FNB Gas
DIE FERNLEITUNGSNETZBETREIBER

Gas Network Development Plan 2020–2030

Scenario Framework **Consultation**

Executive summary

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Scenario framework

Gas Network Development Plan 2020–2030
commissioned by the German transmission system operators (TSOs)

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| Legal disclaimer

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1 Introduction

The world of energy is changing at an ever increasing pace. The ambitious L-to-H-gas conversion project is currently in the process of implementation. Another major transformation has just begun: Other gaseous media, such as green gases, whether this is hydrogen or synthetic methane, are growing in importance and will play an important role in achieving the climate protection targets.

The existing gas infrastructure can make a significant and economically valuable contribution in the energy system of the future. Gas itself is a climate-friendly source of energy and can become completely climate-neutral. The gas infrastructure opens up the opportunity to transport very large quantities of renewable energy as well as to store it over the long term. Alongside the generation of hydrogen and synthetic methane with renewable electricity using power-to-gas (PtG), hydrogen can also be generated from natural gas in a way that is virtually free of emissions.

For this reason, the transmission system operators are conducting a market survey of green gas projects from 21 March 2019 to 12 July 2019. This is the first step in systematically and transparently identifying the demand for transporting hydrogen; this consultation process is being continued in the future network development plans with market participants. Based on the hydrogen transportation requirements, it is planned to identify which pipelines can be retrofitted for transporting pure hydrogen and at what time. If the retrofitting processes and times are confirmed by the Bundesnetzagentur (BNetzA), a binding obligation would arise for the transmission system operators to make gas infrastructure available for hydrogen at the time of the conversion.

It is the task of the transmission system operators to plan, prepare and carry out any conversion to hydrogen of network areas that are currently operated for natural gas. The gas network development plan has proved successful as a central management instrument for the L-to-H-gas conversion. The involvement of the market participants is ensured by the consultation process. The experience gained from the L-to-H-gas conversion can also be applied in similar fashion to the conversion to hydrogen.

With this document, the transmission system operators (TSOs) fulfil their statutory duty to produce and conduct a consultation on the scenario framework in accordance with Section 15a of the Energiewirtschaftsgesetz (EnWG – German Energy Industry Act). The transmission system operators present two scenarios with different development paths – gas demand in one scenario up to the year 2050 and the planned market area merger are considered for the first time.

FNB Gas commissioned a “Study on the regionalisation of PtG services for the scenario framework of the Gas NDP 2020–2030” from the Forschungsstelle für Energiewirtschaft (FfE – Research Institute for the Energy Economy) (the “FfE study”). This study analyses in particular suitable locations for PtG plants as well as sources of supply and regions of demand for green gases. More detailed information on the study can be found in the consultation document of the scenario framework.

2 Input parameters for gas demand and gas supply

The transmission system operators have revised the criteria for considering capacity reservations/capacity expansion claims in accordance with Sections 38/39 of the Gasnetzzugangsverordnung (GasNZV – German Gas Network Access Regulation).

Half of the new gas power plants taken into consideration in the consultation document are located in southern Germany. As in the Gas NDP 2018-2028, the transmission system operators will, if it can be foreseen that power plant projects for particular network operating equipment will come into competition with each other, provide a cluster approach for these gas power plants in southern Germany. In this cluster approach, the transmission system operators will implement a regional structuring of the new power plant requests that are in competition with each other.

As in the previous network development plans, the transmission system operators intend to recognise an average storage capacity of no less than 35% as planning premises in the peak load situation in the Gas NDP 2020–2030. Currently, no storage requests pursuant to Sections 38 and 39 GasNZV have been submitted to the transmission system operators that are taken into consideration on the basis of the criteria in the consultation document of the scenario framework for the Gas NDP 2020–2030.

Capacity reservations/capacity expansion claims pursuant to sections 38/39 GasNZV for planned LNG plants in Brunsbüttel and in Wilhelmshaven are available to the transmission system operators for the Gas NDP 2020–2030. In line with the current situation, the transmission system operators propose that the capacity for the LNG terminals is estimated for planning purposes in competition with bookable GUD and OGE entry points yet to be determined.

In a survey of market partners, 22 green gas projects have been reported to the transmission system operators up to the present date. The consultation document of the scenario framework consolidates these projects and classifies them based on the parameters of gas quality, source/sink, planned commissioning and connected network level. It is already evident now that the majority of these projects address hydrogen as the energy source, and some of these additionally address synthetic methane. Moreover, some biogas projects were also reported.

3 Gas demand

The consumption of natural gas initially increased from 2000 up to 2006, subsequently declined from 2006 to 2014, but has grown again in the last few years. This recent increase has been caused primarily by the rise in the use of gas for power generation. Just under half of all German apartments are currently heated using natural gas.

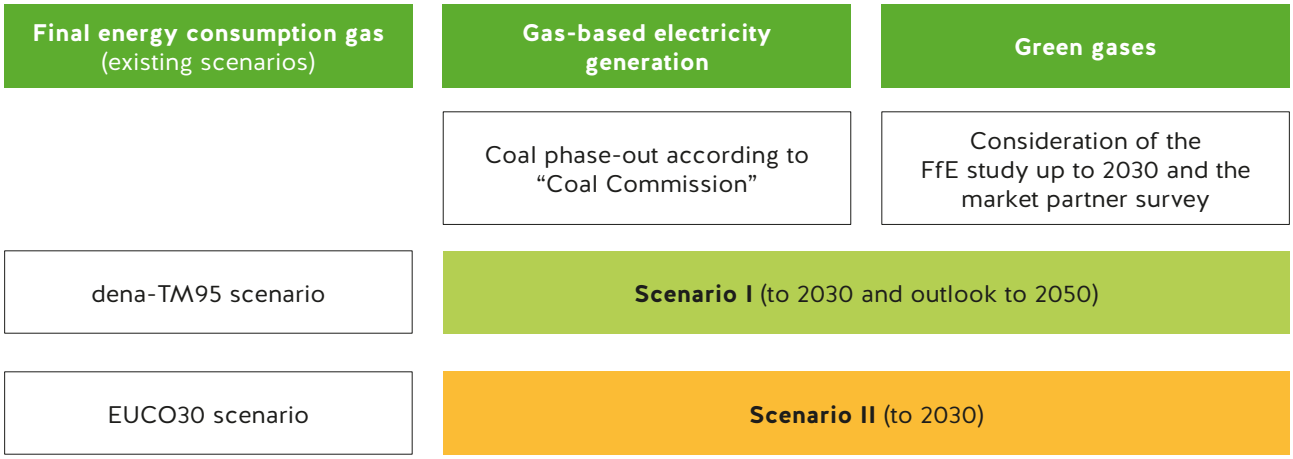
The reduction of greenhouse gas emissions, the expansion of renewable energy sources and the increase in energy efficiency are key targets of European and German energy and climate policy. The long-term goal is a major reduction in greenhouse gas emissions by 80% to 95% by 2050 in comparison with emissions in 1990. These general conditions of energy and climate policy form an important foundation for the large number of existing scenarios for energy and gas demand.

Renowned studies and publications on the future development of gas demand and gas supply in Germany have been analysed for this scenario framework. In the following, gas demand is understood to be the demand for natural gas, biogas and synthetic gases (hydrogen and methane that has been produced using renewable electricity).

For the scenario framework for the Gas NDP 2020–2030, the transmission system operators decided to take the dena-TM95* and EUCO30** scenarios into more detailed consideration (cf. Figure 1). The dena-TM95 scenario focuses on green gases. By using the EUCO30 scenario as a basis for consideration, consistency with the previous scenario framework is retained. The two selected scenarios look ahead to 2030, and in both of them the coal phase-out path, as recommended by the “Commission on Growth, Structural Change and Employment” (“Coal Commission”), is also mapped. For the dena-TM95 scenario for 2030, the “Study on the regionalisation of power-to-gas services for the scenario framework for the Gas NDP 2020–2030” of the Forschungsstelle für Energiewirtschaft (FfE – Research Institute for the Energy Economy) is also used concerning the development of green gases. The dena-TM95 scenario additionally provides a possible outlook for gas demand in 2050, and the specific results of the selected scenarios are presented here. The transmission system operators prefer scenario I.

* dena study and integrated energy transition, technology mix scenario
** Technical report on Member State results of the EUCO policy scenarios

Figure 1: Scenarios for the development of German gas demand



Source: Prognos AG

The tables below show the total German gas usage in the examined scenarios presented in terms of high calorific value (H_S) in each case.

Table 1: Development of German gas demand in scenario I, temperature-adjusted, presentation as high calorific value (H_S)

Gas demand in Germany – scenario I presentation as high calorific value (H_S)	Unit	2017	2020	2025	2030	2040	2050	Change 2030 from 2017	Change 2030 from 2020	Change 2050 from 2020
Gas demand, total	TWh H_S	968	980	998	1,039	1,087	1,159	7 %	6 %	18 %
Final energy demand, gas	TWh H_S	656	650	639	652	687	722	–1 %	0 %	11 %
Industry	TWh H_S	261	274	297	319	337	355	22 %	16 %	29 %
Households/commerce, trade and services	TWh H_S	394	371	333	296	225	155	–25 %	–20 %	–58 %
Transport	TWh H_S	2	4	9	37	125	212	1,757 %	734 %	4,657 %
Non-energy consumption of gas	TWh H_S	38	45	57	69	101	157	81 %	53 %	247 %
Gas usage in the transformation sector*	TWh H_S	274	285	302	319	299	280	16 %	12 %	–2%

* Gas consumption in the transformation sector comprises power plants, district heating plants and the internal gas consumption in the sector.

Source: BDEW/AG Energiebilanzen (final energy consumption of natural gas), calculation of the transmission system operators (temperature-adjusted values), dena 2018, Prognos AG

Table 2: Development of German gas demand in scenario II, temperature-adjusted, presentation as high calorific value (H_s)

Gas demand in Germany – scenario II, presentation as high calorific value (H_s)	Unit	2017	2020	2025	2030	2040	2050	Change 2030 from 2017	Change 2030 from 2020	Change 2050 from 2020
Gas demand, total	TWh H_s	968	980	917	880	---	---	–9 %	–10 %	---
Final energy demand, gas	TWh H_s	656	656	580	525	---	---	–20 %	–20 %	---
Industry	TWh H_s	261	261	222	204	---	---	–22 %	–22 %	---
Households/commerce, trade and services	TWh H_s	394	393	354	313	---	---	–20 %	–20 %	---
Transport	TWh H_s	2	3	4	8	---	---	276 %	185 %	---
Non-energy consumption of gas	TWh H_s	38	39	40	40	---	---	5 %	2 %	---
Gas usage in the transformation sector*	TWh H_s	274	284	297	315	---	---	15 %	11 %	---

* Gas consumption in the transformation sector comprises power plants, district heating plants and the internal gas consumption in the sector.

Source: BDEW/AG Energiebilanzen (final energy consumption of natural gas), calculation of the transmission system operators (temperature-adjusted values), EUCO 2017, Prognos AG

Green gases include biomethane, hydrogen and synthetic methane, which is generated from hydrogen. While biomethane and synthetic methane can be used like natural gas, special conditions apply to pure hydrogen. For this reason, the scenario framework explicitly addresses the possible development in demand for hydrogen in Germany.

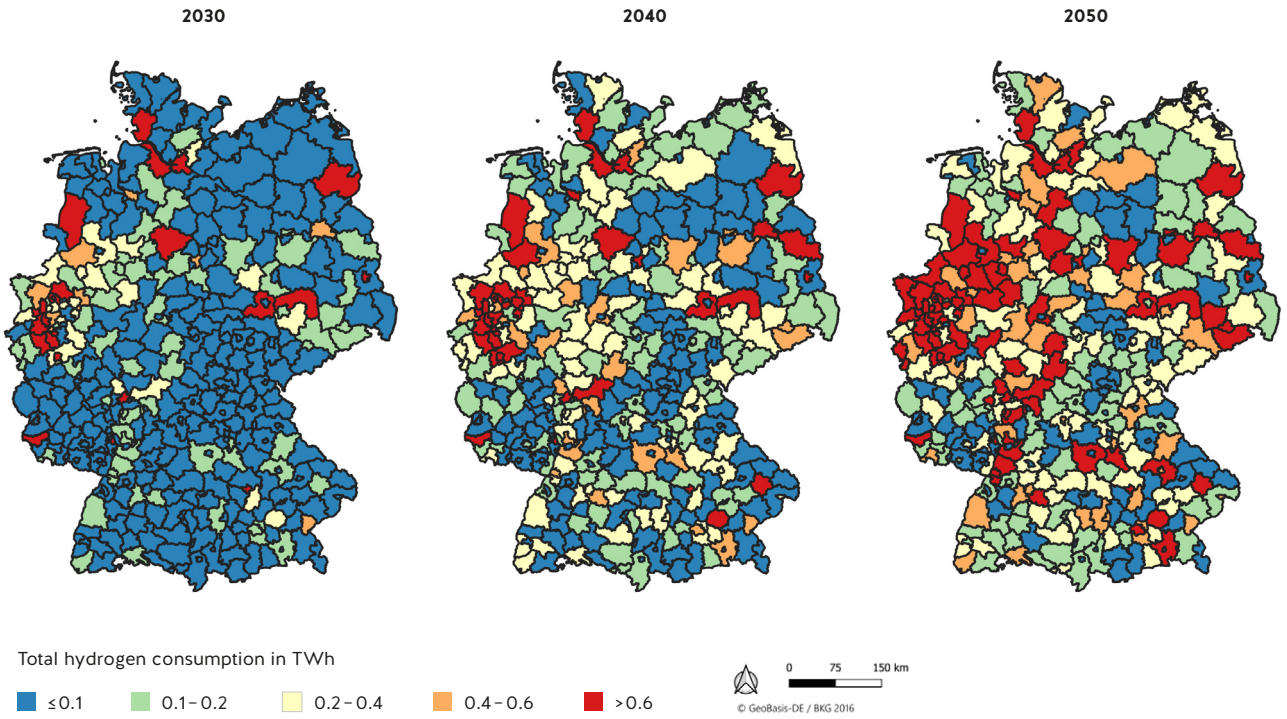
Looking forward, existing hydrogen consumption must be converted to hydrogen that is generated in a climate-neutral way. While consumption is concentrated primarily in material-based use in industry, especially the chemical industry and refineries, its use as an energy source for industrial and private heating purposes, for transport and, potentially, in the generation of electricity will increasingly emerge in the future. A significant rise in the demand for hydrogen will similarly arise in the area of steel production as the industry converts to direct reduction.

There are currently three major industrial hydrogen communities in Germany, which are referred to as the Unterelbe, Weser, Ems cluster, the central Germany cluster and the Ruhr cluster in the FfE study. Based on this existing state of affairs, the FfE study calculates the demand for hydrogen in the transport sector and in industry in TWh per administrative district for 2030, 2040 and 2050. Total hydrogen demand in 2030 is estimated at 94.4 TWh. Set against the annual demand in 2017 of 69.0 TWh, this means that annual demand will have increased by 25.4 TWh (37%).

Of this increase, 17.9 TWh can be attributed to the growing demand in the transport sector. Featuring a concentration in densely populated regions and along major transport routes, every administrative district shows demand for hydrogen in the transport section in 2030. Additional annual demand for hydrogen totalling 7.5 TWh can be attributed to the industrial sector. Strong growth in demand is shown in particular for industry in the Ruhr region.

For example, the Ruhr region is an attractive target area for hydrogen thanks to its high population density, high volume of traffic and high density of relevant industrial installations. The FfE study assesses the development to be sustainable and continuous throughout Germany. Set against 2030, demand for hydrogen is thus expected to double by 2050 (cf. Figure 2). The study focused on the demand for hydrogen in the industrial and transport sectors.

Figure 2: Combined hydrogen demand in the industrial and traffic sectors on a regional basis



Source: FfE 2019

4 Gas supply

Domestic production of natural gas, the generation and injection of biomethane as well as green gases are taken into consideration for the trends in the gas supply in Germany up to 2030.

Domestic production of natural gas

The development path is taken from a current investigation by the Bundesverband Erdgas, Erdöl und Geoenergie e.V. (BVEG – German Federal Association of Natural gas, Petroleum and Geoenergy). Natural gas production is usually presented in cubic metres in the gas industry. To make it easier to compare values, they have been converted into TWh in the scenario framework.

Table 3: German natural gas production in various units

Natural gas production in Germany – Scenario I and II	Unit	2017	2020	2025	2030	Change 2030 from 2017	Change 2030 from 2020	Change 2030 from 2025
Conventional gas	Billion m^3*	7.25	5.82	5.44	3.73	−49 %	−36 %	−32 %
Conventional gas	TWh H_s**	71	57	53	36			

* Quantities relate to natural gas with a uniform high calorific value (H_s) of 9.7692 kWh/m^3
** Quantities converted into TWh (9.7692 kWh/m^3), high calorific value (H_s)

Source: Prognos AG, BVEG 2019

Injection of biomethane

The basis for the assessment is provided by the FfE study. The Germany-wide regionalisation of the use of biomethane for providing electricity and heating is based on the assessment of the current 2018 monitoring report of the BNetzA and the project list for biomethane injection published by Deutsche Energie-Agentur GmbH (dena – German Energy Agency).

The current state of affairs and the development of biogas plants with preparation and injection into the gas grid were taken into consideration for the development of the supply of green gases. Biogas plants with injection into the gas grid are found primarily in north-east Germany. Because of the great uncertainty surrounding the development of biomethane injections, only the projected plants that can be found in dena's injection atlas are taken into consideration. Potential injection increases by 15,820 Nm^3/h (to 149,274 Nm^3/h) as a result of the projected plants [36 plants in total].

A large number of biogas plants generate electricity directly on site today. The transmission system operators see future injection potential for biomethane here. The majority of these plants can be found in the north-west and in the south. This distribution thus runs contrary to the biomethane injection sites, which are primarily located in the north-east.

Green gases (hydrogen, synthetic methane)

On account of the large storage capacity of the natural gas network and the connected natural gas storage facilities, PtG technology offers great potential for storing large volumes of energy and keeping it available for use in a flexible way. Hydrogen can currently be injected into the existing gas infrastructure only to a limited extent. The repurposing of existing transport systems to hydrogen transport systems is additionally conceivable. The transmission system operators give their constructive support for the injection of hydrogen while taking into consideration the compatibility with the entire gas network infrastructure.

Excursus: Conversion of existing systems

As a result of the conversion from L-gas to H-gas, the transmission system operators have gained experience in how network areas can be successfully converted. This concerns both the long-term planning, technical design, coordination with distribution system operators and consumers with a direct connection as well as the actual execution of the conversion. Various factors that are key for the planning of the L-to-H-gas conversion can also be used for any conversion to hydrogen.

The Gas NDP 2018-2028 includes around 90 network expansion measures costing around EUR 2 billion in connection with the conversion from L-gas to H-gas. These investments will already have been made in any case at the time of a potential conversion to hydrogen, but could generate an additional benefit in the course of a conversion to hydrogen.

Further information on this topic can be found in the study on the regionalisation of PtG services produced by the Forschungsstelle für Energiewirtschaft. This has shown that, in terms of PtG potential, the north and, looking forward, also the north-west are well suited as locations.

Total gas supply

The total regional gas supply from domestic production, biomethane and green gas production in 2030 and its change from 2018 is characterised by a sharp decline in conventional natural gas production, especially in Lower Saxony. In contrast, a slight increase in the injection of biomethane and considerable growth in the gas supply from green gases can be expected.

5 Market area merger

The goal of Section 21 GasNZV is "to increase the liquidity of the gas market" by combining the two existing market areas. In fulfilment of this statutory requirement, the TSOs should aim at transfering the capacity existing in the two separate market areas of GASPOOL and NCG (e.g. capacity in the Gas NDP 2018-2028) in terms of quantity and quality into capacity in a Germany-wide market area as far as possible. The opinions expressed in the course of the market dialogue on the draft of the capacity model of the transmission system operators also show that a future offer of capacity that is comparable with the current capacity level is of central importance. Against this background, the transmission system operators are endeavouring, where this is possible in terms of quantity and quality, to provide today's capacity in the separate market areas – listed in the Gas NDP 2018–2028 – in one Germany-wide market area.

A particular challenge in the establishing of a new capacity model for the combined market area is the relatively low exchange capacity between the NCG and GASPOOL market areas that currently exist makes it difficult to offer freely allocable capacities in the combined market area.

The consultation document of the scenario framework provides detailed information on the planned new capacity model. In short, a scenario-based approach is proposed in which the load on the network is mapped using different (load) scenarios. This is combined with a statistical approach in order thus to estimate the demand for market-based instruments (MBIs), such as wheeling, third-party network use and exchange-based spread products, for the various scenarios. The transmission system operators evaluate more than 130,000 network use cases as a basis in their model. These are simulated in a node-edge model that has been specially developed for this purpose.

Why alternatives to the use of market-based instruments cannot be recommended in the view of the system operators is explained in the consultation document of the scenario framework.

The identification of the expansion measures on account of the new system in a market area will have to be supplemented by additional process steps in the Gas NDP 2020–2030. In principle, an assessment has to take place as part of the modelling to determine whether the use of MBIs or an expansion of the network is advantageous. To this end, the costs of the relevant variant analyses have to be juxtaposed.

The use of MBIs and the resulting costs cannot be assigned clearly and by cause to the individual transmission system operators. These also have to be taken into consideration in the efficiency comparison of BNetzA. The costs for MBIs therefore have to have a neutral impact on the profit of the transmission system operators and may not exert an influence on the efficiency comparison.

In order to ensure efficient network access, it should be reviewed on a regular basis in the Gas NDP whether the costs of the MBIs permanently exceed the costs of an alternative network expansion. Should this be the case, the MBIs should be replaced by an appropriate network expansion.

Further general information can be found on the website at http://www.marktgebietszusammenlegung.de/en/

6 Gas exchange between Germany and its neighbouring countries

Incremental capacity

In the course of the 2017–2019 incremental capacity cycle, incremental exit capacity will be offered by GASPOOL at the TTF (Netherlands) in the annual auction on 1 July 2019. The auctions are thus taking place during the consultation phase for this document from 17 June 2019 to 12 July 2019. If the project for the incremental capacity is initiated, the technical capacity corresponding to the successful offer level will be included in the revised scenario framework. The documents on the 2017–2019 incremental capacity cycle are published on the homepage at www.fnb-gas-capacity.de/en. The 2019–2021 incremental capacity cycle will start with the annual auctions on 1 July 2019. Its results, however, will be incorporatetd at the earliest in the scenario framework for the Gas NDP 2022–2032.

Distribution of H-gas sources

The decline in Europe's own production and the conversion from L-gas to H-gas mean that the import demand for H-gas will increase in Europe in the coming years. As the German transmission infrastructure is traditionally heavily characterised by cross-border natural gas flows to supply its neighbouring western and southern European states, it can be expected that the requirements in terms of the cross-border exchange of natural gas will continue to grow in the future.

To be able to assess the impact of future expansions of the infrastructure for importing H-gas into Europe on the German transmission networks, the transmission system operators have updated the model for the distribution of sources that was first produced as part of the Gas NDP 2013 and further developed in the subsequent network development plans. For example, the TYNDP 2018 is now used instead of the TYNDP 2017 and new transmission pipeline projects are taken into consideration when a final investment decision (FID) is available.

Natural gas demand in Europe

On the basis of the data in the current TYNDP 2018, import demand for Europe will further increase by around 57 bcm/a by 2030 compared with start year 2020.

The "EUCO30 scenario" was used from the TYNDP 2018 for the demand side, as it maps a middle road as part of the ENTSOG scenarios up to 2030 in due consideration of the European climate protection targets.

Transport routes and infrastructure projects

In principle, the transmission system operators assume along the lines of the Gas NDP 2018-2028 that the new natural gas volumes will be shipped to Europe through new pipelines from Russia, Africa and the Caspian region or will be provided by tanker as LNG (liquefied natural gas).

As the additional import demand assumed for planning purposes has registered a significant decline on the basis of the TYNDP 2018, the transmission system operators assume that significantly fewer additional infrastructure projects will be required for Europe's supply than was believed just a few years ago. Only projects for which a final investment decision is available (known as FID projects) are therefore taken into consideration in principle in the scenario framework for the Gas NDP 2020–2030. The table below presents an overview of the infrastructure that is taken into consideration. The consultation document of the scenario framework contains a complete list of the infrastructure taken into consideration.

Table 4: Infrastructure considered in the distribution of H-gas sources

Type/region	Technical capacity [bcm/a]	Consideration in the distribution of H-gas sources
Total pipelines, north-east	29.60	-
Total pipelines, south/south-east	129.90	45.40
Total LNG, north-east	30.85	9.00
Total LNG, west	134.25	111.95
Total LNG, south-west	82.9	76.50
Total LNG, south	34.03	17.53
Total LNG, south-east	15.15	7.75
Total transmission pipelines, all regions	**159.50**	**15.40**[1]
Total LNG, all regions	**297.18**	**222.73**

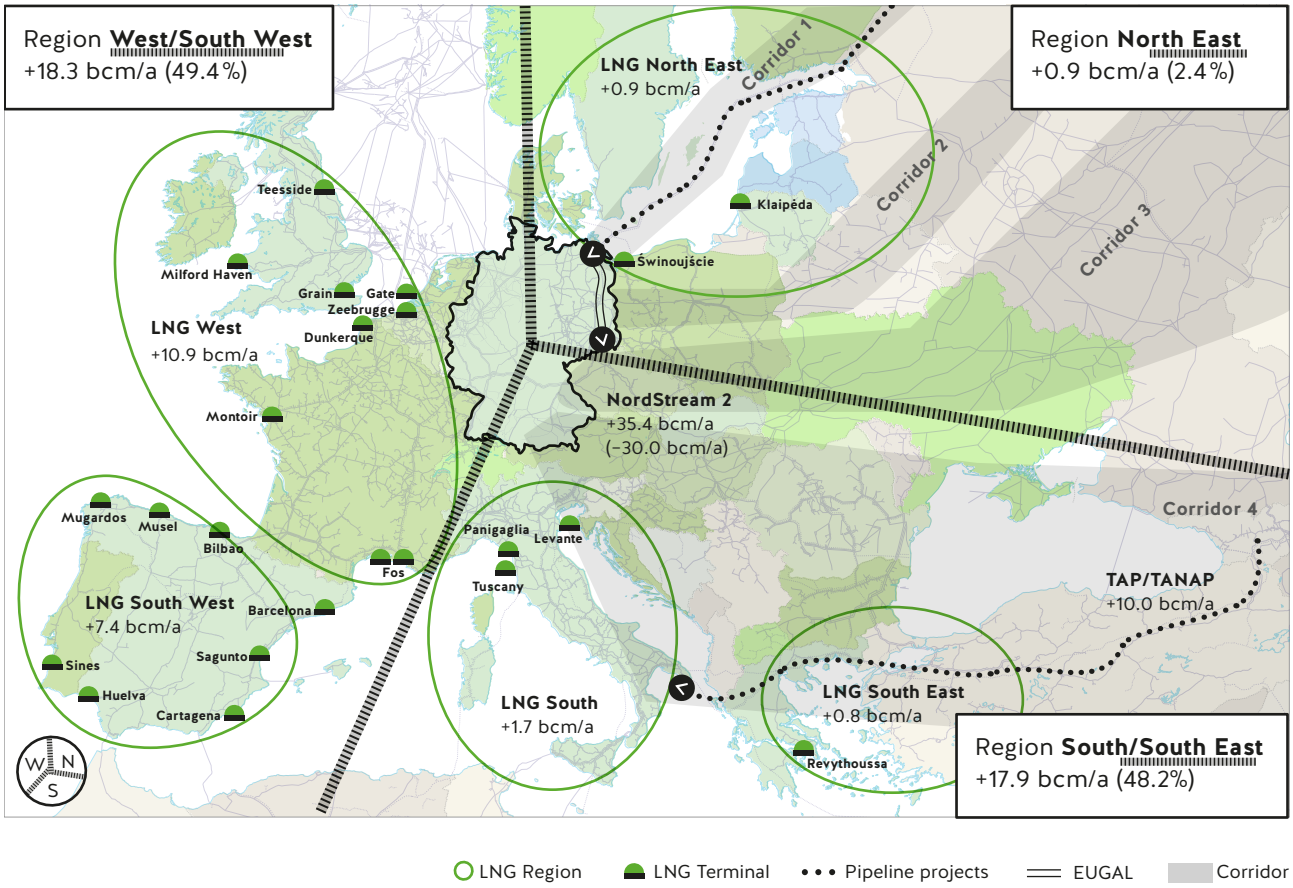
[1] Substitution quantities for the Ukraine transit (30 bcm/a) taken into consideration

Source: Transmission system operators on the basis of the TYNDP 2018

Supply variant for Europe

The impact of the infrastructure projects on Germany is determined within the framework of the distribution of H-gas sources. The illustration below gives an overview of the result. In summary, it can be noted that the additional demand for H-gas that can be expected is set to be covered in roughly equal parts from the west/south-west and south/south-east regions.

Figure 3: Coverage of the additional European demand up to 2030



Source: Transmission system operators

Interconnection points

The German transmission system operators have border crossing points with the West/South-West Europe region (Norway, the Netherlands, Belgium, Luxembourg), the South/South-east Europe region (France, Switzerland, Austria, Czech Republic) and the North-east Europe region (Poland, Russian Federation, Denmark). Germany thus has eleven “gas neighbours”. Please refer to the consultation document of the scenario framework for the description of the cross-border interconnection points.

Virtual interconnection points (VIPs)

The transmission system operators show VIP capacity for the first time in the scenario framework for the Gas NDP 2020–2030. The existing VIPs are mapped in the NDP gas database as of the reporting date of 6 May 2019. It should be noted that the VIP L GASPOOL-NCG will cease to exist as a result of the market area merger on 1 October 2021.

7 Security of supply

In line with Section 15a(1) EnWG, assumptions concerning the impact of conceivable disruptions to supply are made in the scenario framework. The transmission system operators have continually conducted detailed assessments of various disruption scenarios and security of supply scenarios since the Gas NDP 2012. These include the market area conversion from L-gas to H-gas. Lastly, the transmission system operators have presented the TENP security of supply variant, which investigates the effects of any limited availability of the transport capacity of the TENP system that may persist over a longer term.

In the opinion of the transmission system operators, there is no need to model a hypothetical disruption to supply for the Gas NDP 2020–2030. Rather, the transmission system operators see the necessity of further detailing the in-depth conversion plans up to 2030 on account of the future reduction in the availability of L-gas for the German market. Furthermore, the Germany-wide availability of H-gas needs to be examined in the Gas NDP 2020–2030 and presented in an up-to-date H-gas balance up to 2030. The available injection volumes from storage facilities and at interconnection points are considered in more detail here among other things.

Development of the L-gas supply

L-gas production in Germany is in continual decline. The remaining German L-gas reserves should continue to be extracted if possible and can be injected into the natural gas transmission network. L-gas production in the Netherlands is also in decline and subject to restrictions on account of earthquakes that are seen in connection with production. A continual decrease in natural gas exports from the Netherlands to Germany will result from this from October 2020 onwards. For this reason, the German transmission system operators take part in regular exchanges with the Dutch transmission system operator Gasunie Transport Services B.V. (GTS) on harmonising and updating the planning assumptions for future L-gas imports.

These developments have significant impact in relation to the annual volumes and annual output available in Germany. The transmission system operators therefore developed at an early stage a concept for converting the areas supplied with L-gas to H-gas and started on its implementation. The conversion will require consumer appliances to be modified, among other things.

Situation involving gas imports from the Netherlands

In order to take the risks arising from natural gas production into consideration, the Dutch Ministry of Economic Affairs and Climate Policy announced in March 2018 that the production of natural gas in the Groningen area will be ended completely by 2030 at the latest.

The expansion of the Dutch conversion facilities in the coming years will make a significant contribution to compensate for the reduction in the Groningen production. Furthermore, it is planned to convert major industrial customers (annual consumption of more than 100 million m^3 per industrial customer) in the Netherlands to H-gas. These measures will significantly increase the demand for H-gas in the Netherlands. GTS has launched a process for assessing the security of supply taking the growth in demand into consideration.

Despite the reductions in the production volume that have already been decided, another powerful earthquake measuring 3.4 on the Richter scale hit at around 6 o'clock in the morning of 22 May 2019.

Both the Staatstoezicht Op De Mijnen (SodM – Dutch State Supervision of Mines) and the producer at the Groningen field (NAM) have published their initial opinions on the new earthquake. Both assessments assert that, although the reductions in production already lessened the probability of a major earthquake, they are not able to "rule out" the possibility of any earthquakes. The SodM therefore also recommends a further reduction in production as early as the 2019/2020 gas year.

It cannot be predicted at the moment (7 June 2019) whether and, as the case may be, to what extent the new earthquake will impact the L-gas volumes and capacity available for Germany.

The transmission system operators maintain close contacts with GTS in this connection and also in order to coordinate the relevant planning in the Netherlands and Germany.

Domestic production

The Bundesverband Erdgas, Erdöl und Geoenergie e.V. (BVEG – German Federal Association of Natural gas, Petroleum and Geoenergy) sent its current forecast for domestic production to the transmission system operators in May 2019. Minor changes were made to the previous forecast values from 2018 in the updated publication.

At the end of the formal review period in 2030, the possibility of diverting L-gas production volumes will continue to exist only in the Nowega network. At the same time, the security of supply will have to be ensured using the sources that will then still be available (domestic production, Empelde underground gas storage facility, Rehden conversion facility). The transmission system operators are developing a forecast for the period after 2030 for this particular situation and will provide market participants with the opportunity to join the consultation on this special issue at an early stage.

8 Modelling and modelling variants

Overview of the modelling variants

The scenario framework forms the basis for the creation of the Gas NDP 2020–2030. The transmission system operators propose a network modelling variant (base variant). Furthermore, the security of supply scenarios in L-gas and H-gas up to 2030 are updated.

The transmission system operators envisage the following selection and specification for the modelling in the Gas NDP 2020–2030 (cf. Table 5).

The consultation document of the scenario framework contains a comprehensive explanation of the base variant for the modelling of the Gas NDP 2020–2030 and specifies the criteria for including measures from the Gas NDP 2018–2028 in the base network for the modelling of the Gas NDP 2020–2030.

Consideration of hydrogen and synthetic methane in the modelling

The expansion path for PtG facilities has been developed on the basis of available studies [dena 2018, DLR 2015, Energy Brainpool/Greenpeace Energy 2017, Frontier 2017, Moser 2017, UBA 2010, UBA 2017] and assumptions concerning current technical availability and the potential for innovation of PtG plants.

Depending on the relevant design and objective of the studies providing the basis, it can be established that the forecast PtG capacity for 2050 lies between 40 GW_e and 254 GW_e. Target values of up to 16 GW_e are given for 2030. Irrespective of the design of the study in question, the development of PtG plants has to be carried out on an industrial scale in the short term.

It is assumed in the Gas NDP 2020–2030 that installed PtG capacity of 1.5 GW_e will be possible by 2025. With the knowledge gained and thus the cost reduction achieved from this first expansion and development phase, a further average expansion of 1.2 GW_e per year up to 2030 is taken as a basis, which corresponds to total capacity of 7.5 GW_e in 2030.

Table 5: Modelling variants in the scenario framework for the Gas NDP 2020–2030

Modelling variant	Base variant 2025	Base variant 2030	L-gas balance 2030	H-gas balance 2030
Designation	B.2025	B.2030	L.2030	H.2030
Calculation	complete 2025	complete 2030	Balance analysis	
Reporting date/period	31 December 2025	31 December 2030	1 October 2030	
Distribution system operators (internal orders)	Start value: Internal orders 2020, development: the 10-year forecast of the DSOs up to and including 2025, the plausibility of which has been verified, constant updates thereafter		Analysis of the long-term L-gas balances up to 2030	Analysis of the long-term H-gas output balance up to 2030
H-gas sources	Additional demand by distribution of H-gas sources in accordance with Chapter 7.2 of the scenario framework			
IP/VIP	Inventory according to "2020 – SR consultation" database cycle, need for expansion in line with Chapter 7 of the scenario framework in due consideration of the TYNDP			
Use of MBIs	Use of commercial instruments for planning purposes			
Market area interconnection points	Discontinuation of market area interconnection points with effect from October 2021 on account of the merger of the market area			
L- to-H-gas conversion	Modelling of the conversion areas, including conversions up to 2031 in order to identify the necessary network expansions measures up to 31 December 2030			
Underground gas storage facilities	Inventory according to "2020 – SR consultation" database cycle, new build in accordance with Chapter 2.3.2: 100% temperature-dependent capacity			
Power plants	Inventory according to "2020 – SR consultation" database cycle, currently on interruptible basis directly connected systemically important power plants in accordance with Chapter 2.2.1, new build in accordance with Chapter 2.2.2, 100% firm dynamically allocable capacity (fDZK)			
LNG	New build in line with "2020 – SR consultation" database cycle, see also Chapter 2.4.3			
Industry	Constant capacity demand, consideration of the binding additional demand, free allocable capacity approach			
Biomethane	According to "2020 – SR consultation" database cycle			
Hydrogen and synthetic methane	Consideration of the hydrogen projects for which specific implementation intentions, including project data, are available	Consideration of FfE study and market surveys on hydrogen and synthetic methane		

Information: References in the table refer to the consultation document of the scenario framework

Source: Transmission system operators