L-Gas Market Conversion Review

Winter Report 2021

Task Force Monitoring L-Gas Market Conversion

Ministry of Economic Affairs and Climate Policy

Foreword

This is the third 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. This report looks back on the market developments through the previous Gas Year (2019/20) 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 the impact of the Covid-19 induced lockdowns in 2020 and on planned conversions through the Gas Year 2021/22. The estimated volume effect of the 2021 conversions (40 TWh) is the highest of all gas years of the conversion programme, due to the particularly high conversion rates in Belgium and Germany.

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. 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 mid-2022, gas from the Groningen field (Groningen gas) should only be needed in case of a colder than average winter and in case of a severe disruption elsewhere in the L-gas system.

However the 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 G-gas" and "pseudo L-gas" is needed to secure the supply in the G- and L-gas market region.

Pseudo G-gas and pseudo L-gas can be principally produced as follows:

- Pseudo G-gas:
  - 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
- Pseudo L-gas:
  - 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 G-gas 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 170.9 TWh (or 17.5 bcm[2]) 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 GY 2019/20, as Groningen gas production more than halved year-on-year, falling by 86.72 TWh year-on-year, from 171.12 TWh in GY 2019 to 84.4 TWh. Consequently, the share of pseudo G/L-gas in total Dutch G/L-gas production grew from just above 30% in GY 2014/15 to close to 82% in GY 2019/20. During the same period, the utilization rate of nitrogen blending facilities has increased steadily to average at 100% of firm capacity during the GY 2019/20. In the summer period (from May to September) pseudo G-gas is used to inject into G-gas storages for usage through the heating season.

Pseudo G/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 100% of G/L-gas produced in the Netherlands in GY 2022/23. Moreover, it is set to provide almost 95% of the upward production flexibility by GY 2022/23 necessary to meet demand in a cold GY in the L-gas region. Nitrogen blending alone will account for over 87% of G/L-gas produced in the Netherlands in GY 2022/23 and is expected to provide almost 85% of the upward production flexibility necessary to meet demand in a cold GY.

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, this 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) G-gas, as well as the overall security of supply developments within the G/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.

Consumption of L-gas from the Netherlands decreased by 5% (or 24.1 TWh) from 483.1 TWh in the GY 2018/19 to 459 TWh in the GY 2019/20 in the L-gas region. This has been primarily driven by the continued implementation of the market conversion programs in the respective L-gas markets, which reduced demand for L-gas. In GY 2018/19 conversion totaled to 15.76 TWh, with 13.5 TWh taking place in Germany, 1.37 TWh in Belgium, 0.888

[1] A gas year (GY) starts on 1 October and ends on 30 September.

[2] Volumetric data is expressed in Normal cubic meters (Nm^3), under reference conditions of temperature (0 °C) and pressure (101.325 kPa).

TWh in France and 0 in the Netherlands. 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.

Worth to note, that the implementation of nationwide Covid-19 induced lockdowns in the spring of 2020 had a significant impact on natural gas demand worldwide and in Europe. In the L-gas region Dutch L-gas and H-gas consumption fell by 19% (or 13.3 TWh) and 16% (or 34.2 TWh) year-on-year respectively during April and May. Besides the lower economic and industrial activity due to the lockdowns, stronger solar power generation (up by 30% year-on-year) weighed on natural gas consumption during that period.

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 demand met with imports from the Netherlands is expected to fall from 43.6 TWh in GY 2019/20 to 0 in Belgium, from 37.92 TWh to 0 in France and from 151.9 TWh to 0.3 TWh in Germany[4] by GY 2029/30 both in an average and cold GY.

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 Germany, over 98% of the planned conversions have been executed in 2020. As foreseen in the Summer Report of the Task Force, only an amount of 6,000 appliances (0.05 GW) out of 395.000 appliances have been rescheduled from 2020 to 2021. In Belgium, due to the outbreak of the Covid-19 pandemic, delays in the works carried out at TSO level and in the preparation activities at DSO level (amongst others the adaptation of household pressure regulators) led to a postponement of the conversion to 1st of September instead of the 1st of June as previously planned. However, this did not alter the initial conversion target for 2020. In France, 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.

In 2021, over 900,000 of gas connections and appliances are expected to be converted in GY 2021/22 –the highest number through the market conversion programme. The estimated volume effect of the 2021 conversions (40 TWh) is the highest of all gas years, due to the particularly high conversion rates in in Belgium and Germany. While the conversion areas are evenly distributed in terms of appliances per gas year for a large part of the conversions, the resulting volume effect differs due to the regional distribution of industry and power plants with a high gas consumption. Furthermore the high rates can be explained by optimization opportunities only possible for specific areas in Belgium.

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, planned to start operations from 1st of April 2022 with a capacity of 180,000 m^3/h N_2, will be able to produce between 68 TWh to 97 TWh of additional pseudo L-gas. The outbreak of Covid-19 and consequent lockdowns did up until now not have an impact on the commissioning date of the nitrogen plant as of September 2020.

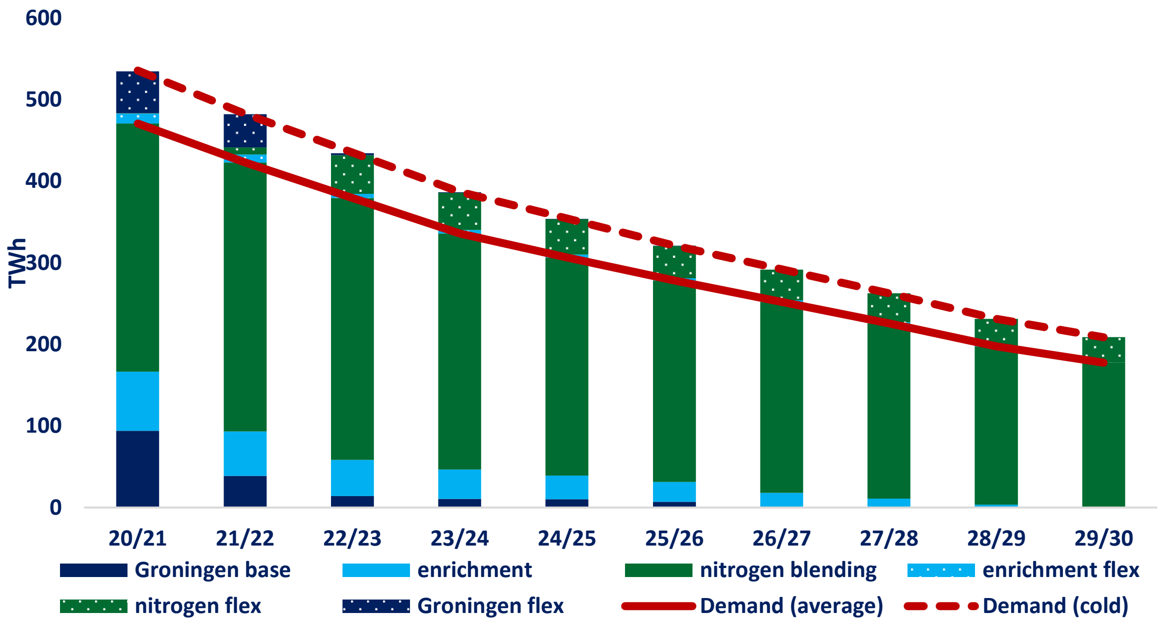
However, the project slack has been exhausted. Uncertainty around the evolution of the Covid-19 and its implications for the conversion planning and construction of the Zuidbroek facility remains a key risk. Due to the current developments, there is a real risk of delay on the commissioning date of the Zuidbroek facility.

[3] GTS (2017), Netwerk Ontwikkelingsplan 2017.
[4] 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).

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.

GTS concluded in her advice of January 2021, that for the base case the minimum production from the Groningen field is needed until GY 2025/2026. Based on the sensitivity analysis performed by GTS, a realistic bandwidth for the closure of the Groningen field is between mid-2025 and mid-2028. The Government of the Netherlands wants to close the Groningen field as quickly as possible. Alternatives for the Groningen field as a backup source for security of supply are therefore being investigated. Anyhow, in the period 2021-2025 L-gas supply flexibility will be entirely provided by the nitrogen blending facilities and the G-gas storages.

L-gas supply-demand balance projection in an average and cold year[5] (GY 20/21-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 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. Net imports of natural gas rose by more than eight-fold since GY 2017/18 to reach 17.33 bcm in GY 2019/20 – accounting for over 40% of the country's total gas consumption.

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

Based on TYNDP2020 dataset, ENTSOG performed several additional disruption case calculations to investigate if sufficient H-gas supply can be delivered to the northwest European markets in an average year and for high demand situations. The results show that there is sufficient transport capacity during disruptions in an average year. Compared to TYNDP2018 (disruptions) calculations the configuration at European level has improved thanks to increased potential from suppliers (specifically extra LNG volume delivered to existing LNG terminals), new import routes in Europe (see TYNDP2020), and the reduced gas demand in France and the UK. The planned increase in capacity on the German/Dutch border raises the flexibility towards the Netherlands.

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.

[5] 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.
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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 decreased 5% (or 24.1 TWh) from 483.1 TWh in the GY 2018/19 to 459 TWh in the GY 2019/20 in the L-gas region. This has been primarily driven by the continued implementation of the market conversion programs in the respective L-gas markets, which naturally reduced demand for L-gas. 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. Groningen gas production more than halved year-on-year, falling to 84.4 TWh in GY 2019/20. This has been possible due to higher L-gas production via nitrogen blending, which increased by over 26% and drove up the utilization rate of nitrogen blending facilities from an average of 90% through the GY 2018/19 to an average 100% of their firm capacity during the GY 2019/20. The share of pseudo L-gas accounted for close to 82% of total Dutch L-gas production in GY 2019/20. Higher pseudo L-gas production was also possible with the expansion of the nitrogen blending capacity at the Wieringermeer conversion facility, starting from 23rd December 2019. L-gas storage played a key role in allowing lower Groningen production, with net withdrawals increasing by 13.14 TWh year-on-year from -6.32 TWh in GY 2018/19 (when injection outpaced withdrawals) to 6.81 TWh in GY 2019/20. Net storage withdrawals met approximately one-fifth of the region's L-gas demand.

4. The Covid-19 induced lockdowns had only a minor impact on the overall schedule of the conversion programs. In Germany, over 98% of the planned conversions have been executed. In Belgium, 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 (amongst others the adaptation of household pressure regulators) led to a postponement of the conversion to 1st of September from 1st of June as previously planned. However, this did not alter the initial conversion target for 2020. In France, the initial plan for 2020 was the conversion of Dunkerque sector, which has been completed 27-28 October 2020 instead of 13 October 2020. Uncertainty around the evolution of the Covid-19 and its implications for the conversion planning and construction of the Zuidbroek facility remains a key risk. Due to the current developments, there is a real risk of delay on the commissioning date of the Zuidbroek facility.

5. In 2021, over 900,000 gas connections and appliances are expected to be converted in GY 2021/22 –the highest number through the market conversion program. The estimated volume effect of the 2021 conversions (40 TWh) is the highest of all gas years, due to the particularly high conversion rates in in Belgium and Germany. The Task Force does not see any possibilities to further accelerate the conversion process. Currently, all efforts are aiming at achieving the scheduled 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 reduced to 0 at an average rate of approximately 10% per year.

6. 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. This will allow to stop production from Groningen by GY 2022/23. For capacity reasons the Groningen field may be needed for security of supply until approximately gas year 2025/2026. GTS concluded in her advice of January 2021, that for the base case the minimum production from the Groningen field is needed until GY 2025/2026. Based on the sensitivity analysis performed by GTS, a realistic bandwidth for the closure of the Groningen field is between mid-2025 and mid-2028. The Government of the Netherlands wants to close the Groningen field as quickly as possible. Alternatives for the Groningen field as a backup source for security of supply are therefore being investigated.

7. Due to the continuously increasing demand for H-gas for the conversion capacity, the Netherlands has become a net importer of gas in GY 2017/18. 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 TYNDP2020 dataset, ENTSOG performed several additional disruption case calculations to investigate if sufficient H-gas supply can be delivered to the NW European markets in an average year and high demand situations. The results show that there is sufficient transport capacity during disruptions in an average year. Compared to TYNDP2018 (disruptions) calculations the configuration at European level has improved thanks to increased potential from suppliers (specifically extra LNG volume delivered to existing LNG terminals), new import routes in Europe (see TYNDP2020), and the reduced gas demand in France and the UK. The planned increase in capacity on the German/Dutch border raises the flexibility towards the Netherlands.

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 mid-2022, Groningen gas should only be needed in case of a colder than average winter and in case of a severe disruption elsewhere in the L-gas system. 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[6]. 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 and most recently on 21 September 2020.

The current report provides an update on the progress of the conversion programs, with a special focus on the impact of the Covid-19 induced lockdowns in 2020 and on planned conversions through the GY 2021/22. Over 900,000 of gas connections and appliances are expected to be converted in GY 2021/22 –the highest number through the market conversion program.

The estimated volume effect of the 2021 conversions (40 TWh) is the highest of all gas years, due to the particularly high conversion rates in in Belgium and Germany.

[6] 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[7]

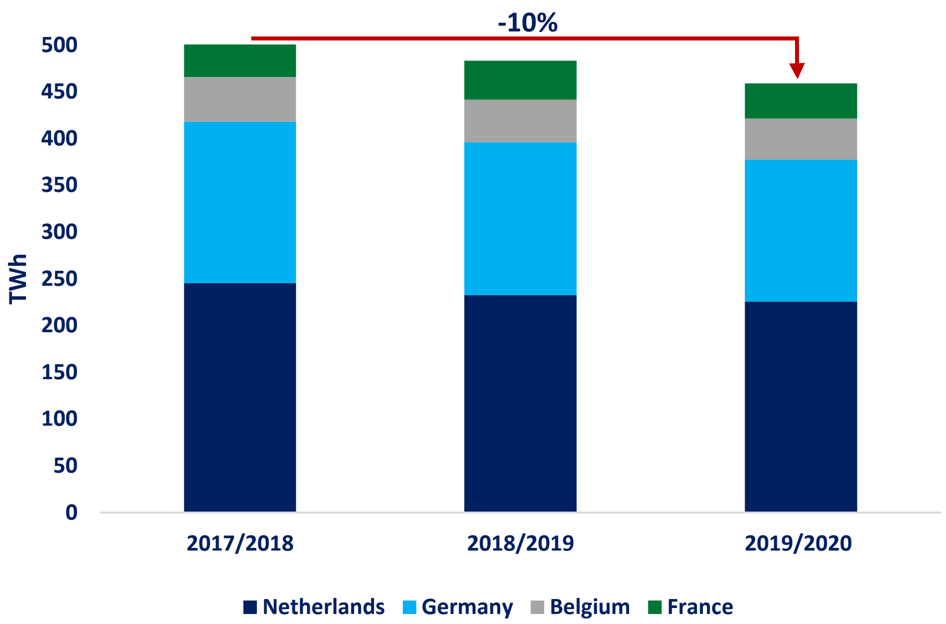
2.1 Recent demand trends

The consumption of Dutch L-gas declined by 9.9% (or 50.5 TWh) in GY 2019/20 compared with GY 2017/18, falling from 509.5 TWh to 459 TWh.

Following a drop of 5% year-on-year (y-o-y) in GY 2018/19, total consumption of Dutch L-gas declined by another 5% (24.1 TWh) from 483.1 TWh in the GY 2018/19 to 459 TWh in the GY 2019/20. The consumption of total H-gas (excluding volumes used for conversion and enrichment in the Netherlands) remained stable in the region, decreased by 1.4% in GY 2019/20.

The main driving force behind lower L-gas consumption in GY 2019/20 has been the continued implementation of the market conversion programs in the respective L-gas markets, which naturally reduced demand for L-gas. In GY 2018/19 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. 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.

Figure 2.1 Consumption of L-gas from the Netherlands in between GY 2017/18 and 2019/20 (TWh)



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. 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.

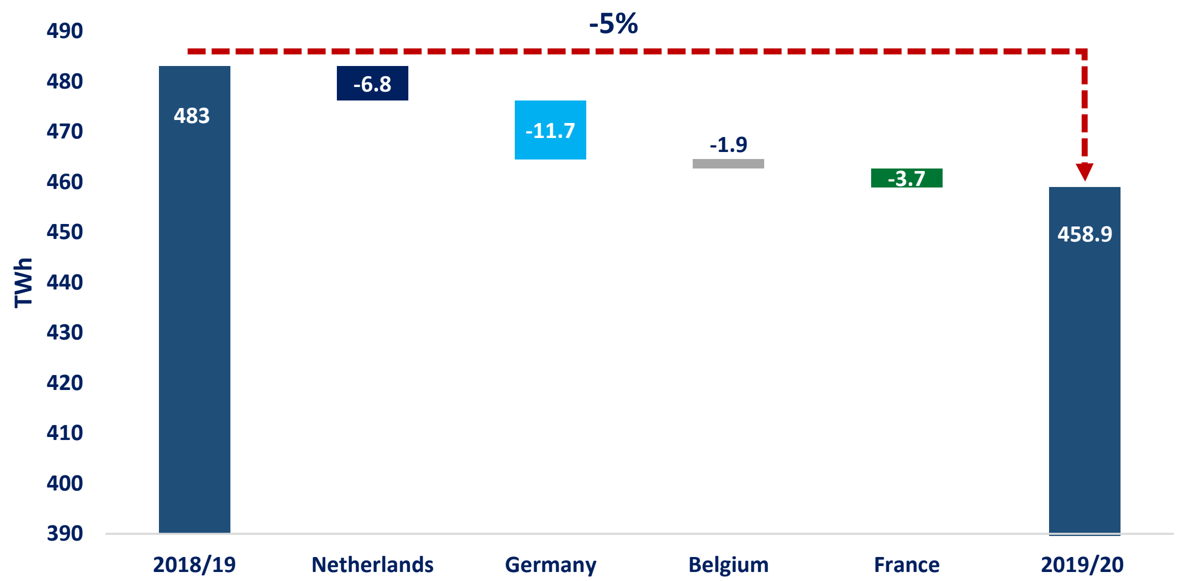
The impact of climatological factors has been minor in GY 2019/20 as the number of wind-adjusted HDD was only slightly lower (0.9%) compared to the previous GY based on the measurements by the Royal Netherlands Meteorological Institute at the weather station De Bilt.[8]

Worth to note, that the implementation of nationwide lockdowns in the spring of 2020 had a significant impact on natural gas demand worldwide and in Europe, including in the L-gas region, where Dutch L-gas and total H-gas consumption fell by 19% (or 13.3 TWh) and 16% (or 34.2 TWh) year-on-year respectively during April and May. Besides the lower economic and industrial activity due to the lockdowns, stronger solar power generation (up by 30% year-on-year) weighed on natural gas consumption during that period. A secondary and indirect impact of the lockdowns was the downward pressure on gas prices, which averaged 28% below last year levels through June and September. This together with recovering carbon prices, prompted an increase in gas-fired power generation at the expense of coal-fired power plants primarily in Germany and the Netherlands where – based on data sourced from ENTSO-E- it in increased by 16% and close to 12% respectively during that period. This provided support both for H- and L-gas consumption.

[7] Demand is an ex ante concept, referring to expected energy quantitied being consumed. Consumption is an ex post concept, referring to energy quantities which have been already consumed.
[8] For more detail regarding the climatological context, please refer to Annex VI of the current report.

As shown in Figure 2.2 Germany accounted for over 48.6% of the decline in Dutch L-gas consumption through the 2019/20 GY, followed by the Netherlands (28.4%), France (15.2%) and Belgium (7.8%). Regarding year-on-year comparisons, France recorded a reduction of 8.8%, Germany 7.2%, Belgium 4.1% and the Netherlands 2.9%.

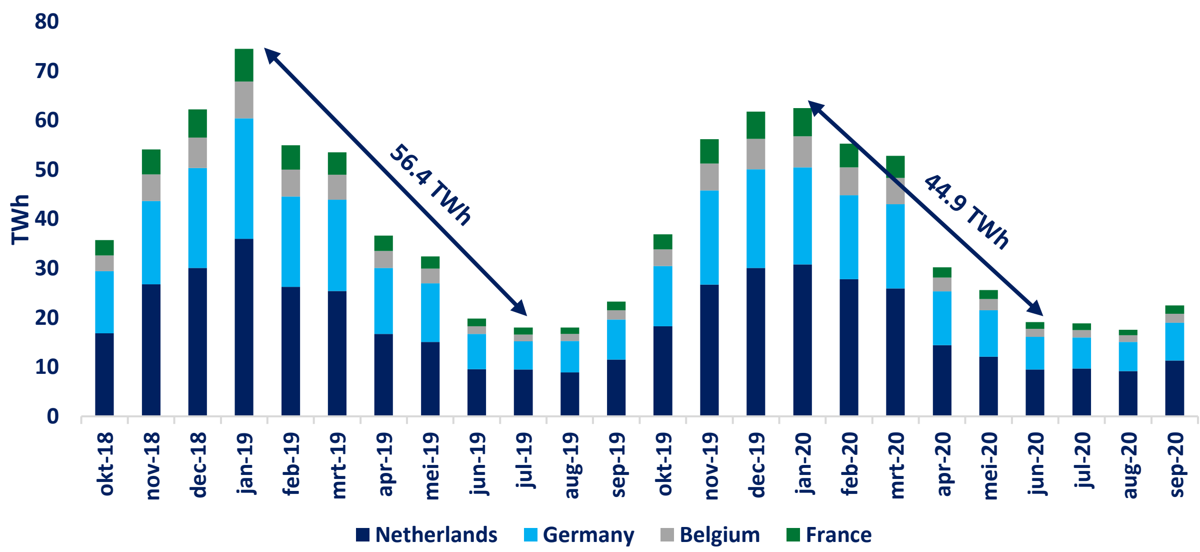
Figure 2.2 Change in Dutch L-gas consumption in GY 2019/20 vs GY 2018/19 (TWh)



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 GY. As such, both monthly peak consumption and the annual demand swing[9] is taken into account when considering the overall evolution of L-gas consumption.

Peak monthly consumption decreased by 16% (12 TWh) in the 2019/20 GY compared to the previous GY and consequently the demand swing (represented by the arrows in Figure 2.3) decreased by 20% (11.5 TWh). This has been largely driven by the climatological context and the more even distribution of HDDs through the 2019/20 heating season.

Figure 2.3 Dutch L-gas monthly consumption October 2018 – September 2020 (TWh)



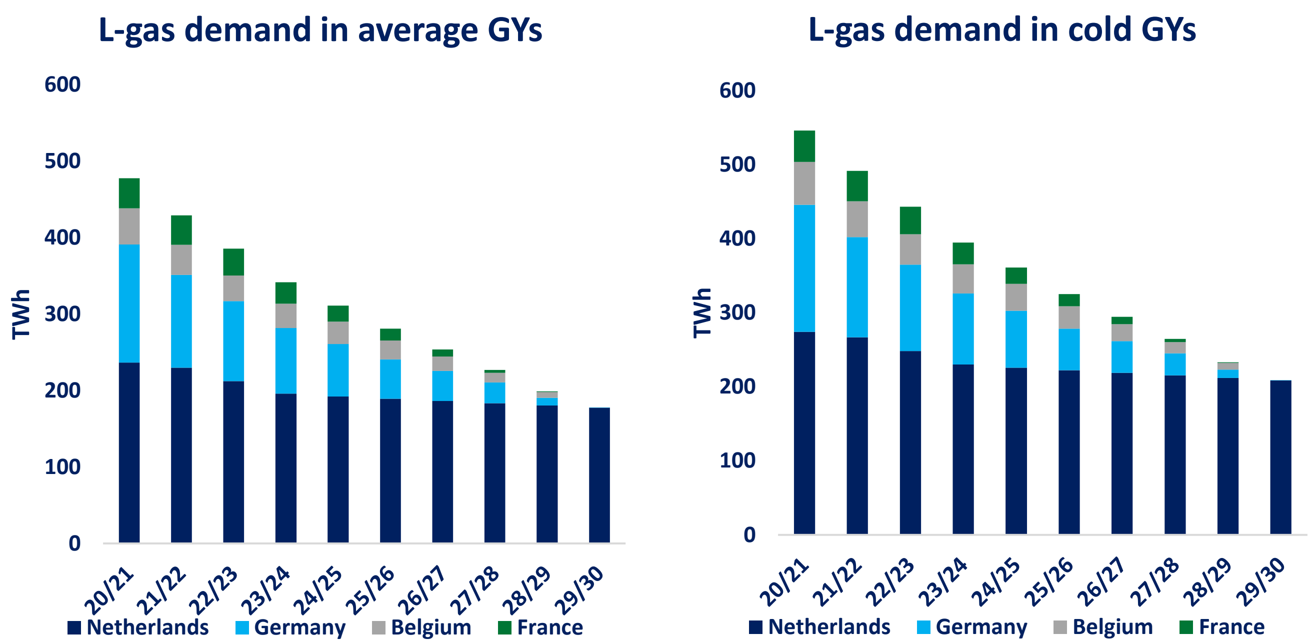
[9] The difference between the highest and lowest monthly gas consumption in a GY.

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

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.[10]

As a consequence, L-gas demand met with imports from the Netherlands is expected to fall from 47.2 TWh in GY 2020/21 to 0 in Belgium, from 39.5 TWh to 0 in France and from 154.4 TWh to 0.3 TWh in Germany[11] by GY 2029/30 both in an average and cold GY[12].

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



[10] GTS (2017), Netwerk Ontwikkelingsplan 2017.
[11] 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).
[12] 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 2.4 and in the tables 2.2 and 2.3 of the Annex.

3. L-gas market conversion volume

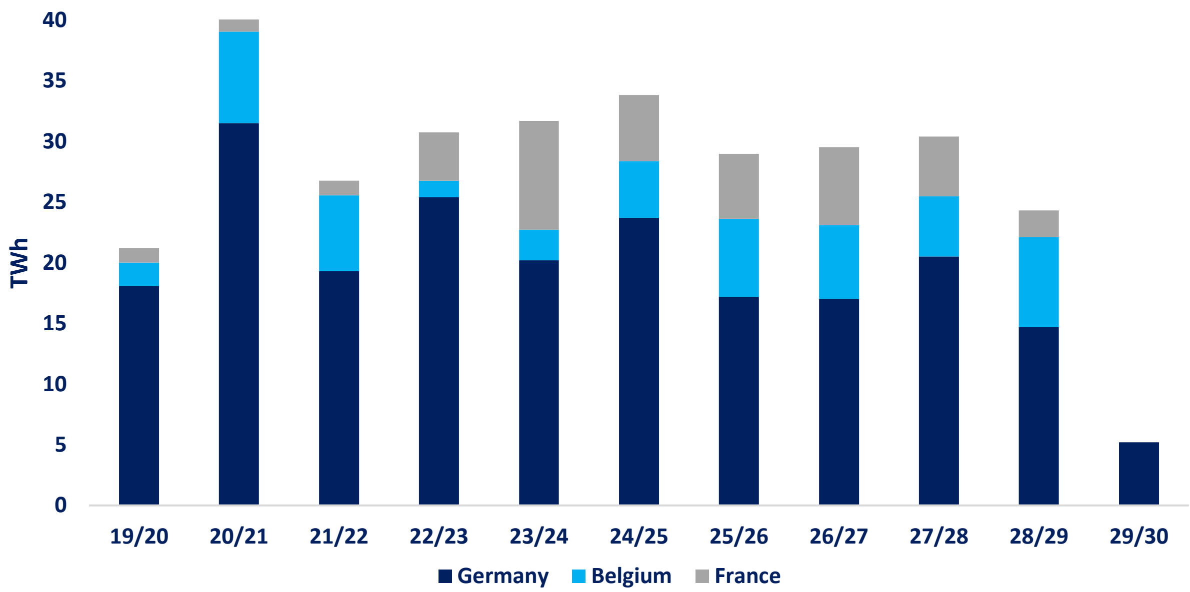
The gas infrastructure operators of Belgium, France and Germany have made arrangements to undertake extensive conversion programs, mainly switching L-gas consumers to H-gas, to reduce the L-gas supply from the Netherlands: by the gas GY 2029/30, their imports of L-gas will be reduced to close to zero.

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 impact of the Covid-19 induced lockdowns in 2020 and on planned conversions through the GY 2021/22. Over 900,000 gas connections and appliances are expected to be converted in GY 2021/22 –the highest number through the market conversion programme.

The estimated volume effect of the 2021 conversions (40 TWh) is the highest of all gas years, due to the particularly high conversion rates in in Belgium and Germany.

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, conversion costs and additional measures[13]

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[14]) had been revised substantially in order to serve as the basis for the market conversion from L- to H-gas. Article 19a of the Basic Energy Law clarifies 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). Furthermore, the law lays down rules on partial reimbursement if customers buy a new gas appliance.

In addition, 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.

[13] For further details please refer to the Winter Report 2020 of the Task Force Monitoring L-Gas Market Conversion.
[14] The text of the Basic Energy Law is accessible at: https://www.gesetze-im-internet.de/enwg_2005/

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 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 2019[15]

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. More than half of this volume accounted to conversions ahead of schedule, which served to bring down demand for Groningen gas.

As these 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.

Conversions in 2020 and the impact of Covid-19

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).

The rapid spread of Covid-19 in Germany has only resulted in minor changes to the original conversion plans for 2020. As foreseen in the Summer Report of the Task Force Monitoring L-Gas Market Conversion, only an amount of 6,000 appliances (0.05 GW) out of 395,000 appliances have been rescheduled from 2020 to 2021.

This, however, will not result in any changes in the import assumptions from the Netherlands in terms of volume or capacity due to the limited size of the conversion area.

It is important to highlight that the technical regulation for the conversion from L- to H-Gas in Germany requires multiple customer contacts between service technicians and the owners of the respective household device. First, an assessment of the natural gas device is performed on site to ensure technical feasibility, planning of the technical adjustment date and spare part logistics. The assessment of the device often takes place more than one year ahead of the physical conversion date. Second, the actual technical adaption takes place either before or after the device is physically supplied with H-gas. Third, 10% of the converted devices are checked again for quality assurance purposes.

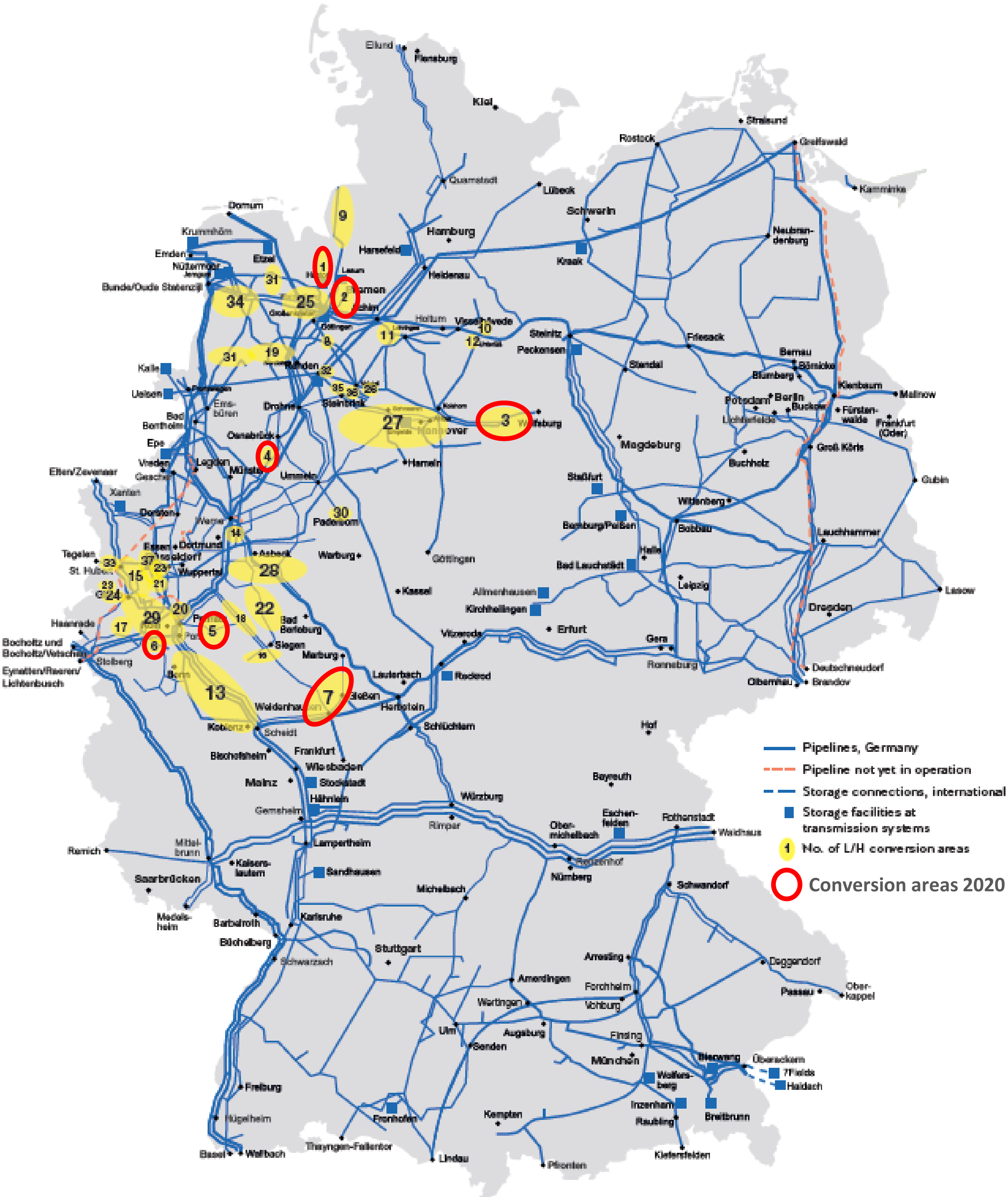
Performing these multiple customer contacts in a limited time schedule was significantly hindered by Covid-19 and its surrounding effects, in particular during the first wave. The Covid-19 pandemic meant that all parties involved were facing challenges previously unknown.

In particular, these included the reduction or temporary suspension of assessment and adjustment work (causes including those refusing entry), guaranteeing the full availability of conversion service providers, the implementation of special hygiene protocols and providing the customers concerned with comprehensive information.

Temporary delays that have accumulated during the first wave of Covid-19 in spring 2020 have mainly been compensated during summer 2020. Further compensation has been achieved by conducting conversion steps later in the year than originally planned, despite higher risks for the involved end customers if their heating installation should malfunction during the switchover process. The last conversion steps in Germany for the year 2020 have successfully been conducted by November 2020. The respective conversion areas are displayed in the illustration below.

[15] For further details please refer to the Winter Report 2020 of the Task Force Monitoring L-Gas Market Conversion.

Map 3.1.1 Conversion areas in 2020



The second wave did not have an impact on the timely implementation of the last conversion steps in the year 2020, which took place during November 2020. DSOs however reported a rising number of households under quarantine that could not be entered on the foreseen date, but not in a critical magnitude to stop or postpone the latest conversion steps. The respective areas are now physically supplied with H-gas. The process of technically adapting heating devices is still ongoing and will approximately last until end of 2020 / beginning of 2021. Possible delays in these works would therefore not lead to an increased demand of L-Gas, but to an increased number of malfunctions and disconnections.

Table 3.1.1 provides a detailed status of the conversion areas in Germany and the respective delays caused by Covid-19.

Table 3.1.1 Market conversion in Germany in 2020

Area in the Gas NDP 2020-2030 (No on map)	TSO	Number of appliances (original plan)	Number of appliances (realized)	Planned technical conversion month (original)	Planned technical conversion month (realized)
EWE-Zone part I (1)	GTG	50,000	38,000	February–June	February–June
EWE-Zone part I (1)	GTG	17,000	23,000	September–October	September–November
Bremen/ Delmenhorst (2)	GUD	30,000	30,000	July	July
Bremen/ Delmenhorst (2)	GUD	22,000	22,000	September	September
East Hannover/ Wolfsburg (3)	GUD	5,000	5,000	March	March
East Hannover/ Wolfsburg (3)	GUD	34,000	34,000	April	May
East Hannover/ Wolfsburg (3)	GUD	27,000	27,000	June	June
East Hannover/ Wolfsburg (3)	GUD	8,000	8,000	September	September
East Hannover/ Wolfsburg* (3)	GUD	0	0	October	October
Teutoburger Wald 5 (4)	OGE (Nowega)	39,000	39,000	October	October
Aggertal pipeline (5)	OGE	4,000	4,000	April	August
Aggertal pipeline (5)	OGE	3,000	0	August	–
Aggertal pipeline (5)	OGE	–	3,000	–	September
Aggertal pipeline (5)	Thyssengas	0	0	April	April
Aggertal pipeline (5)	Thyssengas	5,000	5,000	April	August
Aggertal pipeline (5)	Thyssengas	10,000	15,000	June	September
Aggertal pipeline (5)	Thyssengas	9,000	20,000	August	November
Aggertal pipeline (5)	Thyssengas	16,000	0	October	–
Bonn (6)	OGE	21,000	21,000	March	March
Bonn (6)	OGE	4,000	4,000	June	July
Middle Hesse (7)	OGE	22,000	22,000	March	March
Middle Hesse (7)	OGE	20,000	20,000	April	April
Middle Hesse (7)	OGE	17,000	17,000	June	June
Middle Hesse (7)	OGE	16,000	16,000	July	July
Middle Hesse (7)	OGE	16,000	16,000	September	September
Total		**395,000**	**389,000**		

**no distribution networks*

Despite the difficult Covid-19 situation in spring 2020, the gas demand from the Netherlands will not deviate against the assumptions already published in the Winter Report 2020. However, the challenge ahead will be to manage the high numbers of conversions scheduled for the next years.

Moreover, it is important to highlight that as of December 2020, Covid-19 did not cause any delays for the planned commissioning dates of the grid expansion projects in Germany required for the conversion from L- to H-gas.

GTG's blending facility at the Dutch border is not yet in operation, since it is not yet connected to the H-Gas network of GTS. Delays are due to material, which is requested to have unusual specifications, being available no earlier than January 2021. It is therefore expected that the blending facility will go into operation in Q2 2021.

Conversions in 2021[16]

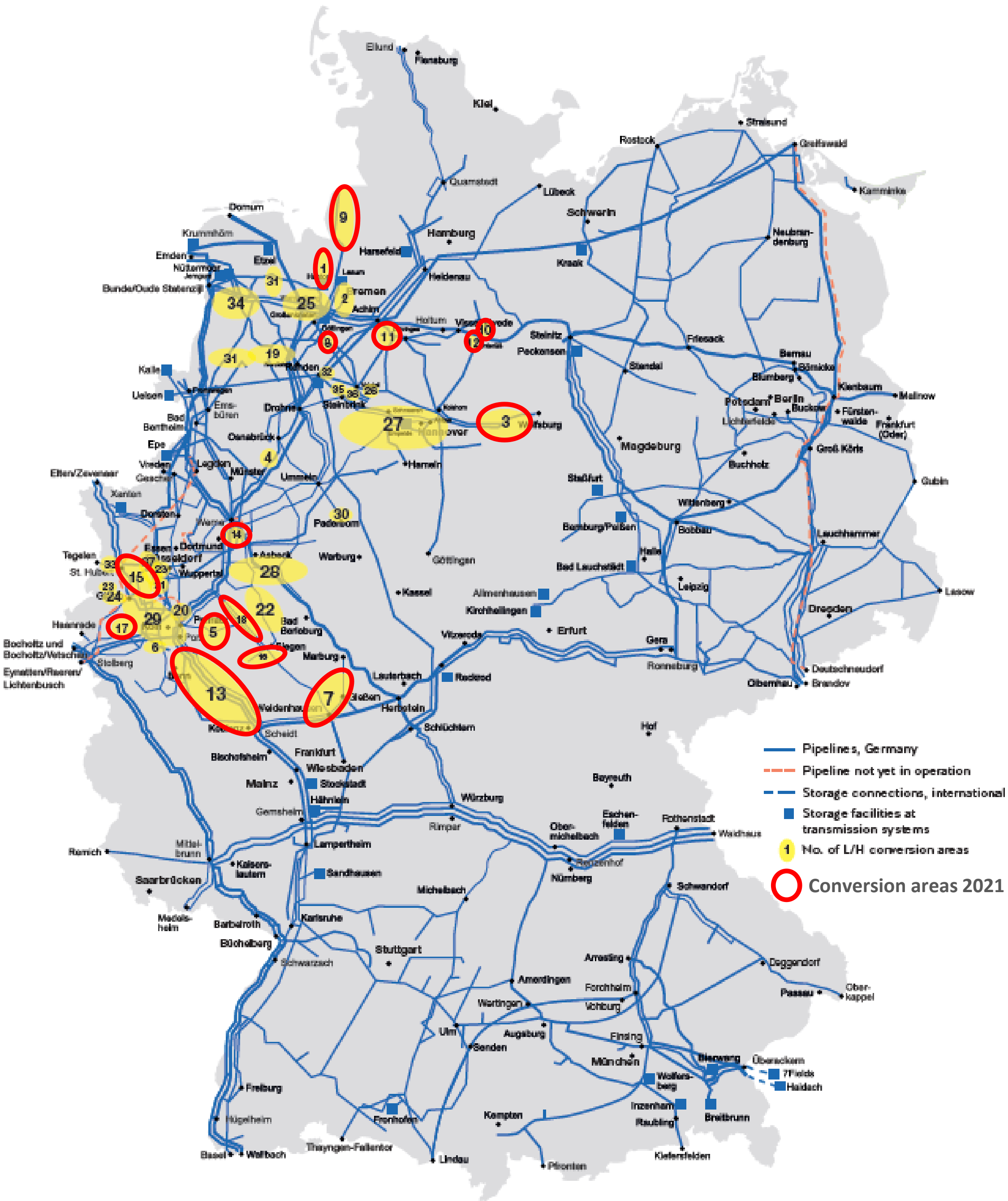
The major challenge for 2021 will be the significant increase of the number of appliances to be converted. The total amount of 570,000 appliances is an increase of approximately 45% against 2020. The planned conversion of 2021 relates to a capacity of 9.5 GWh/h and an estimated volume effect of 31.5 TWh (average year).

The estimated volume effect of the 2021 conversion is the highest effect of all gas years. While the conversion areas are evenly distributed in terms of appliances per gas year, the resulting volume effect differs due to the

[16] The German Network Development (NDP) plan also refers to calendar years for the appliances converted and gas years for resulting gas demand. As conversion usually take place between March and (early) October, the difference is insignificant.

regional distribution of industry and power plants with a high gas consumption. An above-average effect on volume results in particular from the conversion area (15) “Rhineland”, and besides that also from the conversion areas (13) “Middle Rhine” and (3) “East Hannover/ Wolfsburg”. The planned conversion areas in 2021 are displayed in the illustration below.

Map 3.1.2 Conversion areas in 2021



Due to the unclear development of Covid-19, additional risks may arise that could lead to delays. Possible risks include workforce availability, spare parts availability or limited access to households for technicians to perform adjustment works.

Due to the necessity to enter every single household 2 – 3 times for the conversion of one single appliance, the future development of Covid-19 may be crucial to the success of the overall schedule for 2021. Adjustment works in the respective households will start on a large scale in Q1/2021 typically 3 months before the actual conversion date (switchover to physical supply with H-Gas), with a yet unclear Covid-19 situation.

Table 3.1.2 provides a detailed overview of the planned conversion areas in Germany in 2021.

Table 3.1.2 Market conversion in Germany in 2021

Area in the Gas NDP 2020-2030 (No on map)	TSO	Number of appliances (original plan)	Planned technical conversion month
Aggertal pipeline (5)	Thyssengas	14,000	April
Aggertal pipeline (5)	Thyssengas	17,000	June
Aggertal pipeline (5)	Thyssengas	11,000	August
Bergheim 1 (17)	Thyssengas	14,000	October
East Hannover/ Wolfsburg (3)	GUD	8,000	March
East Hannover/ Wolfsburg (3)	GUD	36,000	April
East Hannover/ Wolfsburg (3)	GUD	12,000	June
East Hannover/ Wolfsburg (3)	GUD	9,000	July
East Hannover/ Wolfsburg (3)	GUD	6,000	September
East Hannover/ Wolfsburg (3)	GUD	22,000	October
EWE-Zone part I (1)	GTG	6,000	November
EWE-Zone part II (8)	GTG	31,000	February-August
EWE-Zone part II (8)	GTG	3,000	October
North Bremen/ Osterholz Scharmbeck/ Bremerhaven/ Cuxhaven (9)	GUD	9,000	July
North Bremen/ Osterholz Scharmbeck/ Bremerhaven/ Cuxhaven (9)	GUD	13,000	May
North Bremen/ Osterholz Scharmbeck/ Bremerhaven/ Cuxhaven (9)	GUD	43,000	June
North Bremen/ Osterholz Scharmbeck/ Bremerhaven/ Cuxhaven (9)	GUD	12,000	September
North Bremen/ Osterholz Scharmbeck/ Bremerhaven/ Cuxhaven (9)	GUD	9,000	October
Unterlüß-Gockenholz* (10)	GUD	0	October
Verden (11)	GUD	13,000	October
Munster Gockenholz area (12)	Nowega	6,000	October
Middle Hesse (7)	OGE	6,000	March
Middle Hesse (7)	OGE	18,000	May
Middle Hesse (7)	OGE	27,000	June
Middle Hesse (7)	OGE	18,000	August
Middle Rhine (13)	OGE	45,000	April
Middle Rhine (13)	OGE	21,000	June
Middle Rhine (13)	OGE	8,000	May-August
Middle Rhine (13)	OGE	18,000	September
Middle Rhine (13)	OGE	15,000	October
Oberaden* (14)	OGE	0	June/ September
Oberbergisches Land (18)	Thyssengas	10,000	September
Rhineland (15)	OGE	22,000	July
Rhineland (15)	OGE	21,000	July
Rhineland (15)	Thyssengas	13,000	July
Rhineland (15)	OGE	0	September
Rhineland (15)	Thyssengas	0	July
Rhineland (15)	Thyssengas	0	September
Westerwald/ Sieg (16)	OGE	19,000	September
Westerwald/ Sieg (16)	OGE	16,000	July
Total		**570,000**	

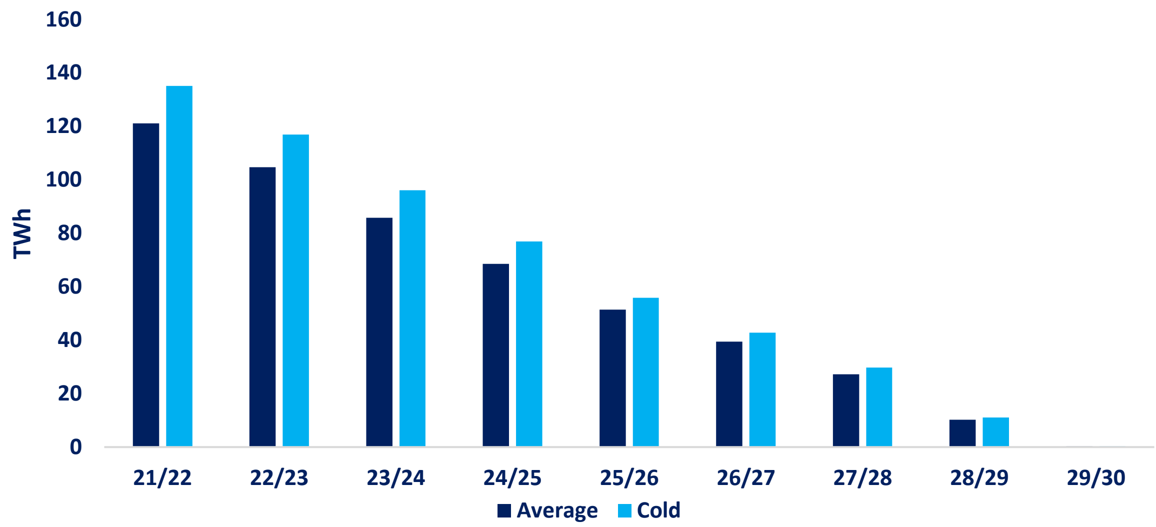
**no distribution networks*

Conversions until GY 2029/30

In Germany, over 3.7 million of gas appliances will need to be converted between GY 2021/22 and GY 2029/30, translating into a total volume of 163.2 TWh.

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 a cold GY.[17]

Figure 3.1.1 Germany's L-gas imports from the Netherlands (GY 2021/22-GY 2029/30) for average and cold GYs (TWh)

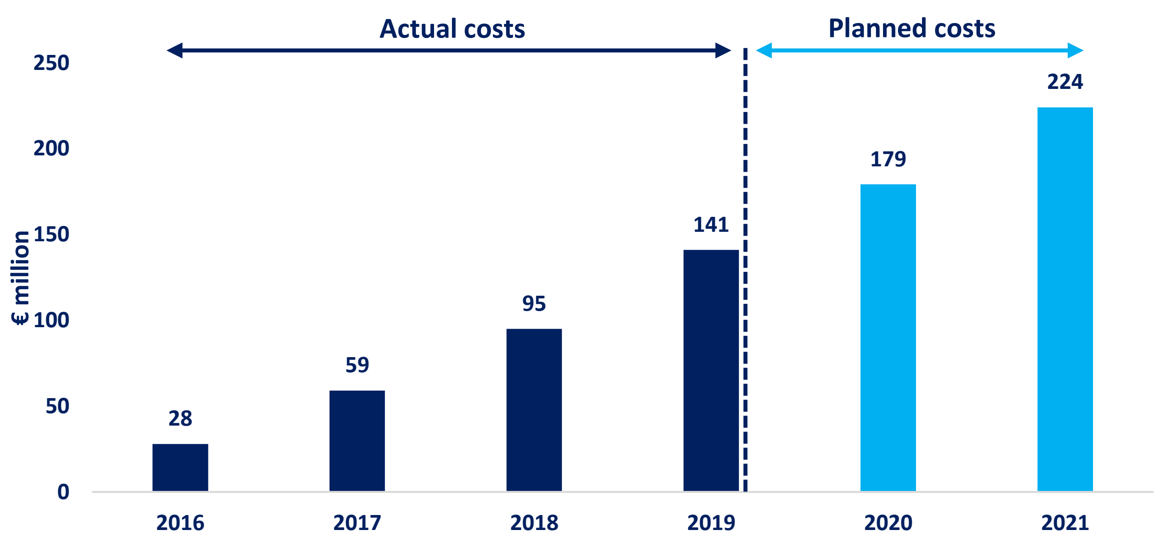


Update on conversion costs

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 – 2019 and the planned costs for the years 2020 – 2021 are displayed in the illustration below, altogether totaling to € 726 million.

Figure 3.1.2 Actual and planned costs for the adaption of appliances, 2016-21 (€ million)



[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).

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 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.

3.2 France

Legislative changes and conversion costs[18]

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 40.73 TWh/y.

Since 2015, the French legal and regulatory framework has been adapted to carry out the conversion of the L-gas network. The regulatory framework for conversion in France was adapted with a new decree dated 29 October 2020. In application of this new decree, L-gas network and storage operators updated the conversion plan which was set up in 2016 taking into account mainly a few planning modifications and feedback from pilot phase.

Costs incurred by the TSO and the DSOs for the conversion of the L-gas networks are covered through gas infrastructures tariffs and are estimated to amount to approximately € 800 million.

Conversions achieved in GY 2018/19 and GY 2019/20

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).

During the GY 2019/20 the conversion program continued in the Grande-Synthe area with 19,000 consumers converted on November 28, 2019.

Conversions in 2020 and the impact of Covid-19

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.

Operations at consumers' houses to check and adapt gas appliances started on 2nd March 2020, with an expected rhythm of 20% of appliances per month from April until June. 2,000 of them were checked and adapted as of mid-March (16/03) when the operations have been suspended due to Covid-19 outbreak.

The lockdown in France stopped the conversion activities by DSO in the sector of Dunkerque on 16 March. It is important to note that the area concerned by the conversion program in France was classified as a red area with respect to Covid-19, which means that it was a highly contaminated area.

From 16 March, conditions for resuming settings of gas appliances have been put in place by the DSO and its implementation has been initiated with customers: a letter and a "health instructions" brochure were sent to customers informing them of the resumption of the settings under specific conditions to guarantee their safety and the safety of the workers. The letter invited them to contact the DSO to confirm their agreement. Local officials and local press relayed these messages.

Settings of customers appliances resumed on 18 May starting with around 30 volunteer heating technicians. A ramp-up took place in the following weeks and significant efforts were made to catch up with the accumulated delay. Thanks to these efforts the Dunkerque sector conversion was successfully achieved on 27-28 October, 2020 instead of 13 October as previously planned.

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. Preparation by GRTgaz of the conversions planned in 2021 and further was launched in 2019 and continued in 2020. In particular, there are two GRTgaz projects to be achieved in 2021. Even if there is delay with respect to the original planning, the current commissioning dates of these two projects remain compatible with the conversions planned in 2021.

[18] For further details please refer to the Winter Report 2020 of the Task Force Monitoring L-Gas Market Conversion.

The status in France at the end of November 2020 is that the second wave of Covid-19 did not have any significant impact on conversion activities because:

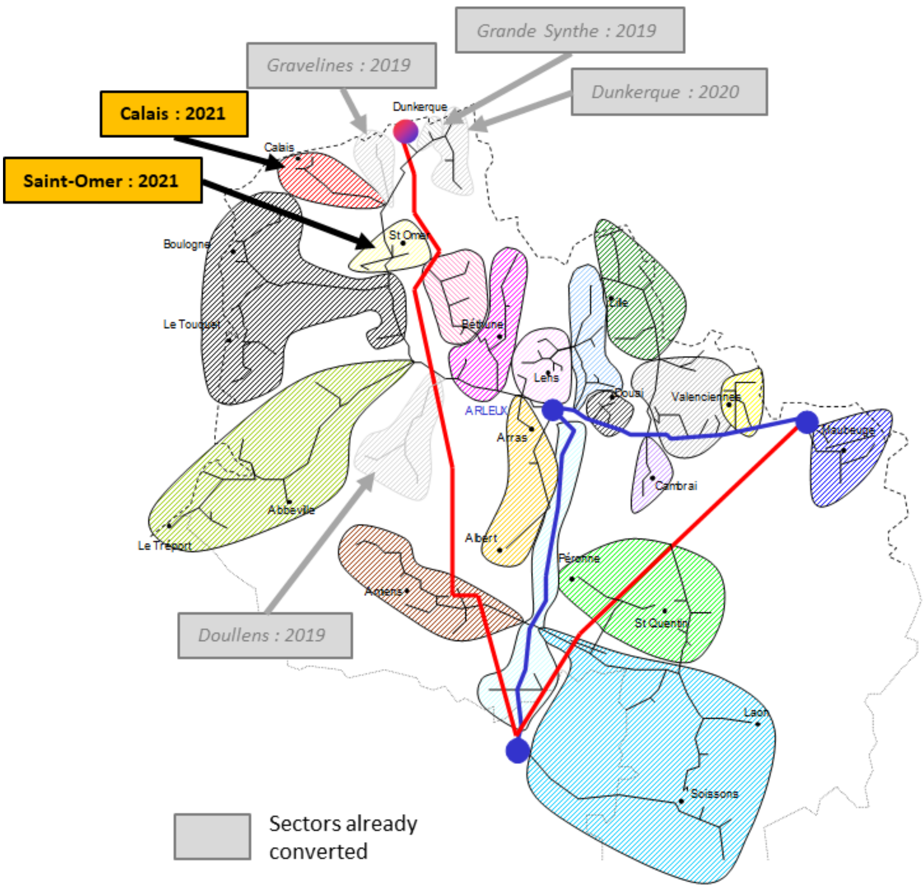
- The second wave in France occurred after the conversion of the Dunkerque sector on 27-28 October;
- Inventory activities for the sectors to be converted in 2021 were mostly achieved at the end of October and they could be finalized at the end of November;
- Preparatory works on the transmission network were not suspended during the second lockdown in November.

Conversions in GY 2020/2021

The plan for 2021 is the conversion of Calais and Saint-Omer sectors in September and October 2021 representing a total annual consumption of 1.2 TWh under average weather conditions. Preparation works for these conversions are currently on track.

During the year 2020 preparation of 2021 and future conversions have been realized. Executed and planned conversions are displayed in the illustration below.

Map 3.2.1 Market conversions in France in 2019 and 2020

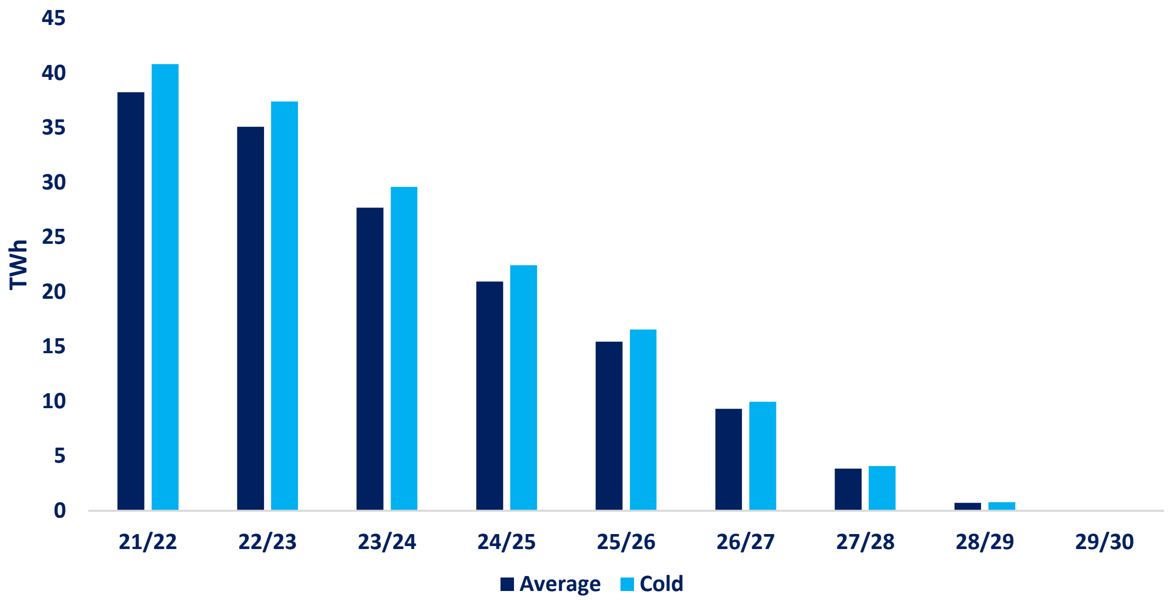


Conversions until GY 2029/30

In France, over 1.26 million of gas consumers will need to be converted between GY 2021/22 and GY 2029/30, translating into a total volume of 38.5 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 L-gas imports from the Netherlands (GY 2021/22-GY 2029/30) for average and cold GYs



3.3 Belgium

Conversions up to 2020 and costs[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.

Each party is responsible for their own costs. The TSO and DSOs pass their costs on to the tariffs. Customers are encouraged to have their devices checked for compatibility at the same time as the compulsory maintenance in order to limit costs.

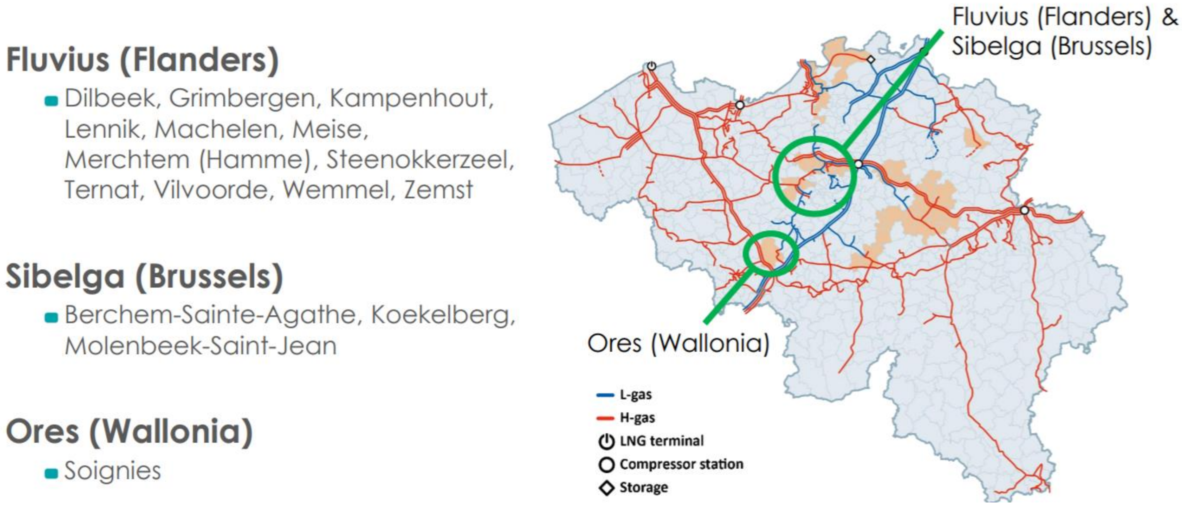
Conversions in 2020 and the impact of Covid-19

In 2020, some 129,761 connections were converted, translating into an annual consumption of 1.92 TWh under average weather conditions. This has been partially enabled by an upgrade of the Winksele compression station whereby H-gas from the natural gas transport backbone (West-East VTN) started to be injected into the L-gas grid.

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 (amongst others the adaptation of household pressure regulators) led to a postponement of the conversion to 1st of September instead of the 1st of June as previously planned. However, this did not alter the initial conversion target for 2020. In total, more than 50,000 connections were 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). The respective conversion areas are displayed in the illustration below.

[19] For further details please refer to the Winter Report 2020 of the Task Force Monitoring L-Gas Market Conversion.

Map 3.3.1 Market conversion in Belgium in 2020



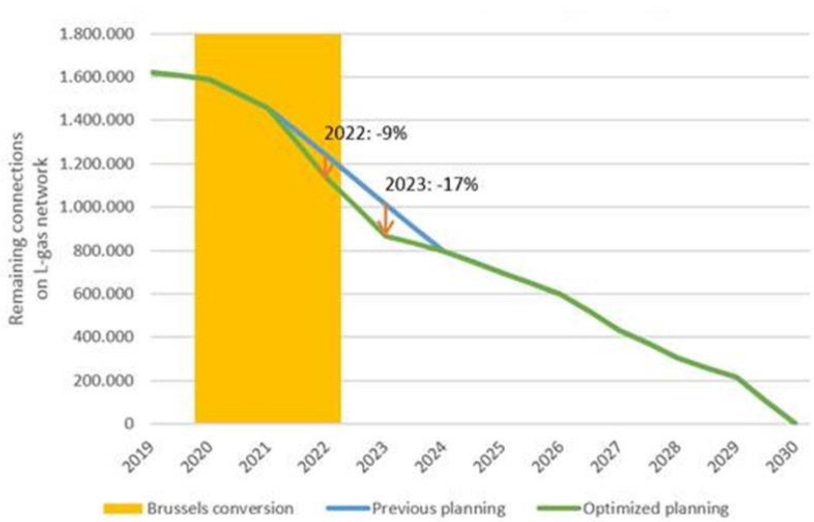
Conversions until GY 2029/30

In Belgium, over 1.5 million of gas connections have to be converted between GY 2020/21 and GY 2029/30, translating into a total volume of 47.22 TWh/y.

Belgium's conversion plan has been slightly revised, with the identification of an opportunity to optimize the conversion of the Brussels Region Distribution Network. In the previous conversion planning, the Brussels Region was converted in four years (2020 till 2023). The optimized conversion planning foresees a phased conversion following the three commercial/physical zones of the Region (Aggregated Receiving Stations), whereby Brussels is converted in three years (2020 till 2022).

The new planning requires a shift of some of the conversion activities from 2022 to 2021, and from 2023 to 2022. It was the result of coordinated effort between the TSO Fluxys and the DSOs involved (Sibelga in Brussels, as well as Fluvius in Flanders for the parts of its network which is supplied by the same TSO station as Sibelga). Adaptions are required on the TSO network to facilitate this shift (notably enabling the simultaneous supply of two types of gases – H and L – to Sibelga from one of the stations on the TSO network), and the DSOs had to anticipate conversion activities and allocate resources accordingly. The optimization of the conversion planning results in a small reduction of L-gas import needs between 2021 and 2023. The graph below shows the change in the planning in terms of number of connections. From 2024 to the end, the conversion planning remains unchanged.

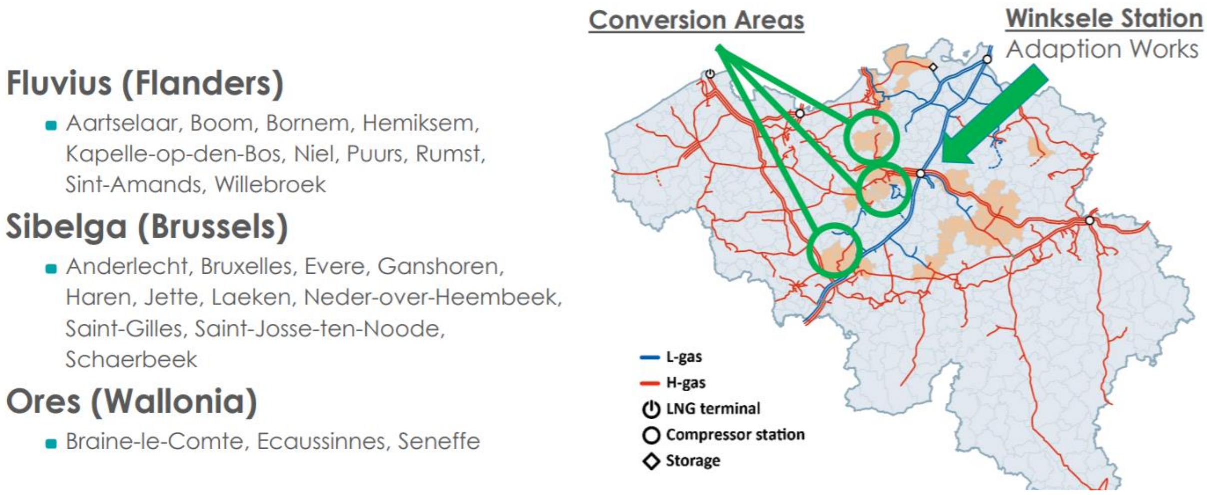
Optimization of the conversion planning in Belgium



In 2021, more than 300,000 connections are expected to be converted, translating into a total volume of 7.53 TWh under average weather conditions. As such, the expected volume effect of the 2021 conversion will be the highest effect of all gas years.

This conversion will be partially enabled by the completion of a further tranche of work in the compressor station of Winksele. More H gas will be supplied from Winksele in the direction of the Brussels Region and Flanders. In Wallonia, several additional municipalities will be converted as well. The conversion is planned on 1st June 2021. No significant issues related to the preparatory works have been reported at this stage. The planned conversion areas in 2021 are displayed in the illustration below.

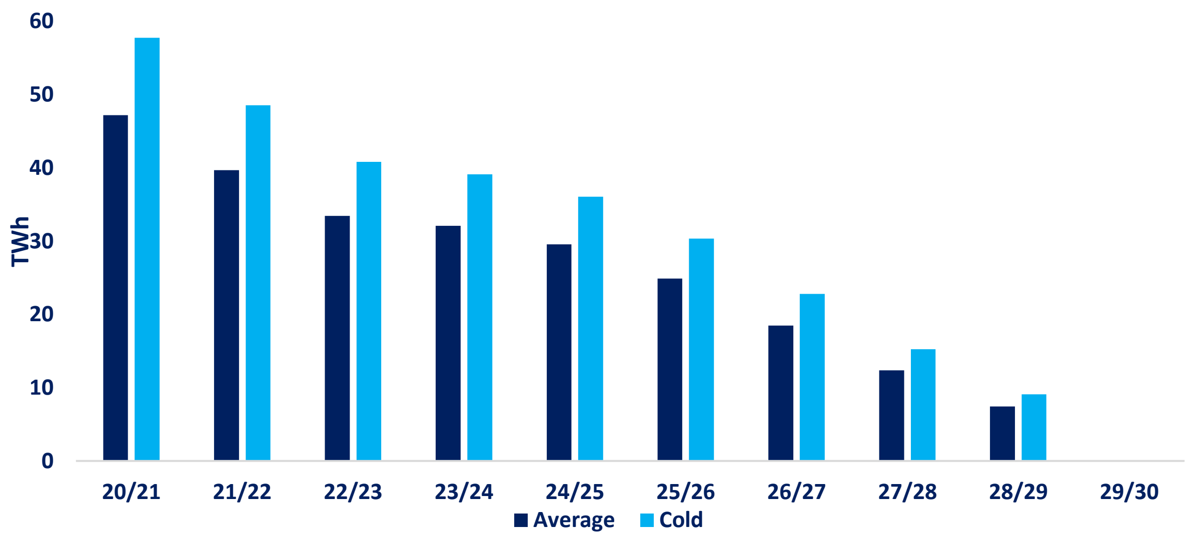
Map 3.3.2 Market conversion in Belgium in 2021



As a consequence to the market conversion, Belgium's L-gas imports from the Netherlands are expected to fall to 0 by GY 2029/30. However, the rising numbers of connections to be converted each year makes the L- to H-gas conversion a challenging program.

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 2020/21-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 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. The plan is to convert 1 industrial consumer in 2021, 4 in 2022 and an additional 4 in 2023. As a consequence, Dutch demand for L-gas is expected to decrease by approximately 3 bcm of annual consumption (~30 TWh), equating to the consumption of the nine largest users[20]. To compensate for a part of the conversion costs of the relevant industrial customers, the Dutch government will establish a compensation scheme.

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

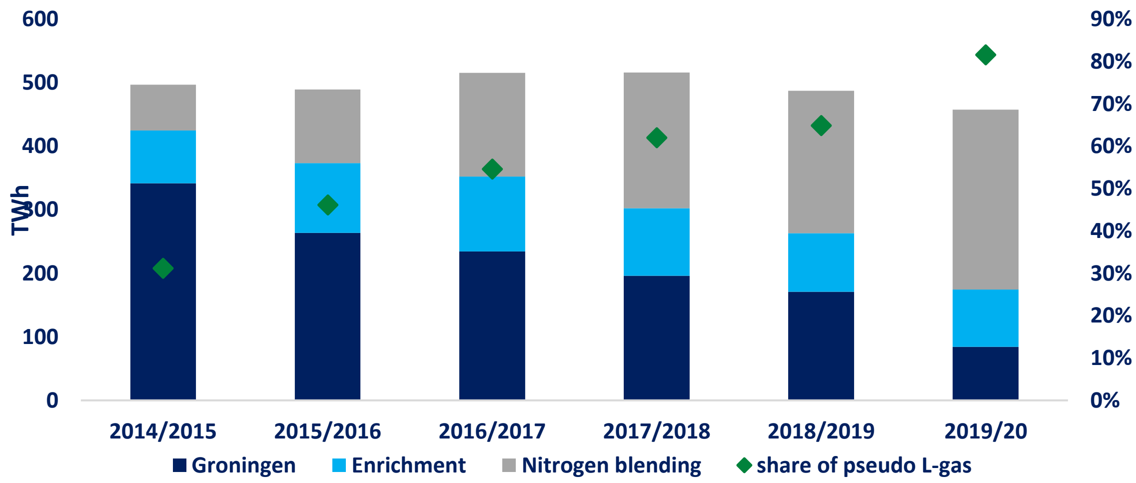
4.1 L-gas production in the Netherlands: recent trends

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 GY 2019/20, as Groningen gas production more than halved year-on-year, falling by 86.72 TWh year-on-year, from 171.12 TWh in GY 2019 to 84.4 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.[21]

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 2019/20 in order to meet the demand for L-gas. During the GY 2019/20, total pseudo L-gas production increased by 18% (or 56.95 TWh) year-on-year, from 316.15 TWh in GY 2018/19 to 373.1 TWh. Consequently, the share of pseudo L-gas in total Dutch L-gas production grew from just above 30% in GY 2014/15 to close to 82% in GY 2019/20.

Figure 4.1 L-gas supply in the Netherlands between GY 2014/15 and GY 2019/20 (TWh)

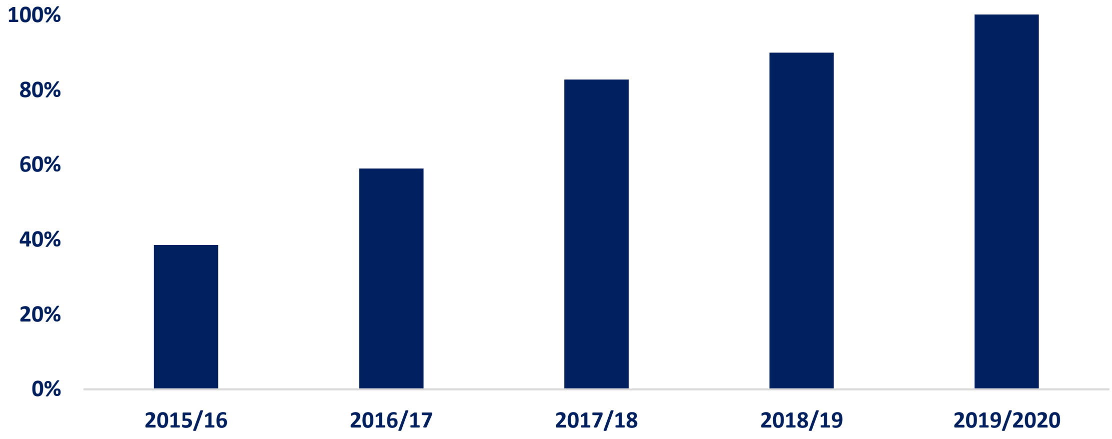


It is important to highlight that this has been entirely driven by a higher L-gas production via nitrogen blending increasing by 26.4% (or 59.2 TWh) while pseudo L-gas obtained via enrichment decreased by 2.4% (or 2.2 TWh)

[20] In the current planning there are four sites where the conversion is expected to be delayed by several months. This should have a limited impact on the gas production from the Groningen gas field as long as other measures remain on schedule.
[21] 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.

following lower gas extraction from the Groningen field. As a consequence, the utilization rate of nitrogen blending facilities has increased from an average of 90% through the GY 2018/19 to an average of 100% of firm capacity during the GY 2019/20. The utilization rate has been above 100% through the summer months (from July to September), indicating the use of back-up nitrogen capacity to produce higher volumes of pseudo L-gas, some of which has been injected into storage for usage through the 2020/21 heating season.

Figure 4.2 Utilization rate of the firm capacity of nitrogen blending facilities (%)



Higher pseudo L-gas production has been made possible with the expansion of the nitrogen blending capacity by 80,000 m^3/h N_2 at the Wieringermeer conversion facility, starting operations on 23rd December 2019, slightly before the planned start date. This has translated into an additional 48.9 TWh/year of pseudo L-gas production capability.

Total nitrogen usage for pseudo L-gas production increased by 28.4% year-on-year, from 2.6 bcm during the GY 2018/19 to 3.35 bcm in the GY 2019/20.

Altogether, L-gas production in the Netherlands has fallen by 6.1% (or 29.77 TWh) year-on-year, from 487.3 TWh during the GY 2018/19 to 457.5 TWh in the GY 2019/20. As such, the decline in L-gas production has been greater than the year-on-year reduction in L-gas consumption (-24.1 TWh) with the difference being compensated by higher withdrawal from L-gas storage sites (see Chapter 5).

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 nor on the traded volumes on Dutch gas hub, the Title Transfer Facility (TTF).

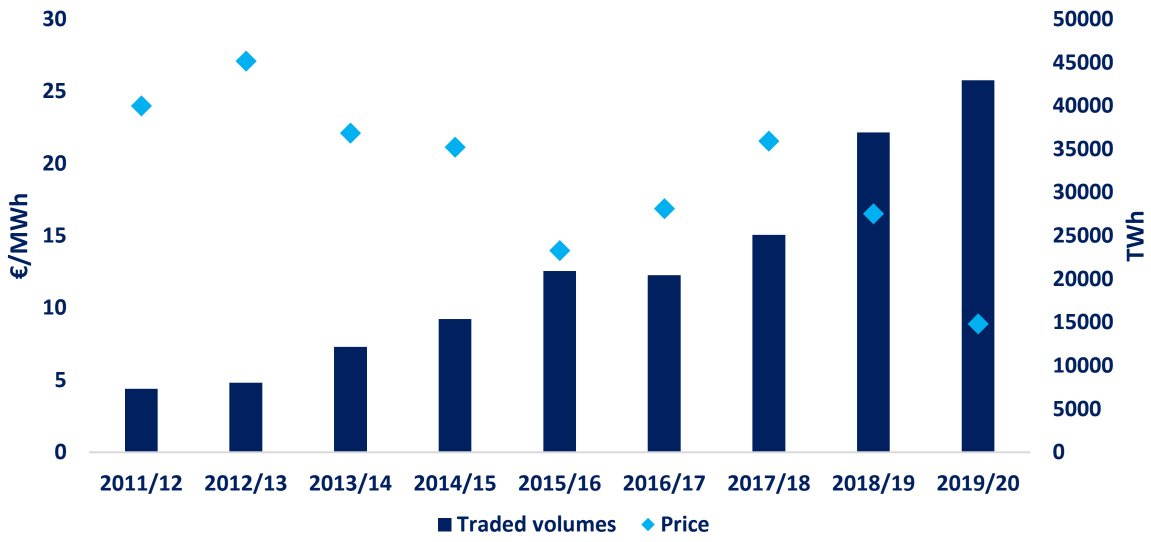
In fact, gas prices on the TTF are reflective of broader regional and global supply-demand dynamics and as such depend less on the levels of natural gas production in the Netherlands.

Natural gas prices on TTF averaged at €8.89/MWh through the GY 2019/20, their lowest price since TTF has been launched in 2003. This has been partly driven by the particularly mild winter weather conditions both in Asia and Europe, the substantial increase in liquefied natural gas (LNG) production capacity (mainly in the United States) and the slowdown of natural gas demand growth both in Asia and Europe following the Covid-19 pandemic outbreak and consequent lockdowns.

Under these market conditions, Europe –with its ample regasification and storage capacity- played a key role in absorbing surplus LNG from the global gas market, with overall LNG imports into Europe[22] rising by over 15 bcm (approximately 170 TWh) year-on-year during the GY 2019/20. The LNG influx into Europe has been particularly strong in the first half of the gas year, which in combination with lower demand provided downward pressure to natural gas prices across European gas hub, including TTF.

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

Figure 4.2 TTF gas prices and traded volumes per heating seasons (2011/12-2019/20)

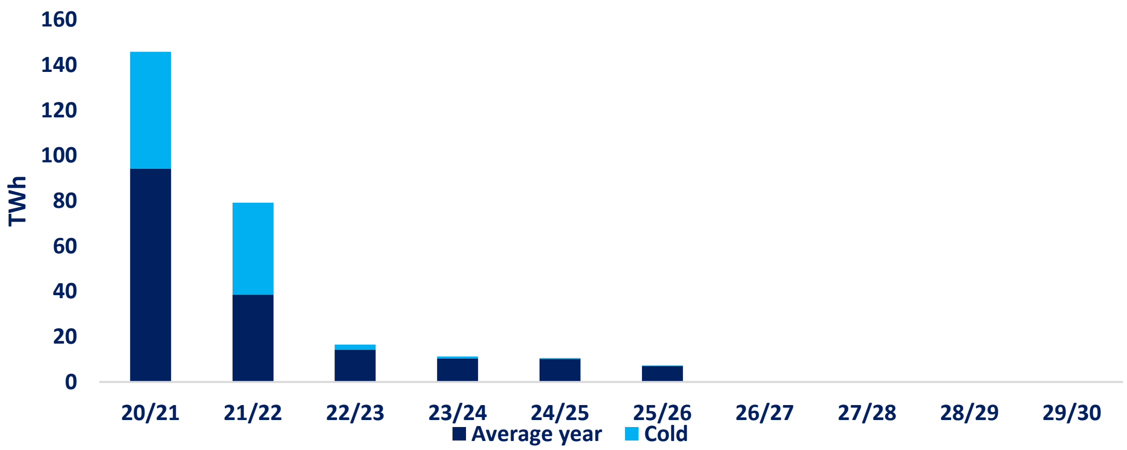


During the same period of time, traded volumes on TTF expanded by 16.3 % year-on-year to over 42,960 TWh, reinforcing TTF's position as Europe's leading gas hub. Importantly, the liquidity of the hub improved as well, as certified by the improving churn ratio[23], increasing from 70 in the GY 2018/19 to 83 in 2019/20.

4.3 Indication of the 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. The initial target has been revised down in March 2020 by the Ministry of Economic Affairs and Climate Policy, to 104.5 TWh (or 10.7 bcm) for an average GY and to 156 TWh (or 16 bcm) for a cold GY. This was possible due to the high nitrogen utilization between October and December and the expansion of the working gas volume of UGS Norg.

Figure 4.3 Indication of the L-gas production from Groningen in an average and cold gas year (GY 2020/21-2029/30)



It is currently being investigated what this means for the date by which 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. For the analysis of this report a scenario elaborated by GTS, based on her advice of January 2021 concerning the required Groningen production, has been used. From Figure 4.3 it becomes clear that Groningen has to produce with an minimal flexible production until the GY 2025/26, to meet L-gas demand in the case of eventual extreme cold GYs and in case of a severe disruption elsewhere in the L-gas system. The Groningen field produces from GY 22/23 onwards 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. GTS concluded in her advice of January 2021, that for the base case the minimum production from the Groningen field is needed

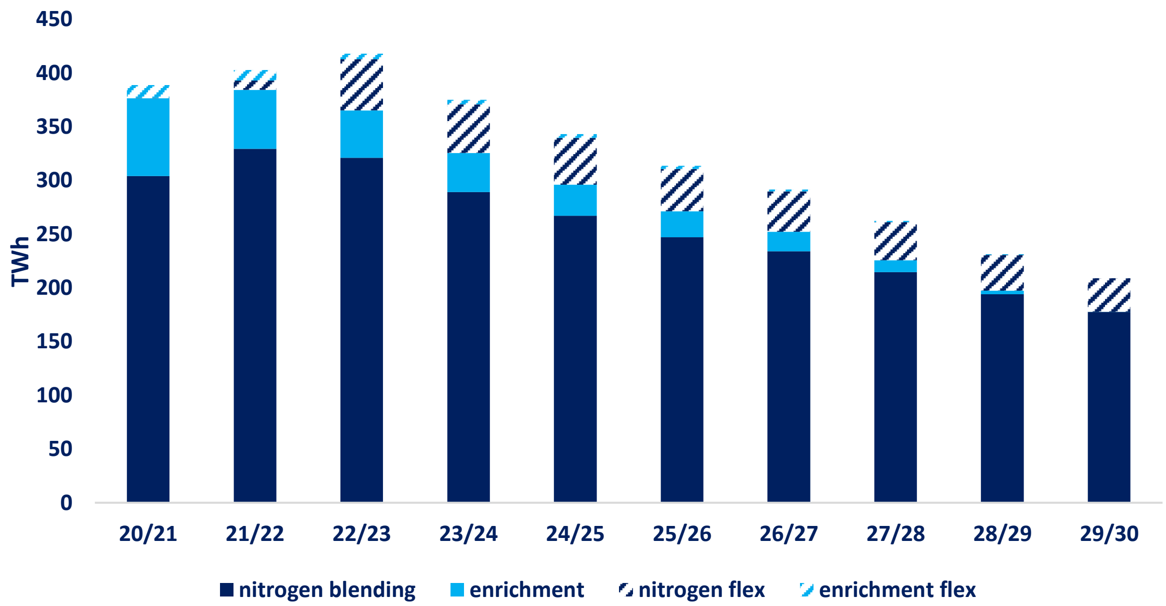
[23] The churn is the ratio between the traded volumes on a hub and the physical deliveries of the hub. A higher churn ratio suggests a more liquid and developed hub.

until GY 2025/2026. Based on the sensitivity analysis performed by GTS, a realistic timeframe for the closure of the Groningen field is between mid-2025 and mid-2028.The Government of the Netherlands wants to close the Groningen field as quickly as possible. Alternatives for the Groningen field as a backup source for security of supply are being investigated.

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 close to over 95% (or 365 TWh) of L-gas produced in the Netherlands and is set to provide over 90% 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 for close to 85% (or 321 TWh) of L-gas produced in the Netherlands and expected to provide over 85% of the upward production flexibility necessary to meet demand in a cold GY[24].

This will be supported by the new nitrogen plant at Zuidbroek, which is currently under construction and is planned to start operations from 1st of April 2022 with a capacity of 180,000 m^3/h N_2 and able to produce between 68 TWh and 97 TWh of additional pseudo L-gas. The outbreak of Covid-19 and consequent lockdowns did not have an impact on the commissioning date of the nitrogen plant. However all the slack in the project planning has been exhausted and there is a real risk of a delay on the commissioning date of the nitrogen plant.

Figure 4.4 Indication of pseudo L-gas production during an average and cold gas year in the Netherlands (GY 2020/21-2029/30)

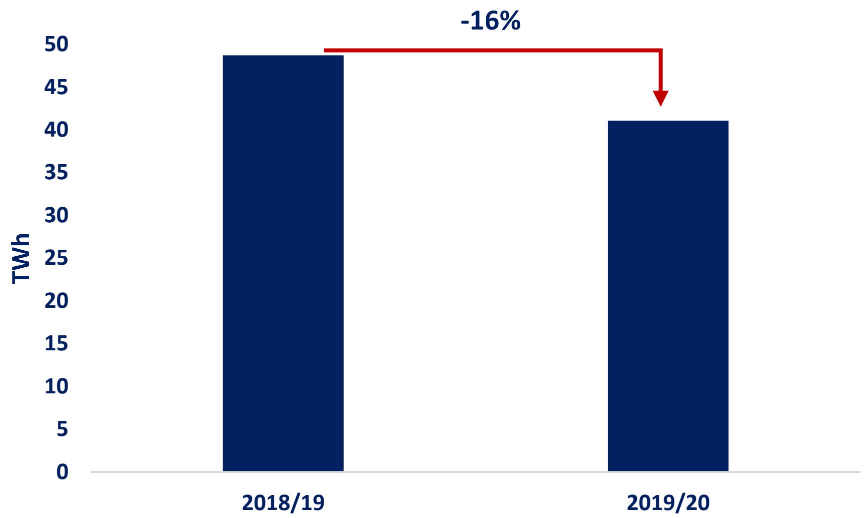


4.4 Indication of the L-gas production outside Netherlands for the period GY 2019/20 – GY 2029/30

In Germany, L-gas production decreased by 15.6% (or 7.6 TWh) from 48.7 TWh in the GY 2018/19 to 41.1 TWh in 2019/20. The overall decline in domestic L-gas production was in line with a lower L-gas consumption in Germany and did not result in an increase of L-gas imports from the Netherlands (see Chapter 1).

[24] In the case of Belgium and France, the demand profile for a cold GY has been calculated based on 1995-96 temperature profile at the request of GTS. The preferred national approach is to consider the year 1962-63 as a cold year profile both in Belgium and France.

Figure 4.5 L-gas production in Germany in the GY 2018/19 and the GY 2019/20 (TWh)

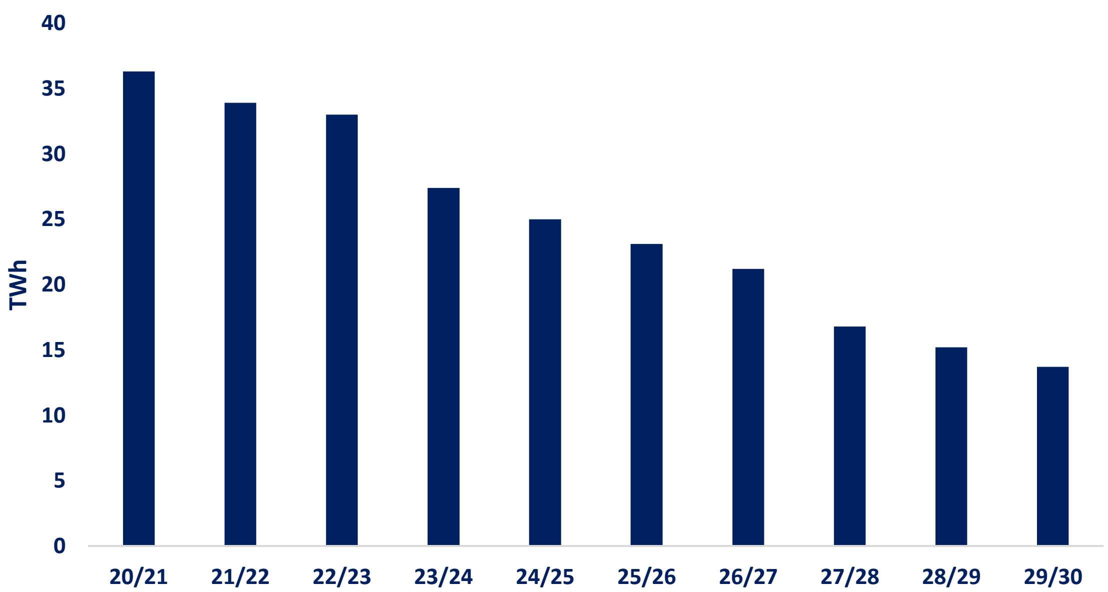


In Germany, L-gas production is expected to decrease at an annual average rate of over 10% from 41.1 TWh in GY 2019/20 to 13.7 TWh by GY 2029/30. There is one peak nitrogen/H-gas conversion facility in Germany, in Rehden, supplying only limited volumes of converted L-gas.

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. GTS has finished their construction of the H-gas connection, however, GTG is not yet connected to H-gas. GTG is still waiting for the necessary material as specified by the Dutch expert, which, according to other Dutch partners, is required to have an unusual specification. The material is expected to be available no earlier than January 2021. It is therefore anticipated that the blending facility will go into operation in Q2 2021.

Once in operation, the blending facility 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 is a further relief to the Groningen production. The building costs of the facility and its operational costs are borne by network users.

Figure 4.6 Indication of the L-gas production in Germany (GY 2020/21-2029/30) in TWh



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.

5. Storage of L-gas

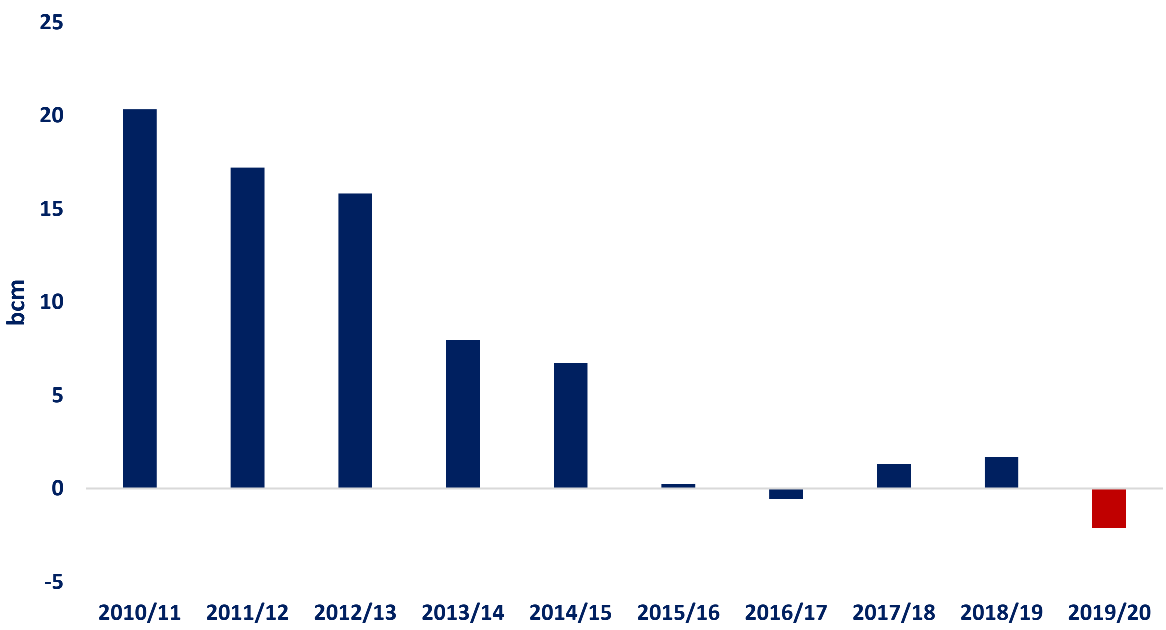
Natural gas storage plays a key role in meeting both seasonal and more short-term demand requirements, providing additional flexibility to the gas system.

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.

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 (2010/11-2019/20)



It is important to highlight that in 2019/20, the seasonal swing turned into negative (-2 bcm). This has been partly enabled by the higher pseudo L-gas output from nitrogen blending facilities on one hand and the greater withdrawal rates from L-gas storages (primarily Norg).

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

Total L-gas storage capacity in Northwest Europe in GY 2019/20 amounted to 110 TWh, with a total withdrawal capacity of 3,045 GWh/d. This represents an approximate 10% increase in working capacity compared with the GY 2018/19 due to the expansion of the permit of the Norg facility in the Netherlands.

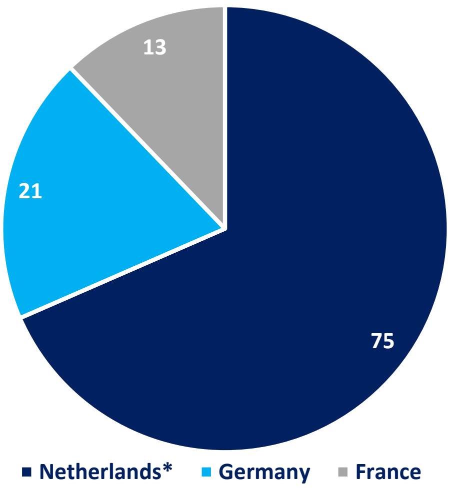
Most of L-gas storage is located in the Netherlands[25] (75.3 TWh or 68%) and Germany (21 TWh or 19%). There is one L-gas storage facility in France with a capacity of 13.4 TWh. L-gas storage in Germany is expected to decrease in 2021, as the Lesum storage facility (with a working capacity of 1.44 TWh) will be converted to H-gas, whilst at the Huntorf storage site a capacity of 70 million m³, about 22% of its total storage capacity, are planned to be converted in 2021 to store H-gas.. There is no L-gas storage in Belgium, which relies on L-gas storages located in the Netherlands.

Over two-thirds of withdrawal capacity is concentrated in the Netherlands, followed by Germany (25.6%). France’s Gournay storage facility accounts for 7% of L-gas withdrawal capacity in northwest Europe. For more details on L-gas storage please refer to Annex 4 of the Report.

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

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. It is currently investigated if the Grijpskerk storage (27.7 TWh working capacity) could be switched to store L-gas gas.

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



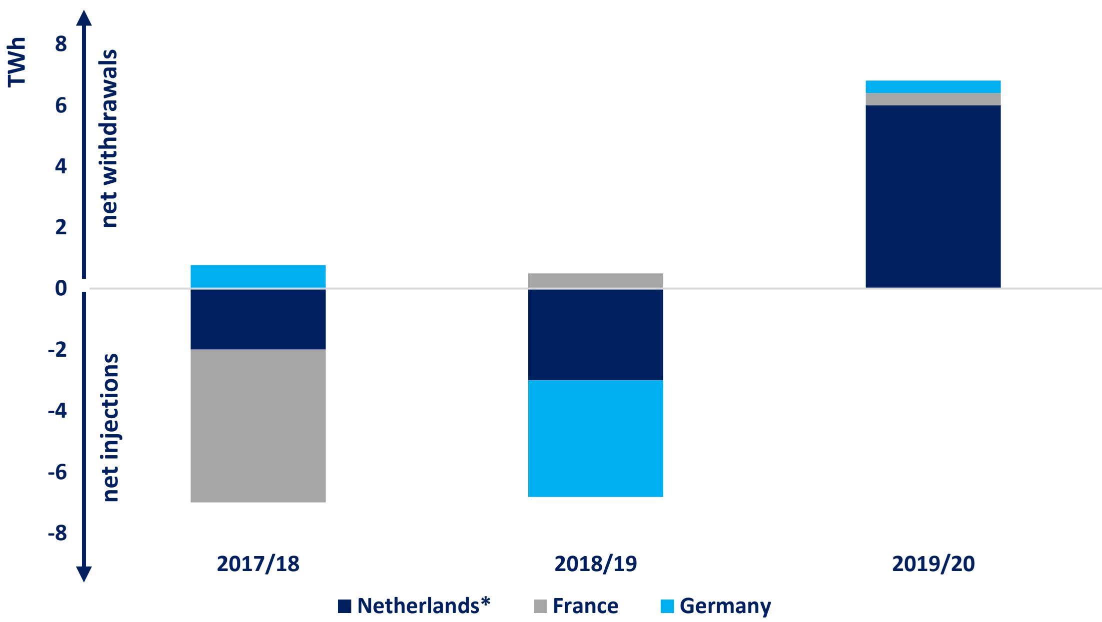
**including Norg*

5.2 The role of L-gas storage during the GY 2019/20

Storage played a key role in meeting L-gas demand through the GY 2019/2020, compensating for L-gas production falling more rapidly (-6.1% or 29.77 TWh) than Dutch L-gas consumption (-5% or 24.1 TWh).

Storage withdrawals increased by 28.9% (or 21.9 TWh) year-on-year from 75.82 TWh in GY 2018/19 to 97.75 TWh in GY 2019/20 and outpaced the growth in injection which rose by 10.7% (or 8.8 TWh) from 82.14 TWh to 90.94 TWh. As such, net storage withdrawals increased by 13.14 TWh year-on-year from -6.32 TWh in GY 2018/19 (when injection outpaced withdrawals) to 6.81 TWh in GY 2019/20.

Figure 5.3 L-gas storage net withdrawals in GY 2017/18 – GY 2019/20



**including Epe Eneco storage site located in Germany*

Worth to note, that the Norg storage facility[26] in the Netherlands alone accounted for 80% of total net storage withdrawals and for 54% of total storage supply through GY 2019/20. This is in line with GTS' advice to utilize working gas volumes to reduce Groningen gas production.

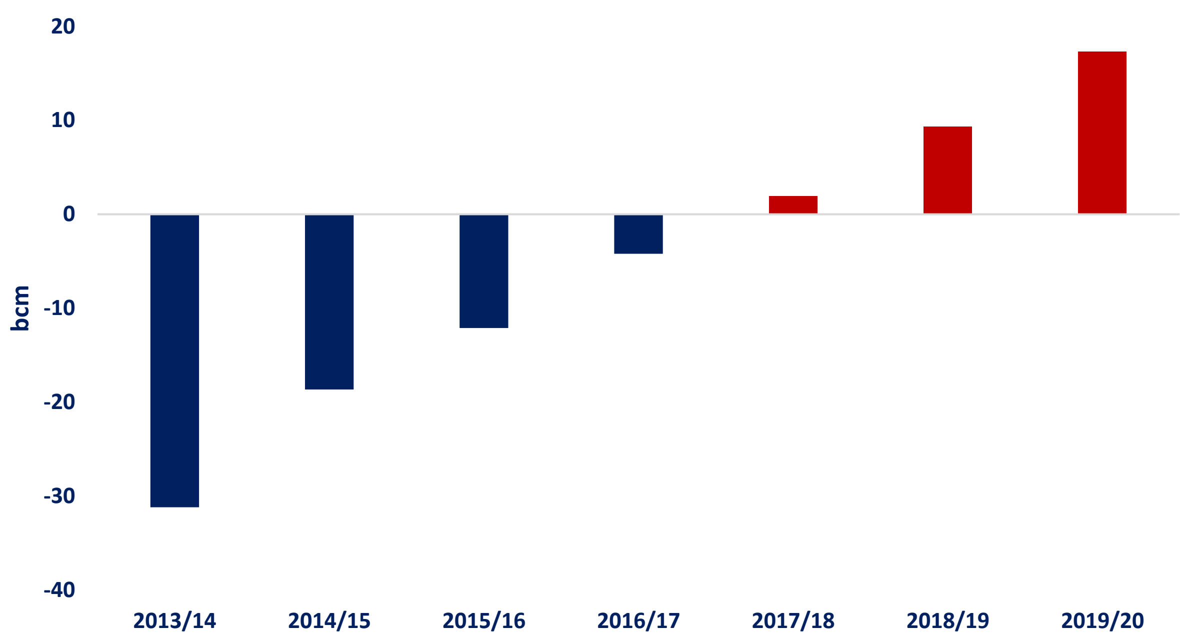
Gas supply from storage sites accounted for over 20% of total L-gas consumption[27] through the 2019/20 heating season, up from 15% during the same period in 2018/19.

6. H-gas imports into the Netherlands

As a consequence of its declining domestic production (see Chapter 5), the Netherlands almost doubled its natural H-gas imports from 28.8 bcm in GY 2013/14 to 57 bcm in GY 2017/18 when it became a net importer of natural gas for the first time in its history. Since GY 2017/18, the imports of the Netherlands remained stable (decreasing by 0.3%), whilst exports and transit flows decreased by 28% between GY 2017/18 and GY 2019/20.

Consequently, net imports of natural gas rose by more than eight-fold since GY 2017/18 to reach 17.33 bcm in GY 2019/20 –accounting for over 40% of the country's total gas consumption, based on data sourced from the electronic database of Statistics Netherlands.

Figure 6.1 Net natural gas imports of the Netherlands per gas year (2013/14-2019/20)



It is important to note, that 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.

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 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 has an annual send-out capacity of 168 TWh/y.

There are also two import interconnectors with Belgium: Zelzate and Zebra, with a combined entry capacity of over 143 TWh/y. Zebra has recently been acquired by GTS and will be integrated into the GTS network.

[26] Since the Norg storage is owned and operated by the same entity who owns and operates the Groningen field and has a direct connection with the Groningen field, the Norg capacity and working volume are taken into account in the Groningen production decisions (Dutch Mining Act, article 52c).
[27] Including L-gas produced and consumed in Germany.

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 provided by ENTSOG indicates that total H-gas entry flows to the Netherlands rose by 1.8% (or 9 TWh) year-on-year through the GY 2019/20. During the same period, exit H-gas flows from the Netherlands fell by 28.5% (or 31.3 TWh) year-on-year. This has been partly due to the lower exit flows primarily towards the United Kingdom, with flows on the BBL pipeline falling by almost tenfold from above 21.6 TWh during the GY 2018/19 to 2.6 TWh through the GY 2019/20 due to higher LNG influx into the United Kingdom. Total net H-gas imports to the Netherlands increased by 10% (or 40.3 TWh) year-on-year, largely driven by the higher feedgas needs of nitrogen conversion facilities.

Figure 6.2 shows H-gas imports to the Netherlands by main entry points, with Emden and Bunde/Oude Statenzijl accounting respectively for 36% and 28% of the total imports in GY 2019/20, whilst LNG imports via GATE for 17%, imports from Belgium for 15% and reverse flows via BBL to 5%.

Figure 6.2 Natural gas imports to the Netherlands by main entry points in the GY 2018/19 and GY 2019/20

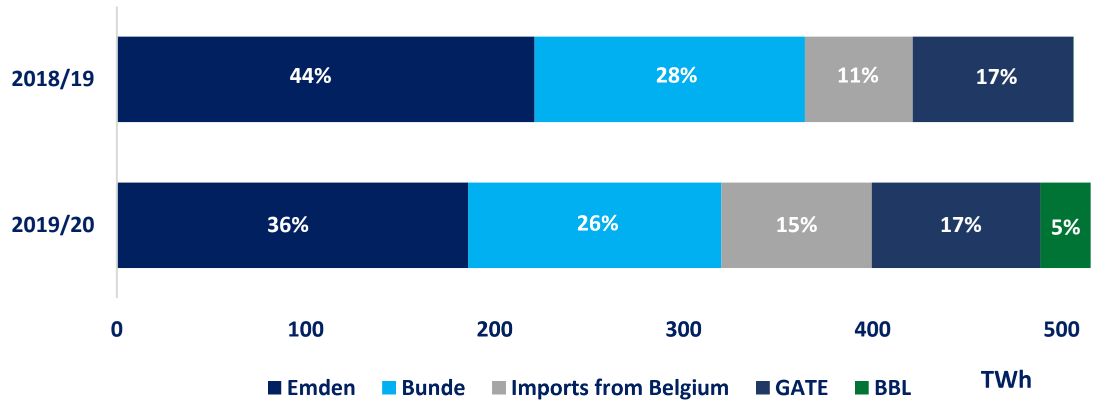
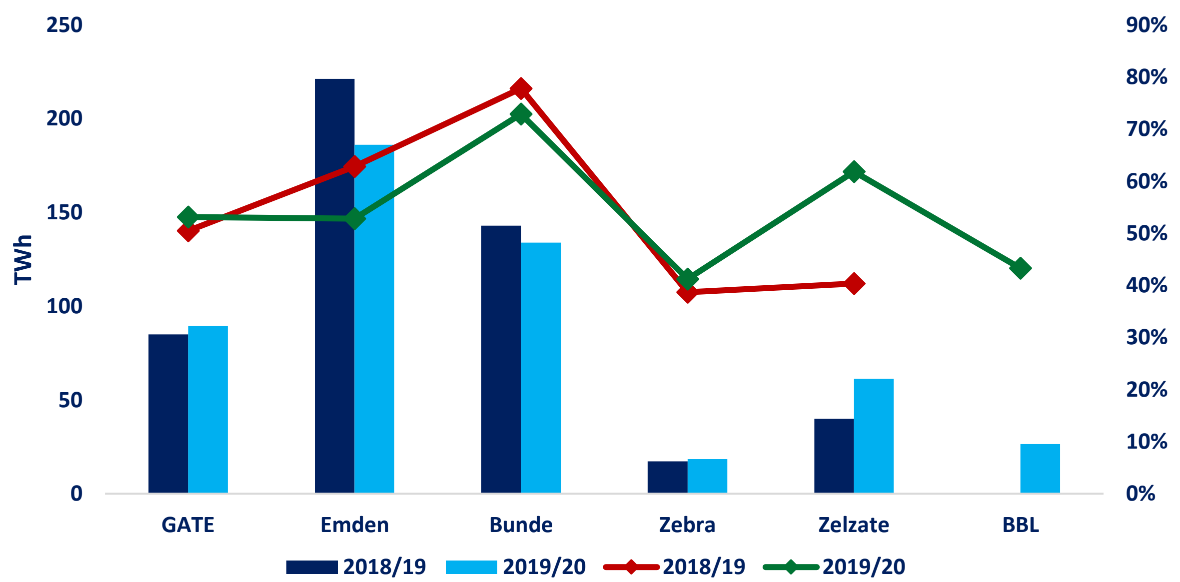


Figure 6.3 provides a comparison of the imported volumes and the utilization rates[28] of the importing facilities through the last two Gas Years.

LNG imports into the Netherlands edged up by 5.2% (or 4.42 TWh) year-on-year, increasing the utilization rate of the Gate LNG terminal to 53% during the GY 2019/20 from 50% through the previous GY.

Figure 6.3 Natural gas imports to the Netherlands by main entry points and utilization rates in the GY 2018/19 and GY 2019/20 *



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

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

Higher LNG imports and lower transit flows towards the United Kingdom weighed on the entry flows via Emden, with imports decreasing by almost 16% (or 35 TWh), driving down the utilization rate of Emden to 53% from 63% during the GY 2018/19.

Imports via the Bunde/Oude Statenzijl interconnection point with Germany decreased only slightly, by 6.3% (or 9 TWh), indicating a continued strong utilization rate of 73% through the GY 2019/20, down from 78% a year earlier. Import flows from Belgium through Zebra and Zelzate rose by almost 40%, significantly increasing the utilization rate of Zelzate from 40% to 62%.

Physical import flows via the BBL pipeline amounted to 26.5 TWh or 43% of the reverse capacity. This has been largely supported by the strong LNG influx into the United Kingdom (up by 38.4% or 63.9 TWh year-on-year).

When considering these entry points, the annual spare import capacity of the Netherlands amounted to over 390 TWh through the GY 2019/20, comparing to approximately 469 TWh of gas consumption during that period of the year.

Based on TYNDP2020 dataset, ENTSOG performed several additional disruption case calculations to investigate if sufficient H-gas supply can be delivered to the NW European markets in an average winter. The results show that there is sufficient transport capacity during disruptions in an average year and in high demand situations. Compared to TYNDP2018 (disruptions) calculations the configuration at European level has improved thanks to increased potential from suppliers (specifically extra LNG volume delivered to existing LNG terminals), new import routes in Europe (see TYNDP2020), and the reduced gas demand in France and the UK. The planned increase in capacity on the German/Dutch border raises the flexibility towards the Netherlands. In 2021, ENTSOG will perform security of supply calculations in order to investigate the transport of gas in a cold winter. For more details on the calculations see Annex VII.

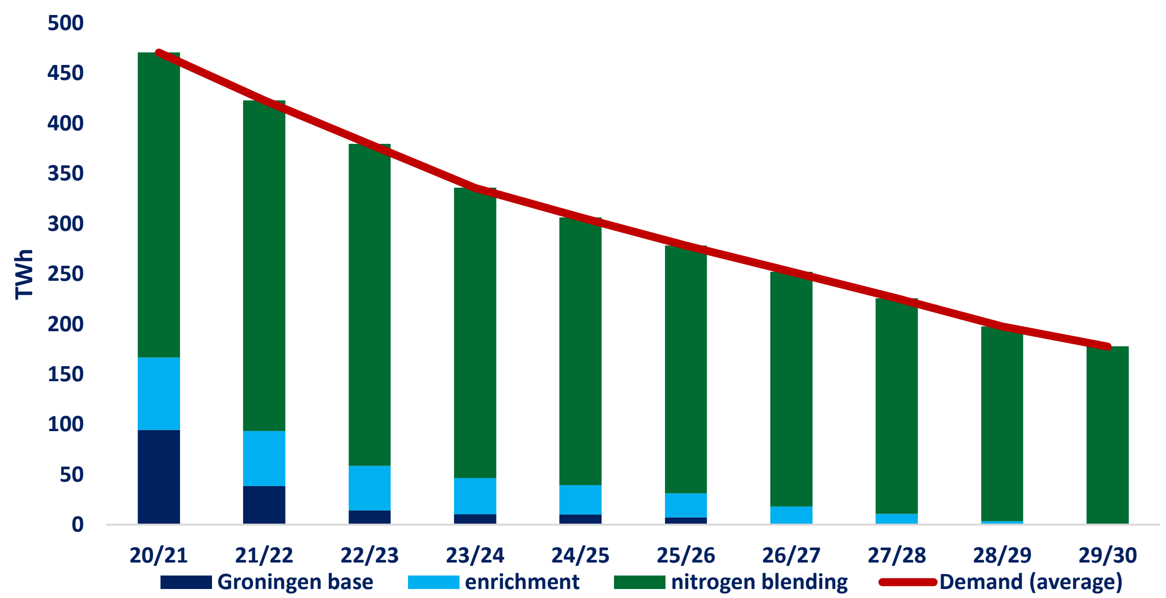
The L-Gas Market Conversion Monitoring Task Force will continue to monitor and assess the deliverability of H-gas supply to the Netherlands and the Northwest European markets served by L-gas.

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.

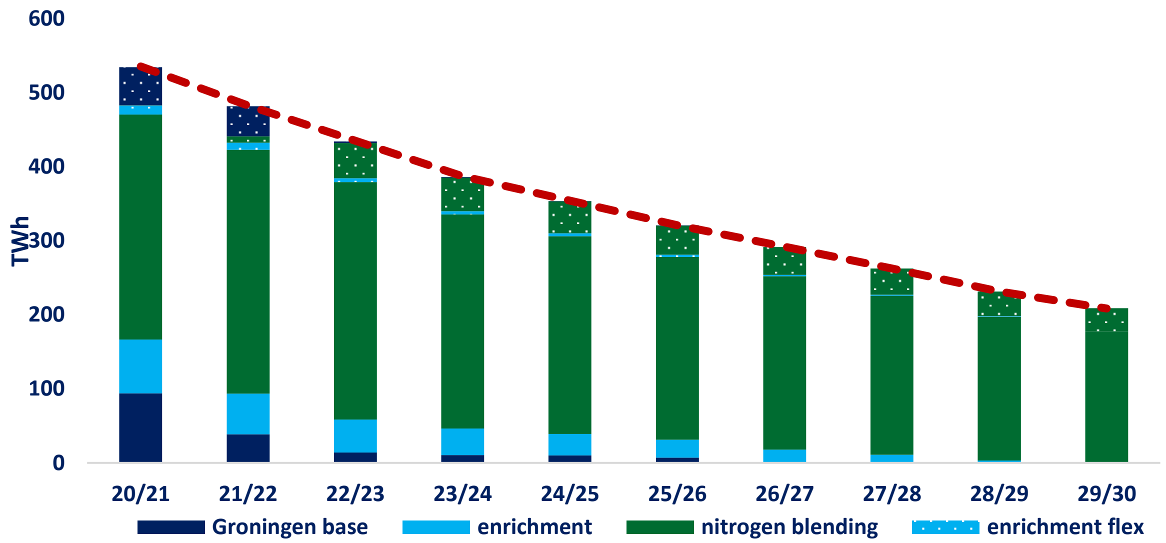
Through the market conversion period, the role of enrichment will decline in line with the decreasing Groningen production. Hence, nitrogen blending facilities will have an increasing role in meeting L-gas demand through the next ten GYs.

Figure 7.1 L-gas supply-demand balance in an average year (GY 20/21-GY 29/30)



GTS concluded in her advice of January 2021, that for the base case the minimum production from the Groningen field is needed until GY 2025/2026. Based on the sensitivity analysis performed by GTS, a realistic bandwidth for the closure of the Groningen field is between mid-2025 and mid-2028. In the consecutive GYs L-gas supply flexibility will be entirely provided by L-gas enrichment and by the nitrogen blending facilities. The Government of the Netherlands wants to close the Groningen field as quickly as possible. Alternatives for the Groningen field as a backup source for security of supply are therefore being investigated.

Figure 7.2 L-gas supply-demand balance in a cold year[29] (GY 20/21-GY 29/30)



The Covid-19 induced lockdowns had only a minor impact on the overall schedule of the conversion programs. Uncertainty around the evolution of the Covid-19 and its implications for the conversion planning and construction of the Zuidbroek facility remains a key risk. Due to the current developments, there is a real risk of delay on the commissioning date of the Zuidbroek facility.

[29] 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.

Annex

Annex I: Consumers demand for L-gas from the Netherlands through the 2018/19 and 2019/20 heating seasons

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

Gas year 18/19	Germany	France	Belgium	Netherlands
October 2018	12.6	3.1	3.2	16.8
November 2018	16.9	5.1	5.4	26.7
December 2018	20.3	5.7	6.2	30.1
January 2019	24.4	6.6	7.5	36.0
February 2019	18.3	4.9	5.4	26.3
March 2019	18.5	4.6	5.1	25.4
April 2019	13.4	3.1	3.4	16.7
May 2019	11.9	2.5	3.0	15.1
June 2019	7.1	1.6	1.6	9.6
July 2019	5.7	1.4	1.4	9.5
August 2019	6.4	1.3	1.4	8.9
September 2019	8.1	1.7	1.9	11.5
Total 18/19	163.6	41.59	45.44	232.43

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

Gas year 19/20	Germany	France	Belgium	Netherlands
October 2019	12.2	3.0	3.4	18.3
November 2019	19.1	5.0	5.5	26.7
December 2019	20.0	5.6	6.2	30.0
January 2020	19.7	5.7	6.3	30.8
February 2020	17.0	4.8	5.6	27.8
March 2020	17.1	4.5	5.3	25.9
April 2020	10.9	2.1	2.8	14.4
May 2020	9.4	1.8	2.3	12.1
June 2020	6.6	1.4	1.6	9.5
July 2020	6.3	1.3	1.5	9.7
August 2020	5.9	1.1	1.4	9.2
September 2020	7.7	1.7	1.8	11.3
Total 19/20	151.9[31]	37.9	43.6	225.6

[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.
[31] 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: 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)

	Cold		Average
	TWh	GWh/d	TWh
20/21	171.7	1032	154.4
21/22	135.1	917	121.1
22/23	116.9	802	104.7
23/24	96.1	686	85.8
24/25	76.9	574	68.5
25/26	55.9	458	51.4
26/27	42.8	343	39.4
27/28	29.7	228	27.3
28/29	11.1	115	10.2
29/30	0.3[32]	2	0.3

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

	Cold[33]		Average
	TWh	GWh/d	TWh
20/21	57.7	426.0	47.2
21/22	48.5	347.0	39.7
22/23	40.8	264.8	33.4
23/24	39.1	248.1	32.1
24/25	36.1	220.2	29.6
25/26	30.4	179.5	24.9
26/27	22.8	124.5	18.5
27/28	15.2	80.2	12.4
28/29	9.1	45.8	7.4
29/30	0.0	0.0	0.0

[32] 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).

[33] In the case Belgium, 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. The preferred national approach is to consider the year 1962-63 as a cold year profile, which is reflected in Figure 2.4 and in the table 2.2 of the Annex.

2.3 Indication of the consumers demand for L-gas from the Netherlands in France[34] until GY 2029/30 (TWh)

	Cold[35]		Average
	TWh	GWh/d	TWh
20/21	42.2	361.9	39.5
21/22	40.8	349.7	38.2
22/23	37.4	313.9	35.1
23/24	29.6	236.8	27.7
24/25	22.4	184.8	20.9
25/26	16.6	127.9	15.4
26/27	9.9	61.0	9.3
27/28	4.1	14.0	3.9
28/29	0.8	0.0	0.7
29/30	0.0	0.0	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
20/21	274.0	4558	236.4
21/22	266.8	4348	229.8
22/23	248.0	4101	212.0
23/24	229.8	3816	195.7
24/25	225.7	3610	192.1
25/26	222.3	3401	189.2
26/27	218.9	3200	186.3
27/28	215.5	2987	183.3
28/29	212.0	2795	180.4
29/30	208.6	2615	177.5

[34] For France, all data are provided on the basis of the conversion plan which was updated in 2020 based on the results of the experimental phase in 2018-2020
The expected demand for France does not take into account the quantity of L-gas blended in the H-gas network 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 2021.

The above forecasts for peak daily demands (in GWh/d) 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.
[35] In the case 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. The French regulation approach is requiring to work with a 2% risk cold GY (using Lille weather data); leading to a demand profil national reference shared with the French stakeholders, about 2% above the GTS's figures. The preferred national approach is to consider the year 1962-63 as a cold year profile, which is reflected in Figure 2.4 and in the table 2.3 of the Annex.

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]
20/21	31.5	571
21/22	19.3	495
22/23	25.4	552
23/24	20.2	505
24/25	23.7	514
25/26	17.2	484
26/27	17.0	458
27/28	20.5	326
28/29	14.7	298
29/30	5.2	108

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

Gas year	Volume converted [TWh]	Number of installations [Thousands]
20/21	7.53	323.02
21/22	6.25	335.75
22/23	1.36	71.1
23/24	2.52	101.63
24/25	4.66	96.25
25/26	6.42	166.14
26/27	6.1	129.57
27/28	4.96	91.04
28/29	7.42	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]
20/21	1	42
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	0

Annex IV: Indication of the 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*
20/21	145.8	94.2
21/22	79.2	38.6
22/23	16.5	14.2
23/24	11.3	10.4
24/25	10.6	10.2
25/26	7.3	7.1
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*
20/21	36	36
21/22	34	34
22/23	33	33
23/24	27	27
24/25	25	25
25/26	23	23
26/27	21	21
27/28	17	17
28/29	15	15
29/30	14	14

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 in GY 2019/20

	Working gas (TWh)	*Withdrawal rate (GWh/d)*
Germany		
Lesum	1.44	52
Nüttermoor L-Gas	0.43	24
Speicherzone L-Gas (EWE)	9.67	247
Empelde	3.55	73
Epe L-Gas (innogy)	1.77	98
Epe L-Gas (UES)	4.47	285
France		
Gournay	13.4	223.3
the Netherlands		
EnergyStock	3	252
Norg (Langelo)	59.34	791
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 GY 2018/19 and GY 2019/20

	2018/19	**2019/20**
The Netherlands	-3	6
France	0.5	0.4
Germany	-3.8	0.4

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

In the 2019/20 Gas Year there were 2057 degree days (including leap day), slightly lower than the 2075 degree days recorded during the 2018/19 Gas Year.

Annex VII: ENTSOG simulations

The gas system connects most of European countries, ensuring the most efficient solution for transporting and storing large amounts of energy over long periods and distances.

The resilience of the European gas system is dependent on the future development of the gas demand and the gas supply. By building different and contrasted scenarios, ENTSOG make it possible to assess the infrastructure needs for contrasted situations with the aim of encompassing all possible developments and delivering the most comprehensive assessment of the European gas system.

ENTSOG has developed a modelling approach since 2010, based on a specific structure facing the need to consider simultaneously network and market dimensions.

L-gas TF simulations

The simulations have been done using a base of TYNDP2020 simulations and some Security Of Supply assumptions for the disruption cases and assess the infrastructure capacities to meet the H-gas demand for all the needs: power, final demand and conversion to L-gas

Difference between TYNDP and SOS assumptions

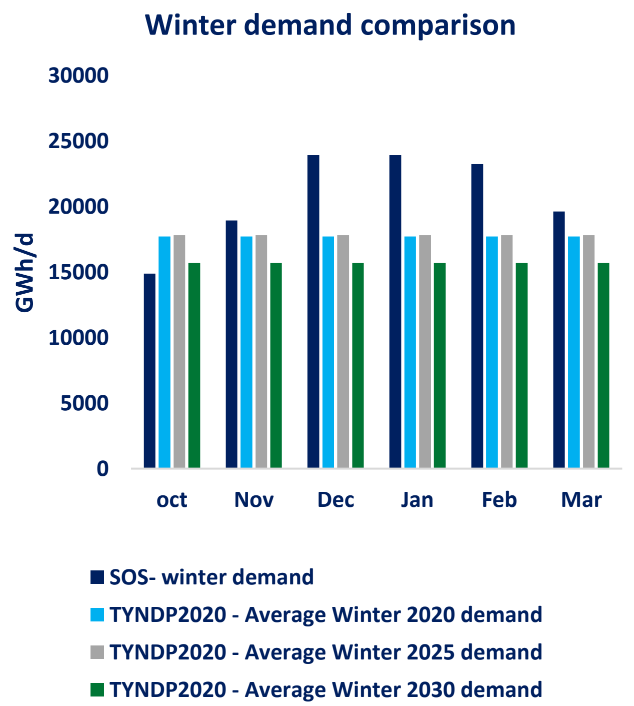
For TYNDP, the network model represents the gas market within the geographical scope of the TYNDP and refers both to the existing and planned infrastructure. Yearly and stressed gas demand data are based on different scenarios all complying with European and national ambitions. It is a long-term assessment of the resilience of Europe's gas infrastructure (20 years).

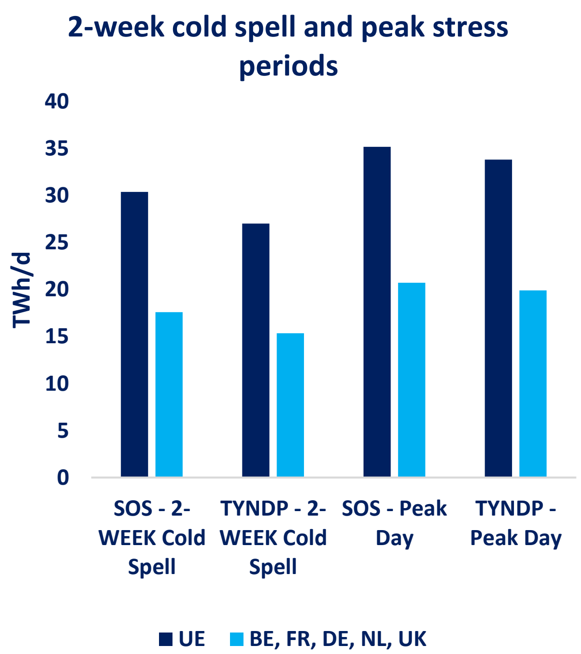
For Security Of Supply, the network model represents the gas infrastructure for the next winter season. Monthly and stressed gas demand are provided by Transmission System Operators and are the coldest demand of the last 20 years. It's a short term assessment of the resilience of Europe's gas infrastructure, in stressed demand cases and in some specific disruption cases.

Simulations input

The simulations have been done using the TYNDP2020 infrastructure, considering FID projects, the scenario gas demand for the year 2020, 2025 and 2030 (figure 1 and 2) for which the gas demand in Netherlands is at the maximum. The demand values in average winter used for TYNDP are lowest compare to SOS monthly gas demand (+21% in average). And the 2-Week cold spell and peak day values in SOS are higher compare to TYNDP values (+1.4 TWh/d in Peak day and + 3 TWh/d in 2-Week cold Spell) and the differences for Belgium, France, Netherlands and Germany area are in the same order.

Figure 1 and 2: Comparison of SOS and TYNDP2020 gas demand in winter and in stressed period (2-Week cold Spell and Peak day)





Five specific disruption cases defined the last SOS report (table 1) are simulated for this exercise.

	Risk Group	#	Disruption scenario
Eastern gas supply	Ukraine	1	Disruption of all imports via Ukraine
	Belarus	2	Disruption of all imports via Belarus
	Baltic Sea	3	Disruption of one Nord Stream offshore pipeline
		4	Disruption of the onshore receiving facility of Nord Stream (Greifswald station)
	North-Eastern	5	Disruption of all imports to the Baltic states and Finland
	Trans-Balkan	6	Disruption of the largest infrastructure to the Balkan region
North Sea gas supply	Norway	7	Disruption of the largest offshore infrastructure to the UK (Langeled)
		8	Disruption of the largest offshore infrastructure to continental EU (Europipe 2)
		9	Disruption of the largest onshore infrastructure from Norway (Emden station)
	Low calorific gas	10	Disruption of the largest L-gas storage (Gas Platform)
		11	Disruption of the L-gas supply (Gas Platform)*
	Denmark	12	Disruption of the largest infrastructure to Denmark (Ellund)
	United Kingdom	13	Disruption of Forties pipeline system
North-African gas supply	Algeria	14	Disruption of the largest offshore infrastructure to Italy (Transmed)
		15	Disruption of the largest offshore infrastructure to Spain (MEG)
		16	Disruption of imports from Algeria, including LNG
	Libya	17	Disruption of all imports from Libya
South-East gas supply	Southern Gas Corridor	18	No existing infrastructure
	Eastern-Mediterranean	19	No existing infrastructure

Table 1: Disruption scenarios

The simulations are done for the specific disruption cases above and for 3 different disruption periods:

- 2-Week Cold Spell: 15th of February to 28th of February
- Peak day: 15th of February
- 2 Months: 1st of January to 28th of February

The simulations results are showing no risk of demand curtailment (gas demand are all satisfied) in **all demand periods and disruption cases.**

To analyse the resilience of the infrastructure, we calculated the Remaining Flexibility for each country. The remaining flexibility aims at capturing the extra supply flexibility a country can access through its infrastructure. This flexibility is measured by the increase of demand an area can accommodate before an infrastructure or supply limitation is reached somewhere in the European gas system. This indicator is calculated independently area-by-area under stressful situations. The value is expressed as a percentage of the demand for a given area. The higher the value, the better the resilience.

Concerning **Netherlands**, we can observe in the figures 3, 4 and 5 some slight changes in the remaining flexibility in case of disruption cases compare to the NONE situation (without any disruptions) in all demand situations. The worst case is Disruption case 9 (Disruption from Norway at Emden station).

The configuration at European level is better compared to last TYNDP and SOS (disruptions) thanks to increased potential from suppliers, specifically for LNG, new import routes in Europe and the reduced gas demand in countries in the Netherlands area.

Figure 3: Remaining flexibility for Netherlands - 2020 - 2 months – 2 weeks – Peak day

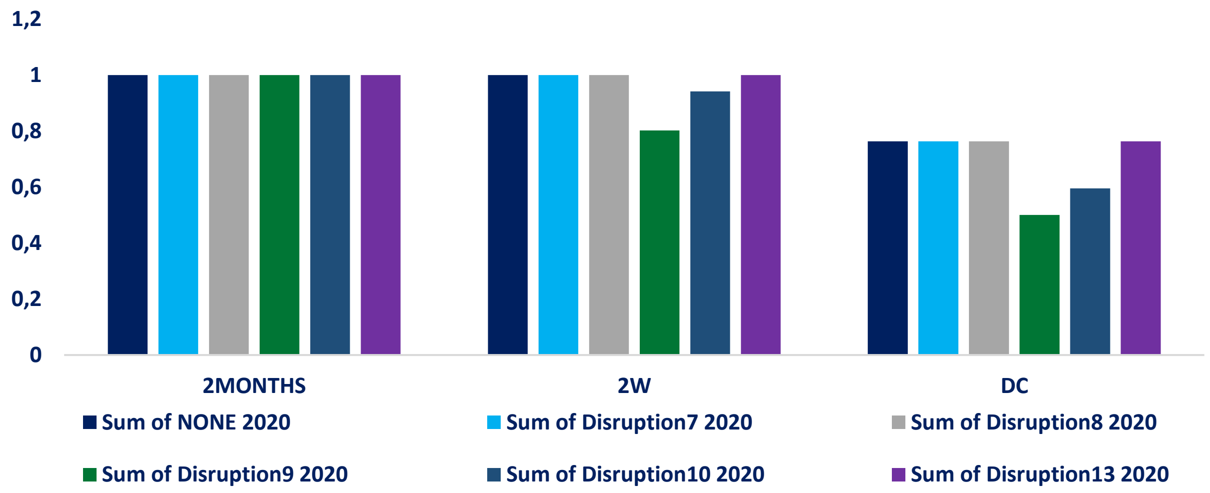


Figure 4: Remaining flexibility for Netherlands - 2025 - 2 months – 2 weeks – Peak day

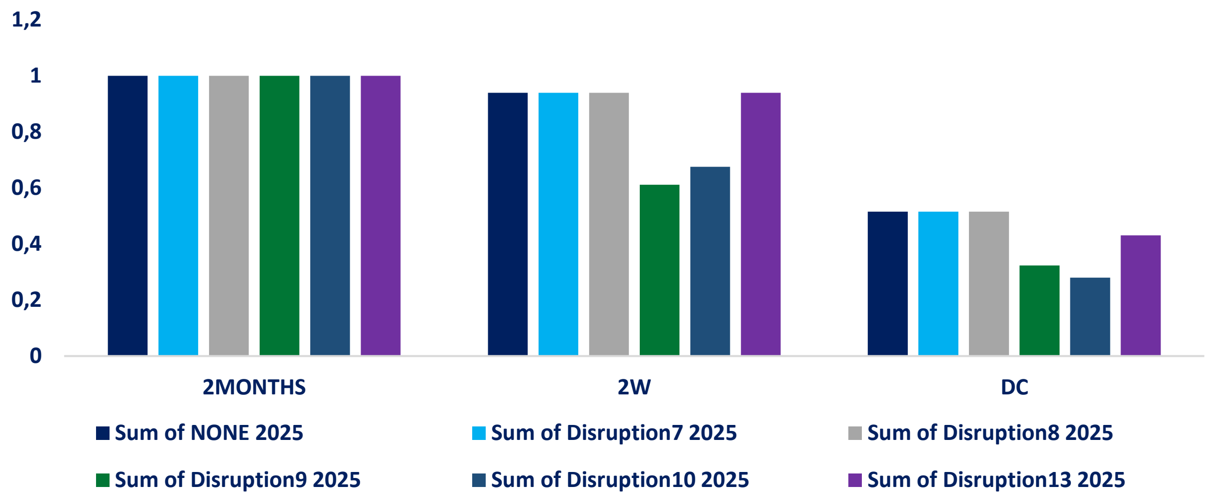
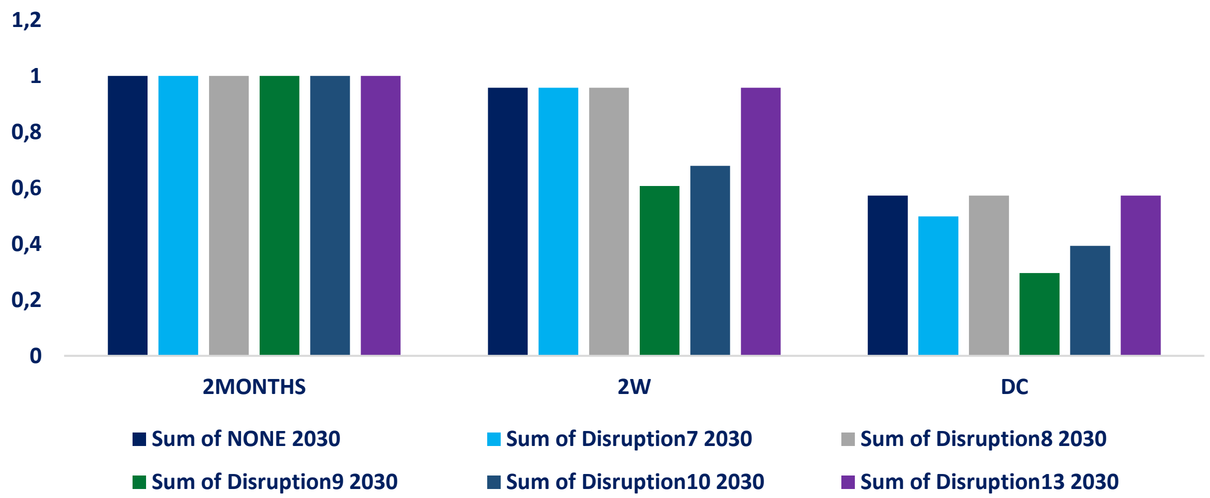


Figure 5: Remaining flexibility for Netherlands - 2030- 2 months – 2 weeks – Peak day



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