

Gas Network Development Plan 2020–2030

Scenario Framework

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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1 Introduction

The world of energy is changing faster and faster. 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 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 conducted 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.

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 L-to-H-gas conversion. The involvement of market participants is ensured by the consultation process. The experience from L-to-H-gas conversion can also be applied in similar fashion to the conversion to hydrogen.

The transmission system operators present two scenarios with different development paths – for the first time, gas demand up to 2050 and the planned market area merger have been considered in one scenario.

With the Scenario Framework on which this document is based, the transmission system operators (TSOs) fulfil their statutory duty to produce the Scenario Framework in accordance with Section 15a of the *Energiewirtschaftsgesetz* (EnWG – German Energy Industry Act). The Scenario Framework was open to consultation from 17 June 2019 to 12 July 2019. In revising the Scenario Framework, the transmission system operators added the section “Consideration of the results of the public consultation”. Key areas of the consultation included the market area merger, the inclusion of the green gas projects in the Gas NDP 2020–2030 and capacity requirements in southern Germany and at the Wallbach cross border interconnection point.

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

2 Input parameters for gas demand and gas supply

The transmission system operators have revised the criteria for capacity reservations/capacity expansion claims in accordance with Sections 38/39 GasNZV.

More than half of the new gas power plants taken into consideration in the Scenario Framework are located in southern Germany. In addition to the Irsching power plant (0.3 GW_e), the Biblis and Leipheim power plants with capacity of 0.3 GW_e and 0.67 GW_e respectively are taken into consideration in the Scenario Framework as special network operating equipment. The total electrical capacity of these three power plants comes to 1.27 GW_e. As the total electricity capacity of these power plants is only 0.07 GW_e more than the demand for new construction on network stability facilities shown in the BNetzA report of 31 May 2017 identifying the demand at network stability facilities in accordance with Section 13 k EnWG, the three power plants mentioned above are taken into consideration in the Scenario Framework in the full amount. As in the previous Network Development Plans, the transmission system operators also intend to estimate an average storage capacity of no less than 35 % as planning premises in the peak load situation in the Gas NDP 2020–2030. Two storage requests pursuant to Sections 38/39 GasNZV have been submitted to the transmission system operators that are taken into consideration in the Scenario Framework for the Gas NDP 2020–2030 on the basis of the criteria.

Capacity reservations/capacity expansion claims pursuant to Sections 38/39 GasNZV for planned LNG plants in Brunsbüttel, Stade and Wilhelmshaven are available to the transmission system operators for the Gas NDP 2020–2030. 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. LNG facilities should be taken into consideration “for planning purposes in terms of competition” so that the networks are not designed to be able to take over further capacity from LNG facilities at the same time in addition to any takeover from the entry points (essentially cross border interconnection points and underground gas storage facilities). Furthermore, it is investigated whether the LNG facilities are recognised in competition with each other. The design of the rival marketing should enable capacity that is not nominated or not booked in the short and medium term to be used at the rival points. Efficient use of the existing gas network infrastructure can be guaranteed in this way.

In a market partner survey, a total of 31 green gas projects were reported to the transmission system operators. The Scenario Framework consolidates these projects and classifies them based on the parameters of gas quality, source/sink, planned commissioning and connected network level. In the Scenario Framework, the transmission system operators have established criteria for the inclusion of green gas projects in the model for the Gas NDP 2020–2030. The transmission system operators propose the consideration of 21 projects based on these criteria. The majority of the project developers requested that the necessary data be anonymised. The transmission system operators have therefore shown aggregated values for the consideration of green gas projects in the Scenario Framework. It is already evident that most of these projects address hydrogen as an energy source, some of which also address synthetic methane. Biogas projects were also reported.

3 Gas demand

The consumption of natural gas initially increased from the base year of 2000 to 2006, then declined from 2006 to 2014 and has now been growing again in the past few years. The increase in recent years was mainly due to the rise in gas-fired power generation. Approximately half of all German apartments are currently heated with 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 the existing scenarios for energy and gas demand.

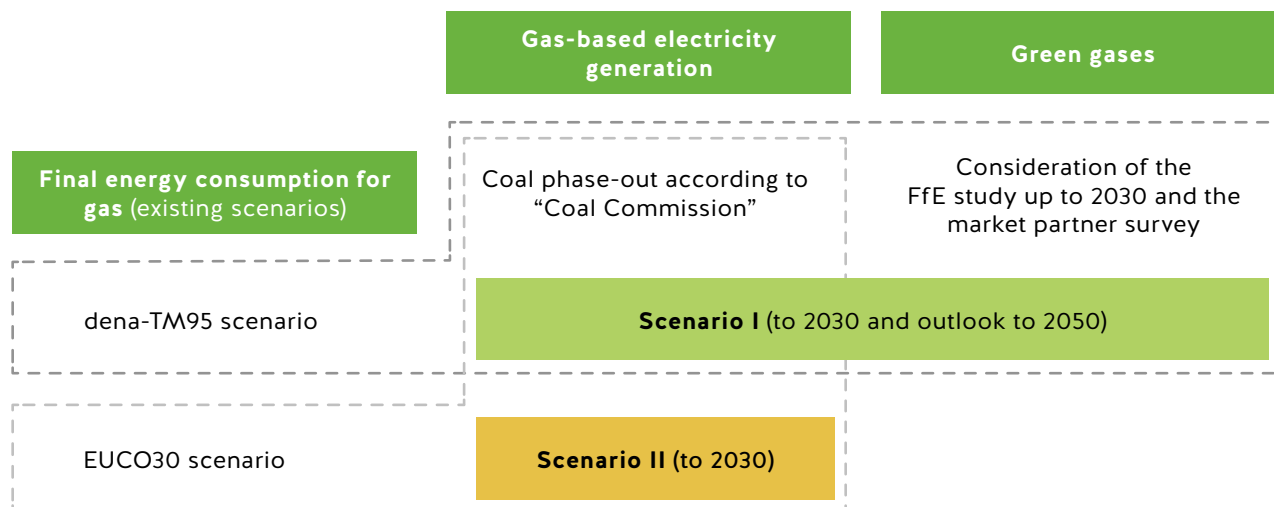
Renowned studies and publications on the future development of gas demand and gas supply in Germany were analysed for this Scenario Framework. In the following, gas demand is understood to be the demand for natural gas, biogas and synthetic gases (hydrogen and methane that has been produced using renewable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

For the Scenario Framework for the Gas NDP 2020–2030, the transmission system operators decided to take the dena-TM95* and EU40** scenarios into more detailed consideration (cf. Figure 1). The dena-TM95 scenario focuses on green gases. By using the EU40 scenario as a basis for consideration, the 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, 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 in 2030 with regard to 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 EU40 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	1,013	1,054	1,095	1,159	9 %	7 %	18 %
Final energy demand for 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	317	333	307	280	22 %	17 %	–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 (H₅)

Gas demand in Germany – Scenario II, presentation as high calorific value (H ₅)	Unit	2017	2020	2025	2030	2040	2050	Change 2030 from 2017	Change 2030 from 2020	Change 2050 from 2020
Gas demand, total	TWh H ₅	968	980	932	894	---	---	–8 %	–9 %	---
Final energy demand for gas	TWh H ₅	656	656	580	525	---	---	–20 %	–20 %	---
Industry	TWh H ₅	261	261	222	204	---	---	–22 %	–22 %	---
Households/commerce, trade and services	TWh H ₅	394	393	354	313	---	---	–20 %	–20 %	---
Transport	TWh H ₅	2	3	4	8	---	---	276 %	185 %	---
Non-energy consumption of gas	TWh H ₅	38	39	40	40	---	---	5 %	2 %	---
Gas usage in the transformation sector*	TWh H ₅	274	284	312	329	---	---	20 %	16 %	---

* 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.

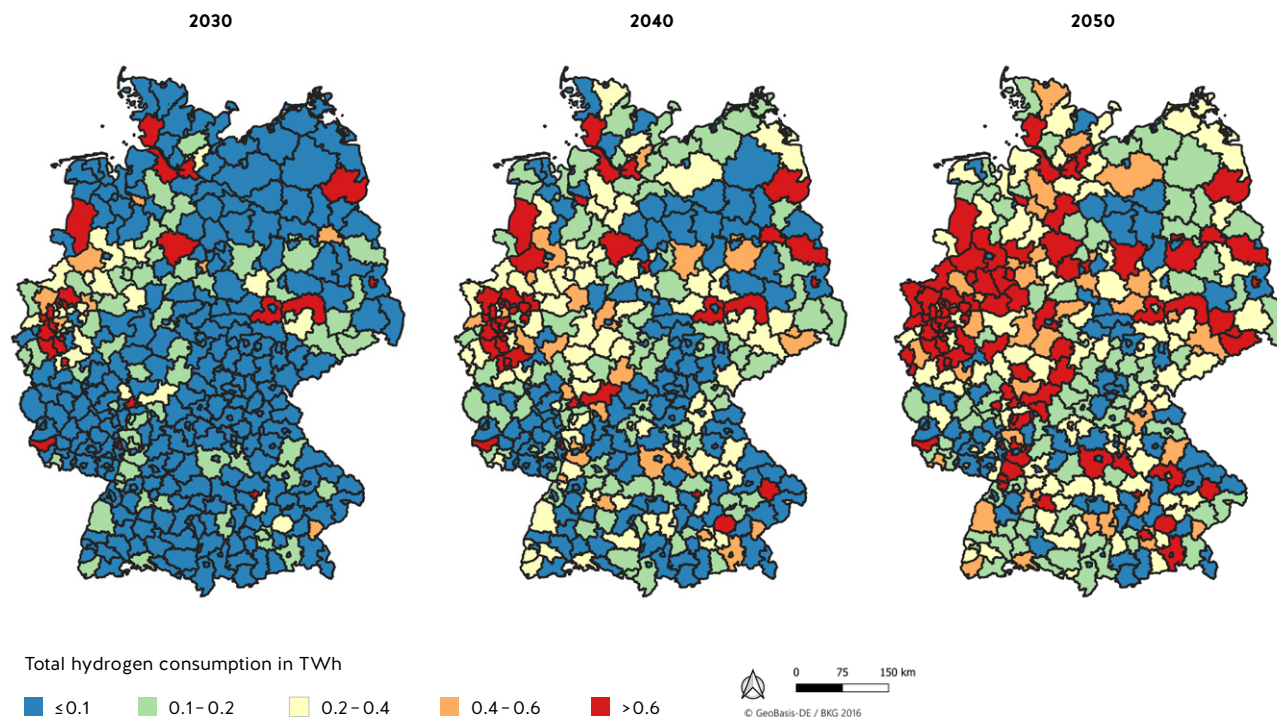
Looking forward, existing hydrogen consumption must be converted to hydrogen that is generated in a climate-neutral way. While consumption is concentrated primarily in the material-based use in industry, especially the chemical industry and refineries, its use as an energy source for industrial and private heating purposes, for transport and, potentially, in the generation of electricity will increasingly emerge in the future. A significant increase 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 Untere Elbe, 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 delivers the demand for hydrogen in the transport sector and in industry in TWh per 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 %).

17.9 TWh of this increase 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 sector in 2030. An additional annual demand for hydrogen of overall 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 and the Rhine corridor are attractive target areas for hydrogen thanks to their 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. Compared with 2030, the demand for hydrogen is expected to double by 2050 (cf. Figure 2). The study focused on hydrogen demand in the industrial and traffic 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/m³.

** Quantities converted into TWh (9.7692 kWh/m³), high calorific value (H_s)

Source: Prognos AG, BVEG 2019

Biomethane injection

The basis for the assessment is the FfE study. The Germany-wide regionalisation of the use of biomethane for providing electricity and heating is based on the assessment of the Federal Network Agency's current 2018 monitoring report 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 injecting into the gas grid are primarily found in the north-east of Germany. Due to great uncertainty regarding 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 Nm³/h (up to 149,274 Nm³/h) as a result of the projected plants [36 plants in total].

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

Green gases (hydrogen, synthetic methane)

PtG technology offers great potential for storing large volumes of energy and using it in a flexible way due to the large storage capacity of the natural gas network and the connected natural gas storage facilities. Hydrogen can only be injected into the existing gas infrastructure up to a certain limit at the current time. The repurposing of existing transport systems to hydrogen transport systems is additionally conceivable. The transmission system operators constructively support 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 successfully converting network areas. 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 hydrogen conversion.

Further information on this can be found in the study on the regionalisation of power-to-gas services by the Research Institute for the Energy Economy. This found that there is also PtG potential primarily in the north and the north-west of Germany.

Total gas supply

The total regional gas supply from domestic production, biomethane and green gas production in 2030 and its change from 2018 is dominated by a sharp decline in conventional natural gas production, particularly in Lower Saxony. By contrast, a slight increase in biomethane injections and significant growth in gas volumes due to green gases are 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 to transfer 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 for the market. 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 – taken from 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. This makes it difficult to freely allocate capacities in the combined market area.

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 by various (load) scenarios. This is combined with a statistical approach, the demand for market-based instruments (MBIs), such as wheeling, third-party network use and exchange-based spread products, to estimate 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 system operators do not recommend alternatives to the use of market-based instruments is described in 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 for this purpose as part of the modelling to determine whether the use of MBIs or an expansion of the network is advantageous. The costs of the respective variant analysis have to be compared.

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 capacity from GASPOOL to the TTF (Netherlands) was offered in the annual auction on 1 July 2019. This incremental capacity offered was not booked. 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 started with the annual auctions on 1 July 2019. Its results will be incorporated at the earliest, however, 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-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 streams 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. Now TYNDP 2018 is used instead of TYNDP 2017, and new pipeline projects are taken into consideration when a final investment decision (FID) has been made.

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 up to 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 ENTSG scenarios up to 2030 in due consideration of the European climate protection targets.

Transport routes and infrastructure projects

In line with the Gas NDP 2018–2028, transmission system operators assume that the new natural gas volumes will be transported to Europe through new pipelines from Russia, Africa and the Caspian region, while volumes will be provided as LNG (liquefied natural gas) by tanker.

As the additional import demand assumed for planning purposes shows 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 provides an overview of the infrastructure considered. The Scenario Framework contains a full list of the infrastructure considered.

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 pipelines, all regions	159.50	15.40¹
Total LNG, all regions	297.18	222.73

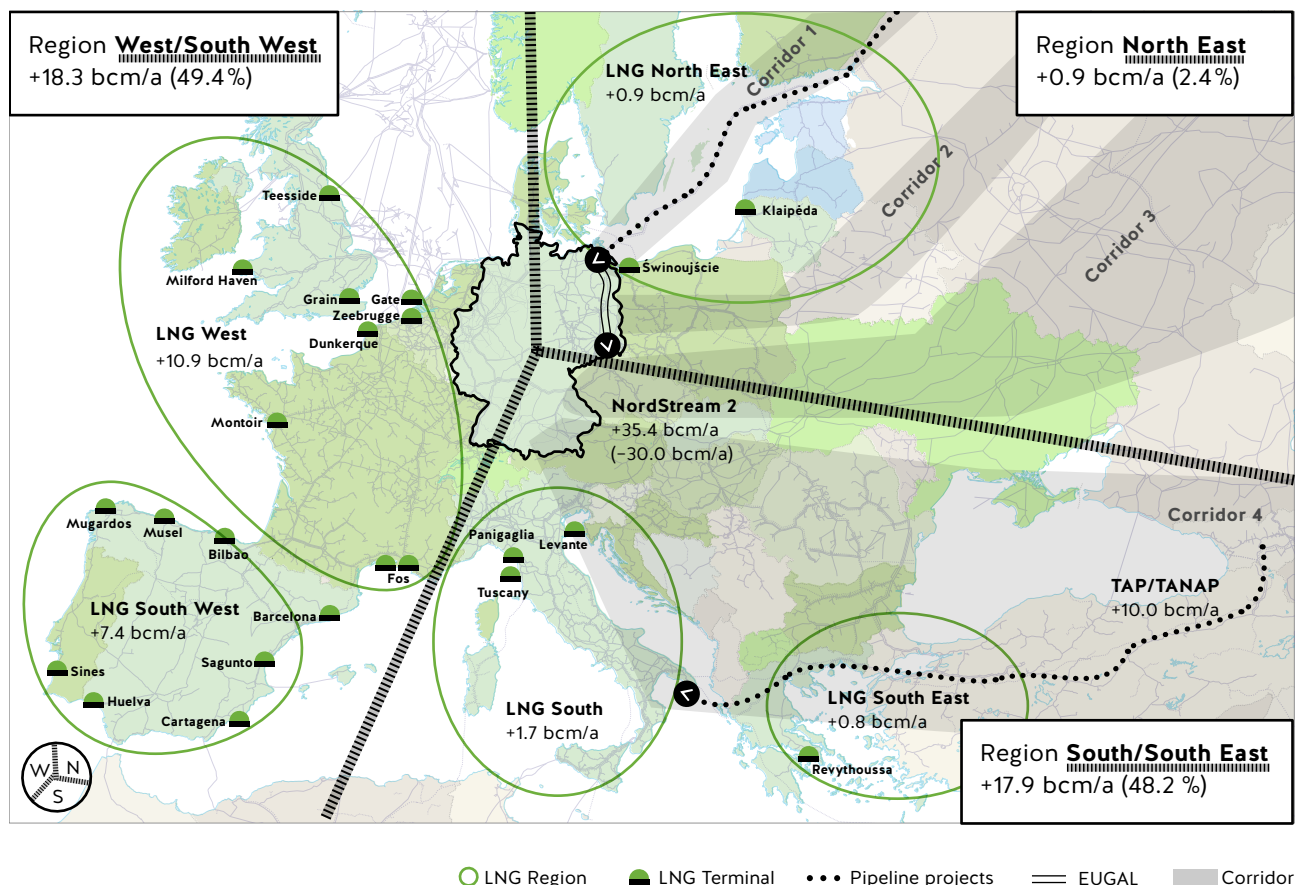
¹ Substitution quantities for the Ukraine transit (30 bcm/a) taken into consideration

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 figure below shows the results at a glance. In summary, the anticipated additional H-gas demand is to be covered approximately equally by the west/southwest and south/southeast regions.

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



Source: Transmission system operators

Cross border interconnection points

The German transmission system operators have IPs to the west/southwest Europe (Norway, Netherlands, Belgium, Luxembourg), south/southeast Europe (France, Switzerland, Austria, Czechia) and northeast Europe (Poland, Russian Federation, Denmark) regions. Germany therefore has eleven “gas industry neighbours”. Please see the Scenario Framework for a detailed 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. The existing VIPs are mapped in the NDP gas database as at 6 May 2019. It should be noted VIP L GASPOOL-NCG will cease to apply as a result of the market area merger as at 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. Since the Gas NDP 2012, transmission system operators have continuously examined various disruption and security of supply scenarios in detail. This includes the market area conversion from L-gas to H-gas. Recently, 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.

There is no need in the opinion of the transmission system operators for the Gas NDP 2020–2030 to model a hypothetical disruption to supply. Rather, the transmission system operators see the necessity of further fleshing out 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 a significant impact in relation to the annual volumes available in Germany and capacity. 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 will provide a significant contribution compensating for the reduction in production in Groningen in the next few years. Furthermore, it is planned to convert major industrial customers (annual consumption of more than 100 million m³ per industrial customer) in the Netherlands to H-gas. These measures 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 plans in the Netherlands and Germany.

Domestic production

The BVEG 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 this particular situation for the period after 2030 and will provide market participants with an early and transparent opportunity to join the consultation on this special issue.

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 Scenario Framework contains detailed information on the base variant for the modelling of the Gas NDP 2020–2030 and sets out the criteria for including measures from the Gas NDP 2018–2028 in the base network for the modelling of the Gas NDP 2020–2030.

Regarding the development of demand in Baden-Württemberg, terranets bw is also conducting complete modelling and identification of the necessary measures and their dimensioning in its network area for 2030 (design variant).

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 using the 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 a large technical scale in the short term.

It is assumed in the Gas NDP 2020–2030 that installed PtG capacity of 1.5 GW_e in total 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 8.2 of the Scenario Framework			
IP/VIP	Inventory according to “2020 – SF” Gas NDP database cycle, need for expansion in line with Chapter 8 of the Scenario Framework in due consideration of the TYNDP			
Use of MBIs	Use of commercial instruments for planning purposes			
Market area inter-connection points	Discontinuation of market area interconnection points with effect from October 2021 on account of the market area merger			
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 – SF” Gas NDP database cycle, new build in accordance with Chapter 3.3.2: 100 % temperature-dependent capacity			
Power plants	Inventory according to “2020 – SF” Gas NDP database cycle, currently on interruptible basis directly connected systemically important power plants in accordance with Chapter 3.2.1, new build in accordance with Chapter 3.2.2, 100 % firm dynamically allocable capacity (fDZK)			
LNG	New build in line with “2020 – SF” Gas NDP database cycle, see also Chapter 3.4.3			
Industry	Constant capacity demand, consideration of the binding additional demand, freely allocable capacity approach			
Biomethane	according to “2020 – SF” Gas NDP database cycle			
Hydrogen and synthetic methane	Consideration of market surveys on hydrogen and synthetic methane in accordance with Chapters 3.5 and 10.3	Consideration of FfE study, Electricity NDP 2019–2030 and market surveys on hydrogen and synthetic methane, see also Chapter 10.3		

Source: Transmission system operators