

Document accompanying the scenario frameworks for electricity and for gas and hydrogen 2025-2037/2045

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Foreword

The publication of the scenario frameworks marks the start of a new network development process for 2025-2037/2045. Various changes are being introduced in this cycle. For the first time, hydrogen is specifically being integrated into a joint scenario framework for gas and hydrogen. Also for the first time, the target years for the gas/hydrogen process are further in the future and aligned with the target years in the scenario framework for electricity. This represents a paradigm shift in the gas and hydrogen sector away from planning based primarily on specific reports to the scenario-based identification of future developments.

For the first time, too, the consultations on the two processes are being launched at the same time and will run side by side. This will make it easier to match up assumptions about the basic energy mix and the shares of different energy sources in meeting the overall demand for energy as well as issues common to both sectors such as power plants and electrolysers. This in turn will make it possible to coordinate the network planning processes for electricity and for gas and hydrogen more closely. This approach includes two joint online information sessions to be held on 13 and 16 September 2024.

The scenario frameworks for both processes – for electricity and for gas and hydrogen – represent a range of likely developments in the energy sector. The frameworks are of essential importance for the scope of the network expansion and conversion requirements to be determined later on in the planning process. The assumptions made in the scenario frameworks are a binding basis for the modelling carried out by the electricity transmission system operators for the electricity network development plan and by the gas transmission system operators for the gas and hydrogen network development plan.

This is particularly important in light of the fact that both the electricity scenario framework and the gas/hydrogen scenario framework have scenarios for the target year 2037 and, importantly, for the climate-neutral target year 2045, when Germany's energy system will be fully decarbonised.

The transmission system operators are required by section 12b (for electricity) and section 15c (for gas) of the Energy Industry Act (EnWG) to draw up a network development plan for electricity and for gas and hydrogen every two years. The public consultation launched with the publication of this document will run from 2 September until 30 September 2024. The Bundesnetzagentur is then expected to approve the drafts, taking into account the responses to the consultation, at the end of 2024 or in the first quarter of 2025. The next step will be for the electricity and gas transmission system operators to draw up their draft network development plans.

With the publication of this document, the Bundesnetzagentur is putting out the two draft scenario frameworks developed separately by the electricity and gas transmission system operators for joint consultation. This accompanying document presents a range of specific questions that the Bundesnetzagentur considers to be of decisive importance for the approval of the scenario

frameworks. The questions are merely intended as guidance to make the consultation process easier, and respondents are not limited to these questions. The Bundesnetzagentur specifically encourages comprehensive responses from the public.

The Bundesnetzagentur is not making its own initial assessments at this early stage with a view to ensuring a neutral consultation process. However, because this cycle introduces various changes, it seems appropriate to make a few points about the content of the drafts.

One point is that the drafts for the two processes (electricity and gas/hydrogen) unfortunately do not include a scenario in which key aspects of the design of the scenario and the input parameters match up. This applies in particular to the network operators' power plant lists and lists of assumed electrolyser projects. However, it is clear to the Bundesnetzagentur that the basis in the two processes for these particular assumptions needs to match up. The electricity and gas transmission system operators will therefore need to modify these lists later on in the process, which is why the Bundesnetzagentur is hoping for impetus from respondents on these aspects in particular and for the facilities concerned to play an active part in revising and aligning the lists.

Another point is that scenario A in the draft electricity scenario framework falls so short of the renewable expansion targets set in the Renewable Energy Sources Act (EEG) that the scenario is not within the scope of, or aligned with, the framework conditions laid down in law or the federal government's energy policy goals. As it stands, scenario A is not compatible with the statutory provisions of section 12a EnWG. Here, too, the scenario will need to be modified later on in the process, and comments on this would be welcome.

As regards the draft scenario framework for gas and hydrogen submitted by the gas transmission system operators on 1 July 2024, the Bundesnetzagentur pointed out to the transmission system operators that more details of the input parameters, in particular, were needed. The Bundesnetzagentur subsequently received a revised version on 16 August 2024, which is the version now being put out for consultation.

The responses to the consultation will be published on the Bundesnetzagentur's website. Responses from authorities will be published unless an authority has specifically stated that its response should not be published; responses from others will be published if the respondent has specifically agreed to full publication.

As part of the consultation process, the Bundesnetzagentur is holding two information sessions on 13 September and 16 September 2024 to provide the opportunity for public discussion on the draft scenario frameworks. Anyone interested is strongly encouraged to attend and can register at www.bundesnetzagentur.de/szenariorahmen.

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1 Questions about the scenario framework for electricity

1.1 Design of the scenarios

1. Do the scenarios sufficiently reflect the federal government's energy policy goals?
2. Is the gap between the scenarios too large, too small or satisfactory?
3. Is the total amount and mix of the gross electricity consumption in the individual scenarios reasonable?
4. Are the shares in the mix of the consumption of grid-based energy (electricity, gas and hydrogen) reasonable?

1.2 Households

5. Is the use of decentralised hydrogen heating as proposed by the transmission system operators in scenario A realistic? Or should, alternatively, the number of household heat pumps be increased? Are there any other alternative options?
6. Are the values of the technical parameters chosen to determine the electricity consumption of heat pumps, in particular the energy use per square metre, correct? Is the resulting amount of electricity consumed per heat pump per year reasonable?
7. Is it justified to assume that there will be a significant decrease in the amount of electricity consumed by appliances in households due to improvements in efficiency, despite numerous new applications as a result of the digitalisation process?

1.3 Trade, commerce and services (including data centres)

8. Is the trend in electricity consumption for trade, commerce and services assumed in the scenarios realistic?
9. Is the low number of heat pumps proposed by the transmission system operators and the resulting need for the use of decentralised hydrogen heating in scenario A realistic?
10. Are the values of the technical parameters chosen to determine the electricity consumption of heat pumps, in particular the energy use per square metre (lower than for households), correct? Is the resulting amount of electricity consumed per heat pump per year reasonable?

11. Is the methodology proposed by the transmission system operators for the individual scenarios to take account of project reports to different degrees according to the project status reasonable? If not, how should the projects be categorised?
12. Is the number of data centres and the level of consumption assuming 5,000 full load hours for data centres appropriate?

1.4 Industry

13. Is the trend in electricity consumption for industry assumed in the scenarios realistic?
14. Is the methodology proposed by the transmission system operators for the individual scenarios to take account of project reports in the industrial sector to different degrees according to the project status reasonable? If not, how should the projects be categorised?

1.5 Transport

15. Are the assumptions made in the scenarios about the number of electric vehicles reasonable, in particular with respect to the low number assumed in scenario A and the associated assumption of a high level of use of synthetic fuels?
16. Should hybrid heavy goods vehicles using overhead catenary cables still be included in a scenario as a probable development?
17. Is the regionalisation of consumption and the calculation of electric vehicle charging time series reasonable?

1.6 Electrolysis and hydrogen

18. Is the electrolysis capacity assumed in the scenarios reasonable?
19. Should such a high dependency on hydrogen imports be assumed in scenario A or should the electrolysis capacity in scenario A be increased to decrease the dependency on imports?
20. Does an estimate of 4,000 full load hours for electrolysers before market modelling seem realistic?
21. What could be an appropriate methodology for selecting assumed electrolyser projects for both processes (electricity and gas/hydrogen)?

1.7 Load flexibility

22. Is a sufficient distinction made between the three types of flexible loads in households (heat pumps, electric cars and small battery storage systems)?
23. A household is counted as either market-oriented or not, irrespective of the type or number of loads. Is this appropriate or should a distinction be made between the different types of technology? Is the gap between the scenarios sufficient/realistic?
24. Is the development of vehicle-to-grid (V2G) technology towards full market readiness in the target years plausible? Do the assumed penetration rates indicate the potential developments?
25. Do the two approaches for load shedding and shifting sufficiently represent the scope of the potential for flexibility by industry? Are the assumptions about possible processes and regionalisation still in line with the state of the art?
26. Should the consumption of electricity by industry respond dynamically to the electricity market beyond the assumed potential for flexibility instead of using fixed load profiles?

1.8 District heating

27. The electrification of public and industrial district heating networks is taken to be achieved by installing electric boilers and heat pumps. Are the assumptions about the mix and the resulting expansion of the technologies plausible?

1.9 Offshore wind

28. Should different assumptions be made about the operational life of assets to determine the end of operation of individual wind farms/grid links? Is the assumption of an operational life of 25 years in scenario A and a longer operational life of 30 years in scenarios B and C appropriate?
29. Should the assumptions in scenario C go beyond the targets in the Offshore Wind Energy Act (WindSeeG) even if the availability of sites is uncertain?
30. Should electrical links be assumed for the potentially usable Dogger Bank sites or should these potential sites be reserved for offshore hydrogen generation?

1.10 Onshore wind

- 31. Is the growth in offshore wind capacity assumed in the scenarios realistic?
- 32. Is the assumed increase in the standard number of full load hours for offshore wind plants realistic, in particular in light of the fact that the growth in capacity means that sites need to be used that are not ideal even with turbines designed for low wind speeds?

1.11 Solar photovoltaics

- 33. Is the assumed growth in solar capacity and the 50/50 split between ground-mounted and rooftop systems reasonable?

1.12 Biomass and run-of-river

- 34. How would you see the role of biomass in the target years? Is the assumed decrease in capacity reasonable?

1.13 Peak shaving

- 35. Is it likely that distribution system operators will use peak shaving more in the future?
- 36. Should more account be taken of peak shaving and, if so, how can peak shaving be represented in the modelling?

1.14 Conventional power plants

- 37. What could be an appropriate methodology for selecting existing and future hydrogen power plants for both processes (electricity and gas/hydrogen)? How should the specific power plants assumed be determined?
- 38. Is the assumed growth in the capacity of conventional power plants realistic? Should a distinction be made between scenarios or target years in the assumption?
- 39. Is the assumption reasonable that there will be no small-scale CHP plants in 2045 because of the lack of a hydrogen network?

1.15 Battery storage

- 40. Is the assumed installed capacity (kW) and corresponding storage capacity (kWh) for small and large-scale battery systems appropriate?
- 41. Are the assumptions about storage capacity (kWh) in relation to installed capacity (kW) realistic?

1.16 European framework

42. Is the assumption of additional interconnectors only in scenario C reasonable?
43. Is the examination of these new interconnectors only on the basis of scenario B using the PINT (*Put one IN at a Time*) methodology reasonable? This would not make it possible to assess interactions between the individual projects.
44. Should the examination also be made on the basis of scenario C using the TOOT (*Take One Out at a Time*) methodology? This would make it possible to assess interactions between the individual interconnectors.
45. Is the allocation of only one European scenario representing the situation in other countries in all the scenarios reasonable?
46. Is the "National Trends+" scenario the most suitable scenario to represent the situation in European neighbouring countries?

2 Questions about the draft scenario framework for gas and hydrogen

2.1 Design of the scenarios

1. The revised EnWG for the first time requires the transmission system operators to assess at least three scenarios that cover the range of likely developments within the framework set by the federal government's climate and energy policy goals. Do the scenarios sufficiently reflect the federal government's climate and energy policy goals?
2. Is the gap between the scenarios too large, too small or appropriate?
3. Is the expected level of demand for methane and hydrogen in the individual scenarios reasonable?
4. Are the shares in the mix of the consumption of grid-based energy (electrical and material energy) reasonable?
5. How would you assess the assumed capacity of the different network users? Is sufficient account taken of capacity requirements or are the assumed capacity requirements too high?
6. Is the choice of studies taken by the transmission system operators as a basis for the scenario framework reasonable or are there other scientific publications that should be taken into account?

2.2 Decarbonisation and security of supply

7. The transmission system operators consider it necessary to look at additional modelling variants for 2037 with a focus on security of supply to balance the aims of meeting climate targets and taking adequate account of security of supply (scenario 4 "Focus on security of supply"). How would you assess the transmission system operators' modelling variants?
8. The transmission system operators also propose a natural gas modelling variant for 2030 in scenario 4 ("Focus on security of supply") to take account of the temporary increase in the demand for methane. Expansion measures resulting from this modelling variant may no longer be required as early as 2037. Would market-based instruments be a possible way of taking account of the forecast increase in the demand for methane up to 2030 without the need for additional significant network expansion measures or is there another, more rational approach?

9. Would it make sense to use other firm capacity products in the modelling instead of firm free capacity (as used in the past) in order to avoid unsustainable expansion measures?
10. Where else could specific adjustments be made in order to meet the objective of decarbonisation in network development planning and at the same time ensure security of supply with natural gas, even during times of peak load?
11. The allocation points for dynamically allocable capacity include cross-border interconnection points. Is the liquidity of the virtual trading points at these cross-border interconnection points still safeguarded even after the invasion of Ukraine?
12. The distribution of sources and the corresponding development of methane capacity at cross-border interconnection points are key factors in the modelling. Which projects with a potential impact on future capacity at cross-border interconnection points should therefore be taken into account?

2.3 Biomethane

13. The transmission system operators point out that the assumptions for biomethane injection based on the latest deliberations in the system development strategy process differ from the EU's requirements. Which assumptions should be taken in the future as the basis for the injection and transit of biomethane?

2.4 Power plants

14. Compared with the power plant requests from the Gas Network Development Plan 2022-2032, the total capacity of requests pursuant to sections 38/39 of the Gas Network Access Ordinance (GasNZV) has almost doubled to around 46 GWh/h. Is such an increase a reasonable planning approach? One possible way of mitigating the resulting increase in the demand for methane would be to cluster power plant capacity. Is this approach justified?
15. Is the choice of allocation points for the individual power plants comprehensible?

2.5 Demand for capacity from distribution system operators

16. How could the process of checking the plausibility of the distribution system operators' long-term forecasts be improved?

17. The transmission system operators propose a reduction of at least 30% compared with 2024 in the long-term forecasts for the modelling variant for 2037 in scenario 4 ("Focus on security of supply"). Is this approach reasonable or which approach would be more appropriate?

2.6 Hydrogen requirements

18. Electrolysers: the transmission system operators propose regionalising the hydrogen entry capacity assumed in the scenario-based modelling variants by distributing the capacity on a pro-rata basis between the project locations from the survey of large consumers. This results in a decrease or increase in the capacity of the individual projects, depending on the scenario. Is this approach justified or which approach would be more appropriate?

19. Which conditions in terms of the probability of implementation should be met in order for a project reported in the survey of large consumers to be taken into account in the gas and hydrogen network development planning process?

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