Indo-German Energy Forum

On behalf of:
Federal Ministry for Economic Affairs and Climate Action
on the basis of a decision by the German Bundestag

Green Hydrogen Pilots in Germany

Green Hydrogen Pilots in Germany

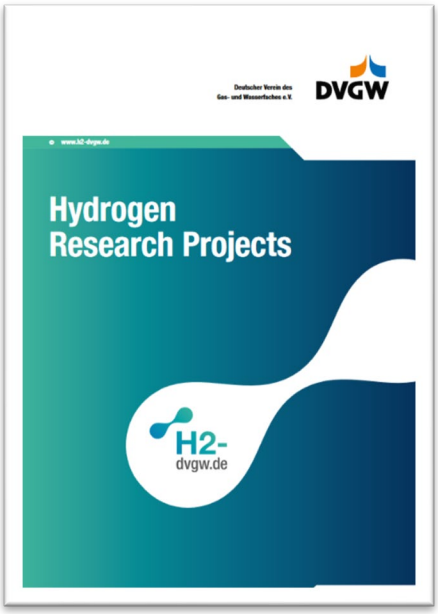
The following sources provide an overview on promising Green Hydrogen Pilot Projects in Germany. As the demand for hydrogen in industrial applications is expected to increase from a current level of 55TWh to 90-110TWh by 2030, it will take significant investment to switch from grey to green hydrogen while increasing the supply at the same time. Government of Germany aims at 10 GW electrolizer capacity installed by 2030. Even with this capacity installed around 80%-90% of green hydrogen would still need to be imported.

Selected Green Hydrogen Pilots in Germany by GTAI

The following video by Germany's Govt. owned Investment Agency Germany Trade and Invest (GTAI) highlights promising green hydrogen pilots in Germany.

Source: https://www.youtube.com/watch?v=0XPCOIoobyY

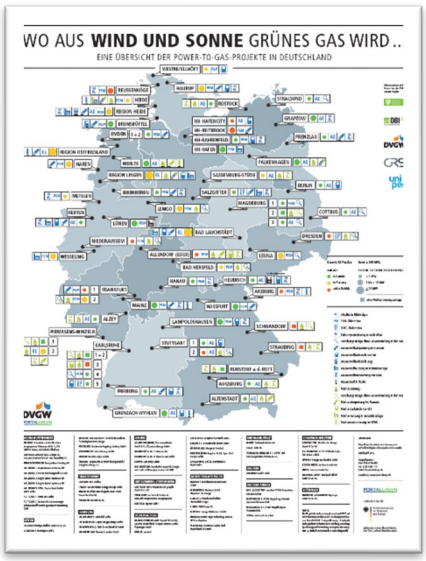
22 hydrogen pilots by DVGW



A booklet by the German Association for Natural Gas and Water, the DVGW (Deutscher Verein des Gas- und Wasserfachs e. V.) provides an overview of the current hydrogen research projects in which the association is involved. The 22 projects presented cover a wide thematic scope – from an analysis of the hydrogen tolerance of individual gas appliances through to the preparation of an approval guideline for power-to-gas plants.

Source: https://www.dvgw.de/medien/dvgw/leistungen/publikationen/dvgw-h2-wasserstoff-forschungsprojekte-broschuere-en.pdf

Map of Power-to-X pilots by DVGW



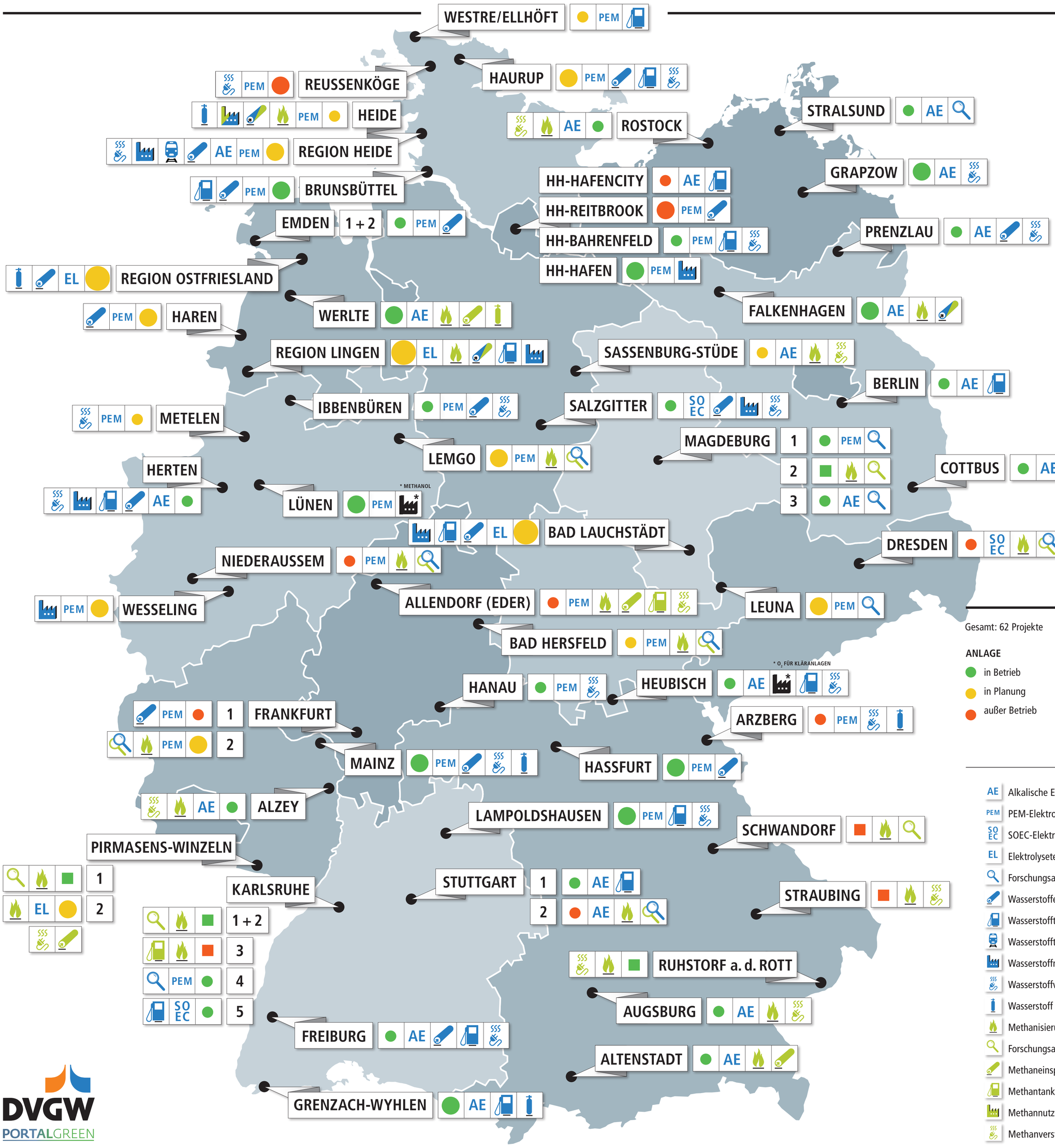
A map of power-to-x projects in Germany was published by the German Association for Natural Gas and Water, the DVGW (Deutscher Verein des Gas- und Wasserfachs e. V.). What makes this map so special is the classification into different applications.

Source: https://www.dvgw.de/medien/dvgw/verein/energiewende/bilder/karte-power-to-gas-anlagen.pdf

www.energyforum.in

WO AUS **WIND UND SONNE** GRÜNES GAS WIRD …

EINE ÜBERSICHT DER POWER-TO-GAS-PROJEKTE IN DEUTSCHLAND



Informationen aus dem Konsortium des PORTAL GREEN Projekts

Gesamt: 62 Projekte — Summe: 308 MW_{el}

ANLAGE
- in Betrieb
- in Planung
- außer Betrieb

ELEKTR. LEISTUNG ELEKTROLYSEUR
- < 1 MW
- 1 bis < 10 MW
- ≥ 10 MW
- reine Methanisierungsanlage

- AE Alkalische Elektrolyse
- PEM PEM-Elektrolyse
- SOEC SOEC-Elektrolyse
- EL Elektrolysetechnologie noch offen
- Forschungsanlage ohne Gasverwendung in der Praxis
- Wasserstoffeinspeisung ins Gasnetz
- Wasserstofftankstelle vor Ort
- Wasserstofftankstelle Zug
- Wasserstoffnutzung in Industrieanlage
- Wasserstoffverstromung mit KWK
- Wasserstoff in Trailer
- Methanisierung
- Forschungsanlage ohne Gasverwendung in der Praxis
- Methaneinspeisung ins Gasnetz
- Methantankstelle vor Ort
- Methannutzung in Industrieanlage
- Methanverstromung mit KWK

BADEN-WÜRTTEMBERG

FREIBURG: Fraunhofer-Institut für Solare Energiesysteme, Badenova AG & Co. KG, bnNETZE GmbH, Hochschule Offenburg

LAMPOLDSHAUSEN: ZEAG Energie AG, Deutsches Zentrum für Luft- und Raumfahrt e.V.

GRENZACH-WYHLEN: Energiedienst Holding AG

KARLSRUHE 1: Engler-Bunte-Institut am KIT

KARLSRUHE 2: DVGW-Forschungsstelle am EBI

KARLSRUHE 3: Engler-Bunte-Institut am KIT

KARLSRUHE 4: Engler-Bunte-Institut am KIT

KARLSRUHE 5: TOTAL Deutschland GmbH/ Sunfire GmbH

STUTTGART 1: Netze BW GmbH

STUTTGART 2: Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg (ZSW)

BAYERN

HASSFURT: Windgas Haßfurt GmbH & Co. KG

ALTENSTADT: MicroPyros GmbH

RUHSTORF AN DER ROTT: Hochschule Landshut, Technologiezentrum Energie

AUGSBURG: Stadtwerke Augsburg Holding GmbH

SCHWANDORF: microbEnergy GmbH

STRAUBING: MicroPyros GmbH

ARZBERG: Bayerisches Zentrum für Angewandte Energieforschung e. V.

BRANDENBURG

COTTBUS: BTU Cottbus

FALKENHAGEN: Uniper Energy Storage GmbH

BERLIN SCHÖNEFELD Flughafen BER: TOTAL Deutschland GmbH

PRENZLAU: ENERTRAG AG

HAMBURG

HH-HAFENCITY: Vattenfall GmbH

HH-REITBROOK: Uniper Energy Storage GmbH

HH-BAHRENFELD: Shell Deutschland Oil GmbH

HH-HAFEN: H&R Ölwerke Schindler GmbH

HESSEN

ALLENDORF (EDER): Viessmann Werke GmbH & Co. KG, microbEnergy GmbH

FRANKFURT A. M. 1: Mainova AG

FRANKFURT A. M. 2: Areva H2Gen GmbH

HANAU: Greenerity GmbH

BAD HERSFELD: Fraunhofer-Institut für Energiewirtschaft und Energiesystemtechnik (IEE)

MECKLENBURG-VORPOMMERN

GRAPZOW: WIND-WASSERSTOFF-projekt GmbH & Co. KG

STRALSUND: Hochschule Stralsund, Institut für Regenerative Energiesysteme

ROSTOCK: Exytron GmbH

NIEDERSACHSEN

REGION OSTFRIESLAND: TenneT TSO GmbH, Gasunie Deutschland Transport Services GmbH, Thyssengas GmbH

WERLTE: Audi AG

SALZGITTER: Salzgitter Flachstahl GmbH

EMDEN 1 + 2: Stadtwerke Emden GmbH

HAREN (EMS): Windpark Fehndorf

REGION LINGEN Amprion GmbH, Open Grid Europe GmbH

SASSENBURG-STÜDE: Bernsteinsee Hotel GmbH

NORDRHEIN-WESTFALEN

HERTEN: Anwenderzentrum H2Herten GmbH

IBBENBÜREN: Westnetz GmbH (Eigentum der innogy)

LEMGO: Technische Hochschule Ostwestfalen-Lippe

LÜNEN: RWE Power AG

METELEN: Innogy SE/Westnetz GmbH

NIEDERAUSSEM: Bayer Technology Services (BTS) und weitere

WESSELING: ITM Power GmbH, Shell Deutschland Oil GmbH

RHEINLAND-PFALZ

MAINZ: Stadtwerke Mainz AG

ALZEY: EWR AG

PIRMASENS-WINZELN 1 + 2: Prüf- und Forschungsinstitut Pirmasens e. V.

SACHSEN

DRESDEN: sunfire GmbH

SACHSEN-ANHALT

BAD LAUCHSTÄDT: aus dem HYPOS-Konsortium, steht noch nicht fest

MAGDEBURG 1: OVGU Magdeburg Lehrstuhl Systemverfahrenstechnik

MAGDEBURG 2 + 3: MPI Magdeburg AG Prozesstechnik

LEUNA: steht noch nicht fest

SCHLESWIG-HOLSTEIN

BRUNSBÜTTEL: Wind to Gas Energy GmbH & Co. KG

REUSSENKÖGE: H-TEC SYSTEMS GmbH (GP JOULE GmbH)

HAURUP: Energie des Nordens GmbH

REGION HEIDE: steht noch nicht fest

HEIDE: steht noch nicht fest

WESTRE/ELLHÖFT: Windpark Ellhöft GmbH & Co. KG

THÜRINGEN

HEUBISCH: AVX/KUMATEC Hydrogen GmbH & Co. KG.

HYPOS
BMBF-geförderte Forschungskonsortium HYPOS mit 102 Industrieunternehmen und Forschungseinrichtungen (Stand 2/2019): 5 abgeschlossene, 18 laufende und 6 geplante Vorhaben zur Herstellung, Verteilung, Speicherung und Verwendung von regenerativ erzeugtem H_2, deshalb nicht einzeln in Karte dargestellt.

IMPRESSUM

Diese Übersicht erhebt nicht den Anspruch auf Vollständigkeit. Alle Angaben ohne Gewähr.

Stand: April 2019

Ansprechpartner:
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PORTALGREEN

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aufgrund eines Beschlusses des Deutschen Bundestages

Deutscher Verein des
Gas- und Wasserfaches e.V.

DVGW

www.h2-dvgw.de

Hydrogen Research Projects

H2-
dvgw.de

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www.mehrwert.de

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October 2020

Hydrogen Research Projects

H2-
dvgw.de

Foreword

Hydrogen is the ideal energy carrier when it comes to reducing greenhouse gas emissions, wherever gas-based energy is and will remain the option of choice. Hydrogen offers a realistic, environmentally friendly and sustainable approach for decarbonising industrial processes as well as the heat and mobility sectors. Germany's extensive gas transmission and supply network offers optimal conditions for making hydrogen available when and where it is needed. The gas infrastructure and climate-friendly gases can thus contribute to meeting both the climate targets and the statutory provisions for the reduction of CO_2 emissions.

This has finally hit home with policymakers, too: The Federal Government's National Hydrogen Strategy of June 2020 encourages the development of domestic markets for the generation and use of hydrogen. It includes investment incentives, operating cost relief, improved overall energy-policy conditions and CO_2 pricing with the intention being to create green hydrogen production capacities of up to five gigawatts in Germany by 2030. Funding is made available for research and development projects such as, for instance, "living labs" with a research focus on hydrogen technology. The hydrogen strategy of the European Union also reflects this trend: The EU intends to install at least 40 gigawatts of electrolysis capacity for producing renewable hydrogen by 2030.

The produced hydrogen has to be injected into the existing natural gas grid in order to be transmitted to where it is needed. In accordance with the Set of Rules of the Deutsche Verein des Gas- und Wasserfaches (DVGW), Germany currently allows blending up to ten per cent volume of hydrogen with natural gas; it is intended to increase this ratio to 20 per cent hydrogen by volume and, in the long run, to 100 per cent where possible. The DVGW has consequently initiated a thorough revision of its Set of Rules with the objective being to pave the way for the injection of hydrogen into the natural gas grid and ensure the protection of all applications at the same time.

It is still necessary, however, to adapt specific components, appliances and systems of the gas network in order to ensure the safe and technically correct conversion of the gas supply system to hydrogen. The DVGW has been promoting research in this area for more than ten years, with the objective being to ensure the technical implementation in conformance with the set of rules. It is actively participating in numerous national and European projects. This booklet provides an overview of the current hydrogen research projects in which the DVGW is involved. The 22 projects presented hereafter cover a wide thematic scope – from an analysis of the hydrogen tolerance of individual gas

appliances through to the preparation of an approval guideline for power-to-gas plants.

In my capacities as Chairman of the Managing Committee of the DVGW and President of the European Research Institute for Gas and Energy Innovation (ERIG), I hope you will enjoy reading this booklet and gain many interesting insights.

G. Linke

Prof. Dr. Gerald Linke,
Chairman of the Managing Committee
of the DVGW

"The DVGW supports the industry on its path to climate-friendly gas supply with research activities and innovation. This will help meet the climate targets and the statutory provisions on the reduction of CO_2 emissions."

PROF. DR. GERALD LINKE
Chairman of the Managing Committee of the DVGW

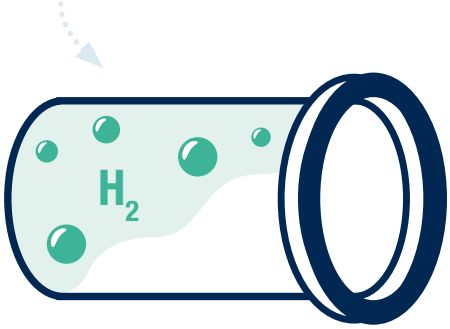
Understanding H_2 – the energy carrier of the future

Hydrogen is a versatile energy carrier which can be used by all sectors – be it as a car fuel, as a feedstock for the industry or as a heating fuel. It can be stored over long periods of time and transmitted over vast distances with almost no loss. Since it can be generated and used without producing greenhouse gases, it can significantly help to protect the climate. In other words, hydrogen is a clean and safe energy carrier with a great potential to decarbonise Germany's energy system and help achieve internationally set climate goals.

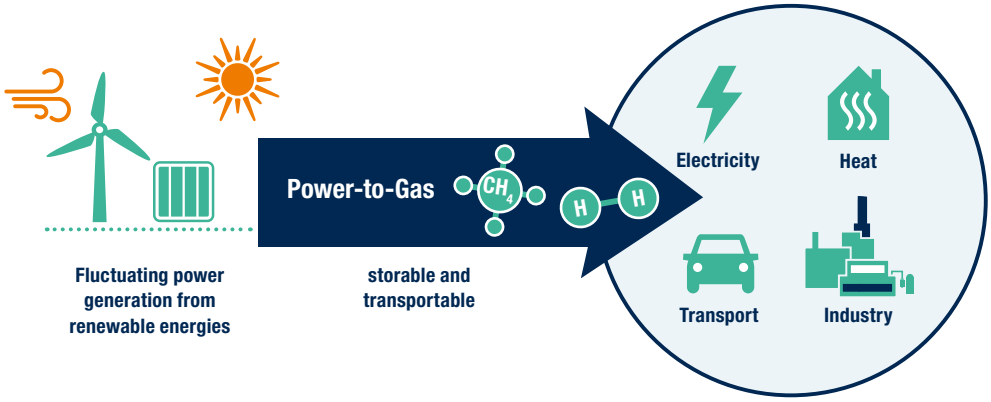
The existing gas infrastructure and its extensive pipeline network play a key role in this context, doubling as a huge energy storage system that can supply the industry as well as households or buildings and even vehicles with green gas. Hydrogen thus offers a great opportunity for coupling the hitherto separate power, heat and mobility sectors, relieving and stabilising the power grids in the process and potentially reducing the need to extend the grid.

Hydrogen is produced either from natural gas or by water electrolysis. Power-to-gas technologies can therefore be employed to produce green hydrogen from wind and solar power combined with water electrolysis. In a second step, the hydrogen thus generated can be converted to methane, which is chemically identical to natural gas. This synthetically produced methane can be injected into the gas grid without any problems and in almost unlimited quantities.

Hydrogen can be blended into and transported by the existing gas infrastructure.



Power-to-gas makes renewable energy storable by transforming electricity into hydrogen (H_2) or methane (CH_4).



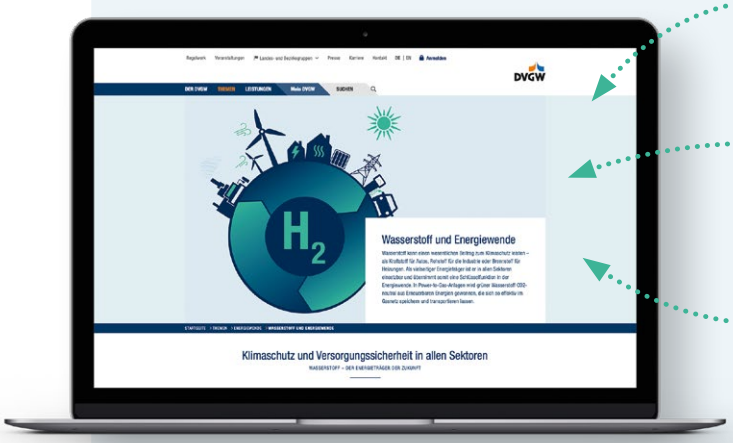
At present, up to ten per cent hydrogen by volume can already be blended into the existing natural gas network. It is intended to increase this concentration up to 20 per cent by volume. In the long term, it is technically feasible to convert grid sections with matching supply and demand to pure hydrogen. Adaptation of the existing gas infrastructure is indispensable, however, for ensuring that all network components and gas applications will tolerate higher hydrogen concentrations. Even small variations in gas quality can adversely affect industrial production processes and technologies.

Thanks to decades of experience in a vast range of different gas mixtures and multiple conversions, the gas industry has both the expert know-how and the knowledge required to manage the necessary change. In the second half of the 20th century, Germany's gas providers have successfully managed the changeover from mains gas – 50 per cent of which consists of hydrogen – to natural gas, and they are currently successfully managing the changeover from L gas to H gas.

The DVGW disposes of broad knowledge in this field and supports the gas industry to ensure that the imminent transition to higher hydrogen concentrations will be just as successful. For many years, the DVGW has been focusing on innovation; it also provides a research budget for this purpose. Numerous research projects on power-to-gas technologies and hydrogen applications have already been successfully completed in cooperation with both DVGW research institutes and external partners. The results prove that both the energy turnaround and the adaptation of the gas infrastructure are technically feasible and make economic sense. The results obtained and the issues that followed in their wake have led to the initiation of other projects that cover three areas: Gas networks and storage systems, gas applications and general subjects.

Numerous research projects are currently investigating how climate-neutral gases and the existing gas infrastructure can help make the present energy system fit for the future, studying technical and economic as well as regulatory aspects. Some of the projects investigate, for example, the impact of hydrogen on gas pipeline and storage system materials or on applications such as gas combustion engines and heating systems. Gas appliances are put through their paces. Additionally, laboratory and field tests are carried out to determine the hydrogen concentration limit that will still permit smooth operation, while other projects are dedicated to investigating how to best convert the gas system and the cost this would entail.

Further information on hydrogen can be found at:
www.h2-dvgw.de



Publications

Events

Research

Photos: © kasto/fotolia, © Uwe Tölle


H2

H_2 RESEARCH AND THE DVGW

GAS GRIDS AND STORAGE SYSTEMS

GAS APPLICATIONS AND MARKETS

OVERARCHING PROJECTS

Photo: © Industryview / iStock

H2 Gas Grid Compendium

Project completion 12/2020

H2-dvgw.de

PROJECT NAME

Compendium – Hydrogen in gas transmission and distribution grids

OBJECTIVE

Evaluation of the hydrogen compatibility of components and products of gas transmission and distribution grids in relation to material and function and subsequent integration of the results into the DVGW Set of Rules

BACKGROUND AND PURPOSE

DVGW studies confirm the hydrogen tolerance of many components of the natural gas infrastructure. The DVGW Set of Rules, however, currently stipulates a hydrogen concentration limit of ten per cent by volume. As it is intended to increase the limit to 20 per cent by volume, the hydrogen tolerance of gas grid components and products will be tested at both the transmission and distribution levels and the results obtained presented in the form of a compendium.

APPROACH AND RESULTS

- Within the project, a book of facts is compiled which reflects the current level of knowledge on how up to 100 per cent hydrogen may impact the gas transmission and distribution grids.
- Gas infrastructure components and products will be described in the form of a one or two-page briefing including an evaluation of the hydrogen tolerance of each component or product.

PROJECT COORDINATOR

DVGW

DBI GUT
Gas- und Umwelttechnik

Photo: © Uniper SE

Transformation Paths for Underground Storage Facilities

Project completion 02/2021

H2-dvgw.de

PROJECT NAME

Hydrogen compatibility of the gas storage infrastructure

OBJECTIVE

Assessment of the hydrogen tolerance of underground storage systems and calculation of cost involved in increasing hydrogen tolerance; derivation of an optimal H2 concentration level and/or optimal transformation path for underground gas storage facilities in Germany

BACKGROUND AND PURPOSE

Underground storage facilities can store energy in the form of renewable gases and, therefore, contribute significantly to meeting climate targets. This project intends to investigate hitherto unresolved research issues relating to the current hydrogen tolerance of gas storage facilities.

APPROACH AND RESULTS

- Available information on the hydrogen tolerance of existing underground storage facilities is gathered and analysed in order to identify knowledge gaps and research needs.
- The collected data serve as a basis for identifying the options on how to make storage facilities (gradually) H_2-ready and describing possible transformation paths.
- Finally, the outlined transformation paths determinate the investment required to increase the hydrogen tolerance of storage facilities.

CO-CONTRACTORS

Initiative Erdgasspeicher e. V · Bundesverband Erdgas, Erdöl und Geoenergie e. V.

PROJECT COORDINATOR

DVGW DBI GUT Gas- und Umwelttechnik

Photo: © Open Grid Europe

Power-to-Gas in Germany

Project completion 10/2020

H2-dvgw.de

PROJECT NAME

Integration of power-to-gas technology into policies supporting a climate-neutral gas system

OBJECTIVE

Providing a basis for discussing power-to-gas market design requirements from the point of view of the markets and grids concerned

BACKGROUND AND PURPOSE

Power-to-gas is crucial for coupling the power and gas infrastructure, because it can be used for the seasonal storage of renewable energies in the form of gases like e.g. hydrogen. As the regulatory framework, however, does not currently provide for the production and storability of renewable gases, the study intends to offer hints on how to integrate power-to-gas technologies.

APPROACH AND RESULTS

- Approaches designed to improve the operation of power-to-gas plants in the current regulatory, infrastructure and market environments are a key outcome of the project.
- It is investigated how to use power-to-gas as a system-friendly measure to manage bottlenecks in the power sector and how to operate power-to-gas plants in a regulated environment, taking into account the re-dispatch potential.
- The research aims to identify and evaluate various tools for promoting the roll-out of climate-friendly gases across all parts of the market.

PROJECT COORDINATORS

IAEW Elektrische Anlagen & Netze, Digitalisierung & Energiewirtschaft | RWTH AACHEN UNIVERSITY | ewi

Photo: © DVGW, Roland Horn

H2 in the Gas Grid

Conversion of Natural Gas Pipelines

Project completion 05/2021

H2-dvgw.de

PROJECT NAME

Preliminary investigations of aspects of gas quality for the transmission and distribution of hydrogen on the basis of the existing natural gas infrastructure

OBJECTIVE

Clarification of technical issues relating to gas quality requirements and elaboration of recommendations for action regarding the conversion of natural gas grids to hydrogen.

BACKGROUND AND PURPOSE

The natural gas infrastructure can be used for transmitting, storing and distributing the energy carrier hydrogen. This, however, requires amending the current European and national set of rules and investigating more thoroughly potential trace elements and necessary processing steps as well as gas quality requirements. The research project aims to resolve these issues.

APPROACH AND RESULTS

- Besides a large-scale data research, practical and theoretical experiments are conducted in order to identify possible sources of contamination and attendant substances in the natural gas grids. Moreover, the results will help evaluate gas quality requirements in conjunction with hydrogen-based gas applications.
- The research also aims at gathering parameters for quality control and for treatment steps and procedures that are required for maintaining the necessary gas quality.
- The results are intended to help amend the DVGW Set of Rules on gas quality.

PROJECT COORDINATOR

DVGW Forschungsstelle ebi

INDUSTRIAL PARTNER

OGE

Open Grid Europe GmbH

Photo: © ONTRAS

H2 Tolerance of Steels

Project completion 07/2021

H2-dvgw.de

PROJECT NAME

Random hydrogen compatibility testing of steel materials for gas pipelines and systems in accordance with ASME B31.12

OBJECTIVE

Random validation of steels used in Germany for application of the US standard based on fracture-mechanical testing

BACKGROUND AND PURPOSE

The safe transmission of hydrogen through the German gas grid is predicated on the hydrogen compatibility of steel components, which this project intends to assess. Up to now, the American Set of Rules ASME B 31.12 (December 2019) is the only standard that describes the compatibility of steel components for up to 100 per cent by volume of hydrogen. The plan is to integrate the evaluation findings into the DVGW Set of Rules.

APPROACH AND RESULTS

- Based on fracture mechanics techniques, about 100 random samples of steels are tested between three and fourteen days.
- Tensile and Charpy impact tests as well as fracture-mechanical tests in a pressurised hydrogen atmosphere are carried out with steels used in the pipelines and plants of transmission and distribution system operators.
- The test results will form the basis for validating the immediate applicability of the American Set of Rules to steel used in Germany.

RESEARCH CENTER

Materialprüfungsanstalt Stuttgart

PROJECT COORDINATOR

OGE

Open Grid Europe GmbH

Photo: © martb/iStock

H2STOP
Assessment of Shut-off Mechanisms

Project completed

H2-dvgw.de

PROJECT NAME
Assessment of the “bag positioning” and “sealing off” shut-off mechanisms for gas pipelines transmitting a natural gas/hydrogen blend

OBJECTIVE
Investigation of the “bag positioning” and “sealing off” shut-off mechanisms in the presence of higher hydrogen blending levels in the gas grid

BACKGROUND AND PURPOSE
“Bag positioning” and “sealing off” shut-off mechanisms during work on natural gas grids are common practice. While the physical and technical implications of both methods are well known in this context, there is a lack of research on gas mixtures, in particular on the injection of hydrogen into the natural gas grid. This was studied in the lab by the H2STOP project.

APPROACH AND RESULTS
- Different materials at different hydrogen concentrations (0 %, 5 %, 10 %, 20 % and 50 %) were tested at between 1 and 5 bar.
- The tests showed bag positioning to be a safe shut-off method for hydrogen/natural gas blends.
- Tests involving the sealing-off of pipes carrying pure hydrogen at a pressure of 5 bar showed about three times higher levels of creeping gas compared with pure natural gas, depending on the viscosity of the gas.

CO-CONTRACTORS
Berufsgenossenschaft Energie Textil Elektro Medienerzeugnisse (BG ETEM) · Hütz + Baumgarten GmbH · Städteler + Beck GmbH

PROJECT COORDINATOR
DVGW DBI GUT Gas- und Umwelttechnik

Photo: © ONITRAS

H2 Membrane

Separation of Hydrogen in Membrane Reactors

Project completion 06/2022

H2-dvgw.de

PROJECT NAME

Testing of different membrane materials designed to separate hydrogen from natural gas/hydrogen mixtures

OBJECTIVE

Construction of a pilot plant and testing of different module geometries and membrane materials designed to separate hydrogen from different natural gas/hydrogen mixtures

BACKGROUND AND PURPOSE

Blending hydrogen with natural gas represents a challenge for some parts of the infrastructure such as e.g. CNG filling stations or plants of the gas industry. Membrane techniques can be employed to separate hydrogen/natural gas blends into their different constituent components. After separating the undesired component, the existing gas infrastructure could be used for delicate applications e.g. in the industry or in the fuel cell sector.

APPROACH AND RESULTS

- In a pilot plant in Prenzlau, tests are conducted to establish which membranes are most suitable for recovering the hydrogen, what volumes can be separated from the gas flow, and the degree of purity of the seperated hydrogen.
- In cooperation with membrane manufacturers, the following parameters will be analysed: (long-term) stability, separating properties, achievable purity, cost, time-to-market, economies of scale and deliverability of the different membrane materials.

PROJECT PARTNERS

ONTRAS Gastransport GmbH · GRTgaz Deutschland · Mitteldeutsche Netzgesellschaft Gas mbH · ENERTRAG

PROJECT COORDINATOR

DVGW DBI GUT Gas- und Umwelttechnik

Photo: © Bet_Noire / iStock

HIGGS
Hydrogen in Gas Grids

Project completion 12/2022

H2-dvgw.de

PROJECT NAME
Hydrogen in Gas Grids

OBJECTIVE
Determining the hydrogen compatibility of the high-pressure gas transmission grid and compilation of data on pan-European rules, standards and certificates for hydrogen blends with natural gas at volumes up to 100 per cent

BACKGROUND AND PURPOSE
The EU Directives on energy and the environment stipulate a reduction of greenhouse gas emissions by at least 45 % by the year 2030. Hydrogen from renewable sources can help meet this target. The existing natural gas grids are able to transmit hydrogen. The HIGGS project investigates the impact of blending and transmitting hydrogen through the natural gas grid.

APPROACH AND RESULTS
- Technical, legal and regulatory barriers as well as remaining “H2 readiness” deficits are identified in order to determine the impact of hydrogen on the gas infrastructure.
- Technical solutions are tested and strategies to retain components with zero or little hydrogen compatibility are designed (e.g. using the membrane separation mechanisms etc.).
- Harmonised test protocols, applicable throughout Europe, will be developed for hydrogen compatibility certification on the basis of test results.

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

PROJECT LOGO
HIGGS Hydrogen in Gas Grids

FUNDING ENTITIES
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.

Photo: © ONTRAS

MefHySto

Metrology for Hydrogen Storage Solutions

Project completion 08/2023

H2-dvgw.de

PROJECT NAME

Metrology for Advanced Hydrogen Storage Solutions

OBJECTIVE

Investigation and advancement of high-precision metrology techniques and methods as well as of relevant hydrogen standards and sets of rules for different hydrogen storage solutions.

BACKGROUND AND PURPOSE

The chemical storage of hydrogen promises to be the go-to solution for storing volatile energy produced from renewable sources and avoiding energy supply interruptions. This, however, requires reliable metrology techniques, standards, reference methods and suitable materials, which the MefHySto project aims to develop.

APPROACH AND RESULTS

- Hydrogen quality requirements for polymer electrolyte fuel cells will be identified and evaluated.
- High-precision density measurements of hydrogen/gas blends will be applied to improve the reference condition equation, which serves as a basis for hydrogen injection modelling and calorific value determination.
- A validated method for measuring and calculating the heat conductivity of hydrogen adsorbed/absorbed by metallic or porous materials will be developed.

PROJECT PARTNERS

Bundesanstalt für Materialforschung und -prüfung (coordinator) · Tschechisches Institut für Metrologie · NPL Management Ltd. · Physikalisch-Technische Bundesanstalt · Commissariat à l'Énergie Atomique et aux Énergies Alternatives (CEA) · DBI Gas- und Umwelttechnik · European Research Institute for Gas and Energy Innovation (ERIG) · Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragon · MAHYTEC SAS · Max-Planck-Gesellschaft zur Förderung der Wissenschaften · Regasificadora del Noroeste · University of Valladolid · DVGW

PROJECT LOGO

MefHySto
Metrology for Advanced Hydrogen Storage Solutions

FUNDING ENTITIES

EMPIR EURAMET

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.

Photo: © Jan-Schneckenhaus / iStock

H2-20

Field Test Injecting 20 % by Volume of Hydrogen into the Distribution Grid

Project completion 07/2023

H2-dvgw.de

PROJECT NAME

Hydrogen in the gas infrastructure: DVGW/Avacon pilot project blending hydrogen with natural gas at volumes up to 20 per cent

OBJECTIVE

Injection of up to 20 per cent by volume of hydrogen into an existing distribution grid supplying about 400 domestic and commercial customers, and deduction of recommendations for action

BACKGROUND AND PURPOSE

Laboratory tests have shown that domestic gas appliances can safely operate on a blend of 20 per cent (by volume) of hydrogen. This project intends to test and validate these findings under real-life conditions in an existing gas supply grid.

APPROACH AND RESULTS

- Field tests are carried out to check the functioning and operating safety of gas appliances. To this end, data on a wide variety of plants and installations as well as maintenance and setting varieties is collected. Moreover, information about user behaviour based on an existing gas distribution grid is gathered.
- Based on the results, recommendations for action are developed regarding the use and distribution of gas.
- The findings are intended to serve as a basis for the future use of hydrogen in gas grids and will be integrated in the DVGW Set of Technical Rules.

PROJECT COORDINATOR

DVGW Forschungsstelle ebi

RESEARCH PARTNERS

avacon

gwi Gas- und Wärme-Institut Essen e.V.

H2 Measurement Accuracy

of Domestic Gas Meters

Project completion 10/2021

H2-dvgw.de

PROJECT NAME

Study of domestic gas meter behaviour in combination with domestic pressure regulators using blends of hydrogen with other gases (EMPIR accompanying project)

OBJECTIVE

Validation of the measurement accuracy of domestic pressure regulators using natural gas blended with 20 per cent hydrogen by volume and pure hydrogen.

BACKGROUND AND PURPOSE

Due to the increasing injection of hydrogen into public gas supply grids, the measurement accuracy of domestic gas meters in the presence of elevated hydrogen levels has to be validated. The Physikalisch-Technische Bundesanstalt (PTB) generally considers gas meters to be technically suitable for blends up to ten percent by volume of hydrogen. This project intends to extend the collection of the hitherto few data available on higher concentrations and pure hydrogen.

APPROACH AND RESULTS

- Test series combine three different types of pressure regulators and diaphragm gas meters using different gases, i.e. nitrogen, methane, methane-hydrogen mixtures and hydrogen, and they will involve the most commonly used meter types.
- Analyses with gas mixtures from 10 up to 30 per cent by volume of hydrogen will provide information about the measurement accuracy and/or regulation accuracy of domestic pressure regulators in combination with diaphragm gas meters.

PROJECT COORDINATOR

PTB

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

Photo: © Heiko Küverling / iStock

H2 Mobility: Status, Trends, Prospects

Project completed

H2-dvgw.de

PROJECT NAME

Analysis of market penetration options for H2-based mobility (passenger cars and trucks) and its potential to reduce GHG emissions, with a view to regulation, support and general political conditions at the national and international level and identification of key success factors in Europe and Germany

OBJECTIVE

Assessment of the potential of hydrogen to reduce greenhouse gas emissions in the passenger car and commercial vehicles sectors and identification of key success factors in Europe

BACKGROUND AND PURPOSE

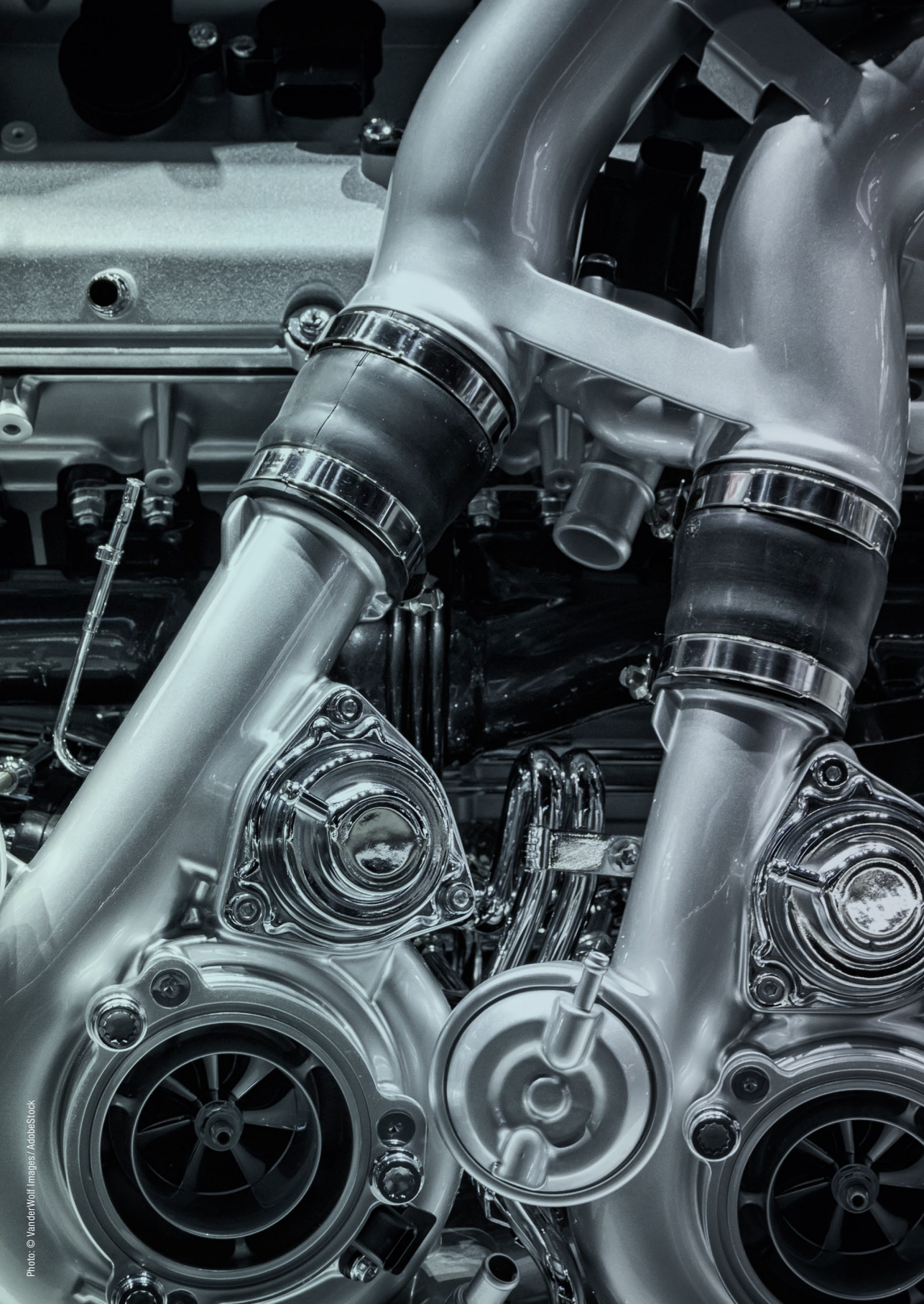
This project aims to answer one of the key questions of the gas industry: What is the economic potential released by producing and transmitting hydrogen in view of the emerging hydrogen-based mobility?

APPROACH AND RESULTS

- Reviewing almost 200 literature sources, the study describes the status of as well as trends and future prospects for hydrogen-based mobility in Germany and selected European countries.
- It assesses the potential to reduce greenhouse gas emissions in the transport sector and possible market options for car makers and producers of hydrogen.
- The results show that climate-policy requirements and stiff competition from Asia favour the market entry, with vehicle technology, economic profitability and infrastructure improving at the same time.

PROJECT PARTNER

CENTER OF AUTOMOTIVE MANAGEMENT



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H2Net&Engines

Hydrogen in the Gas Grid and in Gas Engines

Project completion 12/2021

H2-dvgw.de

PROJECT NAME

H2 in the gas network and interaction with gas engines

OBJECTIVE

Assessment of the hydrogen compatibility of conventional gas engines and possibilities of technological adaptation

BACKGROUND AND PURPOSE

The target to reduce CO_2 emissions by 95 per cent by the year 2050 is predicated on a climate-neutral industry and mobility sector. Hydrogen and methane offer excellent ways to achieve just that. This project studies the impact on current technologies of an altered gas mixture in the gas grid, with a special focus on internal combustion engines.

APPROACH AND RESULTS

- The project investigates how much hydrogen is tolerated by gas-powered internal combustion engines – e.g. of cars or CHPs – and how to optimally adapt existing technologies and gas grids.
- Additionally, possibilities of multi-fuel filling stations and technologies to separate hydrogen from gas mixtures are examined. Pre-defined scenarios and computer models are used to identify the most feasible and, at the same time, most economical solution.

RESEARCH CENTER

DVGW Research Centre at Engler-Bunte-Institute of KIT (DVGW-EBI) · DBI Gas- und Umwelttechnik · KIT Institute for Thermal Energy Technology and Safety (ITES) · KIT Institut für Kolbenmaschinen (IFKM) · Frontier Economics

CO-CONTRACTOR

FVV Forschungsvereinigung Verbrennungskraftmaschinen

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THyGA
Hydrogen/Natural Gas Blends for Gas Applications

Project completion 12/2022

H2-dvgw.de

PROJECT NAME
Testing Hydrogen Admixtures for Gas Applications

OBJECTIVE
Enable the European-wide adoption of hydrogen and natural gas blends by closing knowledge gaps regarding technical impacts on residential and commercial gas appliances.

BACKGROUND AND PURPOSE
Using the existing gas infrastructure, hydrogen and hydrogen admixtures can be used as an alternative to natural gas for space heating, water heating and gas cooking. The THyGA project sets out to develop and communicate a detailed understanding of the impact of blends of natural gas and hydrogen on end use applications, specifically in the domestic and commercial sectors.

APPROACH AND RESULTS
- Up to 100 residential and commercial gas appliances will be tested to find out how they react to various H2 concentration scenarios.
- One of the project's target is to benchmark and develop pre-certification protocols (test gases) for different level of H2 in natural gas for coming integration in standardization, these protocols will be validated through tests
- As a result, recommendations for manufacturers, decision makers and end-users along the gas value chain are made to enable mitigation strategies for retrofit.

PROJECT PARTNERS
ENGIE (coordinator) · BDR Thermea Group · Commissariat à l'Energie Atomique et aux Energies Renouvelables (CEA) · Dansk Gasteknisk Center (DGC) · DVGW Research Centre at Engler-Bunte-Institute of KIT (DVGW-EBI) · Electrolux AB · GAS.BE ·Gas- und Wärme-Institut Essen (gwi) · GERG – The European Gas Research Group

PROJECT LOGO
THyGA

FUNDING ENTITIES
This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement (No. 874983). This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme, Hydrogen Europe and Hydrogen Europe research.

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LivingH2

Demonstration of a Hydrogen Fuel Cell CHP

Project completion 09/2022

H2-dvgw.de

PROJECT NAME

Living Laboratory Demonstration of Complete Pure Hydrogen Fuel Cell Cogeneration System

OBJECTIVE

Demonstration of a complete solution of a renewable hydrogen power supply in a living laboratory environment, using a hydrogen fuel cell cogeneration system, fed with hydrogen generated by electrolysis from renewable power

BACKGROUND AND PURPOSE

The use of fuel cells for the supply of heat and power to stationary systems can help to increase the share of renewables in the energy sector and reduce CO_2 emissions and energy costs at the same time. Fuel cell-based CHP systems running on green hydrogen can, therefore, supply CO_2-free energy to buildings and gradually replace existing conventional combined heat and power generators (CHP) systems. The project studies the technological development of these pure H2 CHP systems.

APPROACH AND RESULTS

- Fuel cell CHPs will be optimised for pure hydrogen operation through technological innovation.
- A complete, pipeline-based hydrogen supply system will be installed to be tested in a typical domestic environment, the “living lab”, including the production of renewable hydrogen, pipework installation in a building, odorisation and an H2 CHP.
- Finally, the solution will undergo a technical, economical, ecological and social assessment.

PROJECT PARTNERS

inhouse engineering GmbH (coordination) · ENGIE (coordination) · Commissariat à l’Énergie Atomique et aux Énergies Renouvelables (CEA) · DBI Gastechnologisches Institut gGmbH · Ostbayerische Technische Hochschule Regensburg · European Research Institute for Gas and Energy Innovation (ERIG)

PROJECT LOGO

FUNDING ENTITY

GEFÖRDERT VOM

Bundesministerium für Bildung und Forschung

Funding ID:
03SF0587B

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H2 Test Specifications
For Gas Supply

Project application under preparation

H2-dvgw.de

PROJECT NAME

Test specifications for hydrogen in gas supply

OBJECTIVE

Development of scientific principles for a performance test for products used in gas infrastructure and application technology in combination with hydrogen

BACKGROUND AND PURPOSE

A swift advancement of the transformation of the energy system across to hydrogen requires the timely preparation of the gas infrastructure and the relevant gas technologies to ensure their safe operation. This project intends to enhance the DVGW Set of Rules for gas valves and fittings, pipework, gas installation, gas appliances and components as well as gas additives on the basis of scientifically validated test procedures and test benches.

APPROACH AND RESULTS

- With regard to fittings and components, the focus is on the tightness of devices and components as well as the long-term suitability and resistance of materials.
- The researchers also focus on test and limit gases that are used for combustion tests, test procedures for combustion monitoring, safety-related questions of the thermal stability of appliances, performance tests and emission monitoring.

PROJECT COORDINATOR

DVGW Forschungsstelle ebi

RESEARCH PARTNERS

DVGW DBI GUT Gas- und Umwelttechnik

gwi Gas- und Wärme-Institut Essen e.V.

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PORTAL GREEN

Power-to-Gas Guideline

Project completion 10/2020

H2-dvgw.de

PROJECT NAME

Development of a power-to-gas guideline for the integration of renewable energies

OBJECTIVE

Elaboration of a guide to permits of power-to-gas plants, covering both permitting processes and technical aspects relating to the construction and operation of plants and systems

BACKGROUND AND PURPOSE

Power-to-gas technologies play a key role in future energy systems as they pave the way for the integration of renewable energies in sustainable supply systems. The current inconsistent technical rules and the lack of harmonised laws hamper the construction of such plants, however. The project aims to prepare a bi-sectional guideline with the objective being to illustrate the process and facilitate its implementation.

APPROACH AND RESULTS

- The guideline sections consider the content-related and chronological sequence of procedures for approval processes in the areas of grid injection, reconversion into electricity, mobility and industrial use.
- As part of the guideline explanation of responsibilities is given, and a decision trees will help users, e.g. selecting the relevant approval processes.
- The results will be integrated in the DVGW Set of Rules.

PROJECT PARTNERS

DBI Gas- und Umwelttechnik gGmbH · University of Wuppertal · Uniper Energy Storage GmbH · DVGW

PROJECT COORDINATOR

GRS

Gesellschaft für Anlagen- und Reaktorsicherheit gGmbH

FUNDING ENTITY

GEFÖRDERT VOM

Bundesministerium für Bildung und Forschung

based on a resolution of the German Bundestag

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H2-IQ
Hydrogen for Districts

Project application under preparation

PROJECT NAME
Hydrogen as an energy carrier for districts

OBJECTIVE
Testing and development of grids and gas heating appliances in two districts in the Kassel region adding 20 per cent and 100 per cent by volume of hydrogen to the natural gas

BACKGROUND AND PURPOSE
As other sectors, the heat market can benefit from the climate protection potential of hydrogen that helps to reduce greenhouse gas emissions. A field study to be carried out in rural and urban environments aims to find out how to use hydrogen for heating existing and new buildings, relying on the existing natural gas infrastructure.

APPROACH AND RESULTS
- Over two heating periods, hydrogen is injected into the gas distribution grids of two test regions. A blend with 20 per cent by volume of hydrogen will go into the grid of a rural area, and pure hydrogen into a yet-to-be-built gas grid in an urban district of the city of Kassel.
- Hydrogen conversion kits and conversion concepts for condensing appliances to convert them from natural gas to pure hydrogen will be developed and tested.
- Based on the project findings, a data base will be set up collecting information on the hydrogen compatibility of individual gas heating appliances in existing buildings.
- The results will be integrated in the DVGW Set of Rules.

PROJECT PARTNERS
Becker Büttner Held BBH · EAM Netz · Gas- und Wärme-Institut Essen (gwi) · Honeywell Gas Technologies GmbH · Städtische Werke Netz und Service · Viessmann · DVGW

PROJECT COORDINATOR
House of Energy

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Roadmap Gas 2050

Strategy for a Climate-neutral Gas Supply

Project completion 06/2022

H2-dvgw.de

PROJECT NAME

Creating a roadmap to implement the DVGW Energy Impulse by 2050

OBJECTIVE

Development of a holistic, number-based concept for the provision of climate-neutral gases, with the objective being to integrate the gases in the gas infrastructure and adapt the gas utilisation technologies

BACKGROUND AND PURPOSE

Studies carried out as part of the DVGW's research activities have proven gas-based concepts to be feasible and sensible elements of a future energy system. The Roadmap Gas 2050 project aims to devise a holistic concept. To this end, the project combines the benefits of using the gas infrastructure and the gas appliances that were shown by previous studies and describes the possible synergies in quantitative terms.

APPROACH AND RESULTS

- The national and international generation potential of renewable gases is analysed, considering both conventional and alternative ways of hydrogen production.
- Moreover, the future demand of "green" gases is determined
- Gas devices are tested systematically to determine the ideal hydrogen/natural gas blending ratio for gas applications. The results will reveal the need to adapt technologies to blends between 50 and 100 per cent by volume of hydrogen for the different application sectors.
- Finally, possible transformation paths for the gas infrastructure will be determined. A conclusive holistic energy system modelling will then outline the future role of gas in the energy turnaround.

PROJECT COORDINATOR

DVGW Forschungsstelle ebi

RESEARCH CENTERS

DVGW DBI GUT Gas- und Umwelttechnik

gwi Gas- und Wärme-Institut Essen e.V.

Fraunhofer ISI

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H2R
The Rhineland – A Hydrogen Region

Under preparation

H2-
dvgw.de

OBJECTIVE

Seven-phase development of a hydrogen infrastructure in the Rhineland; expansion and sharing of knowledge about hydrogen to achieve sector coupling

BACKGROUND AND PURPOSE

The Rhineland region intends to actively promote the production, distribution and use of hydrogen in order to achieve the energy turnaround. To this end, the cities of Cologne, Hürth, Brühl and Wesseling as well as the Rhein-Sieg and Rheinisch-Bergisch districts formed a joint initiative in 2018, with the intention being to create a sector-coupled energy system. Important regional companies and players, including the DVGW, support the "Initiative H2R – Wasserstoff Rheinland".

APPROACH AND RESULTS

- During the first project phase, the initiative participated in the "Model Region Hydrogen Mobility" competition organised by the federal state of North-Rhine Westphalia.
- The project partners are drawing up a detailed concept on energy and transport turnaround that includes the generation, distribution and use of hydrogen, and which will be implemented in the years to come.
- Based on the detailed concept, existing structures will be further developed and the new sector coupling elements of the H2R initiative will be planned.
- A technology concept will describe the optimal use of the region's potential.

PROJECT LOGO

H2R Wasserstoff Rheinland

FUNDING ENTITY

Ministerium für Wirtschaft, Innovation, Digitalisierung und Energie des Landes Nordrhein-Westfalen

Photo: © dem10 / iStock

SuperP2G

Linking European Power-to-Gas Initiatives

Project completion 10/2022

PROJECT NAME

Synergies utilising renewable power regionally by means of power-to-gas

OBJECTIVE

Lowering the threshold for need-owners to validate and put power to gas to practice for “Smart Energy Systems”, “Sectorial Integration” as well as “Local and Regional development”

BACKGROUND AND PURPOSE

The increasing use of renewable energies calls for sector coupling with storage elements such as power to gas technologies. The project aims to design an internationally applicable assessment tool and point out potential areas of application or case studies in Europe. To this end, SuperP2G links leading power-to-gas initiatives from five European countries and increases the visibility of power to gas across Europe.

APPROACH AND RESULTS

- SuperP2G links leading national projects and regions with the relevant stakeholders in the EU, with the objective being to exploit synergies related to assessment tools and procedures.
- The potential in each of the participating countries will be identified. Finally, a pan-European conclusion regarding market conditions and stakeholder needs will be drawn.

PROJECT PARTNERS

Technical University of Denmark (coordinator) · Energifonden Skive – GreenLab · Consiglio Nazionale delle Ricerche (CNR-ITAE) · Bologna University, Economic Engineering Department · Groningen University, Economics Department · DBI Gastechnologisches Institut · DVGW Research Centre at Engler-Bunte-Institute of KIT (DVGW-EBI) · European Research Institute for Gas and Energy Innovation (ERIG) · Energy Institute at Johannes Kepler University, Linz

PROJECT LOGO

FUNDING ENTITIES

This project has received funding in the framework of the joint programming initiative ERA-Net Smart Energy Systems’ focus initiative Integrated, Regional Energy Systems, with support from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 775970.

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HEAVENN

Lead Project for the Introduction of Hydrogen in Europe

Project completion 12/2025

PROJECT NAME

H2 Energy Applications (in) Valley Environments (for) Northern Netherlands

OBJECTIVE

Development of a hydrogen valley in the northern Netherlands for the large-scale demonstration of the production, distribution, storage and local end use of green hydrogen

BACKGROUND AND PURPOSE

The ultimate goal of a climate-neutral energy system is the total integration of renewable energies generated from onshore and offshore wind turbines and solar panels. The European lead project HEAVENN intends to show how to create a totally integrated regional hydrogen infrastructure on the basis of the existing natural gas infrastructure.

APPROACH AND RESULTS

- The practical implementation of the overall green hydrogen value-added chain in a fully integrated ecosystem (valley) will serve as a blueprint for the application of green hydrogen in regions throughout Europe.
- Six existing and envisaged project clusters at six locations in the northern Netherlands are part of the research. The hydrogen produced will be provided across all sectors.
- Based on the experience gained from the project, the project partners will develop replicable business models for the far-reaching commercialisation of hydrogen across the entire regional energy system.

PROJECT PARTNERS

New Energy Coalition (coordinator) · Stichting Energy Valley · Qbuzz · Gemeente Groningen · Nouryon Industrial Chemicals · Nederlandse Aardolie Maatschappij · Nederlandse Gasunie · Gemeente Emmen · Emmtec Services · Cemtec Fonden · Hinicio · Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón · ENGIE Energie Nederland · Gemeente Hoogeveen · Hyenergy Transstore · Enercy · Groningen University · Pitpoint.CNG · Green Planet Real Estate · European Research Institute for Gas and Energy Innovation · Gemeenschappelijke Regeling Samenwerkingsverband Noord-Nederland · Bytesnet Groningen · H2tec · U.V.O. Vervoer · Ewe Gasspeicher · EBN Energie Beheer Nederland · Groningen Seaports · Lenten Scheepvaart · Nederlandse Particuliere Rijnvaart-centrale Cooperatie · Hydrogen Ireland Natural Resources Association Company · The European Marine Energy Centre

PROJECT LOGO

FUNDING ENTITIES

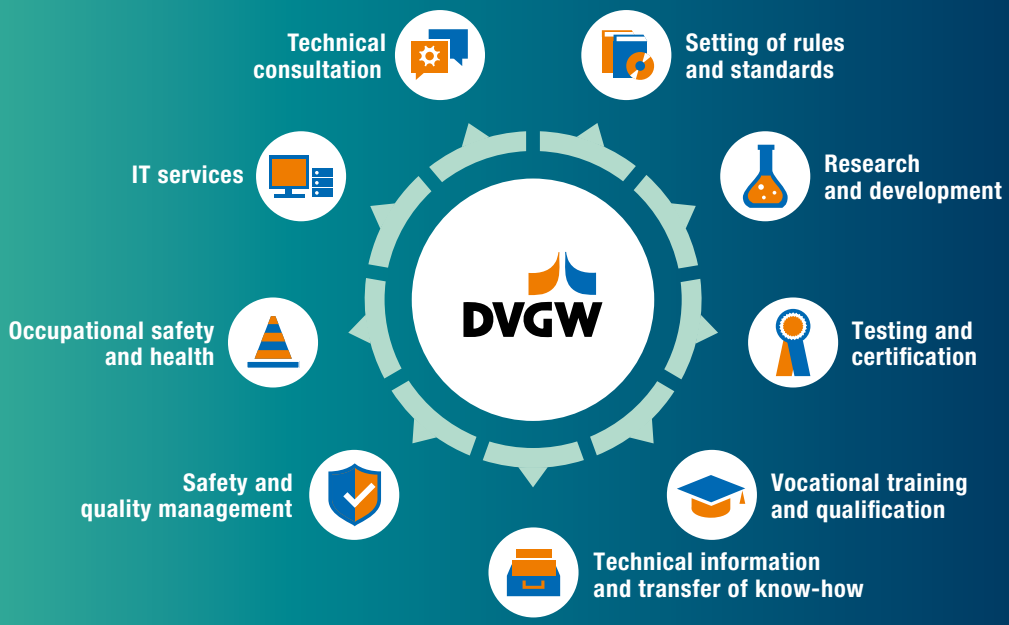
This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (FCH JU) under grant agreement no. 875090. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme, Hydrogen Europe and Hydrogen Europe research.

The DVGW –
Innovating and Setting the Rules for the Gas and Water Industry

The Deutsche Verein des Gas- und Wasserfaches e. V. (DVGW, German Association of the Gas and Water Industry), an officially recognised rule-setting body, spreads technical and scientific know-how and promotes technical innovation. In this capacity, it doubles as a network of excellence in all aspects relating to the supply of natural gas and drinking water. The DVGW promotes and supports the gas and water industry in all scientific and technical matters, with a strong focus on safety and hygiene as well as environmental and consumer protection. The ongoing development of the DVGW Technical Rules constitutes the basis of the technical self-management of the German gas and water industry and guarantees the safe and secure supply of gas and water to the highest international standards. Research, the basis of innovation, forms a key part of the DVGW's activities. The DVGW sponsors research projects pursued by different institutes and conducts in-house research projects.

The association, which was founded in 1859, boasts about 14,000 members. The DVGW is an independent non-profit organisation and, as such, free from economic lobbyism and political influence. At the local level, the DVGW operates through its district groups, whereas at the supra-regional level the federal-state groups are the first point of contact for its members. The head office in Bonn and the branch offices in Berlin and Brussels handle subjects of national or European dimensions.

The DVGW Service Portfolio ➔


Technical consultation
Setting of rules and standards
IT services
Research and development
DVGW
Occupational safety and health
Testing and certification
Safety and quality management
Vocational training and qualification
Technical information and transfer of know-how

Research within the DVGW

The German energy and water industries are continually facing new challenges. The energy turnaround in particular calls for the development of advanced concepts for the energy carrier gas, taking into account climate and environmental policies as well as systemic, economic and safety-related targets.

The DVGW's research activities comprise regional and national projects as well as research cooperation across Europe. Forming the basis for the technical advancement of the gas industry, they promote standardisation and the development of the regulatory framework and ensure the scientific quality of the DVGW's opinions. This proves the advantages of maintaining an interdisciplinary network of excellence.

The DVGW's gas research activities are organised in a decentralised fashion, distributed among a total of six institutions that combine scientific expertise and university partnerships with the gas industry's practical experience. The individual institutes are complementary in their competences and form an integrated network that covers all aspects relating to gas and energy.

ERIG
European Research Institute for Gas and Energy Innovation

Being one of the founding members of the **European Research Institute for Gas and Energy Innovation (ERIG),** the DVGW is involved in numerous European research projects. The non-profit network of innovation is based in Brussels and supports European cooperation in research into sustainable and innovative gas technologies as well as the use of natural gas in combination with renewable energies. In June 2020, Prof Gerald Linke, Chairman of the DVGW Managing Committee, was appointed president of ERIG, which strengthens the close cooperation between both institutions in the area of gas research. One of ERIG's top priority goals – in addition to increasing the share of climate-friendly gases – is supporting the integration of volatile renewable energies in the gas system through technologies like power-to-gas, with the objective being to create a more robust energy supply network through more flexible supply, demand and storage.

The DVGW Gas Research Network
Overview