. In contrast to electricity, hydrogen can be stored in large quantities at lower costs.



INFRASTRUCTURE

Building on the existing gas network, the hydrogen backbone will be launched in Lower Saxony to transport renewable gas efficiently from the producer to the consumer. Existing pipelines need to be reequipped for the most part.

ANWENDUNG



Industry

Green hydrogen will make a crucial contribution to decarbonise the industry. Especially in the chemical and steel industries, where electricity-based solutions cannot replace fossil fuels.

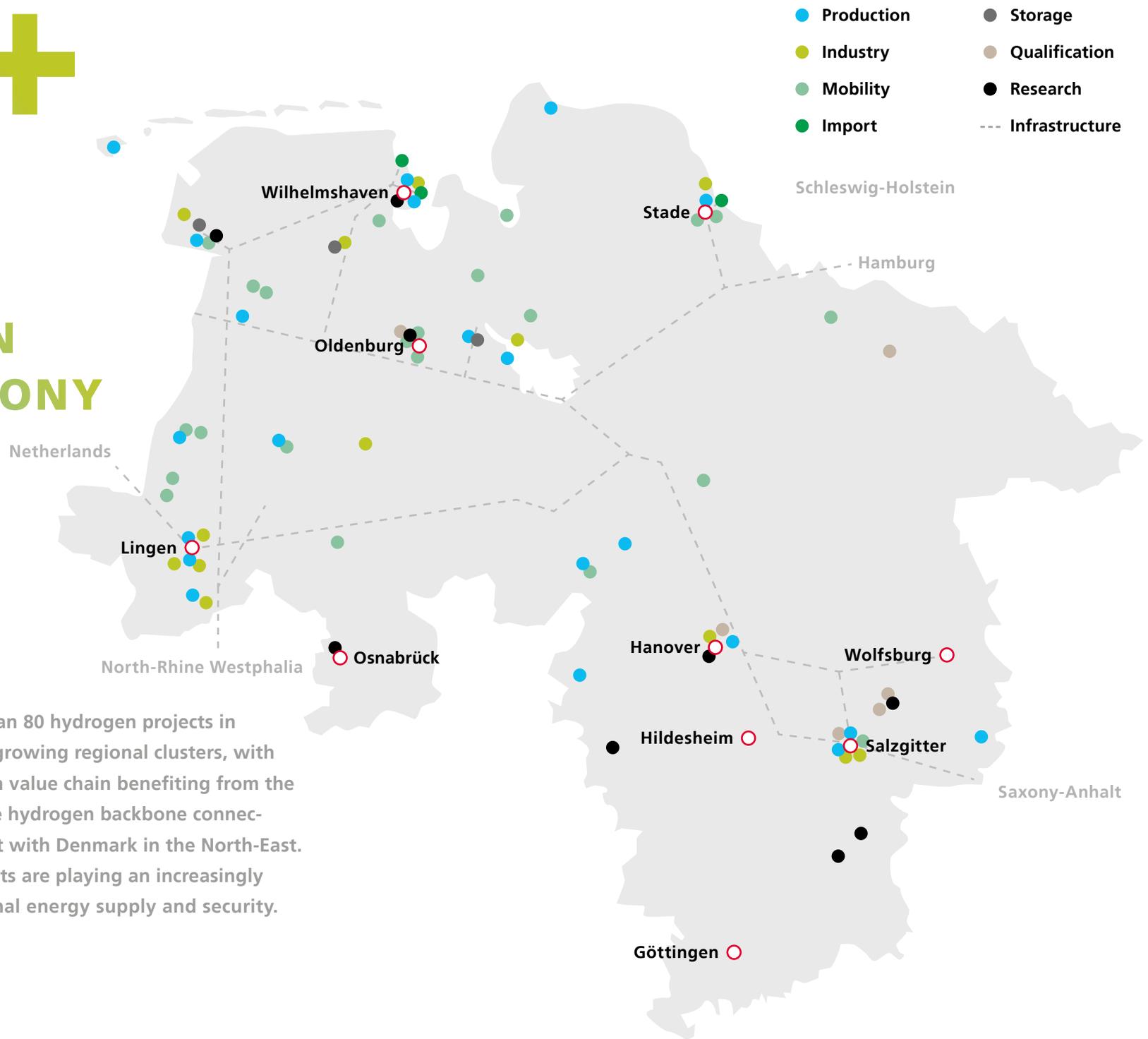


Mobility

The use of hydrogen in mobility makes sense wherever batteries do not last long enough. Trucks, buses, and other commercial and special vehicles with long ranges will be refitted with fuel cells. In rail transport, diesel locomotives will be replaced by hydrogen trains and in shipping and air traffic, hydrogen will replace fossil fuels in the form of e-fuels.

80+

HYDROGEN PROJECTS IN LOWER SAXONY



There are already more than 80 hydrogen projects in Lower Saxony. The map shows growing regional clusters, with each project along the hydrogen value chain benefiting from the other. Furthermore, it shows the hydrogen backbone connecting the Netherlands in the west with Denmark in the North-East. In addition, decentralised projects are playing an increasingly important role for future regional energy supply and security.

PRODUCTION

A number of projects will produce hydrogen on a large scale.



Large Electrolyser

— Lingen

RWE is building one of the largest electrolysis plants in Germany. The pilot plant, with an initial capacity of 14 megawatts, is to produce green hydrogen in mid-2023. A pressure alkaline electrolyser and a PEM electrolyser will both be tested.



Power-to-X

— Werlte

Green Hydrogen from the Power-to-X system by kiwi AG will be processed into synthetic methane with CO₂ from the neighboring biogas plant. The methane is then fed into the gas network.



Biomethane-Plasmalysis

— Hanover

The complete waste collection vehicle fleet of the waste management company aha in Hanover will gradually be switched to hydrogen vehicles with a fuel cell drive. To fuel the fleet, hydrogen will be self-produced in a plasmalysis process using the company's own bio-methane from waste treatment.



Hydrogen Hub

— Haren

In Haren, a future model for a sustainable mobility in agriculture is being tested. Self-produced green hydrogen will be used for the operation of agricultural vehicles. Part of this project is the development of a fuel cell drive tractor.

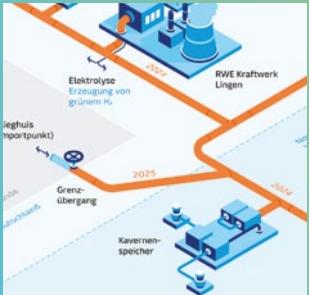
Hydrogen may be used instantly, stored or processed into so called derivatives.



Clean Hydrogen Coastline

— Region Northwest

In the Northwest region, 400 megawatts of electrolysis capacity will be built up by 2026. The hydrogen will then decarbonise the steel industry in Bremen. In the future, excess hydrogen may be temporarily stored in the underground cavern storage facility in Huntorf. The HyPerLink project provides the necessary infrastructure.



GET H2

— Lower Saxony + North Rhine-Westphalia

A federal-wide infrastructure with a coupling of sectors along the hydrogen value chain is being developed in this project. To provide the pipelines with green hydrogen, three large-scale electrolyzers will be built in Lingen with 100 megawatts each.

INDUSTRY

Green Hydrogen will contribute to the decarbonisation of the industrial sector.



KRUH2

— Krummhörn

From hydrogen production, to storage, to usage – this project encompasses the whole value chain at the location Krummhörn in Lower Saxony. Hydrogen will be used for heat supply, as an alternative fuel for the company vehicle fleet at OGE, and for reconversion to electricity if needed.



SeWAGE Plant H

— Hanover

With its large-scale modernisation concept, Hanover's municipal utility organisation drastically aims to reduce its own energy consumption while producing green hydrogen. To clean water, the sewage treatment plant only requires the oxygen from the electrolysis. The hydrogen will be sold and used to power fuel cell-operated buses in the region.

Seven percent of worldwide emissions being released every year originate in the steel industry.



Green Steel Production

— Lingen

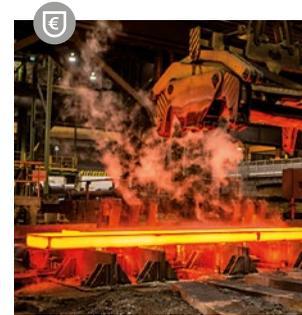
A direct reduction test facility to produce green steel is set up by RWE, CO2GRAB, LSF and BENTELER Steel/Tube. Using hydrogen instead of conventional methods, the release of carbon dioxide in the steelmaking process is avoided.



Hydrogen Drying

— Cloppenburg

Stored hydrogen may be converted back to electricity in the event of power shortages. For this process, it needs to be dried. Bilfinger is developing a demonstration plant in which moisture is removed through absorption.

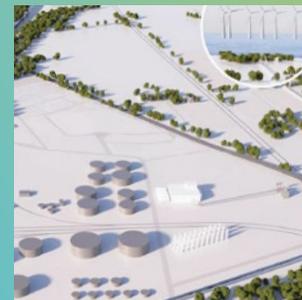


SALCOS

— Salzgitter

The Salzgitter AG is building direct reduction plants for a climate-friendly steel production. CO₂ emissions will be reduced by more than 95 percent with this process based on the use of hydrogen. The first facility will be operational in 2026.

IPCEI-PROJECT



Lingen Green Hydrogen

— Lingen

Together, bp and Orsted aim to produce green hydrogen on an industrial scale. An electrolysis plant with an output of 100 megawatts will be built to replace the currently gray with green hydrogen in the fuel production in the bp refinery.

So-called e-fuels, based on hydrogen, will enable air and sea transport to become climate-friendly.

MOBILITY

Emission reduction in the mobility sector plays a key role in achieving Germany's climate goals.



Hydrogen train

Weser-Elbe

With the Coradia iLint, Alstom developed the world's first passenger train powered by fuel cells. This is intended to reduce emissions in the German rail network. Since 2022, the hydrogen train is used in regular passenger traffic.



Waste Collection Vehicles

Osterholz-Scharmbeck

In 2021, FAUN started the serial production of hydrogen waste collection and cleaning vehicles based on the same BLUEPOWER chassis. By 2026, they want to have 12,000 vehicles on the road.



Hydrogen Truck

Winsen (Luhe)

Clean Logistics' "Fyuriant" truck has a range of over 400 km and is able to refuel in less than 15 minutes. By the end of 2023, up to 450 vehicles are to be delivered annually. The production plant in Winsen is currently being extensively expanded.



Air and Sea Traffic

Stade

The "Innovation and Technology center North develops environmentally friendly means of transport. The aim is to reduce CO₂ emissions from planes and ships significantly. In Stade, climate-friendly fuel cell and hydrogen technologies will be advanced.

*On the streets, tracks, water, or in the air:
hydrogen enables low carbon mobility.
Especially in the heavy-duty transport sector.*



HyWays for Future

— Oldenburg

Produce locally and use locally - that's the goal of EWE's HyWays for Future project. It encompasses the development of electrolysis capacities, hydrogen fueling stations and investments in fleets of hydrogen-powered buses, waste collection vehicles, trucks and cars.

IPCEI-PROJECT



Air Traffic

— Stade

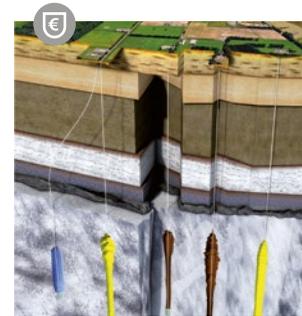
With the project "Hydrogen for the infrastructure and production in aviation in Northern Germany" (WIPLiN), Airbus aims to advance the expansion of the hydrogen infrastructure. With partners, the basis for the development of a hydrogen-powered commercial aircraft is laid.

Air traffic causes particularly high emissions.

This is set to change with hydrogen.

STORAGE TRANSPORT IMPORT

Hydrogen storage solutions are key for a secure supply with renewable energy.



H2Cast

— Etzel

In the joint project in Etzel, experts are investigating whether underground salt caverns are suitable for the storage of hydrogen. The project is intended to show that former gas and oil caverns may also contain large amounts of hydrogen. The existing caverns should then store up to 22.5 TWh of hydrogen.



Salt caverns

— Krummhörn

Uniper is investigating the development, construction and operation of new underground storage facilities for hydrogen at the Krummhörn natural gas storage site. The storage facility will be one of the first of its kind and is scheduled to be completed and in operation by 2024.



H₂ercules

Western Lower Saxony

In the H₂ercules project, electrolysis capacity and infrastructure is built to connect hydrogen producers in Lower Saxony with customers in western and southern Germany. Up to one gigawatt of electrolysis capacity and approx. 1,500 km of pipelines are to be built.

IPCEI-PROJECT



HyPerLink

Lower Saxony

Gasunie's infrastructure project is part of the large-scale Clean Hydrogen Coastline project. Here, pipelines to connect hydrogen production and import sites with underground storage facilities and consumers in Bremen, Hamburg and Salzgitter are to be established.

Step by step, the hydrogen backbone in Lower Saxony will be connected with other regional networks.

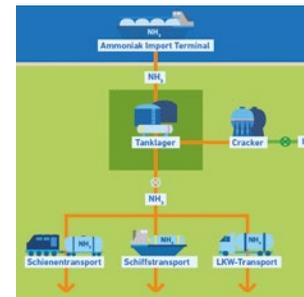
Hydrogen will be imported in Wilhelmshaven and transported to consumers and storage facilities.



Green Energy Hub

Wilhelmshaven

Wilhelmshaven aims to become the energy hub 2.0. The port will be a landing point for hydrogen imports, but also its derivatives like ammonia or synthetic methane and thus decisive for future supply with renewable energies.



Green Wilhelmshaven

Wilhelmshaven

Uniper wants to import hydrogen by means of ammonia on a large scale. At the same time, the project aims to produce green hydrogen on site by electrolysis. Combined, these efforts could cover 10–20 percent of the total hydrogen demand of Germany in 2030.

QUALIFICATION

The hydrogen economy requires further training for professionals in many sectors.

Employee Qualification for H₂ Vehicles in the Logistics Sector

— Brunswick

Numerous logistics companies, but also municipalities and regional authorities are currently switching to more energy-efficient and low-emission vehicles. This course prepares vehicle users for the numerous challenges, this transformation process poses.

H₂ Skills

— North-East Lower Saxony

In this project, the need for further training in companies is examined. Based on the results, initial approaches for certificate courses, additional examinations, further training and supplementary modules for existing qualification offers are being developed.

Hydrogen for Professionals and Executives

— University of Oldenburg

The training program builds on existing professional qualifications and experiences of the participants and enables them to assess, initiate and control hydrogen projects. During this course a hydrogen project is planned and calculated realistically.

Transformation Pilots

— Online

This course aims to raise awareness and to build expertise to influence energy consumption in organisations. By a combination of qualification and network, employees and companies are enabled to initiate and shape transformation processes.

Hydrogen Forum for Skilled Workers

— Lower Saxony

At the annual forum, experts discuss the qualification and recruiting of skilled workers for hydrogen. Around 150 participants may expect changing focus topics such as “mobility” or “industry”.



RESEARCH

Universities in Lower Saxony combine their efforts to explore the potential of hydrogen.



H₂ Signpost

— Clausthal and others

The project investigates how a hydrogen-based energy system in Lower Saxony can be shaped. For this, it is defined which technical variants are advantageous, as well as the influence of legal, ecological and economic aspects.



Sustainable Hydrogen Combustion Concepts

— Hanover and others

In this innovation laboratory “WaVe”, research on the use of hydrogen in combustion engines without the release of pollutants such as nitrogen is conducted.



Water Electrolysis: From Material to System

— Hanover and others

The process of electrolysis in which water is separated into hydrogen and oxygen requires vast amounts of electricity. The innovation laboratory “InnoEly” works on advancing the efficiency of the electrolysis process in hydrogen production.



H₂ Region Northwest Lower Saxony

— Oldenburg and others

Researchers are investigating how hydrogen may be established as a local back up energy supplier. For this purpose, locally produced green hydrogen is stored in a converted compressed air energy storage power plant, and then reconverted as a climate-friendly power supply.



Thermal Management of Hydrogen Filling Stations

— Brunswick and others

For the use of hydrogen in the mobility sector effective solutions for the refueling process are required. In the project “THEWA”, researchers aim to explore and provide general system concepts for future hydrogen gas stations.

OUR PARTNERS

The Hydrogen Network of Lower Saxony is a joint project of the Climate Protection and Energy Agency Lower Saxony (KEAN), the Institute of North German Economy on behalf of the Business Associations of Lower Saxony (UVN) and the Lower Saxony Educational Association for Work and Life on behalf of the German Federation of Trade Unions (DGB). In addition, cooperation partners are the Innovation Center Lower Saxony (IZ) and the Energy Research Center Lower Saxony (EFZN).



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Hydrogen Land No. 1

H2

Lower Saxony will become Hydrogen Land No. 1

	2030	2050
Hydrogen requirement in Lower Saxony	ca. 30 TWh	144 TWh
Generated on site	18 TWh	40 TWh
Imported	40 %	72 %
Required electrolysis power	13 GW	31 GW
Power from renewable sources*	20 GW	30 GW

* Renewable electricity for hydrogen production comes from e.g. onshore wind turbines in Lower Saxony.

There is expansion potential in the North Sea of 61 GW offshore wind energy.

Sources:

Simulative short study on use of hydrogen technology in Lower Saxony (SiKuWa) [Leibniz University, IfES, ISFH]

Production of green hydrogen through wind energy at sea – potential and need in Germany [German Windguard]



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