L-Gas Market Conversion Review

Summer Report 2022

Task Force Monitoring L-Gas Market Conversion

Ministry of Economic Affairs and Climate Policy

Foreword

This is the sixth edition of the report monitoring the conversion of the low calorific gas (L-gas) markets in Belgium, France, Germany, and the Netherlands in order to reduce demand for Groningen gas (one of the sources for L-gas). This report looks back on the market developments through the previous heating season (2021/22) and looks forward to the coming gas years with regard to the observed and expected demand for Dutch L-gas and conversion progress of gas installations.

The current report provides an update on the progress of the conversion programs, with a special focus on conversions through the Gas Year 2021/22. The estimated volume effect on the L-gas demand of the 2021/22 Gas Year was 29 TWh. The conversion programme is expected to reach its highest level through Gas Years 2022/23 and 2023/24, with an average volume effect on the L-gas demand of over 45 TWh per Gas Year.

The report is compiled by the International Energy Agency (IEA), the European Network of Transmission System Operators for Gas (ENTSOG), Gasunie Transport Services (GTS), and the Netherlands Ministry of Economic Affairs and Climate Policy (Min. EZK), under the umbrella of the Task Force Monitoring L-gas Market Conversion, consisting of government representatives, representatives of transmission system operators (TSO's) and energy market regulators from Belgium, France, Germany, and the Netherlands, and an observer from the European Commission. The activities of the Task Force are supported by the Benelux Secretariat-General. The report is published semi-annually. The Netherlands will use this report to inform the Dutch Parliament on the progress of reducing the demand for Groningen gas.

Executive summary

The government of the Netherlands announced in March 2018 its decision to terminate natural gas production from the Groningen field as soon as possible but not later than 2030, in order to guarantee safety in the area of Groningen against the risk of earthquakes resulting from natural gas extraction.

The initial schedule for production phase-out - which aimed for termination in 2030 at the latest - was revised in 2019 following the adjusted advice of the State Supervision of the Mines after an earthquake occurred on 22 May 2019, with the objective of accelerating the termination by Gas Year[1] (GY) 2022/23 for average weather conditions. From 1 October 2022, gas from the Groningen field (Groningen gas) should indeed only be needed in case extreme low temperatures (-9 degrees Celsius or colder) and in case of a severe disruption elsewhere in the L-gas system. To be able to guarantee production in those circumstances the field will operate on minimum flow during the entire gas year.

However, household appliances still need Groningen-gas in the Netherlands (max. Wobbe 44.4 MJ/m3) and L-gas in Germany, Belgium, France (max Wobbe 46.5 MJ/m3). Without Groningen gas, so called "pseudo L-gas" is needed to secure the supply in the L-gas market region.

Pseudo L-gas can be principally produced as follows:

- nitrogen is added to high calorific gas (H-gas) in order to bring down the Wobbe-value until it meets the upper Wobbe-limits of the L-gas specifications (46.5 MJ/m3);
- enrichment: adding H-gas to (pseudo) Groningen-gas[2] until the upper Wobbe-limit of the L-gas specifications (46.5 MJ/m3) is reached.

Whilst Groningen gas production has halved from 341.8 TWh (or 35 bcm) in GY 2014/15 to 171 TWh (or 17.5 bcm[3]) in GY 2018/19, the production of pseudo G/L-gas more than doubled during the same period of time. This trend accelerated through the last two Gas Years, as Groningen gas production gas production more than halved from 171 TWh in GY 2018/19 to 75.9 TWh in GY 2020/21. This trend continued through the 2021/22 heating season, as Groningen gas production more than halved (a decline of 23.7 TWh) year-on-year, from 44.8 TWh to 21.1 TWh.

In line with the declining natural L-gas production from the Netherlands, the production of pseudo L-gas more than doubled between GY 2014/15 and GY 2020/21, rising from 155 TWh to close to 384 TWh. Higher pseudo L-gas production has been made possible with the expansion of the nitrogen blending capacity by 80,000 m3/h N2 at the Wieringermeer conversion facility, starting from 23rd December 2019. This has translated into an additional 48.9 TWh/year of pseudo L-gas production capability.

During the 2021/22 heating season, total pseudo L-gas production declined by 8.4% (or 18.2 TWh) year-on-year, from 217 TWh to 198.9 TWh due to the steep decline in Dutch L-gas demand[4] (-15%). As Groningen production fell more steeply than pseudo L-gas output, the share of pseudo L-gas in total Dutch L-gas production grew from 83% in the 2020/21 heating season to 90% during the 2021/22 gas winter.

Due to the high pseudo L-gas production via nitrogen blending, the utilization rate of nitrogen blending facilities remained close to the average of the 2020/21 heating season, standing at 103% through the 2021/22 gas winter. The utilization rate of above 100% indicates the use of back-up nitrogen capacity to produce higher volumes of pseudo L-gas.

Pseudo L-gas is playing an increasingly important role in reducing Groningen gas production, with its share expected to increase from 65% in GY 2018/2019 to close to 93% of L-gas produced in the Netherlands in GY 2022/23.

In the GY 2022/23, pseudo L-gas will account to close 93% (or 381 TWh) of L-gas produced in the Netherlands and is set to provide over 80% of the upward production flexibility necessary to meet Dutch L-gas demand in a cold GY in the L-gas region. Nitrogen blending alone will account to 81% (or 335 TWh) of L-gas produced in the Netherlands and expected to provide almost 72% of the upward production flexibility necessary to meet demand in a cold GY in 2022/23.

[1] A gas year (GY) starts on 1 October and ends on 30 September.
[2] Pseudo Groningen-gas (or pseudo G-gas) is obtained via enrichment: nitrogen is added to high calorific gas (H-gas) in order to bring down the Wobbe-value until it meets the upper Wobbe-limits of the G-gas specifications (44.4 MJ/m3). This gas quality is stored in the Dutch G/L-gas storages.
[3] Volumetric data is expressed in Normal cubic meters (Nm^3), under reference conditions of temperature (0 °C) and pressure (101.325 kPa).
[4] Demand of L-gas produced in the Netherlands (both Groningen gas and pseudo L-gas).

Pseudo L-gas is exported to neighboring markets in Belgium, France and Germany, where it serves dedicated L-gas consumers –who will be converted to other sources of energy, most notably H-gas, as a result of the Groningen phase-out.

The gas infrastructure operators of Belgium, France and Germany have made arrangements to undertake extensive conversion programs, mainly switching L-gas consumers to H-gas, to reduce the L-gas supply from the Netherlands: by GY 2029/30, imports of L-gas will be reduced to nearly zero.

The current report aims to monitor the progress in L-gas conversion in Belgium, France and Germany and the activities in the Netherlands to reduce the consumption of (pseudo) Groningen-gas, as well as the overall security of supply developments within the L-gas market region. It provides the analysis needed by the Min. EZK to decide on the allowed Groningen production and to meet the requirements of the resolution of the Dutch Parliament to be informed twice a year about the progress in reducing the demand for Groningen gas.

Total consumption of Dutch L-gas declined by 15% (47.8 TWh) from 313.3 TWh in the 2020/21 heating season to 265.5 TWh in 2021/22 (and by 28% or 101.4 TWh when compared with 2017/18 heating season). This has been the steepest observed decline through a heating season, since the L-Gas Market Conversion Review has been launched. The steep reduction in L-gas consumption was partly driven by climatological factors, as well as the continued implementation of the market conversion programs in the respective L-gas markets.

In GY 2019/20 conversion totaled to 21.22 TWh, with 18.1 TWh taking place in Germany, 1.92 TWh in Belgium, 1.2 TWh in France and 0 in the Netherlands. In GY 2020/21 conversion totaled to over 40 TWh, with 31.5 TWh taking place in Germany, 7.5 TWh in Belgium, 1 TWh in France and 0 in the Netherlands. These conversions naturally reduced demand for L-gas during the consequent heating season.

In the ten consecutive years, between GY 2019/20 and GY 2029/30, combined L-gas exports from the Netherlands to Belgium, France and Germany are expected to be reduced at an average rate of approximately 10% per year.[5] Consequently, L-gas demand met with imports from the Netherlands is expected to fall from 44.6 TWh in GY 2020/21 to 0 in Belgium by 2024/25, from 39.2 TWh to 0 in France and from 143.2 TWh to 0.3 TWh in Germany[6] by GY 2029/30 both in an average and cold GY[7].

To make the transition successful, the following criteria should be met:

- the remaining L-gas demand is met with an adequate amount of L-gas supply, including pseudo L-gas production, and sufficient transport capacity to ensure security of supply at any time;
- H-gas supply to the Netherlands and the Northwest European markets needs continued monitoring as it is used as feedstock to produce pseudo L-gas;
- new nitrogen and conversion facilities come into operation without delays;
- there are no significant delays in converting appliances from L- to H-gas;
- the continuation of the Dutch TTF market structure (e.g. commercially one gas quality).

The Covid-19 induced lockdowns had only a minor impact on the overall schedule of the conversion programs in 2020.

In GY 2020/21 over 900,000 gas connections and appliances have been converted – the highest number through the market conversion programme so far. The estimated volume effect on L-gas demand of the 2021 conversions (40 TWh) is almost the double of the 2020 conversions (21.2 TWh) and is the highest of all gas years so far, due to the particularly high conversion rates in Germany and in Belgium. The estimated volume effect on L-gas demand of the 2021/22 conversions (28.66 TWh) is 29% lower than in the GY 2020/21. The conversion programme is expected to reach its highest level through GYs 2022/23 and 2023/24, with an average volume effect on the L-gas demand of over 45 TWh.

Notably, the optimization of the conversion planning in Belgium is expected to allow for higher conversions in the GYs 2022/23 and 2023/24, indicating a potential reduction of Belgium's L-gas imports from the Netherlands to 0 by GY 2024/25.

[5] GTS (2017), Netwerk Ontwikkelingsplan 2017.
[6] Please note that the remaining demand in the gas year 2029/30 (0.3 TWh / 100.000 kWh/h) is given by a regional grid in Germany, that can only be supplied via the Netherlands (Haanrade / Thyssengas).
[7] In the case of Belgium and France, the demand profile for a cold GY has been calculated based on 1995-96 temperature profile by GTS as stated in the Dutch Gas Act for the L-gas supply-demand balance of this Report. In the case of Belgium, the preferred national approach is to consider the year 1962-63 as a cold year profile. The French regulation approach is requiring to work with a 2% risk cold GY (using Lille weather data); leading to a demand profile national reference shared with the French stakeholders, about 2% above the GTS's figures. The preferred national approach both in the case of Belgium and France are reflected in Figure 2.5 and in the tables 2.2 and 2.3 of the Annex.

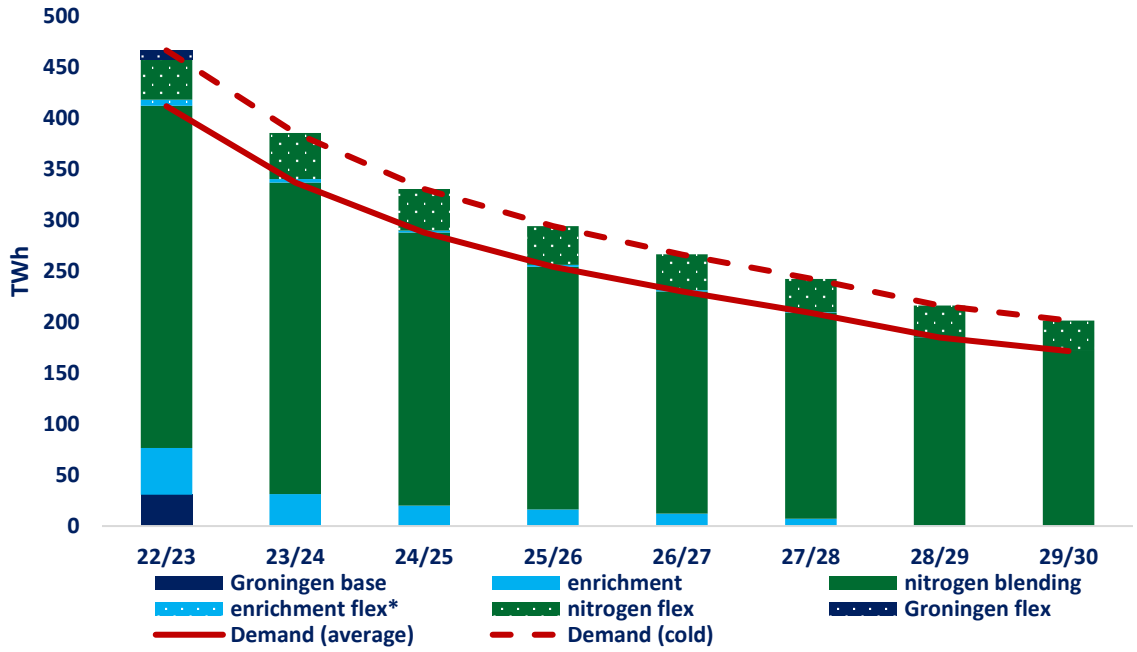
The analysis of the conversion programs, provided in Chapter 3 of the Report, shows an alignment with the expected L-gas demand in each market and for each gas year.

To meet this declining L-gas demand against an even faster decreasing Groningen production, the Netherlands will increase the production of pseudo L-gas, primarily by means of additional nitrogen blending.

Additional purchase of nitrogen allowed to expand the nitrogen blending capacity by 80,000 m^3/h N_2 at the Wieringermeer conversion facility from 215,000 to 295,000 m^3/h starting from 23rd December 2019. This translated into an additional 48.9 TWh of pseudo L-gas production capability. Moreover, a new nitrogen plant at Zuidbroek, which is currently under construction and was planned to start operations 1st of April 2022 with a capacity of 180,000 m3/h N2, will be able to produce between 68 TWh and 97 TWh of additional pseudo L-gas. Being heavily impacted by the outbreak of Covid-19 and consequent lockdowns, the planned commissioning date of the nitrogen plant is now expected to be in the beginning of GY 2022/23[8]. However, the project schedule remains very tight.

The increase of H-gas conversion capacity via nitrogen blending in the Netherlands, the allowed Groningen production and the market conversion from L-gas to H-gas in Germany, Belgium, France as well as in the Netherlands will ensure the security of pseudo L-gas supply to consumers in all markets both in an average and in a cold year. Although GTS concluded in earlier advice[9] based on a sensitivity analyses that the bandwidth for the closure of the Groningen field was mid-2025 to mid-2028, a measure was identified in 2021 to speed up this closing date. This is the conversion of the storage Grijpskerk from H-gas to L-gas. In doing so, the storage will be able to take over the back-up role of the Groningen field. This could speed up the closure of the Groningen field, to mid-2023 or mid-2024, as concluded by GTS in June 2021[10]. The final decision on this measure has been taken at the start of 2022: the State Secretary for the Extractive Industries decided to grant the permit for the conversion of gas quality of the storage and subsequently it is filled with pseudo G-gas during the injection season of gas year 2021/22. Anyhow, from October 2022 onwards L-gas supply flexibility will be entirely provided by the nitrogen blending facilities, enrichment, the L-gas storages and the Groningen field until its final closure.

L-gas supply-demand balance projection in an average and cold year[11] (GY 21/22-GY 29/30)



The Groningen production cap for the GY 2022/23 will be set on 28 TWh for both an average and a cold year, since this is expected to be a sufficient level in order to ensure security of supply. In paragraph 4.3 this is explained in more detail.

[8] For the exact date, see https://www.gasunietransportservices.nl/en/transparency/remit/urgent-market-messages
[9] https://www.rvo.nl/sites/default/files/2021/04/GTS-Advies-leveringszekerheid-voor-benodigde-Groningenvolumes-en-capaciteiten-gasjaar-2021-2022-en-verder.pdf
[10] https://open.overheid.nl/repository/ronl-7b0ae804-18de-4eff-9410-3152a0ded2b9/1/pdf/bijlage-2-brief-verdere-versnelling-sluiting-groningenveld-mogelijk.pdf
[11] In the case of Belgium and France, the demand profile for a cold GY has been calculated based on 1995-96 temperature profile by GTS as stated in the Dutch Gas Act for the L-gas supply-demand balance of this Report. In the case of Belgium, the preferred national approach is to consider the year 1962-63 as a cold year profile. The French regulation approach is requiring to work with a 2% risk cold GY (using Lille weather data); leading to a demand profile national reference shared with the French stakeholders, about 2% above the GTS's figures.

As a consequence of a declining domestic production and the subsequently growing need for H-gas to feed the nitrogen facilities to deliver it as pseudo L-gas to L-gas consumers, the Netherlands almost doubled their H-gas imports from 28.8 bcm (or 281.4 TWh) in GY 2013/14 to 57 bcm (or 556.9 TWh) in GY 2017/18. In fact, the Netherlands became a net importer of natural gas in GY 2017/18 for the first time in the country's history.

The Netherlands' position as a net importer of natural gas is particularly visible during the heating season. Net imports of natural gas rose by more than four-fold in the 2019/2020 heating season compared with the same period of the previous GY and remained at a similar level through the 2020/21 heating season. Net imports during the 2021/22 heating season rose to their highest level on record.

Consequently, the security of L-gas supply is becoming intimately linked to the deliverability of H-gas into the Netherlands.

Key findings

1. Based on the received data of the expected consumers demand for Dutch L-gas in Germany, France and Belgium, and on the achieved results with regards to the market conversion in the three countries, GTS can make a detailed assessment of the necessary volumes of L-gas for the coming year and the years after that. As a result, a more precise assessment can be made of the necessary production from the Groningen field.

2. Consumption of Dutch L-gas declined by 15% (47.8 TWh) from 313.3 TWh in the 2020/21 heating season to 265.5 TWh in 2021/22 (and by 28% or 101.4 TWh when compared with 2017/18 heating season). This has been the steepest observed decline through a heating season, since the L-Gas Market Conversion Review has been launched. The steep reduction in L-gas consumption was partly driven by climatological factors, as well as the continued implementation of the market conversion programs in the respective L-gas markets. The analysis of the conversion programs, provided in this Report, shows an alignment with the expected L-gas demand in each market and for each Gas Year.

3. The use of Groningen gas more than halved (a decline of 23.7 TWh) year-on-year during the 2021/22 heating season, from 44.8 TWh to 21.1 TWh. During the 2021/22 heating season, total pseudo L-gas production declined by 8.4% (or 18.2 TWh) year-on-year, from 217 TWh to 198.9 TWh due to the steep decline in Dutch L-gas demand (-15%). As Groningen production fell more steeply than pseudo L-gas output, the share of pseudo L-gas in total Dutch L-gas production grew from 83% in the 2020/21 heating season to 90% during the 2021/22 gas winter. L-gas storage played a key role in allowing lower Groningen production, with net withdrawals accounting for over 17% of the region's total L-gas demand during the 2020/21 heating season.

4. The new nitrogen plant at Zuidbroek, which is currently under construction and was planned to start operations 1st of April 2022 with a capacity of 180,000 m3/h N2 and able to produce between 68 TWh and 97 TWh of additional pseudo L-gas. Being heavily impacted by the outbreak of Covid-19 and consequent lockdowns, the planned commissioning date of the nitrogen plant is now expected to be in the beginning of GY 2022/23. However, the project schedule remains very tight.

5. The Covid-19 induced lockdowns had only a minor impact on the overall schedule of the conversion programs. The volume effect on L-gas demand of the 2021 conversions was 40 TWh. The estimated volume effect on L-gas demand of the 2021/22 Gas Year is 29 TWh. The conversion programme is expected to reach its highest level through Gas Years 2022/23 and 2023/24, with an average volume effect on L-gas demand of over 45 TWh per Gas Year.

6. Notably, the optimization of the conversion planning in Belgium is expected to allow for higher conversions in the GYs 2022/23 and 2023/24, indicating a potential reduction of Belgium's L-gas imports from the Netherlands to 0 by GY 2024/25.

7. Under the current market conditions, the Task Force does not foresee any possibilities to further accelerate the conversion process. Currently, all efforts are aiming at achieving the agreed demand reduction for the coming years. In the ten consecutive years, between GY 2019/20 and GY 2029/30, combined L-gas exports from the Netherlands to Belgium, France and Germany are expected to be gradually reduced to 0.

8. Together with the increase in nitrogen capacity, the allowed Groningen production and the structural decrease in L-gas demand in the region, the facilities of GTS combined with the L-gas facilities from others (most notably the L-gas storages) will be able to meet the decreasing L-gas demand, when the precondition of sufficient H-gas is supplied towards the Netherlands is met. The Government of the Netherlands wants to close the Groningen field as quickly as possible. Therefore UGS Grijpskerk is used to store L-gas instead of H-gas. This will allow to stop production from Groningen at the start of the GY 2023/24 or the GY 2024/25. For capacity reasons the Groningen field is needed for security of supply until then.

Contents

1. Introduction

The government of the Netherlands announced in March 2018 its decision to terminate natural gas production from the Groningen field as soon as possible, in order to guarantee safety in the area of Groningen against the risk of earthquakes resulting from natural gas extraction.

The initial schedule for production phase-out - which aimed for termination in 2030 at the latest - was revised in 2019 following the adjusted advice of the State Supervision of the Mines after an earthquake occurred on May 22, with the objective of accelerating the termination by Gas Year (GY) 2022/23 for average weather conditions. From the start of the GY 2022/23, Groningen gas should only be needed in case of extreme low temperatures (-9 degrees Celsius or colder) and in case of a severe disruption elsewhere in the L-gas system. To be able to guarantee production in those circumstances the field will operate on minimum flow during the entire gas year. Groningen gas has a notably lower calorific value compared to the average European gas, which means it cannot simply be replaced by other domestic or imported sources. These need to be converted, principally via nitrogen blending, to L-gas.

L-gas is consumed in the Netherlands and exported to neighboring markets in Belgium, France and Germany, where it serves dedicated L-gas consumers – who will be converted to other sources of energy, most notably H-gas as a result of the Groningen phase-out. In fact, whilst over 90% of L-gas in Northwest Europe is produced in the Netherlands, almost half of it is currently consumed in the three importing markets.

Hence, the decision to terminate Groningen production has consequences in terms of adaptation for the Dutch domestic gas market, but also for export markets in Belgium, France and Germany. The four countries have been working together since 2012 on the phasing-out of L-gas consumption, which was initially motivated by the natural decline of the Groningen field. Belgium, France and Germany have developed and are implementing concrete plans to have their consumers of L-gas converted to other sources of energy, most notably H-gas, by 2030.

The Dutch Parliament adopted a resolution which requires the Ministry of Economic Affairs and Climate Policy of the Netherlands (Min. EZK) to report twice a year on concrete measures to reduce the demand for Groningen gas and their foreseen impact[12]. In this report, explicit attention has to be given to measures within and with regard to neighboring countries. Moreover, the claimed reductions should be substantiated with actual data and options should be investigated to accelerate the reduction of the demand. In order to fulfil this requirement, the Netherlands proposed to establish a Task Force on Gas Market Conversion Monitoring within the framework of the Pentalateral Gas Platform. The authorities of Belgium, France and Germany concurred with this proposal.

The current report aims to monitor the progress in L-gas conversion in Belgium, France and Germany and the activities in the Netherlands to reduce the consumption of L-gas, as well as the overall security of supply developments within the low-calorific market region. It provides the analysis needed by the Min. EZK to decide on the allowed Groningen production and to meet the requirements of the resolution of the Dutch Parliament. It also creates a dedicated platform through the Task Force to further improve transparency and mutual understanding among the involved countries, and enables to share options to accelerate the conversion, without prejudice to national operators and end users. During the previous months, it has served as a platform to monitor and discuss developments related to Covid-19 and its impact on the market conversion planning. The Netherlands has used the information received during these meetings to inform their Parliament on 21st February, 8 April, on 19 June, on 21 September 2020 and on 11 February, 16 April, 25 June 2021 and most recently on 14 March 2022.

The current report provides an update on the progress of the conversion programs, with a focus on the planned conversions through the GY 2021/22. Close to 890,000 of gas connections and appliances are expected to be converted in GY 2021/22 –the second highest number through the market conversion program so far.

The estimated volume effect of the 2021/22 conversions (29 TWh) is the second highest of all gas years so far, due to the particularly high conversion rates in Germany and Belgium.

[12] The Parliament's resolution followed the decision made by the Dutch Council of State on July 3, 2019, which annulled the Min. EZK's decision on the allowed Groningen production in the Gas Year 2018/19. The Council of State concluded that it was not sufficiently motivated why the demand for Groningen gas could not be reduced faster than foreseen. The Council of State not only referred to Dutch demand but also to exports. According to the Council of State it was not sufficiently clear what the Ministry meant with his statement that he is in dialogue with neighboring countries to reduce their demand and what actions he undertakes to accelerate the reduction of exports of Groningen gas.

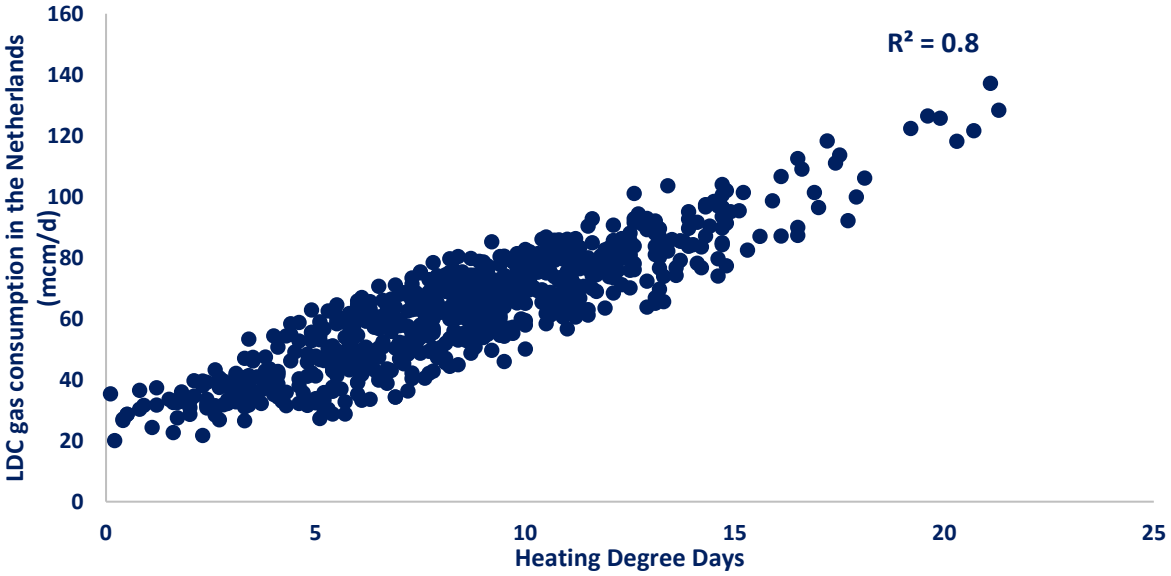
2. L-Gas demand[13]

2.1 Recent demand trends

L-gas is predominantly consumed in the residential and commercial sectors for space heating purposes. Consequently, L-gas demand shows a significant seasonal profile, with over two-thirds of consumption occurring through the heating season of the Gas Year (GY)[14].

It is important to note, that there is particularly a strong correlation between the number of heating degree days (HDD) and L-gas consumption, given its predominant use for space heating purposes. This correlation in well demonstrated through the influence of HDDs on daily Local Distribution Network (LDC) consumption in the Netherlands. LDC demand is largely met by L-gas in the Netherlands.

Figure 2.1 Correlation between HDDs and daily LDC consumption in the Netherlands (October 2018-March 2022)



Total consumption of Dutch L-gas declined by 15% (47.8 TWh) from 313.3 TWh in the 2020/21 heating season to 265.5 TWh in 2021/22 (and by 28% or 101.4 TWh when compared with 2017/18 heating season). This has been the steepest observed decline through a heating season, since the L-Gas Market Conversion Review has been launched. The steep reduction in L-gas consumption was partly driven by climatological factors, as well as the continued implementation of the market conversion programs in the respective L-gas markets.

In GY 2019/20 conversion totaled to 21.22 TWh, with 18.1 TWh taking place in Germany, 1.92 TWh in Belgium, 1.2 TWh in France and 0 in the Netherlands. In GY 2020/21 conversion totaled to over 40 TWh, with 31.5 TWh taking place in Germany, 7.5 TWh in Belgium, 1 TWh in France and 0 in the Netherlands. These conversions naturally reduced demand for L-gas during the consequent heating season.

In addition, HDDs fell by 7% year-on-year[15] during the 2021/22 gas winter, which weighed on space heating requirements in the residential and commercial sectors.

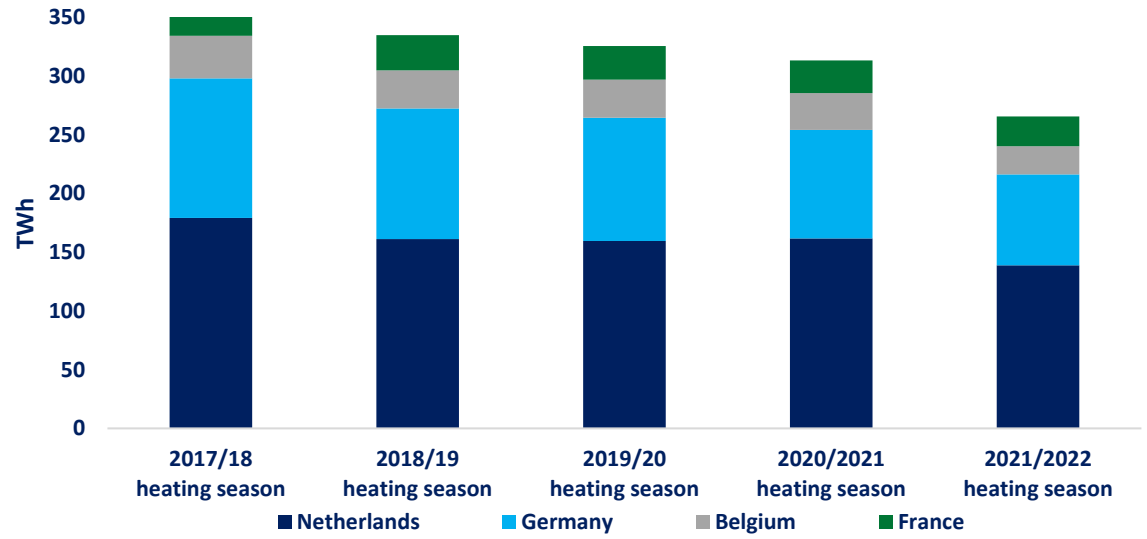
It is important to highlight that market conversion volumes do not necessarily translate into the same amount of L-gas consumption change as other demand side factors also have an influence on the overall L-gas demand. This includes HDDs which drive space heating requirements or wind speeds which can have an impact on gas-to-power demand.

H-gas consumption decreased less steeply than Dutch L-gas demand, declining by an estimated 5% (or over 52 TWh) from 1051 TWh during the 2020/21 heating season to 999 TWh through the 2021/22 gas winter. This

[13] Demand is an ex ante concept, referring to expected energy quantities being consumed. Consumption is an ex post concept, referring to energy quantities which have been already consumed. The two terms are used in an interchangeable manner in this Report.
[14] A Gas Year starts on 1st October and ends on 30 September. The heating season (or gas winter) lasts from 1st October until 31st of March.
[15] For more detail regarding the climatological context, please refer to Annex VI of the current report.

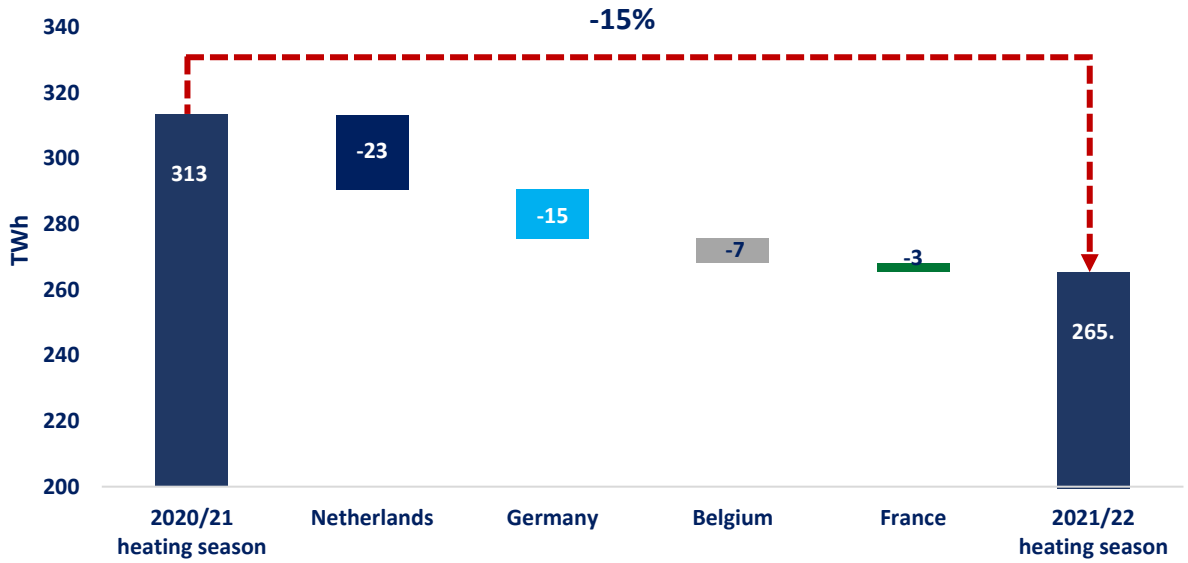
decline was partly driven by lower HDDs reducing space heating requirements and record high gas prices weighing on gas demand both in the power and industrial sectors.

Figure 2.2 Consumption of L-gas from the Netherlands through the 2017/18-2021/22 heating seasons



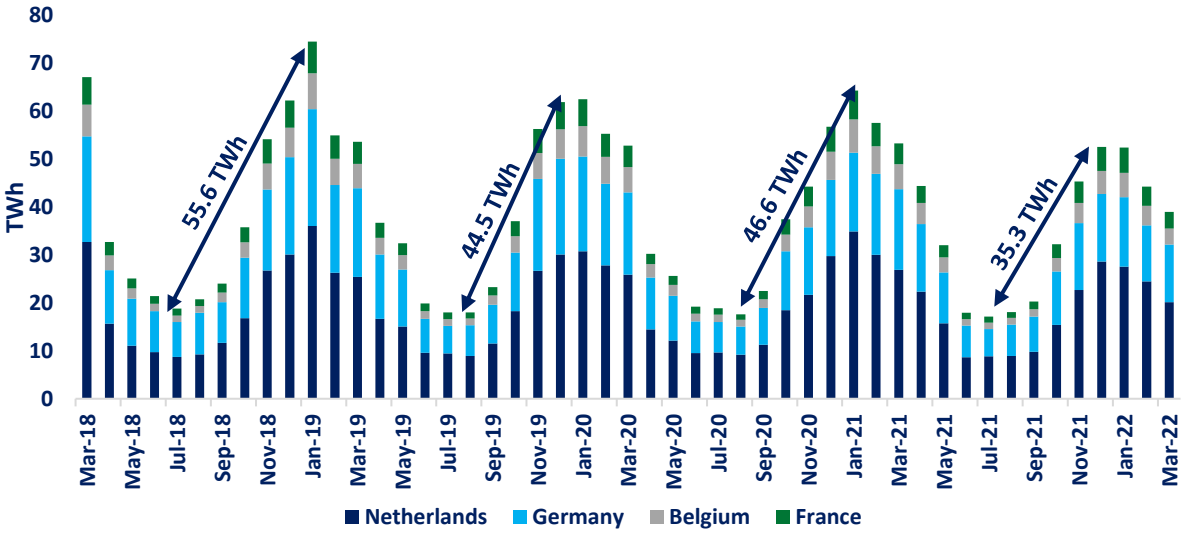
As shown in Figure 2.3 the Netherlands alone accounted for close to 48% of the net decline in Dutch L-gas consumption through the 2021/22 heating season, followed by Germany (31%), Belgium (15%) and France (5%). The strong decline in L-gas consumption in the Netherlands was largely driven by climatological factors. Regarding year-on-year comparisons, Belgium recorded a reduction of 23%, Germany 16%, the Netherlands 14% and France 9%.

Figure 2.3 Change in Dutch L-gas consumption in 2020/21 vs 2021/22 heating seasons



Whilst total Dutch L-gas consumption decreased by over 15%, peak monthly consumption decreased by 18% (11.8 TWh) in the 2021/22 heating season compared to the previous heating season and consequently the demand swing (represented by the arrows in Figure 2.4) declined by 24% (11.3 TWh). This has been partly driven by the climatological context and the milder winter temperatures during the 2021/22 heating season. As such, colder winters could reverse this trend in the future. L-gas consumption continues to display a strong seasonal profile, with important flexibility requirements which are met by the nitrogen blending facilities, enrichment, the L-gas storages and the Groningen field until its final closure.

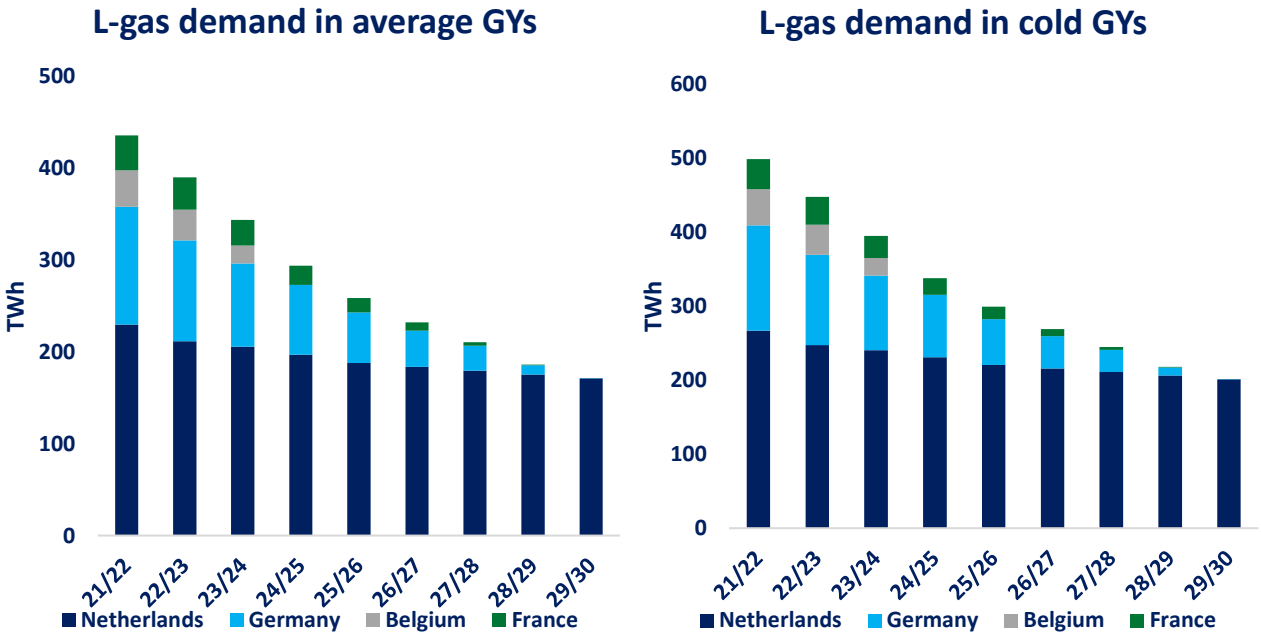
Figure 2.4 Dutch L-gas monthly consumption March 2018 – March 2022



2.2 The expected annual demand for L-gas from the Netherlands until GY 2029/30

In the ten consecutive years, between GY 2020/21 and GY 2029/30, combined L-gas exports from the Netherlands to Belgium, France and Germany are expected to be gradually reduced at an average rate of approximately 10% per year.[16] As a consequence, L-gas demand met with imports from the Netherlands is expected to fall from 44.6 TWh in GY 2020/21 to 0 in Belgium by 2024/25, from 39.2 TWh to 0 in France and from 143.2 TWh to 0.3 TWh in Germany[17] by GY 2029/30 both in an average and cold GY[18].

Figure 2.5 Expected annual demand for Dutch L-gas (TWh)



[16] GTS (2017), Netwerk Ontwikkelingsplan 2017.
[17] Please note that the remaining demand in the gas year 2029/30 (0.3 TWh / 100.000 kWh/h) is given by a regional grid in Germany, that can only be supplied via the Netherlands (Haanrade / Thyssengas).
[18] In the case of Belgium and France, the demand profile for a cold GY has been calculated based on 1995-96 temperature profile by GTS as stated in the Dutch Gas Act for the L-gas supply-demand balance of this Report. In the case of Belgium, the preferred national approach is to consider the year 1962-63 as a cold year profile. The French regulation approach is requiring to work with a 2% risk cold GY (using Lille weather data); leading to a demand profile national reference shared with the French stakeholders, about 2% above the GTS's figures. The preferred national approach both in the case of Belgium and France are reflected in Figure 2.5 and in the tables 2.2 and 2.3 of the Annex.

3. L-gas market conversion volume

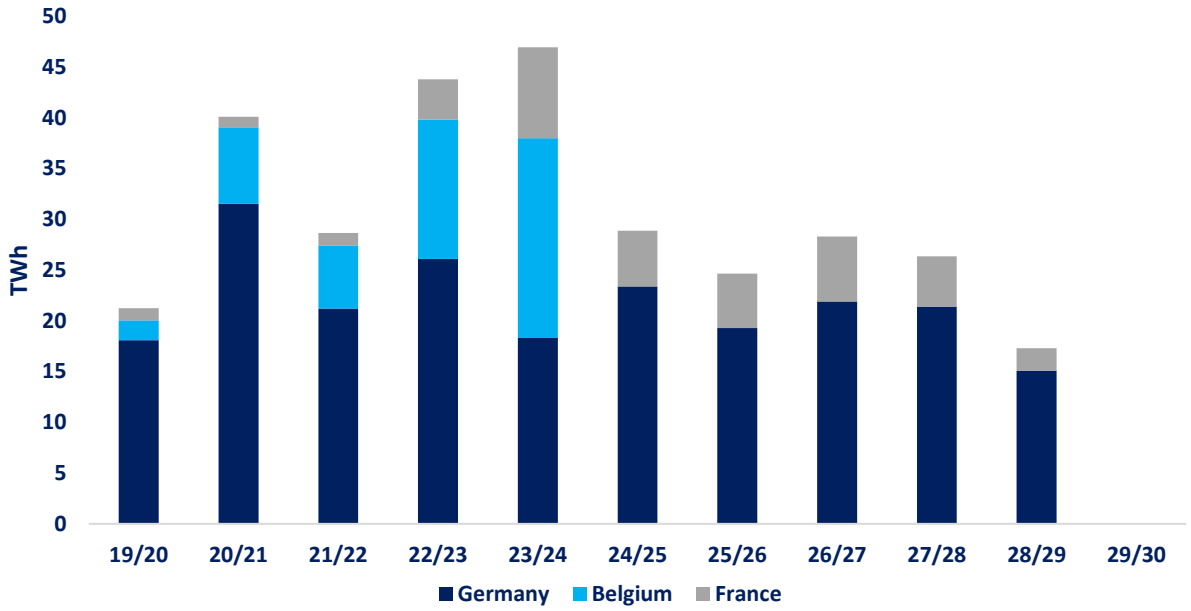
The gas infrastructure operators of Belgium, France and Germany have made arrangements to undertake extensive conversion programs, mainly switching L-gas consumers to H-gas, to reduce the L-gas supply from the Netherlands: by the gas GY 2029/30, their imports of L-gas will be reduced to close to zero.

Both the realized number of gas installations or consumers that are converted and the corresponding volumes are important to consider. In this report, countries supply data for each.

The current report provides an update on the progress of the conversion programs, with a special focus on the conversions through the GY 2021/22. Close to 890,000 gas connections and appliances are expected to be converted in GY 2021/22 –the second highest number through the market conversion programme so far, although 5% lower compared to GY 2020/21.

The estimated volume effect of the 2021/22 conversions (28.66 TWh) is 29% lower than in the GY 2020/21, when it was just over 40 TWh. The conversion programme is expected to reach its highest level through GYs 2022/23 and 2023/24, with an average volume effect of over 45 TWh. Notably, the optimization of the conversion planning in Belgium is expected to allow for higher conversions in the GYs 2022/23 and 2023/24, indicating a potential reduction of Belgium's L-gas imports from the Netherlands to 0 by GY 2024/25.

Figure 3.0 Volume effect of actual and planned conversions between GY 2019/20 and GY 2029/30 (TWh, based on average temperatures).



3.1 Germany

Legislative changes and conversion costs

In order to implement the market conversion in Germany some 5.5 million gas appliances need a physical adaptation. A sophisticated timetable for the conversion process was put into place in 2014 and legal changes have been introduced. As of 2017, the Basic Energy Law (Energiewirtschaftsgesetz) had been revised substantially in order to serve as the basis for the market conversion from L- to H-gas. § 19a of the Basic Energy Law clarifies since that the legal responsibility for the process lies with the transmission system operators and that the necessary costs of adaptation of gas appliances are socialized (as an integral part of the gas grid fee). In addition, at a later stage the Basic Energy Law was amended concerning access to the German L-gas grid in order not to provide substantial amounts of L-gas to new customers.

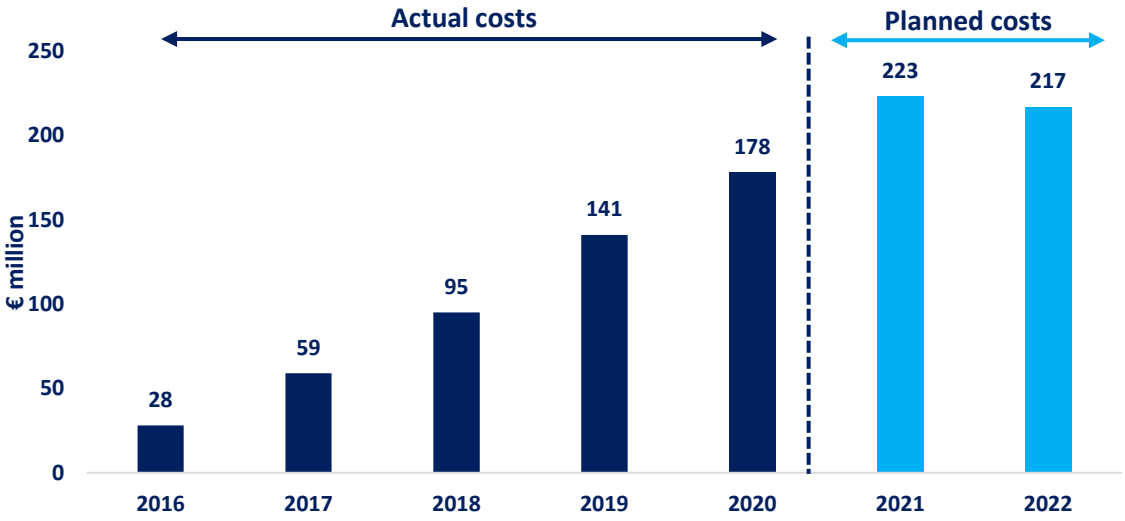
The total costs for the conversion from L- to H-gas in Germany are estimated at approx. EUR 4 billion. The conversion costs can be split into two different cost categories: (1) costs for adapting the customers' appliances from L- to H-gas and (2) costs for grid expansion.

The costs for adapting the customers appliances from L- to H-gas are reimbursed. The reimbursement only refers to the adaption and not the replacement of appliances. Customers with installations that cannot be adapted from

L- to H-gas and have to be replaced are entitled to receive a lump sum of up to EUR 600 under certain circumstances.

The actual costs for the adaption of appliances from the years 2016 – 2020 and the planned costs for the years 2021 – 2022 are displayed in the illustration below, altogether totaling to € 941 million.

Figure 3.1.1 Actual and planned costs for the adaption of appliances, 2016-21 (€ million)



The respective costs are financed by a "market conversion levy" that is paid on top of the TSO transport tariffs. Estimates for the cumulated market conversion levy until 2029 see costs of roughly € 2.3 billion.

Costs for grid expansion on TSO and DSO level are not included in the market conversion levy described above. TSO costs for grid expansion related to L- to H-Gas conversion amount to another € 2 billion and are financed by the regular transport fees.

The German TSO GTG Nord had built a new blending facility at the Dutch border in order to reduce the need for Groningen gas by up to 6 TWh a year, cf. below.

Conversions from 2015 to 2021[19]

Approximately 300,000 appliances have been converted from L- to H-gas in the years 2015 – 2018. During the years 2015 – 2018, several early conversions have been implemented ahead of the scheduled dates for conversion. Furthermore, the German TSOs have accelerated the planning for the consecutive years repeatedly. The conversions realized between 2015 and 2018 account for a capacity of 4.6 GWh/h and a yearly volume of 28 TWh. More than half of this volume accounted to conversions ahead of schedule, which served to bring down demand for Groningen gas earlier.

As the advanced changes had been made years before the due date, they continue to be a relief for the Groningen production in the years to come.

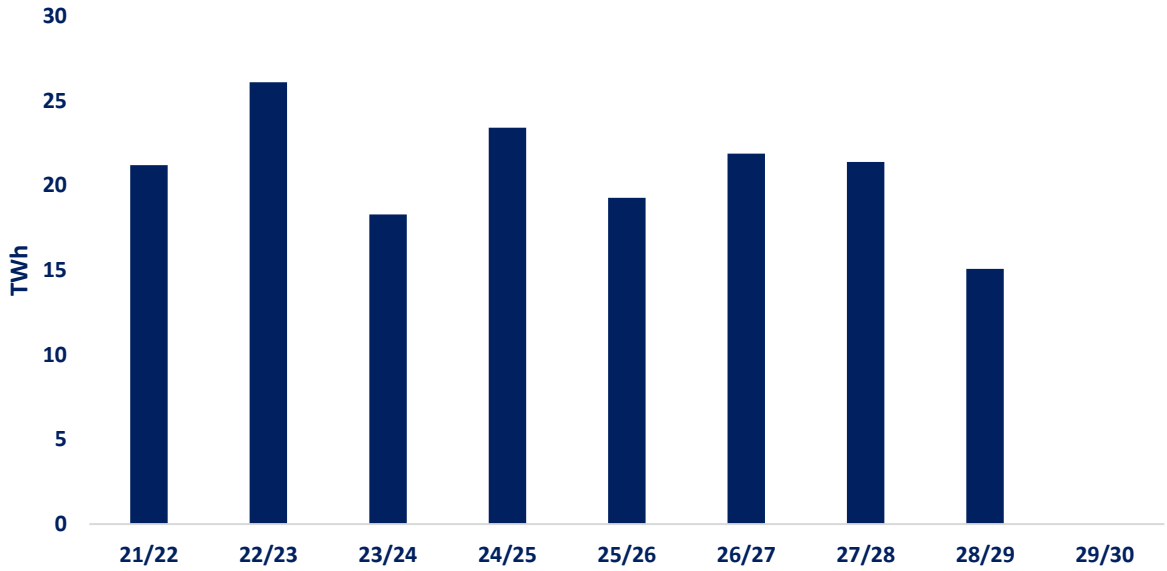
In 2019, 10 areas with 319,000 appliances in total have been converted as planned. Conversion relates to a capacity of 4 GWh/h and a volume of 13.5 TWh.

In 2020, 7 areas with 389,000 appliances have been converted. Conversion relates to a capacity of 5.15 GWh/h and an estimated volume effect of approximately 18.1 TWh (average year).

In 2021, over 571,000 appliances were converted, with an estimated volume effect of 31.5 TWh (average year) -the highest volume effect of all gas years through the entire conversion programme. While the number of appliances to be converted per gas year is rather stable for the upcoming years, the resulting volume effect differs significantly due to the regional distribution of industry and power plants with a high gas consumption.

[19] For further details please refer to the Winter Report 2021 of the Task Force Monitoring L-Gas Market Conversion and to the Winter Report 2022 of the Task Force Monitoring L-Gas Market Conversion.

Figure 3.1.2 Estimated volume effect of market conversion per Gas Year (TWh)



Grid expansion required for the L-/H-Gas conversion steps in 2021 were commissioned in time. Most importantly, the ZEELINK pipeline has started its regular operation in May 2021. ZEELINK is a newly built 216 km H-gas pipeline project required for several conversion steps from July 2021 onwards (in particular for the area of Düsseldorf / Rhineland), as well as for many conversion steps in the following years.

Conversions in 2022

In 2022, 495,000 installations are to be converted leading to an estimated volume effect of 21.2 TWh. As of September 2022, all conversion activities during the year 2022 are on track.

Map 3.1 Conversion areas in 2022

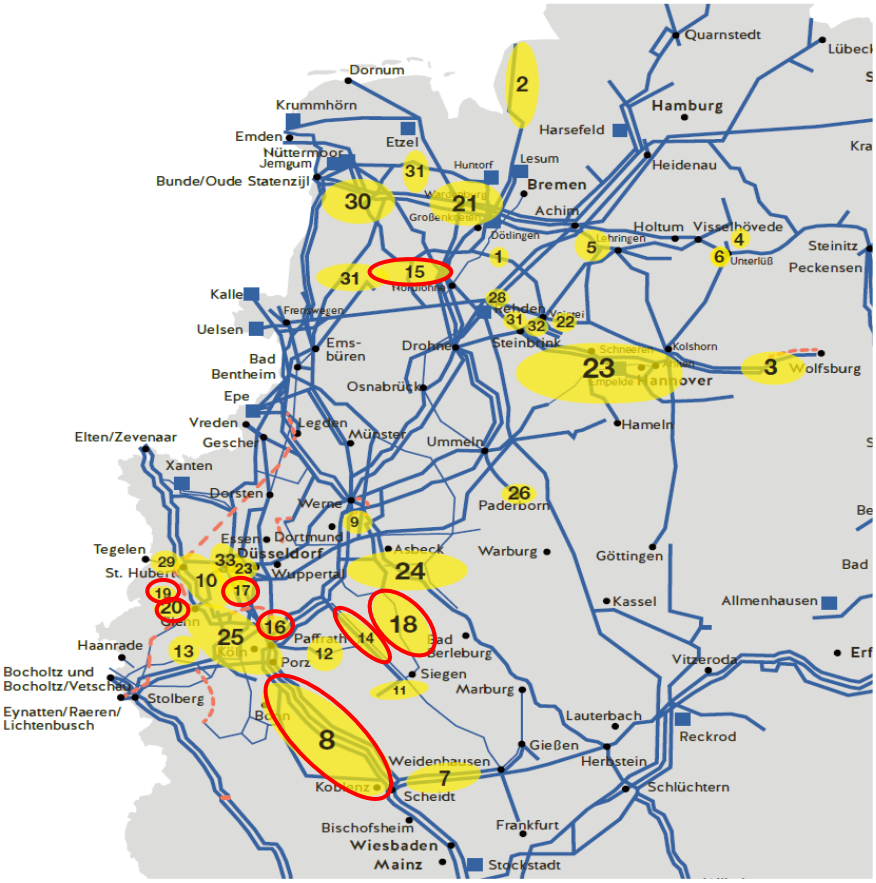


Table 3.1 Market conversion in Germany in 2022

Nr.	Conversion Area	TSO	# of installations	
16	Bergisches Land*	OGE	0	June
16	Bergisches Land	TG	2 000	June
17	Düsseldorf	TG	6 000	May
17	Düsseldorf	OGE	10 000	May
20	Mönchengladbach	TG	65 000	March
20	Mönchengladbach	TG	0	October
8	Mittelrhein	OGE	31 000	August
8	Mittelrhein	OGE	20 000	September
8	Mittelrhein	OGE	32 000	September
8	Mittelrhein	OGE	33 000	April
8	Mittelrhein	OGE	61 000	May – July
8	Mittelrhein	OGE	25 000	October
14	Oberbergisches Land	OGE	3 000	June
14	Oberbergisches Land	TG	1 000	May
15	EWE-Zone Teil III	GTG	56 000	February – July
15	EWE-Zone Teil III	GTG	28 000	September – November
18	Südwestfalen	OGE	44 000	April
18	Südwestfalen	OGE	4 000	May
18	Südwestfalen	OGE	24 000	June
18	Südwestfalen	OGE	22 000	August
18	Südwestfalen	OGE	5 000	September
19	Viersen-Meerbusch	OGE	9 000	June
19	Viersen-Meerbusch	OGE	11 000	September
19	Viersen-Meerbusch	OGE	4 000	September
19	Viersen-Meerbusch	TG	2 400	September
Total			**495 000**	

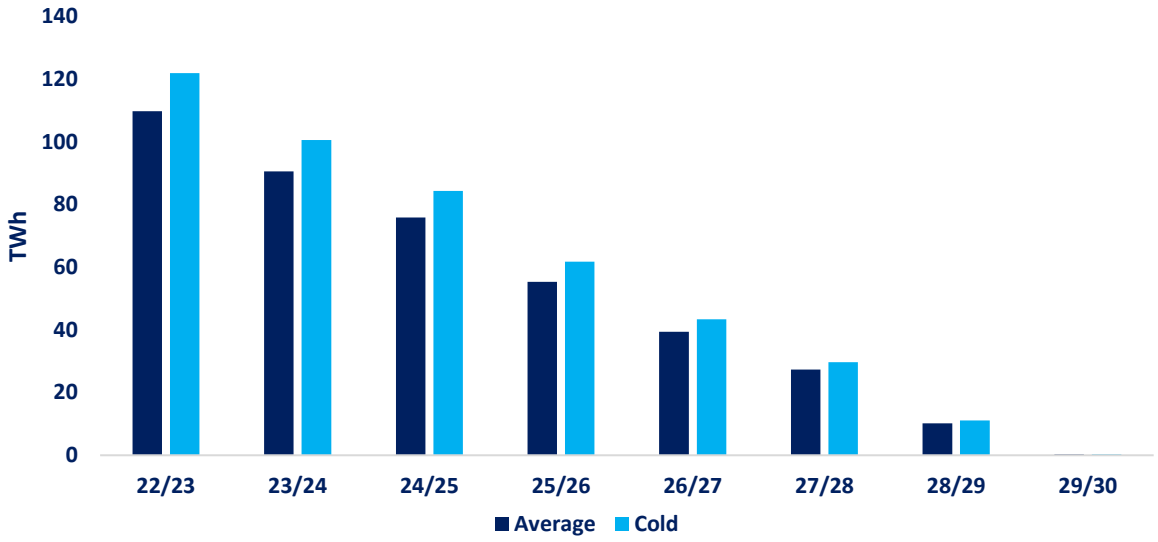
Conversions until GY 2029/30

In Germany, over 3.26 million of gas appliances will still need to be converted between GY 2022/23 and GY 2028/29, translating into a total volume of 146 TWh.

The conversion planning as presented the winter report 2022 remains unchanged. This applies in particular to the acceleration measures that were incorporated into the planning and that lead – inter alia – to a completion of market conversion in Germany by 2029 instead of 2030.

Consequently, L-gas imports from the Netherlands to Germany are expected to fall to 0.3 TWh by GY 2029/30, both in an average and cold GY.

Figure 3.1 Germany's L-gas imports from the Netherlands (GY 2021/22-GY 2029/30) for average and cold GYs



3.2 France

Legislative changes and conversion costs[20]

In France almost 1.3 million of gas consumers have to be converted between GY 2019/20 and GY 2029/30, translating into a total volume of 43.4 TWh/y.

Since 2015, the French legal and regulatory framework has been adapted to carry out the conversion of the L-gas network. Costs incurred by the TSO and the DSOs for the conversion of the L-gas networks are covered through transmission and distribution tariffs and are estimated to amount to approximately EUR 800 million.

Conversions in GY 2018/19 and 2020/21

A pilot phase has been decided to test the conversion process. During GY 2018/19 the conversion of the L-gas network was carried out in the Doullens area (6,000 consumers converted on April 9, 2019, rural area with a majority of individual housing) and the Gravelines area (10,000 consumers converted on September 17, 2019, urban area with collective housing).

The initial plan for 2020 was the conversion of Dunkerque sector in October 2020 representing 42,000 customers and translating into an annual consumption of 1 TWh under average weather conditions. The Dunkerque sector was successfully converted on 27-28 October 2020 instead of 13 October as previously planned. This sector is number four in France, the biggest and last of the pilot phase. On the TSO side the network modifications for the conversion of the Dunkerque sector were achieved by the end of 2019 and therefore the Covid-19 crisis had no consequence on that part of the program.

[20] For further details please refer to the Winter Report 2021 of the Task Force Monitoring L-Gas Market Conversion and to the Winter Report 2022 of the Task Force Monitoring L-Gas Market Conversion.

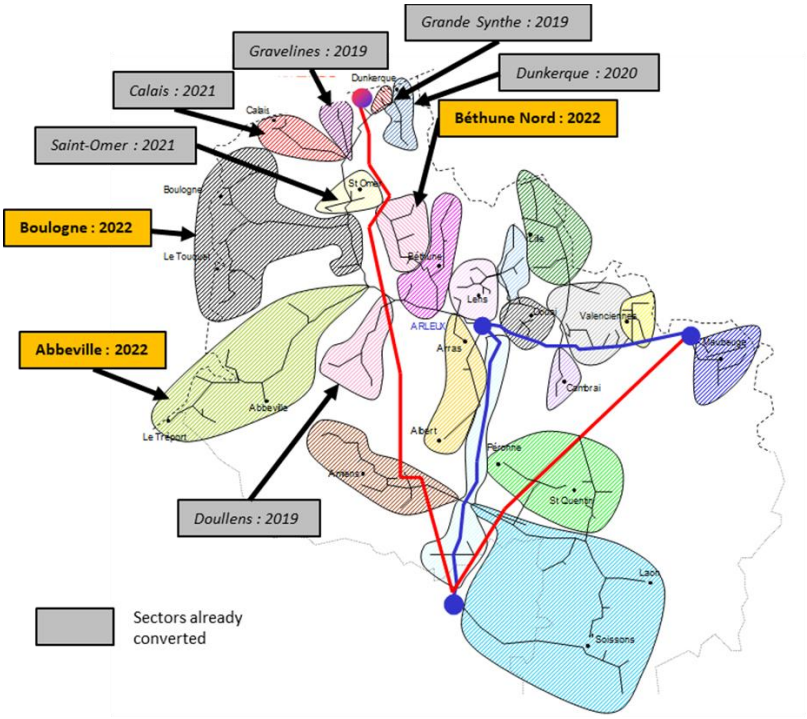
In 2021, 54 000 customers were converted in Calais and St Omer sectors respectively representing and translating into an annual consumption of 1.2 TWh under average weather conditions.

Conversions in 2022

The initial plan for 2022 is the conversion of Bethune Nord, Boulogne and Abbeville areas respectively in June, September and October 2022 representing 122 000 customers and translating into an annual consumption of 4 TWh under average weather conditions.

The inventory of gas appliances in the 3 areas which will be converted in 2023 (212 000 connections) have begun in July 2021. Network modifications by the TSO for the conversion of these areas are underway and namely the construction of 4 connections between the H gas network and 3 areas. There are no delays or changes in converted appliances for 2022 at that time.

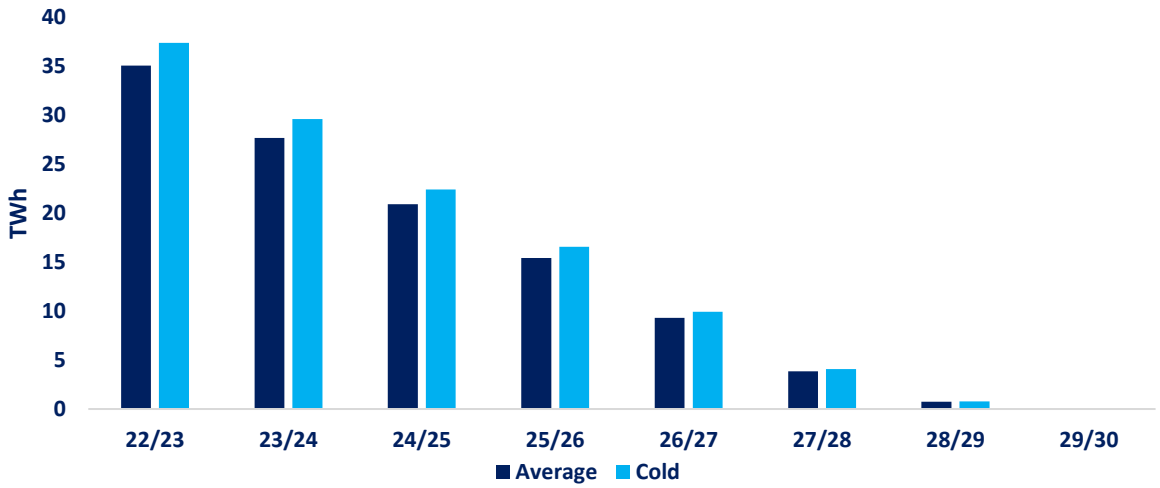
Map 3.2 Market conversions in France in 2019-2022



Conversions until GY 2029/30

In France, over 1.2 million of gas consumers will need to be converted between GY 2022/23 and GY 2029/30, translating into a total volume of 37 TWh/y. Consequently, L-gas imports from the Netherlands to France are expected to fall to 0 by GY 2029/30, both in an average and cold GY.

Figure 3.2 France's consumers demand for L-gas from the Netherlands (GY 2022/23-GY 2029/30) for average and cold GYs



3.3 Belgium

Conversions up to 2022[21]

In GY 2018/19, around 35,000 connections were converted in Wallonia and Flanders. These conversions took place at junction points between the H- and the L-grids.

In GY 2019/20, almost 130,000 connections were converted, translating into an annual consumption of 1.92 TWh under average weather conditions. Due to the outbreak of the Covid-19 pandemic, delays in the works carried out at TSO level and in the activities at DSO level led to a postponement of the conversion from 1st June 2020 to 1st September 2020.

In 2021, more than 300,000 connections were converted, translating into a total volume of 7.53 TWh under average weather conditions. As such, the volume effect of the 2021 conversion was the highest to date. The conversion took place as planned, without any delay to be reported. The areas converted in 2021 are displayed in Map 3.3 below (yellow areas).

Conversions in 2022

In 2022, around 252 000 connections were converted translating into a volume of 3.73 TWh under average weather conditions. The conversion has been divided in two phases: Flanders & Wallonia (1st of June) and Brussels (1st of September). The conversion of Brussels is now completed.

Remainder of the conversion – optimization of the conversion planning

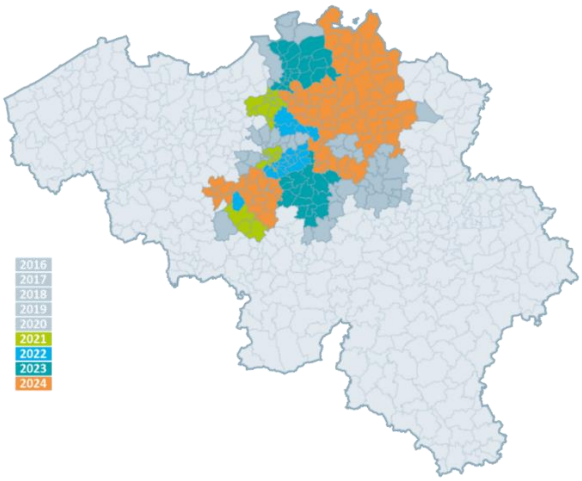
The successful completion of the L/H conversion phases to date led the Belgian gas network operators (TSO and DSOs) to identify ways of converting larger L-gas market areas to H-gas each year, thereby reducing the total duration of the conversion program. The new indicative planning foresees that the Belgian L/H conversion should be completed on September 1, 2024 (instead of June 1, 2029, as previously planned). The areas to be converted year by year are shown in Map 3.3.

This optimization of the conversion planning is the result of a joint analysis by the Belgian TSO and DSOs, whereby individual conversion areas have been grouped, resulting in efficiency gains. This was made possible by the previous conversion phases, whereby the network operators acquired positive experience and confidence in the feasibility in such a scheme. Essentially two changes have been brought to the conversion planning:

- The L-gas areas of Antwerp, which were due to be converted in 2028 and 2029, are now planned for conversion in 2023.
- The L-gas areas previously planned for conversion in 2025, 2026 and 2027 are now scheduled in 2024.

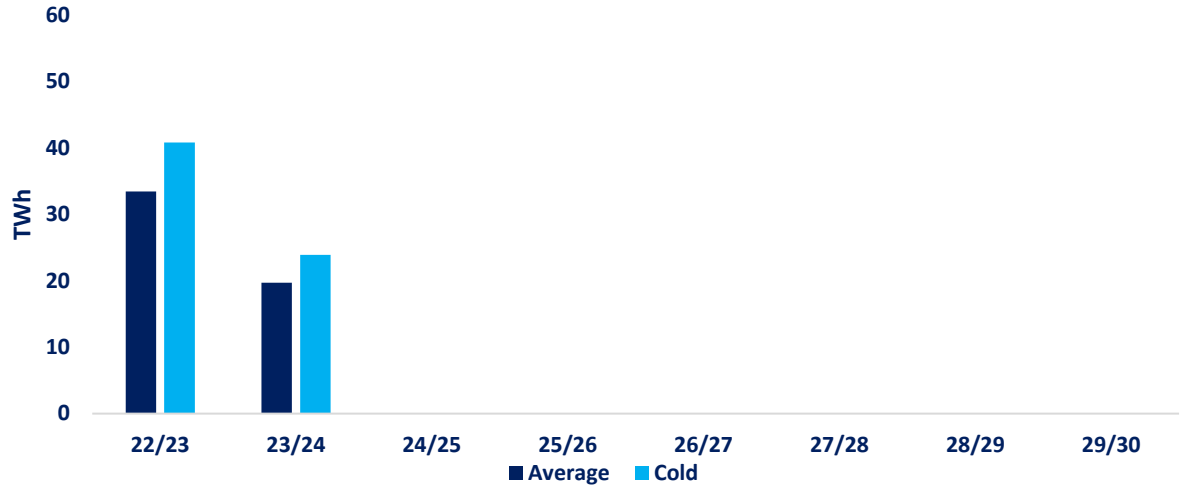
The conversion phases of 2023 (1st of June) and 2024 (1st of June and 1st of September) are formally validated.

Map 3.3 Indicative market conversion planning in Belgium



[21] For further details please refer to the Winter Report 2021 of the Task Force Monitoring L-Gas Market Conversion and to the Winter Report 2022 of the Task Force Monitoring L-Gas Market Conversion.

Figure 3.3 Belgium's L-gas imports from the Netherlands (GY 2022/23-GY 2029/30) for average and cold GYs



3.4 The Netherlands

Contrary to other L-gas consuming countries, the Netherlands has decided not to enter into a large scale conversion operation. Instead, a new, large nitrogen facility is being built which, together with the already existing nitrogen facilities and some underground storage facilities, will be able to provide enough L-gas (volume and capacity) to meet Dutch demand in the years to come. For more details, please refer to Chapter 4 of the Report.

The legislative framework has however been adapted in order to limit future L-gas consumption. The Dutch Gas Act has already been adapted to prevent future L-gas consumption growth by prohibiting the connection of newly built houses and buildings to the gas grid. The new legislation concerning the conversion of industrial customers (adopted on June 20, 2020) specifies that industrial customers consuming more than 100 million cubic meters (mcm) annually are not allowed to use L-gas after October 2022. As a consequence, Dutch demand for L-gas is expected to decrease by approximately 3 bcm (~30 TWh), equating to the consumption of the nine largest users. Three of the nine users have already been converted from G-gas to H-gas, one is planned to be converted before October 2022, the five remaining users will be converted in the upcoming years.

In addition, steps are being taken to phase-out natural gas from the Dutch energy system between now and 2050. This follows the Paris Agreement on Climate Change and the Dutch Climate Agreement.

4. L-gas production

4.1 L-gas production in the Netherlands: recent trends

Following an increasing number of earthquakes in the province of Groningen, linked to the natural gas extraction in the area, the Dutch authorities have imposed successive caps on Groningen's gas production starting from 2014. Consequently, Groningen gas production has halved from 341.8 TWh (or 35 bcm) in GY 2014/15 to 171.1 TWh (or 17.5 bcm) in GY 2018/19. This trend accelerated through the last two Gas Years, as Groningen gas production gas production more than halved from 171.12 TWh in GY 2018/19 to 75.9 TWh in GY 2020/21.

This trend continued through 2021/22, as Groningen gas production almost halved (a decline of 23.7 TWh) year-on-year, to 43.96 TWh.

Groningen gas has a notably lower calorific value compared to the average European natural gas fields, which means that it cannot simply be replaced by other (imported) natural gas sources. These need to be converted to

L-gas referred in the current report as "pseudo L-gas". Pseudo L-gas can be produced either via nitrogen blending or via enrichment.[22]

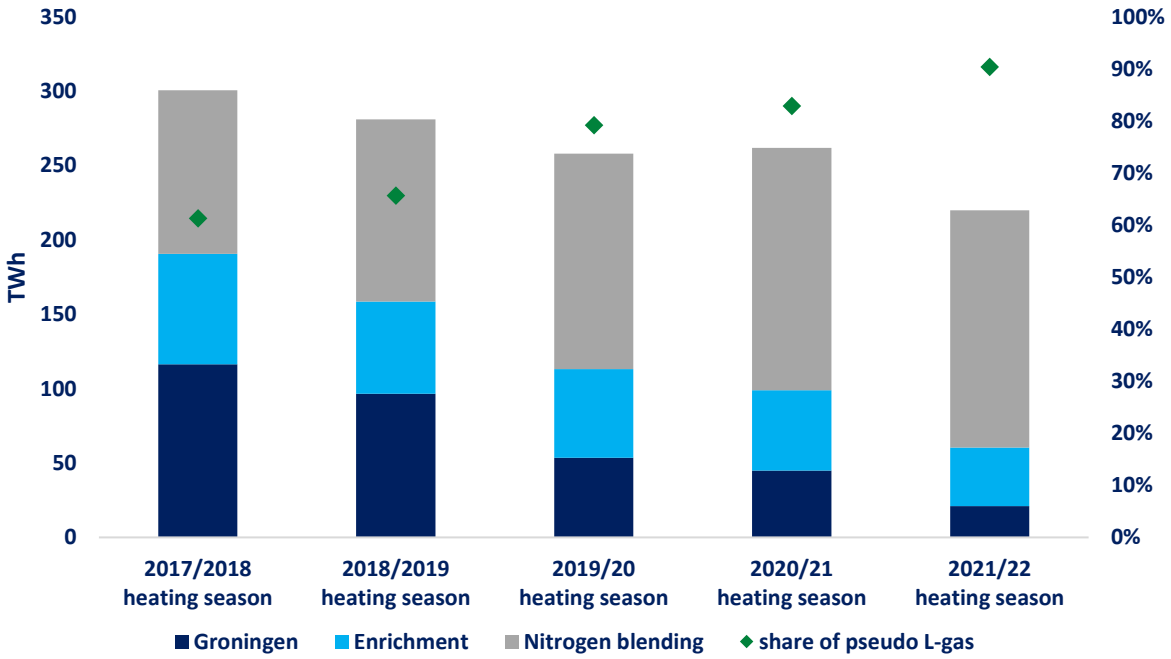
In line with the declining natural L-gas production from the Netherlands, the production of pseudo L-gas more than doubled between GY 2014/15 and GY 2020/21, rising from 155 TWh to close to 384 TWh.

Higher pseudo L-gas production has been made possible with the expansion of the nitrogen blending capacity by 80,000 m3/h N2 at the Wieringermeer conversion facility, starting from 23rd December 2019. This has translated into an additional 48.9 TWh/year of pseudo L-gas production capability.

During the 2021/22 heating season, total pseudo L-gas production declined by 8.4% (or 18.2 TWh) year-on-year, from 217 TWh to 198.9 TWh due to the steep decline in Dutch L-gas demand (-15%). As Groningen production fell more steeply than pseudo L-gas output, the share of pseudo L-gas in total Dutch L-gas production grew from 83% in the 2020/21 heating season to 90% during the 2021/22 gas winter.

It is important to highlight that the decline in pseudo L-gas output was primarily driven by lower production via enrichment, which decreased by 27% (or 14.7 TWh). Pseudo L-gas obtained via nitrogen blending was more resilient and declined by 2% (or 3.4 TWh). The share of nitrogen blending in total Dutch L-gas supply rose from 62% during the 2019/20 heating season to 73% through the 2021/22 gas winter.

Figure 4.1 L-gas supply in the Netherlands through the 2017/18 - 2021/22 heating seasons

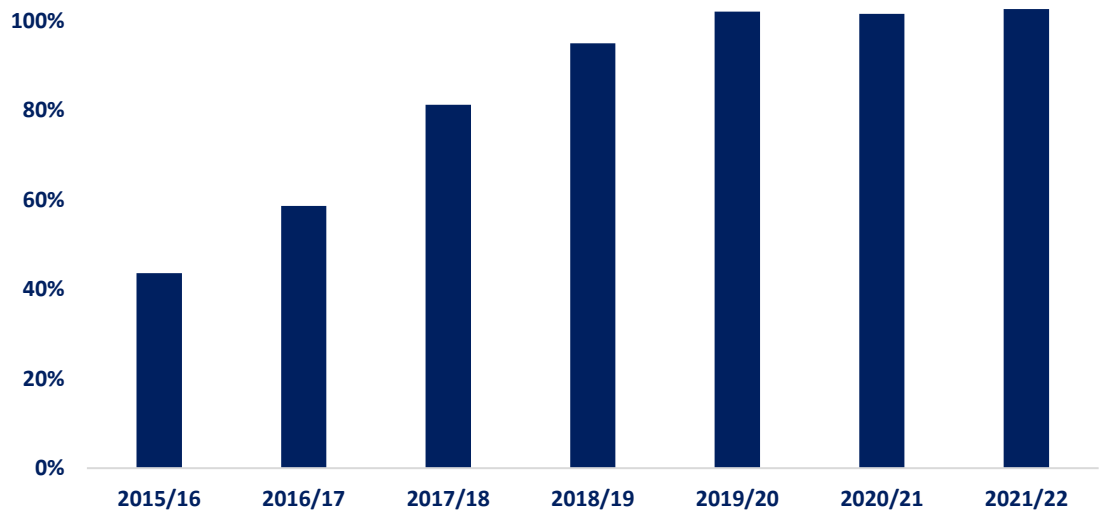


Due to the high pseudo L-gas production via nitrogen blending, the utilization rate of nitrogen blending facilities remained close to the average of the 2020/21 heating season, standing at 103% through the 2021/22 gas winter. The utilization rate of above 100% indicates the use of back-up nitrogen capacity to produce higher volumes of pseudo L-gas.

Total nitrogen usage for pseudo L-gas production decreased marginally by 0.9% year-on-year, from 1.9 bcm during the 2020/21 heating season to 1.89 bcm in 2021/22.

[22] In the process of nitrogen blending nitrogen is added to H-gas in order to bring down the Wobbe-value until it meets the upper Wobbe-limits of the L-gas specifications. Enrichment refers to the process adding H-gas to Groningen-gas until the upper Wobbe-limit of the L-gas specifications.

Figure 4.2 Utilization level of firm capacity of nitrogen blending facilities in the Netherlands through the 2015/16 - 2021/22 heating seasons



Altogether, L-gas production in the Netherlands have fallen by 16% (or 41.9 TWh) year-on-year, from 261.9 TWh during the 2020/21 heating season to 220 TWh through the 2021/22 gas winter. As such, the decline in L-gas production has been smaller than the year-on-year reduction in L-gas consumption (-47.8 TWh) resulting in lower withdrawal from L-gas storage sites (see Chapter 5).

4.2 The impact of decreasing Groningen production on the Dutch gas market

Natural gas in the Netherlands is traded on the virtual gas hub, the Title Transfer Facility (TTF).

It is important to note, that gas prices on the TTF are reflective of broader regional and global supply-demand dynamics and as such depend less on the levels of natural gas production in the Netherlands.

Following the steep drop through GY 2019/20, natural gas prices on TTF recovered strongly through the 2020/21 heating season, increasing by 48% year-on-year to an average of €16.6/MWh. The sharp decline in Russian pipeline flows (down by 25% during the heating season) and the very low storage levels across the European Union –standing 18% below their 5-year average on 1st October 2021- provided strong pressure on TTF prices, which averaged at €96.4/MWh through the 2021/22 heating season –their highest level on record. Russia's brutal invasion of Ukraine at the end of February 2022 created a moment of unprecedented market uncertainty, fuelling volatility and driving up European gas prices to record levels. Intraday gas prices on TTF soared to an all-time high of EUR 345/MWh on 7 March 2022.

TTF traded at a premium of €5/MWh compared to Asian spot LNG prices in Q1 2022. This in turn supported a strong LNG inflow into Europe[23]. LNG imports surged by 55% y-o-y to reach over 75 bcm (256 TWh) during the 2021/22 heating season – an all-time high for this period of the year. Almost 67% of the incremental LNG was supplied by the United States, which reinforced its position as Europe's largest LNG supplier, meeting over 40% of the continent's total LNG imports.

[23] The European Union, Turkey and the United Kingdom.

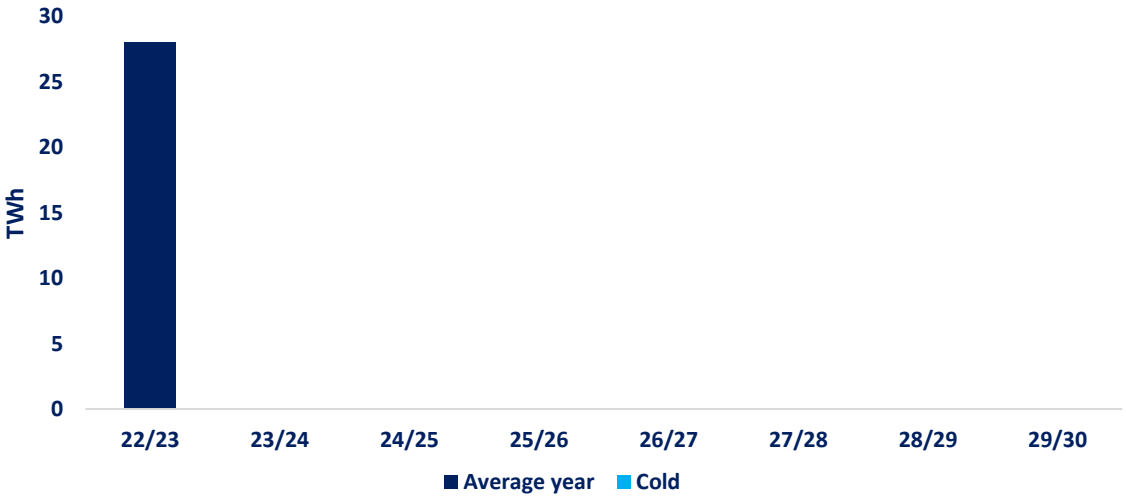
Figure 4.2 TTF gas prices and traded volumes per heating seasons (2011/12-2021/22)

During the same period of time, traded volumes on TTF broadly flat, rising by 0.5% and reinforcing TTF's position as Europe's leading gas hub.

4.3 Indication of the L-gas production in the Netherlands for the period GY 2022/23 – GY 2029/30

The Groningen production cap for the GY 2021/22 has been set at 45 TWh, 49% below its cap for the previous GY 2020/21 (set at 89 TWh). Based on the expected consumption of L-gas, as mentioned in chapter 2.2, and the expected production of pseudo L-gas and production of L-gas outside the Netherlands, the need for Groningen production is 31 TWh in an average year for the GY 2022/23 and 40 TWh in a cold year. This expected need for Groningen production is higher than the production cap, which will be set at 28 TWh for both an average and a cold year.

Figure 4.3 Indication of the L-gas production from Groningen in an average and cold gas year (GY 2022/23-2029/30)



This production volume is the result of the decision of the State Secretary to keep all Groningen production locations open, in line with the advice of GTS. These production locations will produce at a minimum flow in order to ensure availability in case of extreme cold or an outage in the L-gas system. In an additional advice on the

gas year 2022/23 published on 16 September 2022[24] GTS expects that the security of supply for the L-gas market can be ensured with this production volume when assuming a demand reduction compared to the expectations for L-gas consumption in this report. The difference in this assumption about the L-gas demand can be explained by the current trend in energy efficiency, as a response to high gas prices and the European proposal to save gas as part of the Safe Winter Package. When assuming a 15% demand reduction in line with the European proposal the needed Groningen production in terms of volume would be lower than the cap of 28 TWh. Therefore, the level of 28 TWh is expected to be sufficient to ensure security of supply in terms of volume as well as capacity for the GY 2022/23. Whether or not this demand reduction will continue in the GY 2022/23 is uncertain. Although GTS expects the security of supply for the L-gas market can be ensured with the cap on Groningen production set on 28 TWh, legal measures to increase Groningen production by the Secretary of State are possible in case a significant deviation in the market assumptions, that were used for the estimates that were made up front, would be observed by GTS during the gas year.

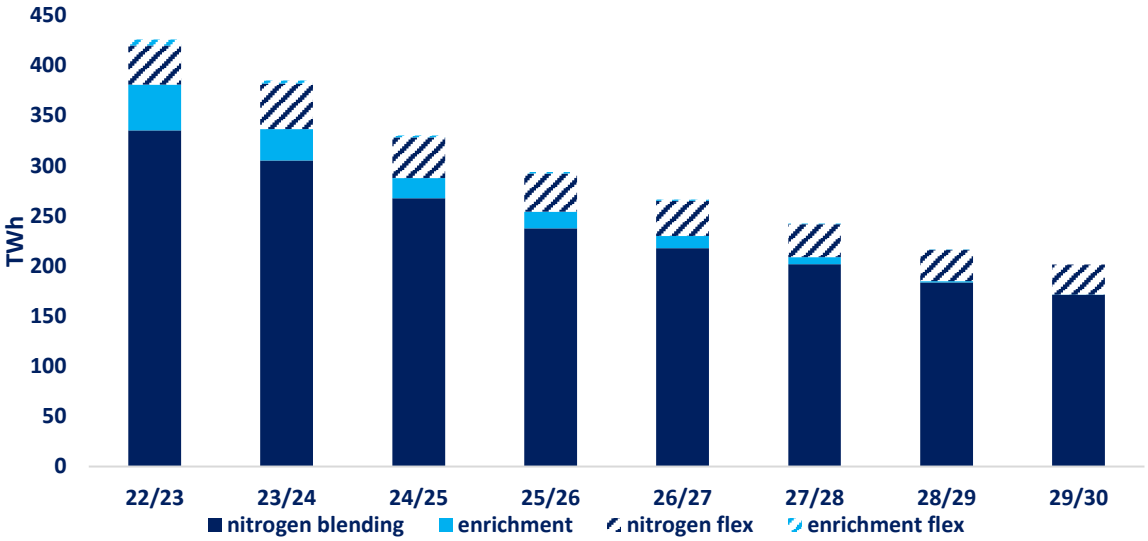
It is currently being investigated when the gas production from Groningen can come to a full stop, i.e. no production even in the case of a cold GY. In this investigation two factors play a role: volume and capacity/flexibility. From Figure 4.3 it becomes clear that Groningen produces without any flexibility: the Groningen field produces in GY 2022/23 at its minimum. This minimum production is necessary in order to produce the required capacity in case of extreme cold and/or an outage in the L-gas system (the so called "back-up functionality"). The Government of the Netherlands wants to close the Groningen field as quickly as possible. An important measure to be taken can be the storage of L-gas instead of H-gas in gas storage Grijpskerk. When capacity and volume of the storage are enough, the storage can take over the back-up functionality of the Groningen field and speed up the closure to mid-2023 or mid-2024, as concluded by GTS in June 2021. The decision to convert the storage to G-gas was taken at the start of 2022, where the State Secretary of the Extractive Industries granted the permit to change gas quality of the storage.

To substitute the declining production from the Groningen field, the production of pseudo L-gas will further increase, primarily by means of additional nitrogen blending with (imported) H-gas. In the GY 2022/23, pseudo L-gas will account for close to 93% (or 381 TWh) of L-gas produced in the Netherlands and is set to provide over 80% of the upward production flexibility necessary to meet Dutch L-gas demand in a cold GY in the L-gas region. Nitrogen blending alone will account to 81% (or 335 TWh) of L-gas produced in the Netherlands and expected to provide almost 72% of the upward production flexibility necessary to meet demand in a cold GY in 2022/23.

This will be supported by the new nitrogen plant at Zuidbroek, which is currently under construction and was planned to start operations 1st of April 2022 with a capacity of 180,000 m3/h N2 and able to produce between 68 TWh and 97 TWh of additional pseudo L-gas. Being heavily impacted by the outbreak of Covid-19 and consequent lockdowns, the planned commissioning date of the nitrogen plant is expected to be in the beginning of GY 2022/23[25]. However, the project schedule remains very tight.

Figure 4.4 Indication of pseudo L-gas production during an average and cold gas year in the Netherlands (GY 2022/23-2029/30)

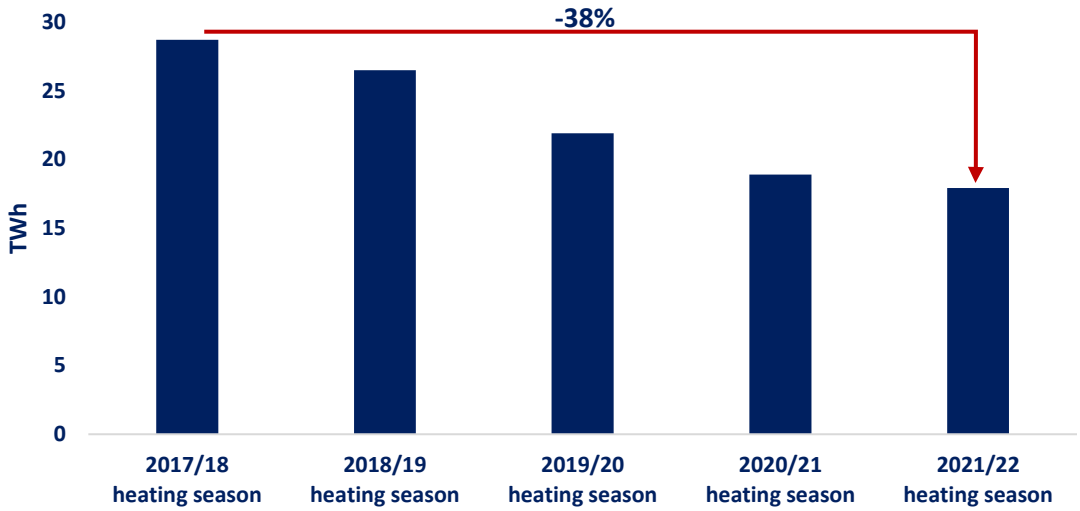
[24] Aanvullend advies leveringszekerheid voor benodigde Groningencapaciteiten en -volumes gasjaar 2022/2023, d.d. 16 september 2022, L 22.0478
[25] More information at https://www.gasunietransportservices.nl/transparency/remit/urgent-market-messages/2-2406



4.4 Expected L-gas production outside Netherlands for the period GY 2019/20 – GY 2029/30

In Germany, L-gas production fell by 38% between 2017/18 heating season and 2021/22. Following the steep declines through the 2019/20 and 2020/21 heating season, L-gas output in Germany decreased by over 5% during the 2021/22 heating season to 17.92 TWh. Due to a lower total L-gas consumption (mainly as a result of the conversions already undertaken) this did not result in an increase of L-gas imports from the Netherlands.

Figure 4.5 L-gas production in Germany between 2017/18 and 2021/22 heating seasons



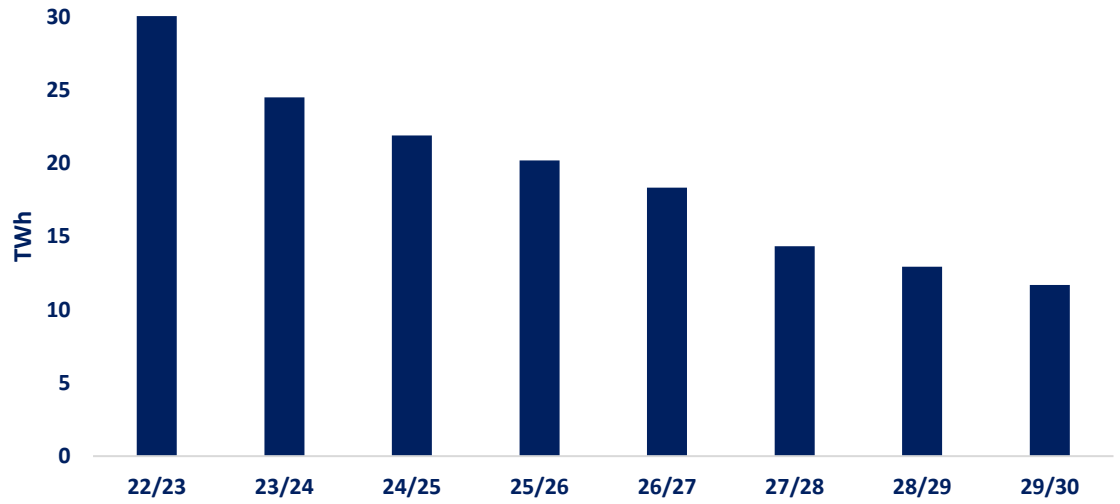
In Germany, L-gas production is expected to decrease at an annual average rate of ~12% from 31.5 TWh in GY 2021/22 to 11.7 TWh by GY 2029/30. There is one peak nitrogen/H-gas blending facility in Germany, in Rehden, supplying only limited volumes of converted L-gas. In 2021, the blending facility in Rehden was extended with a local nitrogen plant for backing of the local supply demand balance.

In addition, the German TSO GTG Nord built a blending facility at the Dutch border. This facility allows for blending Dutch Groningen gas with H-gas. This blending facility is in operation since April 2021 and allows for an annual decrease of L-gas deliveries from the Netherlands of up to 30% (5-6 TWh/y approx.) of the demand of GTG's cross border point Oude Statenzijl, depending on, inter alia, the actual amount of gas imports. Thus, the facility is a further relief to the Groningen production. The building costs of the facility and its operational costs are borne by network users.

There is no L-gas production in Belgium or France. The French nitrogen/H-gas blending facility located at Loon Plage (near Dunkerque) designed for peak-load needs only was abandoned in 2021 as this area of GRTgaz

network was converted. There is one peak nitrogen/H-gas blending facility in Belgium, in Lillo, supplying only limited volumes of converted L-gas.

Figure 4.6 Indication of the L-gas production in Germany (GY 2021/22-2029/30) in TWh



5. Storage of L-gas

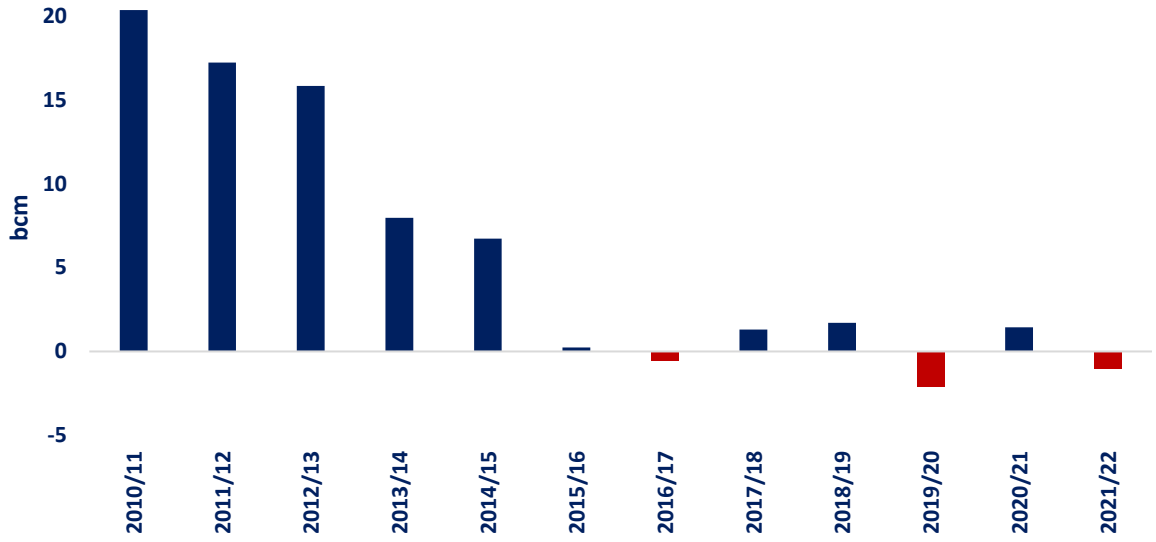
Natural gas storage plays a key role in meeting both seasonal and more short-term demand requirements, providing additional flexibility to the gas system.

Given the high seasonal profile of L-gas demand (see Chapter 2), storage capacity is required to ensure the adequate deliverability of L-gas supply.

It is important to note that in the past the Groningen field had a significant seasonal swing –the difference in output during the heating and summer season- providing supply flexibility to the entire system. As shown on the figure below, the production swing of Groningen has practically disappeared by 2015/16 and turned into negative several times since then, including in 2021/22.

This in turn, is increasing the importance of L-gas storage in meeting both seasonal and short-demand variations.

Figure 5.1 Seasonal swing in Groningen gas production (2010/11-2020/21)



5.1 Available storage volume of L-gas (in TWh) per country

Total L-gas storage capacity in Northwest Europe stands at over 119 TWh, with a total withdrawal capacity of 3,572 GWh/d. This is a marked increase from the 2021/22 heating season, when total L-gas storage capacity stood at just 96.1 TWh and with a withdrawal capacity of 2,934 GWh/d.

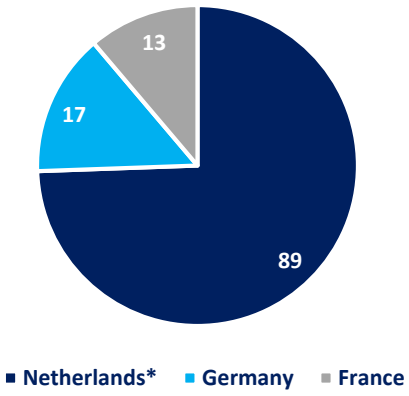
The increase is due to the conversion of the The Grijpskerk storage site was converted from H-gas to L-gas service and it has been filled with L-gas since April 2022. The storage site's working gas capacity was downgraded to 23.85 TWh from 27.67 TWh. UGS Grijpskerk has a withdrawal capability of 620 GWh/d.

Most of L-gas storage is located in the Netherlands[26] (89 TWh or 74%) and Germany (17 TWh or 14%). There is one L-gas storage facility in France with a capacity of 13.4 TWh. There is no L-gas storage in Belgium, which relies on L-gas storages located in the Netherlands.

Almost three-quarters of withdrawal capacity is concentrated in the Netherlands, followed by Germany (21%). France's Gournay storage facility accounts for 6% of L-gas withdrawal capacity in northwest Europe. For more details on L-gas storage please refer to Annex 4 of the Report.

It is important to highlight that Northwest Europe's largest L-gas storage site, Norg, has been used to store pseudo L-gas instead of gas coming from the Groningen field since 1st April 2020. This allows for a more optimal utilization of nitrogen blending plants, as the facility can be filled with pseudo L-gas that the market cannot absorb during the summer season (April-September) of the GY.

Figure 5.2 L-gas storage distribution by markets (TWh)



**including Norg as production storage*

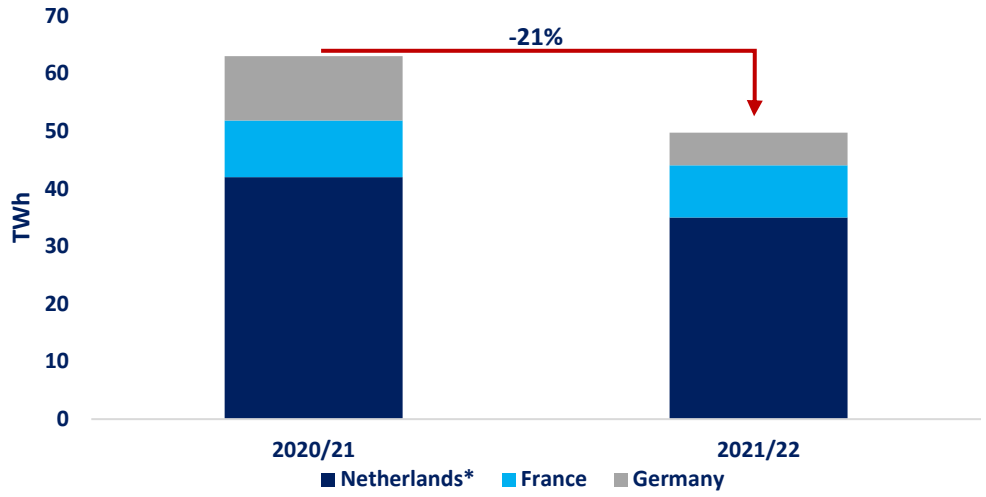
5.2 The role of L-gas storage during the 2020/21 heating season

Storage played a key role in meeting L-gas demand through the 2021/2022 heating season, with gas supply from storage sites accounted to almost 17% of total L-gas consumption[27] during this period.

As total L-gas demand declined more sharply (-55.4 TWh) compared to L-gas production (-42.9 TWh), the reliance on storage declined compared to last year through the 2021/22 heating season. Consequently, net storage withdrawals decreased by over 21% (or 13 TWh) year-on-year from 63 TWh during the 2020/21 heating season to 50 TWh during the 2021/22 gas winter. The Norg storage facility in the Netherlands alone accounted for close to 55% of total net storage withdrawals during the 2020/21 gas winter.

Figure 5.3 L-gas storage net withdrawals during the 2020/21 and 2021/22 heating seasons

[26] This includes three of the Epe storage sites, which are physically located in Germany, but are incorporated in the Dutch gas network.
[27] Including L-gas produced and consumed in Germany.



**including Epe Eneco storage site located in Germany*

5.3 L-gas storage outlook

The evolving supply and demand outlook for L-gas will have implications on L-gas storage capacity through the medium-term.

In Germany, the Lesum L-gas storage site has been converted into full H-gas storage service in 2021, resulting in a decline of 1.55 TWh L-gas storage capacity (and 52 GWh/d withdrawal capacity). Moreover, a volume of 70 million m³ is converted to store H-gas at the Huntorf storage site in Germany.

After the Lesum facility has been converted in 2021, the Speicherzone L-Gas (EWE) storage facility will be gradually converted to H-gas until 2027, following a partial reconversion starting in 2021, resulting in 8,35 TWh working L-gas storage capacity. The Empelde, Epe L-gas (UES) and Epe L-gas (RWE Gas Storage West) storage sites are expected to undergo a partial conversion starting by 2024, and a final conversion to H-gas by 2029 respectively. As such, after 2029 L-gas working storage capacity in Germany will not be required anymore.

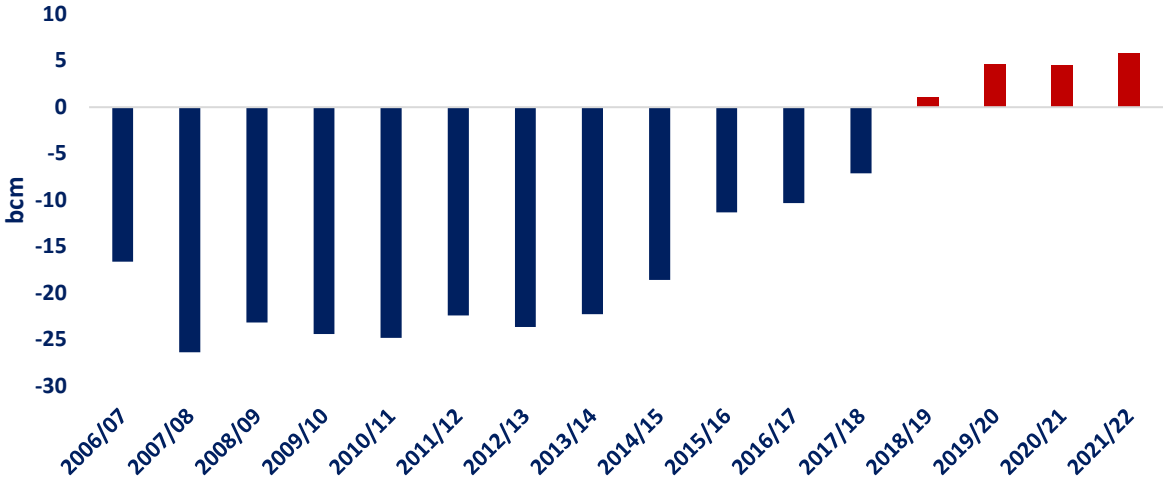
In France, the Gournay (13 TWh) storage facility is expected to be removed from the L-gas network by April 2026.

6. H-gas imports into the Netherlands

As a consequence of its declining domestic production (see Chapter 5), the Netherlands almost doubled its natural gas imports since 2014, from 259 TWh to 507.5 TWh in 2018 to become a net importer of natural gas for the first time in its history. The country's imports stood at around 600 TWh in 2021.

The Netherlands' position as a net importer of natural gas is particularly visible during the heating season. Net imports of natural gas rose by more than four-fold in the 2019/2020 heating season compared with the same period of the previous GY and remained at a similar level through the 2020/21 heating season. Net imports during the 2021/22 heating season rose to their highest level on record.

Figure 6.1 Net natural gas imports of the Netherlands per heating season (2006/07-2020/21)



More than half of the imported H-gas is being converted to L-gas to supply L-gas consumers both in the Netherlands and in the export markets. Consequently, the security of L-gas supply is becoming intimately linked to the deliverability of H-gas into the Netherlands.

Russia's invasion of Ukraine and the European Union's commitment to phase-out Russian gas "as soon as possible" is set to redraw H-gas supply dynamics in Northwest Europe.

The Netherlands has three main entry points for H-gas supply. Norwegian natural gas is imported via the Emden terminal in Germany which feeds into the Dutch gas grid and has an entry capacity of 352 TWh/y. Russian imports to the Netherlands need to transit via Germany through the Bunde/Oude Statenzijl interconnection, with an entry capacity of 184 TWh/y. LNG from the global gas market can be imported via the Gate LNG Terminal, which had an annual send-out capacity of 168 TWh/y. The GATE terminal started to offer ~44 TWh/y of additional interruptible capacity from beginning of June 2022. In the aftermath of Russia's invasion of Ukraine, the Netherlands has intensified its efforts to further diversify gas imports. The Netherlands' Eemshaven LNG import terminal is set to begin operations in mid-September 2022. The terminal will use two floating storage and regasification units (FSRUs), with an import capacity of ~89 TWh/y (or 8 bcm/y). There are also two import interconnectors with Belgium: Zelzate and Zebra, with a combined entry capacity of over 143 TWh/y. Zebra has been integrated into the GTS network.

Moreover, the BBL pipeline – connecting the Netherlands and the United Kingdom – became bidirectional on 1 July 2019, enabling natural gas imports into the Netherlands with an annual capacity of 61.32 TWh/y.

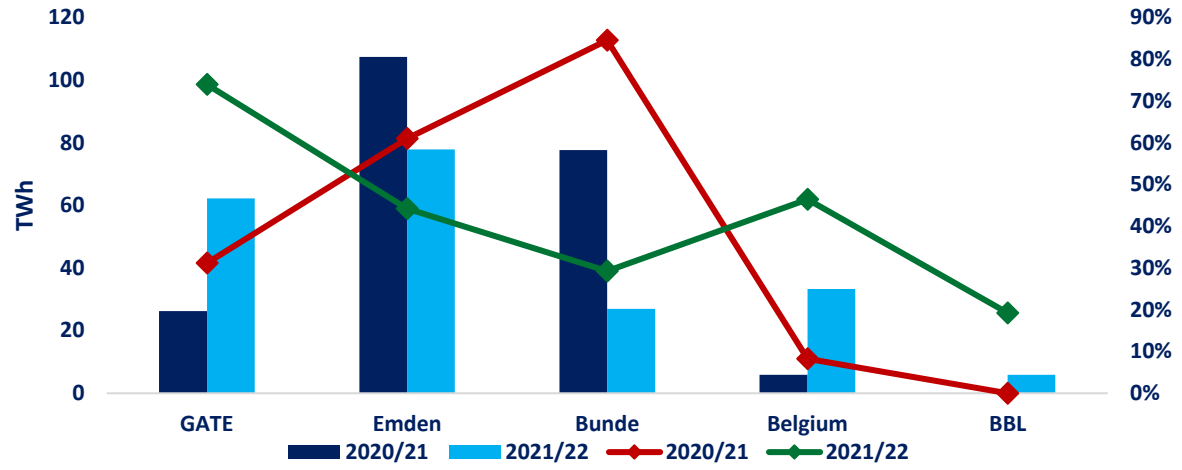
Data from ENTSOG's Transparency Platform indicates that total H-gas entry flows to the Netherlands decreased by 5% (or 11 TWh) year-on-year through the 2021/22 heating season. This has been primarily due to the lower entry flows from Norway via Emden (-29.6 TWh) as Norwegian gas deliveries have been partly redirected towards Germany. Consequently, the utilization level at Emden dropped from 61% during the 2020/21 heating season to 44% in 2021/22. Flows from Germany via the Bunde-Oude interconnection point declined by 50.8 TWh year-on-year, as Russian deliveries fell sharply to Northwest Europe. The utilization level of the Bunde-Oude interconnection point plummeted from 85% during the 2020/21 gas winter to just 29% through the 2021/22 heating season.

Gazprom unilaterally cut gas supplies to GasTerra on 1st June 2022, following the company's refusal to adhere to the new payment system advanced by Russia. GasTerra was prepared for this situation by purchasing the volumes elsewhere. There are no problems expected for the security of supply for L-gas and also probably not for H-gas. Precautions have been taken to be able to deal with a sudden unexpected imbalance in the system. The Netherlands declared the early warning stage of its gas emergency plan on 20 June 2022, following the German early warming stage and the steep supply cuts from Russia to Northwest Europe via the Nord Stream pipeline system.

Lower pipeline deliveries were partly compensated by higher LNG inflow via GATE, which rose by more than twofold (or 36 TWh) compared to last year. Consequently, the utilization rate of the GATE regasification plant to from 31% during the 2020/21 heating season to 74% through the 2021/22 gas winter. In addition, pipeline deliveries from Belgium rose by more than fivefold (27 TWh) year-on-year. This has been partly supported by the strong LNG inflow into the Zeebrugge LNG terminal in Belgium. Imports via the BBL pipeline rose to 5.9 TWh during the 2021/22 heating season compared to close to 0 through the 2020/21 gas winter.

Figure 6.2 provides a comparison of the imported volumes and the utilization rates[28] of the importing facilities through the last two heating seasons.

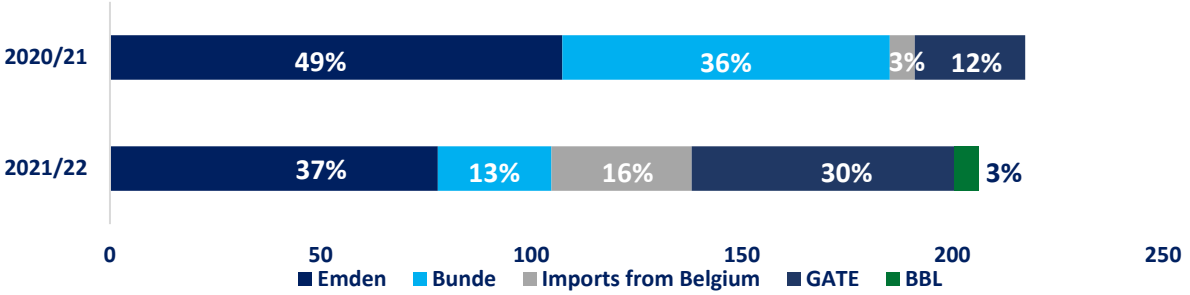
Figure 6.2 Natural gas imports to the Netherlands by main entry points and utilization rates in the 2020/21 and 2021/22 heating seasons



** the columns represent imported volumes in TWh, the lines show the utilization rates of the given entry point*

Figure 6.3 shows H-gas imports to the Netherlands by main entry points through the last two heating seasons. The share of Emden in H-gas imports fell from 49% during the 2020/21 heating season to 37%, the share of Bunde/Oude Statenzijl plummeted from 36% to 13%, whilst the share of Gate rose from 12% to 30% and the share of imports from Belgium increased from 3% to 16%. BBL accounted for 3% of the Netherlands' H-gas imports through the 2021/22 heating season.

Figure 6.3 Natural gas imports to the Netherlands by main entry points in the 2020/21 and 2021/22 heating seasons



When considering these entry points, the annual spare import capacity of the Netherlands rose by 6% year-on-year to 248 TWh through the 2021/22 heating season, comparing to ~202 TWh of gas consumption during that period of the year.

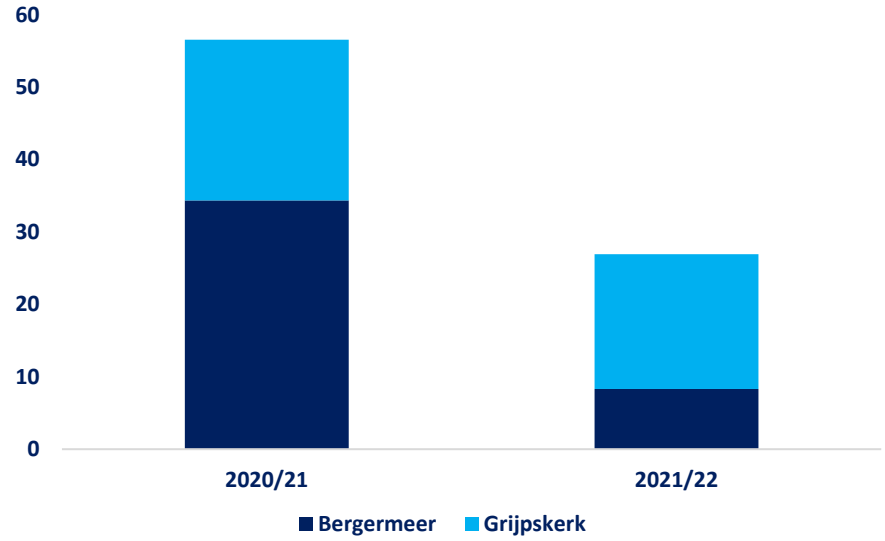
Data from ENTSOG's Transparency Platform and information submitted by the Task Force, indicates that H-gas exit flows from the Netherlands fell by 33% (or 20 TWh) year-on-year during the 2021/22 heating season from 62 TWh through the 2020/21 heating season to 42 TWh. This has been largely driven by the lower exit flows towards the United Kingdom. Export flows via the BBL pipeline fell from 31 TWh during the 2020/21 heating season to below 5 TWh during the 2021/22 heating season. This has been driven by much tighter price spreads between TTF and the National Balancing Point (NBP, the gas hub of the United Kingdom). The price spread collapsed from an average of USD 0.36/mmbtu during the 2020/21 heating season to close to USD 0/mmbtu through the 2021/22 gas winter. Exit flows towards Belgium fell from 19 TWh during the 2020/21 heating season to 4 TWh through the 2021/22 gas winter. Exit flows to Germany via the Bocholtz interconnection point rose by 155% (or 20 TWh) compared to the 2020/21 heating season.

It is important to highlight, that H-gas storage facilities played a key role in the H-gas supply-demand balance of the Netherlands during the 2021/22 heating season. Net H-gas withdrawals met over 40% of the Netherlands' H-gas demand through the 2021/22 gas winter. While H-gas import flows declined by close to 14 TWh, exit H-

[28] Actual import flows divided by firm capacity of the entry point (Lesser Of Rule applied).

gas flows dropped by 20 TWh and the domestic demand (including for pseudo L-gas production) of H-gas fell by 20 TWh year-on-year during the 2021/22 heating season. Consequently, H-gas net withdrawals declined by 52% (or 29 TWh). Data from GIE indicates that the combined net withdrawals from the Bergermeer and Grijpskerk H-gas storage facilities declined from 56.6 TWh through the 2020/21 heating season to 26.9 TWh during the 2021/22 gas winter. For Grijpskerk a full production of the working gas capacity during the winter of GY 2021/22 was needed for the conversion of the gas storage to a storage for L-gas instead of H-gas.

Figure 6.4 Net withdrawals from H-gas storage sites in the Netherlands during the 2020/21 and 2021/22 heating seasons



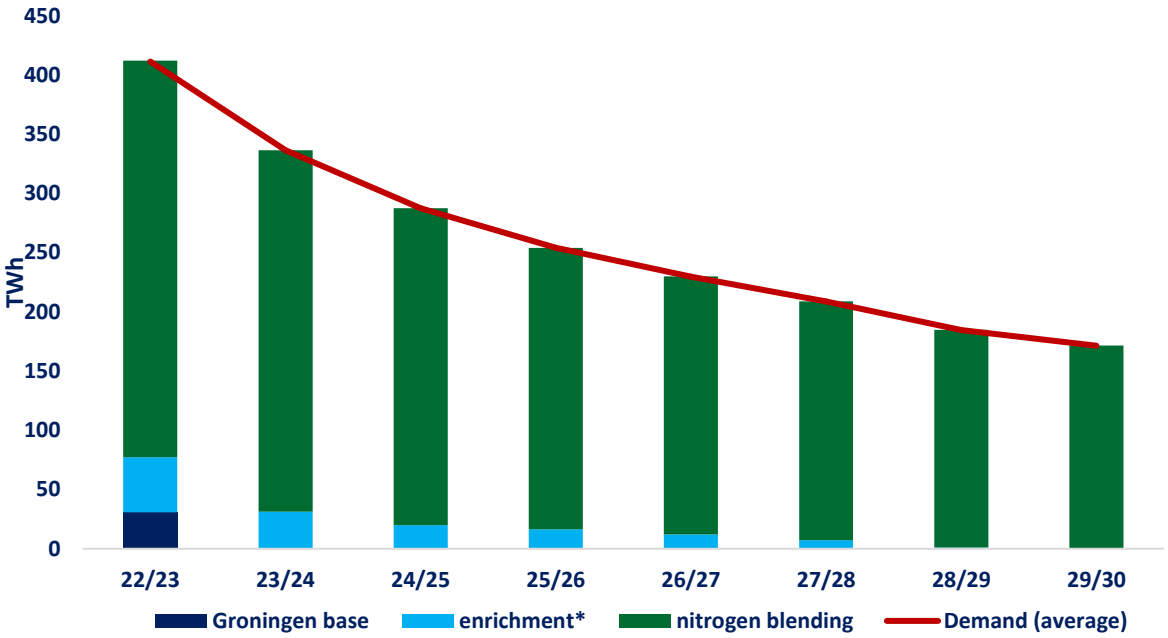
**For Grijpskerk a full production of the working gas capacity during the winter of GY 2021/22 was needed for the conversion of the gas storage to a storage for L-gas instead of H-gas.*

7. Conclusion & implications for Groningen production until 2029/30

Overall, it can be concluded that the L-gas market conversion is progressing well and that security of L-gas supply is being ensured by increasing of H-gas conversion capacity via nitrogen blending in The Netherlands and the market conversion from L-gas to H-gas in Germany, Belgium and France. The increase of H-gas conversion capacity via nitrogen blending in The Netherlands and the market conversion from L-gas to H-gas in Germany, Belgium and France as well as the activities in the Netherlands to reduce the consumption of L-gas, will ensure the security of L-gas supply to consumers in all markets both in an average and in cold year.

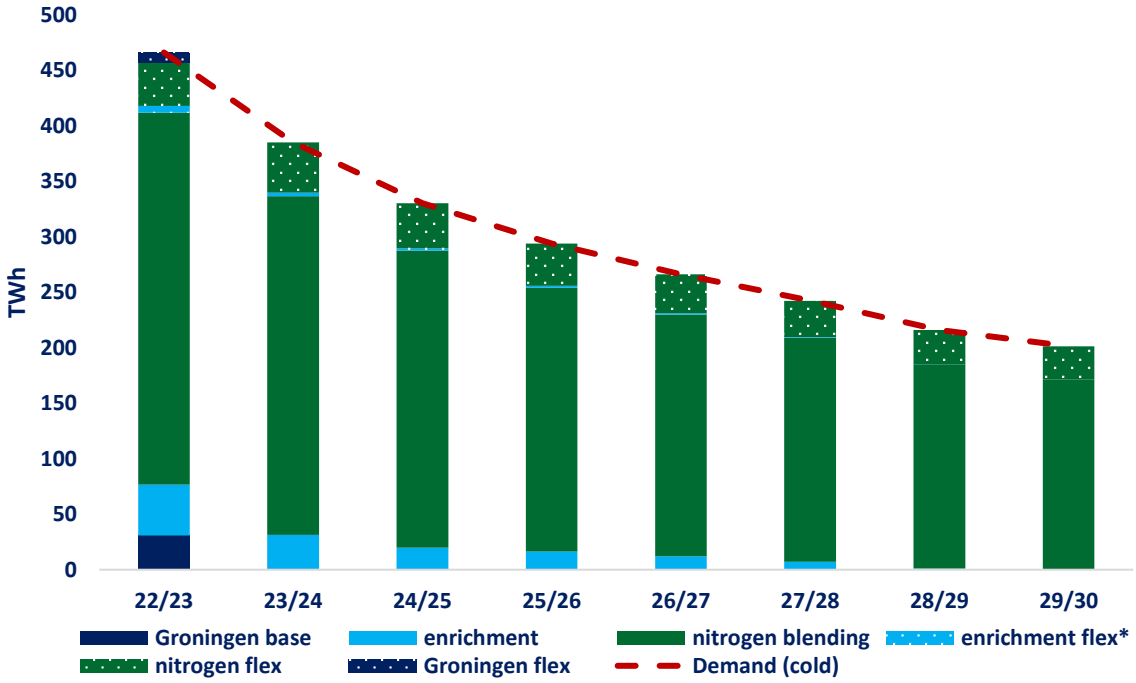
Through the market conversion period, the role of enrichment will decline in line with the decreasing Groningen production. Hence, nitrogen blending facilities will have an increasing role in meeting L-gas demand through the next eight GYs.

Figure 7.1 L-gas supply-demand balance in an average year (GY 2022/23-GY 2029/30)



However, it may be necessary to maintain flexible Groningen production until the start of the GY 2023/24 or the start of the GY 2024/25, to meet L-gas demand in the case of extreme cold days or in case of a severe disruption elsewhere in the L-gas system. In the consecutive five GYs L-gas supply flexibility will be entirely provided by L-gas enrichment and by the nitrogen blending facilities.

Figure 7.2 L-gas supply-demand balance in a cold year[29] (GY 2022/23-GY 2029/30)



[29] Please refer to footnote 6 on page 4 of the current Report.

Annex

Annex I: Consumers demand for L-gas from the Netherlands through the 2018/19 and 2021/22 heating seasons

1.1 Consumers demand for L-gas from the Netherlands[30] in the 2018/2019 heating season in TWh

Heating season 18/19	Germany	France	Belgium	Netherlands
Oct-18	12.6	3.1	3.2	16.8
Nov-18	16.9	5.1	5.4	26.7
Dec-18	20.3	5.7	6.2	30.1
Jan-19	24.4	6.6	7.5	36.0
Feb-19	18.3	4.9	5.4	26.3
Mar-19	18.5	4.6	5.1	25.4
Total	111.0	29.9	32.7	161.2

1.2 Consumers demand for L-gas from the Netherlands in the 2019/2020 heating season in TWh

Heating season 19/20	Germany	France	Belgium	Netherlands
Oct-19	12.2	3.0	3.4	18.3
Nov-19	19.1	5.0	5.5	26.7
Dec-19	20.0	5.6	6.2	30.0
Jan-20	19.7	5.7	6.3	30.8
Feb-20	17.0	4.8	5.6	27.8
Mar-20	17.1	4.5	5.3	25.9
Total	105.1	28.5	32.2	159.4

1.3 Consumers demand for L-gas from the Netherlands in the 2020/2021 heating season in TWh

Heating season 20/21	Germany	France	Belgium	Netherlands
Oct-20	12.3	3.2	3.5	18.7
Nov-20	14.1	4.1	4.3	21.9
Dec-20	15.9	5.2	5.9	30.0
Jan-21	16.4	6.0	7.0	35.1
Feb-21	16.9	4.9	5.7	30.3
Mar-21	16.8	4.4	5.2	27.1
Total	92.4	27.8	31.5	163.1

1.4 Consumers demand for L-gas from the Netherlands in the 2021/2022 heating season in TWh

Heating season 21/22	Germany	France	Belgium	Netherlands
Oct-21	11	3	3	15
Nov-21	14	4	4	23
Dec-21	14	5	5	29
Jan-22	14	5	5	28
Feb-22	12	4	4	24
Mar-22	12	3	3	20
Total	77	25	24	139

Annex II: Indication of the demand for L-gas from the Netherlands until GY 2029/30

2.1 Indication of the demand for L-gas from the Netherlands in Germany until GY 2029/30 (TWh)

[30] For Germany and Belgium, this accounts for imports of L-gas from the Netherlands and not total domestic demand. For France, this accounts for final consumers demand per month, not taking into account L-gas injections/withdrawals in/from Gournay storage and L/H blending. For the Netherlands, it accounts for domestic demand.

	Cold		Average
	TWh	GWh/d	TWh
22/23	122	802	110
23/24	101	686	91
24/25	84	574	76
25/26	62	458	55
26/27	43	343	39
27/28	30	228	27
28/29	11	115	10
29/30	0.3[31]	2	0.3

2.2 Indication of the demand for L-gas from the Netherlands in Belgium until GY 2029/30 (TWh)

	Cold		Average
	TWh	GWh/d	TWh
22/23	41	265	33
23/24	24	150	20
24/25	0	0	0
25/26	0	0	0
26/27	0	0	0
27/28	0	0	0
28/29	0	0	0
29/30	0	0	0

2.3 Indication of the demand for L-gas from the Netherlands in France until GY 2029/30 (TWh)

	Cold		Average
	TWh	GWh/d	TWh
22/23	37	314	35
23/24	30	237	28
24/25	22	185	21
25/26	17	128	15
26/27	10	61	9
27/28	4	14	4
28/29	1	0	1
29/30	0	0	0

2.4 Indication of the demand for L-gas in the Netherlands until GY 2029/30 (TWh)

	Cold		Average
	TWh	GWh/d	TWh
22/23	247	2891	212
23/24	240	2833	206
24/25	231	2703	197
25/26	220	2660	188
26/27	216	2605	184
27/28	211	2570	179
28/29	206	2534	175
29/30	201	2498	171

Annex III: Expected market conversion volume until GY 2029/30

3.1 Expected market conversion volume in Germany until GY 2029/30 (TWh)

Gas year	Volume converted [TWh]	Number of installations [Thousands]

[31] Please note that the remaining demand in the gas year 2029/30 (0.3 TWh / 100.000 kWh/h) is given by a regional grid in Germany, that can only supplied via the Netherlands (Haanrade / Thyssengas).

21/22	21.2	495
22/23	26.1	552
23/24	18.3	503
24/25	23.4	516
25/26	19.3	508
26/27	21.9	561
27/28	21.4	311
28/29	15.1	308
29/30	0	0

3.2 Expected market conversion volume in Belgium until GY 2029/30 (TWh)

Gas year	Volume converted [TWh]	Number of installations [Thousands]
21/22	6.24	336
22/23	13.73	374
23/24	19.7	494
24/25	0	0
25/26	0	0
26/27	0	0
27/28	0	0
28/29	0	0
29/30	0	0

3.3 Expected market conversion volume in France until GY 2029/30 (TWh)

Gas year	Volume converted [TWh]	Number of connections [Thousands]
21/22	1.2	54
22/23	4	122
23/24	9	177
24/25	5.5	212
25/26	5.3	279
26/27	6.4	197
27/28	4.9	183
28/29	2.2	37
29/30	0	0

Annex IV: Expected L-gas production until GY 2029/30

4.1 Indication of the L-gas production in the Netherlands from Groningen until GY 2029/30 (TWh)

	Cold	*Average*
22/23	28	28
23/24	0	0
24/25	0	0
25/26	0	0
26/27	0	0
27/28	0	0
28/29	0	0
29/30	0	0

4.2 Indication of the L-gas production in Germany until GY 2029/30 (TWh)

	Cold	*Average*
22/23	30.0	30.0
23/24	24.5	24.5
24/25	21.9	21.9
25/26	20.2	20.2
26/27	18.3	18.3
27/28	14.3	14.3
28/29	12.9	12.9
29/30	11.7	11.7

Annex V: L-gas storage in northwest Europe

5.1 Working gas volume and daily withdrawal capacity of L-gas storage sites in Germany, France and the Netherlands

	Working gas (TWh)	***Withdrawal rate (GWh/d)***
Germany		
Lesum *(converted to H-gas)*	1.553	52
Nüttermoor L-Gas	0.43	24
Speicherzone L-Gas (EWE)	8.35	259
Empelde	2.29	73
Epe L-Gas (RWE)	1.77	98
Epe L-Gas (UES)	4.48	238
France		
Gournay	13	215
the Netherlands		
EnergyStock	3	252
Norg (Langelo)	49	742
Alkmaar	5	357
Epe Nuon	3	117
Epe Eneco	1	95
Epe Innogy	3	119
Peakshaver	1	312

5.2 Net withdrawals (in TWh) of L-gas per country in 2019/20 and 2020/21 heating seasons

	2020/21	**2021/22**
The Netherlands	42	35
France	9.8	9.1
Germany	11.2	5.7

Annex VI: Climatological context

GTS will make an analysis of the climatological context in the L-gas region. GTS will use the temperature measurements of the measurement station in De Bilt to determine this context. This will then be used to analyse the difference between the expected demand in an average year and the realized demand using GTS' degree day method.

L-gas is predominantly used in the residential sector for space heating, therefore L-gas gas demand is strongly correlated with the temperature and wind. This is also the reason why the allowed Groningen production is determined by the number of degree days in a year. The definition of the degree days is given in the Dutch Gas Act. As stated in the Dutch Gas Act, both the temperature and wind are measured at weather station the Bilt.

The number of degree days can be calculated by

$D = \Sigma \max[(14 - Teff),0]$

Where:

D = the number of degree days

14 = heating limit (the so-called "stookgrens")

Teff = daily average effective temperature

$Teff = T - (V/1,5)$

Where:

T = daily average temperature

V = daily average wind speed

In the 2021/22 heating season there were 1655 degree days, almost 7% less than during the 2020/21 heating season, when there were 1773 degree days. 1716 degree days were recorded during the 2019/20 heating season and the 1699 degree days during the 2018/19 heating season.

Contributors

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