L-Gas Market Conversion Review

Ministry of Economic Affairs and Climate Policy

Winter Report 2020

Task Force Monitoring L-Gas Market Conversion

Foreword

This report monitors 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. This first report looks back on the most recent gas year (2018/2019) 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 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 report is published semi-annually in January and June. The Netherlands will use these reports 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, 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 after an additional earthquake occurred on May 22, with the objective of accelerating the termination by Gas Year[1] (GY) 2022/23 for average weather conditions. From mid-2022, gas from the Groningen field (Groningen gas) should only be needed in case of a colder than average winter.

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 to L-gas referred in the current report as "pseudo L-gas".

Pseudo L-gas can be principally produced in two ways:

- nitrogen blending: 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;
- enrichment: adding H-gas to Groningen gas until the upper Wobbe-limit of the L-gas specifications.

Whilst Groningen gas production has halved from 341.8 TWh (or 35 bcm) in GY 2014/15 to 170.9 TWh (or 17.5 bcm[2]) in GY 2018/19 the production of pseudo L-gas more than doubled between during the same period of time. As a consequence, the utilization rate of the conversion facilities has increased steadily from GY 2014/15 to an average of 91% through the GY 2018/19.

L-gas is consumed in the Netherlands and is exported to neighboring markets in Belgium, France and Germany, where it serves a dedicated network for 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 reduce the L-gas supply from the Netherlands: by GY 2029/30, imports of L-gas will be reduced to nearly zero. In the meantime, these countries undertake extensive conversion programs, mainly switching L-gas consumers to H-gas.

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 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 5% (26.4 TWh) from 509.5 TWh in GY 2017/18 to 483 TWh in GY 2018/19. This has been partly driven by the start of the implementation of the market conversion programs in the respective L-gas markets, accounting for over 40% of total Dutch L-gas demand reduction in GY 2018/19.

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.[3] Consequently, L-gas imports are expected to fall from 49.7 TWh in GY 2019/20 to 0 in Belgium, from 42.7 TWh to 0 in France and from 166.7 TWh to 0.3 TWh in Germany by GY 2029/30.

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

- the reduced L-gas demand should be met with adequate L-gas supply, including transport capacity;
- H-gas deliverability should be guaranteed as it is used as feedstock to produce pseudo L-gas;
- the continuation of the Dutch TTF market organization (e.g. commercially one gas quality).

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 a more quickly decreasing Groningen output), the Netherlands will increase the production of pseudo L-gas, primarily by means of nitrogen blending.

Additional purchase of nitrogen from 1st January 2020 allows to expand the nitrogen blending capacity by 80,000 m3/h N2 at the Wieringermeer conversion facility from 215,000 to 295,000 m3/h. This would translate into an

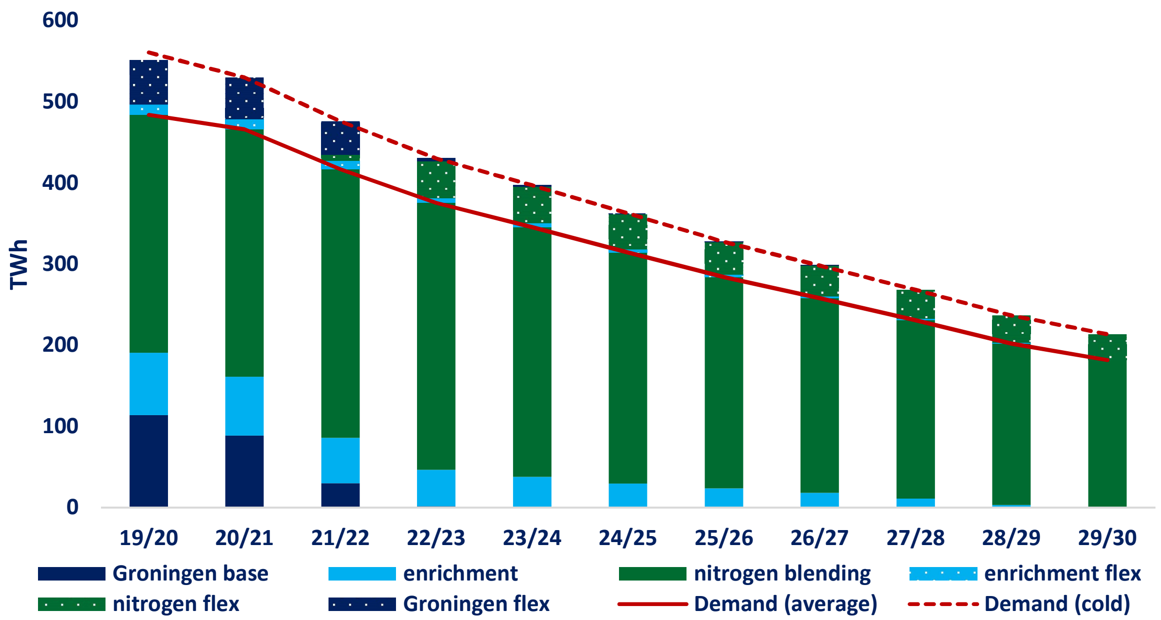
[1] A gas year (GY) starts on October 1st and ends on September 31st
[2] Volumetric data is expressed in Normal cubic meters (Nm^3), under reference conditions of temperature (0 °C) and pressure (101.325 kPa).
[3] GTS (2017), Netwerk Ontwikkelingsplan 2017

additional 48.9 TWh of pseudo L-gas. Moreover, a new nitrogen plant at Zuidbroek, planned to start operations from 1st of April 2022 with a capacity of 180,000 m3/h N2, will be able to produce over 68 TWh of additional pseudo L-gas.

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 The Netherlands will ensure the security of L-gas supply to consumers in all markets both in an average and in cold year.

However, it may be necessary to maintain flexible Groningen production until the GY 2024/25, to meet L-gas demand in the case of extreme cold days. This is currently being investigated. In the consecutive five GYs L-gas supply flexibility will be entirely provided by L-gas enrichment and by the nitrogen blending facilities.

L-gas supply-demand balance projection in an average and cold year (GY 19/20-GY 29/30)



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 since 2014, from 259 TWh to 507.5 TWh in 2018. In fact, the Netherlands became a net importer of natural gas in 2018 for the first time in the country's history.

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

Based on ENTSOG's winter outlook simulations for 2020, there is enough import and cross-border capacity to satisfy H-gas global needs for the Netherlands and the L-gas area (even when considering the most severe demand cases with a 2 week cold spell and peak day) through the GY 2019/20.

The L-Gas Market Conversion Monitoring Task Force will continue to monitor and assess the deliverability of H-gas supply to the Netherlands and the Northwest European markets served by L-gas.

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. The analysis shows that the implementation of conversion programs in Germany, France and Belgium is on schedule, and Germany has even taken additional measures that enabled the accelerated reduction in Groningen production. In all three countries, the technical operation of the conversion of the appliances is matched with legislation to achieve the consumers demand reduction. Due to the gained experience thus far with the first conversion activities, in the coming years larger numbers of appliances can be converted per year. The case of Germany shows that a long term planning, a close collaboration between all the relevant actors (ministry, TSOs, regulatory authorities, and companies) and a clear communication towards consumers are crucial to ensure the desired pace of the conversion operation.

3. At this moment, the involved participants in the Task Force do not foresee any possibilities to further accelerate the conversion process. Currently, all efforts are aimed 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 at an average rate of approximately 10% per year. As a consequence, L-gas imports are expected to fall from 45.4 TWh in GY 2018/19 to 0 in Belgium, from 41.6 TWh to 0 in France and from 163.6 TWh to 0.3 TWh in Germany by GY 2029/30.

4. The L-gas demand in the L-gas region was 5% lower in the GY 2018/2019 than in the preceding GY. This was partly due to mild temperatures, but for 40% caused by the conversion programs.

5. To be able to meet the L-gas demand in the region, the production capacity of nitrogen has structurally increased in order to produce less volume from the Groningen field, and in the GY 2018/2019 the nitrogen capacity was used for 91%. Together with the increase in nitrogen capacity, the allowed Groningen production and the structural decrease in L-gas demand in the region, GTS will be able to meet the decreasing L-gas demand, when the precondition of sufficient H-gas is supplied towards the Netherlands is met.

6. Due to the continuously increasing demand for H-gas for the conversion capacity, the Netherlands has become a net importer of gas in 2018. Because of these developments, the security of supply of L-gas has increasingly become more dependent on the flow of the increasing H-gas volumes into the Netherlands. Based on ENTSOG's simulations for 2020, there is enough import and cross-border capacity to satisfy H-gas global needs for the Netherlands and the L-gas area (even when considering the most severe demand cases with a 2 week cold spell and peak day) through the GY 2019/20.

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 after an additional earthquake occurred on May 22, with the objective of accelerating the termination by the Gas Year 2022/23 for average weather conditions. From mid-2022, Groningen gas should only be needed in case of a colder than average winter. 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 a dedicated network for 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 Min. EZK to report twice a year on concrete measures to reduce the demand for Groningen gas and their foreseen impact[4]. 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.

[4] 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.

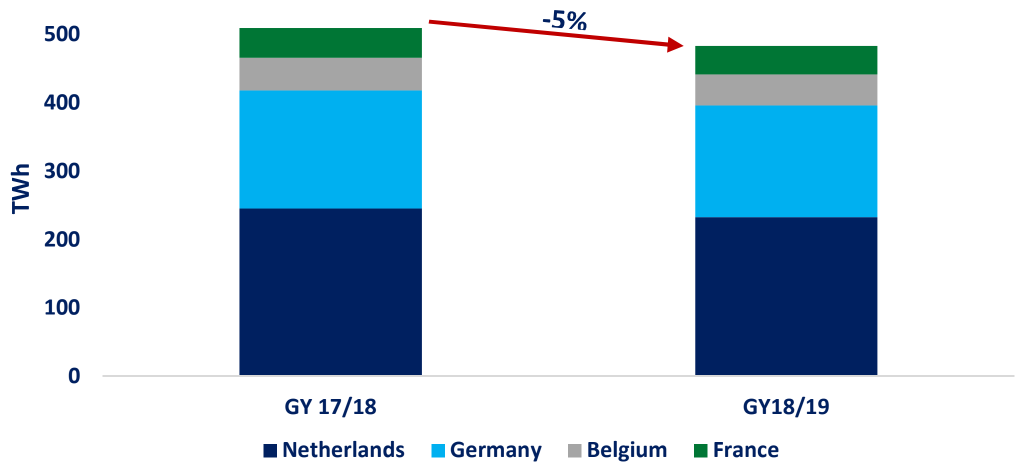
2. L-Gas demand

2.1 Recent demand trends

Total consumption of Dutch L-gas declined by 5% (26.4 TWh) from 509.5 TWh in gas year (GY) 2017/18 to 483 TWh in GY 2018/19. This has been partly driven by the start of the implementation of the market conversion programs in the respective L-gas markets. In GY 2018/19, market conversion totaled to 15.76 TWh, with 13.5 TWh taking place in Germany, 1.37 TWh in Belgium, 0.888 TWh in France and 0 in the Netherlands. Hence, it can be estimated that market conversion accounted for over 40% of total L-gas demand reduction in GY 2018/19.

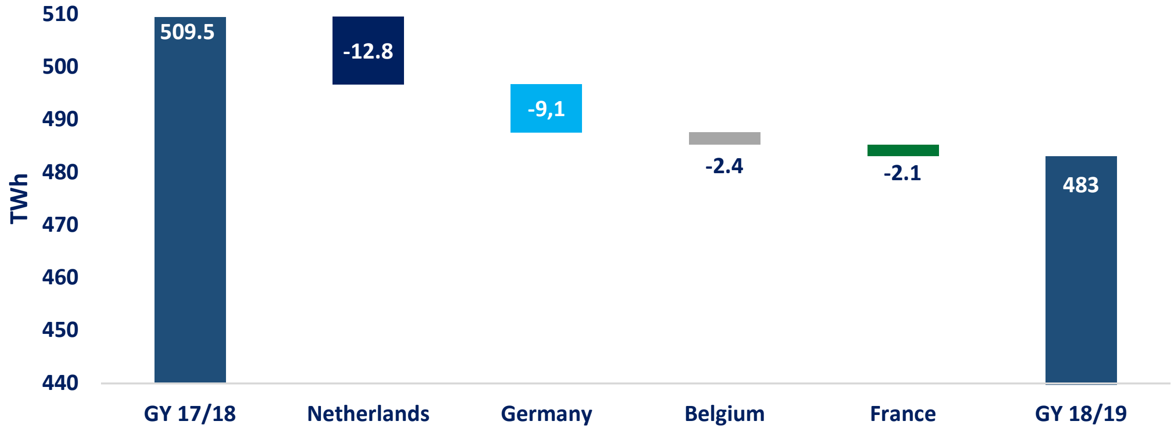
It is important to highlight that market conversion volumes do not necessarily translate into the same amount of L-gas consumption change as other demand side factors also have an influence on the overall L-gas demand. In GY 2018/19, due to a particularly mild winter season, the number of heating degree days (HDD) was 4% lower compared to the previous GY and almost 10% lower compared to an average GY (for more details see Annex VI), weighing primarily on L-gas consumption in the residential and commercial sectors.

Figure 2.1 Consumption of L-gas from the Netherlands in the GY 2017/18 and GY 2018/19 (TWh)



As shown in Figure 2.2, the Netherlands accounted for nearly half (48.5%) of the decline in L-gas consumption in the GY 2018/19., followed by Germany (34.5%), Belgium (9%) and France (8%). Given that currently there is no market conversion program in place in the Netherlands, this decrease is assumed to be mainly driven by the milder winter season and the lower heating requirements. Whilst the decline of Dutch L-gas consumption in volumetric terms was lower in Germany, Belgium and France this can be explained by their lower L-gas consumption. In fact, L-gas consumption decreased in all markets by ~5% in GY 2018/19 vs GY 2017/18.

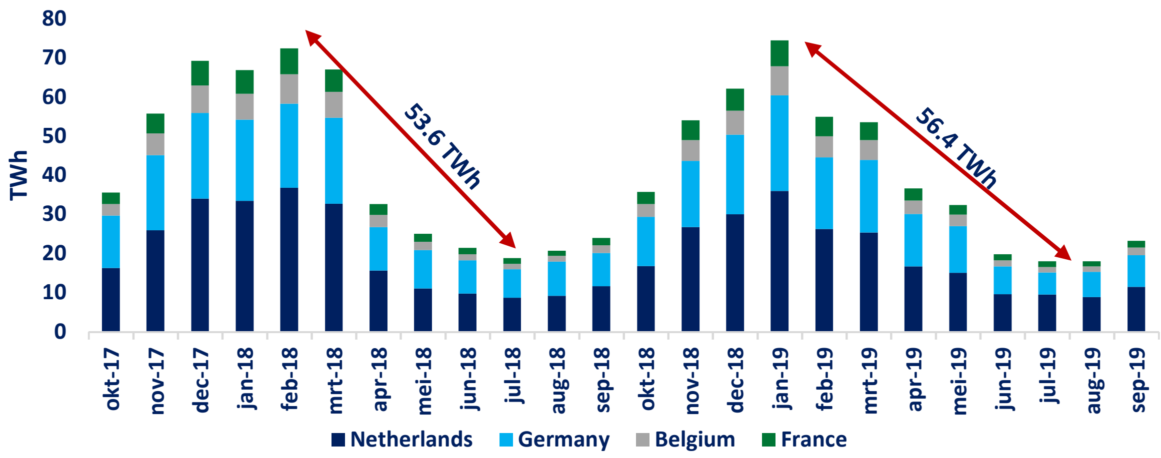
Figure 2.2 Change in Dutch L-gas consumption in GY 2018/19 vs GY 2017/18 (TWh)



L-gas is predominantly consumed in the residential and commercial sectors for space heating. Consequently, L-gas demand shows a significant seasonal profile and as such both monthly peak consumption and the annual demand swing[5] is taken into account when considering the overall evolution of L-gas consumption.

Peak monthly consumption grew by 2.8% (2 TWh) in GY 2018/19 compared to the previous GY, due to colder temperatures in January 2019. Consequently, the demand swing (represented by the arrows in Figure 2.3) increased by 5% (2.82 TWh).

Figure 2.3 Dutch L-gas monthly consumption in GY 2017/18 and GY 2018/19 (TWh)



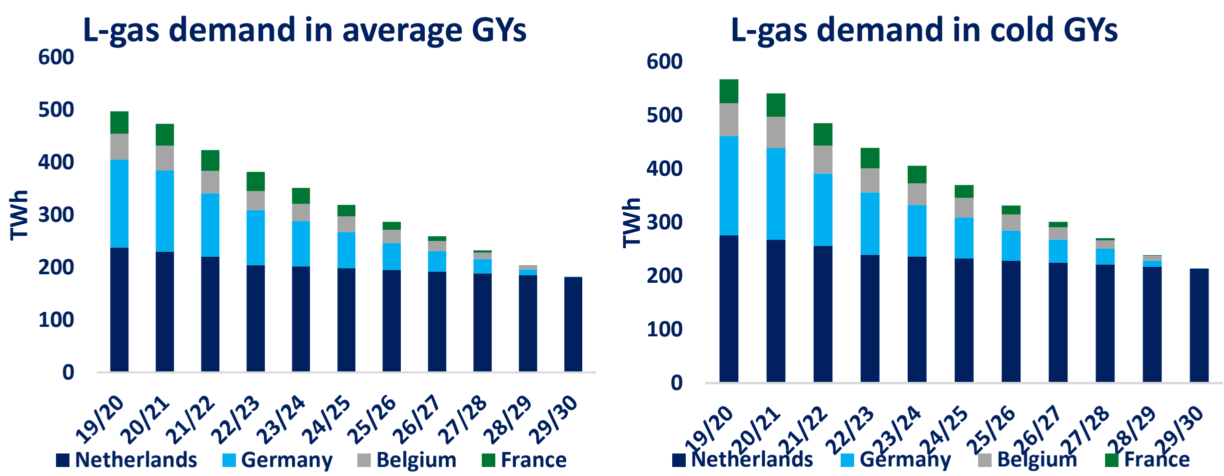
2.2 The expected annual demand for L-gas from the Netherlands until GY 2029/30

Given that the winter season of the GY 2018/19 has been particularly mild (see Annex VI), it can be expected that L-gas demand will slightly increase in GY 2019/20 when considering average meteorological conditions and by 17.4% when assuming a cold GY.

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 at an average rate of approximately 10% per year.[6]

As a consequence, L-gas imports are expected to fall from 45.4 TWh in GY 2018/19 to 0 in Belgium, from 41.6 TWh to 0 in France and from 163.6 TWh to 0.3 TWh in Germany by GY 2029/30.

Figure 2.4 Expected annual demand for Dutch L-gas (TWh)



[5] The difference between the highest and lowest monthly gas consumption in a GY.
[6] GTS (2017), Netwerk Ontwikkelingsplan 2017

3. L-gas market conversion volume

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

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

3.1 Germany

Germany has undertaken substantial additional efforts to speed up the conversion process and to support the Groningen situation. Advanced conversions ahead of the agreed schedule for conversion account for 15 TWh per annum. Furthermore, a blending facility built by GTG Nord decreases the yearly L-gas demand by up to 6 TWh. Taken together, conversions ahead of schedule and the blending facility reduce the German L-gas demand substantially in the short term. The amount of up to 21 TWh represents nearly 13 % of the volume of L-gas that Germany imported from the Netherlands in the gas year 2018/19.

Legislative changes

In order to implement the market conversion in Germany 5.5 million gas appliances need a physical adaptation. A sophisticated time-table 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). It also deals with practical aspects of the conversion process in the single households. Additionally, a regulation was adopted which deals with gas heaters that cannot be adapted to the new gas quality for technical reasons. It constitutes a claim of up to EUR 500 against the grid operator if the gas heater cannot be adapted technically but needs to be replaced (between 0 and EUR 500, depending on the age of the gas heater).

Furthermore, in 2018 the law on access to the L-gas grid had been changed within the Basic Energy Law. It makes it much more difficult for users seeking new access to the L-gas grid to be connected. In effect, it prevents that L-gas demand is driven up substantially by new connections to the L-gas grid, esp. by new industrial clients that would have had a legal right to be connected to the L-gas grid before the revision.

Conversions ahead of schedule

German TSOs have taken measures that further relieve the Groningen situation. In 2014, a time-table for the German market conversion had been drafted. In the years 2017 and 2018, additional conversions to H-gas had been materialised ahead of schedule. These advanced conversions to H-gas have substantially reduced the German demand for L-gas. These extraordinary measures have led to a reduction in Germany's annual L-gas demand of approx. 1.5 billion cubic metres in addition to the baseline reduction of 1.3 bcm already planned. Ordinary and extra-ordinary measures account for a decrease of 28 TWh.

Early conversions ahead of schedule that have been implemented until 2018 include the conversion of industrial customers in Essen (initially foreseen for 2029), chemical industries in Dormagen and Leverkusen (initially foreseen for 2021 and 2024) and the conversion of a power plant in Cologne (initially foreseen for 2024). In particular, the early conversion of the power plant in Cologne provided a substantial effect for the L-gas consumption in Germany.

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.

Conversions from 2015 to 2018

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. 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.

Table 3.1 Market conversion 2015-2018 Germany

Area	TSO	Year	Appliances
Schneverdingen	GUD	2015	8,000
Walsrode / Fallingbostel	GUD	2016	12,000
Achim	GUD	2017	23,000
Nienburg / Neustadt / Hannover Nord	GUD	2017	44,000
Bremen / Delmenhorst	GUD	2017	15,000
Teutoburger Wald 1	GUD	2017	2,000
Hüthum	TG	2017	10,000
Emsland 1*	Nowega	2017	--
Dormagen*	OGE	2017	--
Leverkusen*	OGE	2017	--
Posthausen I	GTG	2018	4,000
Bremen / Delmenhorst	GUD	2018	77,000
Hannover Ost / Wolfsburg	GUD	2018	61,000
Peine	GUD	2018	15,000
Essen*	OGE	2018	--
Teutoburger Wald 2	OGE	2018	5,000
Köln*	OGE	2018	--
***industrial appliances only**			

Conversions in 2019

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. The respective conversion areas are displayed in the illustration below.

Map 3.1.1 Market conversion in Germany in 2019

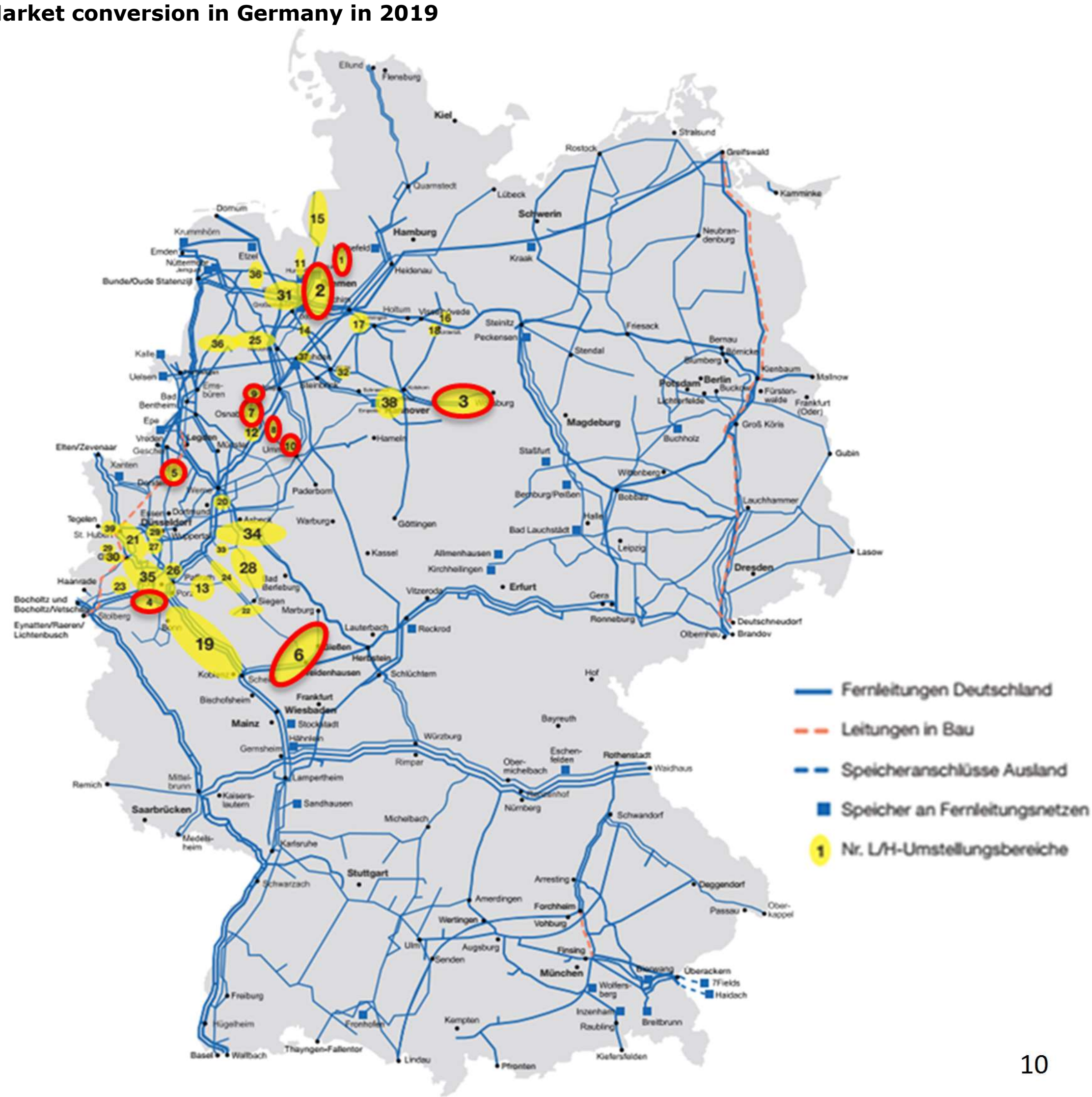


Table 3.2 Market conversion in Germany in 2019

Area (number in map)	TSO	Year	Appliances
Bonn (4)	OGE	2019	11,000
Marl (5)	OGE	2019	0*
Teutoburger Wald 3 (8)	OGE	2019	15,000
Bremen / Delmenhorst (2)	GUD	2019	42,000
Mittelhessen (6)	OGE	2019	63,000
Teutoburger Wald 4 (9)	OGE	2019	3,000
Teutoburger Wald 6 (10)	OGE	2019	13,000
Hannover Ost / Wolfsburg (3)	GUD	2019	60,000
Posthausen II (1)	GTG Nord	2019	48,000
Osnabrück (7)	OGE	2019	64,000

**Industrial conversion only*

Planned conversion in gas year 2019/20

In 2020, 7 areas with 394,000 appliances are planned to be converted. Conversion relates to a capacity of 5.2 GWh/h and a volume of 18.1 TWh. The respective conversion areas are displayed in the illustration below.

Map 3.1.2 Planned market conversion in Germany in GY 2019/20

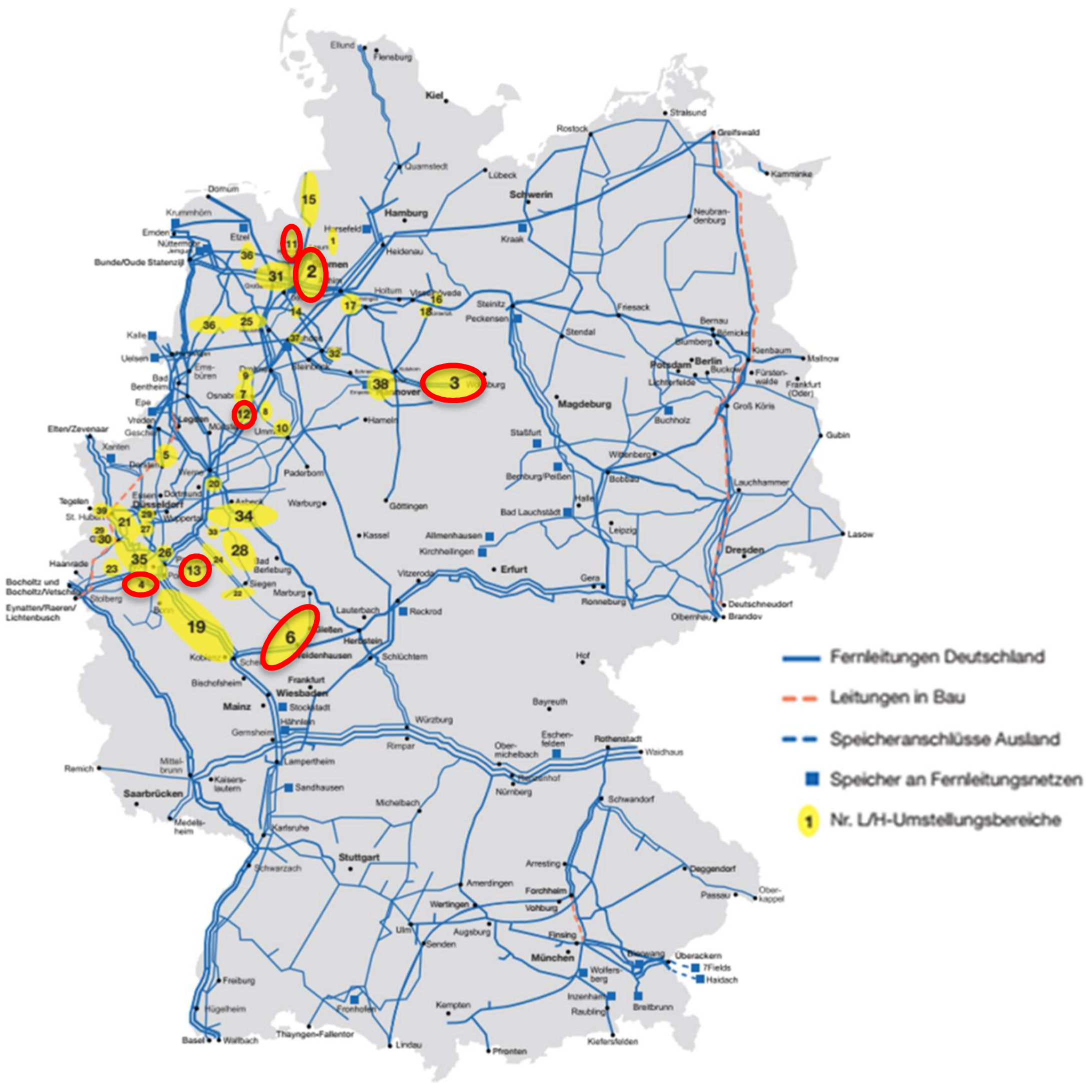


Table 3.3 Planned Market conversion in Germany in 2019/20

Area (number in map)	TSO	Year	Appliances
EWE-Zone Teil I (11)	GTG	2019/20	66,000
Bremen / Delmenhorst (2)	GUD	2019/20	52,000
Hannover Ost / Wolfsburg (3)	GUD	2019/20	74,000
Teutoburger Wald 5 (12)	OGE / Nowega	2019/20	39,000
Mittelhessen (6)	OGE	2019/20	92,000
Bonn (4)	OGE	2019/20	25,000
Aggertalleitung (13)	OGE	2019/20	7,000
Aggertalleitung (13)	TG	2019/20	39,000

Experiences from conversion

All conversion projects until end of 2019 have been implemented on schedule as planned. Key elements of successful implementation can be described as follows:

- Long term planning: German gas industry process standards require TSOs to inform their DSOs 38 months in advance before the conversion date. However, practice has shown that longer periods are better suited. It is recommended to conclude TSO / DSO conversion contracts that typically provide the legal and technical framework for a defined conversion area, approximately five years before the conversion. Basic concepts should be defined approximately six or seven years in advance. Long term planning allows service providers to build up or recruit personnel on a secure basis. Furthermore, the realization period of grid expansion projects has to be taken into account. Grid expansion is required for many conversion areas on TSO level i.e. to reconnect L-gas areas to H-gas systems, but also on a DSO level to segment the grid.

- Definition of pilot regions: Pilot regions are advisable to build up competences on a market level, but also on a DSO level. Especially in areas with a significant number of appliances to be converted, pilot areas can be beneficial for DSOs to become more acquainted with processes such as the interaction with end customers that do not respond to the DSO’s notifications.

- Communication: Broad communication of the conversion project is a key element to reduce the number of end customers that do not respond to the DSO and have to be disconnected from the grid.

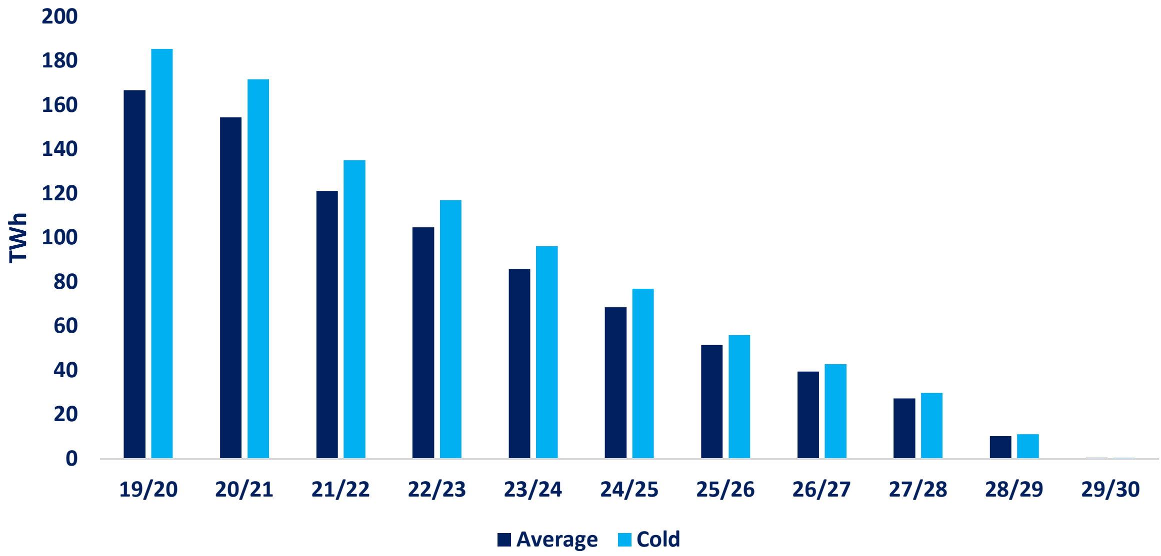
- Support by the regulator: The practical role of the German regulator (BNetzA) in the market conversion process goes beyond its legal responsibility (approval/denial of the costs of the conversion process as necessary for the adjustment). The agency supervises the overall process for security of supply reasons and the internal inter-service working group acts as a mediator for all involved stakeholders (incl. customers). Furthermore, BNetzA established a yearly open forum on topics of market conversion as an overall platform of exchange.

Conversions until GY 2029/30

In Germany, approximately 4 million of gas appliances will need to be converted between GY 2020/21 and GY 2029/30, translating into a total volume of 178.2 TWh.

Consequently, L-gas imports from the Netherlands to Germany are expected to fall close to 0 by GY 2029/30, both in an average and cold GY.

Figure 3.1 Germany's L-gas imports from the Netherlands (GY 2019/20-GY 2029/30) for average and cold GYs



Costs of conversion projects

The total costs for the conversion from L- to H-gas in Germany are estimated at approx. EUR 4 billion. These costs are socialized within Germany. The conversion costs can be split into two different cost categories:

A) Costs for adapting the customers' appliances from L- to H-gas

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[7] under certain circumstances.

The respective costs are financed by a "market conversion levy" that is paid on top of the TSO transport tariffs. The market conversion levy does not apply to transport fees on transit and storages. The costs of the market conversion levy per year are displayed in the table below. Please note that the costs include all costs that are spent in the respective year regardless of the actual year of conversion.

Actual costs 2018	EUR 95.5 million
Levy amount 2019[8]	EUR 132 million
Levy amount 2020[9]	EUR 179 million

Estimates for the cumulated market conversion levy until 2029 see costs of roughly EUR 2 billion.

B) Costs for grid expansion

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-/H-Gas conversion amount to another EUR 2 billion and are financed by the regular transport fees.[10]

[7] This includes a claim of 100 EUR according to § 19a of the Basic Energy Law for any type of gas appliance that is replaced by a new appliance in the course of the market conversion process in the respective area plus a claim of up to 500 EUR according to the above mentioned regulation if the gas heating cannot be converted to H-gas.
8 Planned costs 2019 after correction of previous years planned vs. actual
[9] Planned costs 2020 after correction of previous years planned vs. actual
[10] All years, according to network development plan 2018

3.2 France

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.

Legislative changes

Since 2015, the French legal and regulatory framework has been adapted to carry out the conversion of the L-gas network:

- Operators of the L-gas transmission and distribution networks have to manage the conversion of their network (Energy Code, articles L.431-6-1 and L. 432-13);
- Distribution system operators are in charge of the conversion to H-gas of gas appliances for consumers connected to their network (Energy Code, article L. 432-13). DSOs and TSOs have to check if all necessary actions have been taken regarding the conversion to H-gas of consumers connected to their network (Environmental Code, article L. 554-11) and they are allowed to curtail the gas supply if a consumer opposes such a verification (Environmental Code, article L. 554-10);
- Costs incurred by the TSO and the DSOs for the conversion of the L-gas networks are covered through transmission and distribution tariffs (Energy Code, articles L.431-6-1 and L. 432-13);
- Financial assistance is granted to consumers who have to replace a gas appliance that cannot be supplied with H-gas (2019 Finance Bill, article 183).

Conversions in GY 2018/19

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).

Conversions until GY 2029/30

During the GY 2019/2020, the conversion of the L-gas network was carried out in the Grande Synthe area (19,000 consumers converted on November 28, 2019).

The next conversion is scheduled in October 2020 (Dunkirk area, 42,000 consumers).

Map 3.2 Market conversions in France in GY 2019/20 and GY 2020/21

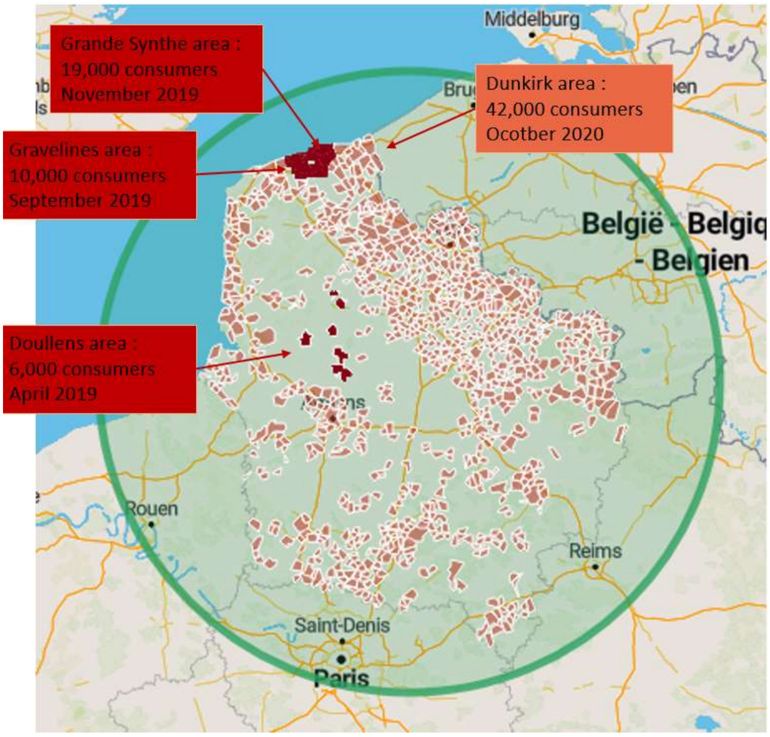
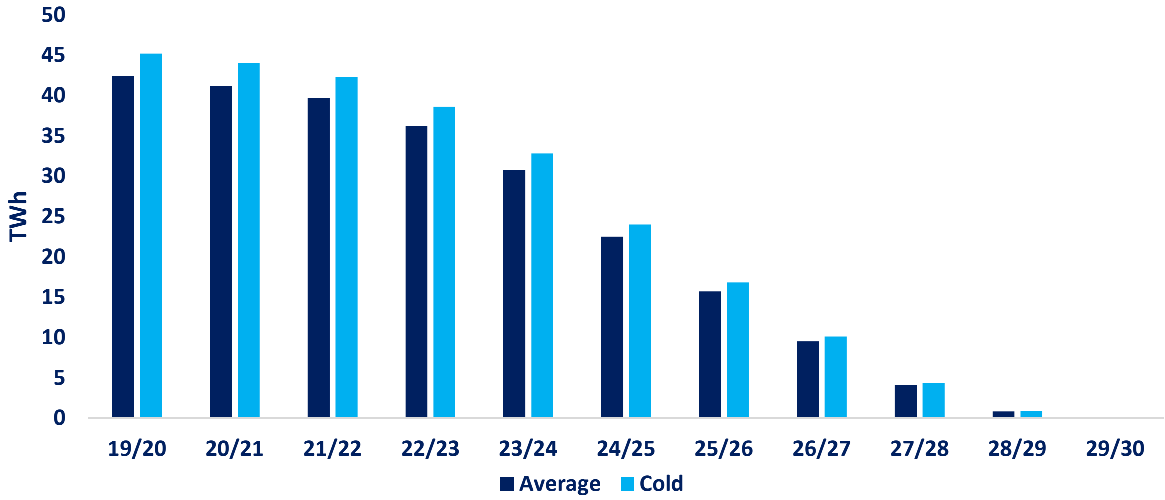


Figure showing in dark red already converted areas and in light red areas to convert

Experiences from conversion

The conversion process has been improved during the pilot phase. Keeping up with the planned schedule has required strong involvement from network operators and local authorities. The gas supply had to be temporarily curtailed for 10% of residential consumers during the conversion of the L-gas network in the Doullens area, but improvements made it possible to limit these curtailments in the Gravelines and Grande Synthe areas. The pilot phase has highlighted the issue of the availability of the necessary number of trained gas technicians throughout the conversion process to carry out operations under the best possible safety conditions.

Figure 3.2 France's consumers demand for L-gas from the Netherlands (GY 2019/20-GY 2029/30) for average and cold GYs



Costs of conversion projects

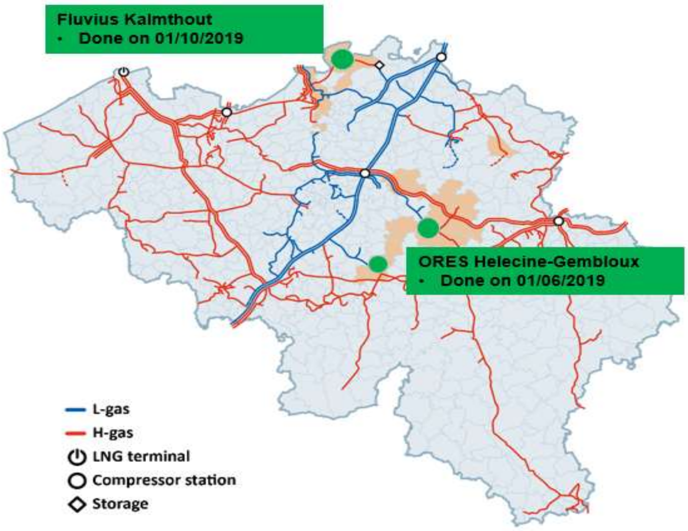
According to the first estimates, the costs of the conversion of the French L-gas network will amount to approximately EUR 800 million. The general conversion process started with significant investments on the transmission network, especially to connect the L-gas network to the H-gas network. Already EUR 47.7 million has been spent.

3.3 Belgium

Conversions in GY 2018/19

In Belgium, the L- to H-gas conversion project continued in GY 2018/19, with the conversion of 15,000 connections on June 1, 2019, in Wallonia (municipalities of Gembloux, Hélécine, Incourt, Jodoigne, Lincent, Orp-Jauche, Perwez, Sombreffe). Another 20,000 connections were converted on Oct 1, 2019, in Flanders (Brasschaat, Essen, Kalmthout, Wuustwezel). These conversions took place at junction points between the H- and the L-grids. No particular issue is to be reported for this phase.

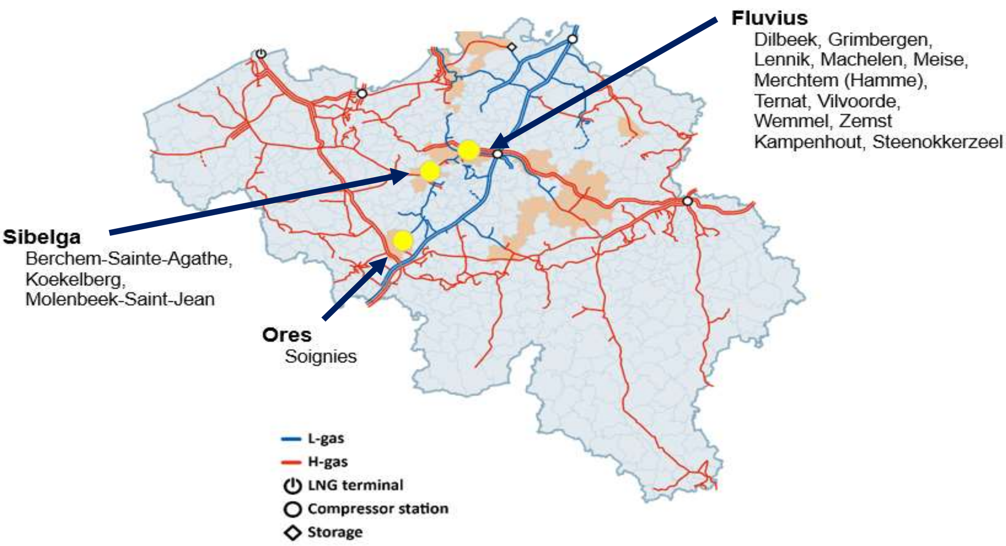
Map 3.3.1 Market conversion in Belgium in GY 2018/19



Conversions in GY 2019/20

The project will ramp up in gas year 2019/2020, with more than 125,000 connections to convert, partially enabled by an upgrade of the Winksele compression station whereby H-gas from the natural gas transport backbone (West-East VTN) will start to be injected into the L-gas grid. In total, more than 50,000 connections will be converted in the western part of the Brussels-Capital Region (Berchem-Sainte-Agathe, Koekelberg, Molenbeek-Saint-Jean), more than 70,000 connections in Flanders (Dilbeek, Grimbergen, Kampenhout, Lennik, Machelen, Meise, Merchtem (Hamme), Steenokkerzeel, Ternat, Vilvoorde, Wemmel, Zemst) and 6,000 connections in Wallonia (Soignies). All these conversions will take place on June 1, 2020.

Map 3.3.2 Market conversion in Belgium in GY 2019/20



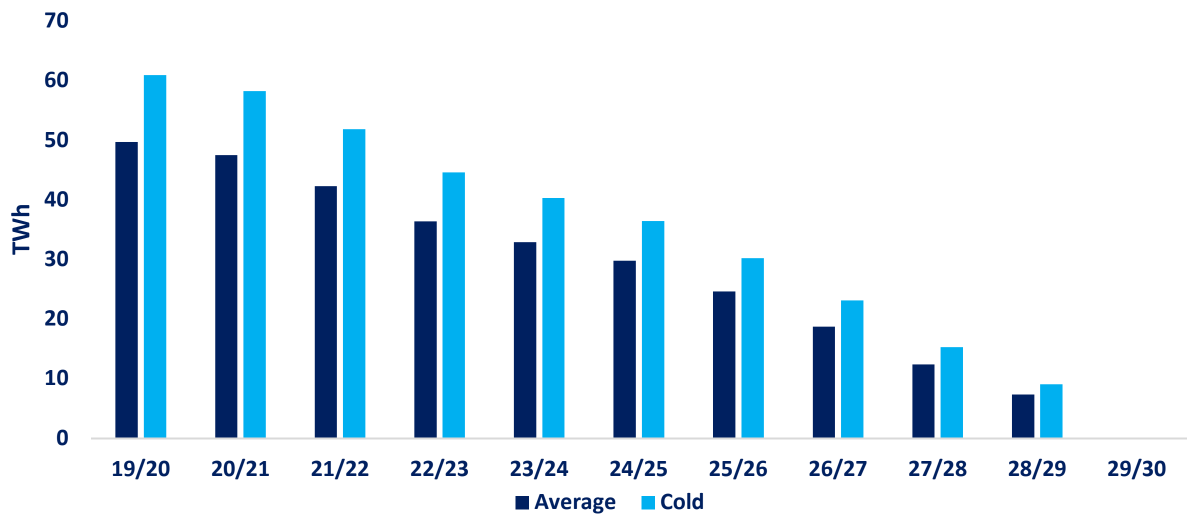
Conversions until GY 2029/30

In Belgium, almost 1.5 million of gas connections have to be converted between GY 2020/21 and GY 2029/30, translating into a total volume of 47.43 TWh.

As a consequence to the market conversion, L-gas imports to Belgium from the Netherlands is expected to fall to 0 by GY 2029/30.

In the longer term, the Belgian market conversion has to take account of the remaining L-gas volumes required for France.

Figure 3.3 Belgium's L-gas imports from the Netherlands (GY 2019/20-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 storages, will be able to provide enough L-gas (volume and capacity) to meet Dutch demand in years to come. For more details, please refer to Chapter 4 of the Report.

This being said, 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.

Moreover, legislation has been proposed which will require the nine largest industrial users (each with a consumption of more than 100 mcm per year) to switch to other sources of energy by October 2022 at the latest, while other companies will not be allowed to consume more than 100 mcm of L-gas per year after October 2022. This legislation is currently being discussed with the Dutch Parliament.

If and when adopted, the Dutch demand for L-gas will decrease by almost 3 bcm (~30 TWh) at least (the consumption of the nine largest users).

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 170.9 TWh (or 17.5 bcm) in GY 2018/19. Production in GY 2018/19 was almost 2 bcm lower than the production cap of 19.4 bcm allowed for an average GY.

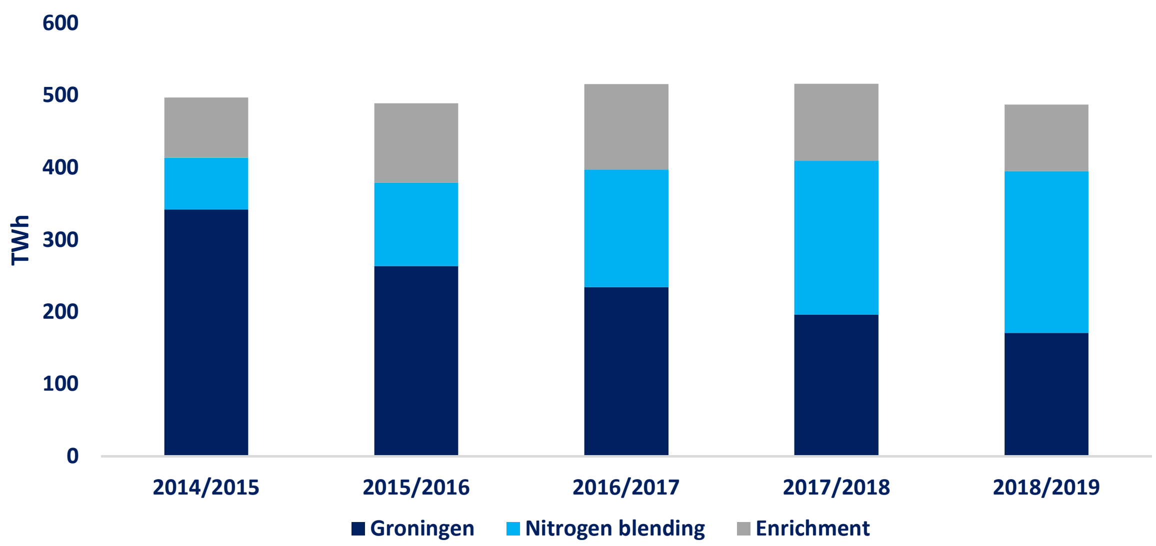
Groningen gas has a notably lower calorific value compared to the average European natural gas fields, which means that it cannot simply be replaced by other (imported) natural gas sources. These need to be converted to L-gas referred in the current report as "pseudo L-gas".

Pseudo L-gas can be principally produced in two ways:

- 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: adding H-gas to Groningen-gas until the upper Wobbe-limit of the L-gas specifications.

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 18/19. In particular, production of L-gas via nitrogen blending increased by over three-fold during that period. The production of L-gas through nitrogen blending translated into 2.6 bcm of nitrogen demand in GY 2018/19.

Figure 4.1 L-gas supply in the Netherlands (GY 2014/15-GY 2018/19)



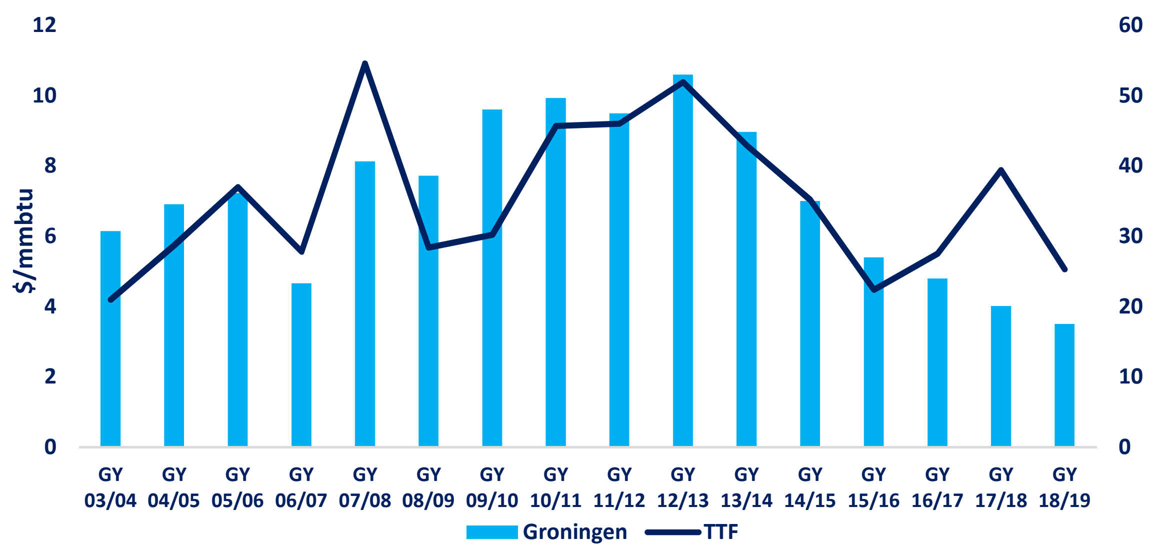
In fact, in GY 2018/19, almost two-thirds of all L-gas (65% or 316 TWh) produced in the Netherlands was pseudo L-gas. As a consequence, the utilization rate of the conversion facilities has increased steadily from GY 2014/15 to an average of 91% through the GY 2018/19.

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

It is important to highlight that reduced gas production in the Netherlands did not appear to have any impact on the level of wholesale gas prices.

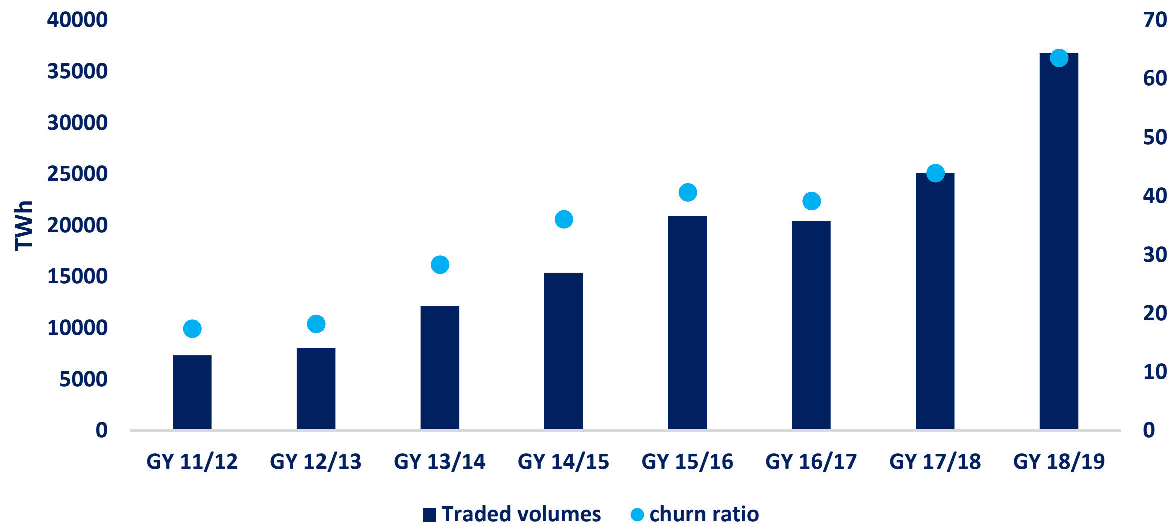
In fact, gas prices on the Dutch gas hub, the Title Transfer Facility (TTF) are reflective of broader regional and global supply-demand dynamics and as such depend less on the levels of natural gas production in the Netherlands. TTF prices were twice as high in the GY 2012/13 than in GY 2018/19.

Figure 4.2 Groningen production and TTF gas prices (GY 2003/04-GY 2018/19)



Similarly, the lower production levels did not have any impact on the development of the TTF, which has become in recent years Europe's leading gas hub, overtaking the United Kingdom's National Balancing Point in 2016.

Figure 4.3 The development of trading on TTF (GY 2011/12-GY 2018/19)



The traded volumes on TTF have been four times higher in GY 18/19 compared to GY 12/13. Importantly, the liquidity of the hub improved as well, as certified by the improving churn ratio[11], increasing from 18 in GY 12/13 to 63 in GY 18/19.

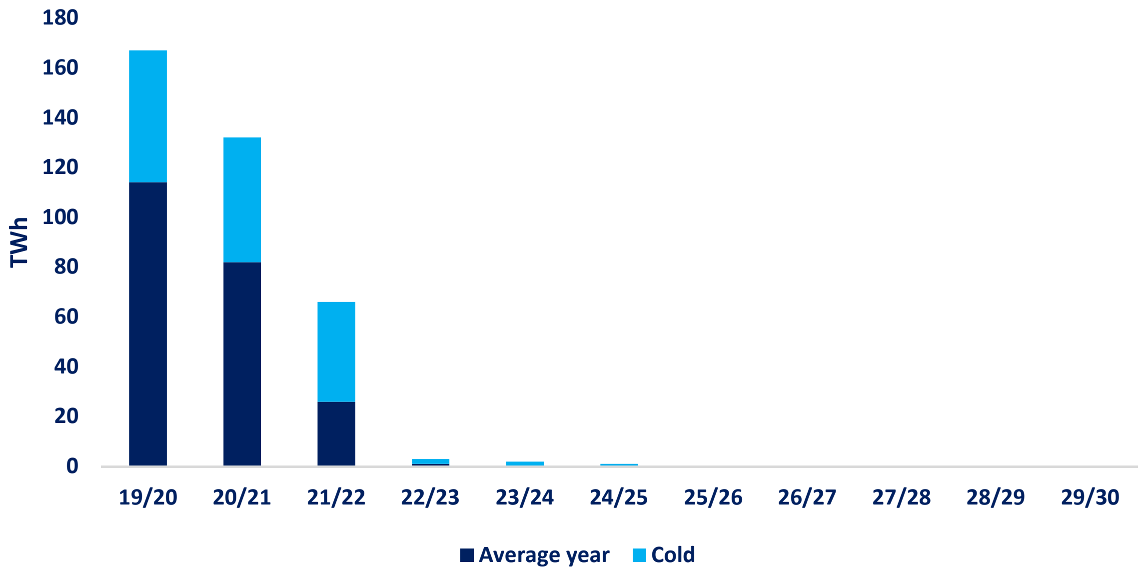
During the same period, traded volumes rose by just over 55% on Continental Europe's second largest hub, Germany's NetConnectGermany (NCG), whilst its churn rate remained below 5. TTF's traded volumes were over 10 times more than the volumes exchanged on NCG during the GY 2018/19.

[11] The churn is the ratio between the traded volumes on a hub and the physical deliveries of the hub. A higher churn ratio suggests a more liquid and developed hub.

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

The Groningen production cap for the GY 2019/20 has been set at 11.8 bcm (or 114 TWh) for an average GY and 17 bcm (167 TWh) in a cold year. Gas production from Groningen is expected to reach 0 by mid-2022 for an average GY. Gas production from Groningen is expected to decline further in the coming GY's in particular when the new nitrogen facility comes into operation. This is foreseen to happen in spring 2022. It is currently being investigated what this means for the date by which the gas production from Groningen can come to a full stop. In this investigation two factors play a role: volume and capacity/flexibility. For the analysis of this report a scenario elaborated by GTS has been used with an eventual minimal flexible production until the GY 2024/25, to meet L-gas demand in the case of eventual extreme cold GYs. The capacity factor will be discussed in the June report.

Figure 4.4 Expected L-gas production from Groningen (GY 2019/20-2029/30)



To substitute the declining production from the Groningen field, the production of pseudo L-gas will further increase, primarily by means of nitrogen blending with (imported) H-gas.

Additional purchase of nitrogen from 1st January 2020 allowed to expand the nitrogen blending capacity by 80,000 m3/h N2 at the Wieringermeer conversion facility. This has translated into an additional 48.9 TWh of pseudo L-gas. Moreover, a new nitrogen plant at Zuidbroek is currently being constructed and is planned to start operations from 1st of April 2022 with a capacity of 180,000 m3/h N2 and able to produce over 68 TWh of additional pseudo L-gas.

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

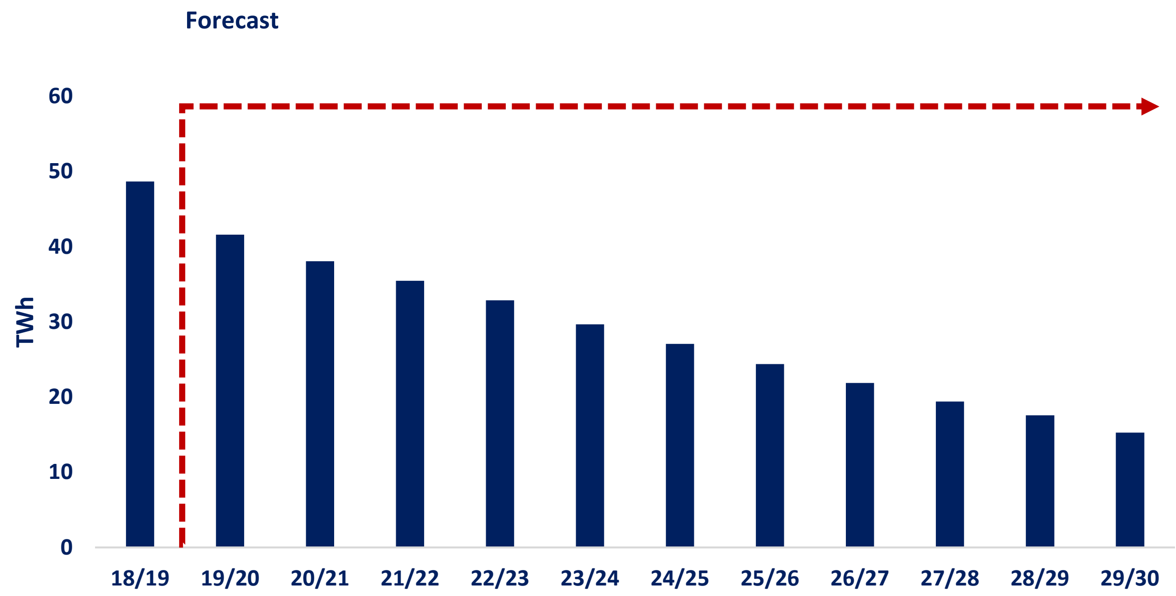
In Germany, L-gas production is expected to decrease at an annual average rate of ~9% from 48.7 TWh in GY 2018/19 to 15.3 TWh by GY 2029/30. There is one peak nitrogen/H-gas blending facility in Germany, in Rehden, supplying only limited volumes of converted L-gas.

In addition, the German TSO GTG Nord is currently building a blending facility at the Dutch border. The facility allows for blending Dutch Groningen gas with H-gas. This measure allows 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. Thus, the facility which becomes operational in the second quarter of 2020 is a further relief to the Groningen production. The building costs of the facility and its operational costs are borne by the German side.

There is no L-gas production in Belgium or France.

There is one nitrogen/H-gas blending facility in France. It is located at Loon Plage (near Dunkerque) and it was designed for peak-load needs only. In 2021 this part of GRTgaz network will be converted to H-gas and this facility will be abandoned. There is one peak nitrogen/H-gas blending facility in Belgium, in Lillo, supplying only limited volumes of converted L-gas.

Figure 4.5 Expected L-gas production in Germany (GY 2019/20-2029/30)



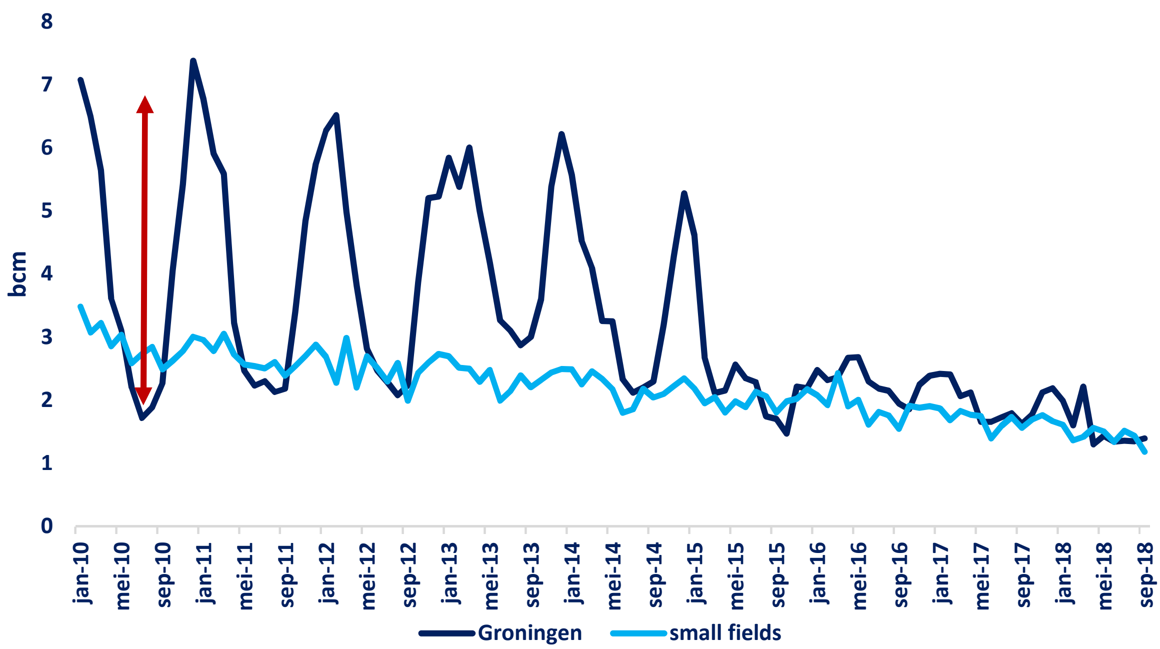
5. Storage of L-gas

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, providing supply flexibility to the entire system. As shown on the figure below, the production pattern of the Groningen field has flattened in recent years, hence increasing the role and importance of L-gas storage.

Figure 5.1 Groningen monthly gas production (2010-18)



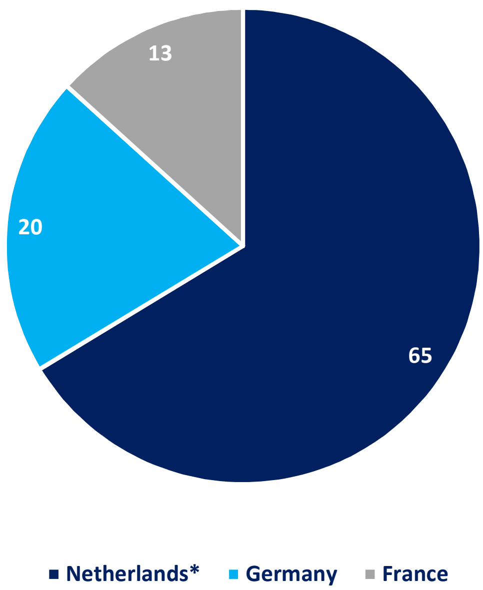
5.1 Available storage volume of L-gas (in TWh) per country in 2018/2019

Total L-gas storage capacity in Northwest Europe amounts to 98.4 TWh, with a total withdrawal capacity of 3,033 GWh/d.

Most of L-gas storage is located in the Netherlands[12] (65 TWh or 66%) and Germany (20 TWh or 20%). 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 and in France. For more details on L-gas storage please refer to Annex 4 of the Report.

[12] This includes three of the Epe storage sites, which are physically located in Germany, but are however incorporated in the Dutch gas network.

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



**including Norg as production storage*

Consequently, almost two-thirds of withdrawal capacity is concentrated in the Netherlands, followed by Germany (26%). France's Gournay storage facility accounts for 8% of L-gas withdrawal capacity in northwest Europe.

5.2 Injected and withdrawn storage volume (in TWh) of L-gas per country in 2018/2019

L-gas storage withdrawals corresponded to ~4% of Germany's L-gas demand requirements through the GY 2018/19. Higher injections allowed storage stocks to increase by 3.82 TWh.

In France, L-gas storage withdrawals ensured ~30% of the country's L-gas demand requirements through the GY 2018/19. Higher withdrawals resulted in a decrease of L-gas storage stocks by 0.5 TWh.

In the Netherlands, L-gas storage withdrawals met almost one-quarter of the country's L-gas demand through the GY 2018/19. Higher injections resulted in an increase of 4 TWh in L-gas storage stocks.

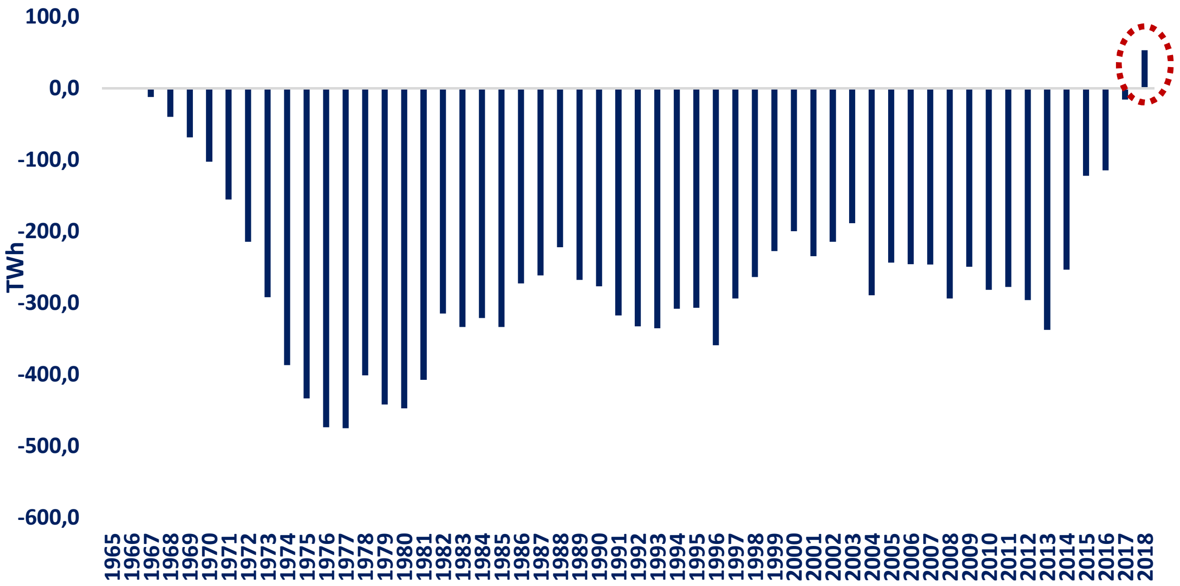
6. Net H-gas imports into the Netherlands

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.

In fact, the Netherlands became a net importer of natural gas in 2018 for the first time in the country's history.

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.

Figure 6.1 Net natural gas imports of the Netherlands (1965-2018)



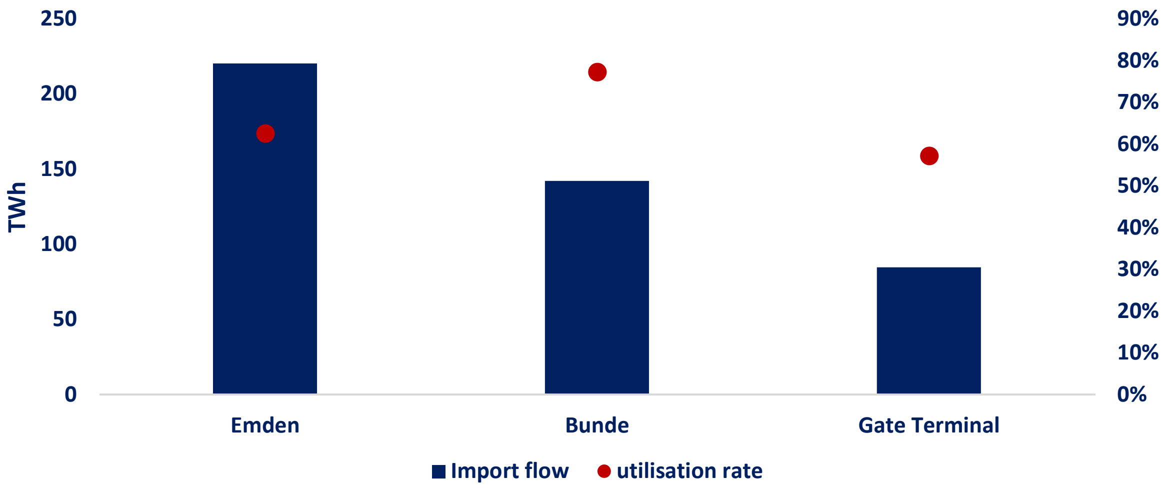
Consequently, the security of L-gas supply is becoming intimately linked to the deliverability of H-gas into the Netherlands.

The Netherlands has three main entry points. Norwegian natural gas is imported via the Emden terminal in Germany which feeds into the Dutch gas grid. Russian imports to the Netherlands need to transit via Germany through the Bunde/Oude Statenzijl interconnection. LNG from the global gas market can be imported via the GATE LNG Terminal.

Data provided by ENTSOG suggests that the utilization rate[13] has been over 60% for Emden and 77% for the Bunde/Oude Statenzijl interconnection point through the GY 2018/19. The utilization rate of the GATE Terminal reached 57%.

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

Figure 6.2 Natural gas imports (TWh) to the Netherlands by main entry points and utilization rate in GY 2018/19



When considering these three main entry points, the annual spare import capacity of the Netherlands amounted to 237 TWh.

There are also two import interconnectors with Belgium; however, one of them (Zelzate) is used by shippers to access the TTF Market and storage sites located in the Netherlands. This is likely to remain the case in the medium term. The second interconnector (Zebra[14]) allows actual import flows from Belgium, but has a rather limited capacity of 4 bcm/y.

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 5 bcm/y.

Based on ENTSOG's winter outlook simulations for 2020, there is enough import and cross-border capacity to satisfy H-gas global needs for the Netherlands and the L-gas area (even when considering the most severe demand cases with a 2 week cold spell and peak day) through the GY 2019/20.

The L-Gas Market Conversion Monitoring Task Force will continue to monitor and assess the deliverability of H-gas supply to the Netherlands and the Northwest European markets served by L-gas.

[14] Zebra has recently been acquired by GTS and will be integrated into the GTS network.

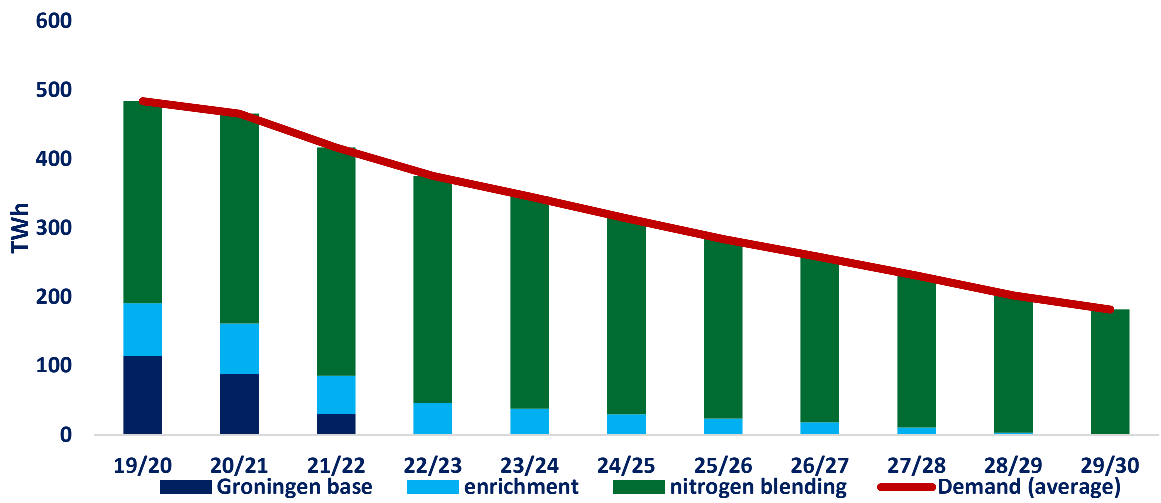
7. Conclusion & implications for Groningen production until 2029/30

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.

In order to allow the reduction of Groningen production below 12 bcm (117 TWh) in GY 2018/19, the active shippers on Norg will fill the underground storage facility with 1 bcm less L-gas through the 2020 injection period, than the withdrawn gas volume through the 2018/19 heating season.

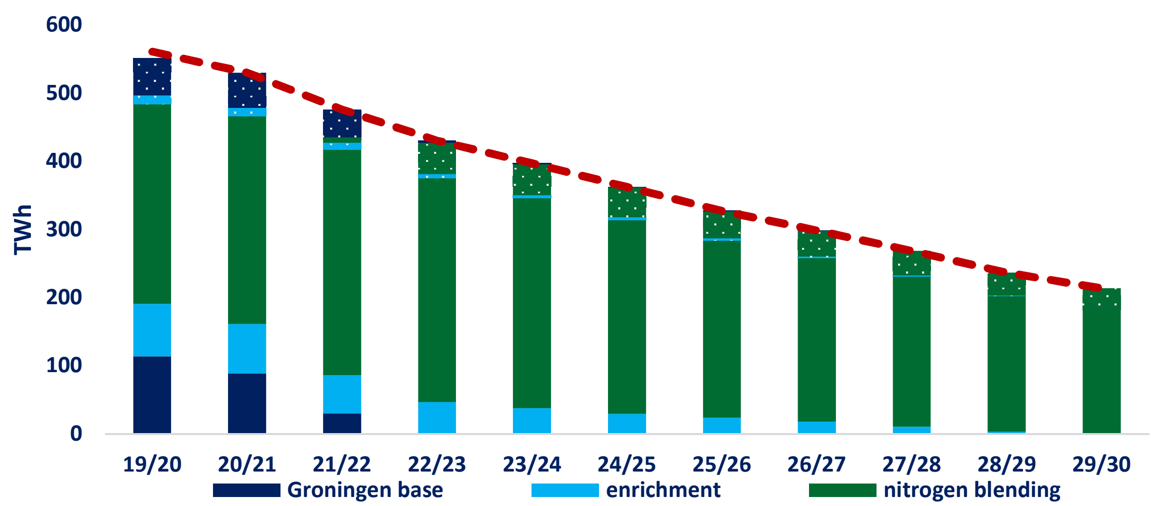
Through the market conversion period, the role of enrichment will decline in line with the decreasing Groningen production. Hence, nitrogen blending facilities will have an increasing role in meeting L-gas demand through the next ten GYs.

Figure 7.1 L-gas supply-demand balance in an average year (GY 19/20-GY 29/30)



However, it may be necessary to maintain flexible Groningen production until the GY 2024/25, to meet L-gas demand in the case of extreme cold days. This is currently being investigated. In the consecutive five GYs L-gas supply flexibility will be entirely provided by L-gas enrichment and by the nitrogen blending facilities. The required capacity will be discussed in the June report.

Figure 7.2 L-gas supply-demand balance in a cold year (GY 19/20-GY 29/30)



Annex

Annex I: Consumers demand for L-gas from the Netherlands in GY 2017/18 and GY 2018/19

1.1 Consumers demand for L-gas from the Netherlands[15] in the gas year 2017/2018 in TWh

Gas year 17/18	Germany	France	Belgium	Netherlands
October 2017	13.4	2.92	3.003	16.273
November 2017	19.2	5.07	5.489	25.970
December 2017	21.9	6.23	7.035	34.049
January 2018	20.8	6.05	6.587	33.449
February 2018	21.5	6.56	7.559	36.775
March 2018	22.0	5.71	6.640	32.687
April 2018	11.1	2.81	3.079	15.669
May 2018	9.8	2.03	2.148	11.081
June 2018	8.5	1.63	1.549	9.751
July 2018	7.3	1.47	1.320	8.698
August 2018	8.7	1.37	1.438	9.222
September 2018	8.5	1.87	1.978	11.642
Total 17/18	172.5	43.73	47.826	245.266

1.2 Consumers demand for L-gas from the Netherlands in the gas year 2018/2019 in TWh

Gas year 18/19	Germany	France	Belgium	Netherlands
October 2018	12.6	3.10	3.225	16.799
November 2018	16.9	5.07	5.372	26.741
December 2018	20.3	5.66	6.162	30.053
January 2019	24.4	6.60	7.456	35.983
February 2019	18.3	4.93	5.418	26.270
March 2019	18.5	4.58	5.052	25.401
April 2019	13.4	3.14	3.436	16.674
May 2019	11.9	2.47	2.979	15.064
June 2019	7.1	1.56	1.601	9.575
July 2019	5.7	1.44	1.398	9.478
August 2019	6.4	1.30	1.420	8.893
September 2019	8.1	1.74	1.916	11.502
Total 18/19	163.7[16]	41.59	45.435	232.433

[15] 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.

[16] The import figures above do not account for the import via the storage "NUON Epe Gasspeicher". The injection for this storage is only possible from the Netherlands, withdrawals are possible from Netherlands and Germany. In the gas year 18/19 the additional export from the Netherlands to Germany via the Nuon storage accounted for 0,48 TWh, which is reflected in chapter 6.2 "Injected and withdrawn storage volume".

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

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

	Cold			Average
	TWh	**kWh/h**	**GWh/d**	**TWh**
19/20	185.4	47.700.000	1.145	166.7
20/21	171.7	43.000.000	1.032	154.4
21/22	135.1	38.200.000	917	121.1
22/23	116.9	33.400.000	802	104.7
23/24	96.1	28.600.000	686	85.8
24/25	76.9	23.900.000	574	68.5
25/26	55.9	19.100.000	458	51.4
26/27	42.8	14.300.000	343	39.4
27/28	29.7	9.500.000	228	27.3
28/29	11.1	4.800.000	115	10.2
29/30	0.3[17]	100.000	2	0.3

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

	Cold			**Average**
	TWh	**kWh/h**	**GWh/d**	**TWh**
19/20	60.868	22524652	451.71	49.654
20/21	58.173	21240961	425.98	47.437
21/22	51.813	18775062	376.49	42.250
22/23	*44.534*[18]	*15566228*	*312.32*	*36.371*
23/24	*40.241*	*12358858*	*248.13*	*32.886*
24/25	*36.398*	*10969842*	*220.20*	*29.737*
25/26	*30.174*	*8940474*	*179.54*	*24.617*
26/27	*23.092*	*6220980*	*124.51*	*18.690*
27/28	*15.250*	*4003850*	*80.17*	*12.358*
28/29	*9.030*	*2287693*	*45.84*	*7.324*
29/30	*0.000*	*0.00*	*0.00*	*0.000*

2.3 Expected consumers demand for L-gas from the Netherlands in France[19] until GY 2029/30 (TWh)

	Cold			Average
	TWh	**kWh/h**	**GWh/d**	**TWh**
19/20	45.2	19 135 773	382.7	42.4
20/21	44.0	18 693 909	373.9	41.2
21/22	42.3	18 078 749	361.6	39.7
22/23	38.6	16 240 664	324.8	36.2
23/24	32.8	13 490 036	269.8	30.8
24/25	24.0	9 536 657	190.7	22.5
25/26	16.8	6 621 310	132.4	15.7
26/27	10.1	3 233 215	64.7	9.5
27/28	4.3	763 935	15.3	4.1
28/29	0.9	0	0	0.8
29/30	0	0	0	0

[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 supplied via the Netherlands (Haanrade / Thyssengas).
[18] The conversion planning in Belgium is still indicative for the years 2022-2029
[19] For France, all data are provided on the basis of the 2016 conversion plan that has been authorized for an experimental phase. The initial schedule is subject to change following the analysis of the results of this experimental phase.
The expected demand for France does not take into account the quantity of L-gas blended in the H-gas network (2,5 TWh during gas year 2018-2019 for both technical and commercial blending). A technical blending volume of 0,4 TWh in 2020 is estimated. Moreover, commercial blending may occur due to the oversize of the L-gas supply contract between Engie and GasTerra. Due to the unability to forecast the L-gas excess volumes sold by Engie on the Dutch and Belgian markets and the unability to forecast the efficiency of inter-TSO swaps, commercial blending of L-gas in the H-gas network could be anywhere between 0 and 20 TWh in 2020.
The above forecasts for peak daily and hourly demands (in GWh/d and kWh/h) correspond to final L-gas consumers in France and they can be supplied both by Taisnières B (Belgium/France interconnection point) and Gournay storage (and if necessary with nitrogen/H-gas blending facility at Loon Plage, only for 19/20 and 20/21 winters).
The above forecasts for peak daily and annual L-gas demands (in GWh/d and TWh) are based on an evaluation of peak daily and annual demands for each geographical sector to be converted for each year of the conversion period. For each year residual L-gas demand is the sum of gas demand for geographical sectors which are not yet converted to H-gas according to the current provisional conversion planning in France.

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

	Cold			Average
	TWh	kWh/h	GWh/d	TWh
19/20	275.770	126867154	3045	237.847
20/21	267.121	124626364	2991	229.936
21/22	256.166	122068805	2930	219.778
22/23	239.098	118137871	2835	204.058
23/24	236.389	116831089	2804	201.740
24/25	232.526	115315961	2768	198.296
25/26	228.735	113739592	2730	194.993
26/27	224.950	112163222	2692	191.694
27/28	221.171	110586853	2654	188.401
28/29	217.397	109010484	2616	185.112
29/30	213.629	107434115	2578	181.828

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]
19/20	18.1[20]	394
20/21	31.8	568
21/22	19.3	495
22/23	25.4	552
23/24	20.2	505
24/25	23.7	514
25/26	17.2	499
26/27	17.0	458
27/28	15.1	232
28/29	8.5	191
29/30	0.0	0

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

Gas year	Volume converted [TWh]	Number of installations [Thousands]
19/20	2.22	129.76
20/21	5.19	233.18
21/22	5.88	228.86
22/23	3.48	215.09
23/24	3.15	101.63
24/25	5.12	96.25
25/26	5.93	166.14
26/27	6.33	129.57
27/28	5.03	91.04
28/29	7.32	212.31
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]
19/20	1.2	21
20/21	1.5	44
21/22	3.5	60
22/23	5.4	120
23/24	8.3	180
24/25	6.8	180
25/26	6.2	240
26/27	5.4	200
27/28	4.3	180
28/29	0.8	40
29/30		

[20] Please note that the converted volume above refers to a year with average temperatures.

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

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

	Cold	*Average*
19/20	169	114
20/21	140	89
21/22	71	30
22/23	4	1
23/24	2	1
24/25	1	0
25/26	0	0
26/27	0	0
27/28	0	0
28/29	0	0
29/30	0	0

4.2 Expected L-gas production in Germany until GY 2029/30 (TWh)

	Cold	*Average*
19/20	41.6	41.6
20/21	38.1	38.1
21/22	35.5	35.5
22/23	32.9	32.9
23/24	29.7	29.7
24/25	27.1	27.1
25/26	24.4	24.4
26/27	21.9	21.9
27/28	19.4	19.4
28/29	17.6	17.6
29/30	15.3	15.3

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	2	52
Nüttermoor L-Gas	0.43	24
Speicherzone L-Gas (EWE)	10	306
Empelde	2	73
Epe L-Gas (innogy)	2	98
Epe L-Gas (UES)	4	238
France		
Gournay	13	248
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 Injected and withdrawn storage volume (in TWh) of L-gas per country in 2018/2019

	Injection (TWh)	Withdrawal (TWh)
Germany	9.8	6.0
France	12.3	12.8
The Netherlands	60.0	56.0

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

$D = \Sigma \max[(14 - T_{eff}),0]$

Where:

D = the number of degree days

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

Teff = daily average effective temperature

$T_{eff} = T - (V/1,5)$

Where:

T = daily average temperature

V = daily average wind speed

The number of degree days in an average year of the last 30 gas years is 2300, were the coldest gas year had 2914 degree days and the warmest had 1783 degree days. In gas year 2017/2018 there were 2160 degree days and in 2018/2019 there were 2075 degree days. This means that both gas years were warmer than average and therefore the temperature dependent demand in the L-gas region was lower than the average forecasted demand in both years.

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