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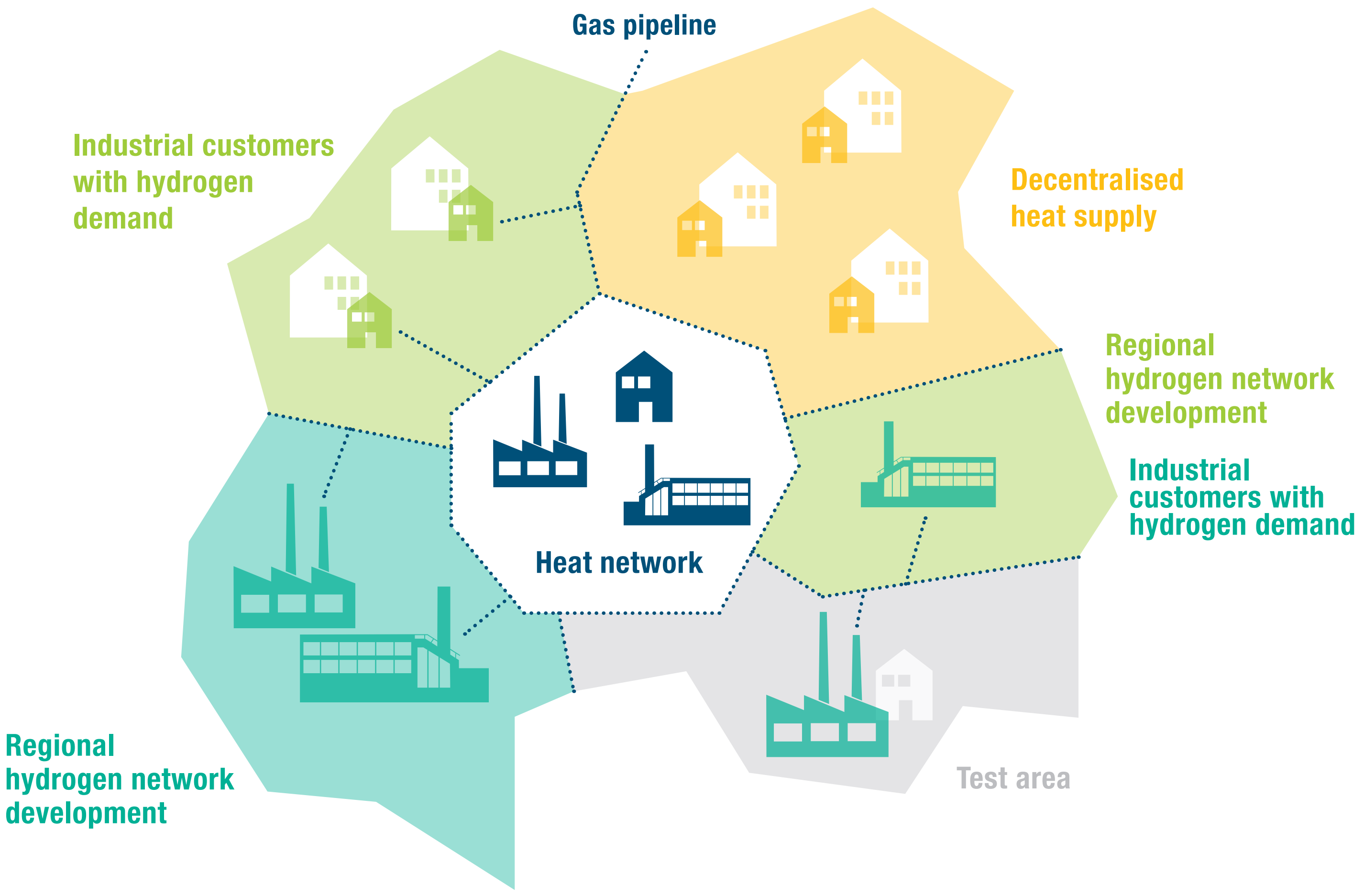
Hydrogen Supply at the Local Level

The role of hydrogen in a future climate-neutral energy system



In the future, industries and power plants will depend on new gases like hydrogen and biomethane.

This can be advantageous for local heat supply systems and pave the way for a realistic opportunity to achieve climate neutrality in a socially compatible way.

New gases and renewable power help to protect the climate and deliver energy security

There's no getting around the numbers: Germany's total annual energy consumption is approximately 3,000 terawatt-hours (TWh), 600 TWh of which is consumed as electricity. The remaining 2,400 TWh is produced from chemical compounds like oil, coal, etc.

In other words: While there's no doubt that the climate-neutral production of both molecules and electrons is an important requirement, the biggest leverage comes from using climate-neutral 'new' gases like hydrogen and biomethane.

Understanding this is crucial for any planning project that involves prospective energy supply systems, as the highest demand for new gases comes from power generation plants and industrial plants that employ thermal processes. These plants are located across Germany, are currently being powered by natural gas and cannot electrify their processes for several reasons: Be it for technical and plant engineering reasons, the high cost incurred by establishing a power connection, and/or the high cost of electricity.

The connection to a network that supplies new gases will consequently enhance the attractiveness of each federal state, administrative district and municipality as an industrial or business location.

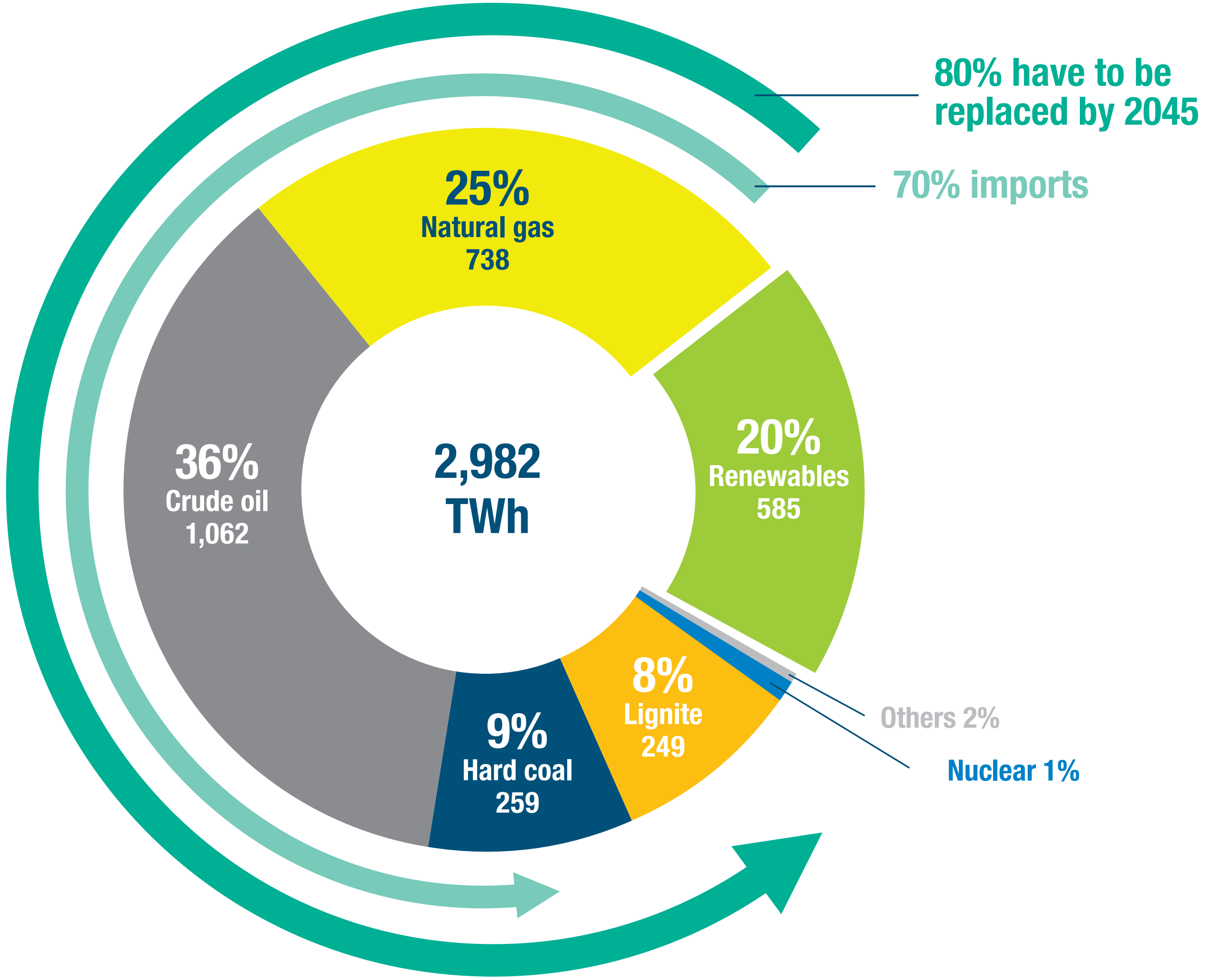
Although the share of electricity in total final energy consumption will increase, renewable gases and, above all, hydrogen will provide the bulk of the energy supply. Renewable gases will make our energy system more resilient and more flexible because they are easy to transport and can supply energy to areas where power grids do not exist. Moreover, they can be stored for long periods of time and thus reliably provide energy year-round.

Today's natural gas network can be made hydrogen-ready by 2045, at the reasonable cost of about € 25bn, and based on normal maintenance cycles that comply with the pertinent requirements.

In the years to come, hydrogen will be available in increasing quantities, and prices will consequently be more competitive as governments and businesses around the globe keep transforming the energy value chain.

This brochure presents a neat overview of the latest facts and figures to show that it is clever and worthwhile to invest in local supply networks for new gases.

There's no getting around hydrogen to meet the demand for energy.



Primary energy consumption in Germany in 2023 (TWh)
Source: AGEB 2023/Daten und Fakten; AG Energiebilanzen e. V. (agenergiebilanzen.de)

The gas network ensures that the energy transition will be successful

Supplying the industry, power plants and households with climate-neutral energy requires expanding the power network AND transforming the gas network. In Germany, 1.8m business entities and about 20m households are connected to and receive natural gas through this underground infrastructure.

The future supply of climate-neutral hydrogen and biomethane to current consumers of natural gas is a crucial prerequisite for a successful energy transition.

The pipeline network of almost 600,000km can safely transmit large quantities of energy over great distances across Germany, at any time. For example, a gas pipeline can transmit about eight times as much climate-neutral energy as an electricity pipeline – over the same distance.

The long-term and seasonal storage capacity of the gas infrastructure is an additional asset that helps offset the volatile energy generation from wind and solar, avoid bottlenecks and, ultimately, stabilise the supply of power. During periods of low renewable electricity generation and high demand, i. e. usually in the winter, ultra-flexible gas power plants ensure the reliable supply of power and are therefore vital components of the German energy system. Their continued existence is the only way to expedite the expansion of renewable energies, for the gas network can store additional large amounts of energy that would otherwise have to be shut off.

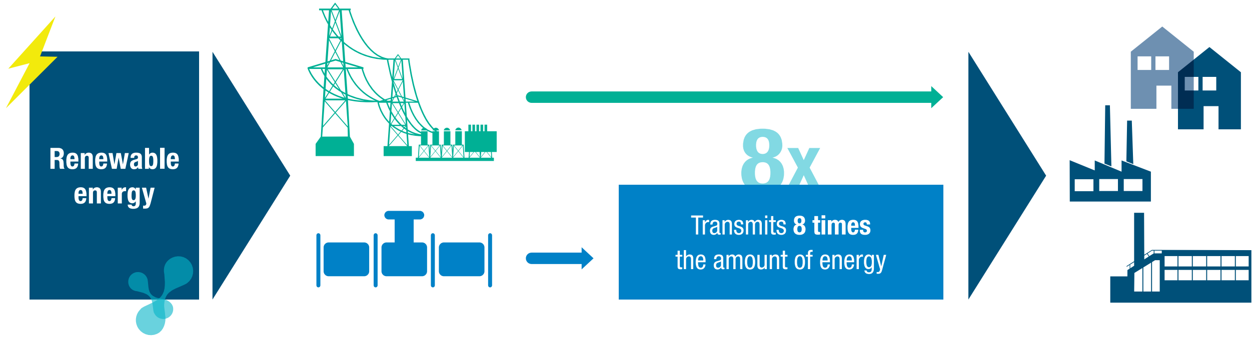
97% of the components of the German natural gas network are already "H_2ready", i. e. suitable for transporting hydrogen. Components that are not suitable for hydrogen transport can be replaced without necessitating major urban development measures. In other words, there is no need for a massive network expansion, as would be required in the case of electricity or district heating.

The current gas pipeline network can transport climate-neutral energy across Germany

The long-distance pipeline network (white)
consists of pipes with diameters of up to 140cm that transmit large quantities of gas at high pressures of up to 100 bar.

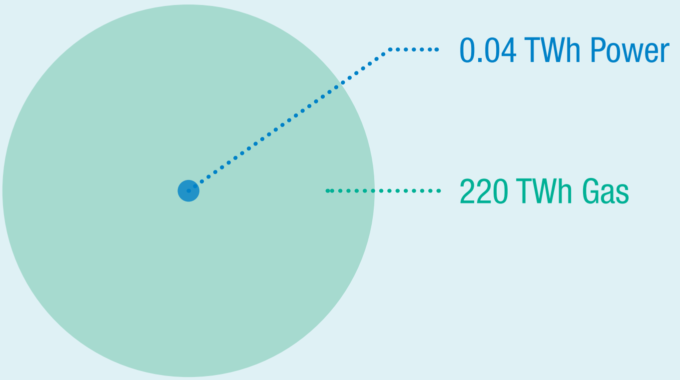
The close network of distributions pipelines (green)
distributes gas to regional consumers at lower pressures.

The combination of infrastructures facilitates the secure supply of climate-neutral energies



The transmission capacity of a 380 kV ((approx. 2x2 GVA) overhead line was compared with a high-pressure gas pipeline (DN 1000).

Storage capacity of the German power and gas infrastructure



Most of the gas pipeline network is already hydrogen-ready

All materials and components that come into contact with hydrogen have to be leak tight, stable and technically safe so that the energy carrier can be transported in a technically safe manner. All materials must be resistant to embrittlement and other changes, and all components must function perfectly.

All gas storage facilities as well as the compressor and gas metering stations that are currently installed in the German gas network can safely operate on blends of 10% hydrogen. Thanks to the fact that, unlike the almost fully H_2compatible pipelines, all other gas systems can be accessed from above ground, the latter can be converted faster and more cost-effectively than pipelines, and at the same time, require less planning and effort.

“H_2 readiness” of the system

The percentages indicate the H_2-readiness of the individual components, i. e. the allowable maximum concentration of hydrogen in the gas mixture at which they will operate safely according to the latest findings.

In 2024, the DVGW carried out the brief study called “H_2-Transformationskosten II” that calculated the cost of converting the entire gas infrastructure to hydrogen, taking into account increasing electrification due to e. g. electric heat pumps, and assuming that two thirds of the currently existing gas connections would remain in place.

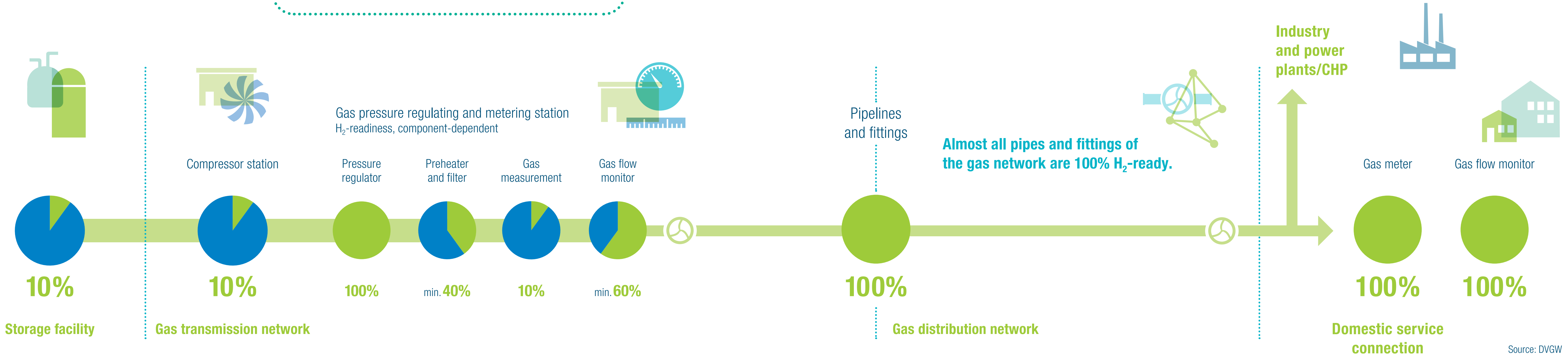
The result of the study showed that up to the year 2045, the conversion of the gas distribution networks to hydrogen would incur an additional cost of only €4bn, as compared with regular maintenance (€47bn vs. €43bn). In other words, a comparably small additional investment would enable the conversion of the gas networks to a hydrogen distribution infrastructure that could supply hydrogen to domestic and commercial customers as well as the industry and gas power plants.

Gas distribution network

The conversion to hydrogen of the German gas distribution networks incurs an additional cost of €4bn up to the year 2045 if carried out alongside regular maintenance work, including the associated replacement of components (scenario: 2/3 of gas connections for households and businesses and 81% of the current network length).

Long-distance transmission network

The H_2 core grid is to be completed by 2032 through the reallocation and construction of new transport grid lines and will cost 18.9 billion euros.



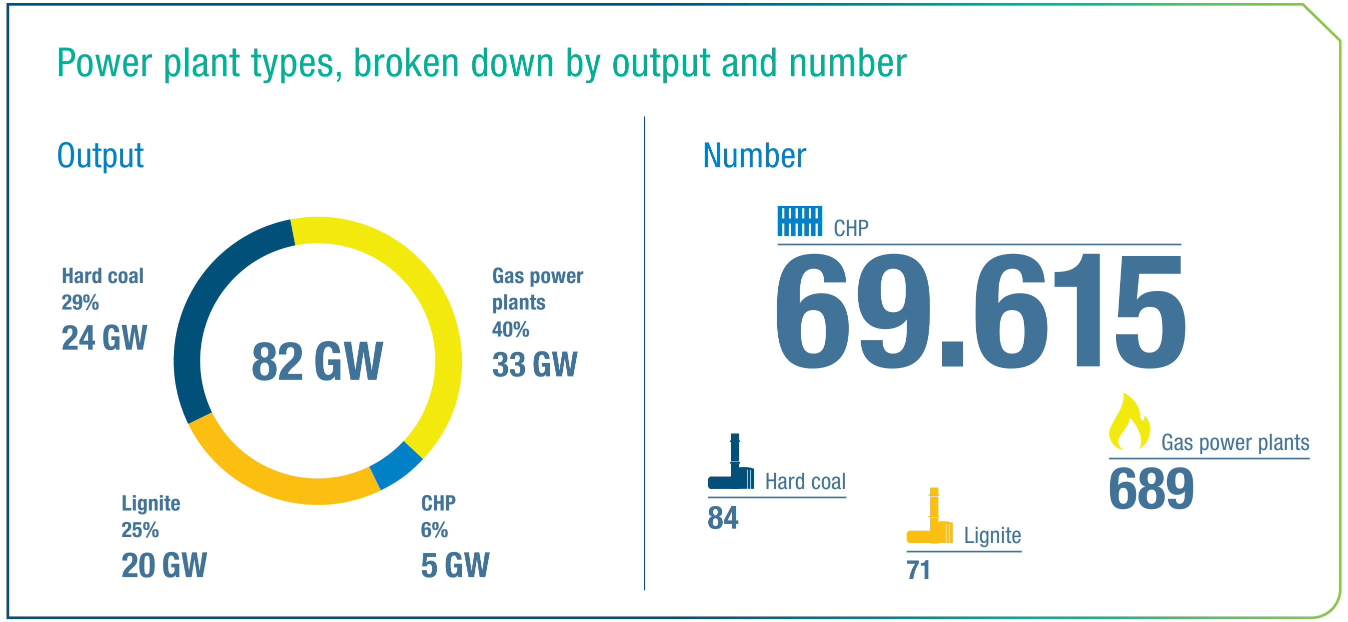
Source: DVGW

Hydrogen is a crucial factor in securing Germany’s energy supply

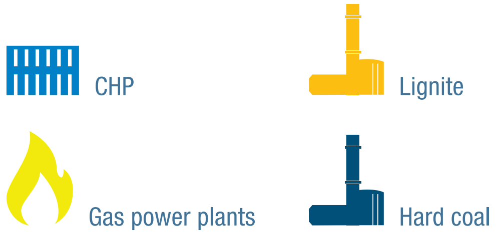
About 700 coal and gas-fired power plants and almost 70,000 smaller combined heat and power plants (CHP) cover almost half of Germany's current demand for electricity as well as shortfalls in renewables generation from wind and solar. Coal will be phased out of the energy mix by 2038 at the latest, and natural gas will follow by 2045. Securing Germany’s energy supply therefore requires maintaining existing plants, initially converting them from coal to natural gas and later to hydrogen (H_2).

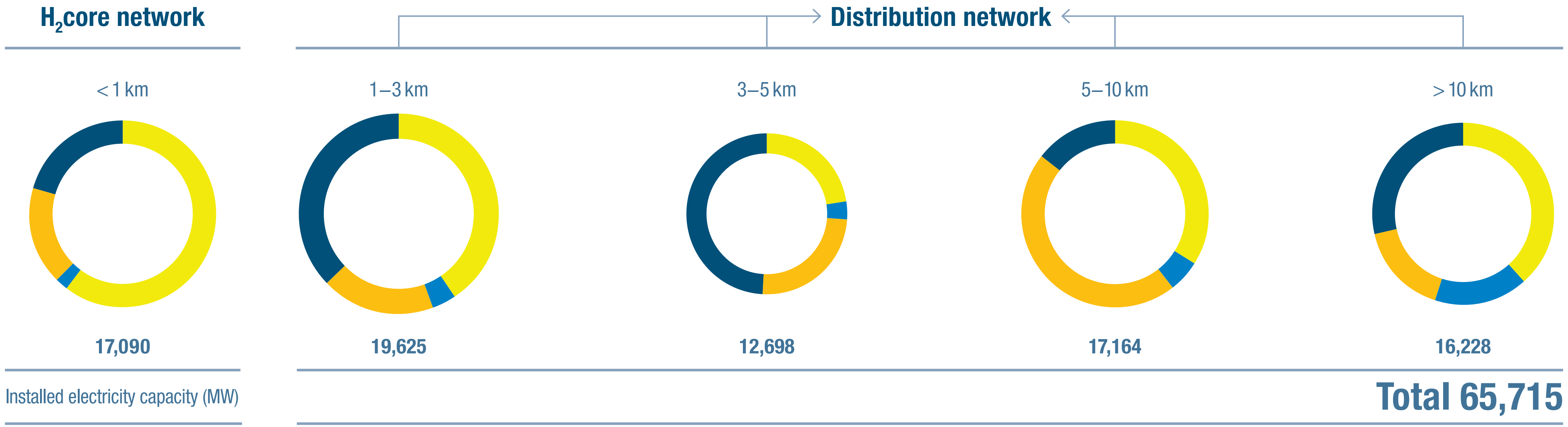
The gas network is key to supplying power plants with energy, which secure Germany’s power supply on days when too little energy is produced from wind and solar. For this reason, the DVGW commissioned an analysis of power plant locations, which found that power plants are widely distributed across the regions. 90 percent of the plants, or 80 percent of the total output, are more than one kilometre away from the planned H_2 core network and depend on the existing gas distribution network. This well-developed regional gas distribution network needs to be converted to hydrogen in order to supply the power plants with energy, ensuring security of supply for Germany’s energy system. Especially the almost 70,000 decentralised CHP plants, which also play a crucial role in supplying the regional heat networks with energy, require an hydrogen distribution network structure that together with the planned hydrogen core network for the transport of large quantities of hydrogen throughout Germany will provide the efficient and resilient infrastructure required in this context.

The power plant strategy pursued by Germany’s federal government reflects that the need for hydrogen-powered power plants has been recognised, as illustrated by the construction of new hydrogen power plants that will generate 10 GW of energy. However, around 40 GW are required to ensure security of supply.



Only a small percentage of the installed power plant capacity is located close enough to the planned hydrogen core network





Energy for process heat –
The role of gas networks in industry and commerce

Both the industry and the manufacturing sector, which include about 6,000 major industrial customers (among others, plants that produce steel, chemicals and glass) and more than one million commercial customers, use a large proportion of the energy supplied as natural gas to generate process heat, among other things. In the past years, demand has increased to about 200 TWh (AG Energiebilanzen), which is equivalent to one tenth of the current final energy demand and one fifth of the gas demand in Germany.

However, due to process-related reasons not every industry can switch to electricity for powering their processes. Rather, the respective industries will continue to depend on gaseous energy carriers and, in the future, hydrogen in order to become climate-neutral. An adequate infrastructure that is capable of supplying climate-friendly gases is therefore indispensable.

The planned H_2 core network, which consists of 9,000 kilometres of transmission pipelines, intends to supply hydrogen to large industrial users in the future. However, many industrial and commercial consumers and, above all, small and medium-sized enterprises currently have the energy for process heat supplied by the gas distribution network. Like a large number of power plants, they are located too far away from the core network and will therefore probably not be connected to it.

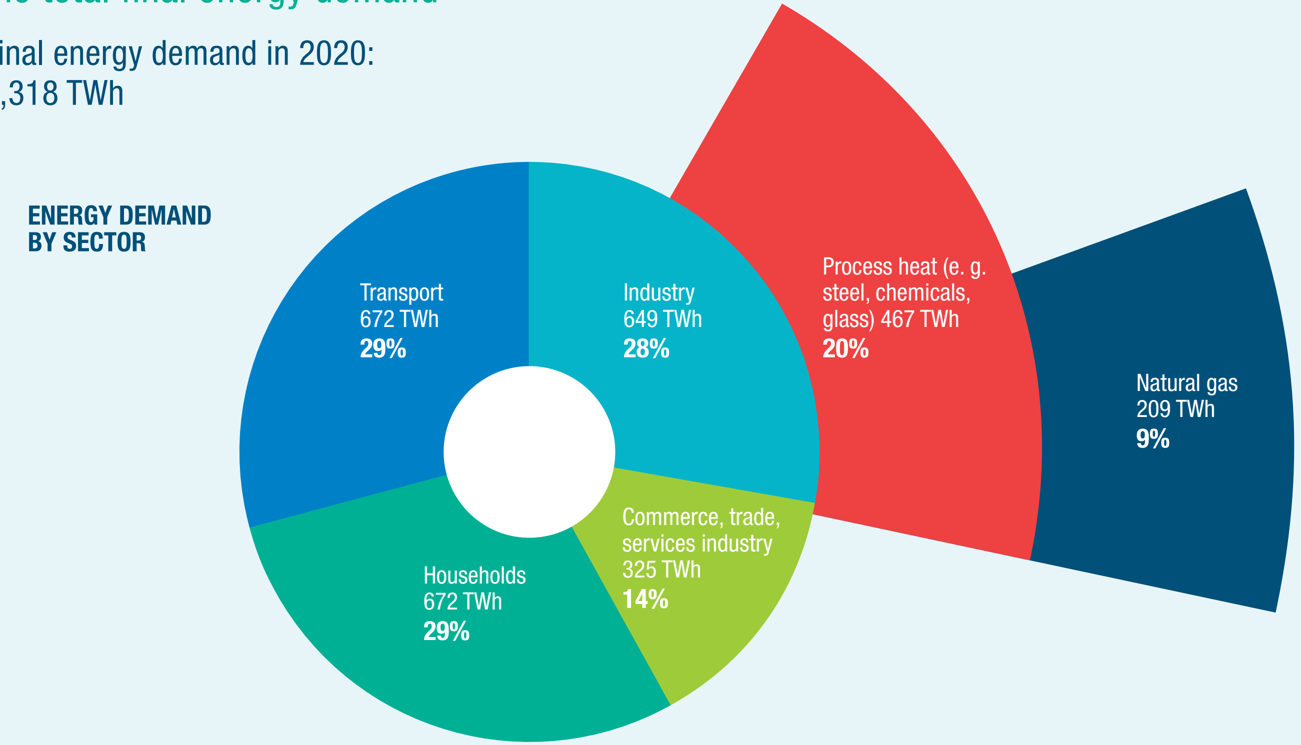
The distance analysis shows that the vast majority of enterprises with a total gas demand for process heat of about 160 TWh are more than one kilometre away from the planned H_2 core network and might depend on an H_2 distribution network.

Regional employment depends, among other things, on the future supply of hydrogen; enterprises need energy to safeguard their location.

Prozesswärme –
woher kommt die Energie?
(Available in German only)

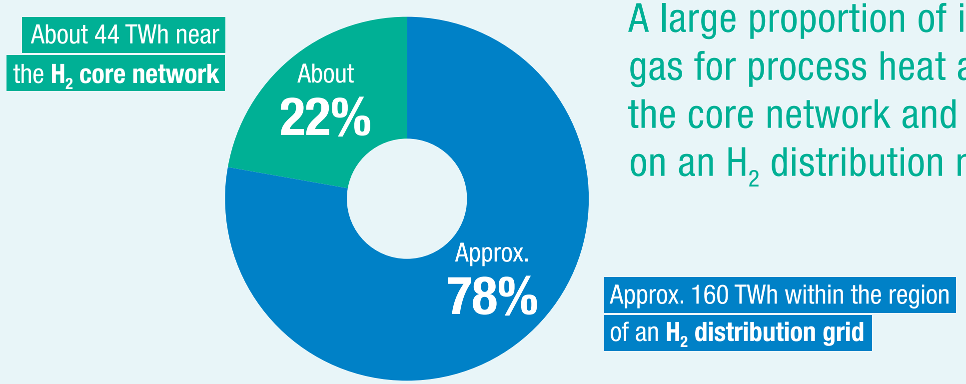
Industrial users of gas for process heat account for one tenth of the total final energy demand

Final energy demand in 2020:
2,318 TWh



Source: Arbeitsgemeinschaft Energiebilanzen (2023)

A large proportion of industrial users of gas for process heat are not located near the core network and would have to rely on an H_2 distribution network.



We have diverse energy supply options

Germany has a heterogeneous building stock that covers the full range from historic half-timber houses to energy-efficient new buildings. This calls for a differentiated approach to implementing a climate-neutral heat supply. It includes considering the actual state of the infrastructure as well as the feasibility of the transition in terms of costs and duration and the security of energy and energy supply, in addition to taking into account the efficiency of the various heating technologies.

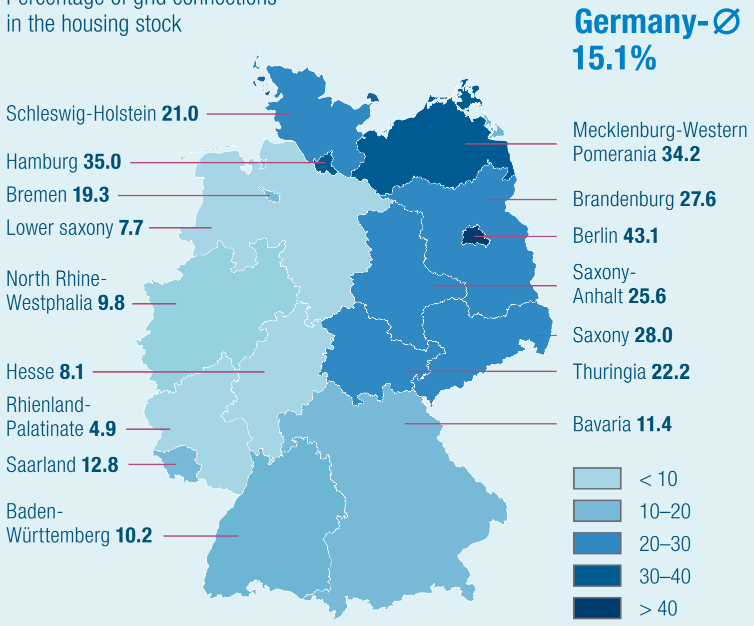
About 75 percent of all buildings are currently heated by gas and oil. On closer consideration, apparently simple solutions like, for instance, a substantial changeover to electric heat pumps turn out to be impractical. The reason is that, on the one hand, the power generation and power infrastructure systems have not been designed to electrify the heating and transport sectors and are unlikely to be properly upgraded by 2045. Heat pumps, on the other hand, are not always the most efficient option for all building types and residential areas when it comes to climate-neutral heating, due to their mode of operation.

Often, the use of heat networks and the existing infrastructure for the direct supply of climate-neutral gases such as hydrogen and biomethane – especially to older buildings and densely built-up urban districts – is a more economical alternative. Admittedly, the cost involved in upgrading an existing network to accommodate the large-scale connection of end customers or the associated unreasonable financial burden on consumers can often impede such developments.

The systemic approach to energy networks taken by two renowned institutions has led them to conclude that hydrogen will definitely play a role in the heat sector. A comprehensive study by the ISE and IEE Fraunhofer Institutes reached the conclusion that "all potentially climate-neutral energy sources – i. e., electricity, district heating, renewables (photovoltaics, wind power, solar, geothermal and biomass) and hydrogen – will have to be used for the generation of heat" to achieve climate-neutral energy supply by 2045 (cf. the "BottomUp Studie zu Pfadoptionen einer effizienten und sozialverträglichen Dekarbonisierung des Wärmesektors / Bottom-Up Study on Path Options for an Efficient and Socially Acceptable Decarbonisation of the Heating Sector", abstract, p. 4). The study found that the use of hydrogen for heating always depends on the local situation and, consequently, produced different results for the four municipalities that were the subject of the research project. The Federal Environment Agency, too, considers hydrogen to be a vital component in municipal heat supply planning (cf. "Transformation der Gasinfrastruktur zum Klimaschutz/Transformation of gas infrastructure to climate protection", p. 226 et seq.).

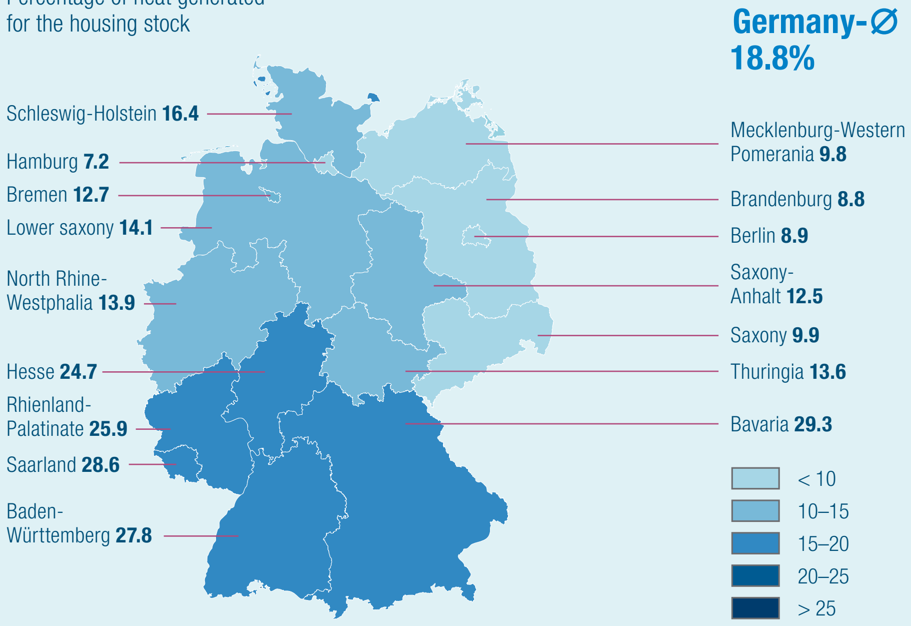
District heating

Percentage of grid connections in the housing stock



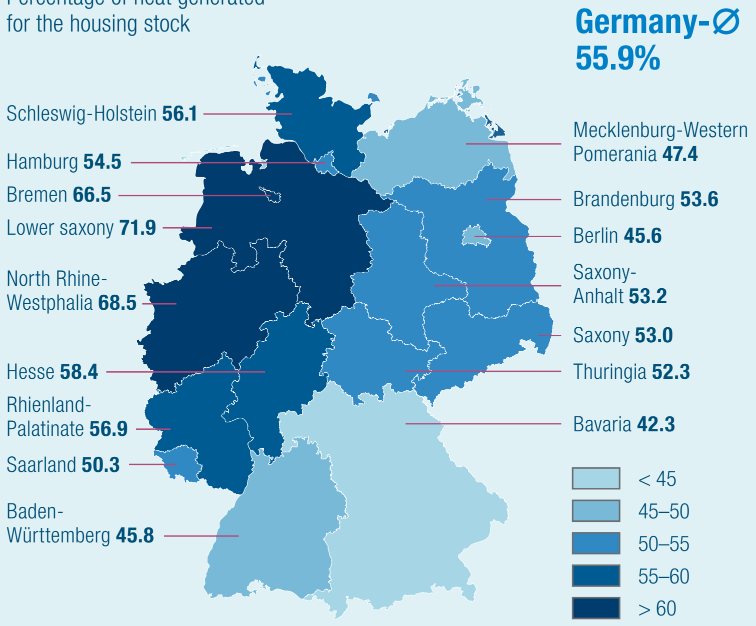
Oil

Percentage of heat generated for the housing stock



Natural gas

Percentage of heat generated for the housing stock



Source: Statistisches Bundesamt/Zensus 2022, based on a diagram in "Die Welt" (online publication), 01.07.2024

A successful climate protection strategy depends on a realistic, pragmatic approach

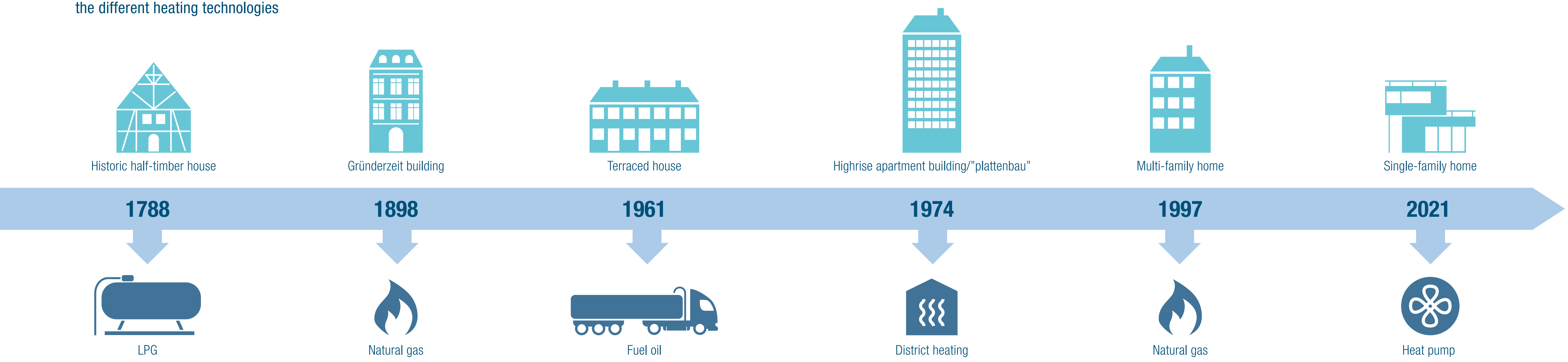
The public debate on the publication of the Gebäudeenergiegesetz (GEG, Building Energy Act) and the Wärmeplanungsgesetz (WPG, Heat Planning Act) delayed many local decisions. Proponents and opponents of heat networks, hydrogen and heat pumps entered into a dispute using arguments that were difficult for laypeople to understand. It is patently obvious that this has not helped the fight against climate change.

Intelligent energy concepts, developed with the local people and adapted to local conditions with a sense of proportion, are the only solution to ensuring that efficient climate protection schemes can be combined with security of supply in a socially compatible way. Given the great differences between heating systems across Germany, heat networks powered by renewables will be continually upgraded or built from scratch here and there in the future as well, whereas sufficient green electricity will be available elsewhere. The same is true for biomass, which is unevenly distributed in Germany.

So, what about hydrogen? Whenever the supply from local renewable sources is not sufficient, we must resort to "outside" sources to meet the energy demand. Germany's extensive gas network is the backbone of the country's robust energy supply, and as such facilitates the reliable supply of the new, climate-neutral gases whenever the power grid is not strong enough to handle the required demand.

A diverse heating market calls for individual solutions

The illustration exemplifies the present heterogeneous building stock in Germany and the different heating technologies



Hydrogen technologies for heating and operating CHPs are readily available

Manufacturers of gas appliances have long since embraced hydrogen. For instance, all gas condensing appliances made by leading manufacturers are compatible with natural gas/hydrogen blends of up to 20% hydrogen. The first manufacturers have already announced that modular retrofitting systems that are compatible with pure hydrogen will be available in 2026. The existing pipelines in buildings designed for natural gas are basically also suitable for operation with hydrogen. Moreover, pure hydrogen heating systems are currently being field-tested and prepared to be launched to the general market.

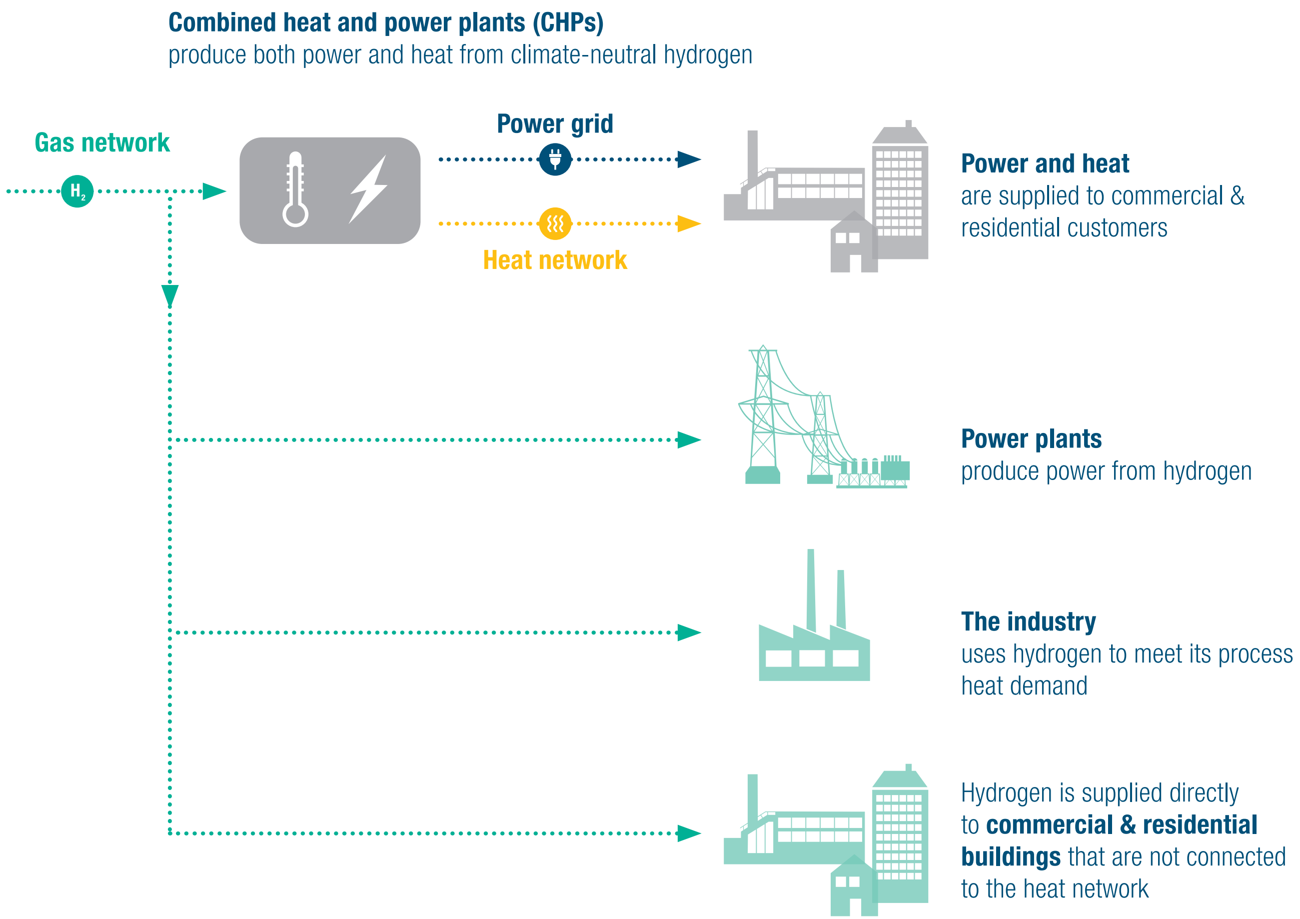
The situation regarding the conversion of combined heat and power (CHP) plants to hydrogen service is similar. At present, combined heat and power plants (CHP), gas turbines and fuel cells that provide electricity, heating and cooling in a highly efficient way usually run on natural gas or biomethane. Gas engines in CHP plants are converted to hydrogen service primarily by modifying the injection and engine control systems. Larger CHP plants, (from approx. 100 kWel upwards) in particular, already run on pure hydrogen, e. g. the Haßfurt, Gampern (Austria) or Hamburg CHPs, to name but a few. The conversion of gas turbines to hydrogen service is also reasonably manageable: in all probability all it takes is replacing the burners and – sometimes – the air intake systems, which can be done during regular maintenance work.

Often, the goal is to produce so-called process heat instead of combined heat and power. Process heat is used by manufacturers for drying, hardening or melting activities, for example. Many industries currently use natural gas in large quantities for these processes. Even now, the manufacturers of the necessary industrial gas burners are well prepared for the moment when the industry changes over to hydrogen: In some cases, all it takes is to adapt a ball valve to a second component inside the burner, and the appliance will run on hydrogen, with no CO_2 emissions at all.

The examples above show that hydrogen is by no means a "magic gas", and that the technology to use it for residential and commercial purposes as well as in manufacturing is readily available on the market.

Hydrogen is a versatile gas

Usage as fuel for CHPs in heating and building networks and for the decentralised heat generation



Where will hydrogen come from in the future, and what will it cost to transport it to Germany?

In the long term, Europe will have to import hydrogen from other regions. Although a sufficient supply of hydrogen might still be produced in Europe in 2030, the middle of the century will see a gap between supply and demand.

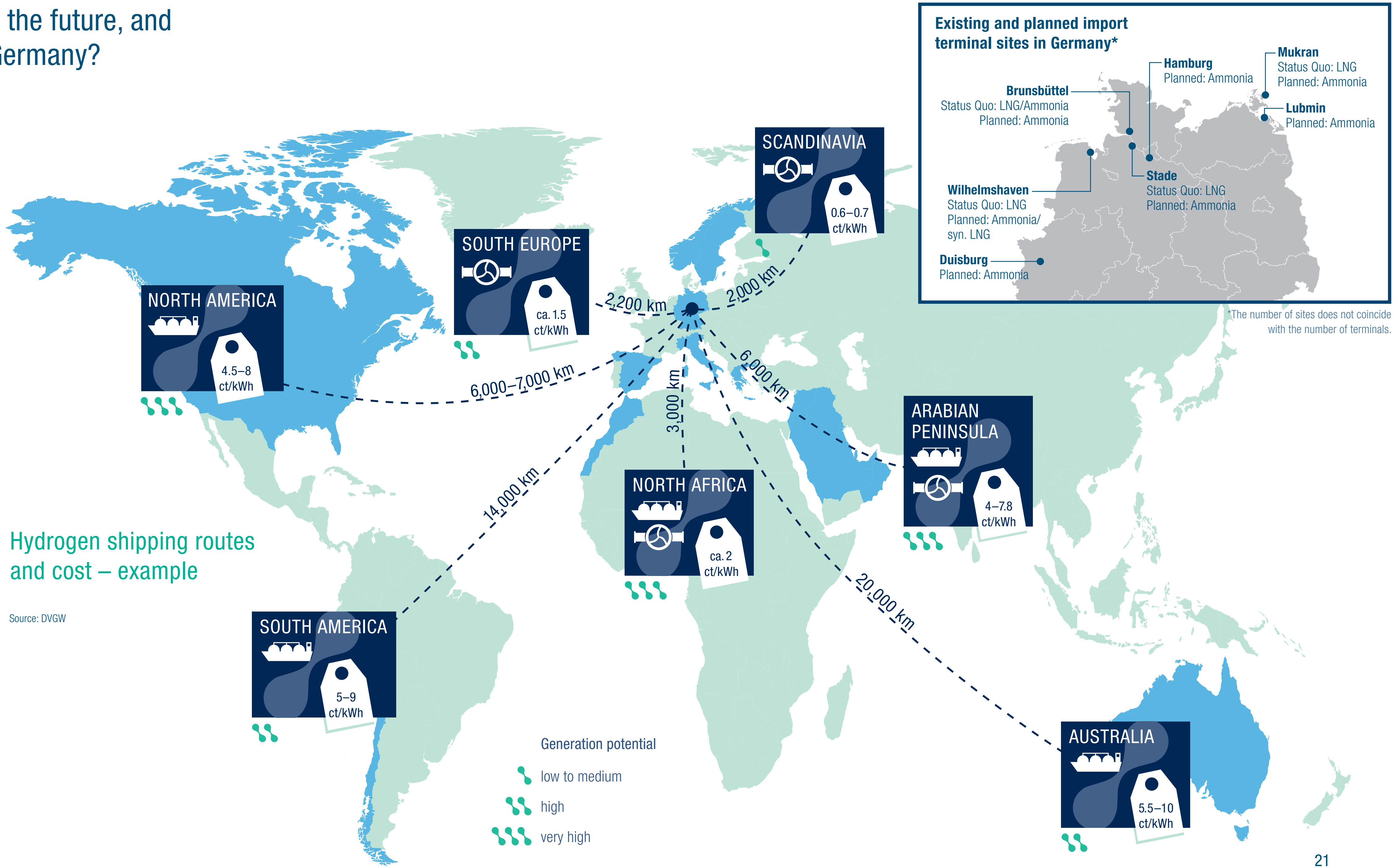
Germany will continue to depend on imports of both energy and hydrogen. In its National Hydrogen Strategy, the Federal Ministry of Economics even assumes that by 2030, about 50 to 70 percent of Germany's demand will have to be covered by imports of hydrogen or hydrogen derivatives.

Large amounts of gaseous hydrogen can be transported to Germany either via pipeline or – over longer distances – by sea, with transport by pipeline being the most economical and efficient option for distances of up to about 5,000 kilometres. This mode of transportation is suitable for gaseous hydrogen.

Transport by ship is an option whenever the distance between the production site and the importing country is too long. As large volumes need to be shipped to make this investment pay off, however, it is necessary either to liquefy hydrogen at low temperatures or to convert it – using a variety of methods – into a derivative like ammonia, for instance.

Hydrogen shipping routes and cost – example

Source: DVGW



*The number of sites does not coincide with the number of terminals.

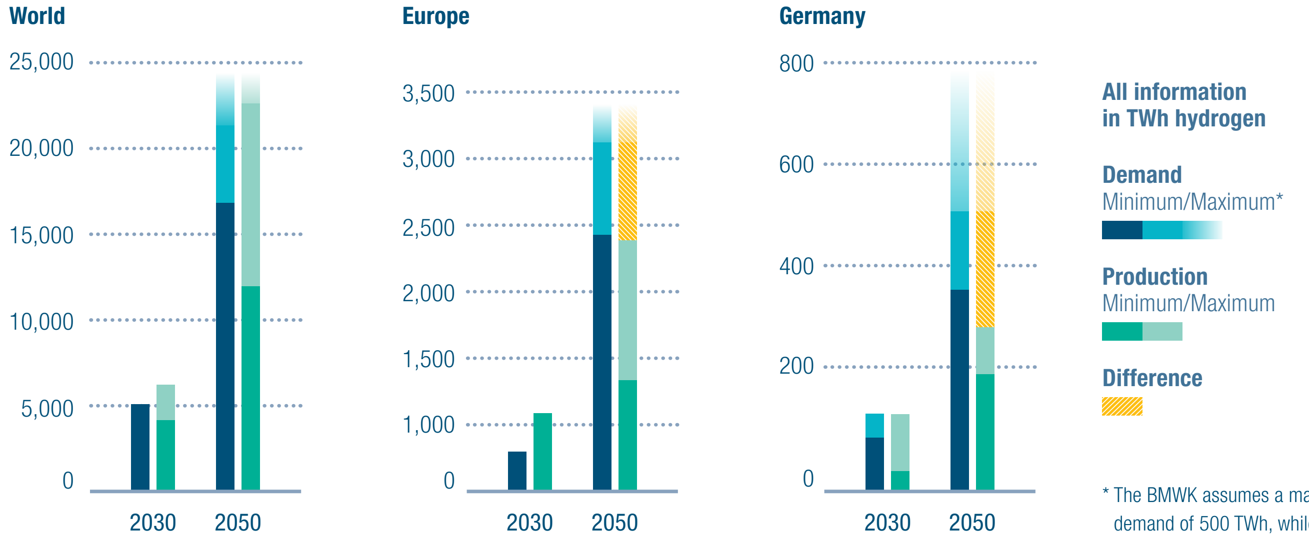
The global import potential for hydrogen

As the global demand for hydrogen is set to increase in the coming decades, production capacities need to be ramped up more rapidly to satisfy consumer needs. The world could produce enough climate-neutral hydrogen to meet consumption requirements. The potential production quantities surpass the forecast global demand. However, investments and quick decisions are urgently required now in order develop production capacities and infrastructure in due time.

Several studies and forecasts assume that global demand for climate-friendly hydrogen production will reach 5,000 terawatt hours (TWh) by 2030. By 2050, this demand will even increase to between 17,000 and 22,000 TWh of hydrogen. While such figures may seem ambitious from today's point of view, the technological and economic production potential exceeds the projected demand by up to 22,700 TWh by the year 2050, depending on the scenario.

Models show that the global demand for climate-friendly hydrogen can be met in the years 2030 and 2050.

By 2050, Europe will need to import hydrogen to meet the expected demand. Germany, by contrast, will have to start importing hydrogen already in 2030.



* The BMWK assumes a maximum demand of 500 TWh, while other sources forecast a significantly higher demand of up to 800 TWh.

Source: Based on data made available by the World Energy Council, the Hydrogen Council and IRENA as well as the BMWK

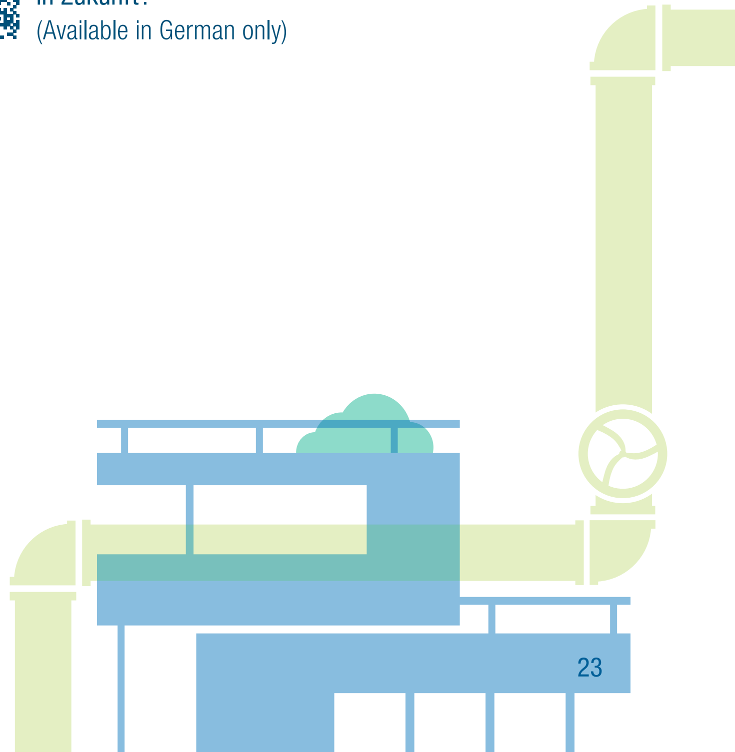
What will be the cost of hydrogen for heating?

The intense consultations on the Building Energy Act have made it clear that the energy and heating turnaround are not to be had for nothing. End consumers will see a considerable mark-up in prices that will reflect both the cost of production of climate-neutral fuels and electricity and the upgrading of the gas, power and heat network infrastructure. This is being demonstrated by numerous studies. Yet it is important to identify the most cost-effective path towards achieving climate-neutrality. One example illustrating this point is the increased use of hydrogen-ready gas power plants, which would reduce the cost of the German energy transition by €150bn, as was shown in the recent study by McKinsey called "Zukunftspfad Stromversorgung" (the future path of electricity supply).

Various factors need to be considered so that local residents can identify the most cost-effective heating option for their homes. These factors include, among others, the energy requirements of the building in use as well as potential refurbishment costs and the investment, operating and maintenance costs of heating systems.

The DVGW commissioned the Frontier Economics Institute to investigate various scenarios in this context. The study compared electric heat pumps with green gas (hydrogen or biomethane) heating systems in both properly and poorly renovated buildings. The results show that the available heating technologies each offer cost advantages and disadvantages. While electric heat pumps are particularly advantageous in well-insulated buildings, green gas heating systems can be more cost-effective in poorly insulated buildings. The total annual cost expected for heating e. g. a D-rated single-family home with electricity (€4,059 – €5,132) differs considerably from the cost of hydrogen heating (€3,105 – €4,624). Although price development forecasts are subject to a high degree of uncertainty, the study shows that no option should be ruled out a priori.

Publikation
„Was kostet der Wasserstoff in Zukunft?“
(Available in German only)



Transformation plan for gas distribution networks

The gas distribution network currently supplies about 1.8m industrial and commercial customers as well as 50% of all German households with natural gas. In the future, many of these end customers will have to rely on hydrogen to achieve climate targets; the current gas distribution network must therefore be upgraded to become tomorrow's hydrogen distribution network.

The DVGW "H2vorOrt" initiative and the Verband kommunaler Unternehmen (VKU, German Association of Local Utilities) are jointly preparing a concept for making over 560,000km of gas distribution pipelines climate-neutral.

The Gas Distribution Transformation Plan (GTP) launched in 2022 initiated a planning process that spans several years and involves more than 240 grid operators who analyse their customers' needs, the decentralised feed-in situation, the development of hydrogen supply by upstream network operators and the technical compatibility of their networks with hydrogen. The plan is an open-ended process and considers the conversion as well as the decommissioning and the partial new construction of pipelines.

The GTP aims to accelerate the decarbonisation of the gas distribution network and create a coherent target image for the whole of Germany on the basis of individual grid operator planning and in coordination with the other stages of the supply chain.

h2vorOrt.de
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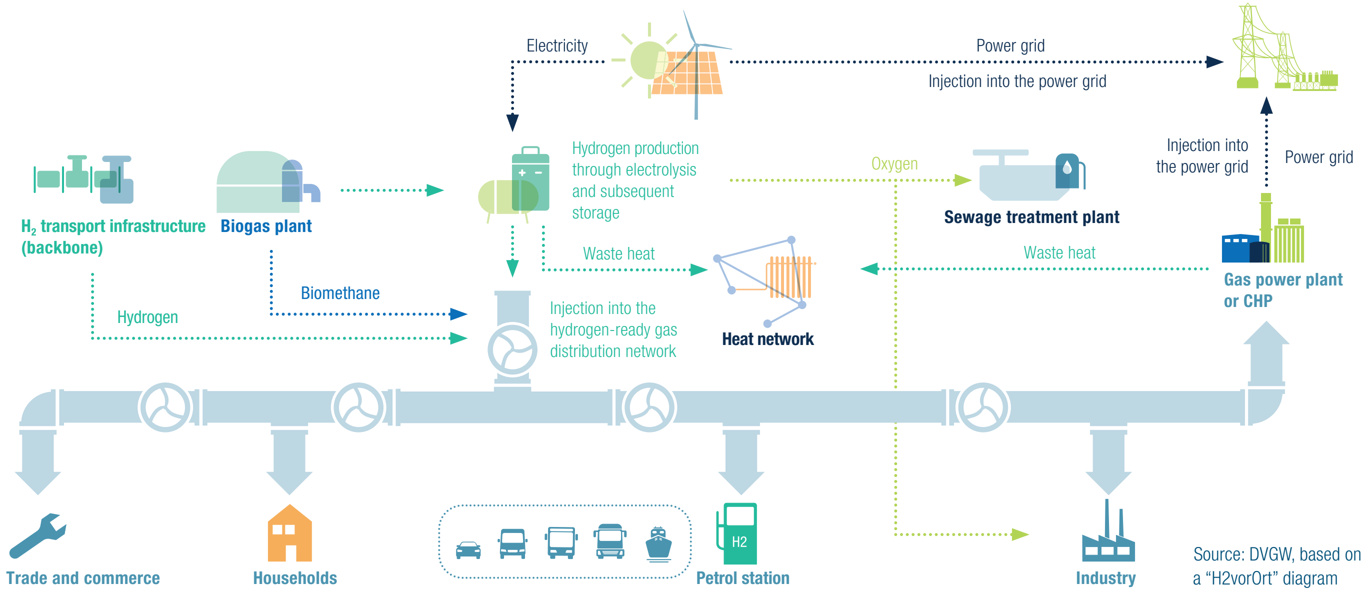


Source: DVGW, based on a "H2vorOrt" diagram

"Municipal heat planning" – a practical guide for mayors and local government officials

Municipal heat planning (kommunale Wärmeplanung or kWP in German) is another time-consuming addition to the already busy agenda of many local authorities and their responsible bodies. As staffing levels decrease in line with the number of citizens, the provision of electricity, gas and possibly also heat is often outsourced to third parties. At the same time, the legislator exerts pressure on citizens to act quickly.

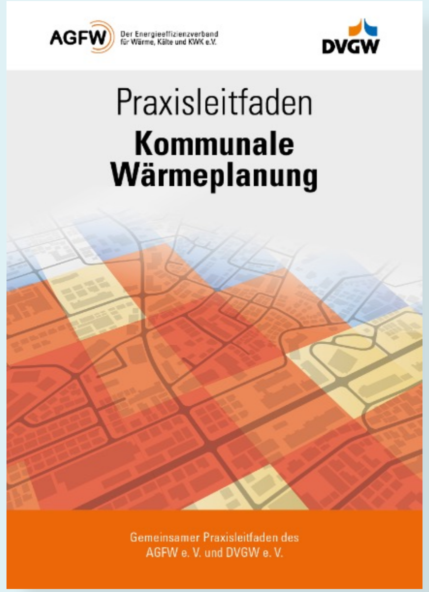
The DVGW and the Fernwärmeverband (AGFW, German Association for District Heating) have jointly developed the practical Municipal Heat Planning guide (kWP-Praxisleitfaden) in cooperation with the ASUE (Arbeitsgemeinschaft für sparsamen und umweltfreundlichen Energieverbrauch, Association for the Efficient and Environmentally Friendly Use of Energy) to help alleviate this sometimes precarious situation.

The concise, easy-to-read guide that is structured along the lines of the Heat Planning Act (Wärmeplanungsgesetz, WPG) provides an introduction to the structural guidelines of the kWP and offers some basic knowledge about the technical parameters that need to be observed. In addition to addressing potential local renewable energy sources, it offers information on how to handle existing networks and, at the same time, promote or harmonise the three goals of the well-known energy policy triangle, i. e. security of supply, consumer protection and sustainability.

Explaining the general conditions of heat planning

Structure and design
Options for municipal action
Methodological approach

Praxisleitfaden
„Kommunale Wärmeplanung"
(Available in German only)



Practical hydrogen applications – examples

Industrial and domestic users of hydrogen in Emmerich

Just short of the border with The Netherlands, the municipal utilities of Emmerich are setting the course for hydrogen. The Hanseatic city on the Lower Rhine boasts a population of approximately 32,000 people and over the decades has become a regionally important industrial location. It is now home to companies from e. g. the chemical and mechanical engineering sectors with a correspondingly great interest in and demand for climate-neutral energy, in this case hydrogen. “Many enterprises in Emmerich now embrace hydrogen as a future carrier of energy, with applications in both production and transport. Hydrogen also plays an important role in the so-called heat transition, and we want it to power our heat network in the future”, says Managing Director Steffen Borth while explaining the utilities’ plans. The plans for the future hydrogen core network include the supply of hydrogen to Emmerich, and transmission network operator Thyssengas is planning to convert an existing natural gas pipeline to climate-neutral hydrogen service in the future.

stadtwerke-emmerich.de
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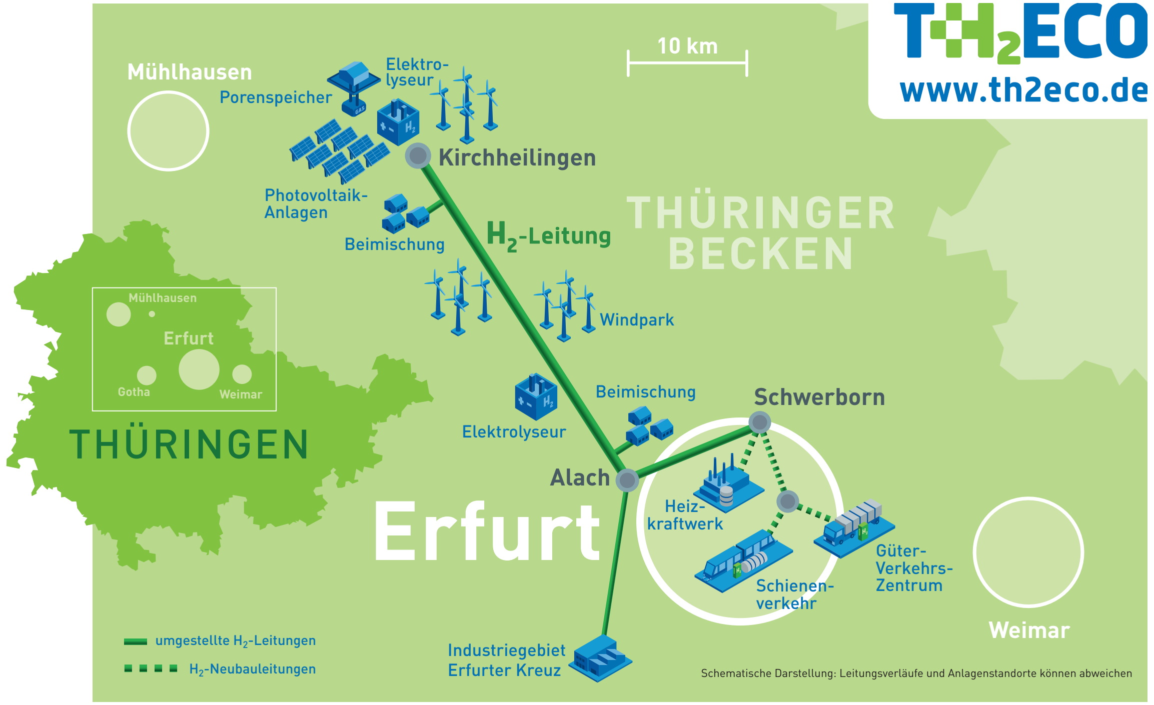
TH_2ECO – A hydrogen infrastructure for Thuringia

The TH_2ECO project covers the entire hydrogen value chain, from production to storage and transportation through to many other applications. It envisages to produce green hydrogen in Thuringia from 2025 onwards and transmit it via an existing gas pipeline to the Erfurt area, where the local combined heat and power plant will use the climate-neutral gas to generate heat for district heating purposes. Moreover, the hydrogen will be injected into the natural gas network for the direct supply of industrial companies and households.

Additionally, a public filling station for hydrogen vehicles will be built to promote climate-neutral mobility especially in heavy-duty transport.

After the successful implementation of this Thuringian “H_2 eco-system”, the project intends to upgrade the hydrogen infrastructure and connect it to supra-regional networks in order to facilitate import and export across Europe.

th2eco.de



Flensburg: Using green hydrogen for the generation of power and district heating

Coal in the past, natural gas at present, and hydrogen in the future: This is the plan for the Flensburg power plant in a nutshell. Over 90% of Flensburg's population use district heating, which is supplied by the central combined heat and power plant. Since 2011 the plant – originally commissioned as a hard coal-only power plant – has been continually modernised and expanded by Flensburg's utilities to reduce CO_2 emissions. Efficient gas and steam turbines have in the meantime replaced almost all coal-fired boilers and generate heat and power simultaneously through cogeneration (CHP). The installation of large heat pumps for the generation of district heating is envisaged in order to achieve climate-neutrality in the future. This measure will be complemented by powering the gas and steam turbine units with green hydrogen, which an electrolysis plant in Esbjerg (Denmark) is scheduled to produce in the next few years, using electricity from offshore wind farms. A cross-border hydrogen transmission network will then transport the hydrogen to Flensburg and other regions.

stadtwerke-flensburg.de
(Available in German only)

© Stadtwerke Flensburg

H_2Direkt. 100 percent hydrogen in an existing gas distribution network

Thüga AG, Energie Südbayern GmbH (ESB) and Energienetze Bayern GmbH & Co. KG (ENB) have completely converted an existing natural gas network to 100% hydrogen service as part of the unique H_2Direkt research project. Since September 2023, ten private households and one commercial customer based in Hohenwart, Bavaria, get their heat delivered from green hydrogen for an initial period of 18 months.

The conversion required only a few structural modifications. H_2-readiness has been demonstrated for all components of the existing network and the boiler rooms. Only the gas boiler and gas meter had to be replaced, and a hydrogen injection system was installed on site. H_2Direkt is a small-scale but practical example that illustrates how the current fossil gas network can be successfully repurposed for climate-neutral hydrogen. All customer groups – domestic, commercial and industrial customers – can theoretically benefit from the conversion.

The pilot project forms part of the TransHyDE project "Sichere Infrastruktur" (secure infrastructure) project and is funded by the Bundesministerium für Bildung und Forschung (BMBF, German Federal Ministry of Education and Research).

esb.de/privatkunden/gas/wasserstoff

© Ilona Stelzl

The DVGW – A network of the German gas, hydrogen and water industries

In Germany, the DVGW Deutscher Verein des Gas- und Wasserfaches (German Technical and Scientific Association for Gas and Water) is the Network of Excellence for all gas and drinking water supply related concerns. The DVGW is a recognised regulator and provider of technical and scientific know-how as well as an initiator and sponsor of research projects and innovation.

The not-for-profit association develops the generally recognised rules of technology for the gas and water sectors, based on the outstanding work of more than 280 technical committees with over 3,000 voluntary experts and the scientific work of research institutes. The DVGW Technical Rules form the foundation for the technical self-management and direct responsibility of the German gas and water industry and guarantee safety, hygiene and environmental protection in the supply of gas and water at the highest international standards.

Climate-neutral gases and, in particular, the use of hydrogen as a future energy source are a key focus in the work of the DVGW.

The DVGW operates at both the local and supra-regional levels and is represented throughout Germany by nine regional and 62 district groups.

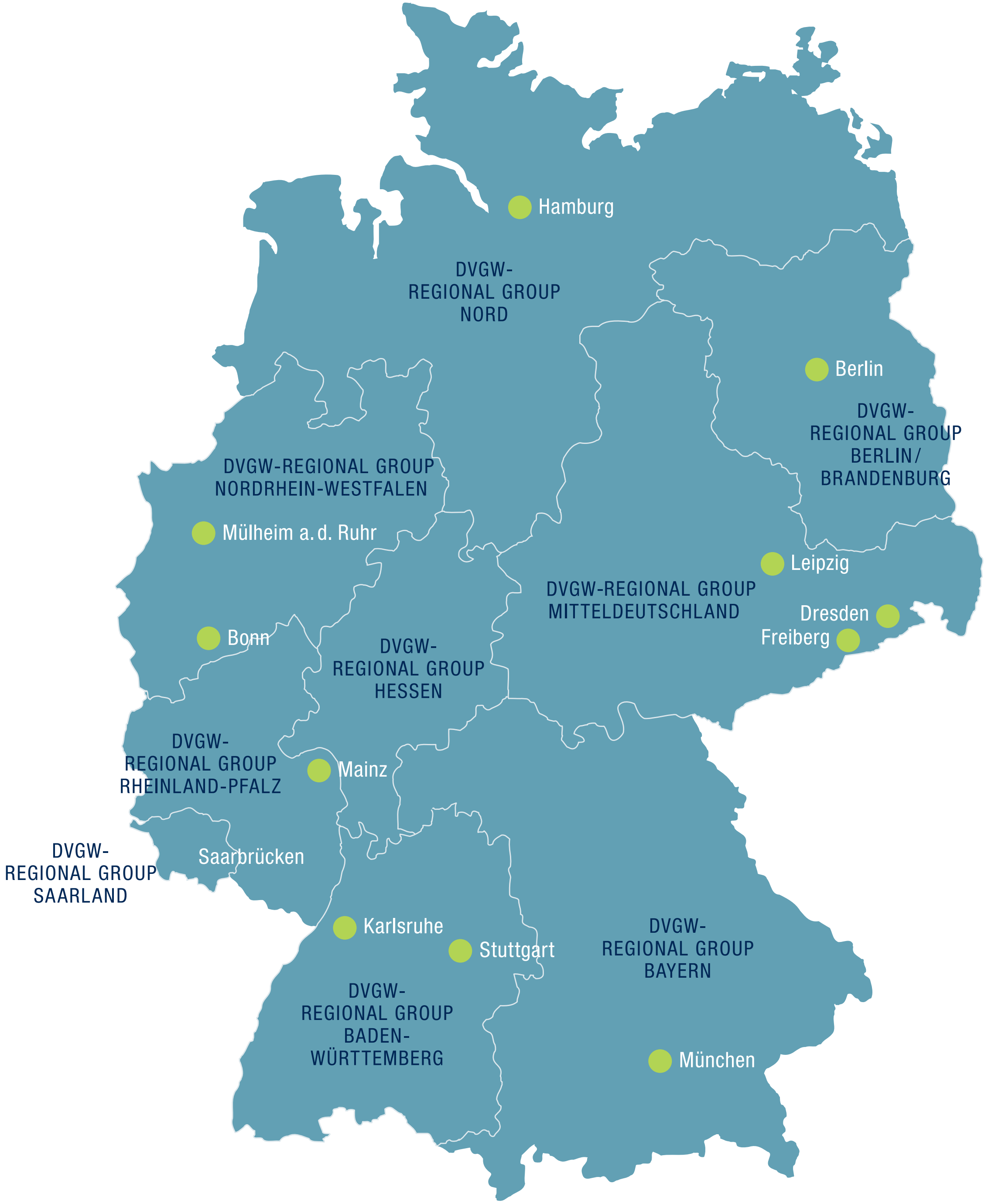
We are

A network of technical and scientific institutes

A notified regulator that relieves the state of some of its obligations

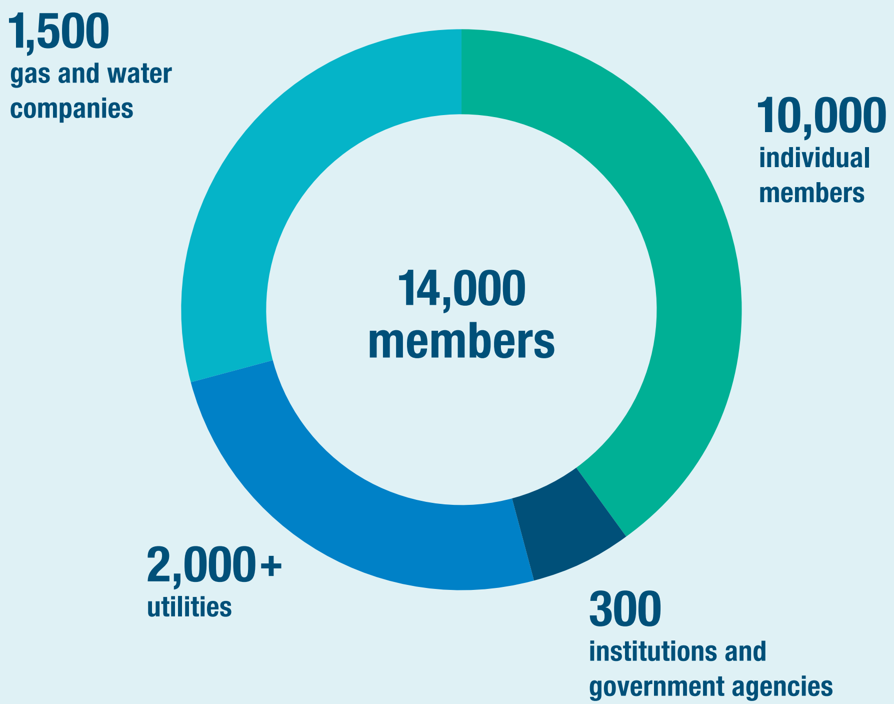
Certifiers and auditors of technical safety management

An educational institution offering qualification and further training courses



The DVGW – facts and figures

- Founded 1859 in Frankfurt/Main
- Head office: Bonn
- Representative offices: Berlin and Brussels
- > 1,000 employees in the DVGW group
- 62 local groups
- 9 regional groups
- 7 DVGW-owned research sites (gas and water)
- Cooperation with 50 universities and colleges promoting young talents



We represent

66,000
employees

The operators of
> 1 m. km
of pipeline network

7.3 bn. €
annual investments in assets

91% ... of the German gas network operators are DVGW members

73% ... of the drinking water in Germany is provided by DVGW members

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