NATIONALER WASSERSTOFFRAT

WHITE PAPER

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Greenhouse gas savings and the associated hydrogen demand in Germany

1 BACKGROUND AND CLASSIFICATION

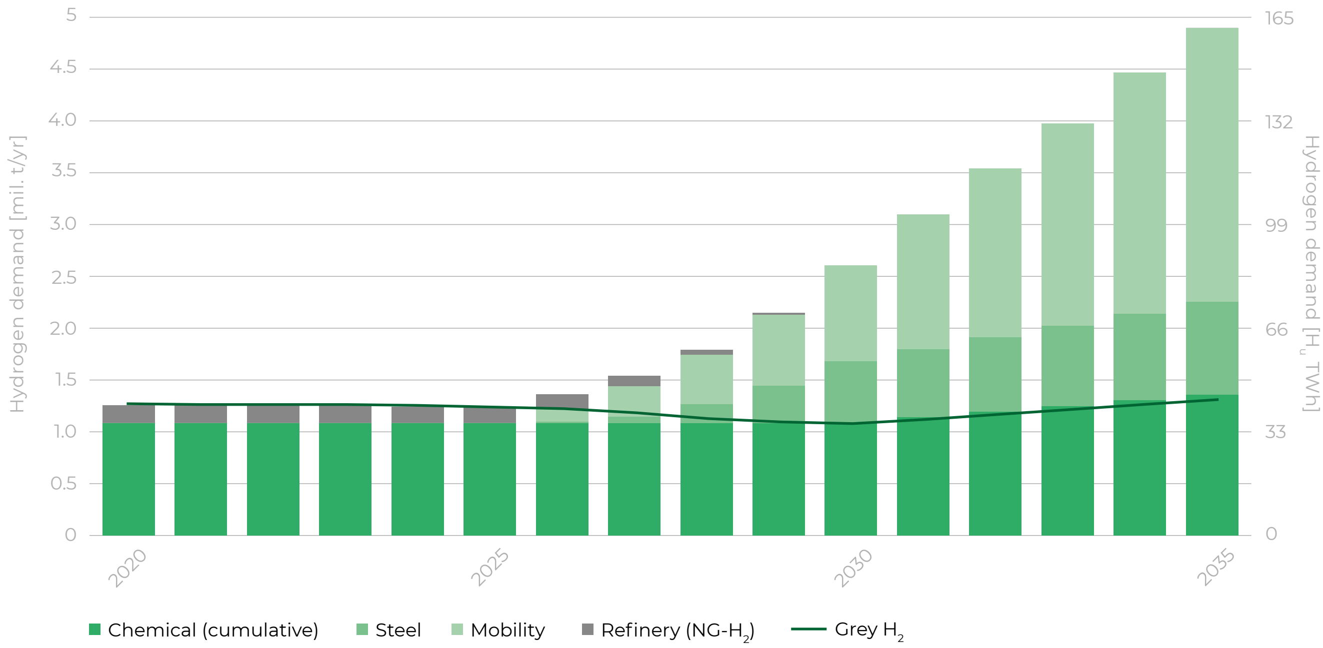
The German National Hydrogen Council (Nationaler Wasserstoffrat, NWR) advises the German Federal Government on the implementation and further development of the German National Hydrogen Strategy. In doing so, it uses a specially developed model for data collection and evaluation in order to be able to base its work on uniform and realistic estimates regarding hydrogen demand in Germany in the coming years or decades. Changes in the framework conditions can be mapped and effects on the H_2 demands can be quickly depicted when using this model.

However, the geopolitical upheavals following Russia's attack on Ukraine and the resulting changes, especially for the energy sector, have now changed the framework conditions to such a severe extent that merely making adjustment is not readily possible. This is why in order to carry out a fundamental adjustment of the data material in the next step, the model should be finalised using the available data and taking the previous framework conditions as a basis.

Nevertheless, two key statements clearly stand out. For one, the demands are significantly higher than anticipated in the German Federal Government's previous quantity plans. The German National Hydrogen Council (Nationaler Wasserstoffrat, NWR) had already figured on about 44 TWh (around 1.3 million t/yr)[1] of green hydrogen in 2030 before the Russian war of aggression on Ukraine, without including the heating market, reconversion and the replacement of conventional (grey) H_2. This already corresponds to an electrolysis capacity of more than 18 GW at home in Germany and abroad.[2] Due to the changed framework conditions, it is becoming apparent that the demand will be significantly higher. An acceleration of the transformation process in the steel industry alone can be expected to generate an additional H_2 demand of up to approx. 0.25 million t/yr (which corresponds to approx. 8 TWh) in 2030. Overall, a total quantity of 56 to 93 TWh can be expected for 2030. This corresponds to an electrolysis capacity of 23 to 39 GW2, without it being possible to say whether this would have to be installed domestically or abroad: the question of the origin of climate-neutral or virtually climate-neutral hydrogen is not further examined in this paper.

1 A concise overview of the various H_2 demands in millions of tonnes and TWh, as well as the corresponding CO_2 avoidance, can be found at the end of this document.
2 Based on the lower calorific value (H_u) of H_2, at 60 per cent efficiency and 4,000 full load hours p.a.

Figure 1: Hydrogen demand in various sectors (excluding heating) by 2035



Ultimately, it should be noted that considerable quantities of hydrogen are already being used today, especially in the chemical industry[3]. But in this context, grey hydrogen is used; the corresponding order of magnitude is shown in Figure 1. The following illustrations, however, only refer to the percentage of climate-neutral or virtually climate-neutral hydrogen. That being said, in the long term, the demanded quantities of grey hydrogen will also have to be covered by green hydrogen.

A second insight pertains to the CO_2 avoidance associated with the use of hydrogen in various industries. The 'avoidance lever' is particularly pronounced in the steel industry, with 25 t of avoided CO_2 per tonne of green hydrogen. All things considered, in the sectors examined here, close to 170 million t CO_2 p.a. will be able to be avoided in 2050 (excluding heating) through the use of climate-neutral or virtually climate-neutral hydrogen. The data analysis thus confirms the key role a rapid ramp-up of climate-neutral hydrogen plays in achieving the climate targets.

[3] Around 1.1 million tonnes of grey hydrogen per year are used in the chemical industry (excluding refineries); here, it is assumed that this will be replaced by climate-neutral hydrogen to a significant degree in the second half of the 2030s.

2 FRAMEWORK CONDITIONS AND APPLIED METHODS

The hydrogen demands of the mobility, steel production, chemical and – with limitations – heating industry were determined based on the respective industry's strategy for achieving the climate targets. In doing so, only the most important CO_2 and H_2-relevant processes were identified and considered by the industry representatives:

- Chemical: Production of methanol, ammonia and H_2 (to meet the general demand) and substitution of fossil resources for basic chemicals
- Steel: Conversion to direct reduction of iron ore and heating demand-related high-temperature processes in electrical steel production as well as the same for downstream processing
- Mobility: Hydrogen and derivatives in refineries and as fuel for aviation, the transport of heavy goods, ships and trains
- Heating: Replacement of fossil fuel in building heating systems[4]

Brief outlines were prepared by industry representatives from these sectors, plausibility checks were carried out by Fraunhofer and data was graphically prepared and compiled into a uniform, comparative database. Fraunhofer did not collect any data of its own.[5] In order to provide a virtually complete picture, other sectors are mentioned in this document and included in the overall calculation. Fraunhofer's analysis, however, does not include these industrial sectors (such as glass and paper production, for example, or reconversion).

3 DEMANDS IN DIFFERENT SECTORS

The key interest of all stakeholders as regards an assessment of hydrogen demands lies in the year 2030: before then, the corresponding market ramp-up has to have begun, after which a market should exist in which supply satisfies demand. In 2030, however, it is to be expected that demand will exceed supply. Therefore, it is of the utmost importance to provide a reasonably plausible estimate of the demand to be expected at that time in order to be able to take regulatory measures and engage in making private sector investments accordingly.

A reliable illustration is available for the process industries presented below as a well as the transport and mobility sector. The heat and energy sectors – which, however, are subject to significantly greater uncertainties – are less clear but equally important.

[4] Here, the heating market is considered on the basis of the bottom-up study commissioned by the NWR, as shown in Section 3.3. The previously mentioned considerations regarding the replacement of fossil fuels in building heating systems are listed here for systematic reasons but are not given further consideration. This is because the bottom-up study mentioned is not only more recent, but it also goes into more precise detail about the heating market and factors in process heat as well, provided that the industrial users are connected to distribution grids.

[5] The graphically prepared data is available in an extensive collection of slides. Selected charts are featured in this document to illustrate the approach and the most important results.

3.1 PROCESS INDUSTRIES

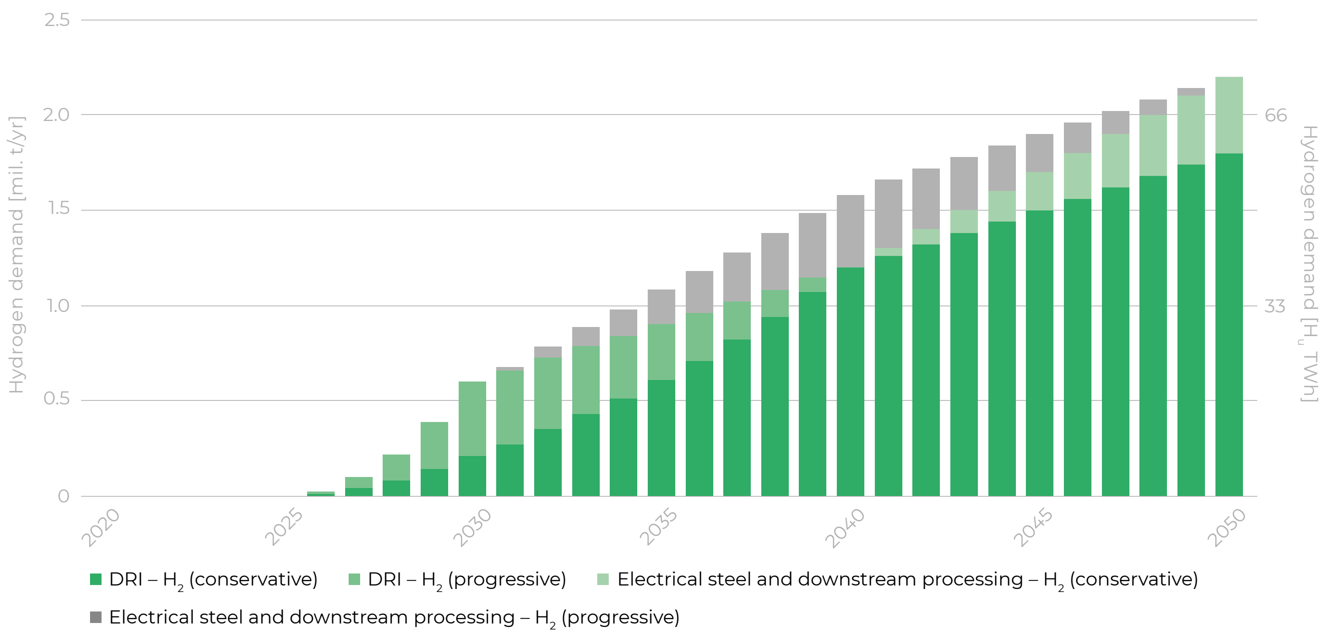
For various industrial sectors, natural gas is not only a source of energy, it is also a necessary part of production as a process gas. Electrification is mostly impossible in the process industries, or at least uneconomical. This is why making a switch to using hydrogen as a process gas is usually the only way towards achieving carbon-neutral production.

STEEL INDUSTRY

For the steel industry, climate-neutral hydrogen is indispensable for achieving the climate targets and running production in a way that is climate-neutral. The hydrogen is needed both as a reducing agent for the direct reduction of iron ore for primary steel production and as an energy source in various high-temperature processes in secondary steel production and downstream steel processing. A considerable demand for climate-neutral hydrogen in the steel industry is already developing prior to 2030. This means that it is already possible to realise significant amounts of CO_2 reductions with a high efficiency factor in the second half of this decade (around 28 t CO_2 per 1 t H_2 by replacing coal with climate-neutral H_2 in the direct reduction process).

If capacities for 10 million tonnes of direct reduced iron (DRI) are built up by 2030, it will result in a hydrogen demand of up to 600,000 t/yr (approx. 20 TWh). Natural gas must be used for the direct reduction of iron ore so that the first direct reduction plants will already be able go into operation at the beginning of the second half of the 2020s. This bridge, however, has become narrower and more expensive in terms of being a flexible option for the steel industry. By 2030, there is also likely to be a build-up of DRI capacities in excess of 10 million t (up to 14 million t). This also means that the hydrogen demand could turn out to be about 40 per cent higher than previously expected (850,000 t/yr, which corresponds to about 28 TWh). A significantly increased demand (1.6 million t/yr, or approx. 53 TWh) is now also to be expected for the period between 2030 and 2035. A hydrogen demand of about 2.2 million t/yr (73 TWh) is needed for the complete decarbonisation of the steel industry.

Figure 2: H_2 demand for DRI, electrical steel and downstream processing – conservative demand as well as more rapidly increasing demand in a progressive scenario



CHEMICAL INDUSTRY

The goal in the chemical industry (excluding refineries) is to replace the existing hydrogen demand of approx. 1 million t (grey hydrogen up to now) with climate-neutral hydrogen. Doing this requires completely new plant concepts that have to be invested in, especially in the case of ammonia production. These investments are most likely not to be expected until the 2030s due to reasons of economic efficiency.

The considerable, additional hydrogen demand in the future results from the necessity to also make the raw material basis, which has been comprised of mostly fossil resources to date, greenhouse gas-neutral. The use of CO_2 as a source of carbon will play a role here in addition to increased recycling efforts and the use of biomass. Hydrogen is needed as a co-factor for the conversion of CO_2 into greenhouse gas-neutral hydrocarbons as a raw material (green naphtha) or directly as basic chemicals (methanol). The demand for hydrogen presented in this regard results from an initial estimate that about 55 per cent of the carbon demand is expected to be covered by CO_2 in the future. However, the hydrogen demand can also turn out to be higher if the quotas for recycling and biomass taken as a basis for the raw material supply are not met. But this future hydrogen demand will also only arise in the course of the 2030s if the corresponding conversion technologies for CO_2 have reached the necessary level of technical maturity. The possible hydrogen demand for the process heat supply, which is currently covered by natural gas, was not accounted for here.

OTHER PROCESS INDUSTRIES

The fundamental question of the extent to which gas can be replaced by carbon neutral substitutes, such as hydrogen, and with which timescales, arises not only for the steel and chemical industries, but also for a number of other industrial sectors in Germany, such as glass and paper production. For example, in 2021, gas consumption for glass production was just under 14 TWh p.a.[6] and just under 26 TWh p.a for the paper sector.[7] For 2030, however, the Federal Association of the German Glass Industry (Bundesverband Glasindustrie e.V.) only anticipates around 1 TWh, and the Association of German Paper Factories (DIE PAPIERINDUSTRIE e.V.) has no known estimate of H_2 demands in 2030.

3.2 TRANSPORT SECTOR

Hydrogen produced in a climate-friendly way can present a significant contribution to achieving goals in the transport sector, too. In addition to directly used renewable electricity, hydrogen and hydrogen-based fuels will already become the most important energy source in the medium term, especially in road-based heavy goods transport, shipping, aviation and rail transport. The use of hydrogen or hydrogen-based fuels is an important solution wherever lots of people or heavy goods are transported over long distances. The use of hydrogen and hydrogen derivatives in the mobility sector was examined in the following in relation to applications, both for road-based transport and for other applications. The role of hydrogen-based fuels (e-fuels) was considered separately. Overall, the NWR considers a hydrogen demand of about 30 TWh in 2030 to be plausible. This is subdivided into directly used hydrogen (particularly in fuel cell-electric drive systems used for heavy goods transport), at approx. 20 TWh, and

[6] See the final report from HyGlass titled 'Wasserstoffnutzung in der Glasindustrie als Möglichkeit zur Reduzierung von CO_2-Emissionen und des Einsatzes erneuerbarer Gase' (Hydrogen utilisation in the glass industry as a possibility to reduce CO_2 emissions and utilise renewable gases) [in German], retrieved on 7 December 2022 at: https://www.bvglas.de/index.php?eID=dumpFile&t=f&f=2514&token=69553e2ada72ffc160a9ebce8174bfcedf2870ec.

[7] See: DIE PAPIERINDUSTRIE – Leistungsbericht PAPIER 2022 (Association of German Paper Factories – performance report titled PAPER 2022) [in German], retrieved on 24 November 2022 at:https://gas.info/industrie/papierherstellung-gas, energy demand: 47 TWh/a, 55 per cent of which is gas.

hydrogen used for the production of synthetic products, at approx. ten TWh. The demand for hydrogen in the mobility sector will drastically increase again by 2035, not least due to it being driven by even more demanding CO_2 reduction targets from 2030 onwards. According to current estimates, the NWR expects consumption to be three to four times that of 2030, especially in the heavy-duty commercial vehicle sector.

PRIVATE TRANSPORT INCLUDING LIGHT COMMERCIAL VEHICLES

These days, the passenger car transport sector focuses mainly on battery-electric powertrains to meet its CO_2 reduction targets. As long as the expansion of the necessary charging infrastructure, including the associated electricity grids, is successful and the necessary critical raw materials for the battery are made available, a substantial market share should be achieved. Some manufacturers, some of which are focused on areas outside the EU, are also working on further developing fuel cell electric vehicles as a supplementary market segment. It should be stressed that these developments are mostly taking place outside of Germany within different political and geographical frameworks and that economically competitive alternatives to battery electric passenger cars can be expected to come from there. The expected hydrogen demand for passenger car applications is relatively low, at least for 2030.

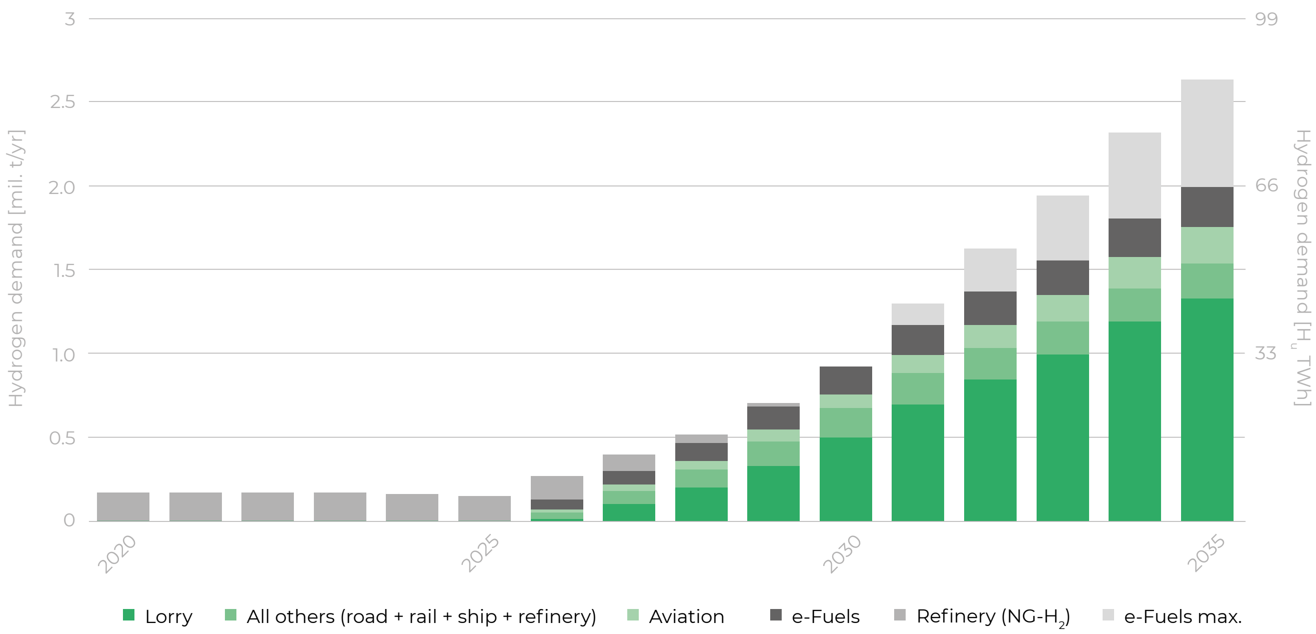
HEAVY GOODS TRANSPORT

For high ranges, some lorry manufacturers have already announced or even launched fuel cell vehicles. The predicted quantity of just under 0.5 million tonnes of H_2 (17 TWh) for 2030 is based on the assumption that, in addition to H_2 utilisation in refineries, approx. 38,000 Heavy Duty Vehicles (HDVs) with fuel cells will be licensed in Germany.[8]

The European Commission is currently revising the CO_2 targets for heavy-duty commercial vehicles. Should stricter guidelines be formulated in the course of this and confirmed in the parliamentary process, then even these 38,000 trucks will not be enough to meet these targets.

[8] A recent study commissioned by the German Federal Ministry of Transport (Bundesverkehrsministerium) showed that by 2030, about 38,000 hydrogen-powered lorries will be licensed. An annual consumption of approx. 380,000 t H2 can be expected for these HDVs. On top of that, there are another approx. 100,000 t H2 for lorries that are licensed outside of Germany but will be travelling in Germany and therefore have to be refuelled there.

Figure 3: Trend in hydrogen demand for different modes of transport



REFINERIES

For methodological reasons, here, the use of hydrogen in refineries is attributed to the mobility sector. It is assumed that the hydrogen currently being used in this sector, which is produced from natural gas, can be replaced by green hydrogen relatively quickly. This creates a demand for fuel substitution totalling about 0.33 million t (11 TWh) of hydrogen by 2030.

AVIATION

Feasibility studies and economic analyses, such as the DLR (Deutsches Zentrum für Luft- und Raumfahrt – German Aerospace Center) aviation strategy,[9] show that hydrogen can be an essential component of future aviation technology. If technologically advanced hydrogen-powered aircraft are deployed in segments in which they are the most cost-effective means of decarbonisation, they could reach an optimistic market potential of 35 to 40 per cent by 2050.[10] If sustainable aviation fuels (SAFs) power the remaining 65–60 per cent of aircraft, the climate impact of aviation would drop enormously, bringing the CO_2 reduction targets set by the EU and ATAG within reach.[11] The significant use of hydrogen and derivatives will however only become relevant in the 2030s – in view of legal provisions (RED II), a quantity of approx. 100,000 t H_2 (approx. 3 TWh) can be assumed for 2030.

[9] See: Auf dem Weg zu einer emissionsfreien Luftfahrt (On the path to emission-free aviation) [in German], 2021 (https://www.dlr.de/content/de/downloads/publikationen/broschueren/2021/luftfahrtstrategie-des-dlr-zum-europe-an-green-deal-zusammenfassung.pdf?__blob=publicationFile&v=4).

[10] McKinsey: Hydrogen-powered aviation: A fact-based study of hydrogen technology, economics, and climate impact by 2050 (May 2020).

[11] See also 'Hydrogen in aviation in Germany', position paper of the German National Hydrogen Council (NWR) from 16 April 2021.

SHIPPING

Hydrogen and its derivatives play a crucial role in decarbonisation for the maritime sector, as direct electrification in this sector will only succeed in very specific areas at best. Nevertheless, the quantities to be considered for Germany in 2030 are to be estimated as rather low (approx. 15,000 t H_2, which corresponds to about 0.5 TWh). However, assuming an ambitious quota as early as the end of the 2020s, a quantity of around 80,000 t H2 (approx. 2.5 TWh) can be expected.[12]

THE ROLE OF E-FUELS

In 2030, 75 per cent of all existing vehicles on the road will probably still be equipped with an internal combustion engine. In this regard, a market ramp-up of virtually climate-neutral, hydrogen-based fuels, which is necessary for aviation and shipping, can bring about further greenhouse gas reductions in the transition phase. For all applications that are difficult to electrify, where neither vehicles nor infrastructure for direct hydrogen use are available, or where avoiding transport and shifting modes of transport are not possible, electricity-based fuels could also be used; for example, for mobile machinery in the construction industry and in agriculture. A conservative estimate by the NWR estimates just under 6 TWh, which would likely be imported from countries outside the EU as hydrogen-based derivatives containing carbon (for cost reasons).

OTHER APPLICATIONS

The use of fossil diesel in rail transport is being restricted more and more. Hydrogen and fuel cells are significant alternatives here, though they will foreseeably only lead to manageable hydrogen demand quantities and must be anchored in the European developments accordingly, especially against the backdrop of the new trans-European networks.

3.3 HEATING MARKET

The heating sector is responsible for more than half of Germany's energy demand and is an important segment for achieving climate protection goals. The bottom-up study on the heating market commissioned by the NWR has shown that a 'one-size-fits-all' solution does not exist, but rather a bundle of technological options is necessary for decarbonisation. Heat pumps, heating grids, heat from renewable sources and hydrogen play the most important roll. Hydrogen is particularly indispensable for district heating and process heat and is up to 40 per cent cost-effective, regardless of the cost development considered. But hydrogen can also play a role in the decentralised space heating sector, especially in areas where district heating is less prevalent. The heating market varies greatly from one place to another, and a reliable sales forecast is only possible once the locally suitable decarbonisation strategy has been identified in all of Germany's supply areas in the course of municipal heating planning efforts. However, the analyses have shown that in all supply areas, the decarbonisation strategies up to 2030 are essentially the same and the use of hydrogen in the heat market will only take place thereafter. An initial projection based on the four supply areas analysed for the bottom-up study shows (depending on the scenario) a hydrogen demand for centralised and decentralised heat generation totalling five to ten TWh/a for 2030 and then a rapid increase in demand to a magnitude of 125–500 TWh/a in 2045.[13]

Here, process heat is accounted for insofar as consumers are connected to distribution grids. Other quantities are not found here but can be found in Section 3.1 Process Industries.

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[12] See, for example, Roadmap for the Maritime Energy Transition (https://vdma.org/viewer/-/v2article/render/53444203).

[13] In the Hydrogen Action Plan Germany 2021–2025 (see https://www.wasserstoffrat.de/fileadmin/wasserstoffrat/media/Dokumente/EN/2021-07-02_NWR-Hydrogen_Action_Plan.pdf), the NWR had still addressed greenhouse gas neutrality up to 2050; in this document, figures for 2045 are given where available, even if this leads to a certain amount of inconsistency.

3.4 ENERGY SUPPLY

The use of hydrogen in the energy sector for the production of electrical energy played only a minor role in the NWR's previous analyses for 2030. However, in the context of EU taxonomy and other regulations (such as those on the promotion of hydrogen power plants in the Renewable Energy Sources Act), this could change for new power plants constructed in the 2020s, as CO_2 targets can in part only be achieved with a significant degree of H_2 co-firing. At the same time, with the completed phase-out of nuclear power and the advancing phase-out of coal, necessary investments in secured power plant capacity up to 2030 and beyond are pending. Attention must be paid to H_2-readiness and the corresponding retrofittability in order to ensure that these capacities can also guarantee security of supply in a completely climate-neutral energy system in 2050. It can be assumed that these power plants will be operated with an increasing share of hydrogen or even entirely with hydrogen – and also that this will be done in order to be able to meet the framework conditions for the financing of any projects that arise due to the specifications of the EU taxonomy. The NWR expects a demand of up to 20 TWh for 2030 and up to 288 TWh for 2040 for the period under consideration.[14] It should however be noted that the demands regarding electricity generation partly overlap with the CHP segment of centralised heat generation.

4 CO_2 AVOIDANCE

One insight gained from the data analysis is the heterogeneous, relative CO_2 avoidance lever when using hydrogen in different industries. This CO_2 avoidance lever in the steel sector is significantly higher than in all others, as a direct switch from coal to hydrogen as a reducing agent is possible here thanks to the technological shift to the hydrogen-based DRI reduction process. At the same time, the use of natural gas as a flexible option can already avoid considerable amounts of CO_2 in the steel sector right from the start. This option, i.e., the use of natural gas as a 'bridge' to hydrogen-based technologies, is generally not possible in other sectors. Having said that, this bridge has become significantly narrower, in other words, more uncertain and also more expensive, due to the changed geopolitical framework conditions.

All things considered, the data analysis confirms that climate-neutral hydrogen and climate-neutral hydrogen derivatives are indispensable for achieving the climate targets. A demand of about 18.5 million t/yr of climate-neutral H_2 (approx. 616 TWh) by 2045 or 2050 is expected for the sectors examined here. Based on the assumptions made in this document, around 13 million t (approx. 444 TWh) of this is accounted for by pure hydrogen and around 5 million t (172 TWh) by hydrogen in the form of derivatives. This means that almost 170 million tonnes of CO_2 per year can be avoided, 55 million tonnes of which are due to the high efficiency factor in the steel industry alone. In the chemical industry, the avoidance lever is smaller because the current raw materials (primarily petroleum derivatives) are less carbon intensive than the coking coal used in the steel industry. Moreover, there is virtually no alternative strategy for making the industry climate-neutral other than using hydrogen and its derivatives to do so. The avoidance lever is also lower in the transport sector because this sector uses energy sources (petrol and diesel) that are already physically less carbon-intensive than, for example, the hard coal used in the steel sector. Conversely, for many transport scenarios, it is important to have as much energy on board as possible, especially in road freight transport – and hydrogen has a high energy density and at the same time presents a maximum CO_2 avoidance lever.

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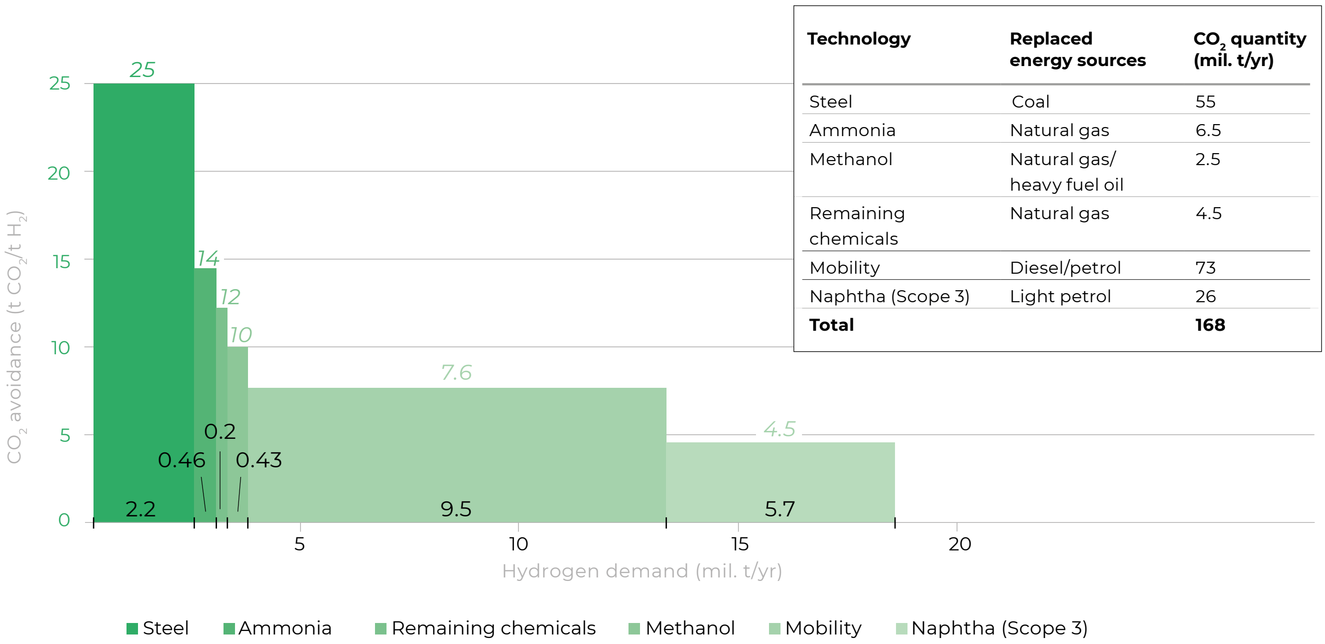
[14] See Hydrogen Action Plan Germany 2021–2025 (https://www.wasserstoffrat.de/fileadmin/wasserstoffrat/media/Dokumente/2021-07-02_NWR-Wasserstoff-Aktionsplan.pdf).

Figure 4: CO_2 avoidance levers through conversion to H_2-based technologies (2050)



Technology	Replaced energy sources	CO_2 quantity (mil. t/yr)
Steel	Coal	55
Ammonia	Natural gas	6.5
Methanol	Natural gas/ heavy fuel oil	2.5
Remaining chemicals	Natural gas	4.5
Mobility	Diesel/petrol	73
Naphtha (Scope 3)	Light petrol	26
Total		**168**

Statements on and analyses of the CO_2 avoidance levers in the various sectors are important for emphasising the short to medium-term significance of hydrogen in the individual applications. They are by no means designed to be used as the sole criterion, for example, in funding decisions; in particular, the indicator 'specific CO_2 avoidance' does not allow any direct conclusions to be drawn with regard to the economic efficiency for the respective application.

SUMMARY AND PROGNOSIS

This white paper identifies the green hydrogen demand of all sectors. According to it, hydrogen will play a significant role in reducing greenhouse gas emissions in industry, especially the steel and chemical industries, as well as in the mobility, heating and energy supply sectors. The hydrogen demands of all sectors in Germany for 2030 and 2040–2050 (i.e., the period in which Germany wants to become climate neutral) are based on data from the respective industrial sectors, as presented (see Table 1).

Table 1

Sector/year	2030			2040–2050	
	Mil. t H_2	TWh[15]	CO_2 emissions reduction (mil. t)	TWh	CO_2 emissions reduction (mil. t)
Process industries		**21–31**		**298**	**95**
Steel industry	0.6–0.9	20–28	15–21	73	55
Chemical industry[16]	1.1	36	–	225	40
Other process industries	0.03–0.1	1–3	N/A	N/A	
Transport sector		**30–32**		**253**	**73**
Private transport incl. light commercial vehicles	–	–	–	5	
Heavy goods transport (heavy-duty commercial vehicles)	0.5	17	3.5	104	
Refineries	0.1	3	1	0	
Aviation	0.1	3	0.6	52	
Shipping	0.02–0.08	0.5–2.5	0.1–0.5	8	
E-Fuels[17]	0.2	6	1.2	83	
Heating market[18]		**5–10**		**125–500**	
Energy supply		**0–20**		**288 (2040)**	
Total		**56–93**		**964–1364**	
Total demand[19] incl. grey hydrogen		**92–129**	**–**	**964–1364**	

[15] The conversion is based on the lower calorific value for hydrogen, therefore 1 million t H_2 corresponds to about 33.33 TWh.
[16] For 2030, it is assumed that the demand of the chemical industry, which has been covered by grey H_2 up till now, not be covered by climate-neutral hydrogen. This means that the data for 2030 concerns the demand for grey hydrogen. For the 2040–2050 timescale, the hydrogen demand shown refers exclusively to green hydrogen.
[17] For demands beyond aviation and shipping.
[18] Centralised and decentralised generation.
[19] This total includes the amount of grey hydrogen that is expected to be gradually replaced by climate-neutral or virtually climate-neutral hydrogen after 2030 (see footnote 16) and thus reflects the total demand.

This information was checked for plausibility and therefore provides a rough yet valid overview of expected quantities that have to be produced in or imported to Germany. For 2045–2050, this is naturally associated with great uncertainty. For 2030, the total quantity of 56–93 TWh constitutes a plausible range. This corresponds to an electrolysis capacity of 23–39 GW,[20] without it being possible to say whether this would have to be installed domestically or abroad or whether part of the hydrogen demand can be covered by blue hydrogen for certain periods of time.

It is clear that the use of green hydrogen has great potential for CO_2 avoidance in all the sectors mentioned: industry, mobility, heating and energy supply. The data analysis shows that green hydrogen and its derivatives can make an indispensable contribution to achieving the climate targets, provided that corresponding capacities are available at the times mentioned.

If you are interested in finding out more or have any questions, please contact:
Hydrogen Coordination Office (Leitstelle Wasserstoff)
E-Mail: info@leitstelle-nws.de,
Website: www.wasserstoffrat.de/en

[20] See footnote 2.

NATIONALER WASSERSTOFFRAT

THE GERMAN NATIONAL HYDROGEN COUNCIL

On 10 June 2020, the German Federal Government adopted the National Hydrogen Strategy and appointed the German National Hydrogen Council. The Council consists of 26 high-ranking experts in the fields of economy, science and civil society. These experts are not part of public administration. The members of the National Hydrogen Council are experts in the fields of production, research and innovation, industrial decarbonisation, transportation and buildings/heating, infrastructure, international partnerships as well as climate and sustainability. The National Hydrogen Council is chaired by former Parliamentary State Secretary Katherina Reiche.

The task of the National Hydrogen Council is to advise and support the State Secretary's Committee for Hydrogen with proposals and recommendations for action in the implementation and further development of Germany's National Hydrogen Strategy.

Contact: info@leitstelle-nws.de, www.wasserstoffrat.de/en