H_2-BAROMETER

Independent assessment of the hydrogen economy in Germany

Edition 2
November 2023

Foreword

Dear readers,

We are delighted to present the latest edition of the H_2 barometer. This edition is dedicated to an important milestone on the road to a sustainable and climate-friendly hydrogen economy.

The plans for a German hydrogen network are becoming more concrete. Federal Minister of Economics Dr. Robert Habeck has presented the plans for a 9,700-kilometre core network by 2032. The development of the German core network is a clear sign of the impressive commitment of the transmission system operators in Germany. They are making a significant contribution to laying the foundations for a hydrogen supply.

We are very proud that our full cost index HydexPLUS is playing a central role in the ramp-up of the hydrogen economy by becoming the leading index for the German government's Carbon Contracts for Difference (CCfDs). CCfDs and the GHG quota are key support measures that are driving forward the use of green hydrogen.

Our edition also sheds light on the major challenges facing network operators. E-Bridge analyses show that neither complete repurposing nor decommissioning of gas networks are the right approach. Instead, an individual and spatially differentiated view of the gas distribution networks is required as an indispensable prerequisite for early planning security.

However, we also see that there are still challenges to overcome. A lack of incentives in the space heating sector and concurrent requirements for energy suppliers, such as municipal thermal design, make the use of hydrogen considerably more difficult. Innovative solutions need to be found here in order to work together on a sustainable heating transition.

A special highlight of this edition is the exclusive interview with Sabine Augustin, Head of Corporate and Strategic Development at Open Grid Europe. Her in-depth knowledge and inspiring views provide valuable insights into current developments and future prospects.

We hope that this edition of our H_2-barometer will inspire you, inform you and open up new perspectives. Together, we can make a positive contribution to overcoming the challenges of ramping up the hydrogen economy.

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Theses and overall mood

Key messages from the H_2 barometer

Regulation

1. Carbon Contracts for Difference (CCfDs) can serve as an important instrument for the energy transition in the industrial sector and promote the hydrogen economy by increasing demand for hydrogen and the respective infrastructure. HydexPLUS serves as an underlying price index and benchmark for determining the level of subsidies for hydrogen-based technologies.
2. The GHG quota not only supports the achievement of the CO_2 targets in the transport sector, but also increases the competitiveness of green hydrogen by proportionally covering the full H_2 costs. Furthermore, market indicators suggest that the mineral oil sector will be very willing to avoid the penalties and purchase GHG quota certificates instead.

Upstream

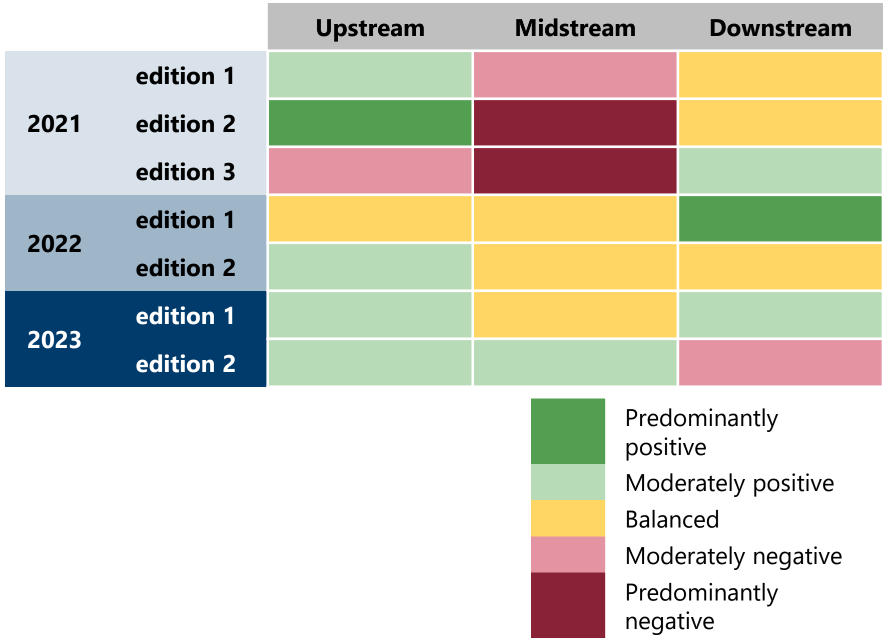
1. Due to the growing feed-in of renewable energy and higher expected gas and CO_2 prices, green H_2 will become more competitive in the future. If the capacity utilisation of the electrolyser is optimised to 50 % per year, the marginal costs already show improved competitiveness compared to conventional H_2.
2. The optimised HydexPLUS full cost index has a comparable price level to the Hydex marginal cost index. Thanks to the optimised electrolyser operation, the capital cost component is almost completely balanced out in comparison to the volatile marginal costs. This demonstrates the benefits of optimised electrolyser operation in terms of full costs.
3. There is scope for optimisation in the procurement of electricity for the production of RFNBO-compliant hydrogen. A flexible design of power purchase agreements allows for cost-efficient electricity purchasing.

Midstream

1. Gas distribution network operators should develop a strategic target vision for each network area. Central input parameters for such an assessment are regionalised, scenario-based demand forecasts and the local supply situation of green H_2.
2. The H2 core network is the central infrastructure for the future import and distribution of hydrogen in Germany and is therefore also a key criterion when considering transformation options for gas distribution networks. The regulatory-supported development is an important signal for the ramp-up of the hydrogen economy.

Downstream

1. Municipal thermal design have a major influence on the future options for local gas distribution networks. It is therefore necessary for gas distribution network operators to be actively involved in the planning process in order to present the complex opportunities and challenges of the gas infrastructure in a transparent manner.
2. The amendment to the Building Energy Act takes clear steps towards climate protection. The resolution is open to all technologies but sets strict limits for the use of hydrogen in the heating market. Gas distribution network operators in particular will face significant new requirements and liability obligations.



In both the transport and industrial sectors, subsidisation measures will ensure that green hydrogen is more competitive in the future. HydexPLUS is the benchmark for the full costs of H_2 generation within the framework of CCfDs.
There are currently still no regulatory incentives for hydrogen in the space heating sector. The risk here remains with the gas network operators, who are expected to provide target visions for their gas networks on the one hand and drafts for municipal thermal design on the other.
Although the amendment to the Building Energy Act is formulated in a technology-neutral way, the realistic and timely use of hydrogen is made more difficult rather than easier.

E-Bridge competence in energy

INTERVIEW

Interview with Sabine Augustin, Head of Corporate Development & Strategy at Open Grid Europe (I/II)

As a transmission system operator, Open Grid Europe GmbH (OGE) operates the largest gas transmission network in Germany with around 12,000 kilometres. The company is shaping the energy mix of the future by transporting renewable and decarbonised gases such as hydrogen and developing a CO_2 infrastructure. OGE is an important player in the energy transition and a pioneer of the green transformation in Germany and Europe.

As a transmission system operator, OGE is actively shaping the planning of the future hydrogen infrastructure. OGE's existing natural gas pipelines already connect various sources of supply with large energy consumers and storage facilities - these pipelines are gradually being converted to hydrogen. To implement its strategy, OGE is developing important projects relating to sector coupling and hydrogen - often together with partners. In the National Hydrogen Council and numerous industry and association activities, OGE is working together with politicians to develop the right framework conditions for the hydrogen ramp-up.

Sabine Augustin, Head of Corporate Development & Strategy at Open Grid Europe

Ms Augustin, what role will transmission system operators in general and OGE in particular play in the ramp-up of the hydrogen economy in the coming years? What vision are you pursuing at OGE?

Hydrogen network operators have a key role to play in the success of the hydrogen economy. Over the next few years, we will be building the network that will enable customers across the country to be supplied with hydrogen safely, thereby solving the chicken-and-egg problem. The expansion of the H_2 network creates the basis for investment decisions - both on the producer and the customer side.

We at OGE have a clear goal that we want to achieve in the next 10 years: more than 2,000 kilometres of hydrogen network in the north, west and south of Germany. A network that supplies the industrial centres, provides access to storage facilities and - very importantly - opens up 5 import corridors for Germany.

Most of the hydrogen for Germany will come from abroad and these import corridors are therefore of particular importance. OGE's network enables the import of H_2 from Norway and the North Sea, connects to the networks in Belgium and the Netherlands, connects to the French network for hydrogen from Spain and opens up the import corridor via the Czech Republic. For us, partnerships and co-operations are an important key to success. This includes partnerships with other network operators, with whom we also jointly construct parts of the network. We work closely with the major network operators in our neighbouring countries and various producers to facilitate the import corridors for hydrogen. OGE also maintains a close dialogue with industrial customers and storage operators. And we cooperate with distribution network operators, who play a decisive role in ensuring that hydrogen is also distributed.

Interview with Sabine Augustin, Head of Corporate Development & Strategy at Open Grid Europe (II/II)

In which part of the value chain do you see the greatest challenges in ramping up the hydrogen economy? What solutions would you suggest?

The hydrogen ramp-up can only succeed if all parts of the value chain are interlinked. I am convinced that the decision in favour of the hydrogen core network envisaged by Economics Minister Habeck for the coming months will bring momentum to the market. This will create planning security for producers and customers on the transport side.

However, this alone will not be enough. In the first few years, hydrogen will still be more expensive than fossil fuels and a balance must be found for this. With the Inflation Reduction Act (IRA), the USA has chosen a path in which the production of hydrogen is massively supported. Production projects are popping up like mushrooms there. In Germany, the focus is, as usual, more on supporting the demand side. With the CCfDs, the German government is planning to promote the use of hydrogen on a large scale. I very much hope that these will provide a similarly strong impetus for Germany as the IRA did in the USA.

In the hydrogen sector, there will be a revival of the midstream role. While this has become less important in the liberalised electricity and gas market, it is important for the hydrogen ramp-up to aggregate demand and enter into long-term supply contracts.

In your opinion, which political decisions are sending positive signals with regard to the ramp-up of the hydrogen economy? Where do you see an acute need for improvement on the part of political decision-makers?

The decision in favour of the hydrogen core network and the start of the CCfDs will send out positive signals for the hydrogen ramp-up. These are two very decisive measures.

In my view, political decision-makers should now focus more on SMEs, which account for a large proportion of jobs and value creation in Germany. Most medium-sized companies are connected to the distribution network. It is therefore important to plan the further development of the network at the distribution level directly after the decision in favour of the core network. At the same time, it is important to further develop the CCfDs so that they also work for SMEs.

The role of hydrogen in the heating market is always the subject of heated debate. Local authorities will have to deal with this intensively over the next few years as part of municipal thermal design. The answers will vary from supply area to supply area. The political decision-makers must organise the framework for municipal thermal design in such a way that it is open to all technologies, without any taboos of thinking.

REGULATION

Carbon Contracts for Difference (CCfDs)

What are carbon contracts for difference (CCfDs)?

- CCfDs help industrial companies to invest in climate-friendly production facilities that would otherwise not pay off (e.g. in the steel, cement, paper or glass industries).
- The additional costs incurred by companies from emission-intensive sectors due to the construction and operation of more climate-friendly plants compared to conventional plants are to be offset by the state.
- This funding offers an opportunity for the market launch of climate-friendly processes, such as the use of green hydrogen.
- CCfDs serve to hedge against price risks, compensate for additional costs and create secure investment framework conditions.

How a CCfD works

- Reduction costs are additional production costs that arise in green steel production over and above the costs of grey production per ton of CO_2 saved.
- The contract price is set per ton of CO_2 saved and corresponds to the expected reduction costs minus the CO_2 price.
- The example in the figure on the right shows that steel produced with green hydrogen, for example, is competitive after 15 years due to falling reduction costs and an increased CO_2 price. After that, the company has to pay the subsidies back to the state as the contract price is negative.

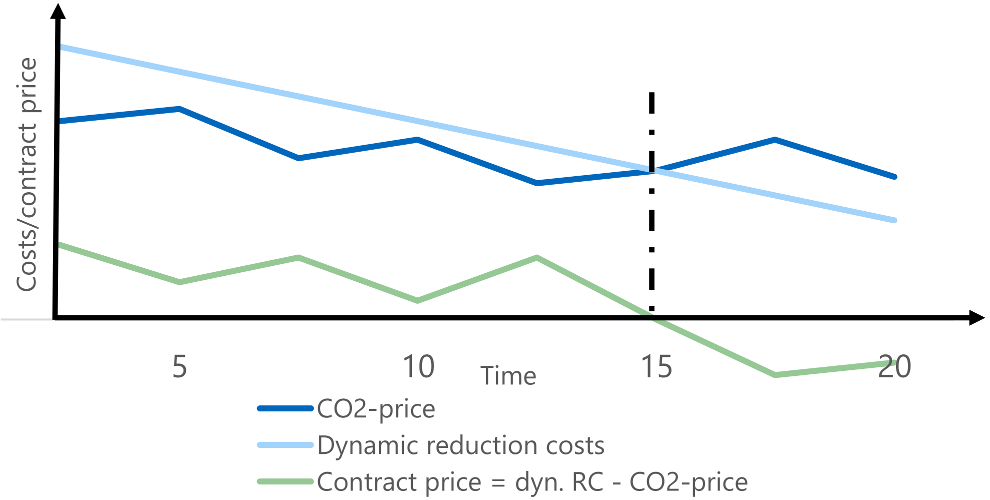
> Carbon contracts for Difference can serve as an important instrument for the energy transition in the industrial sector and promote the hydrogen economy by increasing the demand for hydrogen and respective infrastructure. HydexPLUS serves as an underlying price index and benchmark for determining the level of subsidies for hydrogen-based technologies.

Base prices and price indices

- As no trading data is available for green hydrogen, cost indicators are used to determine the base prices and futures contracts.
- For green and blue hydrogen, the unweighted average of the values of the HydexPLUS green and blue hydrogen cost indicators is used for the respective accounting period.

Positive effects for the hydrogen economy

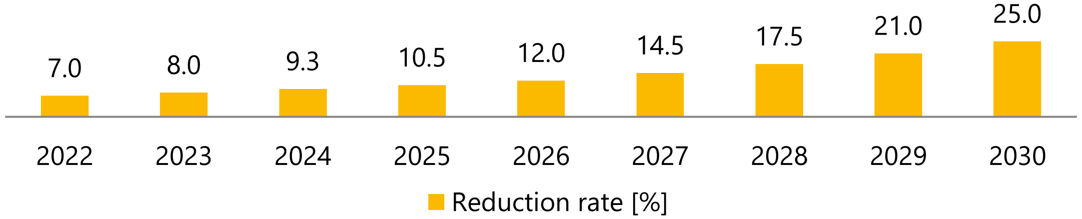
- Development of the hydrogen infrastructure is supported and boosted.
- Innovations for the production of hydrogen and its use in the industry sector are promoted.
- Demand for hydrogen from the industry sector is stimulated.



Source: BMWK 2022 [Link]

Green H_2 certificates from the GHG quota in accordance with RED II can be monetised in the transport and mineral oil sector

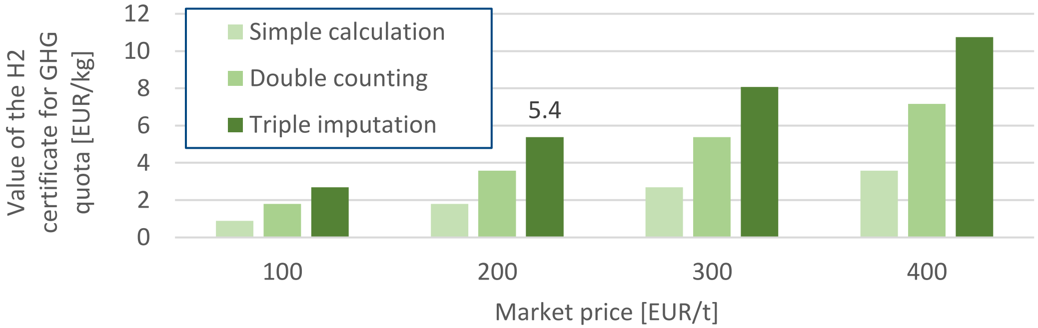
- According to the 37th Federal Immission Control Ordinance (BImSchV) and the delegated act of the EU, electricity-based fuels (RFNBO - renewable fuels of non-biological origin) can be counted towards the greenhouse gas quota if the corresponding criteria for green hydrogen production are met.
- The GHG reduction rate for the transport sector will increase from the current level of 8 % to 25 % by 2030 (Section 37a (4) sentence 1 BImSchG).



- Companies which distribute mineral oil fuels on the market have two options for fulfilling the GHG quota:
  1. Reduction of their own CO_2 emissions through direct sales of low-emission fuels.
  2. Purchase of GHG quota quantities from third parties that only offer low-emission or emission-free fuels themselves and are therefore not subject to the quota obligation or exceed their obligation.
- The revenue potential and the willingness of the transport sector to pay are supported by applicable penalties (approx. EUR 600/t_{CO2}) under RED II if the GHG quota is not achieved.

The GHG quota not only supports the achievement of the CO_2 targets in the transport sector, but also increases the competitiveness of green hydrogen by proportionally covering the full H_2 costs. Furthermore, market indicators suggest that the mineral oil sector will be very willing to avoid the penalties and purchase GHG quota certificates instead.

- The monetary value of a green hydrogen certificate is calculated according to the 37th BImSchV, as follows:
  1. The base value of the CO_2 equivalent (fossil) is reduced as a percentage by the GHG reduction rate, which increases to 25 % by 2030.
  2. This value is then subtracted from the GHG emissions caused by green hydrogen, including the propulsion efficiency factor (which, according to the latest draft bill, is set at 0.4 for hydrogen compared to 1 for combustion engines). Once the delegated act has been transposed into national law, no GHG emissions will be attributed to RNFBO-compliant hydrogen.
  3. The difference gives the GHG reduction quantity that is saved through the use of green hydrogen. According to the latest draft bill, this GHG reduction can be multiplied by three for green hydrogen.
- The monetary value of a green hydrogen certificate based on a triple credit and a market price of 200 EUR/t_{CO2} is 5.4 EUR/kg_{H2} .
- Depending on the H_2 full costs (see HydexPLUS), the full costs can be covered proportionately through quota trading.



Calorific value of H2: 33.33 kWh/kg

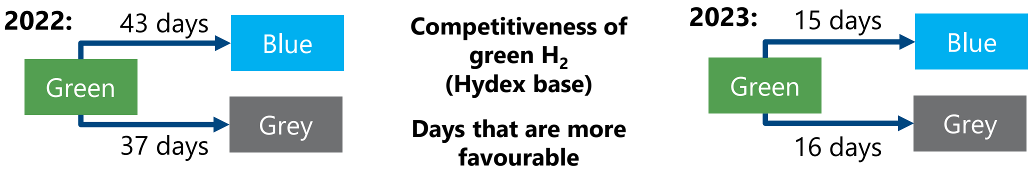

HYDROGEN
FUEL
H2
UPSTREAM

Hydex - Development of marginal costs for hydrogen production

- The marginal cost-based hydrogen price index Hydex fell significantly on average across all generating technologies in 2023 and was no longer as volatile as in 2022. This can be explained in particular by the decrease in electricity, gas and CO_2 input prices (Figure 1).
- Annual averages for 2022 and 2023 in comparison:

Hydex	Green	Blue	Grey
Average value 2022 EUR/MWh	358	209	202
Average value 2022 EUR/kg	11.93	6.96	6.73
Average value 2023 EUR/MWh	178	91	96
Average value 2023 EUR/kg	5.96	3.03	3.19

- In times of high RE feed-in, green hydrogen (Hydex green) is competitive with conventional H_2 based on natural gas (Hydex blue and Hydex grey).



- If only the 50% of days with the most favourable electricity input prices are considered in the production of green H_2, green hydrogen becomes more competitive compared to conventional hydrogen (Figure 2). This would result in a production price of EUR 5.16/kg (2023) for green hydrogen.

Due to the growing feed-in of renewable energy and higher expected gas and CO_2 prices, green H_2 will become more competitive in the future. If the capacity utilisation of the electrolyser is optimised to 50 % per year, the marginal costs show improved competitiveness compared to conventional H_2 today already.

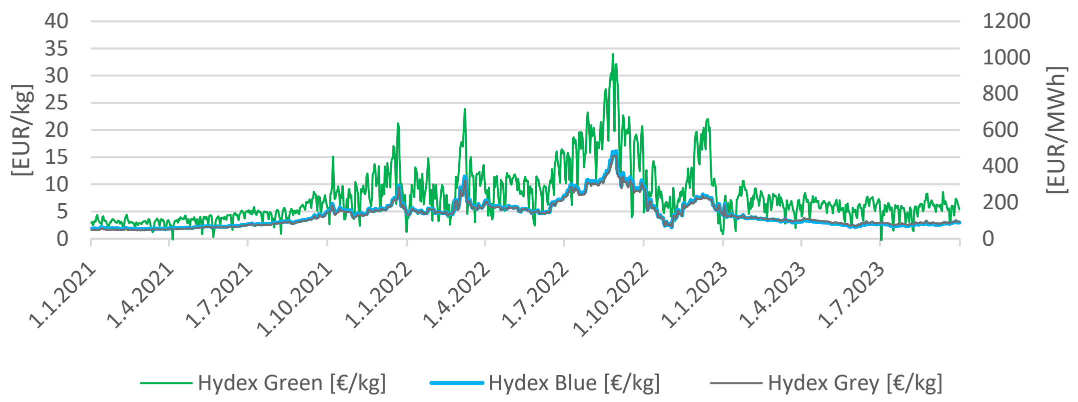


Figure 1: Hydex - Historical price development 2021 - 2023 in EUR/kg and EUR/MWh

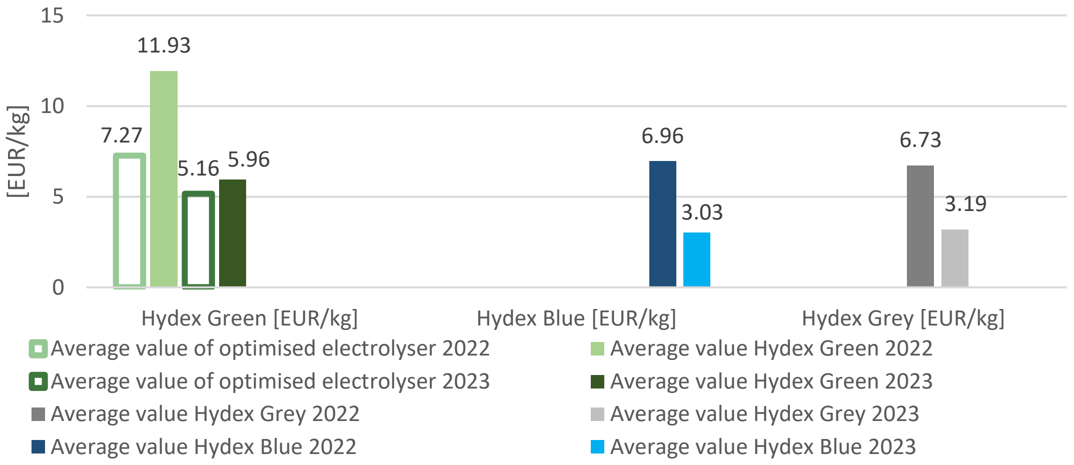


Figure 2: Hydex - average prices 2022/2023 and with 50 % of the cheapest days for green hydrogen production

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HydexPLUS - Development of optimised full costs for hydrogen production

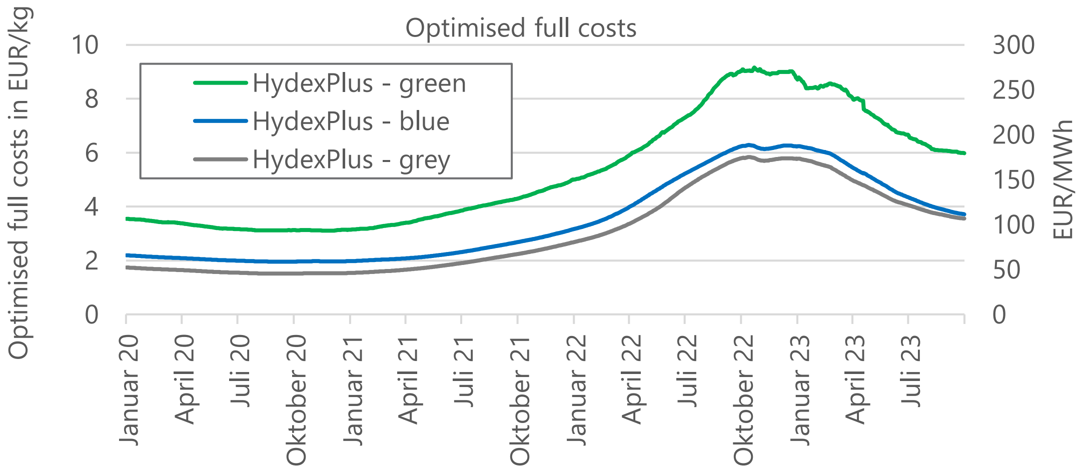
Evaluation over time

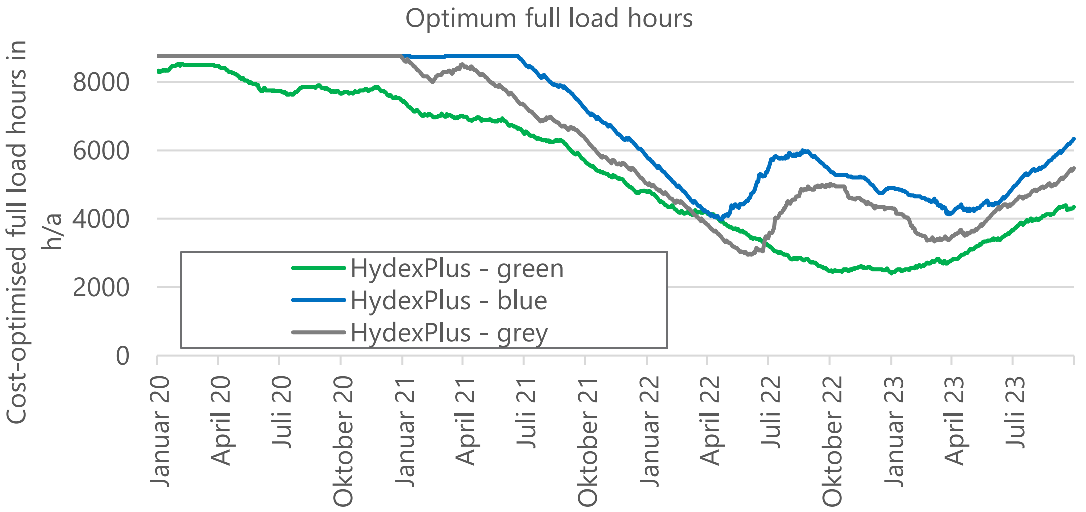
- Cost-optimised operating point (full costs and optimum full load hours) is calculated on a daily basis for the previous year. On the right: Development from Jan. 2020 to Sept. 2023.
- Increase in generation costs since mid-2021, especially from the beginning of 2022 due to the energy crisis. The first slight easing on the markets at the end of 2022 leads to a brief stagnation of the HydexPLUS indices. There has been a significant decline in prices since the beginning of 2023.
- At the end of September, the full costs for green H_2 were around EUR 6/kg and for blue and grey H_2 at EUR 3.65 and EUR 3.50/kg, respectively. The optimum full load hours for green generation were around 4300 h/a. Reformers for grey H_2 should preferably run for 5500 h/a and for blue H_2 for around 6300 h/a in order to produce at optimum cost.

Interpretation and conclusions

- Despite a slight easing of the commodity markets, the cost-optimised operating mode for electrolysis is around 50% of the hours per year. This shows the major influence of electricity procurement costs on the H_2 full costs.
- HydexPLUS green is at the same cost level as the average Hydex green for 2023. The optimised operating mode with lower electricity procurement costs compensates for the additional capital costs taken into account.
- Increased CO_2 certificate costs lead to a significant convergence and a narrowing of the spread between blue and grey hydrogen.
- As with the Hydex blue and Hydex grey marginal cost indices, the HydexPLUS full cost index is also expected to have higher grey generation costs than blue costs in the future.

The optimised HydexPLUS full cost index has a comparable price level to the Hydex marginal cost index. Thanks to the optimised electrolyser operation, the capital cost component is almost completely balanced out in comparison to the volatile marginal costs. This demonstrates the benefits of optimised electrolyser operation in terms of full costs.





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Publication
Energate Messenger: https://www.energate-messenger.de/markt/gas-oel-und-wasserstoff/
E-Bridge Consulting: https://e-bridge.de/kompetenzen/energy-markets/wasserstoff/

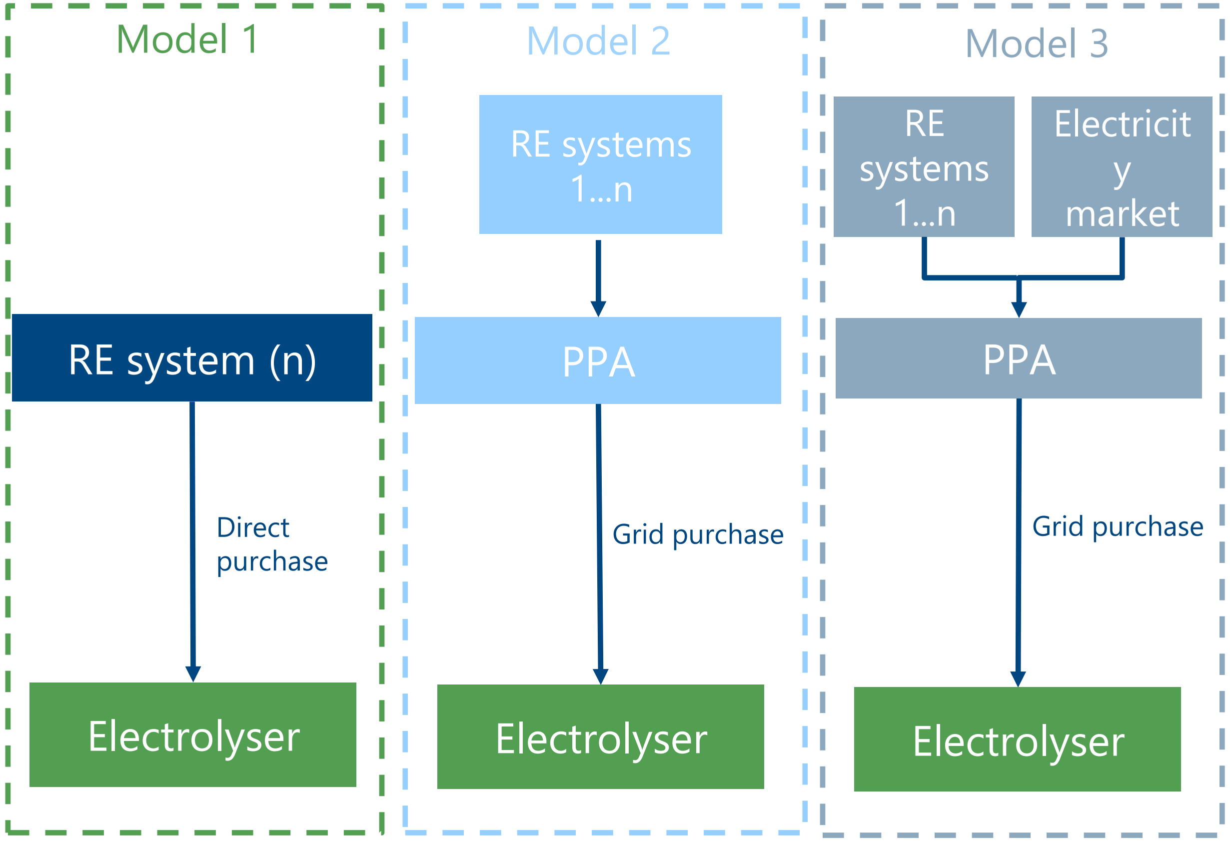
Electricity procurement for the production of RFNBO-compliant green hydrogen

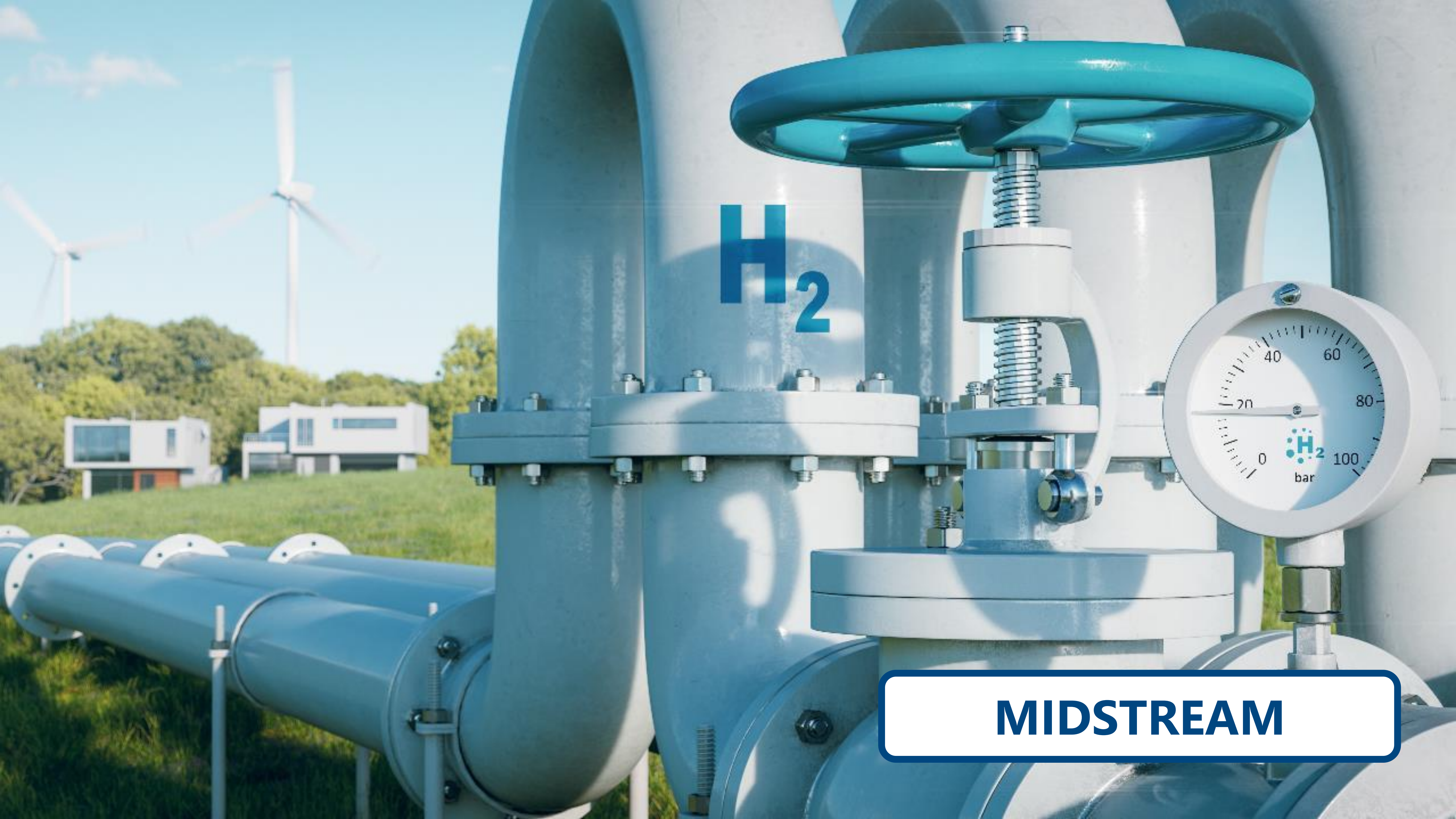
- Business models for electrolysers depend to a large extent on the extent to which the criteria for green electricity procurement adopted by the EU in the RED II delegated act can be achieved and organised. Green electricity procurement is therefore of central importance.
- There are clear regulations on the temporal and geographical correlation of electricity and hydrogen production as well as on the additionality of renewable energy plants (RE). There are individual exemptions (<20 EUR/MWh; 36% of the CO_2 price).
- There are basically three different models for procuring electricity (see illustration):

1. **Direct connection EE system**:
   - Integrated model across the entire supply chain.
   - The limited flexibility of electrolyser production can be countered by larger renewable energy plants and storage solutions.
2. **Unstructured PPA model:**
   - Electricity procurement via long-term PPAs in the same price and bidding zone at a fixed price.
   - PPA enables independent site selection.
   - Utilisation of the electrolyser can be increased by selecting various suitable renewable energy plants.
3. **Structured PPA model:**
   - Electricity procurement in the same price and bidding zone via structured flexible PPAs.
   - PPA allows electricity procurement to be organised flexibly; part of the electricity can be purchased directly on the electricity (spot) market at low price periods and below the cost thresholds (<20 EUR/MWh; 36 % of the CO_2 price).

> There is scope for optimisation in the procurement of electricity for the production of RFNBO-compliant hydrogen. A flexible design of the PPA agreement allows for cost-efficient electricity purchasing.

Figure: Electricity procurement models:





H2
40
60
20
80
0
100
bar
MIDSTREAM

A regionally differentiated view of the future options for gas distribution networks is a prerequisite for early planning security

Status quo: Most gas distribution system operators are planning to completely switch to hydrogen[1]

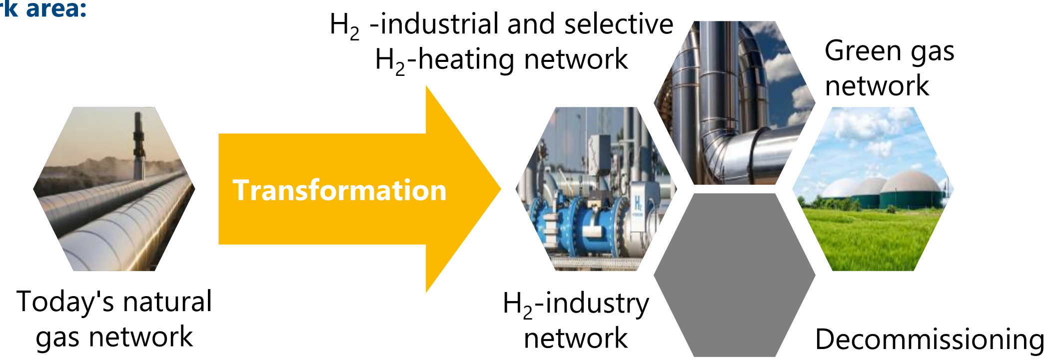
- 212 of the 226 (93%) gas DSOs participating in the DVGW's gas transformation process expect hydrogen distribution by 2045.
- 7 % plan to purchase only climate-neutral methane via the upstream grid operator in the target year.
- Current legal situation: There is an obligation to connect existing customers and (to a limited extent) new customers (§§ 17 and 18 EnWG) to the gas distribution grids, meaning **that in 2021 the record sum of EUR 1.1 billion was still invested in the construction of new grids.**
- First regulatory adjustment by the BNetzA Revision of the KANU determination: New gas pipeline constructions can now be fully depreciated until 2045. However, this regulation does not apply to old systems.

Contradiction

Agora forecast: The length of gas distribution networks will decrease by 71 to 94 percent by 2045[2]

- The current grid tariff system will result in ever higher grid tariffs having to be paid by ever fewer customers.
- Due to the long-term nature of grid investments, many of the newer systems already installed will not have been refinanced by the year of targeted climate neutrality in 2045 (imputed useful life for existing natural gas pipelines of up to 55 years according to GasNEV).
- **According to the Agora study, without further adjustments to the regulatory framework, there is a threat of a sixteen-fold increase in grid tariffs and stranded assets of up to 10 billion euros by 2044.**

Solution: The E-Bridge approach is the development of a realistic future vision for each network area:



Gas distribution network operators should develop a strategic target vision for each network area. Central input parameters for such an assessment are regionalised, scenario-based demand forecasts and the local supply situation of green H_2 .

Sources:
1 DVGW (2023) - The Gas Network Area Transformation Plan 2023 (Link)
2 Agora Energiewende (2023) - A new regulatory framework for natural gas distribution networks (Link)

Milestone: TSOs publish proposal for the core network - Government plans financing via amortisation account

Vision for the hydrogen core network of German transmission system operators

- The hydrogen core network is a proposal by the German transmission system operators and describes the possible starting point for the development of a hydrogen transport network in Germany. The hydrogen core network focuses in particular on the decarbonisation of large-scale industrial applications and central feed-in.

TSOs recently handed in draft proposal to BNetzA which envisages a core grid with a total length of 9,700 km

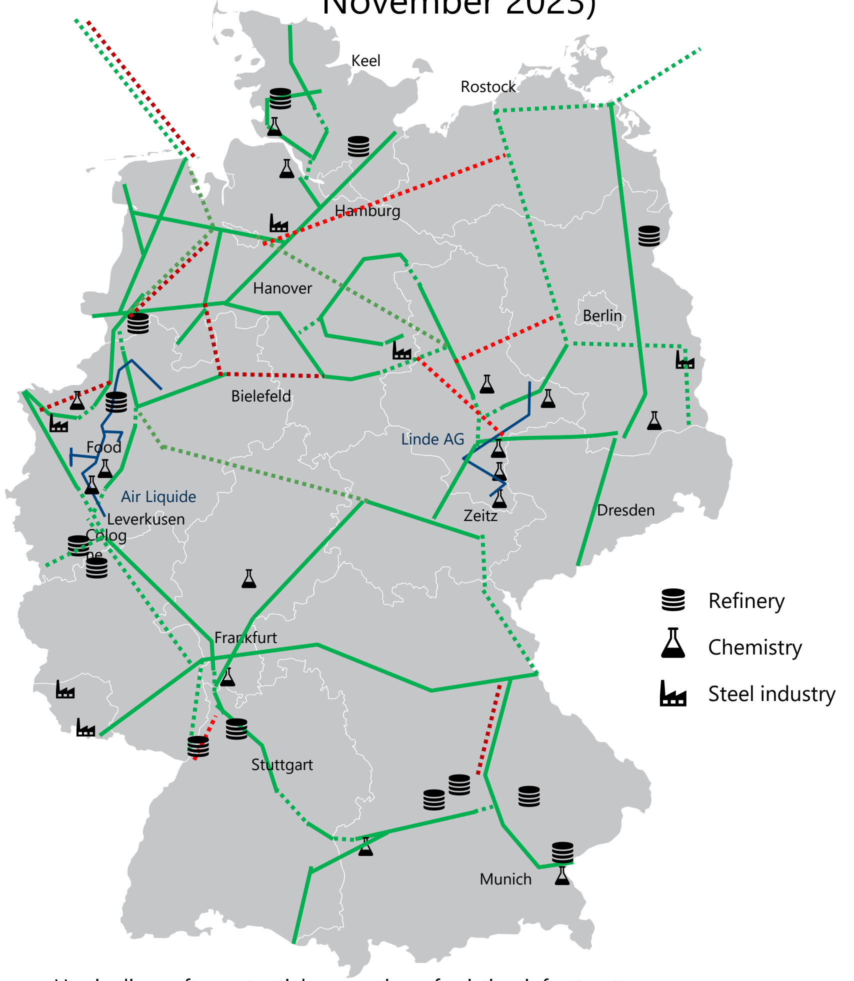
- On 15 November 2023, the TSOs submitted the draft proposal to the BNetzA with a total length of the optimised core network of approx. 9,700 km. Compared to the last planning status (July 2023), this is a reduction of approx. 1,500 km, as some parallel routes have been omitted for reasons of efficiency.
- The core network consists mainly of converted natural gas pipelines (approx. 60%). The entry and exit capacities amount to approx. 100 GW and 87 GW respectively.
- Additionally, on 14 November 2023, two declarations of intent were signed by German and Dutch ministers and representatives of the national TSOs: One on further cooperation in the field of hydrogen infrastructure, as well as a declaration regarding a joint auction for the import of green H_2 for EUR 300 million each.

Financing concept envisages amortisation account to avoid prohibitively high grid tariffs during ramp-up

- The TSOs estimate the necessary investment costs at EUR 19.8 billion. According to the draft amendment to the EnWG on the core grid (§§ 28o - 28s), financing is to be provided via a standardised nationwide grid tariff. On 15 November 2023, the Federal Cabinet also approved the third revision of the EnWG amendment, which already contains key points on the financing model for the hydrogen core network.
- However, the grid tariff is capped to accelerate demand. Any resulting shortfalls are accounted for in a so-called amortisation account, for which the federal government essentially assumes liability. However, this regulation is explicitly limited to the core network and not to the distribution network level.
- An equity interest rate of 6.69% is currently being discussed for the core grid. This would mean that the equity interest rate would be lower than in the WasserstoffNEV, but higher than for natural gas networks. This is justified by the average risk profile of core grid investments due to the introduction of the amortisation account.

> The H_2 core network is the central infrastructure for the future import and distribution of hydrogen in Germany and is therefore also a key criterion when considering transformation options for gas distribution networks. The regulatory-supported development is intended to solve the chicken-and-egg problem and is an important milestone for the ramp-up of the hydrogen economy.

Hydrogen core network 2032 Germany
(Schematic representation of the draft proposal 15 November 2023)



- H_2 pipelines after potential conversion of existing infrastructure
- Possible new construction areas for H_2 pipelines
- Existing private hydrogen network (Air Liquide & Linde AG)
- Pipelines from the latest planning status (July 2023) not included in the draft proposal (November 2023)

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DOWNSTREAM

The Municipal Thermal Design Act influences the transformation options for heat-influenced gas distribution networks

Participation options and obligations for gas network distribution system operators in municipal thermal design

- Operators of energy supply networks are obliged to provide data for analysing the current situation and potential.
- The gas distribution network operator has a legal right to propose the supply of a planned sub-area by means of a hydrogen network.
- There is no legal obligation to construct, operate or expand the corresponding thermal design infrastructure.
- At the same time, there is no legal obligation for customers to use the corresponding infrastructure.

Transformation of the natural gas network*

Redesignation as a hydrogen network expansion area

- Interlocking with the GEG: Designation as a prerequisite for the future installation of H_2-ready gas heating systems
- A detailed and binding roadmap is required for repurposing (see subsequent slide and § 71k GEG)
- Classification as a hydrogen network expansion area is "very unlikely" if there is currently no gas network there.

Transformation to a green gas distribution network

- Possibility of heating supply with green methane under the following conditions:

1. Consistency with plans of upstream gas network operators
2. Gas distribution network operator must demonstrate how sufficient green methane can be produced and stored.
3. Cost efficiency and affordability must be ensured by gas distribution system operators.

Examination of alternatives: e.g. generation of district heating with hydrogen

- If a sub-area is planned neither as a hydrogen network area nor as a green gas distribution network, an examination of alternatives is necessary.
- A sensible alternative would be, for example, to provide green heat for heating networks via gas distribution networks at higher pressure levels (especially peak loads).
- The possibility of decommissioning natural gas pipelines is mentioned in the Annex, but without detailed specification of the requirements.

Municipal thermal design has a major influence on the future options for local gas distribution networks. It is therefore necessary for gas distribution network operators to be actively involved in the planning process in order to present the complex opportunities and challenges of the gas infrastructure in a transparent manner.

*Requirements of the Building Energy Act must be observed (see following slide)

Source: Approved draft law (link)

According to the Building Energy Act, there are three options for the future installation of gas-fired heating systems

1. New heating systems with at least 65 % renewable gases

- Heating systems can be fuelled with biomethane, green or blue hydrogen.
- In terms of energy content, the proportion of renewable gases must be 65%.
- In the case of supply via a network infrastructure, proof of balance is sufficient. The heating system operator must provide evidence of this (→ corresponding tariff offers required).
- Combinations with technologies such as solar thermal energy or heat pumps are possible.

2. Operation of natural gas heating systems temporarily possible

- In areas without existing thermal design: use of gas heating systems with lower requirements for green gas use (>15% from 2029, >30% from 2035 and >60% from 2040) (§ 71)
- No RE quota required for heating system breakdowns in the next five years (Section 71i)
- If the connection to a heating network is planned within the next 10 years, no further requirements are placed on the heating systems.

3. Operation of gas heating systems up to connection to a H_2 network possible

- It must be possible to convert the heating system to 100 % H_2 operation with little effort.
- Location must be in a H_2 expansion area according to municipal thermal design.
- Complete supply of the area with H_2 must be ensured by the end of 2044.
- The operator of the gas distribution network must submit a binding roadmap for complete repurposing by 30 June 2028.

§ 71k: Requirements roadmap for the complete conversion of gas distribution networks to hydrogen

1. Submission by the operator of the gas distribution network in cooperation with the office for the implementation of municipal thermal design **by 30 June 2028**
2. Complete conversion of the supply to all customers **to 100 % hydrogen by the end of 2044**
3. Presentation of technical and time-related steps to convert the infrastructure in **accordance with the transmission system operators' NEP gas** or **sufficient decentralised production and storage of hydrogen**
4. **Presentation of the financing,** in particular clarification of the costs of retrofitting
5. Description of the **intermediate steps in terms of time and space** (for 2035 and 2040), taking into account the federal government's climate protection targets
6. Publication of an **investment plan** with two- to three-year milestones for the realisation of the new construction or conversion of the gas network to H_2
7. Necessity of **approval and regular (every three years) review of** the timetable by the BNetzA
8. Obligation to **publish** the timetable

→ **In the event of non-compliance with the plan: Liability** for the costs of retrofitting the heating systems by the **gas DSO**

The amendment to the Building Energy Act takes clear steps towards climate protection. The resolution is open to all technologies but sets strict limits for the use of hydrogen in the heating market. Gas distribution network operators in particular will face significant new requirements and liability obligations.

*Source: Approved draft bill incl. amendments by the Committee on Climate Protection and Energy (link)

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