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Hydrogen research projects 2024

Time for an energy change

Shaping the future with hydrogen

PRODUCTION & SUPPLY

INFRASTRUCTURE

APPLICATION SECTORS

ENERGY SYSTEMS & MARKET RAMP- UP

REAL – WORLD LABORATORIES & MODEL REGIONS

All topics and research projects of the Hydrogen Innovation Program

www.dvgw.de/themen/forschung-und-innovation/energieforschung/dvgw-innovationsprogramm-wasserstoff

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DVGW

Hydrogen Research Projects 2024

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Preface

Hydrogen is one of the keys to a successful energy transition and the achievement of climate goals. It offers considerable potential, especially for industrial processes which it would be difficult or not feasible to electrify. However, hydrogen also offers a number of possibilities for carbon-neutral energy supply in other sectors such as the storage of electric power from renewable sources or heat supply to buildings.

The successful integration of hydrogen in Germany's future energy system depends on three main factors: availability, technical prerequisites and infrastructure. This is why DVGW has concentrated its research activities on precisely these aspects and has been able to lay some of the groundwork for the successful utilization of hydrogen over the past few years.

DVGW has been supporting research and innovations in the field of climate-neutral gases for more than a decade and is a major partner in national and international projects. The results of these activities contributed to technological progress and the standards needed for the integration of hydrogen in the German energy system. This brochure presents over 80 projects, giving an impression of current research activities by DVGW and the Hydrogen Competence Network, which cover the entire hydrogen value chain – from production through infrastructure and storage to utilization.

For example, a study recently completed by the DBI Group for DVGW highlights the importance of the German gas grid and the future hydrogen grid for the security of energy supplies in Germany when coal and natural gas have been phased out from the energy mix. Another study carried out by the DVGW EBI Institute outlines initial basic conditions and prerequisites for the import of hydrogen to Germany by sea and pipeline.

Both these studies represent what DVGW intends to achieve with its practically oriented research work – the rapid ramp-up of hydrogen use in Germany.

I hope that you will enjoy reading this brochure and find it interesting and exciting.

Prof. Dr. Gerald Linke
Chairman of the Board of Directors, DVGW

Photo: © DVGW

“Hydrogen has many applications, will be available in the near future and could potentially be distributed using existing infrastructure. Through its research activities, DVGW continues to pave the way for the use of hydrogen in Germany.”

Our institutes – pooled hydrogen expertise

“The rapid, comprehensive market ramp-up of hydrogen and other climate-friendly gases will be essential for the transformation of gas supplies. At the interface between basic research and the application of this research in the gas and water industry, we intend to make a significant contribution to the success of the energy transition with our expertise. The main technological and system emphases in our research work include the production and supply of hydrogen and hydrogen derivatives and the integration of hydrogen in gas infrastructure as well as hydrogen utilization. Our portfolio also includes water issues in the context of the energy transition, such as water management in connection with power-to-X processes. Together with GWI and DBI, we pool our knowledge and capacities in the Hydrogen Competence Network and are working on the current issues in a targeted way in a spirit of cooperation.”

“Hydrogen will play a key role in the transformation of German energy systems. With the knowledge currently available, it would not be technically feasible to fully electrify all sectors in order to achieve climate neutrality. For this reason, renewable gases, including hydrogen, will be essential for achieving a sustainable reduction in greenhouse gas emissions. However, the integration of hydrogen in a climate-neutral energy system poses tremendous technical, regulatory and economic challenges. These challenges at all levels of the value chain are being tackled by DGVW within the H2 Competence Network of the German Energy Industry. GWI is proud to be able to shape the future viability of our industry within a wide variety of research projects together with our partner institutes DVGW-EBI and DBI within this research network featuring high-quality research teams.”

: © DVGW-EBI

Dr. Frank Graf
Head of Gas Technology, DVGW-EBI

Photo: © GWI Essen e.V.

Dr. Rolf Albus
Managing Director,
Gas- und Wärme-Institut Essen e.V.

“Hydrogen is the answer to many challenges posed by the energy transition. With respect to the defossilization of the mobility, industry and space heating sectors, hydrogen will be essential or will allow the process to be completed faster and more cost-effectively. Especially in the areas of energy, transport and seasonal energy storage, hydrogen will provide future energy systems with the resilience and efficiency needed to achieve climate goals and for Germany to remain attractive as an industrial location. The DBI Group has been involved in research and has been working on the integration of renewable energies in the existing energy system for more than two decades. We are proud to be able to make a significant contribution to achieving climate and environmental protection goals together with EBI, GWI and DVGW within the Hydrogen Competence Network.”

Photos: © DBI-Gruppe

Gert Müller-Syring and Dr. Jörg Nitzsche
Members of the Management Board of the DBI Group

H2-Kompetenzverbund der deutschen Energiewirtschaft

As a climate-friendly fuel of the future, hydrogen will play a key role for the energy system. In order to forge ahead with hydrogen utilization and the market ramp-up of a hydrogen industry, innovative solutions will be essential. DVGW recognized this requirement at an early stage and has continually expanded its hydrogen expertise.

In April 2022, DVGW founded the **H2 Competence Network of the German Energy Industry** and is pooling the hydrogen expertise of its research institutes within this network. The objective is to further intensify existing cooperation arrangements within individual research projects and to establish closer links between renowned institutes.

H_2-Switch100 – hydrogen grid for households

"Within the framework of H_2-SWITCH100, we are investigating the work actually required for changing existing low-pressure systems over to hydrogen operation. The components and gas lines installed in the pilot area are representative of the characteristics of our network. This will establish a further option for achieving Hamburg's climate targets which is also well received by local residents. The project is being supported by DBI and TÜV SÜD."

Aljoscha Baack
Project Manager, H_2-SWITCH100, Gasnetz Hamburg

More information on the H_2-Switch100 project

HAMBURG

LINGEN (EMSLAND)

GELSENKIRCHEN

GET H_2 – development of nationwide H_2 infrastructure

"Through dialogue within the GET H_2 initiative, we have been able to develop hydrogen projects combining the production, transport, storage and utilization of hydrogen. The first elements of the project are to be ready for operation in 2025."

Frank Heunemann
Managing Director, Nowega GmbH, and coordinator of the GET H_2 initiative

More information on the GET H_2 project
www.get-h2.de/

Real-world laboratories for a future with hydrogen

RÜDERSDORF

HyCAVmobil: hydrogen storage in Rüdersdorf cavern storage facility

"Climate-neutral energy supplies will not be feasible without hydrogen storage. Our current HyCAVmobil project (Rüdersdorf hydrogen storage cavern) currently shows that the industrial-scale storage of green hydrogen, with utilization in line with demand, is feasible. This project benefits from scientific support from the Institute of Networked Energy Systems of DLR – the German Aerospace Centre."

Tobias Moldenhauer
Head of Hydrogen with energy service provider EWE

More information on the HyCAVmobil project

HOHENWART

H_2Direkt – changeover of gas network to 100% hydrogen

"In future, hydrogen can replace fossil natural gas. This is confirmed by our H_2Direkt project in Hohenwart. The main advantage is that the infrastructure is already available. Together with partners such as DVGW, we are working directly on the transformation of existing grids."

Dr. Elke Wanke
Head of Renewable Gases,
Energienetze Bayern GmbH

More information on the H_2Direkt project
www.esb.de/h2direkt

Security of supply and climate neutrality with hydrogen

Germany's energy supplies must already be diversified in a few years' time and must be climate-neutral by 2045 at the latest. However, the transformation of energy systems which will be needed for this purpose can only succeed if all the technologies and options available are used with a view to reducing greenhouse gas emissions at affordable cost and with acceptable risks.

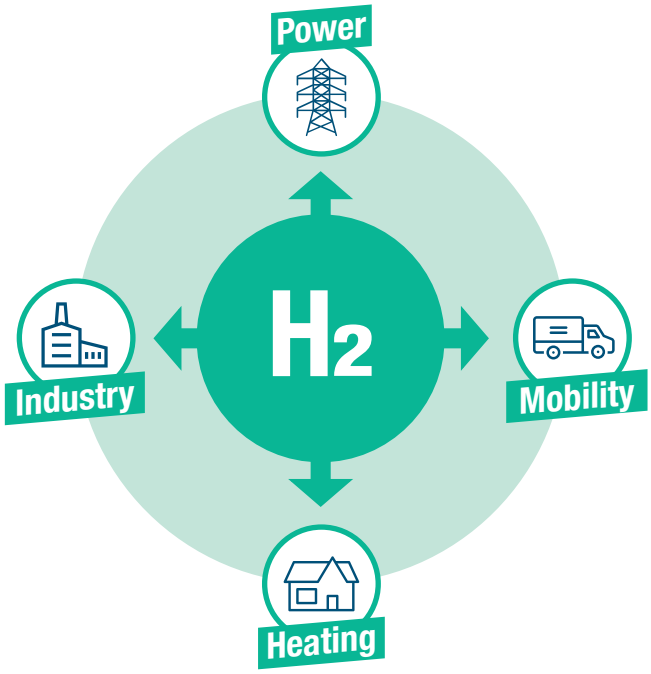
In addition to the expansion of renewable energies and the widespread use of electrified solutions, this will also include ramping-up climate-friendly gases such as the highly versatile fuel, hydrogen (H_2). Hydrogen can be used in all sectors: as a fuel for motor vehicles, a raw material for industry or as a heating fuel. As greenhouse gas emissions are avoided in hydrogen production and utilization, hydrogen can make a key contribution to climate neutrality and to the success of the energy transition in Germany.

One of the main advantages of hydrogen is that it can be stored for long periods of time and transported over considerable distances. The existing gas infrastructure with its widespread pipeline network will play a key role. The gas grid provides a gigantic energy storage facility and can supply industrial plants or buildings as well as vehicles with climate-friendly gas fuel.

Hydrogen therefore offers an opportunity of interlinking previously separate sectors of power generation, mobility, space heating and industry. This approach will reduce the burden on power grids, stabilizing them, also reducing the need for power grid expansion and safeguarding security of supply.

DVGW is providing the gas industry with comprehensive expertise in this field in order to ensure that the impending transformation of the gas system can be successful with a growing share of hydrogen. For many years, DVGW has already focused on innovations and has a research budget available for this purpose. Together with the DVGW research institutes and external partners in Germany and other countries in Europe, a large number of research projects have already been successfully completed. The results show that the energy transition will be technically feasible and economically viable using gas infrastructure.

On this basis, the **DVGW Hydrogen Innovation Program** was launched in 2021. Within the framework of this program, further projects with different emphases along the stages of the value stream – production, infrastructure, utilization and in connection with the entire energy system are being initiated and supported.



The many research projects in progress are considering the question of how the energy system can be shaped in a future oriented way, achieving the target of climate-neutrality by 2045, using climate-neutral gases – especially hydrogen – and existing gas infrastructure. The projects cover technical, regulatory and economic aspects.

Some of the projects are investigating the potential for hydrogen production and the effects of hydrogen on gas pipeline and storage facility materials. Other projects involve work on the utilization of hydrogen in applications such as internal combustion engines or heating systems. Real-world laboratories are being implemented and field trials carried out to determine the percentage of hydrogen that can currently be added to natural gas. Further projects are investigating the ideal changeover of the energy system and the possible cost.

This brochure is intended to give you an overview of relevant projects from the DVGW Hydrogen Innovation Programme and real-world laboratories and cooperation projects with the participation of the DVGW research institutes that have joined forces in the **Hydrogen Competence Network of the German Energy Industry.** The brochure highlights the potentials of hydrogen for climate protection and the economy and underlines the fact that the transformation has already started.

Production and supply

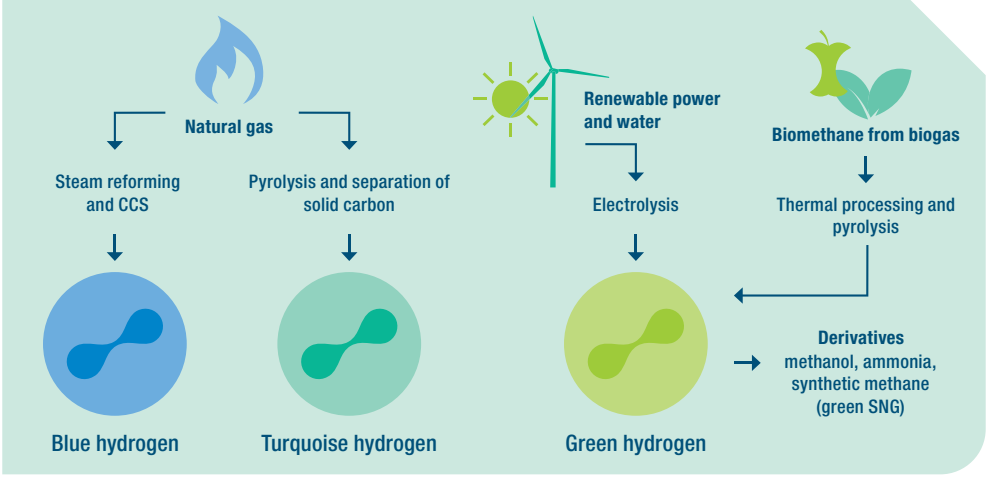
The destination is green, but the route is multi-coloured

The transformation of energy systems is one of the major challenges we face this century. Equal consideration needs to be given to climate protection, resilience and social compatibility. Throughout the world, there is a broad consensus that hydrogen produced in a climate-friendly way will be a key element in securing sustainable energy supplies. In order to achieve the climate goals set out in international agreements and to phase out the use of fossil fuels, many nations have opted to use hydrogen. Several different production processes are available.

However, it will not only be domestic hydrogen production that will be crucial for energy supplies. It is highly probable that it will not always be possible to meet national energy demand using domestic production capacities for renewable energies. Germany as an energy importer and other European countries will need to import hydrogen from other countries, both within and outside Europe.

Hydrogen, will be a key element in sustainable energy supplies in the future. Several production paths are available. These have been colour-coded for greater clarity. Green hydrogen is climate neutral in the broad sense of the term.

DVGW and its research institutes have already explored many aspects of hydrogen production and supply, including the potential availability of hydrogen in 2030 and 2045 and the cost of hydrogen supply, in a variety of research projects. Scientists working at the DVGW institutes have also calculated what carbon footprint is created per kilowatt-hour produced with the various hydrogen production processes. Other topics that have been investigated include the import possibilities for hydrogen and its derivatives and the state of development of the various technologies. The production of derivatives and biogenic processes also play a role in research activities.

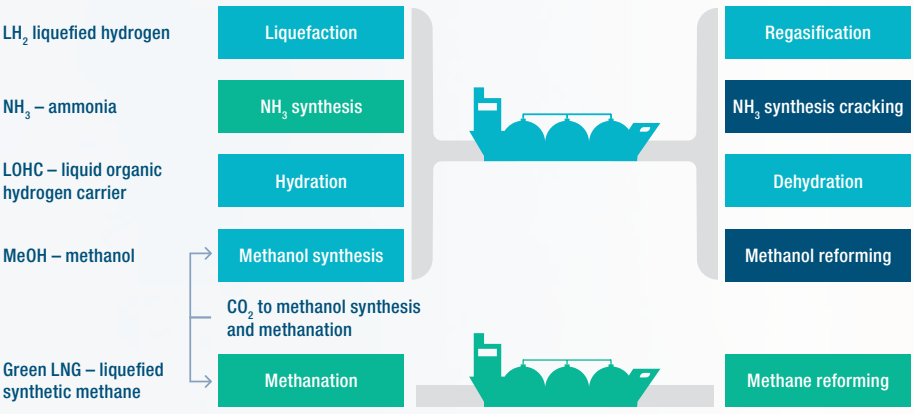


Development status of H_2 derivatives for marine transport

Development status of major plants for the production of H_2 derivatives for marine transport and the conversion of these derivatives into hydrogen gas for use as a fuel and raw material.

NASA technology readiness level

Concept formulation	Validation	Testing and prototype	Ready for operation
1-3	4-5	6-7	8-9



Importing H_2

Completed

BACKGROUND AND OBJECTIVE

In future, hydrogen will be a key element in safeguarding climate-friendly energy supplies. Global demand is set to grow strongly over the next few decades. Especially Germany will be forced to import hydrogen from other countries, both within and outside Europe. Depending on the distance and location of the region of origin, hydrogen may be carried either by pipeline or by marine transportation. Especially where long distances are covered by vessels, it is crucial to decide whether hydrogen is to be transported as a gas, in liquefied form or as a constituent of other chemical compounds.

In DVGW's "Importing H_2" project, completed in 2023, the various process chains and transport options were investigated and compared with reference to a number of different criteria. Existing publications were also studied in order to obtain data, facts and forecasts of global hydrogen demand and worldwide production capacities and to identify possible sources of hydrogen imports and transport routes.

RESULTS

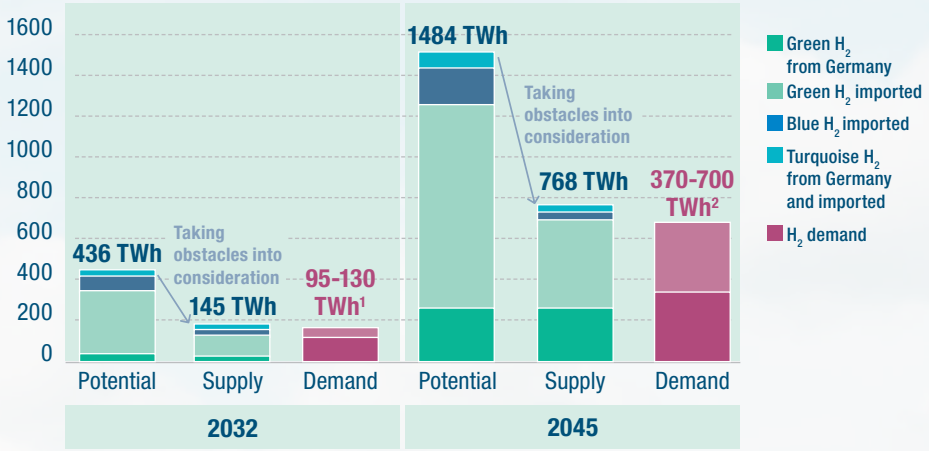
- In global terms, the hydrogen production potential available is sufficient to meet global demand.
- Hydrogen imports will be essential for Europe, and especially Germany.
- For the ramp-up of hydrogen, a variety of initiatives and rapid investment in the development of production capacities will be necessary.
- For distances up to 5,000 km, pipeline transport may be the most economical option. However, in the final resort, the relationship between production and transport costs is the crucial factor and not just the distance.
- Certain transport routes are already quite well-developed, but there is still much to do.
- Most transport options include process steps that are currently not commercially available. The most highly developed process chain is currently "Green LNG". In the long term, the transport option "liquefied hydrogen" will be the most efficient.

RESEARCH INSTITUTES

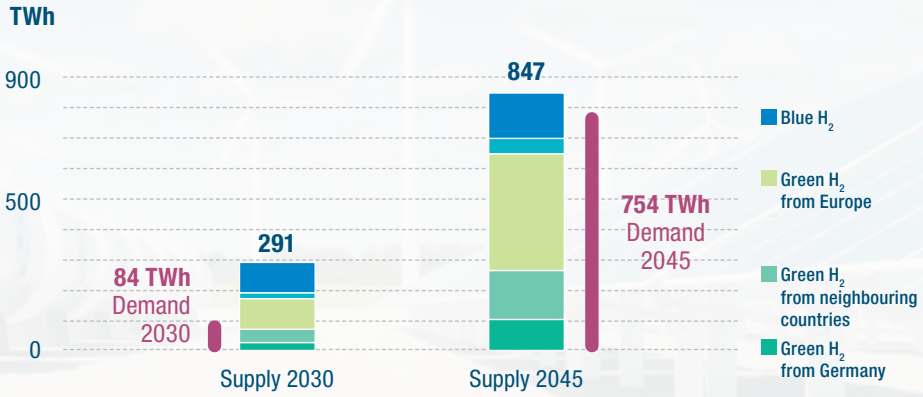
DVGW Forschungsstelle | ebi | gwi

Full information on the project is available at **www.dvgw.de/h2-import**

Potential hydrogen quantities and supply restricted by regulatory and infrastructure obstacles versus demand in Germany.



Demand coverage in 2030 und 2045* (base scenario)



Source: DVGW (2022) availability and cost comparison of hydrogen – merit order for climate-friendly gases in 2030 and 2045

PRODUCTION AND SUPPLY

H_2 availability and quantities

Completed

BACKGROUND AND OBJECTIVE

Hydrogen will be essential for secure energy supplies in Germany. The crucial question is how much hydrogen can be provided to meet growing demand. For this reason, DVGW's research work also includes calculations of the hydrogen quantities that can be made available in the medium and long term on the basis of production and import potentials subject to specific political conditions.

The market ramp-up was estimated and future hydrogen supply volumes were calculated in two projects. The projects also considered what regulatory and infrastructure obstacles restrict the availability of hydrogen. For the realization of hydrogen imports, the general conditions (including transport, regulations, quality requirements and economic viability) will be decisive.

RESULTS

- In the basic scenario, about 290 TWh of low-CO_2 to climate-neutral hydrogen could be available in 2030 and the quantity could rise to 850 TWh by 2045. Green hydrogen from electrolysis plants in Germany and other European countries would account for at least 60 percent of this figure.
- In view of realistic production and import potentials (including imports from countries outside Europe), 436 TWh could be available in 2032 and 1,484 TWh in 2045. However, current conditions (including transport, regulations, quality requirements and economic viability) have the effect of restricting import volumes.
- However, the emission limit for green or low-carbon hydrogen laid down in the European Renewable Energy Directive (RED) will drastically reduce the hydrogen supply potential by about 40 percent by 2032. This will mainly be a result of the fact that hydrogen imported by marine transportation routes will be above the emission limit.
- The requirements of the RED for green hydrogen, such as additional supply or temporal and geographic correlation, will only restrict the potential relatively slightly as a result of exceptions and the comparatively small effect of the regulation in this area.
- National transport capacities will be more than adequate for 2032. They will be appropriately sized for 2045 and will be required to meet expected demand, with a small buffer.

SERVICE PROVIDER

frontier economics

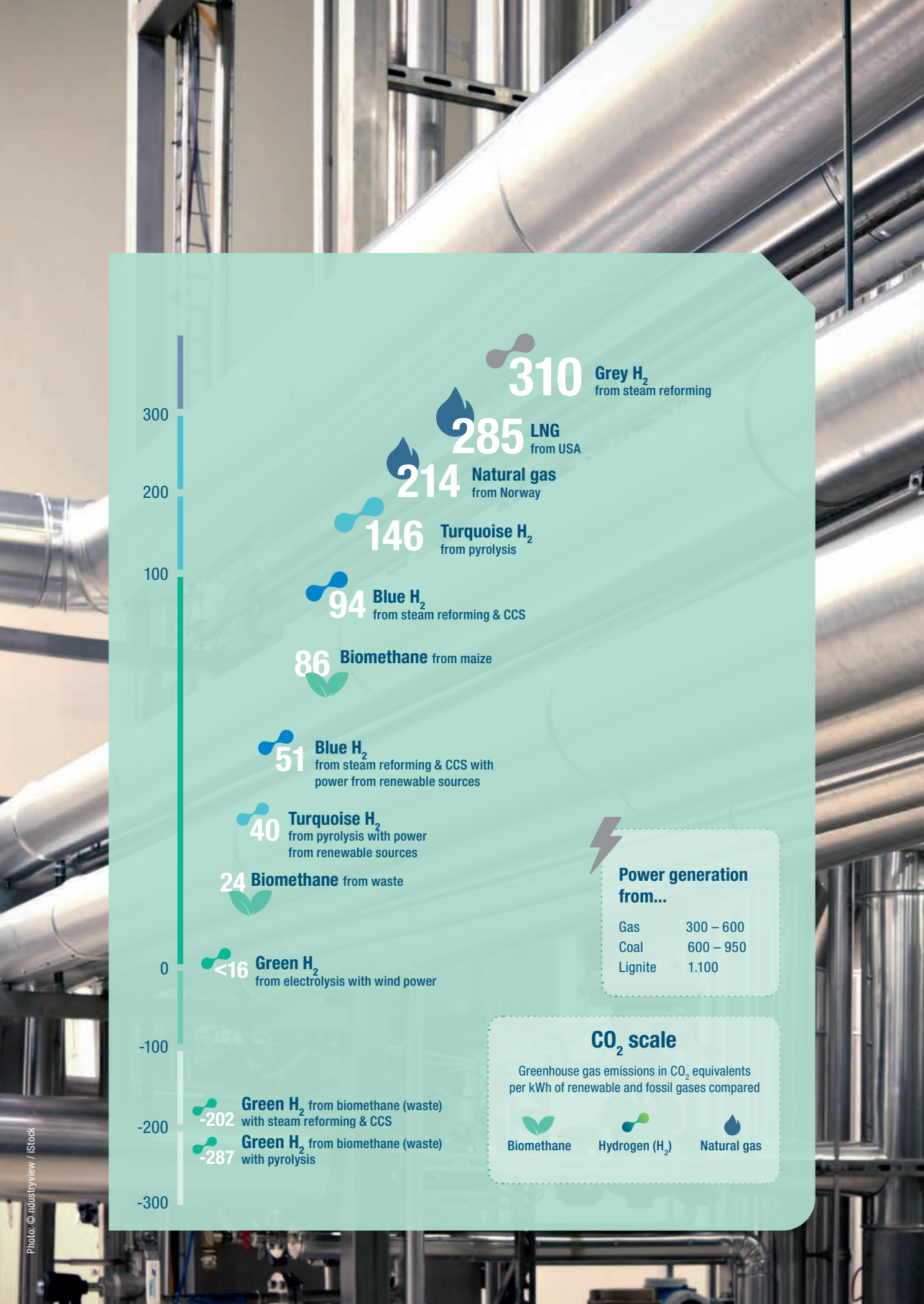


Photo: © ndustryview / iStock

PRODUCTION AND SUPPLY

Carbon footprint of hydrogen

H2-dvgw.de

Completed

BACKGROUND AND OBJECTIVE

Alternative hydrogen production processes already offer potential for the reduction of greenhouse gas emissions. This project included calculations of the carbon dioxide emissions per kilowatt-hour (kWh) of hydrogen produced and forecasts concerning developments in these figures over the next few decades. The study was based on a sensitivity analysis using GEMIS Version 5.0. Emissions for green, blue and turquoise hydrogen production in Germany and other countries were considered. Biomethane was also taken into consideration as a possible raw material.

RESULTS

- In future, it may be possible to reduce greenhouse gas emissions from blue, turquoise and green hydrogen production by about 75 to 95 percent compared with conventional production processes.
- In the case of blue and turquoise hydrogen, the upstream emissions connected with the methane used have a decisive impact on overall emissions. With biomethane as a feedstock, negative greenhouse gas emissions are possible.
- In the case of green hydrogen production using power from photovoltaic systems, the upstream emissions connected with the production of the photovoltaic modules are decisive. The main factor is the power mix in the country where the modules are produced.
- On this basis, green hydrogen production using offshore wind power in Germany offers the greatest potential for CO_2 emission reduction.

PROJECT PARTNERS

DVGW Forschungsstelle | ebi | gwi

Full information on the project is available at **www.dvgw.de/co2-footprint**

Photo: © malp / AbodeStock

Leuna100

Completion 08/2026

BACKGROUND AND OBJECTIVE

A new catalytic converter allows the economically viable production of green methanol from biomass or CO_2. The carbon used passes through a continuous cycle instead of creating emissions. The objective is the production of green methanol ready for the marketplace for marine transport and aviation.

APPROACH

- Innovative new production process
- For the first time, the process will not involve heterogeneous catalysis, but rather a liquid-phase reaction, which is scalable in three dimensions (homogeneous catalysis).
- End-to-end process chain for the RED-II-compliant production of green methanol

PROJECT PARTNERS

C1 Green Chemicals • Technical University of Berlin • Fraunhofer Institutes for Environmental, Safety and Energy Technology (UMSICHT) and Wind Energy (IWES) • DBI Gastechnologisches Institut • Leibniz-Institut für Katalyse, University of Rostock (LIKAT)

PROJECT COORDINATOR

Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie (NOW)

FUNDING

Project supported by:

Bundesministerium für Wirtschaft und Klimaschutz

In accordance with a resolution of the German Bundestag

To the project:
www.leuna100.de

KA4H$_2$ – utilization of sewage treatment plant effluent for H_2 production via water electrolysis

Completion 12/2025

BACKGROUND AND OBJECTIVE

Sewage treatment plants offer ideal conditions for hydrogen production. The (waste) water for electrolysis and by-products such as oxygen and waste heat can be used on site. The KA4H$_2$ project aims to investigate optimum conditions for the production of hydrogen from purified wastewater at sewage treatment plants. The objectives are to simplify approval procedures and to allow the installation of water electrolysis units at sewage treatment plants.

APPROACH

- Development and comparison of various methods for producing the ultrapure water required from sewage treatment plant effluent
- Analysis of the effects of ultrapure water and hydrogen production on local-authority sewage treatment plants and the environment
- Assessment of the synergy potentials between hydrogen production and sewage treatment plants at one location
- Analysis of the potential added value of combining hydrogen technologies with sewage treatment plants

PROJECT PARTNERS

DVGW • DVGW Forschungsstelle • ebi

University of Kassel • Umwelttechnik BW GmbH

FUNDING

Baden Württemberg Ministry of the Environment, Climate Protection and the Energy Sector

Alternative H_2 production and derivatives

COnnHy – climate-neutral methane-based hydrogen production

Completion 07/2024

BACKGROUND AND OBJECTIVE

In order to ensure adequate hydrogen supplies, production processes based on the cracking of natural gas or methane and the separation of carbon or carbon dioxide will be necessary as a transitional technology. The COnnHy project is investigating the low-emission production of hydrogen from natural gas and biogas by the Boudouard reaction at reduced temperatures. Solid carbon is a by-product of the process.

APPROACH

- Assessment of the optimum operating window and appropriate materials for dry reforming and the Boudouard reaction
- Concept for the reactor, product and educt processing, and carbon treatment
- Laying the groundwork for implementation of a demonstration-scale plant

CO-FINANCING BODY

EuroNorm

PROJECT COORDINATOR

DVGW DBI GUT Gas- und Umwelttechnik

FUNDING

Project supported by:

Bundesministerium für Wirtschaft und Klimaschutz

In accordance with a resolution of the German Bundestag

Symboko – synthesis of methanol from biogas, with full carbon utilization

Completion 09/2024

BACKGROUND AND OBJECTIVE

As a result of their high energy density, green liquid fuels such as “green” methanol are beneficial for storage and transportation in vehicles, and especially ships. In the first phase of the project, an innovative process was developed for methanol production from biogas using hydrogen and oxygen from renewable sources. The purpose of the second phase is to demonstrate a small-scale decentralized production chain with the separation of carbon by plants, green hydrogen production, gas production by fermentation and liquefaction in an innovative integrated process.

PROJECT PARTNERS

WS Reformer • Leibniz-Institut für Katalyse (LIKAT) • AMS Technology

PROJECT COORDINATOR

DVGW DBI GUT Gas- und Umwelttechnik

FUNDING

Project supported by:

Bundesministerium für Wirtschaft und Klimaschutz

In accordance with a resolution of the German Bundestag

Photo: © Guindilla y Pimenta / AdobeStock

$BioH_2$ – Climate-neutral heat utilization and hydrogen production from biogenic residues and waste

Completion 06/2026

BACKGROUND AND OBJECTIVE

The objective of the $BioH_2$ project is to investigate climate-neutral, decentralized heat utilization and hydrogen production through the thermochemical conversion of biogenic residues and waste by the BHYO process. With a view to ensuring energy savings and greenhouse gas emission reductions, the project aims to investigate the optimum process technology and to evaluate the optimum utilization paths.

APPROACH

- Development of a patented thermochemical conversion reactor to produce synthesis gas from a variety of different types of biomass
- Investigation and development of process stages such as gas scrubbing and water gas shift reaction to improve H_2 yield at the same time as reducing CO_2 concentration in the product gas, and pressure swing adsorption
- Performance of plant test runs with various types of biomass to evaluate plant parameters for smooth and trouble-free process interaction

PROJECT PARTNERS

DBI Gas- und Umwelttechnik GmbH, Freiberg • BHYO • DBFZ Deutsches Biomasseforschungszentrum • Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V.

PROJECT COORDINATOR

TH Bingen – University of Applied Sciences

FUNDING

Project supported by:

Bundesministerium für Wirtschaft und Klimaschutz

In accordance with a resolution of the German Bundestag

Biogenic processes

Biogenic CO_2 conversion

Completion 12/2026

BACKGROUND AND OBJECTIVE

With the aid of methane-forming microorganisms (methanogens, organisms forming part of the archaea), hydrogen produced by electrolysis can be converted into methane in combination with CO_2. This is beneficial because methane has a higher energy density per unit volume than hydrogen. Furthermore, the gas infrastructure needed for storing and distributing methane and the appliances required (gas boilers) for methane utilization are already available on a nationwide basis and need no further technical modifications.

The BioKon project aims to optimise the biological methanation process in bubble columns. A process for the conversion of carbon dioxide from renewable sources and hydrogen from electrolysis into methane by biological methanation is established in the bubble column, which is suitable for retrofitting at biogas plants.

APPROACH

- Development and optimization of an innovative ceramic gas feeder system for biological methanation in a bubble column
- Investigation of the effects of process engineering parameters on the development and stability of microbiological systems, focusing on high-performance cultures
- Derivation and testing of approaches to the microbiological and process engineering optimization of biological methanation in the bubble column
- Preparation of a concept for the integration of the process in a biogas plant, including technical and economic assessment

PROJECT PARTNERS

Fraunhofer Institute for Ceramic Technologies and Systems (IKTS) • MicroPro • Ökotec Biogas Gesellschaft

PROJECT COORDINATOR

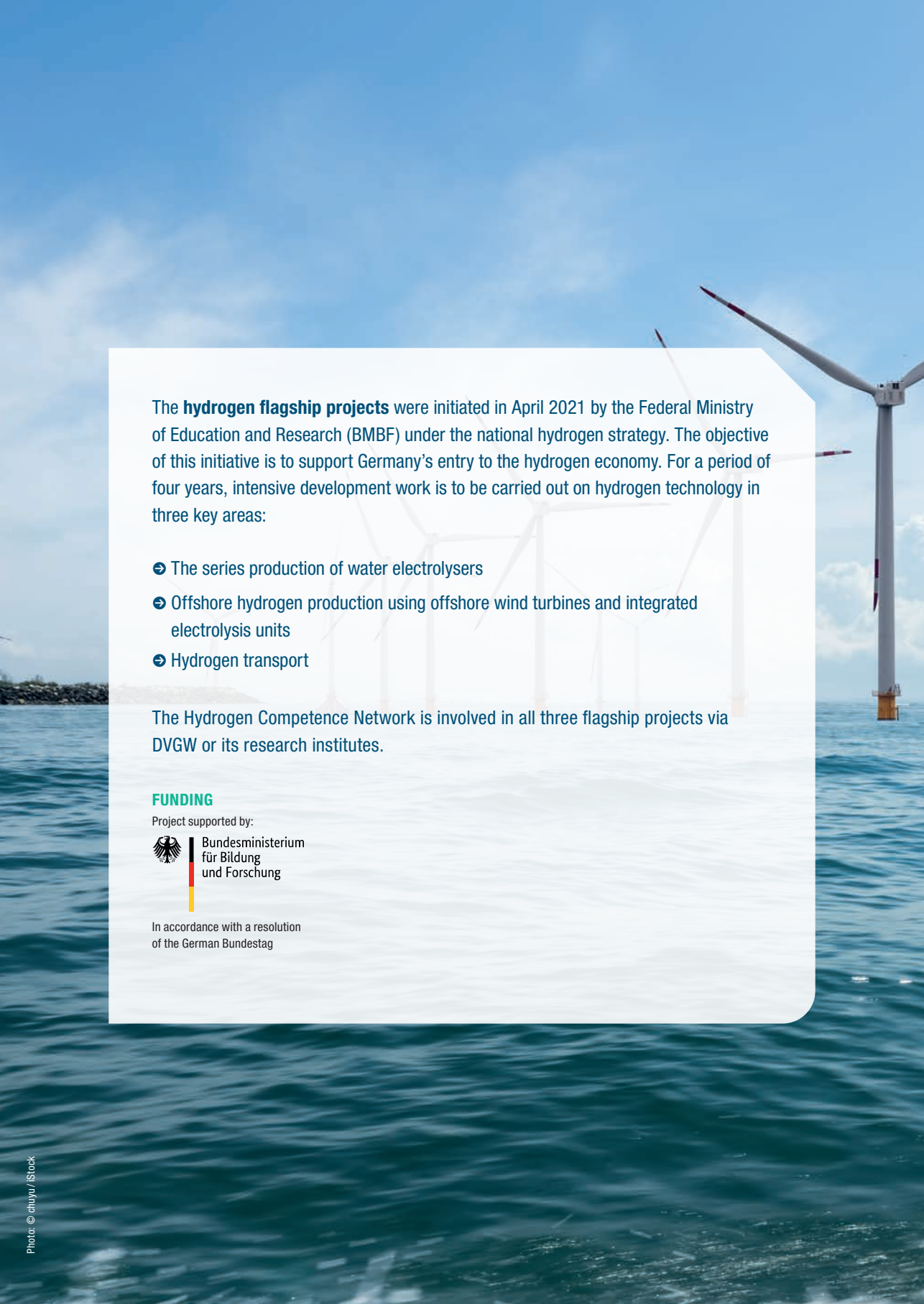
DVGW DBI GUT Gas- und Umwelttechnik

FUNDING

Project supported by:

Bundesministerium für Wirtschaft und Klimaschutz

In accordance with a resolution of the German Bundestag



The **hydrogen flagship projects** were initiated in April 2021 by the Federal Ministry of Education and Research (BMBF) under the national hydrogen strategy. The objective of this initiative is to support Germany's entry to the hydrogen economy. For a period of four years, intensive development work is to be carried out on hydrogen technology in three key areas:

- The series production of water electrolysers
- Offshore hydrogen production using offshore wind turbines and integrated electrolysis units
- Hydrogen transport

The Hydrogen Competence Network is involved in all three flagship projects via DVGW or its research institutes.

FUNDING

Project supported by:

Bundesministerium
für Bildung
und Forschung

In accordance with a resolution
of the German Bundestag

Hydrogen flagship projects

H_2Mare

Completion 03/2025

BACKGROUND AND OBJECTIVE

Using offshore wind farms with integrated electrolysers, it is feasible to produce green hydrogen on an industrial scale at the same time as saving the cost of connection to the electric power grid. The hydrogen produced in this way can then be converted into synthetic fuels. The objective of the flagship project H_2Mare is to turn this vision into reality.

PARTICIPATION OF THE DVGW GROUP

The DVGW Research Unit at the Engler-Bunte Institute of KIT is one of 30 partners in this project and contributes work in the gas and water sectors to the projerct elements *H_2Wind* and *PtX-Wind*.

APPROACH

- Development of a process chain for the offshore production of liquefied methane and a process for the production of CO_2 from seawater through the combined installation and operation of a catalytic honeycomb methanation plant and a liquefaction plant
- Investigation of technological and environmental water management issues for PtX processes on offshore platforms, including various waste water treatment processes
- Technical and economic assessment of the entire offshore process chain

H_2Giga

Completion 03/2025

BACKGROUND AND OBJECTIVE

In order to meet German demand for green hydrogen, large numbers of high-performance, cost-effective electrolysers will be needed. For this reason, the H_2Giga flagship project is investigating the industrial production of these units. Working together, established electrolyser manufacturers, component suppliers from various sectors of industry, research institutes and universities are forging ahead with the development of electrolysis technologies.

PARTICIPATION OF THE DVGW GROUP

DBI – Gastechnologisches Institut is participating in the project . “Electrolysis – removal of obstacles to innovation” as part of H_2Giga

APPROACH

- Assessment of measures to reduce obstacles to innovation in the fields of initial and further training, testing and standardization as well as legal conditions with a view to accelerating the market ramp-up of electrolysers

Photo: © Aerial Drone / AdobeStock

TransHyDE

Projects

System analysis
DVGW | ebi

Safe infrastructure

Standardization
DVGW
DVGW CERT
gwi

LNG2 Hydrogen
DVGW
DVGW | ebi

Regulations
DVGW

AmmoRef

AppLHy

GET H_2
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Mukran
gwi

Helgoland

Transport vectors investigated by the individual projects

- All transport vectors
- NH_2 ammonia
- LH_2 liquefied hydrogen
- H_2 gaseous hydrogen
- LOHC – liquid organic hydrogen carrier

Project supported by:
Bundesministerium für Bildung und Forschung
In accordance with a resolution of the German Bundestag

Hydrogen flagship projects

TransHyDE

Completion 03/2025

BACKGROUND AND OBJECTIVE

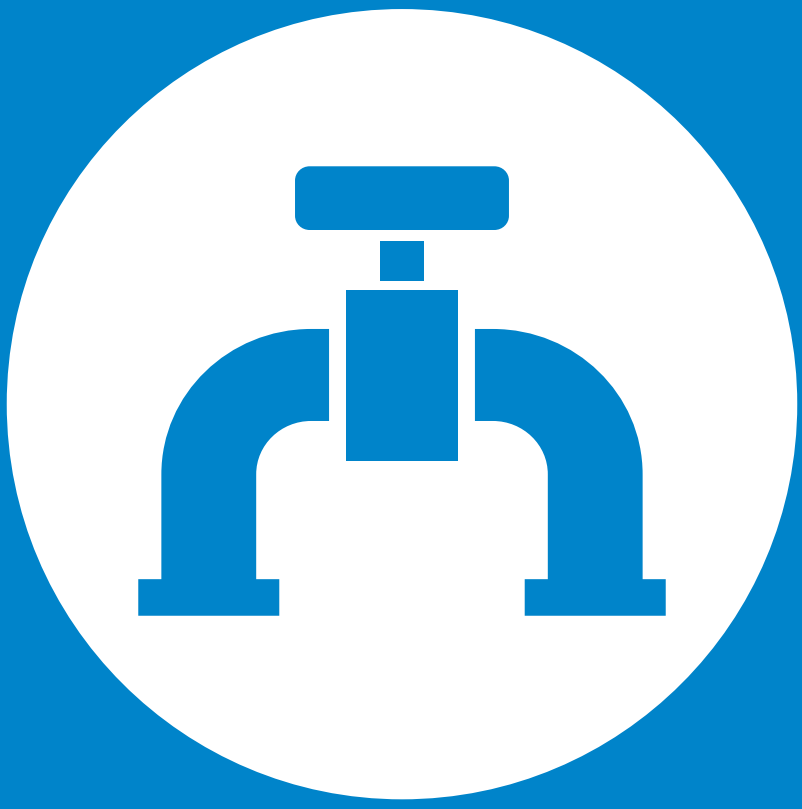
A well-functioning hydrogen economy will require suitable transport infrastructure. New solutions will be necessary, especially for hydrogen imports. There are many ideas, but it is not clear which approach will be suitable for which application and how they can be combined most effectively. The objective of this flagship project is to develop, assess and test hydrogen transport technologies.

PARTICIPATION OF THE DVGW GROUP

The DVGW Research Unit at the Engler-Bunte Institute of KIT is participating in the TransHyDe projects *system analysis*, *LNG2Hydrogen* and *GET* H_2. DVGW, DVGW Cert GmbH and Gas- und Wärme-Institut Essen are also partners in *the standardization and certification projects*. The Essen institute is also participating in *the Mukran hydrogen* storage project.

APPROACH

- Testing and upscaling of four demonstration projects for hydrogen transport technologies – in high-pressure tanks, in existing gas pipelines, in the form of ammonia and using liquid organic hydrogen carriers (LOHC)
- Systematic analysis of the role of hydrogen in energy systems and preparation of a roadmap outlining comprehensive hydrogen infrastructure for the future
- Development of possible standards and safety regulations for hydrogen transport technologies
- Assessment of the safety of hydrogen transport technologies, the efficient separation of hydrogen from ammonia and the filling of tanks with liquid hydrogen
- Development of a standardized catalogue of criteria and neutral objective assessment of the hydrogen-readiness of all the hydrogen transport technologies considered by the project
- Technical and economic assessment of various hydrogen supply options and continued use scenarios for LNG terminals focusing on SNG and methanol



Infrastructure

How we are making the gas grid H_2-ready

To achieve the goal of climate neutrality, the entire energy industry will need to be restructured. That not only applies to the power sector, but also to the energy system as a whole. Hydrogen will be one of the keys to this transformation. Step by step, hydrogen will replace natural gas, which is currently predominant, and account for the lion's share of the planned climate-neutral gases.

Hydrogen must be available on a nationwide basis in order to supply the almost 2 million companies and about 19 million households connected to the gas grid in Germany. Extremely well-developed infrastructure with a total length of over 540,000 kilometres is available for the transport, distribution and storage of climate-neutral gases. The infrastructure will need to be modified and converted where necessary.

DVGW research shows that the gas system can be upgraded and extended for the future distribution of hydrogen cost-effectively at reasonable additional cost.

The gas industry has already seen a number of changeovers of this type in the course of its history. The expertise and competence needed for the upcoming transformation are available. It is already technically feasible to operate gas grids with at least 10 percent hydrogen. The growing production and import capacities will provide an opportunity for increasing this share from 10 to 20 percent and to 100 percent in the long term.

This is why the research and standardization efforts of DVGW are currently focusing to a large extent on pipeline materials and individual components. Components are being tested to confirm their fitness for service with hydrogen in a large number of projects – this applies to the transport of hydrogen/methane mixtures as well as pure hydrogen.

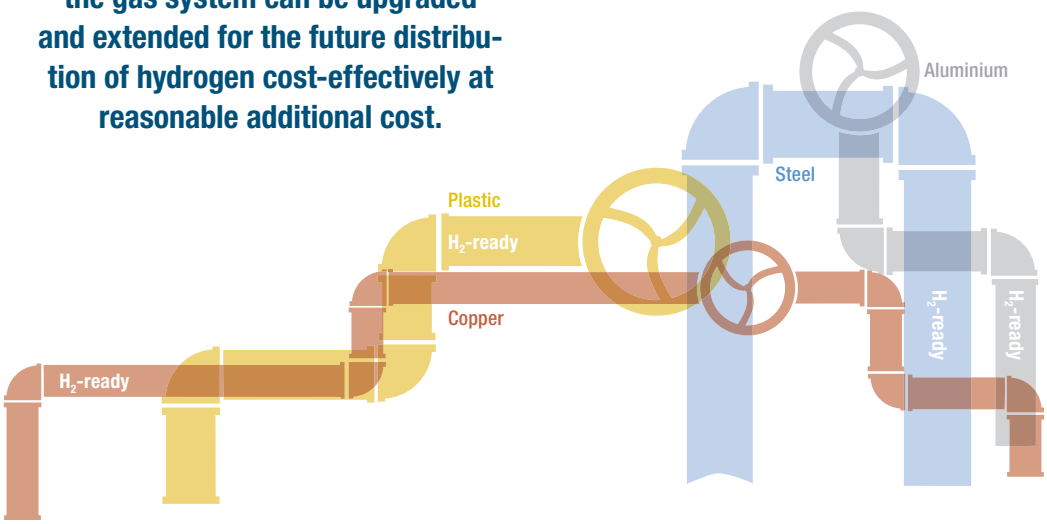


Photo: © Uniper SE

MefHySto – Metrology for Advanced Hydrogen Storage Solutions

Completed

BACKGROUND AND OBJECTIVE

The chemical storage of hydrogen is a highly promising possibility of storing volatile fuels from renewable sources and avoiding interruptions to energy supplies. For this purpose, reliable measurement methods, standards, reference methods and suitable materials will be needed. The objective of the MefHySto project was to investigate and continue the development of precise measurement methods and procedures for various hydrogen storage technologies in accordance with the applicable codes and standards.

PROJECT PARTNERS

University of Leoben (project coordination) • PIPELIFE Austria • Österreichische Vereinigung für das Gas- und Wasserfach (ÖVGW) • Borealis • DBI Gas- und Umwelttechnik • Polymer Competence Center Leoben • agru Kunststofftechnik Gesellschaft

FUNDING

EMPIR EURAMET

The EMPIR initiative is co-funded by the European Union's Horizon 2020 research and innovation programme and the EMPIR Participating States

This project has received funding from the EMPIR programme co-financed by the Participating States and from the European Union's Horizon 2020 research and innovation programme

To the project and the results:
www.mefhysto.eu

H_2 storage

Transformation paths for underground storage facilities – hydrogen compatibility of gas storage infrastructure

Completed

BACKGROUND AND OBJECTIVE

Underground storage facilities will play a key role in the energy transition and the achievement of climate goals. They can be used to store energy in the form of renewable gases. A crucial aspect will be the storage of climate-friendly hydrogen from future power-to-gas plants. In this context, the question of whether existing gas storage facilities can be used to store hydrogen and the cost of adapting to the storage of hydrogen will be crucial.

This project explored the effects of hydrogen on underground storage facilities. All the major components of existing underground and above-ground facilities, performance data and thermodynamic behaviour with respect to natural gas, hydrogen, and natural gas/hydrogen mixtures as well as the economic effects on plant infrastructure and the operation of future hydrogen storage facilities were investigated. The project was based on existing publications and research projects.

RESULTS

- All the cavern storage facilities in Germany will be fully available for the storage of up to 100 percent hydrogen.
- On the basis of this study, it is assumed that four of the 16 porous rock storage facilities will be fit for the storage of pure hydrogen. However, individual investigations will be needed to confirm fitness for hydrogen storage.
- The storage facilities considered to be fit for the storage of hydrogen will have a storage capacity of about 32 TWh.

CO-INITIATORS

Initiative Erdgasspeicher • Bundesverband Erdgas, Erdöl und Geoenergie

PROJECT COORDINATOR

DVGW DBI GUT Gas- und Umwelttechnik

Photo: © Bet_Noire / iStock

HIGGS – Hydrogen in gas grids

Completed

BACKGROUND AND OBJECTIVE

Under EU environmental and energy legislation, greenhouse gas emissions are to be reduced by 45 percent by 2030. Hydrogen from renewable sources can help in achieving this objective. The existing natural gas grids can carry this hydrogen.

This EU project investigated the hydrogen compatibility of the high-pressure gas transmission system and the effects of hydrogen addition and hydrogen transport on the natural gas system. Information on European regulations, standards and certifications concerning hydrogen admixtures up to 100% by volume was also compiled.

PROJECT PARTNERS

Fundación para el Desarollo de las Nuevas Tecnologías del Hidrógeno en Aragón (FHA) • TECNALIA • OST Ostschweizer Fachhochschule • European Research Institute for Gas and Energy Innovation (ERIG) • Redexis Gas • DVGW

FUNDING

This project has received funding from the Fuel Cells and Hydrogen 2 Undertaking under Grant Agreement No. 875091. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme and Hydrogen Europe and Hydrogen Europe Research.

To the project:
www.higgsproject.eu

H_2 transmission pipelines

H_2 and welding – effects of welding on the hydrogen absorption and degradation of H_2 transmission pipelines

Completion 10/2025

BACKGROUND AND OBJECTIVE

In Germany, the transformation to an economy with hydrogen-based energy supplies is to be accomplished mainly on the basis of the changeover of the existing natural gas system. However, the feasibility of repairing and expanding existing natural gas pipelines needs to be investigated if they are to be changed over to hydrogen.

The welding of existing gas pipelines at operating pressure is one of the key repair technologies used, irrespective of the composition of the gas carried by the pipeline. The project H_2 and welding is intended to clarify whether and to what extent the properties of welded pipeline steels in gas systems may be degraded as a result of hydrogen absorption.

APPROACH

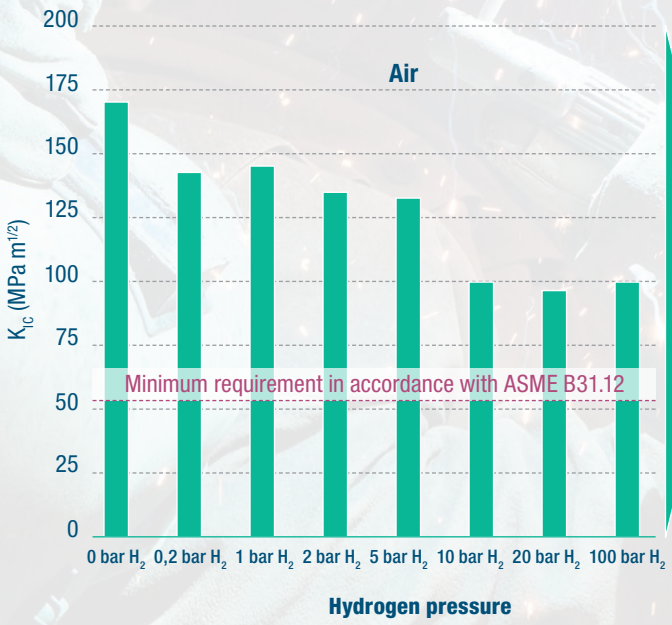
- Autoclave tests at constant hydrogen pressures to obtain information on hydrogen concentrations and possible degradation
- Welding tests with instruments on selected materials and joints to determine temperatures on the inner surface of the pipe, both under realistic laboratory conditions and in industrial operation
- Characterization of the welded joints produced on the basis of macro sections combined with hardness mapping of the welding material, heat affected zone and parent metal
- Numerical simulation of the temperature field in the pipe cross-section and calculation of hydrogen diffusion

RESEARCH INSTITUTE

Bundesanstalt für Materialforschung und -prüfung (BAM)

Effect of H_2 partial pressure

Variation of H_2 pressure, material, ST 35



An increase in the H_2 partial pressure results in a slight fall in the fracture toughness K_{IC}. followed by saturation.

All the results are higher than the minimum value of 55 MPa $m^{1/2}$ required by ASME B31.12.

Photo: © ONTRAS

H_2 fitness of steels

Completed

BACKGROUND AND OBJECTIVE

For the safe transport of hydrogen via the German gas grid, it is necessary to assess the fitness of steel components for service with hydrogen and to adapt the DVGW codes of practice accordingly. To date, requirements for 100 percent hydrogen have only been laid down in the US standard ASME B 31 12 of December 2019.

This project therefore included tests on random samples of steel materials used in gas pipelines and plants. Materialprüfungsanstalt Stuttgart carried out technical tests on a representative sample of steels used for German and in some cases European pipelines.

RESULTS

- All the steels tested are fit for service with hydrogen. Both ageing behaviour in operation and fracture toughness are in accordance with expectations for the safety and reliability of pipelines for hydrogen transport over a period of decades.
- The comprehensive tests also took into account variables such as the effect of hydrogen pressure. These tests now allow more precise predictions of useful life and forecasts of the service life of pipelines over a longer period of time.
- The results are transferable to pipelines operated at lower pressures. The pipelines in the German gas grid may remain in operation with hydrogen.

RESEARCH INSTITUTE
Materialprüfungsanstalt Stuttgart

PROJECT COORDINATOR
OGE

Assessment of the fracture mechanics of H_2 pipelines

Completion 10/2024

The results of the project. "H_2 fitness of steels" have since been incorporated in DVGW code of practice G 464 for high-pressure gas pipelines >16 bar. This code of practice describes in detail the performance of fracture mechanics assessments for high-pressure gas pipelines. The procedure described can also be applied in principle to lower hydrogen partial pressures.

For gas pipelines operated at lower pressures, the question arises as to whether fracture mechanics assessments in accordance with DVD G 464 are absolutely necessary. In the short project "Fracture mechanics assessments of H_2 pipelines", Open Grid Europe GmbH is therefore investigating the question of the hydrogen partial pressure above which relevant effects on pipeline integrity are to be expected, whether fracture mechanics assessments are not necessary for gas pipelines with operating pressures below 16 bar and the maximum operating pressure below which fracture mechanics assessments are generally not required.

To the project:
www.dvgw.de/h2-stahl

Photo: © onurdongel / iStock

Changeover to H_2

Completion 12/2024

BACKGROUND AND OBJECTIVE

Several projects have already shown that it is technically feasible to change gas distribution networks over to hydrogen. However, not all the questions arising in connection with the specific changeover procedure have yet been answered. The objective of this project is to outline a standardized concept for the changeover of a system section and the customers connected to it. A detailed description of the relevant phases in the hydrogen changeover process (gas distribution network, domestic services and gas appliances) is to be prepared.

APPROACH

- Determination of conditions to be considered, analyses and tests as well as aspects to be taken into account when dividing a network into sections (e.g. specialist personnel and time requirements) on the basis of an investigation of publications available, expert workshops and a pilot hydrogen system
- Development of efficient processes for changeover to 100 percent hydrogen for gas distribution networks, domestic services and gas appliances
- Preparations for a follow-up project for the practical verification and optimization of the changeover process

RESEARCH INSTITUTES

DVGW Forschungsstelle ebi | DVGW DBI GUT Gas- und Umwelttechnik | gwi

TrafoHyVe – transformation process for the integration of hydrogen at the level of gas distribution systems

Completion 12/2024

BACKGROUND AND OBJECTIVE

It will be necessary to ensure the acceptance of hydrogen by distribution system operators and local users. The objective of this project is therefore to develop innovative planning methods laying the foundation for the transformation of distribution networks and the use of hydrogen.

APPROACH

- Assessment of technical, infrastructure and economic aspects on the basis of actual data of the rural and urban distribution grids of the participating municipal utilities and network operators
- Development of a simple method for estimating the cost of changing a distribution system over to hydrogen
- Development of strategies for implementing the energy transition at the level of distribution networks and for the reliable, structured planning of a hydrogen changeover project for existing networks

PROJECT COORDINATOR

DVGW Forschungsstelle ebi

FUNDING

Bundesministerium für Wirtschaft und Klimaschutz

In accordance with a resolution of the German Bundestag

H_2 distribution grids

H_2Infra – safe and efficient operation of hydrogen distribution networks

Completion 12/2024

BACKGROUND AND OBJECTIVE

In connection with research carried out within the framework of the projects "H_2-Netz" and "H_2-Home" funded by the Federal Ministry of Education and Research (BMBF), a research infrastructure for hydrogen distribution networks was established in Bitterfeld-Wolfen. This is now being used and developed to clarify a large number of open questions.

The research work focused on ensuring the functioning of a hydrogen distribution network, including all its components, under dynamic operating conditions, especially at the same time as ensuring extremely high gas quality and security of supply for future applications.

APPROACH

- Identification of residual materials that currently impair hydrogen quality and determination of their origins (pipe materials, manufacturing process)
- Investigation of the H_2 readiness of infrastructure components

PROJECT PARTNERS

DBI Gas- und Umwelttechnik • Mitteldeutsche Netzgesellschaft Gas (MITNETZ Gas) • Leipzig University of Applied Sciences

FUNDING

Project supported by:

Bundesministerium für Wirtschaft und Klimaschutz

In accordance with a resolution of the German Bundestag

To the project:
www.dbi-gruppe.de/h2infra

Photo: © DVGW, Roland Horn

HyWaBe – extension of ISO 18453 to hydrogen

Completion 11/25

BACKGROUND AND OBJECTIVE

ISO 18453 was included in the CEN/DIN standards in 2005. The calculation methods stated in the standard only apply to natural gas and only within a limited pressure and temperature range. The standard therefore does not adequately reflect many current and future applications and hydrogen is not taken into consideration at all. Within the framework of this project, the standardized calculation method is to be extended to hydrogen. In addition, typical constituents of hydrogen mixtures, depending on the production process (e.g., carbon dioxide and carbon monoxide) are also to be taken into consideration.

APPROACH

- Research covering existing publications concerning thermodynamic material data in the natural gas / hydrogen (zero – 100%)/water system over the pressure and temperature range considered and associated measurement uncertainties
- Testing and commissioning the measurement system and initial measurements on the basis of the research carried out
- Experimental determination of the thermodynamic data required
- Development and adaptation of the calculation algorithm

RESEARCH INSTITUTE

University of Bochum – Department of Thermodynamics

INDUSTRIAL PARTNER

OGE

H_2 quality

H2-dvgw.de

Hydrogen quality in a national German hydrogen system

Completed

BACKGROUND AND OBJECTIVE

Natural gas infrastructure can be used for the transport, storage and distribution of hydrogen. However, there is still a need for some research concerning possible trace substances and treatment steps as well as requirements concerning gas composition and standardized calculation methods. Research work on gas quality is concentrating on these aspects. A number of studies are being carried out to gain an overview of hydrogen quality requirements.

RESULTS

- A preliminary study showed that the transportation of hydrogen via converted natural gas pipelines is feasible. An up-to-date overview of gas quality requirements stated in standards and the scope of these requirements was drawn up.
- In the first stage of the project, investigations were carried out with co-financing by the GET industry initiative to determine the requirements to be met in the fields of production, transport, distribution, storage and utilization. It was found that large quantities of very high-quality hydrogen will be needed in 2045, and that appropriate treatment will be required.
- These points were considered in greater detail in the second stage of the project and solutions were developed with respect to the hydrogen quality required in networks and the approach to be adopted for ensuring compliance with these requirements.

RESEARCH INSTITUTES

DVGW Forschungsstelle, ebi, DVGW, DBI GUT Gas- und Umwelttechnik, frontier economics

INDUSTRY PARTNER

OGE

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H_2 Membran – establishment and operation of a pilot plant for testing membranes

Completion 07/2024

BACKGROUND AND OBJECTIVE

The addition of hydrogen to natural gas poses challenges for some infrastructure facilities such as natural gas refuelling stations or gas industry plants. Hydrogen / natural gas mixtures can be separated into their components using membrane technologies. If the constituent which is not required in each case is removed, existing gas infrastructure may also be used for sensitive applications in industry or for fuel cells. The objective of the project is to determine which membranes are suitable for separating hydrogen and natural gas from a gas mixture.

APPROACH

- Installation and commissioning of the demonstration plant in Prenzlau for testing the suitability of membranes for hydrogen recovery from mixtures
- Tests on (long-term) stability, separation properties, possible purity values, cost, time to market, scalability and delivery capabilities, together with the membrane manufacturers

PROJECT PARTNERS

ONTRAS Gastransport • GRTgaz Deutschland • Mitteldeutsche Netzgesellschaft Gas (MITNETZ Gas) • ENERTRAG

PRODUCT COORDINATOR

DVGW DBI GUT Gas- und Umwelttechnik

H_2 quality

H2-dvgw.de

RingWaBe – round-robin hydrogen quality tests: comparability of hydrogen quality analysis

Completion 12/2025

BACKGROUND AND OBJECTIVE

Constant hydrogen quality is a pre-requisite for the acceptance of hydrogen technologies and maintaining the value of such technologies. In order to ensure compliance with quality standards, the composition of the gas must be regularly measured and monitored upstream from and at the point of use. Various round-robin tests are being carried out to compare and verify sampling procedures, test laboratories, instrumentation and methods in accordance with ISO 21087:2010.

APPROACH

- Development of new gas standards and establishment of secondary standards
- Performance of round robin tests at realistic industrial and application conditions for the validation of analysis laboratories and hydrogen sampling in the field (e.g. at hydrogen refuelling stations, pipeline systems and electrolysers)
- Creation of a statistically well-founded basis for hydrogen sampling as a reference for fuel quality by round-robin tests
- Testing new off-line and online analysis procedures for monitoring the quality of pure hydrogen during future transport in gas pipeline systems

PROJECT PARTNERS

Bundesanstalt für Materialforschung und -prüfung • German Aerospace Center • DVGW Research Unit at the Engler-Bunte Institute of KIT • Open Grid Europe • Physikalisch-technische Bundesanstalt • TÜV SÜD Industrie Service • Westfalen • Zentrum für Brennstoffzellenforschung • Zentrum für Sonnenenergie- und Wasserstoff-Forschung

PROJECT COORDINATOR

Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie (NOW)

FUNDING

Project supported by:

Bundesministerium für Verkehr und digitale Infrastruktur

The project “RingWaBe –comparability of hydrogen quality analysis” is receiving total funding of €3,708,252 from the Federal Ministry of Transport and Digital Infrastructure within the framework of the National Innovation Program Hydrogen and Fuel Cell Technology – Phase 2 under project code 03B11026. The funding guidelines are being coordinated by NOW GmbH and implemented by Projektträger Jülich (PTJ).

Photo: © AdobeStock Studio

H_2 and plastics – behaviour of multilayer plastic pipes for gas supply systems

Completion 07/2024

BACKGROUND AND OBJECTIVE

In the case of plastic pipe systems, both the long-term behaviour of the material and gas losses via permeation through the pipe wall are important. Taking into consideration gas losses, it is necessary to determine what types of plastic pipes may be used for hydrogen by network operators in accordance with current safety standards. The project focuses on multilayer pipes for pressure ratings up to 45 bar.

APPROACH

- Assessment of multilayer pipes already developed for use in gas supply, together with manufacturers
- Laboratory tests of various types of pipes
- Assessment of application possibilities taking into consideration work on pipelines in the field

INDUSTRY PARTNER

SKZ

PROJECT COORDINATOR

DVGW DBI GUT Gas- und Umwelttechnik

HydEKus – H_2 and materials

Completion 09/2024

BACKGROUND AND OBJECTIVE

Insufficient scientific knowledge is currently available concerning materials such as elastomers, flange materials, sealants, lubricants or flat gaskets. The objective of this project is to compile and evaluate basic scientific knowledge and results which will be important for many players in the gas industry for ensuring the safe completion of the transformation of gas infrastructure.

APPROACH

- Experimental investigations of components and materials in order to gain scientific knowledge for the preparation and implementation of test specifications
- Compilation and further development of scientific knowledge for hydrogen applications
- Definition of requirements to be met by products used in gas infrastructure

RESEARCH INSTITUTE

DVGW Forschungsstelle ebi

INDUSTRY PARTNER

OGE

INFRASTRUCTURE

H_2 readiness of components and materials

H_2 tolerance of ductile cast iron

Completion 08/2024

BACKGROUND AND OBJECTIVE

In Germany, some 10,000 kilometres of ductile cast iron pipes are installed in gas distribution systems. However, well-founded results indicating whether and in what form these pipes may be used safely for the transport and distribution of hydrogen are not available. This project considers the question of how the hydrogen readiness of ductile cast iron can be demonstrated, and what aspects need to be taken into consideration for the conversion of existing pipelines.

APPROACH

- Compilation of basic information on the hydrogen readiness of ductile cast iron
- Analysis of research reports from the United Kingdom, Spain and Germany concerning the use of ductile cast iron pipelines for hydrogen distribution and assessment of such information for the DVGW codes of practice
- Fracture mechanics calculations with different pressures and hydrogen concentrations

SERVICE PROVIDER

Veenker Ingenieurgesellschaft

H_2toPipe – Innovative materials for the efficient transport of green hydrogen via the Austrian gas grid

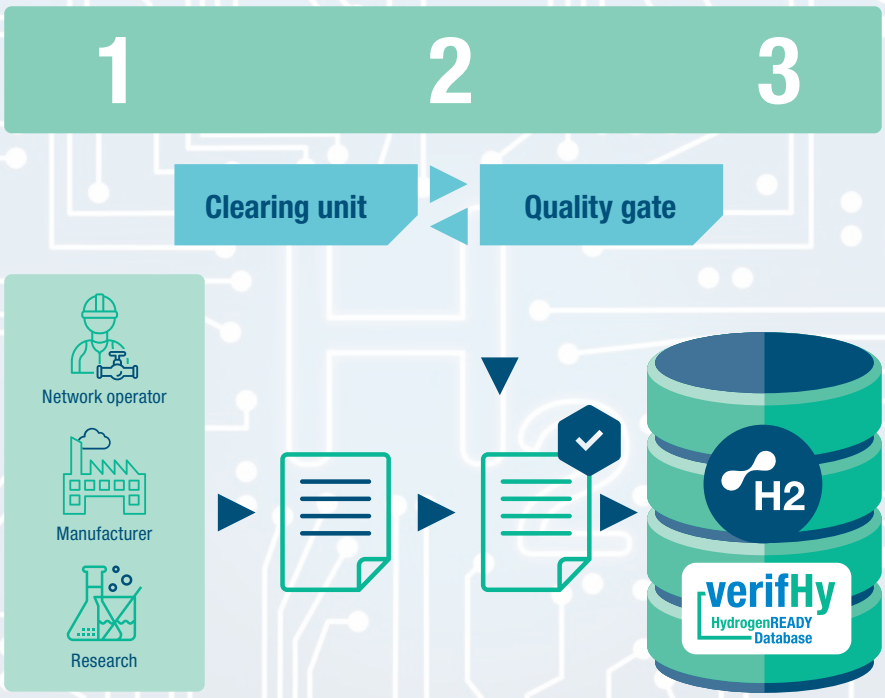
Completion 09/2025

BACKGROUND AND OBJECTIVE

The permeation properties of polyethylene are to be massively improved by the targeted modification of material morphology and the use of fillers and barrier layers. In addition, fracture mechanics methods are to be used to analyse the expected service life of polyethylene when exposed to hydrogen.

PROJECT PARTNERS

University of Leoben (Project coordinator) • PIPELIFE Austria • Österreichische Vereinigung für das Gas- und Wasserfach (ÖVGW) • Borealis AG • DBI Gas- und Umwelttechnik • Polymer Competence Center Leoben • agru Kunststofftechnik Gesellschaft



INFRASTRUCTURE

H_2 readiness of components and materials

H_2 database

Completed

BACKGROUND AND OBJECTIVE

DVGW studies confirm that many natural gas infrastructure components are fit for service with hydrogen. In order to obtain a comprehensive overview of the H_2 readiness of gas networks and components, DVGW compiled full information from completed and current projects in an online database.

The results laid the foundation for a digital work of reference concerning the hydrogen tolerance of components and products used throughout gas infrastructure, including underground storage facilities, as a function of materials and functions – this is the “verifHy” database.

RESULTS

- Existing knowledge on the effects of up to 100 percent hydrogen by volume in gas transmission and distribution systems, as well as underground storage facilities was compiled and transferred to a work of reference.
- Components and products are presented in brief, one-to-two-page descriptions and their H_2 tolerance is assessed.
- The existing work of reference was digitized and is now available in the form of an online database, including the results of scientific and research work as well as manufacturers’ information.
- The verifHy database initially included information on 250 materials, 75 components and 105 products taken from DVGW research. The data are being continuously extended. All the data in verifHy are verified by DVGW prior to publication, and then on a continuous basis.

PARTICIPATING PROJECTS

H_2-compendium, distribution system operators • H_2-compendium, transmission system operators (parts 1 and 2) • H_2 database, underground storage facilities

PROJECT PARTNERS

DVGW DBI Gruppe DVGW S & C

Photo: © FedotovAnatoly /iStock

H_2 detection –gas leakage from buried pipelines carrying gases with low and high H_2 concentrations

Completed

HINTERGRUND UND ZIEL

The transmission and distribution of hydrogen, whether in the form of mixtures with natural gas or as pure hydrogen, gives rise to safety concerns with respect to the detection of leakages from buried pipelines. This project was concerned with the propagation of hydrogen from leakages, both in and from the soil, as well as with the above-ground detection of leakages. In the course of the project, a technology screening to identify possible measurement methods for above-ground hydrogen detection was carried out. Selected instruments were then assessed in terms of metrology and reviewed to identify possible applications.

RESULTS

- The three H_2 gas detection units investigated demonstrated a high sensitivity to hydrogen. The above-ground inspection of buried pipelines is feasible using these instruments.
- The two additional (methane) gas concentration measurement units also investigated may be used for the above-ground inspection of gas pipelines carrying mixtures with a hydrogen concentration of up to 30 percent by volume.
- The above-ground inspection of buried pipelines carrying hydrogen in accordance with DVGW code of practice G 465-1 is therefore feasible using these instruments.

RESEARCH INSTITUTE

DVGW Forschungsstelle ebi

INDUSTRY PARTNER

OGE

Safe operation with H_2

ECLYPSE – characterization of the leakage rates of test leaks

Completed

BACKGROUND AND OBJECTIVE

In the case of natural gas or LNG, air can be used as a test gas without any problems. However, the measurement results are changed in the case of mixtures of methane and hydrogen. It would still be preferable to use air as a test gas for these mixtures. The objective of the ECLHYPSE project was to find out whether and how measurements made using air as a test gas could be converted to obtain results applicable to natural gas, hydrogen or mixtures of natural gas and hydrogen. For this purpose, the applicability of flow models for different test gases and pressures was investigated using various different test leaks.

RESULTS

- Conversion factors for air and methane were determined for the reference point and the entire reference pressure range. In the case of the addition of up to 30 percent hydrogen by volume to the methane, there was only a slight increase in the conversion factor.
- For methane and mixtures with up to 30 percent hydrogen, a general conversion factor of 1.7 is recommended for the entire test pressure and leakage rate range. There was considerably greater variation in correction factors for hydrogen and detailed consideration of the specific applications is required.

RESEARCH INSTITUTES

gwi, DVGW Forschungsstelle, ebi

Flange tightness – tightness testing of flanged joints for operation with hydrogen

Completed

BACKGROUND AND OBJECTIVE

This project investigated the tightness of flanged joints. The main focus was on the question of whether the test methods and test fluids currently used are suitable for the testing of gas systems to be operated with hydrogen and hydrogen/natural gas mixtures. On the basis of the results, additional tests and test fluids were added to the current tightness test procedure.

RESULTS

- All the flanged joints tested in the course of the project were tight.
- The results required were outperformed by a factor of 1000.

RESEARCH INSTITUTE

gwi

HySpeed – flow speeds of H_2 in gas pressure regulating stations

Completion 07/2025

BACKGROUND AND OBJECTIVE

As hydrogen has a lower energy density than natural gas, hydrogen must flow at a speed about 3 to 4 times higher (approx. 60 m/s) than methane in order to deliver the same energy quantities and to maintain the energy transport capacity of the German gas grid.

The “HySpeed” project is investigating the practical effects of such higher flow speeds with hydrogen on gas infrastructure and especially gas pressure regulating stations and components.

APPROACH

- Investigation of effects on higher flow speeds with hydrogen at gas pressure regulating stations on parameters including pressure loss, vibrations and pulsations, as well as acoustic effects.
- Investigation of existing publications, calculations, simulations and measurements to determine the maximum acceptable or admissible flow speeds for hydrogen in gas systems while maintaining safe network operation

INDUSTRY PARTNER

Honeywell Gas Technologies

RESEARCH INSTITUTES

gwi DVGW DBI GUT Gas- und Umwelttechnik

H_2 safety

Completion 05/2025

BACKGROUND AND OBJECTIVE

As in the case of natural gas systems, hazard areas for hydrogen systems need to be defined and sized for safety and insurance reasons. As with natural gas, the possibility that gas may be released into the atmosphere cannot be excluded.

While small quantities of hydrogen presumably do not represent a hazard, larger quantities should be combusted in a controlled process. The ignition of large hydrogen clouds may result in pressure waves with the potential to cause significant damage. Flares may be used for controlled combustion. However, the DVGW codes of practice do not provide any information which could be of assistance for the selection and safe operation of flares. The objective of the H_2 safety project is to obtain the information required.

APPROACH

- Analysis of published experimental and numerical data, software calculations and flow simulations with gases
- Development of rules for the sizing of hazard areas.
- Definition of conditions for the use of flare systems and preparation of design requirements for H_2 flares
- Additional safety requirements for hydrogen operation

PROJECT COORDINATOR AND CO-SPONSOR

OGE

Safe operation with H_2

H_2Vent

Completion 01/2025

BACKGROUND AND OBJECTIVE

For the development of hydrogen infrastructure and the conversion of parts of natural gas systems to hydrogen operation, it is first necessary to obtain well-founded information on the behaviour of hydrogen. The codes of practice currently available for the commissioning and shut-down of pipeline sections only cover flow parameters and procedure requirements for natural gas.

In the gas industry, it is normal practice to purge pipelines with ambient air. This procedure cannot be used in the case of hydrogen for safety reasons. However, the purging of pipelines to obtain an inert state will be a crucially important operation for the future hydrogen industry. Scientific and technical investigation of the appropriate procedures is therefore required. This is the main focus of this research project, with a view to ensuring the safe operation of hydrogen infrastructure.

APPROACH

- Preparation of a semi-analytic single-dimensional model for the simplified description of purging processes
- Preparation of a numerical model for the investigation of detailed flow processes in longer sections of gas transmission pipelines
- Numerical simulation (based on computational flow dynamics) of various purging scenarios in gas pipelines and integration of the results in the model
- Verification of the quality of forecasts by the extended model using comparisons with available measured values and data from CFD simulations, appropriate adjustment of the model

RESEARCH INSTITUTE

TU Bergakademie Freiberg - Institute of Mechanics and Fluid Dynamics


Bei Gasgeruch:
Keine Panik!
Gashahn zu!
Keine Flammen, keine Funken, keine Schalter betätigen, kein Telefon!
Mitbewohner warnen (klopfen, nicht klingeln), raus aus dem Haus!
Alle Fenster und Türen auf, für Durchzug sorgen!
Bereitschaftsdienst anrufen – von außerhalb des Hauses!
DVGW

Photo: © DVGW

INFRASTRUCTURE

H_2 odorization

Completed

BACKGROUND AND OBJECTIVE

The addition of odorants to natural gas, LPG and other fuel gases (odorization) is important for the rapid identification of leaks. These gases are virtually odourless. While odorization is normal practice in public gas supply systems, the use of odorants for the distribution of gases containing hydrogen has not been investigated in detail. For this reason, DVGW initiated various research projects for the in-depth investigation of this safety aspect.

The project H_2Odor was concerned with the use of conventional odorants in hydrogen and hydrogen / natural gas mixtures and the effects of these substances on fuel cell applications. The project H_2 OdoSen clarified the odorization of hydrogen and also investigated an alternative safety concept using sensor-based gas detection.

APPROACH

- The project investigated odorization and the option of the sensor-based detection of gas leakages in building interiors in connection with the distribution of gas mixtures with a high hydrogen concentration via pipeline systems.
- The results show that odorization is generally feasible for hydrogen and gases containing hydrogen (fifth gas family, group A) in accordance with DVGW code of practice G 280:2018 without any problems while complying with high safety standards.

RESEARCH INSTITUTES

DVGW | DBI GUT Gas- und Umwelttechnik | DVGW Forschungsstelle ebi

Photo: © Heiko Küverling/iStock

H_2 and valves

Completed

BACKGROUND AND OBJECTIVE

For the safe introduction of hydrogen, appropriate modifications to the DVGW codes of practice will be needed. The safe handling of hydrogen will be crucially important in view of its very special physical properties. This applies especially to the effects on the strength and toughness of materials used in existing gas transmission infrastructure and especially in valves.

In several DVGW projects, various aspects such as hydrogen tolerance and tightness as well as the long-term behaviour of valve coatings and seal systems in hydrogen operation were investigated. In addition, fracture mechanics analyses were carried out to verify stability and to investigate possible incipient cracking on welds in valves.

RESULTS

- The effects of hydrogen on coatings and base materials as well as on hardness were so marginal that it must be assumed that the materials are fit for service with hydrogen.
- Irrespective of the individual material, the spring forces determined did not indicate any effects of load cycles in a hydrogen atmosphere on the material. It can therefore be assumed that the spring units investigated are fit for service with hydrogen.
- Tests on random samples of valves showed that they are fit for a future changeover to hydrogen service with respect to external tightness. Nevertheless, the condition of the valves concerned should be inspected and assessed prior to a planned pipeline changeover.
- Also taking into consideration residual welding stress, all valves investigated, which constituted a representative cross-section of the valves installed, offered adequate safety reserves for operation with high-pressure hydrogen.

PARTICIPATING PROJECTS

H_2 and isolating valves (KuFeH_2) • H_2 tightness of valves • H_2 tolerance of valves (UKoBaRi H_2) • H_2 tolerance of welds on valves (UKoBaRiS-H_2)

RESEARCH INSTITUTES

DNV AS • Fraunhofer Institute for Mechanics of Materials IWM

Application sectors

Hydrogen – the all-rounder

Hydrogen is a highly versatile fuel with a wide variety of possible applications in different sectors. It can already be mixed with natural gas and distributed for heating residential buildings via the existing gas infrastructure.

In addition, hydrogen will play a key role in the decarbonization of industrial processes, especially where high temperatures are required. Although conversion to hydrogen will call for investments, it will allow sustainable, carbon-neutral production in processes for which the use of electric power is not feasible.

In the transport sector, natural gas can be used in fuel cells to generate electricity for powering road vehicles and ships. In marine transport and aviation, hydrogen will also be a key element in climate-neutral mobility.

Hydrogen can be stored without any problems in existing gas storage facilities and used for power generation in power plants or decentralized power generation in fuel cells where required. This way, power supplies can be safeguarded at times when renewable energy sources such as solar and wind power are only available to a limited extent, without having to use fossil fuels such as gas or coal.

It is already feasible to supply buildings, industrial plants, power plants and commercial establishments to a large extent using 100% hydrogen or hydrogen / natural gas mixtures.

In its research projects, DVGW is exploring all these areas of application and investigating requirements concerning gas composition and the transformation of applications to hydrogen. Household appliances and industrial applications are being tested to verify their hydrogen tolerance and the establishment of hydrogen infrastructure for the logistics sector is being assessed.

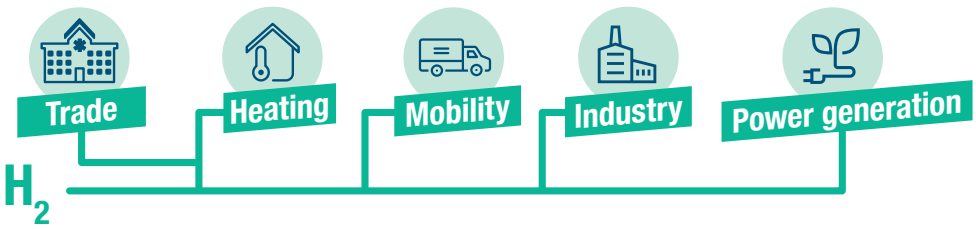
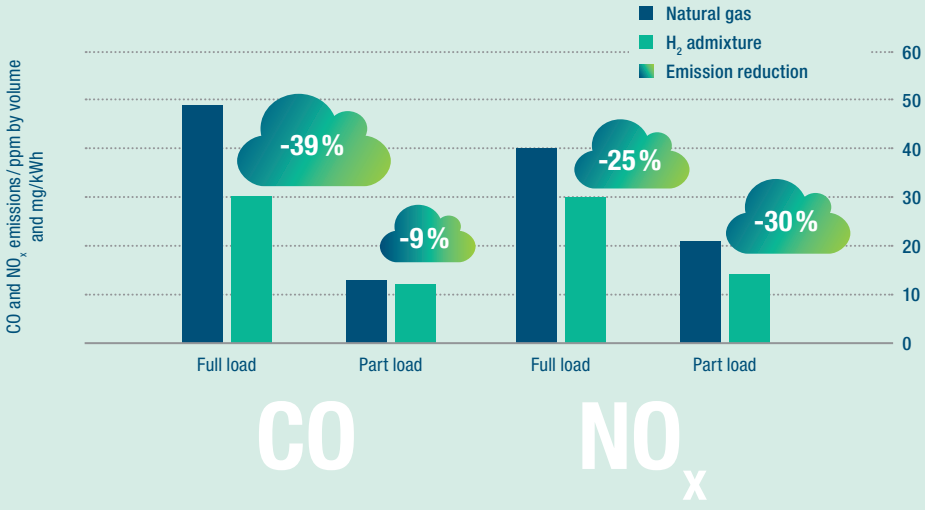


Photo: © Jan-Schneckenhaus / iStock

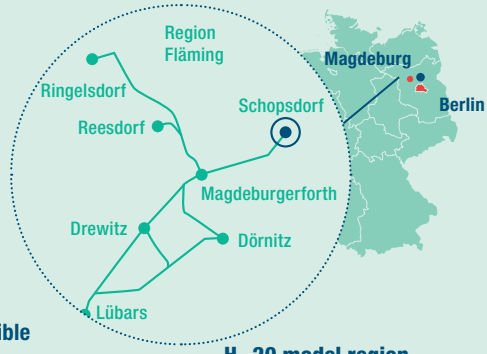
Emission reduction through H_2 admixture



Facts and figures – the H_2-20 project

- Seven villages in Fläming (Saxony-Anhalt)
- Medium-pressure distribution system built in 1994
- Pipeline length 35 km
- About 350 gas appliances, some more than 30 years old, from more than 30 manufacturers
- 300 random sample measurements during admixture phases
- Admixture of 10, 15 and 20 percent H_2 during two heating seasons, with staged changes

Up to 20 percent hydrogen admixture possible without changes to network and appliances



H_2-20 model region – Fläming in Saxony-Anhalt

Building sector – H_2 addition

H_2-20 – field test with 20% hydrogen in distribution system

Completed

BACKGROUND AND OBJECTIVE

In order to test the H_2 readiness of a real-life gas supply area, mainly with households and very few commercial establishments, hydrogen was added to a gas distribution system in the region of Fläming (Saxony-Anhalt) which had been in operation since 1994. Before the tests were carried out, operational and safety checks were made on 352 gas appliances operated by customers. At the same time, all the components of the distribution system were checked to verify their hydrogen tolerance and an injection unit was installed.

Hydrogen was then injected into the system in steps of 5 percent up to a maximum admixture rate of 20 percent. Scientific support was provided on site. The actual hydrogen concentration was measured on a random sample basis at about one third of the gas appliances and the quality of combustion was tested.

RESULTS

- The field test shows that it is technically feasible to add hydrogen to the existing gas grid at significantly higher admixture percentages than currently provided for by the applicable standards.
- All the gas appliances functioned properly with their usual settings without any restrictions or problems. Defects or problems only occurred in very few cases and only five gas appliances needed to be replaced as a matter of precaution at the request of the manufacturer.
- As a result of hydrogen admixture, the emission values of the gas appliances were reduced by up to 39 percent in the case of carbon oxides and 25 percent in the case of nitrogen oxides.
- In the model region, it was also possible to ensure proper gas invoicing during the hydrogen admixture phases.

PROJECT COORDINATOR

DVGW Forschungsstelle ebi

PROJECT PARTNERS

avacon gwi

Photo: © Ruslan Dashinsky / iStock

H_2-prices and costs

Completed

BACKGROUND AND OBJECTIVE

In the course of the heating energy transition, heating systems using fossil fuels will need to be replaced. In connection with this replacement, it is important to consider not only the cost of the new system, but also developments in the cost of the energies to be used in the medium to long term, as such investments are normally made for a service life of at least 15 years.

In order to assess the potential development of prices and costs in this sector, indicative consumer prices were compared with the cost of alternative energies and heating technologies. The comparison took into consideration climate-neutral hydrogen, biomethane and natural gas for household customers in the years 2035 and 2045.

SERVICE PROVIDER

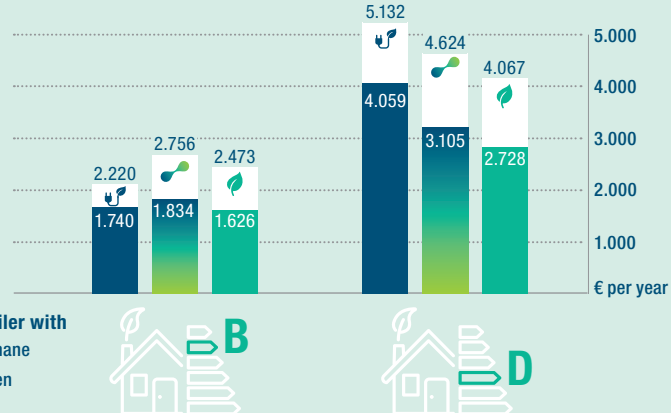
frontier economics

RESULTS

- Depending on scenarios considered, consumer prices for hydrogen in Germany could be below the level of the current maximum gas price set by law in the long term.
- In the long term, none of the heating system solutions considered has a clear cost advantage which would apply to all types of buildings.
- The cost benefits of different heating solutions vary depending on the scenario, timing and type of building. In the case of buildings with higher efficiency classes, heat pumps may have slight cost advantages. On the other hand, gas boilers operating using green gases were found to have an advantage in the case of lower efficiency classes

To the project:
www.dvgw.de/h2-preise-und-kosten

Source: DVGW based on data provided by Frontier Economics



Building sector – heating

WU100 – status and assessment of gas appliance changeover to 100% hydrogen by volume

Completed

BACKGROUND AND OBJECTIVE

As natural gas is increasingly replaced by hydrogen, the domestic space heating sector will also need to prepare for heating with other gases. The objective of this project was to assess the current status of domestic appliances produced by German manufacturers with respect to their fitness and availability for operation with 100 percent hydrogen. The analysis was based on a survey of manufacturers covering not only an overview of technologies currently used but also the possibility of converting existing appliances and the resulting costs.

RESULTS

- The evaluation of responses received from seven manufacturers showed that appliances for operation with 20 percent H_2 by volume are already normal practice and that the cost of these appliances is comparable with conventional units (with automatic combustion control).
- The manufacturers agreed that there was a need for training concerning possible conversion kits.
- The cost of material for conversion kits is less than €500. Additional costs will also be incurred for installation.

RESEARCH INSTITUTE

gwi

To the THyGA project:
www.thyga-project.eu

THyGA – Testing Hydrogen Admixtures for Gas Applications

Completed

BACKGROUND AND OBJECTIVE

Using the gas infrastructure already available, hydrogen and natural gas/hydrogen mixtures may be used as an alternative to natural gas for space heating buildings. This project with EU funding therefore considered the effects of hydrogen and hydrogen mixtures on applications, especially in the private and commercial sector. The objective was to develop better understanding and acceptance of the addition of hydrogen to existing networks in Europe.

In the course of the project, about 100 household appliances were tested with different hydrogen concentration scenarios and a general test protocol for gas appliances for the certification of H_2 readiness was developed. In addition, recommendations for appliance manufacturers, consumers and decision-makers with respect to appliance design, production and certification were prepared.

PROJECT PARTNERS

DVGW Forschungsstelle | ebi | gwi

FUNDING

This project has received funding from the Fuel Cells and Hydrogen 2 Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No. 874983. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation program, Hydrogen Europe and Hydrogen Europe Research.

In view of the growing addition of hydrogen to public gas supply grids, it is necessary to verify the accuracy of domestic gas meters as natural gas and hydrogen have different thermal and physical properties such as density and calorific value. Gas meters are regarded as generally fit for service with hydrogen up to an admixture of up to 10 percent hydrogen. However, only inadequate measurements and test results were available for the use of established gas metering technologies with gas mixtures. For this reason, DVGW commissioned Physikalisch-Technische Bundesanstalt (PTB – Germany's National Metrology Institute) to investigate various aspects of metering technology and accuracy.

COORDINATOR OF ALL PROJECTS

PTB
Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

Building sector – metering technology

Domestic gas meters

Completion 07/2024

BACKGROUND AND OBJECTIVE

This project focuses on gas meters for commercial and light industrial enterprises as well as domestic gas governors and bellows-type gas meters in low-pressure networks up to 2 bar. The question of whether the readings of the gas meters are within their calibration and error limits is especially important. The metering equipment of private households and light industrial and commercial establishments mainly consists of mechanical gas meters. Insufficient results were available concerning the metering behaviour of these meters with hydrogen and hydrogen/methane mixtures.

INITIAL RESULTS AND FURTHER PROCEDURE

- Initial results have shown that domestic gas governors and bellows-type gas meters are generally fit for service with 30 percent hydrogen and pure hydrogen in gas distribution networks.
- In a follow-up project, the measurement consistency and accuracy of commercial and light industrial gas meters in hydrogen networks are to be investigated with a metering procedure that is relatively independent from gas type.
- On the basis of the results already available, the effects of various gases and relevant hydrogen/methane mixtures on the measurement accuracy of domestic governors and bellows-type gas meters in low-pressure networks up to 2 bar are to be analysed.

PROJECTS

H_2 measurement accuracy • Measurement accuracy class 1 • Measurement accuracy 2 bar

H_2-Fronten

Completed

BACKGROUND AND OBJECTIVE

Hydrogen from future electrolysers will be fed to the gas system on a decentralized basis at all pressure levels. The different physical properties of natural gas and hydrogen pose challenges for certain gas equipment and as regards the invoicing of the gas supplied – especially in the case of the mixture of hydrogen with natural gas. This project therefore analysed and assessed procedures for the allocation of gross calorific value and for quantity balancing in order to determine whether they were suitable for invoicing.

RESULTS

- Various hydrogen admixture scenarios were systematically developed and five potential substitute procedures for the determination of invoicing gross calorific value with different admixture gross calorific values were identified. However, the results will need to be verified by field tests.
- Surveys of manufacturers indicated that many software products are already suitable for gas composition tracking and that the sector is generally prepared to consider additional sensor data.

PROJECT PARTNER

Hochschule München University of Applied Sciences

Photo: © Felix / AdobeStock

Gas grid and power plants

Completed

BACKGROUND AND OBJECTIVE

If and when adequate power supplies from renewable sources are not available, power demand in Germany is currently met by more than 70,000 gas-fired and coal-fired power plants, as well as smaller compact cogeneration plants. These also play a key role in the supply of heat by combined heat and power plants. In order to ensure security of supply, it would be beneficial to retain and convert the existing plants, initially to natural gas and then to hydrogen. In order to assess the need for future gas infrastructure, the study considered how many of the power plant locations could be supplied via transmission and distribution systems following conversion.

RESULTS

- Power plants representing three quarters of total generating capacity are located within the area of the gas distribution system.
- Many of the power plant locations, especially smaller power plants and compact cogeneration plants, are located more than 1 km from the gas transmission system, and from the planned core hydrogen network and will therefore need to be supplied via gas distribution networks.
- Even if the core hydrogen network is expanded, the gas distribution network will continue to play a key role in ensuring energy supplies, with regard to both heat and power generation.

RESEARCH INSTITUTE

DVGW DBI GTI Gastechnologisches Institut

LivingH$_2$ – Living Laboratory Demonstration of Complete Pure Hydrogen Fuel Cell Cogeneration System

Completed

BACKGROUND AND OBJECTIVE

Fuel cell compact cogeneration plants using green hydrogen could become an option for CO2-free energy supplies for buildings and gradually replace conventional compact cogeneration plants. This project was concerned with the technological development of hydrogen-powered fuel cell compact cogeneration plants with a view to demonstrating a complete solution for renewable power supplies in a living laboratory environment.

PROJECT PARTNERS

inhouse engineering GmbH (project coordination) • ENGIE (project coordination) • Commissariat à l'Énergie Atomique et aux Énergies Renouvelables • DBI Gas-technologisches Institut • Ostbayerische Technische Hochschule Regensburg • European Research Institute for Gas and Energy Innovation (ERIG)

To the project:
www.erig.eu/livingh2

Power generation and power plants

A sustainable heating sector with H_2 and cogeneration

Completion 03/2022

BACKGROUND AND OBJECTIVE

Germany intends to be climate-neutral by 2045. In view of its size, the heating energy market will play a key role on the way to climate neutrality. However, the heating sector cannot simply be made sustainable on the basis of building renovation, renewable energies and electricity-based technologies. Climate-friendly gases will also be needed. The project therefore investigated the contribution that hydrogen and cogeneration may make to climate neutrality in the building heating sector and the extent to which decentralized cogeneration in combination with climate-neutral gases may contribute to stabilizing the electricity grid.

ERGEBNISSE

- In Germany, the gas grid and district heating systems supply heat to almost 23 million homes, but only supply electricity to about five percent of these homes. In winter, gas demand is almost 3 times as high as in the summer months. Geographical differences make the situation even more difficult, with considerable renewable power generation capacity expected in the North and high energy demand in the south of Germany.
- Through the combined operation of decentralized cogeneration plants and heat pumps, the electricity demand of a city district could be reduced significantly. If large thermal storage capacities such as buffer storage were available, a district could even become autonomous with respect to energy supplies.
- This approach would ensure sustainable electric power supplies and reduce the burden on the power grid at all levels.

RESEARCH INSTITUTES

Frontier economics • RWTH Aachen University

The future of district heat

Completed

BACKGROUND AND OBJECTIVE

In Germany, coal-fired power generation is to be phased out by 2038. This will not only result in the loss of considerable power generation capacity, but also of district heating capacity in the form of coal-fired cogeneration plants. To ensure long-term security of supply, it will be necessary to identify alternative concepts. This project therefore collected information on current coal-fired district heating capacities in Germany and the resulting potential for gas-fired district heating plants and cogeneration applications.

RESULTS

- The use of large numbers of power-to-heat plants to replace existing cogeneration plants may have a detrimental impact on security of supply.
- Suitable options offering additional flexibility include deep geothermal energy plants, industrial waste heat utilization, high-capacity heat pumps and condensing boilers, as well as cogeneration plants using renewable fuels (hydrogen, biogas and biomethane, synthesis gases and solid biomass), which can be operated with a high degree of flexibility.
- At locations where these options are not available, industrial waste heat should be utilized and cogeneration plants powered by renewable fuels should be installed

PROJECT PARTNERS

Gas- und Wärme-Institut • RWTH Aachen University
IAEW • University of Duisburg-Essen

PROJECT COORDINATOR

DVGW DBI GUT Gas- und Umwelttechnik

Photo: © industrieblick/AdobeStock

Green NH_3

Completed

BACKGROUND AND OBJECTIVE

Especially for North Rhine-Westphalia, one of the regions with the most energy-intensive industries in Germany, it will be necessary to develop and implement alternative concepts in connection with the energy transition. This project investigated the possibilities and potential for the direct use of ammonia (NH3) as a boiler fuel.

APPROACH

- Analysis of potential for basic investigation of ammonia utilization for hot water, steam and power plant boilers.
- Development of a low-emission NH_3 burner system and transfer of the results to real-life boiler plants using CFD simulations.
- Implementation at an industrial-scale boiler plant, including long-term tests and initial viability analysis of NH_3 utilization processes and possible flue gas treatment systems

PROJECT PARTNER

Saacke

RESEARCH INSTITUTE

gwi

FUNDING

Ministerium für Wirtschaft, Industrie, Klimaschutz und Energie des Landes Nordrhein-Westfalen

Industry and medium-sized companies – process heat

TTgoesH$_2$ – Integration of hydrogen in industrial and commercial thermal processing technology as a climate-neutral fuel

Completed

BACKGROUND AND OBJECTIVE

Within the framework of the energy transition in Germany, it is intended to feed growing quantities of hydrogen from renewable sources to the gas transmission grid. Increasing hydrogen concentrations will change the composition of the gas. This poses special challenges for the thermal processing sector, which mainly uses gas fuels. The objective of TTgoesH$_2$ was to develop concepts and recommendations for the safe, economical operation of thermal processing plants with hydrogen in the fuel gas. DVGW was involved in two of the participating projects via its institutes.

GreCoCon – Green Combustion Control

Changes in the radiation properties and geometry of flames with reference to the parameters for flame detection with rising, fluctuating or very high hydrogen concentrations were investigated. The innovative combustion control system was tested on various different types of burners, starting with laboratory tests and continuing with tests under realistic application conditions.

ULoBurn – Ultra Low Emission Burners

The objective was to develop and validate concepts and recommendations for the safe, economical operation of thermal processing plants with hydrogen in the fuel gas. In the final stage of the project, a complex test taking into consideration the results of the participating projects of the TTgoesH$_2$ programme was carried out.

RESULTS

- The project showed that various different types of industrial firing systems may be changed over from natural gas to hydrogen. The cost of the changeover is within a reasonable range.

PROJECT PARTNERS OF THE DVGW GROUP

DVGW, DBI GTI Gastechnologisches Institut, gwi

OTHER PARTNERS

TU Bergakademie Freiberg • RWTH Aachen University • University of Duisburg Essen

FUNDING

Project supported by:

Bundesministerium für Wirtschaft und Klimaschutz

In accordance with a resolution of the German Bundestag

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COSIMa – carbon-neutral industrial plant – Saint-Gobain Herzogenrath – feasibility studies

Completion 12/2025

BACKGROUND AND OBJECTIVE

Saint-Gobain intends to make its Herzogenrath glass plant (float glass and automotive glass) carbon neutral by 2030. The objective of the COSIMa project is to investigate whether it is feasible to use green hydrogen instead of natural gas for energy supplies in glass production and to develop smart infrastructure for the optimum use of all energy and material flows at the plant with a view to ensuring the highest possible level of carbon neutrality. In addition, energy optimization potentials for automotive glass production are to be identified.

APPROACH

- Feasibility study for the conversion of glass production to hydrogen with additional electric heating (hybrid furnace)
- Energy modelling covering smart infrastructure for all energy and material flows
- Determination of the energy optimization potential of the production process

RESEARCH INSTITUTE

gwi

CONSORTIUM

Saint-Gobain Sekurit Deutschland (lead company) • RWTH Aachen University, Departments of Industrial Furnaces and Heat Engineering, and Power Generation and Storage Systems

FUNDING

Ministerium für Wirtschaft, Industrie, Klimaschutz und Energie des Landes Nordrhein-Westfalen

Industry and medium-sized companies – glass industry

In view of its considerable heating requirements, especially for the melting process, the glass industry is classed as energy-intensive. Currently, fossil fuels such as natural gas cover more than 70 percent of energy demand. In addition, carbon dioxide is released as a result of the melting of raw materials. The emissions associated with fuel combustion could be avoided by using green hydrogen. The effects of hydrogen use on the melting process for glass production, product quality and pollutant emissions still need to be investigated.

HyGlass – use of hydrogen in the glass industry is a possibility of reducing CO_2 emissions and increasing the utilization of gases from renewable sources

Completed

BACKGROUND AND OBJECTIVE

The HyGlass project investigated the effects of different hydrogen admixture rates up to 100 percent on the various firing processes involved in glass production, with respect to product quality, service life and plant operating parameters. The individual process steps in glass production were analysed and possibilities for the integration of hydrogen were outlined. The project also considered combustion behaviour with hydrogen admixture in glass melting furnaces and the resulting reduction in carbon dioxide emissions.

RESULTS

- The admixture of up to 20 percent hydrogen is possible in almost all industrial applications.
- Higher concentrations or the use of pure hydrogen may lead to changes in fuel properties. These can be accommodated by appropriate technical measures.
- Further research will be needed on the effects on product quality, refractories, compensation strategies, etc.

PROJECT PARTNER

Bundesverband Glasindustrie
(Federal Association of the German Glass Industry)

CONSORTIUM LEADER

gwi

FUNDING

IN4CLIMATE .NRW

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H_2-Alu – investigations concerning the use of hydrogen in the production of secondary aluminium

Completion 07/2024

BACKGROUND AND OBJECTIVE

Aluminium is one of the most important metals for industry, with an extremely wide variety of applications. For example, it is not only used in vehicles and packaging, but is also important in the building industry, and for machinery production. Carbon dioxide emissions arise both in aluminium production and in secondary aluminium processing, including the melting of aluminium scrap and the manufacture of aluminium products. However, the metal processing sector also needs to become climate-neutral and to reduce its emissions. The objective of the H_2-Alu project is to investigate how this can be achieved by using green hydrogen to replace natural gas, combined with oxygen enrichment in the combustion air of a melting furnace.

APPROACH

- Analysis of effects on product quality and the development of compensation measures to maintain the aluminium qualities that can currently be achieved
- Basic materials science analyses of a real production chain for secondary aluminium products including comprehensive laboratory tests (metallography, computed tomography, hardness measurements, tensile tests, off-gas extraction, etc)
- Development of a simulation tool for predicting the effects of hydrogen on aluminium during the manufacturing process

PROJECT COORDINATOR

gwi

FUNDING

Project supported by:

Bundesministerium für Bildung und Forschung

In accordance with a resolution of the German Bundestag

Industry and companies – steel and aluminium

OptiLBO – energy-efficient, carbon-neutral steel production

Completion 01/2025

BACKGROUND AND OBJECTIVE

Secondary steelmaking is mainly based on the use of electric power for energy input. However, fossil raw materials are also used to optimize the melting process. A significant reduction in CO_2 emissions can be obtained by the direct reduction of the natural gas and oxygen used, with a flexible, innovative burner system and more efficient process control. The objective of the OptiLBO project is to reduce CO_2 emissions at the Bous steel plant and to improve the efficiency of an electric arc furnace used for melting scrap iron by reducing the use of natural gas and replacing it by hydrogen.

APPROACH

- Optimization of the energy efficiency of the electric arc furnace at Bous steel plant
- Reducing pollutant emissions by using an innovative mixer produced by additive manufacturing in the burner system
- Development of an AI-based, optimized burner control system
- Possibility of replacing natural gas by hydrogen in the process
- Analysis of the replacement of injection coal in the metallurgical process by environmentally compatible alternatives

PROJECT PARTNERS

Küttner Automation • Kueppers Solutions • Stahlwerk Bous GMH Gruppe

CONSORTIUM LEADER

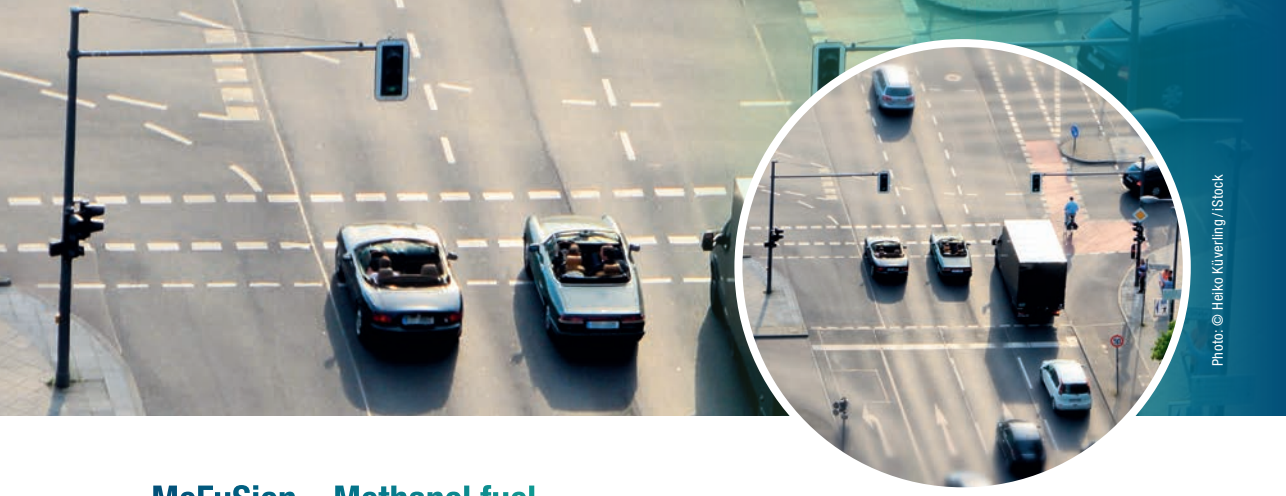
gwi

FUNDING

Project supported by:

Bundesministerium für Wirtschaft und Klimaschutz

In accordance with a resolution of the German Bundestag



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MeFuSion – Methanol fuel cell supply chain investigation

Completion 10/2025

BACKGROUND AND OBJECTIVE

In long-distance and heavy goods traffic as well as in aviation, it will probably only be possible to ensure climate neutrality using e-fuels. Because of the quantities required, energy imports will be necessary. As a liquid, e-methanol has considerable cost advantages compared with gaseous or liquefied fuels. However, the production of e-methanol is energy- and cost-intensive. The conventional process based on fossil raw materials is only economically viable in plants operating in the megatonne range. The objective of the project is to prepare for and accelerate the market launch of efficient, sustainably produced methanol for fuel cell mobility.

APPROACH

- Investigation and scaling of reverse water gas shift (RWGS) technology for the conversion of CO_2 and renewable energy into synthesis gas, with subsequent methanol synthesis and separation
- Verification of fuel cell applications for compatibility with raw methanol and the sustainability of the entire process in a life cycle analysis

PROJECT PARTNERS

CreativeQuantum (project coordinator) • Gumpert Automobile • DBI Gastechnologisches Institut • University of Stuttgart – Department of Life Cycle Analysis

To the project:
www.erneuerbarekraftstoffe.de/projects/mefususion/

H_2 mobility

H_2net&Logistics – utilization of gas systems to supply hydrogen for heavy trucks and rail traffic

Completed

BACKGROUND AND OBJECTIVE

As with other sectors of industry, goods traffic will need to become climate-neutral in the long term. However, it is not yet practicable to use battery-electric drive systems for heavy goods vehicles in view of the inadequate range available. Fuel cells using hydrogen fuel would be an appropriate alternative. In order to use hydrogen in this application, it would be necessary to develop appropriate supply and refuelling networks. Against this backdrop, this project considered the technical possibilities and economic and environmental potential of a system based on the use of the gas grid to supply hydrogen from renewable sources to refuelling stations.

RESULTS

- On the basis of the expected H_2 demand for heavy goods vehicles, a rapid ramp-up of fuel cell trucks and refuelling stations is anticipated.
- A holistic, integrated approach will allow implementation in several phases. Starting from initial locations only based on regional supply routes, the future network can be expanded until it becomes a complete network of public refuelling stations.

PROJECT PARTNER

KNT Consult

CO-INITIATOR

Forschungsvereinigung Verbrennungskraftmaschinen (FVV)

DVGW RESEARCH INSTITUTES

DVGW | DBI GUT Gas- und Umwelttechnik | DVGW Forschungsstelle | ebi | gwi

H_2 network 2030

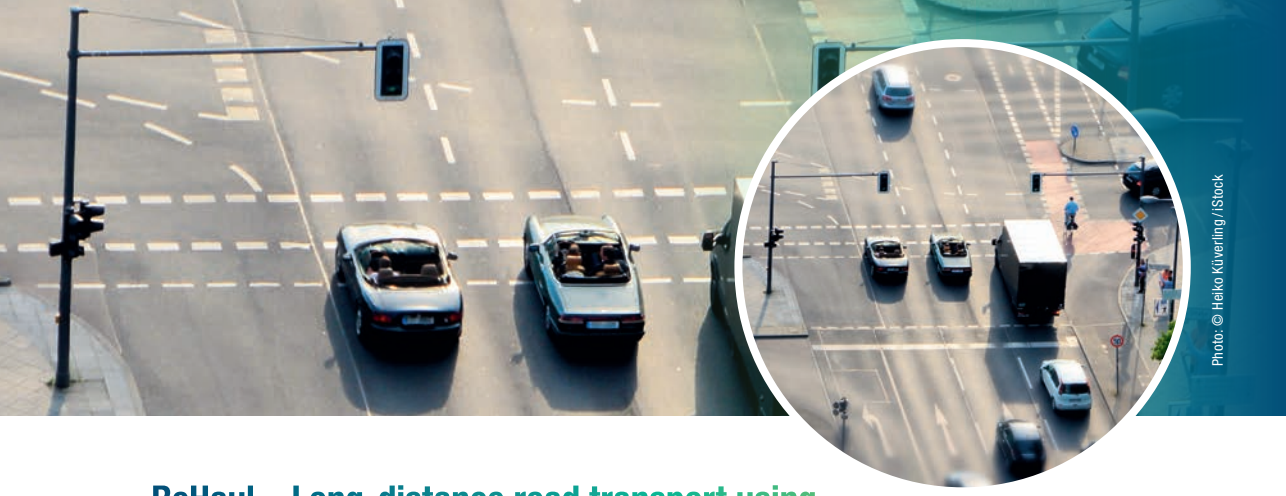
H_2 network 2050

Initially, hydrogen may be supplied to refuelling stations using tanker trucks. As demand increases, probably from 2030 onwards, it will be more effective to supply hydrogen via pipelines.

Where this is not feasible, an alternative would be to establish hydrogen hubs connected to the pipeline system which could supply refuelling stations within a radius of 50 km.

Hydrogen supply via:

- Tanker trucks
- Networks (pipelines)
- H_2 network
- Modelling of area served by network



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ReHaul – Long-distance road transport using renewables, taking into consideration technological improvements and European infrastructure

Completed

BACKGROUND AND OBJECTIVE

The long-distance road transport sector has committed to achieving the planned greenhouse gas reduction goals in Europe in the medium term (up to 2030) and in the long term. New technologies for the achievement of these objectives are approaching their market launch. This study considered the highly promising technologies available both in quantitative and in qualitative terms. The options investigated include battery-electric vehicles (BEV), hydrogen fuel cell electric vehicles (H_2, FCEV) and vehicles with internal combustion engines (ICE) operated using methane from renewable sources (CH_4, biomethane and synthetic methane) as well as the two renewable liquid fuels eco-diesel and hydrotreated vegetable oils (HVO).

RESULTS

- Both in the short term and in the long term, biological and synthetic and renewable fuels represent a convincing option for decarbonizing long-distance heavy goods traffic.
- The technologies of battery-electric and hydrogen fuel cell electric vehicles are assessed positively in terms of their overall efficiency and cost.
- On the basis of the results, EU legislation should be based on the objectives of long-term security for investments, the same greenhouse gas reduction targets for all technologies and the consideration of emissions on the basis of the “well-to-wheel” principle.

PROJECT COORDINATOR

ERIG
European Research Institute for Gas and Energy Innovation

FUNDING

DVGW • eFuel Alliance • Hexagon Composites ASA • Landi Renzo • Neste • NGVA Europe, Natural and bio Gas Vehicle Association • ÖVGW • SVGW • Totalenergies • Uniti • VDMA • VSG

H_2 mobility – European research

DelHyVEHR – delivery of liquid hydrogen at high flow rates in various environments

Completion 12/2026

BACKGROUND AND OBJECTIVE

Liquid hydrogen can allow significant reductions in carbon dioxide emissions in the energy and chemical industries as well as the mobility sector. Although mature technology is already available for the rapid refuelling of passenger cars, there are still considerable challenges in the fields of aviation, marine transport and rail traffic. The objective of the DelHyVEHR project is to close the gaps with respect to the key technologies for distributing liquid hydrogen in these sectors. The project is focusing on pumps, measurement systems, loading and the management of boil-off gas.

APPROACH

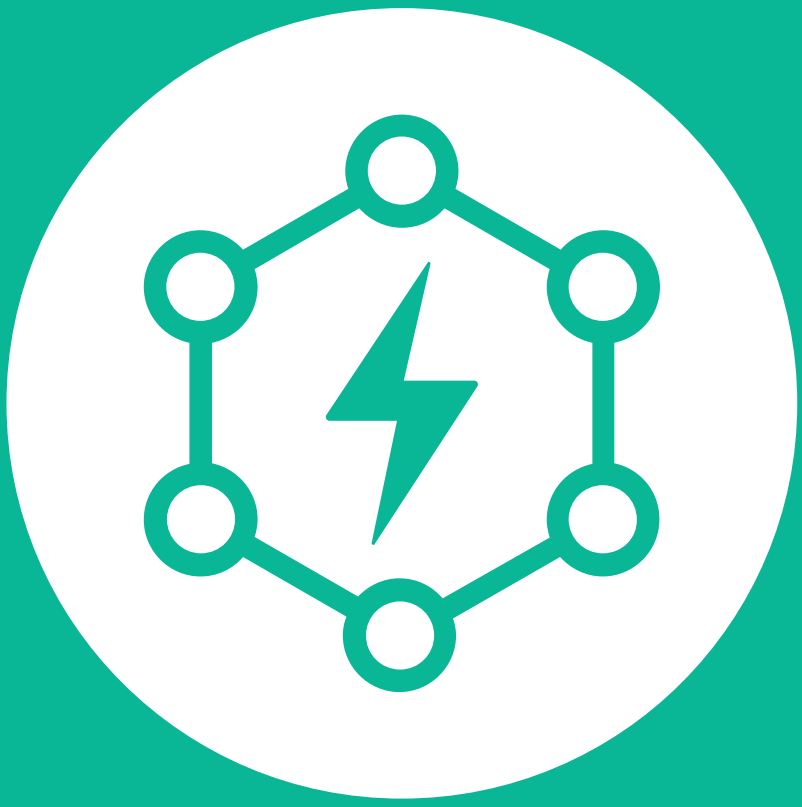
- Development of a highly efficient (>60%), highly reliable, high-flow cryo-pump (5-6 t/h) for liquid hydrogen refuelling stations
- Development and adaptation of loading and dosing systems for high-flow refuelling stations
- Development and optimization of a boil-off gas management system allowing the recovery of >80% of the boil-off hydrogen
- Design, construction and operation of a liquid hydrogen refuelling station for filling a cryogenic storage facility
- Assessment of the economic, environmental and political relevance of the technologies and the demonstration facility in connection with expected capital expenditure and operating cost reductions

PROJECT PARTNERS

Engie (Project coordinator) • Arianegroup • Asociatia Energy Policy Group • European Research Institute for Gas and Energy Innovation • Absolut System Sas • Dekra Services •· Benkei • Trelleborg Clermont Ferrand • Cesame-Exadebit • Fives Cryomec • University of Ulster • Trelleborg Sealing Solutions UK

FUNDING

Europäische Kommission



Energy systems & market ramp-up

Electrons and molecules – partners in a successful energy transition

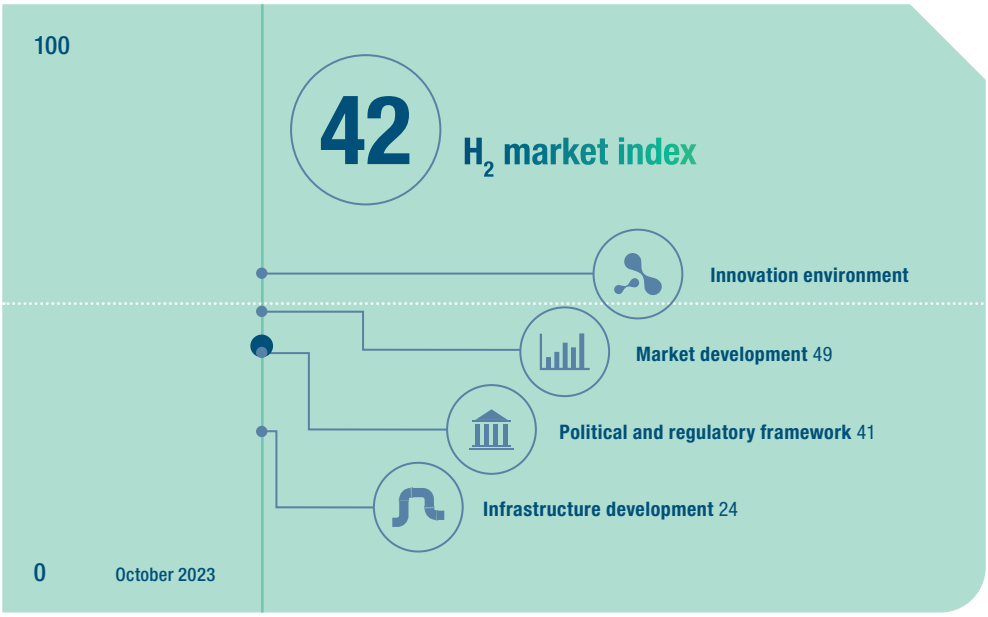
To date, the energy transition in Germany has been based mainly on electric power from renewable sources. The expansion of wind power and photovoltaic systems is an essential component in the decarbonization of the German energy sector. However, depending on weather conditions and the season, there are often severe fluctuations in the generation of renewable power. In addition, renewable energy sources only covered slightly less than 20 percent of Germany's primary energy demand in 2023. Primary energy demand was mainly covered by oil (35.9 percent) and natural gas (24.5 percent). In future, the German energy system will therefore continue to rely on renewable gaseous fuels – both for security of supply and for climate protection.

Gas, and in the future, hydrogen, can not only cover the areas where electricity is not available or cannot be used. By coupling the sectors of electric power, heat and traffic, synergy effects can also be tapped. The objective is to ensure that energy is reliably available at all times and to compensate for fluctuations in the generation and supply of renewable energies.

Sector coupling between electrons and molecules is the key to a successful energy transition and climate-neutral energy supplies for Germany and Europe.

To assess the importance of hydrogen for future energy systems, it is necessary to consider the entire value stream – from production via transport and distribution through to utilization. The analysis should not just consider individual fuels or energy sources, but rather the energy system as a whole. The boundaries between electrons, i.e. electric power, and molecules, i.e. liquid or gaseous fuels, are fluid.

This view is confirmed by the overarching research projects of the DVGW network such as Roadmap Gas 2050, the real-world laboratories for the energy transition or the hydrogen model regions, which are developing concepts and solutions for the climate-neutral energy system of the future.



The overall assessment of the market ramp-up is currently 42 points out of 100, at about the middle of the scale.

H_2 market index

In progress

BACKGROUND AND OBJECTIVE

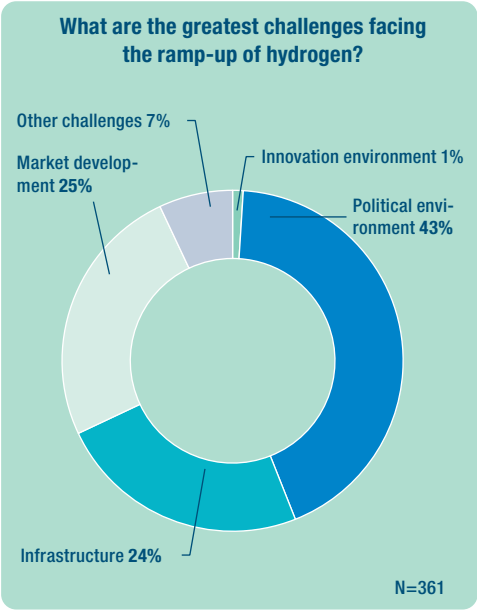
For a ramp-up of the hydrogen industry, the development of the entire value stream from production through to infrastructure and utilization is crucially important. In Germany, industry, business and government are forging ahead with this development extremely dynamically. In order to assess the ramp-up of hydrogen in the perceptions of market players, DVGW has developed an H_2 market index.

The index is calculated on the basis of a random-sample survey of stakeholders in all the areas which are important for the hydrogen industry in Germany. The survey covers the market players' satisfaction with the current and future situation of the hydrogen market. The result is an assessment of the status of development of the hydrogen ramp-up and the priorities to be assigned to future measures on the basis of measurable criteria. Regular updates allow progress with the hydrogen ramp-up to be assessed.

SERVICE PROVIDER

University of Cologne – Institute of Energy Economics

RESULTS



43% of respondents were of the opinion that the political environment currently represents the greatest challenge to the ramp-up of the hydrogen market and see the political environment as an obstacle to the development of infrastructure and production capacities.

To the project:
www.dvgw.de/h2-marktindex

Photo: © OGE

TransNetz – transformation paths for the achievement of climate goals at the distribution system level (phase 1)

Completed

BACKGROUND AND OBJECTIVE

The use of hydrogen offers considerable potential for replacing fossil fuels in industrial processes and can also contribute to the climate neutrality of the local heat energy market and the mobility sector. The crucial question for the market ramp-up of hydrogen is how fast and at what cost energy infrastructure and applications can be adapted to the new conditions.

The objective of the first phase of TransNetz was to develop the basic information required for a technology-neutral, realistic analysis of transformation paths at the distribution system level and to identify influencing factors for scenarios. For this purpose, the areas of hydrogen supply, distribution and utilization were analysed.

RESULTS

- As regards green gas potential in Germany, 9,465 million m³ of biomethane and about 8,740 million m³ of green CO_2 could be available from existing plants and 116,070 million m³ of hydrogen could be available by 2045.
- The analysis of gas distribution systems showed that the number of gas connections and gas demand could fall in residential areas. The fall will be significantly less pronounced in commercial and industrial areas.
- In the case of high-pressure systems, which supply gas to low and medium-pressure systems as well as directly serving industrial customers, cogeneration plants and compact cogeneration plants, there will be less direct impact and a less pronounced tendency to abandon systems.

RESEARCH INSTITUTES

DVGW Forschungsstelle
ebi
DVGW
DBI GUT Gas- und Umwelttechnik
gwi

PROJECT PARTNER

University of Wuppertal

Transformation paths

H2-dvgw.de

Roadmap Gas 2050

Completed

BACKGROUND AND OBJECTIVE

DVGW research has shown that gas-based concepts will be beneficial and feasible as part of the future energy system. In the Roadmap Gas 2050 project, a holistic concept was developed describing possible synergy effects along the value chain in four project elements. As a result of the project, a holistic concept based on facts and figures for the supply of climate-neutral gases, the utilization of the gas infrastructure for the integration of these gases and the adaptation of gas utilization technologies was prepared.

To the project:
www.dvgw.de/themen/forschung-und-innovation/energieforschung/roadmap-gas-2050

INITIAL RESULTS

Supply

- Sufficient quantities of climate-friendly gases could already be supplied from domestic sources and via imports by 2030.

Infrastructure

- The German gas grid can be upgraded and expanded for the future distribution of hydrogen cost-effectively and at reasonable cost.

Applications

- Existing household appliances can already tolerate a H_2 concentration of at least 20 percent. A large number of compensation measures are available for industrial and commercial applications.

Vision for the future

- Even in the scenario where electric power predominates, gas fuels will still be necessary to safeguard security of supply.

PROJECT COORDINATOR

DVGW Forschungsstelle ebi

RESEARCH INSTITUTES

DVGW DBI GUT Gas- und Umwelttechnik

gwi

Fraunhofer ISI

Photo: © sturti/iStock

ENSURE III – new energy system structures for the energy transition

Completion 07/2026

BACKGROUND AND OBJECTIVE

ENSURE is investigating innovative solutions for making the electric power grid fit for the future. In the third phase of the program, the approaches adopted to date for a future-fit energy system are to be demonstrated in practice in hybrid real-life operation. For this purpose, key challenges will be addressed, including the coupling of the electricity grid to other energy sectors (gas, mobility, buildings), allowing possible synergy effects, ("sector integration") and the accommodation of energy supplies from renewable sources, which fluctuate over time. Among other work items, DVGW-EBI is to develop model components in the field of energy hubs, transformation plans and network models for the supply of green hydrogen.

APPROACH

- Simulation and tests in risk-minimised environments for the transfer of the results obtained to use in practice
- Validation of models and approaches using actual plants and verification of the system interaction of the various modules
- Development of technical systems for storing renewable energy and delivering it in line with demand
- DVGW-EBI is carrying out technical and economic analyses of hydrogen transport and distribution infrastructure, the integration of green hydrogen and its contribution to the energy transition.
- Development of transformation paths for the integrated planning of power, gas and heat supplies to city districts

PROJECT PARTNERS

Karlsruhe Institute of Technology (project coordination) • Fraunhofer Institute for Wind Energy Systems (IWES) • RWTH Aachen University • TU Dortmund University • University of Wuppertal • University of Kiel • University of Erlangen-Nuremberg • Technical University of Darmstadt • E.ON • TenneT TSO • Siemens • ABB • Deutsche Umwelthilfe • DVGW • ewi Energy Research & Scenarios • Forschungsgemeinschaft für Elektrische Anlagen und Stromwirtschaft • Germanwatch • Maschinenfabrik Reinhausen • Nexans Deutschland • Institut für Informatik Oldenburg • Öko-Institut • Stadtwerke Kiel

FUNDING

Project supported by:

Bundesministerium
für Bildung
und Forschung

In accordance with a resolution of the German Bundestag

Integrated network structures

MOPPL – modelling for the integrated optimization of long-term transformation paths

Completion 07/2025

BACKGROUND AND OBJECTIVE

The integration of hydrogen technologies for the decarbonization of the energy system will be affected by interaction between the sectors, international markets, German and European political objectives and development strategies for conversion plants and infrastructure. In order to investigate the implications of different strategies, the integrated modelling of gas, hydrogen, electricity and CO_2 markets, taking into consideration both infrastructure and relevant players and conditions will be necessary.

APPROACH

- Development of mathematical procedure for model coupling on the basis of the Benders decomposition method
- Demonstration of the method in connection with an analysis of the implications of flat optimum values and derivation of robust transformation paths as well as coordination between different system levels (e.g. transmission and distribution system levels), taking into consideration political levers (such as admixture levels)

PROJECT PARTNER

University of Duisburg-Essen (project coordination) • Technische Universität Dortmund

DVGW RESEARCH INSTITUTE

gwi

FUNDING

Project supported by:

Bundesministerium für Bildung und Forschung

In accordance with a resolution of the German Bundestag

Real-world laboratories & model regions

Pioneering work for hydrogen in Germany

Green hydrogen will have a key function for the successful implementation of the energy transition. It can be produced in a climate-friendly way and is easy to store. Green hydrogen can compensate for fluctuations in wind and solar power generation as a result of weather conditions, enabling efficient sector coupling.

The use of green hydrogen along the entire value stream is currently being investigated in the "real-life laboratories of the energy transition" of the Federal Ministry for Economic Affairs. Under this program, technical and non-technical ideas and innovations are developed and tested under real-life conditions on an industrial-scale basis. The DVGW research network is participating in the projects presented here.

Real-world laboratories and model regions show how hydrogen can link sectors, create innovative concepts and ensure regional and supra-regional added value.

In addition to the real-life laboratories initiated by the federal government in Germany, some of the German states and energy suppliers have also established model regions and are providing support for them in the framework of regional development programmes. The model regions are performing pioneering work for the production, transport, storage and utilization of hydrogen and are demonstrating how future handling and regional value addition can succeed with this climate-neutral fuel.

A large number of real-life laboratories and model regions are paving the way for the hydrogen economy.

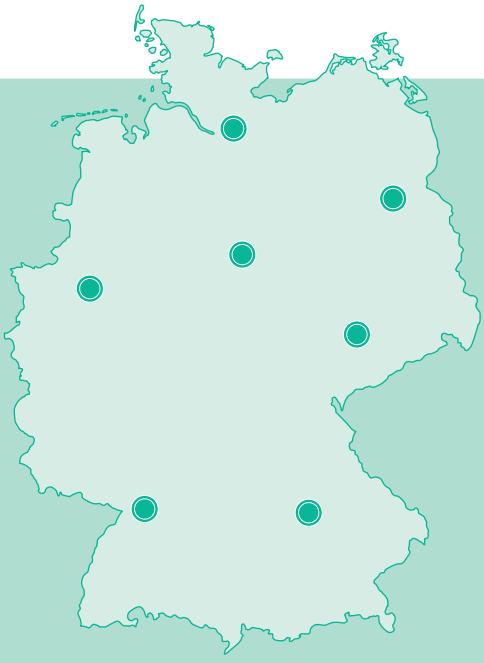


Photo: © smolaw11 / iStock

H_2-Switch100

Completion 2027

BACKGROUND AND OBJECTIVE

The energy industry already accepts that green hydrogen will be essential for the success of the energy transition. However, the role of hydrogen in the space heating of buildings is still unclear. This is why Gasnetz Hamburg, a Hamburg gas utility, is engaged in a pilot project in Hamburg-Harburg to test the feasibility of using green hydrogen.

APPROACH

- The company is currently testing materials and components on 16 domestic and commercial service connections.
- Experts are initially analysing existing equipment and will then prepare plans for the changeover of existing natural gas infrastructure to green hydrogen.
- Domestic services, pipeline materials and the construction dates of the individual system sections represent a cross-section of the Hamburg gas grid.
- As soon as the industrial hydrogen grid in Hamburg has started operation in the vicinity of the pilot area, it is planned to supply green gas here from 2027 onwards.

PROJECT PARTNERS

DBI Gas- und Umwelttechnik • TÜV SÜD • Gasnetz Hamburg

SPONSORING PARTNER

Hamburgische Investitions- und Förderbank (IFB Hamburg)

To the project:
https://www.gasnetz-hamburg.de/

Real-world laboratories of the energy transition

Energiepark Bad Lauchstädt

Completion 08/2026

BACKGROUND AND OBJECTIVE

Energiepark Bad Lauchstädt is one of five projects in the category “Real-world laboratories of the energy transition” focusing on sector coupling and hydrogen technologies. The real-world laboratory in the eastern German chemical industry region is the first industrial-scale project for the smart production of green hydrogen, including storage in salt caverns, transport, marketing and utilization. For the first time, industrial-scale tests of the entire value stream for green hydrogen are to be carried out. In the project phase which started in mid-2022, the main focus is on the installation of plants. The commissioning of all the plants forming part of the project is scheduled for 2025.

APPROACH

- Construction of a large electrolysis plant with a capacity of up to 35 MW in Saxony-Anhalt
- Installation of eight wind turbines and a research plant for gas metering and treatment
- Preparation for the changeover of the gas transmission line to hydrogen operation

PROJECT PARTNERS

Terrawatt Planungsgesellschaft • Uniper • VNG Gasspeicher • ONTRAS Gastransport • DBI Gastechnologisches Institut

PROJECT LOGO

ENERGIEPARK BAD LAUCHSTÄDT

To the project:
www.energiepark-bad-lauchstaedt.de

Photo: © Gorodenkoff / AdobeStock

HyBEST - EnEff:Stadt: innovative hydrogen concepts in existing clusters

Completion 11/2024

BACKGROUND AND OBJECTIVE

For the optimized utilization of renewable energies, smart energy concepts and adequate storage capacities, e.g. based on hydrogen, will be needed. At the level of local districts, efforts are being made to develop energy supply concepts crossing the boundaries of individual systems and allowing the direct use of renewable power in combination with green hydrogen. The objective of HyBEST is to develop and implement concepts for hydrogen-based energy supplies in existing industrial estates at Gifhorn, Herten and Karlsruhe.

APPROACH

- Investigation of various concepts for hydrogen-based energy supplies at three locations in Gifhorn, Herten and Karlsruhe (port district)
- Modelling of the system for the optimization of energy management control
- Technical, economic and environmental analysis of further utilization paths (e.g. H_2 mobility, etc) in the region
- Processing of the results to form a blueprint for the activation of further players with a view to forging ahead with climate-neutral energy supplies

PROJECT PARTNERS

DVGW Research Unit at the Engler-Bunte-Institute of KIT • Stadtwerke Karlsruhe • Gas- und Wärme-Institut Essen • Landkreis Gifhorn • HYCON

FUNDING

Project supported by:

Bundesministerium für Wirtschaft und Klimaschutz

In accordance with a resolution of the German Bundestag

Model regions and innovative H_2 concepts

H2-dvgw.de

Completion 12/2024

BACKGROUND AND OBJECTIVE

Isolated hydrogen supply may provide a nucleus for a region and have a positive effect on regional added value. Through the coupling of different renewable fuels, efficiency improvements and synergies can be achieved. On this basis, the successful implementation of the energy transition and the achievement of climate goals is feasible. In order to achieve these goals, it will be essential, as in this project, to take into consideration local conditions, infrastructure and user behaviour or users' wishes. The project investigates the technology-based transformation of the energy system from fossil energies into a greenhouse-gas-neutral system for the regional distribution of electricity, gas and heat. The project also covers the development of practicable business models for companies.

APPROACH

- Development of a regional energy system, taking into consideration technical conditions and stakeholders' requirements
- The continued use and further development of existing infrastructure and regional integration or utilization of biogas and hydrogen
- Identification of local synergy and sector coupling options as well as practical business models and the development of transformation strategies for municipal utilities and energy suppliers

PROJECT PARTNERS

Erdgas Südwest • EnBW • Netze BW

PROJECT COORDINATOR

DVGW Forschungsstelle ebi

FUNDING

Project supported by:

Bundesministerium für Wirtschaft und Klimaschutz

In accordance with a resolution of the German Bundestag

DVGW

Innovations and standardization in the gas and water industry

As a state-recognized issuer of standards, an organization holding technical and scientific expertise and a promoter of technical innovations, Deutscher Verein des Gas- und Wasserfaches e V (DVGW) is the competence centre for all questions arising in connection with gas and drinking water supplies. DVGW provides support in all technical and scientific areas. The work of the association focuses especially on the topics of safety, hygiene, environmental protection and consumer protection. Through the development of its codes of practice, DVGW lays the foundation for the technical self-regulation of the gas and water industry in Germany, ensuring safe gas and water supplies to the highest international standards. As a basis for technical innovations, research is a key area of DVGW's activities. DVGW supports the research projects of a variety of different institutes and also works on its own projects.

The association, established in 1859, has about 14,000 members. As a non-profit organization, DVGW is economically autonomous and politically impartial. At the local level DVGW is active via its district groups; at the regional level, the state groups are the first point of contact for members. Topics with a national or European dimension are dealt with by DVGW headquarters in Bonn, with offices in Berlin and Brussels.

Research and development work within DVGW

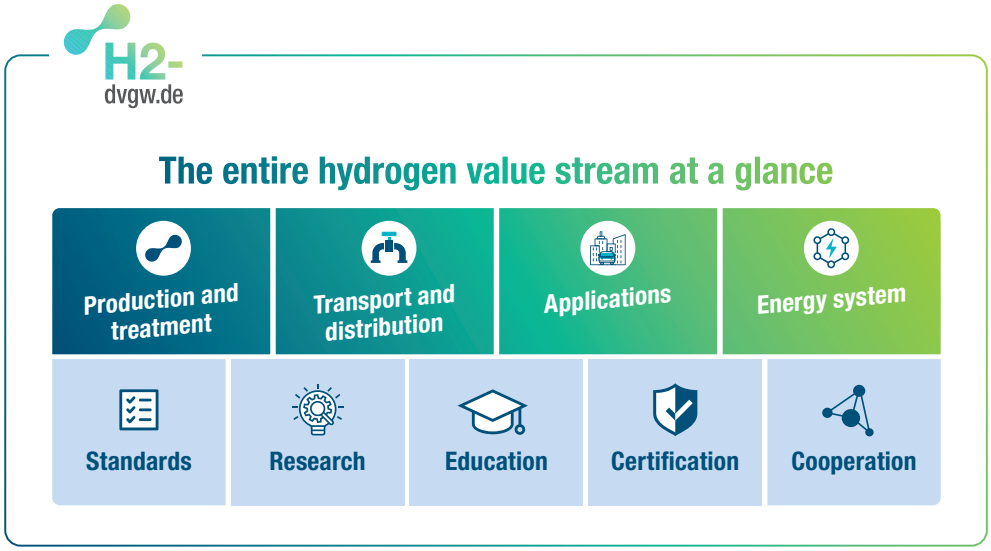
The German energy and water industry continually faces new challenges. In particular, the energy transition calls for the development of future-oriented concepts for gas as a fuel, taking into consideration not only climate and environmental policy aspects, but also systems targets, as well as economic and safety objectives.

DVGW's research work includes projects within the regional and national context as well as pan-European research cooperation arrangements. This research work lays the foundation for further technical development in the gas industry, promotes standardization and ensures the scientific quality of statements and opinions issued by DVGW.

Within DVGW, energy research is organized on a decentralized basis and focuses on a total of five main areas. These combine scientific expertise and partnerships with universities with practical experience from the gas industry. The competences of the individual institutes supplement each other and form a comprehensive network for gas and energy topics.

DVGW Hydrogen Innovation Programme

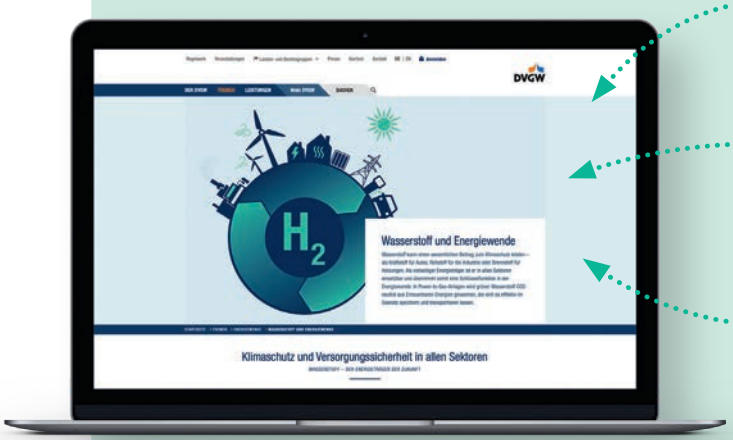
The various projects in the **DVGW Hydrogen Innovation Programme** are investigating how we can make our energy system climate-neutral using hydrogen. The programme covers the entire hydrogen value stream from production and treatment, to transport and distribution as well as storage and utilization. In addition, the programme addresses the question of how hydrogen can be integrated in the future energy system. By combining all the fuels and technologies available, climate neutrality can be achieved fast in a socially compatible way.



Project list

Further information on hydrogen can be found at:

www.h2-dvgw.de



Media

Events

Research

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The H2-Kompetenzverbund der deutschen Energiewirtschaft (H2 competence network of the German energy industry)

At a glance