BUNDESRECHNUNGSHOF

Special Report

# Implementation of the Federal Government's Hydrogen Strategy


28 october 2025

*At a glance*

# Ramp-up of the hydrogen economy comes with significant risks

The Federal Government aims at establishing a hydrogen economy to meet the statutory goal of climate neutrality by 2045. Despite billions in subsidies, the Federal Government is falling short of the goals set out in its hydrogen strategy. This poses a risk to achieving climate neutrality, maintaining Germany's industrial competitiveness and ensuring a sound federal budget.

## → What is it about?

Hydrogen is expected to play a key role in the energy transition. However, there is a lack of supply, demand and infrastructure. Moreover, hydrogen is significantly more expensive than energy sources used to date. The Federal Government is supporting the ramp-up of the hydrogen economy with several billion euros annually, following a planned economy approach. Despite these efforts, the Federal Government is still far from reaching its goal of establishing a hydrogen economy by 2030.

## → What needs to be done?

The Federal Ministry for Economic Affairs and Energy (the Ministry) has acknowledged the need to review its approach and adjust its course of action. At the same time, the Ministry itself considers its planned measures insufficient to make hydrogen competitive in the foreseeable future. The Federal Government must perform a reality check of its hydrogen strategy, design its measures in a more targeted manner and ensure they are subject to regular monitoring. Only in this way can the Ministry minimise the burdens and risks for both, the economy and the federal budget. In addition, the Federal Government should have a plan B to meet climate targets in case the hydrogen ramp-up fails.

## → What is the objective?

The objective is to ensure, in accordance with the relevant legal requirements, a hydrogen supply that is as secure, affordable, environmentally sustainable and climate-neutral as possible. Hydrogen should make a realistic contribution to the energy transition in the future and contribute to a climate-neutral, competitive Germany without jeopardising the stability of the federal budget.

# Content

# List of abbreviations

## A

AMKG H2 Amortisationskonto GmbH

## D

dena *Deutsche Energie-Agentur GmbH*

## E

EIB *Europäische Investitionsbank*

EUA *European Union Allowance*

## F

FID *finale Investitionsentscheidung*

## G

GHF *Green Hydrogen Fund*

## I

IEA *Internationale Energieagentur*

IPCEI *Important Projects of Common European Interest*

## K

KfW *Kreditanstalt für Wiederaufbau*

## M

MWh *Megawattstunde*

## P

PIK *Potsdam-Institut für Klimafolgenforschung*

## T

TWh *Terawattstunde*

## U

UBA *Umweltbundesamt*

# Summary

*The Federal Government regards hydrogen as a cornerstone in the energy transition for Germany to become climate-neutral by 2045 and to maintain its role as an industrial hub. However, despite providing billions in subsidies, the Federal Government is falling short of the goals set out in its hydrogen strategy. This jeopardises not only the achievement of climate neutrality and Germany's industrial competitiveness, but also the stability of the federal budget.*

*The Federal Ministry for Economic Affairs and Energy (the Ministry) has acknowledged in principle that the ramp-up of the hydrogen economy has not been successful so far. At the same time, the Ministry does not consider its planned adjustments to be sufficient to make hydrogen competitive in the foreseeable future. As a result, the success of the hydrogen economy remains uncertain.*

## 0.1

*Climate-neutral hydrogen, known as "green" hydrogen, is intended to replace fossil fuels in areas where direct use of electricity from renewable sources is not feasible. In addition, hydrogen ready gas power stations are expected to contribute to a secure electricity supply. The ramp-up of the hydrogen economy must be built from the ground up. Supply, demand, and infrastructure must be developed in a well-coordinated manner. The Federal Government is funding this ramp-up with several billion euros annually and financially safeguards the development of the infrastructure.*

*Against this backdrop, we have assessed the extent to which the planned ramp-up of the hydrogen economy appears realistic. According to Section 1 of the Energy Industry Act, the hydrogen supply must be as secure, affordable, environmentally sustainable, and climate-neutral as possible (no. 1).*

## 0.2

*Ensuring a secure supply of hydrogen depends on having enough supply. The Federal Government intends to ensure the hydrogen supply through domestic production and, for at least half, through imports. However, the Federal Government is currently failing to meet its targets for domestic production of green hydrogen. It is also unable to cover the expected demand through imports. The measures taken so far have proven insufficiently effective.*

*The Federal Government is unlikely to achieve its goal of stimulating an additional supply of hydrogen by promoting demand. Neither the industrial sector nor the energy sector is expected to significantly increase their demand by 2030. Without binding provisions stipulating that gas power stations shift to hydrogen, a key driver of demand is missing, which hampers the ramp-up of the hydrogen economy.*

*In light of the expected low supply and demand, the development of the hydrogen core network is not proceeding in a synchronised manner: already in 2030, two-thirds of the network shall be operational, despite a likely low utilisation (no. 2).*

## 0.3

*The Federal Government is unable to ensure an affordable hydrogen supply with the existing measures. Currently, green hydrogen is too expensive to compete with other energy sources. As a result, private actors have little incentive to invest in the hydrogen economy. To support the ramp-up of the hydrogen economy, the German parliament, in its role as budget authority, has allocated substantial funding, amounting to €4.3 billion in 2024 and more than €3 billion in 2025. These funds are mainly provided in the form of corporate subsidies. In addition, the Federal Government has entered into long-term financial commitments of several billion euros annually through the end of the decade.*

*Expectations that green hydrogen would become price-competitive have not been met. Instead, hydrogen is likely to remain costly in the future. As a result, permanent public subsidies are likely. For instance, the funds required to compensate for the price difference between green hydrogen and natural gas could amount to between €3 billion and €25 billion per year – just for imports.*

*Building the core hydrogen network also places considerable strain and risk on the federal budget. As the number of network users will be low in the early phase, network operators will initially be reimbursed for part of their network costs via a temporary compensation mechanism (interim financing), funded by a government-backed loan (the so-called amortisation account). In the mechanism, the loan is repaid as the number of network users increases, and revenues rise as a result. If the development of the hydrogen core network is not synchronised with the actual supply and demand, the network costs and the interim financing costs will be unnecessarily high.*

*According to an expert study commissioned by the Ministry, successful implementation of the financing mechanism will require federal funding for hydrogen production, consumption and storage. If the ramp-up of the hydrogen economy fails, the financing mechanism could place an additional burden on the federal budget, potentially amounting to tens of billions of euros (no. 3).*

## 0.4

*Green hydrogen has the potential to be produced and used in a climate-neutral way. However, the actual climate impact of hydrogen production, transport and use remains uncertain. Studies suggest that importing green hydrogen in particular may involve substantial emissions along the supply chain. Since the Federal Government plans to meet at least half of its projected hydrogen demand through imports, this poses a significant risk to achieving a climate-neutral energy supply.*

*Hydrogen production also has an impact on other areas of environmental sustainability. In order to reduce negative environmental effects, the Federal Government aims at establishing internationally ambitious sustainability standards for hydrogen imports. In practice, however, the Federal Government has already had to make concessions on these standards to ensure that producers were willing to supply green hydrogen. Against this backdrop, we point out the risk that a truly sustainable supply of green hydrogen may not be achieved (no. 4).*

## 0.5

*In its comments, the Ministry largely concurred with our assessment. The Ministry attributed the significant delay in ramping up the hydrogen economy to geopolitical developments, overly optimistic planning assumptions and regulatory uncertainty. According to the Ministry, neither green nor blue hydrogen is expected to become competitive in the foreseeable future. At the same time, the Ministry argues that permanent funding would impose an unsustainable strain on the federal budget. However, it believes that Germany's legally binding climate targets cannot be met without the use of green, but also blue hydrogen.*

*As a result, the Ministry announced that it would adjust the market framework and its mix of policy instruments. Nevertheless, it considered that even these measures would not be able to offset the price difference between green or blue hydrogen and fossil alternatives.*

## 0.6

*The Ministry has acknowledged in principle the need for action. However, it remains largely unclear how the Ministry intends to adapt the market framework and policy instruments in practice. Moreover, the Ministry itself does not consider its measures to be sufficient to offset the price disadvantage of hydrogen compared to fossil alternatives in the foreseeable future. As a result, it is uncertain whether and when the subsidised ramp-up of the hydrogen economy can be successfully completed. This uncertainty poses significant risks regarding climate neutrality, the long-term competitiveness of Germany as industrial hub and the*

*stability of the federal budget. Annual public subsidies amounting to tens of billions of euros well into the 2030s would place additional pressure on an already strained federal budget.*

*To meet the legal targets outlined in Section 1 of the Energy Industry Act, the Federal Government must perform a reality check of its hydrogen strategy and the way it has been implemented so far. In this programme evaluation, the Federal Government should reassess whether and when green hydrogen can become available without permanent subsidies*

- → *in sufficient quantities,*
- → *at a competitive price and*
- → *in a climate-neutral and sustainable way.*

*Based on this assessment, the Federal Government should revise its strategy. In its efforts to promote supply and demand and to build the core hydrogen network, the Federal Government should avoid unnecessary costs and risks, acting in line with the principle of economic efficiency.*

*The Federal Government should also assess the overall contribution of the hydrogen economy to the energy transition. This includes the question of whether new technologies could offer alternative ways to decarbonise sectors that were previously expected to rely on hydrogen. Given the climate-related, economic and fiscal significance of the hydrogen economy, the Federal Government should finally implement the monitoring of the ramp-up of the hydrogen economy as laid out in its hydrogen strategy. This is necessary to identify undesirable developments at an early stage and allow for corrective action. If the Federal Government fails to find solutions for the current challenges, it should have a timely plan B to achieve climate neutrality by 2045, without relying on a permanently subsidised hydrogen economy.*

*We urge the Federal Government to address these issues now.*

# 1 Background

## 1.1 Hydrogen in the energy transition

Hydrogen is to play a key role in the energy transition to achieve climate neutrality by 2045 in Germany and by 2050 in the European Union, thereby securing Germany's role as an industrial hub. However, full decarbonisation[1] poses particular challenges to the German industry, as its international competitiveness is under considerable pressure due to structural disadvantages.[2]

There are various methods for producing hydrogen ($H_2$) (see Figure 1).

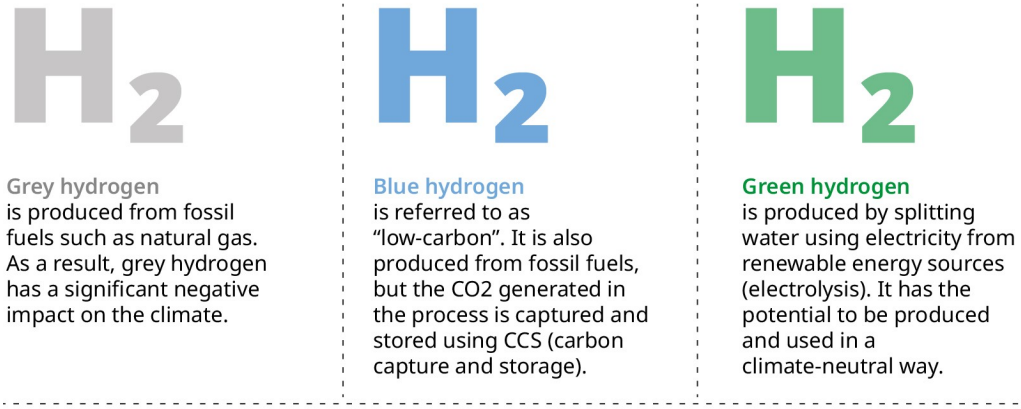
[1] Decarbonisation refers to the transformation of social and economic systems with the aim of moving away from carbon-based energy sources. Economic Ministry: Glossar Energiewende (glossary on energy transition), (in German only), last retrieved on 13 October 2025.

[2] The structural disadvantages are for example energy prices, regulation and investment conditions. See ifo Institut: "Industrie verliert weiter an Wettbewerbsfähigkeit" (industry continues to lose competitiveness), (in German only), last retrieved on 13 October 2025.

Figure 1

## Colour classification: grey, blue and green hydrogen

Hydrogen can be produced using various methods and is accordingly classified by different colours (“colour classification”):




Explanation: Hydrogen can be converted into various other chemical compounds, known as derivatives. Hydrogen derivatives are easier to transport and store than gaseous hydrogen.[3]

Figure: Bundesrechnungshof.

Climate-neutral hydrogen is to replace fossil fuels in areas where the direct use of electricity from renewable energies is not feasible. This applies in particular to the energy-intensive steel and chemical industries. In addition, hydrogen is intended to contribute to the security of the electricity supply by enabling hydrogen-ready gas-fired power stations to generate electricity during periods of low wind or solar output.[4]

The Federal Government aims to ramp up the hydrogen economy.[5] This must be built up entirely, as there is currently neither a supply of hydrogen nor a corresponding demand.[6] At the same time, the infrastructure needed to transport hydrogen from

[3] The most common derivatives of hydrogen are ammonia, methanol, LOHC (liquid organic hydrogen carriers), and e-fuels (electricity-based synthetic fuels). Additional energy is required to convert hydrogen into derivatives and derivatives back into hydrogen.

[4] Federal Government 2023, National Hydrogen Strategy Update (NHS 2023), p. 19. Any further use of hydrogen is not appropriate in terms of energy efficiency and resource conservation. This is because the direct use of electricity from renewable energies can replace significantly more fossil energy and reduce greenhouse gas emissions more effectively than electrolytically produced hydrogen. German Environment Agency (UBA), “Wasserstoff – Schlüssel im künftigen Energiesystem” (hydrogen – key to the future energy system), (in German only), last retrieved on 15 October 2025.

[5] The ramp-up of the hydrogen economy refers to the process of rapidly and broadly creating a hydrogen economy with the aim of establishing and using hydrogen as an energy carrier on a large scale. This includes building production capacity, especially for green hydrogen, the necessary infrastructure for transport and storage, and the development and application of hydrogen technologies in various sectors such as industry, transport and energy production.

[6] Currently, hydrogen in Germany is produced and consumed almost exclusively in the form of grey hydrogen in the chemical industry and in refineries.

producers to users is lacking. In addition, there are, among other things, considerable technical challenges in both production and transport.

## 1.2 Strategies and legal provisions

### Initiatives taken by the Federal Government

The Federal Government has developed strategies and introduced draft legislation to shape the desired ramp-up of a hydrogen economy. In particular,

- → it adopted the National Hydrogen Strategy (NHS 2020) in June 2020, updated it in 2023 (NHS 2023) and, in July 2024, complemented it with an import strategy for hydrogen and hydrogen derivatives (import strategy). The NHS 2023 sets targets for 2030. The Federal Government limits its direct financial support for hydrogen production to green hydrogen.[7] It is not technically possible to produce blue hydrogen in a completely climate-neutral way.[8]
- → The NHS 2020 provided for an annual monitoring report on the ramp-up of the hydrogen economy starting in 2021. So far, no monitoring report has been issued.
- → In October 2025, the Federal Government passed a draft law aimed primarily at accelerating the planning and approval procedures (Hydrogen Acceleration Act).[9] According to the draft bill, hydrogen economy projects should serve paramount public interest.

The current Federal Government adheres to its decision to rapidly ramp up the hydrogen economy. Pursuant to the Federal Government, it will be necessary to make use of "all colours" of hydrogen during this ramp-up.[10]

At the same time, in addition to ramping up the hydrogen economy, the Federal Government also plans to enable the capture, storage and utilisation of emissions that are very difficult or impossible to avoid, as a decarbonisation option. This includes Carbon Capture and Storage (CCS) and Carbon Capture and Usage (CCU).[11]

[7] 2023 National Hydrogen Strategy, p. 4.

[8] From the perspective of the German Environment Agency (UBA), blue hydrogen, even if imported, is not a viable and sustainable energy source for the transition to a climate-neutral energy supply: "Wasserstoff – Schlüssel im künftigen Energiesystem" (hydrogen – key to the future energy system), (in German only), last retrieved on 15 October 2025.

[9] The draft bill to accelerate the availability of hydrogen and amend other legal framework conditions for the ramp-up of hydrogen, as well as to amend other energy law provisions, is currently still in the legislative process. A previous draft prepared by the Federal Government dated 21 June 2024 was not passed by the German Bundestag in the 20th electoral term.

[10] Koalitionsvertrag zwischen CDU, CSU und SPD (Coalition agreement of the parties CDU, CSU and SPD) of 9 April 2025, Verantwortung für Deutschland) (responsibility for Germany), (in German only), for the 21st electoral term (KoaV 2025), recital 141 et seq. as well as 1094 et seq. Last retrieved on 15 October 2025.

[11] Economic Ministry, press release (6 August 2025): "Bundesregierung ebnet den Weg für $CO_2$-Speicherung und -Nutzung (CCS und CCU)" (Federal Government paves the way for $CO_2$ storage and utilisation), (in German only), last retrieved on 15 October 2025.

### Targets and legal provisions of the European Union

The ramp-up of the hydrogen economy significantly hinges on European targets and provisions:

- → The European Union targets an electrolysis capacity of 120 GW by 2030.[12] The European Court of Auditors found that the European Union was unlikely to meet these ambitious targets.[13]
- → In 2023, the EU Commission issued a delegated regulation.[14] According to this regulation, electricity for the production of green hydrogen must be generated additionally, in temporal correlation and in geographical correlation to hydrogen production. These provisions are criticised by hydrogen producers as an obstacle to the ramp-up of the hydrogen economy. In September 2024, the Ministry[15] called on the European Commission to adjust the regulatory framework.
- → In July 2025, the EU Commission presented a delegated regulation on the classification of low- carbon fuels.[16] According to this regulation, hydrogen would be classified as low-carbon (blue) if, including upstream emissions[17], it results in at least 70 per cent fewer $CO_2$ emissions than natural gas.

## 1.3 Driver for audit work and audit focus

The ramp-up of the hydrogen economy is associated with considerable financial burdens and risks for the federal budget. The German Parliament, in its role as budget legislator, has allocated a total of €4.3 billion for the ramp-up in 2024 alone. In

[12] A basic distinction is made between generation capacity and generation volume (energy):
Generation capacity indicates the maximum amount of hydrogen that can be produced at any given time. It is expressed in watts. Large generation capacities are typically expressed in gigawatts (GW) (1 GW corresponds to 1 billion watts).
This must be distinguished from the actual generation realised over a certain period of time, which is expressed in watt hours (Wh). Large amounts of generated energy are typically expressed in terawatt hours (TWh; 1 TWh corresponds to 1 trillion Wh). Normally, plants do not always operate at full capacity, especially if they are to be powered by fluctuating electricity from wind power and photovoltaics. For example, if an electrolyser with a technical capacity of 1 GW runs for 2,000 hours at half capacity (0.5 GW), it generates 1 TWh of hydrogen.

[13] European Court of Auditors, Special report 11/2024: The EU's industrial policy on renewable hydrogen – Legal framework has been mostly adopted – time for a reality check.

[14] Commission Delegated Regulation (EU) 2023/1184 of 10 February 2023 supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a Union methodology setting out detailed rules for the production of renewable liquid and gaseous transport fuels of non-biological origin. Official Journal of the European Union, 2023, L 157/11. The Commission may adopt delegated acts where it has been empowered to do so by a legislative act. Once the Commission has adopted the act, the Parliament and the Council have two months to raise objections. Otherwise, the delegated act enters into force.

[15] We consistently use the designation Federal Ministry for Economic Affairs and Energy (formerly Federal Ministry for Economic Affairs and Climate Action).

[16] C(2025) 4674 final supplementing Directive (EU) 2024/1788 of the European Parliament and of the Council of 13 June 2024 on common rules for the internal markets for renewable gas, natural gas and hydrogen, last retrieved on 18 September 2025. The deadline for raising objections to the delegated act was extended from two to four months at the initiative of the European Parliament. While the hydrogen industry criticizes the regulations as overly restrictive, environmental organisations warn that they could jeopardize climate targets.

[17] Upstream emissions include emissions generated during the production, processing, transport and storage of hydrogen.

addition, the Federal Government has entered into substantial long-term financial commitments of several billion euros annually through the end of the decade (see no. 3). Furthermore, there are considerable risks associated with the financing of the hydrogen core network (core network) that are not reflected in the federal budget (see no. 3.2).

Given the particular importance of the hydrogen economy, we submit an audit report pursuant to Section 99 of the Federal Budget Code, on whether and to what extent hydrogen can fulfil its intended role as a key element of a climate-neutral energy supply. This special report is thus a continuation of our reporting on the energy transition.[18]

The central legal objective is to ensure a pipeline-based hydrogen supply that is as secure (see no. 2), affordable (see no. 3), environmentally sustainable and climate-neutral[19] (see no. 4) as possible. This supply should increasingly rely on renewable energy sources, as stipulated in Section 1 of the Energy Industry Act. In particular, we have

- → focused on green hydrogen,
- → assessed the extent to which current developments make the desired hydrogen economy appear realistic.

For our report, we collected audit evidence at the Ministry.

The report essentially takes into account developments up to 31 July 2025. In addition, the report incorporates the comments made by the Ministry and the Hydrogen Intermediary Network Company GmbH (Hint.co, see no. 2 and no. 4.2) at the end of August 2025 in response to the draft report version. On 15 September 2025, the Ministry issued its monitoring report on the progress of the energy transition.[20] Based on this report, the Ministry outlined ten key measures for secure, clean and affordable energy (10-point plan).[21] In our assessment, we also took the measures announced in the plan and relating to the ramp-up of the hydrogen economy into account.

[18] Most recently we reported on the "Energy transition with regard to the security of supply, affordability and environmental compatibility of electricity supply" (7 March 2024) and in our analysis of the departmental budget for the 2025 federal budget.

[19] In Section 1 of the Energy Industry Act, the term "greenhouse gas-neutral" is used.

[20] EWI & BET (2025): Energiewende. Effizient. Machen. – Monitoringbericht zum Start der 21. Legislaturperiode (energy transition. Efficient. Action. – Monitoring report at the start of the 21st electoral term), (in German only), on behalf of the Economic Ministry, last retrieved on 13 October 2025. Since 2012, an independent commission of experts on energy transition monitoring has been reporting regularly on the status of the energy transition, including the ramp-up of the hydrogen economy.

[21] Economic Ministry; 10 Schlüsselmaßnahmen zum Monitoringbericht (10 key measures for the monitoring report), (only in German), last retrieved on 13 October 2025.

# 2 Secure supply of hydrogen: supply, demand and infrastructure

A secure supply of hydrogen requires sufficient supply from domestic production and imports (see no. 2.1) to meet demand (see no. 2.2), and the establishment of the necessary infrastructure (see no. 2.3).

## 2.1 Supply not as planned

For 2030, the NHS 2023 assumes that Germany's energy demand to be met by hydrogen and hydrogen derivatives will be 95 to 130 terawatt hours (TWh).[22] This demand could multiply by 2045.[23] The Federal Government plans to cover future hydrogen demand through domestic production and – to an extent of 50 to 70 per cent – through imports.

### 2.1.1 Domestic production

In the NHS 2023, the Federal Government has set the goal of installing electrolysers with a total installed capacity of at least 10 GW for the domestic production of green hydrogen by 2030.[24]

#### Funding instruments for creating electrolysis capacity

To this end, the NHS 2023 provides for a mix of six instruments. Using two of such instruments, the Ministry has approved funding for electrolysis projects with a total capacity of 1.7 GW (as of April 2025).[25] The use of the other instruments has been delayed or the Ministry failed to clearly state their effectiveness.[26] This leaves a gap of 8.3 GW to the target of 10 GW (see Figure 2).

[22] By way of comparison, natural gas consumption in Germany in 2024 was around 850 TWh, while electricity consumption was around 460 TWh, see electricity and gas market data from the SMARD information platform of the Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway (Bundesnetzagentur).

[23] By 2045, it is expected to rise to 360-500 TWh of hydrogen and 200 TWh of hydrogen derivatives, see Federal Government: Import Strategy, p. 2.

[24] An electrolyser is a device in which the process of electrolysis takes place to split water into hydrogen and oxygen using electricity.

[25] The two instruments are IPCEI hydrogen (Important Projects of Common European Interest) and Regulatory Sandboxes for the Energy Transition.

[26] Apart from the IPCEI hydrogen (target value of the funding: 2.5 GW) and the Regulatory Sandboxes for the Energy Transition (target value: 0.2 GW) these are: Call for tenders for the construction of system-compatible electrolysers (target value: 3 GW), the implementation of the Renewable Energy Directive II in Germany (target value: 2 GW), a new funding guideline for offshore electrolysers (target value: 1 GW) as well as further (indirect) measures (target value: 1.3 GW).

Figure 2

## Significant gap as to the 2030 electrolysis target

A mix of instruments is supposed to support the creation of 10 GW of electrolysis capacity by 2030. Grant commitments have been made for projects with a total capacity of 1.7 GW (as of April 2025). This leaves a gap of 8.3 GW to the specified electrolysis target.

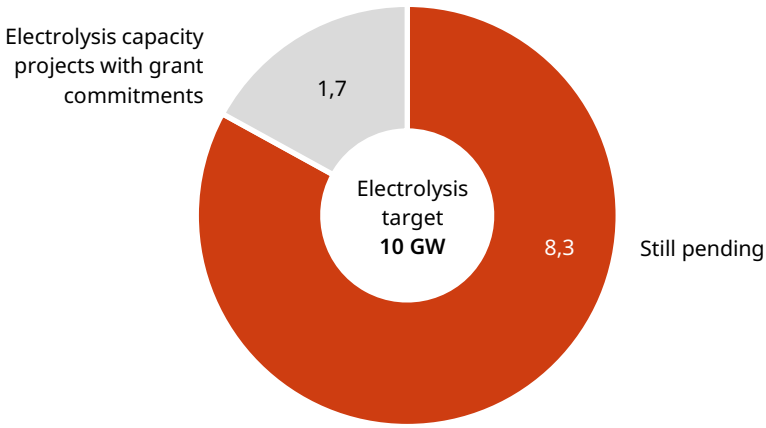



Chart: Bundesrechnungshof. Source: Economic Ministry.

### Actual and announced electrolysis capacity

In April 2025, less than 2 per cent (0.17 GW) of the targeted 10 GW of electrolysis capacity was in operation.[27]

According to the German Energy Agency (abbreviated in German: dena), electrolysis projects with a total capacity of 8.1 GW by 2030 have been announced in Germany. Of these, projects with an electrolysis capacity of less than 5 GW have a high to medium probability of being implemented by 2030. Key challenges for electrolysis projects include funding, long-term reliable demand and the European Union's requirements for green hydrogen.[28] According to the dena, these may lead to project delays or cancellations.[29]

[27] dena, "Elektrolysekapazitäten in Deutschland – Stand und Ausblick" (electrolysis capacities in Germany – current status and outlook), (in German only), last retrieved on 13 October 2025.

[28] dena, "Elektrolysekapazitäten in Deutschland – Stand und Ausblick" (electrolysis capacities in Germany – current status and outlook), (in German only), last retrieved on 13 October 2025.

[29] For example, in 2024, a project developer for electrolysers (planned capacity of 4 GW by 2030) filed for insolvency due to a lack of financing: Energie & Management, "Wasserstoff-Start-up HH2E auf Investorensuche" (hydrogen start-up HH2E seeks investors ), (in German only), last retrieved on 13 October 2025.
In 2025, an energy company stopped the development of new green hydrogen projects due to market uncertainty: Statkraft, press release "Statkraft stoppt Neuentwicklung von grünen Wasserstoffprojekten" (Statkraft halts new development of green hydrogen projects), (in German only), of 8 May 2025.

### 2.1.2 Importing hydrogen

#### Global hydrogen supply

Pursuant to the International Energy Agency (IEA), global production capacity for green and blue hydrogen could reach some 1,600 TWh[30] by 2030. Only 63 TWh[31] of this amount would come from green hydrogen production projects for which a final investment decision (FID) has been made or which are under construction. According to the IEA, for the remaining projects, an implementation by 2030 is unlikely: numerous project developers had postponed or cancelled electrolysis projects, some despite already having an FID or having started construction.[32]

The NHS 2023 assumes that Germany's import needs in 2030 will be at least 47.5 TWh. This corresponds to around three quarters of the projected global production capacity for green hydrogen of 63 TWh. The maximum expected import demand of 91 TWh exceeds this production capacity by just under 50 per cent (see Figure 3).

[30] Data provided by IEA: 49 million tonnes per annum (Mtpa); converted by the Bundesrechnungshof (conversion factor: 33.33 kWh/kg).
[31] Data provided by IEA: 1.9 million tonnes per annum (Mtpa); converted by the Bundesrechnungshof (conversion factor: 33.33 kWh/kg).
[32] IEA, Global Hydrogen Review 2024, revised version (October 2024), p. 61 and pp. 64 et seq.

Figure 3

## Germany's expected import need will be difficult to meet

Germany would have to import at least three quarters of the expected global production of green hydrogen in 2030. Global capacities would not be sufficient to meet the expected maximum import demand.

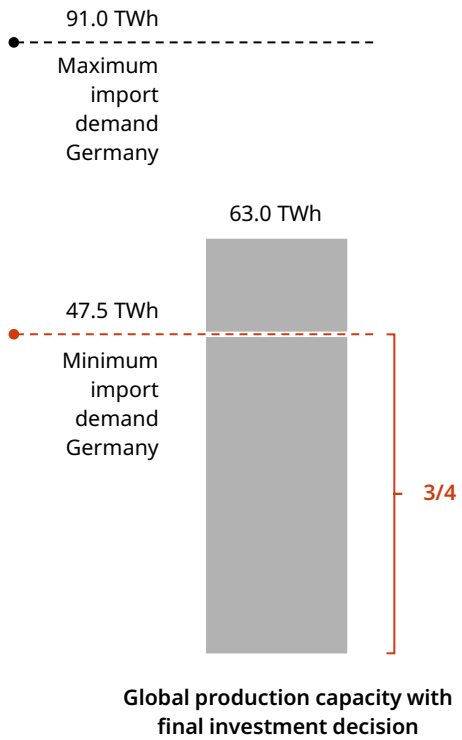



Chart: Bundesrechnungshof. Source: IEA, Federal Government, analysed by Bundesrechnungshof.

### Promoting international supply

In order to increase global supply, the Federal Government promotes the production of green hydrogen and its derivatives in other countries:

→ With the **H2Global** instrument, the Ministry intends to create incentives for the industry to invest in hydrogen applications.[33] To this end, the hydrogen trading company Hint.co, which was incorporated specifically for this purpose, centrally purchases green hydrogen from foreign producers in order to resell it within the EU at a competitive price.[34] Hint.co purchases the hydrogen via auctions for multi-year supply contracts and sells it approximately twelve months before delivery begins under one-year

[33] Economic Ministry "Was ist eigentlich H2 Global?" (What exactly is H2 Global?) in "Energiewende direkt", 25 January 2022.
[34] Purchases are made in the form of hydrogen derivatives that can be transported by ship (e.g., ammonia or methanol).

purchase contracts (also via auctions) to the highest bidder. The Ministry compensates Hint.co for losses resulting from the difference between the purchase and sale price with federal budget funds.

- In the **first round of tenders** for the purchase of hydrogen (as from December 2022), Hint.co was able to conclude a supply contract for one of three lots to import the hydrogen derivative ammonia from Egypt starting 2027 (Egypt Green Hydrogen Project).[35] The FID for the project is still pending. Originally projected for 2023[36], it has now been announced for the second half of 2025.
- The **second round of tenders**, which is currently underway, has been divided into five lots[37]. It is not expected to end before March 2026. The Ministry expects deliveries to begin in 2029. The Ministry has set guidelines for sales by Hint.co to ensure that the funded hydrogen can be used in Germany as far as possible. Sales may only be made to enterprises with branches in Germany, and delivery is only permitted via a port in Germany.[38] Since a subsequent transport to neighbouring countries would be expensive, it is very likely that the hydrogen will be used in Germany.

→ The Green Hydrogen Fund (GHF), established in 2021 by the European Investment Bank (EIB), is intended to provide start-up assistance for the hydrogen economy in emerging and developing countries. Projects are to be funded irrespective of subsequent deliveries of hydrogen to Germany. With contributions of €459 million, Germany is currently the sole donor. The fund is not yet operational and has not yet made any funding decisions.

→ With its **funding guidelines for international hydrogen projects**, the Ministry supports pilot projects outside Europe. Its aim is to test the interaction of various technologies on site and to promote industrial scaling. For example, the Ministry provides investment grants of €13.8 million to support the development of iron production using green hydrogen ("green" iron) in Namibia.[39] The funding guidelines do not guarantee imports from the funded projects to Germany.[40]

[35] The contractual delivery obligation takes effect from 2028. In 2027 and 2028, the supplier has the right to deliver additional quantities (so-called ramp-up quantities). Hint.co would be obliged to accept delivery in such cases.

[36] Renewables Now, "Fertiglobe says 100-MW Egypt hydrogen project set for FID in H1 2025", last retrieved on 15 October 2025.

[37] Split in four regional lots for Africa, Asia, South America/Oceania and North America as well as a global lot, Hint.co corporate website, last retrieved on 13 October 2025.

[38] The Ministry may only issue requirements that are permissible under European law. The Ministry was unable to impose further requirements vis-à-vis the EU Commission.

[39] Reply of the Federal Government to the minor interpellation presented by the Members of Parliament Cornelia Möhring, Dr. Dietmar Bartsch, Jörg Cezanne, further Parliamentarians and the group Die Linke, parliamentary records 20/14426 of 23 December 2024.

[40] With the amended funding guidelines of November 2024, the Ministry now requires that there is a link between hydrogen production and potential imports. According to the Ministry, however, this does not guarantee in the strict sense that the hydrogen produced will be imported into Germany.

### Resilience of energy supply[41]

The Federal Government wants to reduce critical dependencies arising from the import of energy sources and thus strengthen the resilience of energy supply. Reliable hydrogen imports require stable conditions in the supplier countries. Of the twelve potential supplier countries examined in a study for H2Global[42], three countries are considered politically, economically and socially stable or sustainable according to the Fragile States Index[43]; nine show a warning or alert status.

### Interim conclusion: supply fails to increase as planned

The Federal Government will likely miss its hydrogen production and import targets for 2030. A **domestic electrolysis capacity** of 10 GW will not be achieved by 2030. Instead, electrolysis capacity in Germany will probably be less than 5 GW in 2030. The instruments defined in the NHS 2023 fail to have a sufficient effect.

**Imports** will also not be able to meet the demand for **green hydrogen** projected in the NHS 2023, as the quantities available globally are insufficient. There is no indication so far that the measures taken by the Federal Government will significantly increase global supply:

→ The GHF failed to show any effect, as it has not yet started its activities.
→ As to H2Global, it is uncertain for the only lot already awarded whether and when the producer will make the FID for the project.
→ The funding guidelines for international hydrogen projects only relate to pilot projects. A large-scale additional production is thus not to be expected, at least in the foreseeable future.

Even if global supply increases following the use of the Ministry's instruments, there is no sufficient guarantee that the subsidised hydrogen will be used in Germany. Moreover, Germany could become highly dependent on supplies from politically, economically and socially unstable countries.

[41] In the context of a multi-annual audit focus, we audit the resilience of public core functions and of their critical infrastructure, including the energy sector. For us, resilience is the capacity to protect public core functions and their critical infrastructure (preventive component) and to react adequately on incidences (reactive component).
[42] Fraunhofer Institute for Solar Energy Systems ISE (2023): Site-specific, comparative analysis for suitable Power-to-X pathways and products in developing and emerging countries, A cost analysis study on behalf of H2Global; last retrieved on 15 October 2025. Countries surveyed are: Algeria, Australia, Brazil, Columbia; India, Morocco, Mexico, Namibia, Spain, South Africa, Tunisia, Ukraine.
[43] Fragile States Index, last retrieved on 15 October 2025.

## 2.2 Demand not as projected

The NHS 2023 expects hydrogen to be used in particular in the industrial sector and in power plants for generating electricity from hydrogen (hydrogen power plants). From the Federal Government's perspective, promoting demand for hydrogen plays a central role in stimulating a corresponding supply. The "chicken-and-egg dilemma" had to be overcome: in their investment decisions, potential producers needed to have sufficient confidence that customers would make investments of their own, and vice versa. This was only possible with government support.

### Industrial sector

The Ministry endorsed grants for four large steel manufacturers to decarbonise steel production. The subsidised steel producers intended to shift a part of their coal-based steel production to green hydrogen. The planned plants were to start operating with natural gas in 2026 and be gradually shifted to green hydrogen over a period of several years, starting in 2028. The hydrogen demand of the four subsidised projects was projected to exceed 18 TWh annually.

The Ministry considers these funding projects to be a decisive milestone for the ramp-up of the hydrogen economy. As long-term bulk buyers of green hydrogen, the funded projects are intended to stimulate the development of production capacities for green hydrogen and ensure the earliest possible baseline utilisation of the core network.

Meanwhile, doubts emerged that steel producers will meet the planned deadlines for the use of green hydrogen. Furthermore, in June 2025, one of the four steel producers announced that it would not be shifting its production as planned due to a lack of efficiency and the low availability of green hydrogen.[44]

In early October 2025, a large German energy company also announced its withdrawal from a planned green hydrogen project in Africa. In 2022, the company had signed a letter of intent with the project developer to purchase large quantities of green hydrogen in the form of ammonia starting in 2027. However, due to slower-than-expected demand, the company has adjusted its plans.[45] **Carbon Contracts for Difference** are another instrument with which the Federal Government aims to support the industrial use of hydrogen outside the steel industry. Over a period of 15 years, industrial companies are to be reimbursed for the additional costs of climate-friendly production plants compared to conventional plants. In 2024, the Ministry concluded such contracts with 15 companies in an initial bidding process, five of which intend to

[44] ArcelorMittal, press release "ArcelorMittal Europe drängt auf schnellere Umsetzung des Aktionsplans für Stahl und Metalle" (ArcelorMittal Europe urges faster implementation of the Action Plan for Steel and Metals), (in German only) of 19 June 2025.

[45] Tagesspiegel Background Energie & Klima: RWE zieht sich aus Wasserstoff-Projekt in Namibia zurück (RWE withdraws from hydrogen project in Namibia), news of 6 October 2025 (in German only).

shift their production facilities to hydrogen.[46] Contrary to its plans, the Ministry did not implement a further bidding process in 2024.

## Hydrogen power plants

In August 2023, the Ministry announced a 2026 power plant strategy that envisaged hydrogen power plants with a total installed capacity of 23.8 GW – 15 GW of which would be in the form of $H_2$-ready power plants that would initially be operated with natural gas but would shift to hydrogen by 2035.

In late 2024, the Ministry reduced its plans for the intended electrical generation capacity of hydrogen power plants to 7.5 GW by 2040.[47] In doing so, the Ministry assumed a (subsidised) hydrogen consumption of at least 3.5 TWh annually.

The current Federal Government instead intends to swiftly call for tenders for the construction of up to 20 GW of gas-fired power plant capacity, without specifying the technology to be used.[48] The government stated that it had so far refrained from specifying requirements for the immediate or later use of hydrogen, as the timely construction of additional gas-fired power plants was considered necessary to ensure a secure electricity supply.[49]

**Interim conclusion: demand does not rise as planned**

The Federal Government will fall far short of its goal of significantly increasing demand for hydrogen – with the industrial and energy sectors as the main drivers – by 2030:

→ One of the four major **steel projects** will not be implemented, and the schedule and scope of hydrogen use in the other three is questionable. The four projects alone accounted for an annual hydrogen demand of more than 18 TWh. Only one third of the **Carbon Contracts for Difference** concluded with industrial companies so far are intended to promote the use of hydrogen.
→ There are currently no plans any more to make it legally binding that **gas-fired power plants** must be gradually shifted to hydrogen. This means that another significant demand stimulus for the ramp-up of the hydrogen economy is missing.

[46] Economic Ministry, Wirtschaftsministerium vergibt Klimaschutzverträge, (Economic Ministry awards Carbon Contracts for Difference), last retrieved on 13 October 2025.
[47] Draft bill introducing tenders for secured power plant capacity (Power Plant Security Act): In the bill, the capacity of power plants for generating electricity from hydrogen was reduced to a total of 7.5 GW, of which 7 GW are $H_2$-ready power plants. The shift to hydrogen should take place between 2035 and 2040.
[48] Coalition agreement 2025, recital 1066 et seq.
[49] Tagesspiegel Background Energie & Klima: Reiche plant vereinfachte Ausschreibungen für neue Gaskraftwerke in diesem Jahr (Minister for Economic Affairs plans simplified tenders for new gas-fired power stations this year), (in German only), news of 22 July 2025.

Other applications will probably not be able to compensate for this lower demand for hydrogen in the foreseeable future. This means that demand for hydrogen beyond 2030 is also uncertain. The NHS 2023 approach, which aims to achieve additional supply of green hydrogen by promoting demand, has thus not been successful so far.

## 2.3 Infrastructure: core network plans too ambitious

The Federal Government stresses the need to provide the infrastructure required for hydrogen transport at an early stage. This should be done prior to the commissioning of production and application projects.

By 2032, a Germany-wide, efficient, swiftly realisable, expandable and climate-friendly **core network** is to be created to this end.[50] In October 2024, the Federal Network Agency approved the core network, which was planned on the basis of needs assessments and a scenario analysis.[51] The pipelines shall be put into operation in stages between 2025 and 2032.

The Federal Network Agency is supposed to review the approved core network in its "Gas and Hydrogen Network Development Plan" (network development plan) every two years, starting in 2026. If demand changes, it may postpone the commissioning of core network pipelines until 2037 or cancel them (flexibility option).[52]

### Planning of the core network

The approved core network includes pipelines with a total length of 9,040 km, of which 56 per cent are natural gas pipelines to be converted and 44 per cent are new pipelines to be built. The dimensioning is based on the projected feed-in and withdrawal capacities for the target year 2032.

### Feed-in capacity

In 2032, the feed-in capacity[53] of the core network is expected to be 101 GW, including:

**Pipeline-based imports (58 GW)** are to account for the majority of the feed-in capacity. To this end, the core network is to be connected to the planned hydrogen networks via four import corridors (North Sea, Baltic Sea, South-West Europe, Southern Europe) by 2030. However, an FID has not yet been made for the construction of European

[50] Section 28q para. 1 Energy Industry Act.
[51] The core network was modelled by the transmission system operators.
[52] Section 28q para. 8 Energy Industry Act.
[53] The feed-in quantity is the maximum amount of hydrogen that can be fed into the grid at a given point in time.

hydrogen pipelines with a direct connection to the German core network. Several European countries have postponed the commissioning of future hydrogen pipelines in the import corridors until after 2030 or stopped them entirely. For example,

- → the plan for a pipeline from Norway[54] was abandoned in September 2024;
- → a pipeline from the Netherlands[55] (Delta Rhine Corridor) is expected to be put into operation at least four years later, i.e. in 2032 at the earliest; and
- → in autumn 2024, the Federal Government expected the import corridors to be completed between 2032 and 2035.[56]

**"Other feed-ins" (19 GW)** include, in particular, imports of liquid hydrogen or its derivatives (ammonia, methanol) from other regions of the world via ship terminals. However, according to the Ministry, there are considerable technical challenges involved:

- → Large-scale shipping of liquid hydrogen has not yet reached commercial maturity.
- → Although the facilities required for converting ammonia into hydrogen ("crackers") are planned at several German port terminals, the Ministry does not expect the first large-scale commercial application in Germany before 2040.
- → The large-scale conversion of methanol to hydrogen also requires considerable development and demonstration projects.

**Electrolysers (15 GW)** for domestic hydrogen production are also expected to contribute significantly to the feed-in capacity of the core network.

## Withdrawal capacity

In 2032, the core network's withdrawal capacity[57] is expected to be 87 GW. Of this, 62 GW (71 per cent) will be linked to the demand of future hydrogen power plants. This demand corresponds to hydrogen power plants with an electrical capacity of 23.8 GW, as envisaged in the original 2026 power plant strategy (see no. 2.2). [58]

[54] Norwegen begräbt Pläne zum Export von ‘blauem’ Wasserstoff nach Deutschland (Norway scraps plans to export “blue” hydrogen to Germany), Tagesspiegel Background Energie & Klima of 24 September 2024 (in German only).

[55] Letter of the Dutch Minister for Economic Affairs to Parliament on the progress and procedure of the Delta Rhine Corridor of 27 June 2024, last retrieved on 14 October 2025.

[56] Reply of the Federal Government to the written question addressed to the Federal Government in September 2024, Question No. 9/428.

[57] The take-off capacity is the maximum amount of hydrogen, which can be drawn from the grid at a specific point in time.

[58] To provide an electrical generation capacity of 23.8 GW, power plants require a total hydrogen input capacity of approximately 60 GW, assuming an efficiency of 40 per cent.

## Temporal development of the core network

Assuming a linear relationship between the kilometres of pipeline to be built and the capacity of the core network, by 2030 – the target year of NHS 2023 – there would be 6,060 km of core network lines with a withdrawal capacity of 58 GW and a feed-in capacity of 68 GW (see Figure 4).[59]

Figure 4

# Two-thirds of the core network is supposed to be operational by 2030.

Of the total length of the core network planned for 2032, which is 9,040 km, over 6,000 km are expected to be in operation by 2030.

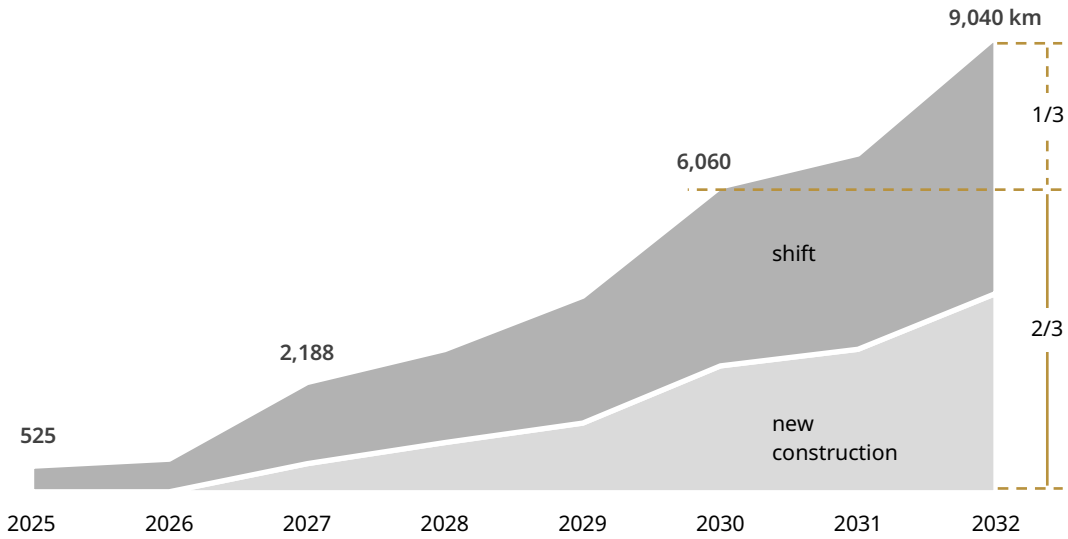



Chart: Bundesrechnungshof. Source: Federal Network Agency (as of 2024).

This 2030 network capacity will probably face a few industrial hydrogen applications with very low needs as to withdrawal capacity and domestic electrolysers with an expected feed-in capacity of less than 5 GW (see no. 2.1.1).

An expert opinion commissioned by the Federal Network Agency has shown that the schedule for the construction of the core network could be extended, particularly in the

[59] Feed-in quantity = (6,060 km / 9,040 km)*101 GW = 68 GW; take-off capacity = (6,060 km / 9,040 km)*87 GW = 58 GW.

case of pipelines leading to power plant sites.[60] In March 2025, the Expert Commission on Energy Transition Monitoring expected that the implementation period of the core network would very likely have to be extended.[61]

**Interim conclusion: core network plans too ambitious**

Given the slow start of the hydrogen economy, the development of the core network is too ambitious.

→ The planned **feed-in capacity** will not be needed in 2030 since the Federal Government's assumed production and import targets are likely to be missed by a wide margin (see no. 2.1). As to the import, this is not only due to a limited supply of hydrogen, but also to unresolved logistical and technical challenges: the construction of the first cross-border import pipelines is not expected to be completed until 2032. Plants for converting derivatives into hydrogen ("crackers") are still in the development phase.
→ The planned **withdrawal capacity** will not be needed in 2030 due to the lack of demand from the steel industry and hydrogen power plants.

## 2.4 Comments made by the Economic Ministry

The Ministry largely concurs with our assessment. It explained that due to geopolitical changes and regulatory uncertainties, the ramp-up of the hydrogen market had been significantly delayed compared to the overly optimistic planning assumptions. Since 2024, the Ministry had therefore mainly been focusing on establishing the market framework, for example for green and blue hydrogen. It added that it was also adapting existing funding instruments.

With these measures, the Ministry aims to enhance the framework conditions and increase predictability for enterprises. However, the measures could probably not compensate for the price difference between green and blue hydrogen and fossil fuel alternatives in the foreseeable future. The Ministry stated that this also applied to alternative decarbonisation options such as CCS, the economic viability of which, on a large scale, had yet to be proven. In view of the binding climate mitigation targets set at European and national level, the Ministry emphasised that there was no alternative to decarbonising industry, the energy sector and the building and transport sectors. It

[60] Fraunhofer IEG and Fraunhofer ISI, Gutachten "Hintergrundszenarien zur Festlegung des Hochlaufentgelts im Wasserstoff-Kernnetz" (expert opinion "Background scenarios for determining the ramp-up fee in the hydrogen core network) of 15 March 2025 (in German only), (expert opinion for the Bundesnetzagentur in connection with the financing of the core network), p. 11.
[61] Expert commission on energy transition monitoring, Statusupdate zum Stand der Energiewende vom März 2025, (Status update on the progress of the energy transition as of March 2025) p. 20. (in German only).

explained that without the use of green and blue hydrogen, the climate targets enshrined in the Climate Protection Act could not be achieved.

The Ministry confirmed that the **supply of hydrogen** (see no. 2.1) could probably not meet the demand projected in the NHS 2023. However, it stated that demand was also significantly lower than anticipated.

The Ministry explained that the global production potential of projects without FID corresponded to a multiple of the projected demand in Germany. It added that planned projects often only received an FID if an offtake agreement was in place. The Ministry emphasised that the aim of the funding was to achieve an FID for more projects. It reported that, for example, the developer of the H2Global project "Egypt Green Hydrogen" had stated in the first quarter of 2025 that the probability of an FID was over 90 per cent.

The Ministry stated that it was very likely that a significant proportion of the green hydrogen production funded in projects abroad would be used in Germany, as Germany was one of the most important hydrogen importers. It reported, for example, that German customers had already indicated interest in "green" iron from the Namibia funding project.

With regard to **resilience**, the Ministry recognised the need to diversify hydrogen imports across a wide range of regions. Accordingly, it explained that the second H2Global auction tendered lots for Africa, Asia, South America, Oceania and North America, among others, in order to reduce dependencies on individual regions and default risks. The Ministry added that there were also promising supplier countries in Europe, including those of the Iberian Peninsula and Denmark.

The Ministry attributed the **low demand for hydrogen** (see no. 2.2) until 2030 to higher hydrogen costs, construction delays and unforeseen developments such as the customs dispute with the USA. It stated that the remaining three subsidised steel companies continued to pursue their projects and planned to complete them. The Ministry added that it was revising its funding programmes for industry decarbonisation, including the instrument of Carbon Contracts for Difference.

In its comments, the Ministry failed to address the significance of the **power plant strategy** as a key driver of demand. However, it criticised that we did not address the interdependency between CCS and hydrogen as decarbonisation options in further network planning. It explained that multiple parallel infrastructures for hydrogen and CCS with high and expensive vacancy rates needed to be avoided.

The Ministry acknowledged that the **development of the core network** was proceeding too ambitiously (see no. 2.3). For necessary adjustments, it referred to the Federal Network Agency's network development planning. However, the Ministry

stated that, with regard to pipeline-based hydrogen imports, our assessment was not up to date: the Ministry explained that it had established cooperation formats with European and African partner countries and was pushing ahead with developing import corridors. It added that an integrated electricity and hydrogen planning was planned in the North Sea region.

Pursuant to its **10-point plan** (see no. 1.3), the Ministry stated that it intended to eliminate "overly complex requirements", e.g. as to the definition of "green hydrogen" at EU level. It added that blue hydrogen was to be treated equally. The Ministry explained that it planned to replace the target of 10 GW of electrolysis capacity with flexible targets based on projects on the demand side in Germany. It noted that the use of CCS should be extended beyond sectors with emissions that are difficult or impossible to avoid to include power plants and energy producers. The Ministry stressed that the plan also provided for the core network and import corridors to be developed in stages and closely aligned with demand trends.

## 2.5 Concluding audit findings and recommendations

The Federal Government cannot guarantee the planned ramp-up of the hydrogen economy in the foreseeable future. In response to the lack of market incentives, the Federal Government has provided extensive support for supply, demand and infrastructure, and has thus followed, in practice, a planned economy approach. However, the momentum required for the intended ramp-up has so far largely failed to materialise. The ramp-up is significantly lagging behind the goals. On the supply side, the Federal Government will fail to reach its production and import targets for 2030. Demand will be considerably lower than projected in the NHS 2023. In light of this, the development of the core network is overly ambitious.

The Ministry largely concurred with our assessment. The objections raised by the Ministry on individual points do not change our assessment:

**Hydrogen supply** (see no. 2.1): The Ministry's reference to the fact that demand for hydrogen is also developing less strongly than expected is not convincing. If supply and demand remain synchronised but at a low level, the hydrogen economy cannot make the expected contribution to climate neutrality.

In our view, the Ministry’s reference to global projects for the production of green hydrogen without FID is also unconvincing. This is because the IEA considers the probability of projects without FID being realised by 2030 to be very low (see no. 2.1.2). Regarding the “Egypt Green Hydrogen” project, the project developer has been stating in its corporate reports since the second quarter of 2022 that the probability of an FID being made exceeds 90 per cent. A binding supply contract with Hint.co has existed for this project since August 2024. Nevertheless, the FID has not yet been made. In

addition, there is no binding requirement to link the funding of hydrogen with its use in Germany, neither in the H2Global program nor in the other initiatives.

In terms of resilience, we acknowledge the Ministry's efforts to minimise dependence on specific supply regions and mitigate default risks by relying on the H2Global initiative. For these efforts to be successful, funding would need to be awarded to bids from low-risk regions in the current auction round, and these projects would need to be actually implemented. However, in light of the currently increasing number of global project cancellations, this is at least doubtful. According to the Ministry, several European supplier countries appear promising. However, the transport infrastructure required for imports from these countries will be operational only after 2030 (see no. 2.3).

**Hydrogen demand** (see no. 2.2): The delayed ramp-up in industrial demand is undisputed. However, the Federal Government fails to recognise its own influence on hydrogen demand beyond funding programmes: As long as the Federal Government does not stipulate that gas power stations must shift to hydrogen in the future, a key driver of demand for hydrogen producers will be missing. This means that an essential prerequisite for achieving the predictability for hydrogen producers, targeted by the NHS 2023, is lacking.

We share the Ministry’s assessment that costly multiple parallel infrastructures should be avoided. We emphasise that this risk is likely to increase. This is particularly due to the fact that the Ministry now appears to be increasingly pursuing the use of CCS, alongside the prospect of shifting gas power stations to hydrogen. Without binding provisions on the future use of hydrogen, the Federal Network Agency is unable to design the core network in line with demand. This creates the risk of pipelines being underutilized or not used at all, along with the development of additional infrastructure for CCS.

**Core network planning** (see no. 2.3): There is agreement that the previous core network planning has been too ambitious. With regard to international pipeline projects, we demonstrated, based on specific reports on delays, that none of the import corridors planned for 2030 will be operational as intended. The Ministry did not provide information indicating otherwise. We do not doubt that the activities cited by the Ministry may potentially support the commissioning of pipelines beyond 2030.

**Overall**, the Federal Government’s strategy for a government-planned ramp-up of the hydrogen economy has so far not been successful. As a result, the Ministry already announced that it would adjust the market framework and its mix of policy instruments. However, despite the Ministry’s comments and the 10-point plan, the details remain largely unclear. We expect that it will be very time-consuming to design the announced measures, potentially coordinate them with the European Commission, and then implement them in concrete terms. This applies, for example, to the intended

changes in regulatory provisions or Carbon Contracts for Difference. It is thus already foreseeable that these measures are unlikely to significantly increase supply and demand until the end of the decade at the earliest. At the same time, the Ministry itself does not consider its actions to be sufficient to offset the price disadvantage of hydrogen compared to alternatives in the foreseeable future (for details, see no. 3).

Against this backdrop, the ramp-up of the hydrogen economy is likely to be associated with significant uncertainty, even after the target year of 2030.

**Recommendations**

In order to ensure a hydrogen supply that is as secure as possible (Section 1 of the Energy Industry Act), the Federal Government must subject its hydrogen strategy and its implementation so far to a reality check. In this programme evaluation, the Federal Government must

→ **review key assumptions and goals**, including national production capacity, imports, demand and infrastructure. The goals should remain ambitious, but also be realistic. In doing so, the Federal Government should reassess the overall contribution that the hydrogen economy can make to the energy transition. This includes the question of whether new technologies could offer alternative ways to decarbonise sectors that were previously expected to rely on hydrogen.
→ analyse **interactions with its overall energy policy** and ensure a coherent approach. For example, domestic production of green hydrogen requires significant amounts of affordable electricity from renewable sources. Furthermore, the Federal Government must minimise the risk of costly multiple parallel infrastructures associated with the use of other decarbonisation options (e.g. blue hydrogen and CCS).
→ prepare a **plan B**. If the Federal Government is unable find solutions to the existing challenges, it will need alternatives in time to achieve climate neutrality by 2045 without relying on a permanently subsidised hydrogen economy.

When revising its hydrogen strategy, the Federal Government should ensure that

→ its **instruments** effectively increase the **supply of hydrogen**. Import promotion should demonstrably lead to meeting demand in Germany and contribute to the resilience of the energy supply.
→ it coherently designs **the approach of demand-oriented** hydrogen policy. For example, without clear provisions for the gradual shift of gas power plants to hydrogen, the necessary driver for demand is likely to be lacking.
→ the **ramp-up** of supply, demand, and infrastructure is designed as **synchronised** as possible. The imminent **network development planning** must adequately take into account the actual development of supply and demand.

When readjusting its strategy, the Federal Government should also **take industrial policy considerations into account**. In doing so, it should ensure the necessary resilience of Germany and Europe.

Given the climate-related, economic and fiscal significance of the hydrogen economy, the Federal Government should eventually implement the monitoring of the ramp-up of the hydrogen economy as laid out in its national hydrogen strategy 2020. Only if the government continuously monitors whether the ramp-up of the hydrogen economy is successful can it take corrective action in the event of undesirable developments. This monitoring must meet the budgetary requirements for programme evaluations as stipulated in Section 7 of the Federal Budget Code.

# 3 Affordable supply

Currently, green hydrogen is not a competitive source of energy – neither in comparison to natural gas nor to hydrogen of other colours. To ensure that the ramp-up of the hydrogen economy can still be a success, the budget legislator made available a total of €4.3 billion in 2024 alone, and more than €3 billion in 2025. The Federal Government has also made significant commitments of several billion euros annually for the period ending in 2030. The commitments result, for example, from pledges to promote domestic electrolysers in the IPCEI Hydrogen (€2.2 billion), imports via H2Global (€3.1 billion) and the decarbonisation of steel production by three steel manufacturers (€5.6 billion).

Regardless of these facts, the required market momentum has not yet materialised (see no. 2).

## 3.1 Hydrogen will remain expensive in the future: long-term funding probable

Expectations that green hydrogen will be price-competitive in the future have not yet been fulfilled: While in 2021 production costs[62] in Central Europe of less than €90 per

[62] Production costs are the total costs (investment and operating costs) of hydrogen production in relation to the amount of hydrogen produced.

megawatt hour (MWh) were projected for 2030, studies currently assume two to three times that amount.[63]

## Comparative calculation for hydrogen imports

With a view to the future price attractiveness of hydrogen and hydrogen derivative imports, we carried out a comparative calculation for the alternative use of natural gas:

- → As to the **costs of hydrogen and hydrogen derivative imports**, we used a study by the Fraunhofer Institute for Solar Energy Systems ISE.[64] Pursuant to this study, the provision costs[65] in 2030 will be between €137 and €318 per MWh.
- → To **estimate natural gas prices**, we used exchange prices on the futures market for the year 2030.[66] These range between €23 and €30 per MWh.
- → The **price of EU emission allowances** (EUA), which must be purchased when using natural gas, is based on estimates made by the Potsdam Institute for Climate Impact Research (PIK) and the price information service ICIS. These range between €90 and €170 per tonne. This corresponds to €20 to €37 per MWh.

The comparative calculation shows a difference between the maximum natural gas price (including EUA) and the minimum hydrogen import price of around €70 per MWh. The difference between the respective average prices is over €170 per MWh. The largest difference between the natural gas price and the hydrogen import price is €275 per MWh (see Figure 5).

[63] BCG (2023), Turning the European Green Hydrogen Dream into Reality: A Call to Action; FfE (2025): Von der Theorie zur Praxis: Warum grüner Wasserstoff teurer ist als gedacht (from theory to practice: why green hydrogen is more expensive than expected), (in German only). Information in the source: 3 €/kg. Converted by the Bundesrechnungshof (conversion factor: 33.33 kWh/kg).

[64] Fraunhofer Institute for Solar Energy Systems ISE (2023): Site-specific, comparative analysis for suitable Power-to-X pathways and products in developing and emerging countries, A cost analysis study on behalf of H2Global: The study examines the production, transport and delivery costs for hydrogen and its most important derivatives (including liquid hydrogen, ammonia and methanol) for twelve possible supplier countries within and outside Europe (including Spain, Namibia and Australia) for the year 2030.

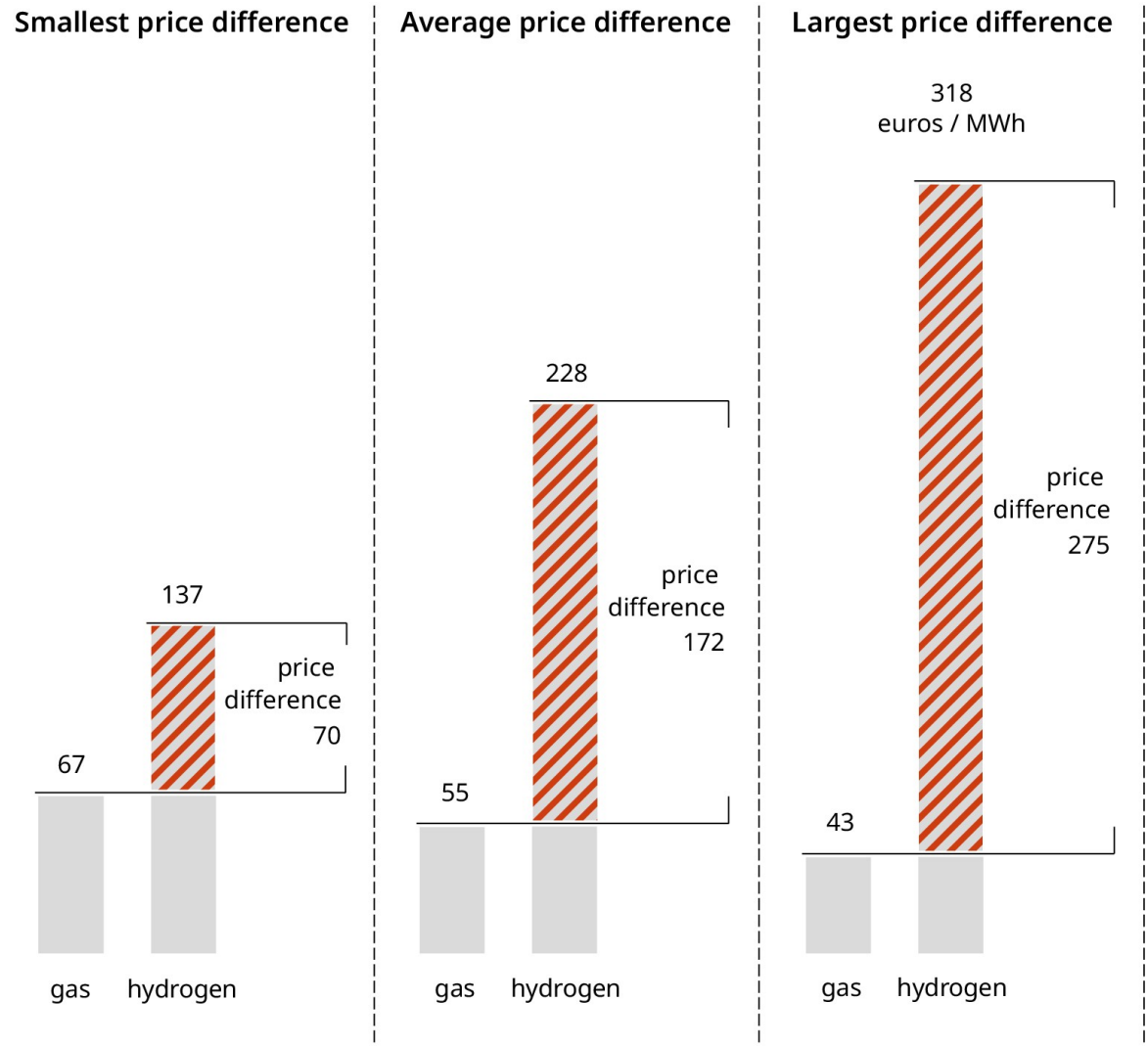
[65] Including transport to Germany.

[66] ICE Endex Gas TTF Yearly Futures - quotations (in the trading period 29 December 2023 – 25 September 2025; last retrieved on 26 September 2025. The TTF natural gas futures contract is the most liquid European natural gas benchmark.

Figure 5

# Imported hydrogen will not be attractive in terms of price in 2030

Based on current projections and price signals for 2030, the price differences between imported hydrogen and natural gas (including emission allowances) are likely to be significant, ranging between €70 and €275 per MWh.




Explanation: Natural gas price based on futures prices, plus the price of EU emission allowances according to estimates made by PIK and ICIS; Range of provisioning costs for hydrogen ($H_2$), liquid hydrogen ($LH_2$), ammonia ($NH_3$) and methanol (MeOH), including transport to Germany by pipeline ($H_2$) and ship (derivatives); Price differences do not take into account transport costs to the point of consumption within Germany.

Chart: Bundesrechnungshof. Source: Fraunhofer ISE; ICE Endex; PIK; ICIS; Federal Office of Economic Affairs and Export Control.

In order for hydrogen imports to be attractive in terms of price, the price difference would have to be offset. If this is done through government funding and based on the volume targets of the import strategy, the funding need for 2030 would be between €3 billion and €25 billion. Otherwise, the prices for EUA would have to rise to between €500 and €1,300 per tonne to compensate for the price difference between natural gas and hydrogen. Currently, the price is below €80 per tonne.

A study on hydrogen costs provides comparable results.[67] It assumes that green hydrogen may cost a maximum of around €90 per MWh[68] in the medium and long term. Otherwise, its use will be inefficient, taking into account the projected prices of natural gas and EUA. The study considers domestic production costs for green hydrogen of €90 per MWh to be possible only between 2040 and 2050, even taking into account significant regulatory measures.

**Interim conclusion: Hydrogen will remain expensive in the future – permanent funding probable**

Green hydrogen will probably not be produced or imported at competitive prices in 2030 and beyond. This means that private sector players do not have any incentive to invest in the hydrogen economy.

The Federal Government will thus have to provide substantial funding to the hydrogen economy in the medium to long term. The funds required to offset the price difference between green hydrogen and natural gas in 2030 could amount to between €3 billion and €25 billion for imports alone. High funding needs would also be likely in subsequent years.

## 3.2 Financing the core network: considerable risks for the federal budget

### Background and basic idea

Both the electricity and natural gas networks are generally financed by fees paid by network users (network charges). Since both networks have numerous industrial and private users with high overall consumption, the network costs are distributed among many users.

[67] Öko-Institut, Deloitte, "Wasserstoff-Erzeugungskosten. Determinanten, Stand und Perspektiven" (Hydrogen production costs. Determinants, status and prospects), last retrieved on 13 October 2025 (in German only).
[68] Information in source: 3€/kg. Converted by the Bundesrechnungshof (conversion factor: 33.33 kWh/kg).

In the future, the core network is also supposed to be funded solely by means of network charges. The hydrogen economy is currently still under construction, which means that the network costs are distributed along a small number of users. This is because hydrogen producers and consumers will only connect to the core network when doing so is economically worthwhile. Network charges that would enable network operators to cover their network costs[69] would thus be comparatively high.[70]

In order to encourage the construction and use of the core network, the Federal Government has developed an "intertemporal cost allocation mechanism" (financing mechanism):

→ In the **"ramp-up phase"**, network charges will initially be capped. To this end, a uniform nationwide ramp-up charge will be set. The difference between the network costs and the revenues from network charges will be reimbursed to the hydrogen core network operators (core network operators) from a loan provided by the Kreditanstalt für Wiederaufbau (KfW) which is guaranteed by the Federal Government. The transactions will be processed via a so-called amortisation account.
→ In the subsequent **"repayment phase"**, the ramp-up charge is intended to generate revenues that exceed the network costs. The surplus is to be used to repay the loan from the ramp-up phase. The repayment phase requires that a sufficient number of users have connected to the network.

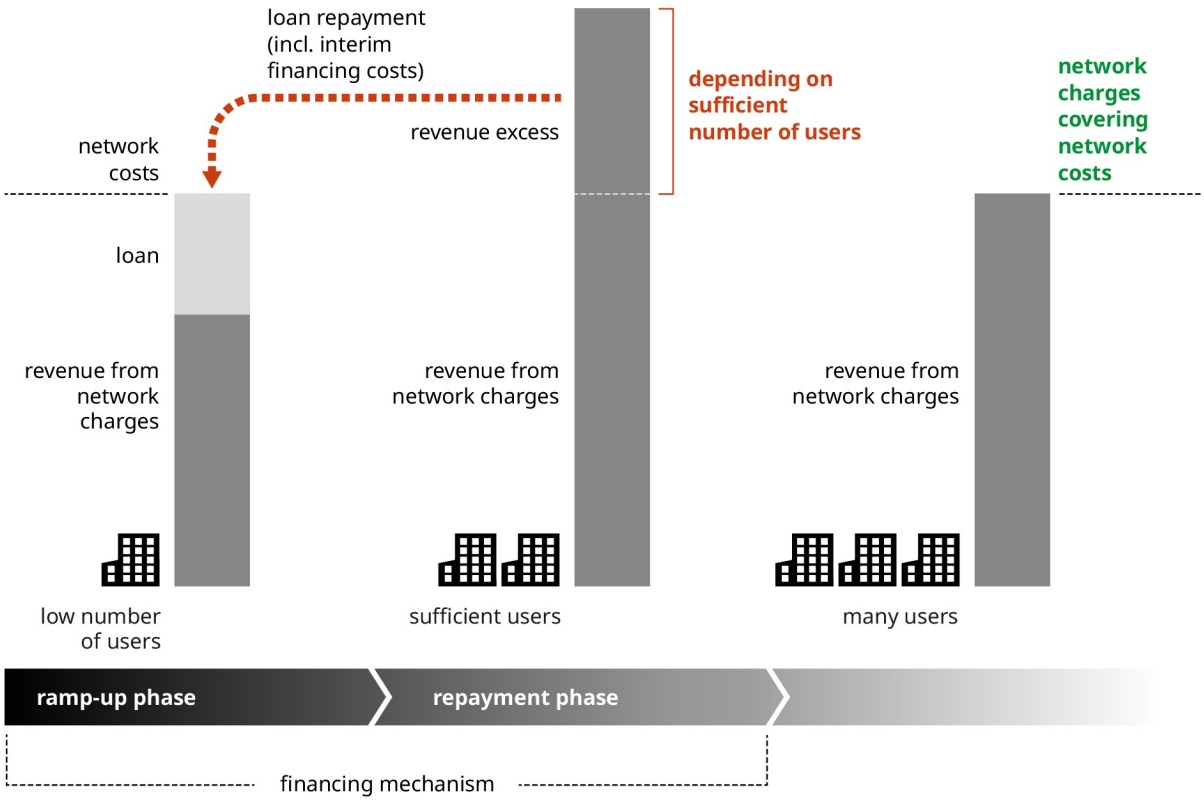
The ramp-up charge shall be set in such a way that the repayment phase can be completed by 31 December 2055. Overall, the financing mechanism is to be fully “self-sustaining on a private-sector basis" (see Figure 6).

[69] Pursuant to Section 14 of the Hydrogen Network Tariffs Ordinance, the network costs are approved by the Bundesnetzagentur.
[70] For the sake of simplicity, such network charges are referred to below as ‘network cost-covering’".

Figure 6

## Financing mechanism with risks

During the ramp-up phase, the core network operators receive a part of their network costs from a government-guaranteed KfW loan. The loan is to be repaid during the repayment phase from excess network charge revenues. However, this requires that a sufficient number of users connect to the network.




Explanation: This is a schematic representation of the ideal process. No quantitative conclusions may thus be drawn from the quantities and areas depicted.

Chart: Bundesrechnungshof. Source: Sections 28r and 28s Energy Industry Act.

### Implementation of the financing mechanism

**Three players** have a key role in implementing the financing mechanism:

→ The newly incorporated enterprise **H2 Amortisationskonto GmbH** (abbreviated in German: **AMKG**) compensates core network operators for the difference between the

network costs and their revenues from network charges during the ramp-up phase.[71] AMKG made its first payment of €172 million in March 2025. The next payment is scheduled for March 2026.[72]

→ **KfW** grants a state-guaranteed loan of up to €24 billion to AMKG. As to this assignment transaction[73], the Federal Government indemnifies KfW against all burdens and risks.[74] On 26 November 2024, KfW concluded a corresponding loan contract with AMKG.

→ The **Federal Network Agency** sets the charges for using the core network during the ramp-up and repayment phases.[75] The Agency shall review the ramp-up charge every three years starting on 1 January 2028.

## Risks in the financing mechanism

### Network underutilisation increases costs of interim financing

In addition to the costs of network expansion and operation, the financing mechanism also causes costs for the interim financing by means of the loan. These are significantly influenced by the KfW's refinancing rates and the actual interim financing needs. In an expert opinion commissioned by the Ministry, the expert estimated the costs of interim financing until 2055 to be between €5.0 billion and €16.3 billion.[76]

If the ramp-up of the hydrogen economy proceeds as planned and the KfW loan can be repaid by year-end 2055, the network users will bear these costs. Whether the financing mechanism will be "self-sustaining on a private-sector basis" over the long term, as envisaged by the Federal Government, depends largely on the scope and timing of the expansion and the use of the core network.

The Ministry's expert stated that an underutilisation of the network (e.g. due to premature construction vis-à-vis supply and demand trends) poses major challenges to financing.[77] Pursuant to the Agency, network costs and interim financing costs could be

[71] The shareholders of AMKG are the core network operators participating in the financing mechanism – either indirectly via Trading Hub Europe GmbH or directly. The role as a shareholder of AMKG is a prerequisite for participation in the financing mechanism.

[72] AMKG, publication of the AMKG on its website, last retrieved on 15 October 2025.

[73] Assignment transaction of 21 November 2024 pursuant to Section 2 para. 4 of the KfW Act (Law Concerning Kreditanstalt für Wiederaufbau).

[74] Also, on 21 November 2024, the Federal Government and KfW signed a warranty and indemnity agreement.

[75] In July 2025, the Bundesnetzagentur has set a fee of 25 Euro/kW per year. Beschluss (decision) of the Große Beschlusskammer Energie of 14 July 2025 in the determination proceedings "to determine the ramp-up fee for the hydrogen core network" (reference number GBK-24-02-2#4).

[76] Fraunhofer IEG, Fraunhofer ISI, ConGas Consulting, Consentec GmbH, "Gutachten zur Validierung eines Konzepts zur privatwirtschaftlichen Finanzierung des Aufbaus eines Wasserstoff-Kernnetzes bei subsidiärer staatlicher Absicherung" (expert opinion on the validation of a concept for private-sector financing of the development of a hydrogen core network with subsidiary state guarantees), (in German only) of 14 February 2024 (expert opinion for the Economic Ministry in connection with financing the core network), p. 45.Last retrieved on 15 October 2025.

[77] Expert opinion for the Economic Ministry in connection with financing the core network, p. 61.

reduced if lower demand were to be addressed by not building pipeline sections or building them later than originally planned when endorsing the core network licence.[78]

An expert opinion commissioned by the Agency has already established that underlying key assumptions have changed fundamentally since the core network was planned. Therefore, the expert opinion considered that it would be possible to extend the timeframe for the core network expansion, particularly for pipelines leading to power plant sites.[79]

### Indirect promotion via parallel funding of supply and demand required

If the Federal Government refrained from providing direct funding to finance the core network, the financing mechanism would only be successful if supply, demand and storage of hydrogen were subsidised by the government during the ramp-up phase, so the expert opinion.[80] The experts argued that such subsidies would allow the government to indirectly fund the core network. The experts also noted that otherwise network usage could be unaffordable for individual users despite the financing mechanism.

### Failure of the financing mechanism

If the repayment phase is not completed by 31 December 2055, the financing mechanism will be deemed to have failed. If it becomes obvious beforehand that the ramp-up of the hydrogen economy will fail, the Federal Government has the right to terminate the financing mechanism at an earlier stage – for the first time on 31 December 2038, and thereafter annually with effect from the end of the following year.[81]

In both cases, the Federal Government will bear at least 76 per cent of the remaining shortfall amount[82] in the amortisation account – and thus the financial risk. The core network operators will bear a maximum risk share of 24 per cent.

This means that the government will have to bear at least €18 billion if the ramp-up of the hydrogen economy fails, the €24 billion loan has already been drawn down in full and repayment has not yet begun.

[78] Bundesnetzagentur, Beschluss (decision) of the Große Beschlusskammer Energie of 14 July 2025 in the determination proceedings "to determine the ramp-up fee for the hydrogen core network" (Reference number GBK-24-02-2#4), recital 47.
[79] Expert opinion for the Economic Ministry in connection with financing the core network, p. 11 and p. 69.
[80] Expert opinion for the Economic Ministry in connection with financing the core network, p. 61.
[81] Section 28r para. 7 Energy Industry Act.
[82] The shortfall includes interim financed network costs and the costs of interim financing.

The government does not currently consider it necessary to reflect potential financial obligations resulting from a future failure of the financing mechanism in the federal budget.

**Interim conclusion: Funding the core network leads to considerable risks for the Federal Government**

The development of the core network is linked to considerable burdens and risks for the federal budget. Contrary to the Federal Government's claims, the core network is only funded exclusively by the private sector at first glance:

→ Even if the ramp-up of the hydrogen economy were a success, the Federal Government would have indirectly subsidised the core network with considerable budgetary resources: the success of the financing mechanism requires substantial federal support for the supply, demand and storage of hydrogen.
→ A premature development of the core network with foreseeable underutilisation will lead to unnecessarily high network costs and interim financing costs. This jeopardises the success of the financing mechanism.
→ If the ramp-up of the hydrogen economy fails, the financing mechanism for the core network could burden the federal budget with a double-digit billion-euro amount.

## 3.3 Comments made by the Economic Ministry

In essence, the Ministry concurs with our assessment that neither green nor blue hydrogen are likely to be competitive in the foreseeable future.

With regard to the **risk of permanent funding** (see no. 3.1), the Ministry has pointed out that the federal budget could not bear such long-term subsidies. It noted that although the price development of hydrogen was subject to great uncertainty, the need for subsidies was likely to decrease significantly. Pursuant to the Ministry, this was because more flexible regulation, strong international competition and expected economies of scale in the production of electrolysers, as well as low electricity prices in times of high supply of electricity from wind power and photovoltaics, would have considerable cost-reduction potential.

The Ministry noted that prices for imports of blue hydrogen could also continue to fall as competition intensified and clear framework conditions were established. Pursuant to the Ministry, tenders issued by the European Hydrogen Bank had already revealed a funding gap of well below €30 per MWh[83]. The Ministry stated that we had only briefly highlighted this potential for falling production costs. It also indicated that the

[83] Information: 1€/kg. Converted by the Bundesrechnungshof.

willingness of customers to pay was also a decisive factor when estimating the need for subsidies, which ranged from €150 to – in individual cases – €240 per MWh[84].

The Ministry fundamentally acknowledged the **considerable risks to the federal budget** posed by the **financing mechanism** for the **core network** (see no. 3.2). It indicated that if the Federal Network Agency used the legal options for extending the timeframe for the expansion of the core network, this would significantly reduce the costs and financial risks for the Federal Government.

In line with its **10-point plan**, the Ministry also stated that it would, for example, wish to focus initially on markets where there was either a high willingness to pay for hydrogen (e.g. refineries) or where demand could be stimulated at a financially reasonable cost.

## 3.4 Concluding audit findings and recommendations

The Federal Government cannot guarantee an affordable supply of hydrogen with its action taken to date. Although it promotes the ramp-up of the hydrogen economy with many billions of euros per year, the necessary momentum on both the supply and demand sides has been lacking.

The Ministry largely concurred with our assessment. The various objections made by the Ministry do not change our view:

**Risk of permanent funding** (see no. 3.1): The Ministry's assessment that hydrogen prices will develop positively is not convincing. Current studies assume that production costs will rise rather than fall by 2030. Previous projections as to economies of scale in the production of electrolysers have proven to be overly optimistic.[85] Low prices for electricity from renewable energies require sufficient availability of appropriate generation facilities. It is questionable to what extent the expansion targets for such energy facilities will be achieved at international and national level.[86] At the same time, electrolysers in Europe will compete with other applications such as heat pumps and electromobility for the use of cheap electricity. Against this background, it is doubtful whether there will be significant cost reductions.

[84] Information provided by the Economic Ministry: 5 to – in individual cases – 8€/kg. Converted by the Bundesrechnungshof (conversion factor: 33.33 kWh/kg).

[85] See Abschließende Prüfungsmitteilung zu der Prüfung der Wasserstoffstrategie und deren Umsetzung – Teil 2: Strategische Steuerung des Markthochlaufs von grünem Wasserstoff (concluding management letter on the audit of the hydrogen strategy and its implementation – part 2: strategic management of the market ramp-up of green hydrogen), (in German only) of 7 October 2024, cf. No. 4.

[86] We have stated several times that the expansion targets for electricity generation from renewable energies will not be achieved in Germany. See Information über die Entwicklung des Einzelplans 09 (Bundesministerium für Wirtschaft und Energie) für die Beratungen zum Bundeshaushalt 2025 of 16 July2025, cf. No. 3.3.2. (information on the development of the departmental budget 09 - Econocmic Ministry) for the deliberations on the federal budget (in German only).

The low funding need stated by the Ministry in auctions published by the European Hydrogen Bank remains subject to considerable uncertainty. This is because three of the projects that have received funding to date have already been withdrawn. These accounted for more than 20 per cent of the total capacity awarded.

We assume that rational actors will choose the lower-cost option of two. The willingness to pay for hydrogen thus hinges on the alternative costs for natural gas. The willingness to pay €150 to €240 per MWh for hydrogen, as cited by the Ministry, is contrasted by alternative costs for natural gas of €43 to €67 per MWh (including EUA) (see no. 3.1). Especially in view of the international competition, we believe that the high willingness to pay, as claimed by the Ministry, is only plausible if further subsidies are granted, e.g. in the form of investment grants.

**Financing the core network** (see no. 3.2): The Ministry did not disagree with our statement that the development of the core network would in any case place a burden on the federal budget. If the ramp-up failed, the burden could run into tens of billions of euros. This would considerably restrict future budget legislators' scope for action.

The statement that the Federal Network Agency could reduce costs and risks for the Federal Government falls short. The Federal Government is responsible for energy policy decisions, such as the use of hydrogen in power plants. Such decisions are a relevant input for the Agency's network development planning. In its comments, the Ministry did not address this aspect.

Overall, green hydrogen will not be able to be produced or imported at competitive prices in the medium term. This means that the hydrogen industry likely needs to receive substantial federal funding until at least the 2030s. This would place a massive burden on the federal budget.

**Recommendations**

In order to ensure a hydrogen supply that is as affordable as possible (Section 1 of the Energy Industry Act), the Federal Government must subject its original **assumptions and measures** taken so far to a reality check. In this programme evaluation, the Federal Government especially must

→ review its assumptions as to whether and when the costs of green hydrogen are likely to fall to a competitive level and the hydrogen economy can reach a "self-sustaining market equilibrium" without depending on subsidies. This also includes having a plan B (see no. 2).
→ avoid unnecessary costs and financial risks – in line with the principle of economic efficiency – when taking action to promote supply and demand and establish the core network.

→ clearly state the costs and risks of the planned hydrogen economy. This will help to strengthen the acceptance of the energy transition. In particular, the Federal Government should clearly communicate who (market participants, taxpayers) is likely to bear the costs and for how long.

The Federal Government should avoid comprehensive subsidising of the hydrogen economy in the long-term.

# 4 Climate neutrality und environmental sustainability

Hydrogen is expected to make a significant contribution to achieving climate neutrality (see no. 4.1). At the same time, green hydrogen has a wide range of effects on numerous other environmental assets. For example, hydrogen production requires large amounts of water and affects biodiversity (see no. 4.2).

## 4.1 Uncertain climate impact of hydrogen

Green hydrogen has the potential to be produced and used in a climate-neutral way. However, when the entire value chain is taken into account, there is a risk that hydrogen, too, could result in significant greenhouse gas emissions. According to a study by the Potsdam Research Institute for Sustainability (RIFS) from October 2024, hydrogen that escapes into the atmosphere acts as an indirect greenhouse gas and is highly harmful to the climate. The study found that two-thirds of the potential emissions were attributable to the hydrogen import chain. As a result, the hydrogen economy itself could become a threat to the climate.[87]

The Ministry acknowledges gaps in knowledge regarding the climate impact of hydrogen production, transport and use. It emphasises the relevance of addressing research needs, continuously analysing associated risks, and, if necessary, implementing further regulatory measures.

[87] RIFS, "Controlling Emissions in Germany's Future Hydrogen Economy", October 2024; Tagesspiegel Background Energie & Klima of 18 November 2024, "Wasserstoff – Klimaschützer, Klimakiller" (hydrogen – climate protector, climate killer); the German Environment Agency (UBA) also noted that importing green hydrogen is associated with significant greenhouse gas emissions: "Welche Treibhausgasemissionen verursacht die Wasserstoffproduktion?" (what greenhouse gas emissions does hydrogen production cause?) of 30 November 2022, p. 9. (in German only).

Despite the existing knowledge gaps, the Ministry believes that replacing fossil fuels with green hydrogen is advantageous overall. To support this view, the Ministry refers to an analysis carried out by the German Institute for Applied Ecology.[88] This analysis examines emissions in Germany based on the territorial principle. The researchers emphasise that importing (green) hydrogen to Germany can already involve significant upstream emissions.

**Interim conclusion: Climate risks from hydrogen imports**

The climate impact of hydrogen production, transport and use is highly uncertain. Studies suggest that green hydrogen can be associated with significant upstream emissions, particularly when it is imported. This undermines the goal of achieving a climate-neutral energy supply as the Federal Government intends to meet at least half of its projected hydrogen demand through imports.

## 4.2 Possible negative effects on other protected assets

Hydrogen has a wide range of effects on other environmental assets. For example, hydrogen production requires large quantities of water. According to the IEA, around 40 per cent of the low-emission hydrogen projects planned for 2030 are located in regions facing water scarcity. Climate change could lead to more regions becoming water-scarce in the future.[89] As a result, developers of electrolysis projects rely on seawater desalination. In addition to fresh water, seawater desalination also produces large quantities of concentrated brine. The brine is returned to the sea, where it can have negative effects on the marine environment, for example by damaging fishing grounds.[90]

### The Federal Government's sustainability requirements for imports

In order to reduce negative environmental effects of the hydrogen economy, the Federal Government aims at establishing internationally ambitious sustainability standards. For example, in the H2Global initiative, the Ministry required hydrogen producers to comply with strict sustainability criteria.

These criteria were adjusted during the first tender round, following consultations with the Ministry, in order to attract more bids. The changes primarily affected criteria

[88] Öko-Institut (2024), „Einordnung zur Treibhausgaswirkung von Wasserstoff“ (assessment of the greenhouse gas effect of hydrogen), (in German only).
[89] IEA, Global Hydrogen Review, p. 90.
[90] Lattemann, S.: “Meerwasserentsalzung” (seawater desalination) in WARNSIGNAL KLIMA: Genug Wasser für alle? (enough water for everyone?) 3rd edition (2011) – Published by Lozán, J. L. H., Graßl, P. Hupfer, L. Karbe & C.-D. Schönwiese; 7 May 2025 (in German only).

relating to biodiversity protection and the use of electricity from renewable energy sources.

**Interim Conclusion: Concessions on Sustainability Requirements**

In the first H2Global auction round, the Federal Government made concessions on sustainability criteria in order to ensure that a sufficient number of bids were received.

## 4.3 Comments made by the Economic Ministry

As to the **climate impact of hydrogen** (see no. 4.1), the Ministry pointed out that certain emissions could be easily and cost-effectively avoided using existing technology. The Ministry stated that this would require either an economic incentive to use hydrogen or a regulatory requirement to avoid emissions.

The Ministry commented that we presented the **effects on other environmental assets** in a simplified and potentially misleading way (see no. 4.2). The Ministry stated that although the sustainability criteria in the H2Global tenders had been adjusted, this served to specify the requirements more precisely. The level of protection, the Ministry emphasised, remained unchanged.

## 4.4 Concluding audit findings and recommendations

The Federal Government is currently unable to guarantee that hydrogen supply will be actually climate-neutral and environmentally sustainable.

The Ministry acknowledges uncertainties regarding the **climate impacts across hydrogen value chains** (see no. 4.1). If the Ministry considers these emission effects to be technically simple and cost-effective to avoid, it must take appropriate action.

The announcement made by the Ministry in its 10-point plan to treat blue hydrogen as being equal in future (see no. 2.4) highlights the conflicting objectives of energy policy: While blue hydrogen may possibly contribute to the ramp-up of a secure and affordable hydrogen economy, it represents only a transitional solution on the path to climate neutrality due to its, albeit reduced, emissions.

With regard to **other protected environmental assets** (see no. 4.2), experts familiar with the tenders noted that certain requirements relevant to biodiversity had been “restricted” to birds and mammals, among other things. Additionally, the criteria for using electricity from renewable sources had been “restricted” to specific forms of water desalination, namely seawater desalination. However, the only H2Global project

to date plans to desalinate brackish water first. This means that electricity from fossil sources may be used for this purpose. According to expert assessments, it would have been unlikely that bids would have been received without such concessions.

The experts concluded that the revised contract generally safeguards the Ministry's sustainability requirements. However, they noted that there were still some residual risks regarding the interpretation and implementation of these requirements, particularly for projects located outside the European Union.

We agree with this assessment of the risks. As the Federal Government intends to meet up to 70 per cent of the expected hydrogen demand through imports, the negative climate and environmental effects of these imports are particularly relevant. Therefore, the contribution of hydrogen to climate neutrality remains uncertain.

**Recommendations**

In order to ensure a hydrogen supply that is as **climate-neutral and environmentally sustainable** as possible (Section 1 of the Energy Industry Act), the Federal Government must subject its approach to a reality check. In particular, the Federal Government must

→ assess how the risks identified will affect the achievement of national climate protection targets and (global) sustainability goals. To this end, the government should systematically analyse studies on the climate and environmental impacts of hydrogen and close any knowledge gaps through further research if necessary.
→ design and implement its measures in such a way that the hydrogen economy can make the intended contribution to climate neutrality and sustainable development. This also applies to the use of blue hydrogen.

If significant negative climate and/or environmental impacts are confirmed, the Federal Government should critically review its goal of covering at least half of its hydrogen demand through imports.

# 5 Conclusion & outlook

The Federal Government regards hydrogen as a key element in the energy transition, as essential sectors can, based on current knowledge, only be fully decarbonized using hydrogen. The Federal Government has taken extensive measures following a planned

economy approach to build up supply, demand and infrastructure for the ramp-up of a hydrogen economy. The Federal Government has already allocated considerable budgetary funds to achieve the ramp-up it is aiming for.

However, this ramp-up has not yet been successful. Key targets for 2030 set out in the National Hydrogen Strategy 2023 are highly unlikely to be met. The statutory goal of a hydrogen supply that is as secure, affordable, environmentally sustainable and climate-neutral as possible is far from being achieved. It is not clear whether or when the phase of subsidised ramp-up can be successfully completed. In view of the financial burdens and risks, continuing with the ramp-up of the hydrogen economy as planned threatens to put further pressure on federal finances, which have been already turned upside down.

The Federal Government must therefore conduct a reality check of its hydrogen strategy and implementation to date, and undertake a fundamental revision. In its comments and with its 10-point plan, the Ministry acknowledged the urgency for action. However, it still remains largely unclear how the Federal Government plans to concretely adjust the market framework and policy instruments to address the existing challenges.

The Federal Government must reconcile various competing statutory goals in its hydrogen strategy to ensure that the overall energy policy is coherent. These competing statutory goals are to ensure a supply that is as secure, affordable, environmentally sustainable and climate-neutral as possible. The Federal Government must also assess the overall contribution of the hydrogen economy to the energy transition. This also includes the question of whether new technologies could offer alternative ways to decarbonise sectors that were previously expected to rely on hydrogen. The use of blue hydrogen must not come at the expense of climate neutrality. The Federal Government must consider the interactions between different decarbonisation options (e.g. hydrogen or CCS), especially when building the necessary infrastructure.

The Federal Government must keep an eye on whether, how, and to what extent other EU Member States are developing a hydrogen economy. It should refrain from taking a separate course of action in the ramp-up of the hydrogen economy that is not aligned with the efforts of the European Union and its Member States and is associated with great uncertainties.

The Federal Government must now address these tasks and not abandon the goal of achieving climate neutrality by 2045, maintaining the future viability of Germany as an industrial hub and avoiding overburdening the federal budget.

Bonn, 28 October 2025

As Chairman of the Governing Board, which adopted this report in accordance with Section 14 (1) No 2 of the Bundesrechnungshof Act,

Kay Scheller
President of the Bundesrechnungshof