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Subject
Advice regarding required Groningen capacities and volumes for security of supply for gas year 2023/2024

Excellency,

Each year we advise you regarding the use of the Groningen field for the security of supply. These recommendations include an estimate of the required capacity and production volume of the Groningen field for the following gas year. With this letter, we are fulfilling our statutory duty[1].

European and Dutch energy markets have changed fundamentally
In recent years, many parties have worked hard to implement measures to reduce gas production from the Groningen field so it can be closed as soon as possible.
A number of measures, such as filling the Norg gas storage facility with pseudo G-gas, exporting pseudo G-gas via Oude Statenzijl to Germany (rather than gas from the Groningen field), increasing pseudo G-gas production by deploying additional baseload nitrogen and purchasing additional nitrogen, have been completed.
Furthermore, the implementation of a number of other measures is ongoing[2], these include converting households in Belgium, France and Germany from low-calorific gas (L-gas) to high-calorific gas (H-gas), converting the nine largest industrial consumers in the Netherlands from G-gas to (mainly) H-gas, completion of the Zuidbroek II nitrogen plant for additional pseudo G-gas production and converting the Grijpskerk gas storage facility to G-gas so that this gas storage facility can take over the backup role from the Groningen field.

Partly thanks to these measures, the Groningen field is 'on pilot light' for the current gas year. This means that only the minimum volume is being extracted so that, in the event of an emergency, the field can serve as backup for the security of supply. Gas extraction from the Groningen field has therefore now entered the next phase. If a sufficient supply of H-gas is secured, the Groningen field can be closed.

However, the situation in the Dutch and European energy market has fundamentally changed as a result of Russia's war in Ukraine. Until recently, Russia was responsible for about one-third of the H-gas supply to north-west Europe, but since the summer, supply has been cut off completely. This created a shortage, resulting in high prices and a drop in gas demand. Part of the lost supply has been replaced by additional Liquified Natural Gas (LNG) via existing terminals in Belgium, the Netherlands and Great Britain. The influx of this extra LNG

[1] In accordance with the Dutch Gas Act, article 10a, paragraph 1, subsection q
[2] For a more extensive description of the current status of these measures, see Annex 1.

has resulted in a reversal of gas flows: supply from Great Britain and Belgium, via the Netherlands to Germany, has increased considerably. However, this is not enough to replace the entire supply of Russian gas, and this has far-reaching consequences for energy supply in the Netherlands.

Prior to the loss of H-gas imports from Russia, there was sufficient H-gas supply to meet the full market demand for H-gas as well as the maximum production of pseudo G/L-gas. Therefore, when drawing up our analysis for the Groningen estimate, we could limit calculations to balancing supply/demand on the G/L-gas market, and we could disregard the H-gas market requirements.
However, there is currently insufficient supply of H-gas to fully serve both markets. The gas market is in equilibrium because the shortage of H-gas has resulted in (very) high prices – with negative consequences for citizens and companies – and to a decrease in gas demand. We expect this this mechanism to continue working in the future.

Due to changes in the balance of supply and demand, we have recalibrated the assumptions in our analyses regarding security of supply and taken the significantly changed supply and demand situation as the starting point. Our models can deal with the physical changes well, but market behaviour – a key variable for model outcomes – is difficult to predict. For example, the interaction of shortages, price and gas demand. These trends affect the Dutch market as well as the market in the rest of north-west Europe.

As stated in the Dutch Gas Act[3], our recommendations are based on minimising production from the Groningen field. Therefore, in our analyses, we assume maximum utilisation[4] of the existing supply routes and for our volume recommendations, we work with a scenario that expects a decline in market demand. As long as supply remains limited, prices will remain relatively high, thus reducing market demand. This market mechanism means that our scenario assumes a volume decrease, which means that less Groningen production is needed for security of supply.

Groningen field uncertainty for gas year 2022/2023
In the summer of the 2021/2022 gas year much effort was made to ensure the gas storage facilities were full for the current winter. Russian gas was still available for part of last summer, but this is not expected to be available for the summer of the 2022/2023 gas year. A shortage of H-gas may therefore present a challenge when filling the gas storage facilities. The extent of this challenge this summer will depend on several factors. For example: the temperature during the rest of the winter, the LNG capacity used, the amount of gas withdrawn from the gas storage facilities and whether gas demand remains at the current low level. These factors will determine whether additional measures are needed to fill the gas storage facilities to ensure security of supply for next winter.

Groningen capacity and volume recommendations
Based on our analyses, we conclude that in the 2023/2024 gas year, the capacity of all current production sites in the Groningen field will be required for security of supply. Based

[3] In accordance with the Dutch Gas Act, article 10a, paragraph 1, subsection q, no. 1
[4] Full utilisation based on the technical capacity, or based on the volume available for the Netherlands. For further information, see Annex 2.

on this conclusion, we recommend no irreversible steps be taken in the current and upcoming gas year and therefore to keep all production sites in the Groningen field open. Keeping all production sites open with a total capacity 43 GWh/h[5] (4.4 million m^3/hour) will have a limited impact on the forecast Groningen production for the current gas year: because more production sites will remain open coming summer, the forecast Groningen production for the 2022/2023 gas year will increase by 4 TWh (0.4 billion m^3) to 31 TWh[6] (3.2 billion m^3).
Keeping all the Groningen field production sites open in the 2023/2024 gas year will result in the same minimum flow forecast for that gas year, namely 31 TWh (3.2 billion m^3). In addition, we recommend maintaining the Groningen production volume at a maximum of 15 TWh (1.5 billion m^3, also known as the 'backup volume') which can be deployed under certain critical conditions, such as an acute gas shortage.

Due to the considerable uncertainty in the current energy markets, we have worked out a large number of scenarios in detail. Our analysis shows that there are conceivable scenarios in which the minimum flow is sufficient to ensure security of supply. However, there are many uncertainties in the assumptions[7] on both the demand and supply sides, unfortunately with greater chance of setbacks than good fortune. In such scenarios with setbacks, the minimum flow from the Groningen field will not be sufficient to ensure security of supply.

We continually monitor trends in the gas market. This is certainly important now, as all of Europe is facing gas shortages and is taking steps to eliminate them as soon as possible. For example, floating LNG terminals have recently come on stream in Germany, which may soon reduce Germany's dependence on high-calorific gas supplied through the Netherlands. As a result – regarding additional LNG supply for Germany – there may be more H-gas available for the Netherlands. More LNG terminals will be operational by the end of 2023, which probably means that Germany will be able to meet its own gas demand.
In addition, various parties are investigating additional LNG import capacity in the Netherlands. Should such initiatives go ahead, they will not result in additional supply before the middle of the next gas year, at the earliest. We will inform you if all these trends result in changes to the planning assumptions and affect the forecast Groningen production for the 2023/2024 gas year.

We are committed to closing the Groningen field as soon as possible

The loss of Russian H-gas supply has had such a considerable impact on the gas balance that additional measures will be needed to ensure security of supply in the Netherlands. Various initiatives in the Netherlands and Europe have already been launched, including measures on both the supply and demand sides:

i. Additional LNG infrastructure and LNG supplies in (north-west) Europe;
ii. Structural energy savings and gas demand reduction;

[5] All volumes in this estimate are shown in TWh. This unit of energy can be converted to billion (n)m3[35.17] by multiplying the number of TWh by 3.6/35.17. The capacities in this estimate are shown in GWh/h, which can be converted at (n)m^3[35.17] by multiplying by the same factor.
[6] We have already indicated this in our advice entitled Aanvullend advies leveringszekerheid voor benodigde Groningencapaciteiten en -volumes gasjaar 2022/2023, dated 16 September 2022, our ref. L 22.0478
[7] See Anex 2 for a clarification of the planning assumptions

iii. Diversifying supply routes and sources: creating diversity in supply, including LNG, and further optimising the network, primarily focused on enabling the current reversal of gas flows;
iv. Well-thought-out gas storage policy: prior to the winter season, fill seasonal gas storage facilities to at least the level required to ensure security of supply for the following year, and if possible, ensure that gas remains in the storage facilities so the challenge to fill the storage facilities next year is not so great. We can also consider filling the seasonal gas storage facilities as soon as conditions permit, in other words, during the winter season, as other countries are already doing.

We will continue our efforts to ensure security of supply in the Netherlands without production from the Groningen field. Unfortunately, geopolitical uncertainty and gas market trends mean this will not be possible if we are to guarantee security of supply for the coming 2023/2024 gas year.
We will continue to monitor energy market developments closely and will keep you informed of any relevant developments.

Yours faithfully,

Bart Jan Hoevers
CEO

Annex 1: Status of measures to reduce Groningen production
Annex 2: Estimated Groningen capacities and volumes required

Annexes

Annex 1: Status of measures to reduce Groningen production

To minimise the Groningen production required for security of supply, measures can be taken on both supply and demand side. A number of these measures, such as filling the Norg underground gas storage facility with pseudo G-gas, exporting pseudo G-gas via Oude Statenzijl to Germany rather than gas from the Groningen field, increasing the use of baseload nitrogen and purchasing additional nitrogen, have been completed. Other measures are still in progress. In this Annex, we provide a brief status of these measures. Besides measures related to the L-gas market, a number of measures are now included which contribute to improving H-gas availability in the Netherlands. Naturally, reducing demand through sustainability measures is an important step, but that is not the topic of this letter. Sustainability measures (approved and proposed policy) are included in the Climate and Energy Outlook (KEV) via market assessment.

1. Conversion in other countries

(Pseudo) L-gas is exported to neighbouring markets in Belgium, France and Germany. These markets consist mainly of households which can only consume L-gas, which means they depend on Dutch pseudo G/L-gas and Groningen gas. To reduce supply of L-gas from the Netherlands, the gas infrastructure operators of Belgium, France and Germany have reached agreements with the Netherlands to carry out extensive conversion programmes. This involves adapting all L-gas appliances for H-gas and connecting these to the H-gas network. Total exports amounting to 134 TWh[8] are forecast for the coming gas year. Conversion in Germany, Belgium and France is on schedule. Belgium is expected to complete the entire conversion program by 1 October 2024, the start of the following gas year. The total L-gas exports to neighbouring countries will be reduced to zero by the end of this decade, see Figure 1.

[8] Winter Briefing Task Force Monitoring L-gas conversion, publication expected in February 2023

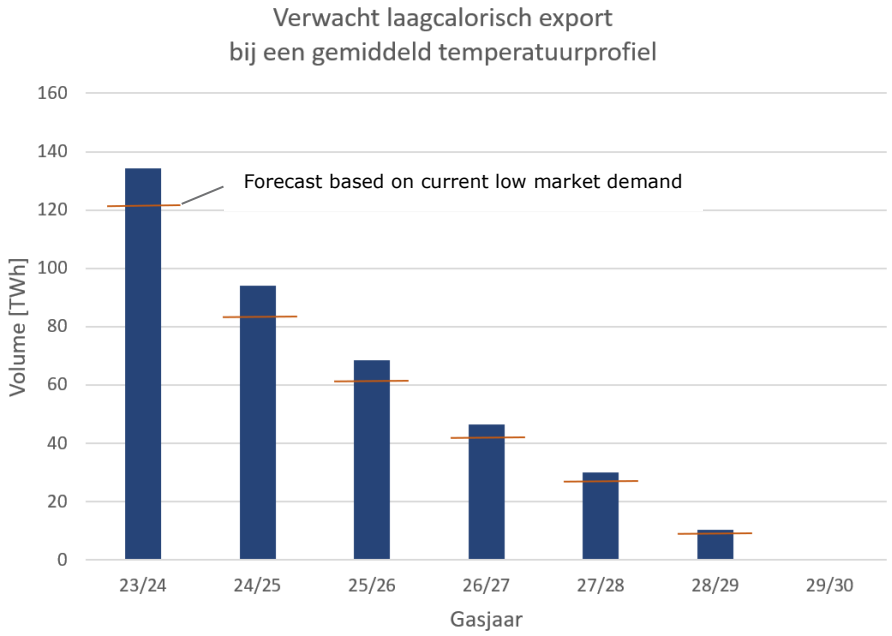

Figure 1: Cumulative forecast L-gas demand from Belgium, France and Germany for an average temperature profile for gas years 2023/2024 to 2029/2030. The blue bars indicate the forecast L-gas demand from the Netherlands issued by Belgium, France and Germany. The orange lines show GTS's forecast for those same gas years based on current (price-driven) low market demand.

2. Commissioning the Zuidbroek II nitrogen plant

The construction and commissioning of the Zuidbroek II nitrogen plant contributes to minimising the Groningen production required: it reduces the role of the Groningen field to production in exceptional situations and accelerates its closure[9]. The COVID-19 pandemic, the subsequent lockdowns and a dispute between the Engineering, Procurement and Construction (EPC) contractor and subcontractor have caused delays. This forecast covers the 2023/2024 gas year, and we assume that the new nitrogen plant will be available at the start of the gas year. The winter of the 2023/2024 gas year will be the first full winter in which the nitrogen plant will be operational and could be fully deployed. DNV-GL previously raised concerns about the availability of the new plant and suggested that the new plant may have a significantly higher failure rate due to 'teething problems'[10]. Furthermore, it is also conceivable that, due to limited H-gas supply, there will be periods when insufficient H-gas is available to use all the nitrogen produced for pseudo G-gas production.

[9] https://www.rijksoverheid.nl/actueel/nieuws/2021/03/08/wetsvoorstel-wat-na-nul-in-internetconsultatie
[10] Validatie van het GTS advies van 31 januari 2020, dated 10 February 2020, report no.: OGNL.192233.1

3. Use of Grijpskerk for G-gas storage

Work began last year to convert the Grijpskerk gas storage facility to G-gas instead of H-gas. On 1 April 2022, you approved the amended storage plan necessary for this conversion. During the summer injection season in the 2021/2022 gas year, the gas storage facilities were filled with G-gas, 21 TWh in total[11]. The leaning process for the gas storage facility is expected to be completed in the current gas year. This means that the full available working volume of G-gas will be produced (this was done during October 2022) so that can be switched to producing a mixture of L-gas and H-gas. This additional production frees up capacity in the gas storage facility for injecting G-gas in the coming injection season. All this is designed to increase the working volume of G-gas so that the gas storage meets the specifications in capacity and working volume to take over the role of backup from the Groningen field. The Nederlandse Aardolie Maatschappij (NAM) has indicated that it expects a low-calorific working volume of 12 TWh to be available by 1 October 2023[12].

4. Conversion of large industrial consumers

On 20 June 2020, the 'Bill to amend the Gas Act concerning the ban on low-calorific gas for the largest customers' came into force[13]. This change in the law prohibits the use of G-gas after October 2022 by companies with an annual consumption greater than 1 TWh per annum, during at least two of the three gas years 2016/2017, 2017/2018 and 2018/2019. Nine companies met these criteria. If these companies submitted an application to GTS, GTS was obliged to disconnect them from G-gas by 1 October 2022 and if required, connect them to an alternative source, such as H-gas. Five industrial consumers no longer use G-gas since the statutory deadline. Conversion of the other four industrial consumers is more complex, and this is planned for the coming gas years[14,15,16]. They have been granted a temporary exemption from the ban on consuming low-calorific gas until the planned conversion date.

5. Increasing LNG supply

During the past year we have invested in expanding the supply of Dutch LNG. Modifications have been made to the Maasvlakte GATE terminal allowing more LNG imports. In addition, we have invested in a new floating LNG terminal in Eemshaven, the Eemshaven Energy Terminal, which came on stream in September 2022. This creates both additional capacity and volume. These two projects mean that the Netherlands can now import about 117 TWh extra LNG. This gas is intended for the European gas market.
However, this supply will not completely replace the Russian gas supply.

Several applications to supply additional LNG via floating terminals are awaiting approval in the Netherlands, but these initiatives have not yet resulted in a final investment decision (FID). Extra LNG import capacity is also being constructed in other north-west European

[11] Stand van zaken conversie Grijpskerk, dated 23 November 2022, Annex to the document with your reference PDGGO-DSGG / 22567440
[12] Stand van zaken conversie Grijpskerk, dated 23 November 2022, Annex to the document with your reference PDGGO-DSGG / 22567440
[13] Wetsvoorstel houdende wijziging Gaswet betreffende verbod op laagcalorisch gas voor de grootste afnemers, dated 3 December 2018, ref. DGETM-E2020/18285567
[14] Voortgang en planning ombouw van industriële grootverbruiker, dated 8 December 2020, our ref. L 20.0616
[15] Verdere versnelling sluiting Groningenveld mogelijk, dated 16 June 2021, our ref. L 21.0252
[16] 6 Aangepaste planning voor de ombouw grootverbruiker, dated 23 November 2021, our ref. L 21.0535

countries. Three floating LNG terminals are expected to come on stream in Germany during the current gas year, with the option for another three to follow. Part of the H-gas supply required in Germany will then no longer have to be supplied from the Netherlands, making more H-gas available in the Netherlands.

6. Pressure increase BBL

BBL Company (BBLC) is the operator of the 230 km pipeline between Balgzand in the Netherlands and Bacton in Great Britain. The capacity of the pipeline is 20.6 GWh/h from the Netherlands to Great Britain and 7 GWh/h from Great Britain to the Netherlands. BBLC has agreed a 'pressure service' with National Grid (the operator of the British gas system) which aims to increase the capacity from Great Britain to the Netherlands from 7 GWh/h to 10 GWh/h. This service is being provided on a best efforts basis by National Grid.
This service is subject to approval by Ofgem, the British regulator, before it can come into effect. BBLC expects to be able to use the service from spring 2023, allowing additional volumes to be transported through the BBL to the Netherlands.

Annex 2: Estimated Groningen capacities and volumes required

It is our statutory duty to advise you on the Groningen capacities and volumes required for the 2023/2024 gas year from the security of supply perspective.
In this Annex, we discuss the process and outcomes leading to our recommendations.

Model

The model used for calculating the Groningen capacities and volumes consists of a supply and demand side.
Every hour these should be in balance: demand is met with supply. Last year, during the forecasting process for the current gas year, we only used the G/L-gas supply/demand balance in our model. We assumed, as in previous years, that there would be sufficient supply of H-gas to facilitate H-gas demand as well as optimally deploying conversion resources. In other words, there was always enough H-gas to deploy 100% of the baseload conversion resources, enabling maximum pseudo G-gas production. With the loss of Russian H-gas supply, we can no longer assume this. For this reason, this year's estimates will be based not only on the supply/demand balance for G/L-gas but also for H-gas. We do this for determining the capacity needed to meet a high gas demand situation (peak day) and determining any additional volume that may be required from the Groningen field.
For our model we make the best possible estimate of expected supply and demand, but there are still many uncertainties. Historical data cannot always be used for future forecasts because the loss of Russian H-gas has led to considerable changes in gas flows. For example, more volume from Belgium and, conversely, less volume from Norway and Germany. Moreover, the effect of additional national measures, such as the price cap on demand, is unclear, and the feasibility of LNG projects and availability of LNG for Europe is uncertain. We are closely monitoring trends on both the supply and demand sides. If new insights lead to a change in the planning assumptions used for this estimate and these affect the expected Groningen production, we will inform you in accordance with our statutory duty[17].

Security of supply recommendations for Groningen capacity in the 2023/2024 gas year[18]

In previous recommendations, the infrastructure standard[19] was used to determine the Groningen capacity required. This standard requires that the so-called
N-1 formula be calculated. This gives the technical capacity of the gas infrastructure which is needed to meet the total gas demand in a calculated area in the event of a disruption of the largest single gas infrastructure during a day with exceptionally high gas demand that occurs with a statistical probability of once every 20 years. This includes taking the utilisation rate of existing infrastructure into account[20].

This infrastructure standard is also used for this estimate. When estimating H-gas import flows, we include the expected utilisation rate for some of these as the most realistic planning assumption. This applies to the supply of H-gas from the small fields[21], Great

[17] In accordance with the Dutch Gas Act, article 10a, paragraph 11
[18] In accordance with the Dutch Gas Act, article 10a, paragraph 1, subsection q, no. 1
[19] In accordance with EU Regulation 2017/1938, article 5
[20] In accordance with EU Regulation 2017/1938, article 5, paragraph 1
[21] Small field producers' own declaration of production, adjusted by a historical factor for the difference between the declaration and actual production.

Britain[22], Belgium[23], Germany[24] and Norway[25]. For the other sources, L-gas and H-gas, we assume full technical availability at the time of extremely high demand, in line with the infrastructure standard. This therefore applies to the seasonal gas storage facilities, as well as to the capacity at the LNG terminals. Wherever possible, capacities are based on public sources[26, 27, 28]. On the demand side, the exceptionally high gas demand which occurs once every 20 years, translates to an effective daily average temperature of -15.5°C. At these temperatures, we have considered demand for both low- and high-calorific gas from Belgium, France, Germany, Great Britain and the Netherlands. This year (unlike last year), we have included Great Britain in the equation as we now include the high-calorific balance too. The estimated forecast demand at exceptionally low temperatures is mainly based on documented sources[29,30,31,32,33]. As usual, for domestic demand, we base our calculations on the recently published Climate and Energy Outlook (hereafter KEV 2022), the source for the foreign L-gas demand comes from the Task Force Monitoring L-gas Conversion (hereafter Task Force), where the participating countries provide a demand estimate.

Figure 2 shows an overview of the various demand and supply side capacities, to scale. The left-hand column shows the sum of H-gas and L-gas demand, the second column shows all the available L-gas and H-gas resources. This figure shows that, in the event that all other resources are available, closure of the Groningen field will result in a shortage of capacity at times of extremely high demand. This shortage can be met from the capacity of some of the Groningen field production sites currently in operation. Other measures may also be considered, such as reducing demand.

If, in line with the infrastructure standard, on top of this, failure of the largest source (Norg storage facility) is taken into account, all Groningen production sites currently operational will be needed to meet the shortfall. This is shown in the third column in Figure 2.

[22] We assume that at the time of peak demand in the Netherlands, Great Britain will need its full supply of H-gas via LNG to meet demand. See also Gas Winter Outlook 2022/23, dated October 2022, as published by National Grid. This means we do not expect H-gas to be available from Great Britain for the Netherlands during peak demand.
[23] At times of extremely high demand, Belgium will make maximum use of its LNG supply. This supply is expected to be needed to meet peak demand in Belgium, and that there will be no H-gas available for import to the Netherlands.
[24] No import expected from Germany. In the event of peak demand, Germany is expected to draw off the maximum available H-gas, to meet its own demand as well as for transport to other countries. Established in consultation with German Transmission System Operators (TSOs).
[25] Estimate based on the current actual production. Norwegian production is currently at its maximum. This is distributed among several European countries, with a large portion from one of the corridors going to Germany. The remainder of this corridor goes to the Netherlands. As long as Germany does not have sufficient other sources of H-gas (i.e., LNG), it is expected that the distribution ratio will be the same at the time of high demand.
[26] https://agsi.gie.eu/
[27] https://alsi.gie.eu/
[28] Use of German H-gas storage facilities behind Oude Statenzijl during peak demand estimated in consultation with German TSOs.
[29] Climate and Energy Outlook 2022, dated 1 November 2022, as published by PBL Netherlands Environmental Assessment Agency
[30] Winter Briefing Task Force Monitoring L-gas conversion, publication expected in February 2023
[31] Entsog Winter Supply Outlook 2022/2023, dated October 2022, document number SO0038-22
[32] Gas Winter Outlook 2022/23, dated October 2022, as published by National Grid.
[33] In the event of peak demand, Germany is expected to draw off the maximum available H-gas, to meet its own demand as well as for transport to other countries. Determined in consultation with German TSOs.

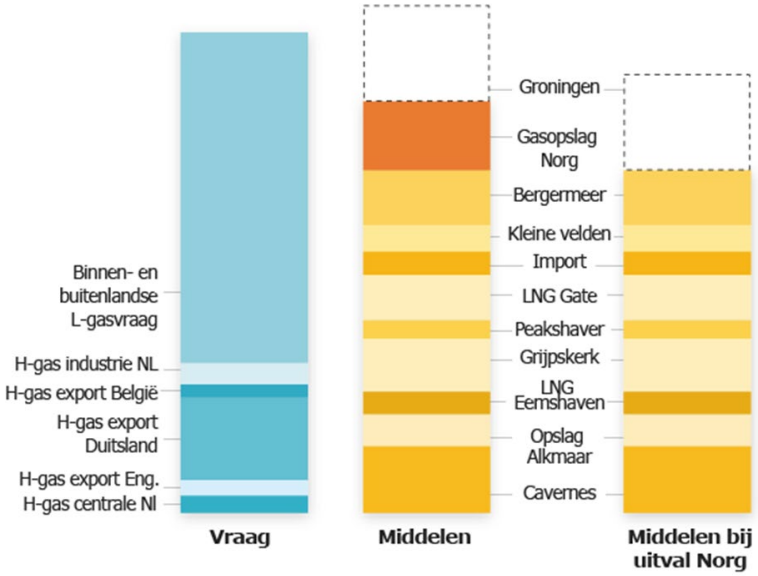

Figure 2: The forecast balance of high- and low-calorific resources for a daily average effective temperature of -15.5°C, divided into segments. The column on the left shows the demand segments where L-gas demand is based on the KEV 2022 and Task Force figures, the supply segments are shown on the right. The second column shows all available resources, with the third column showing all resources except the Norg storage facility (in line with the infrastructure standard).

For the 2023/2024 gas year, we recommend maintaining a maximum capacity of 43 GWh/h available in the Groningen field to meet supply needs at a time of peak demand.

Based on the planning assumptions and on making the full capacity of the Groningen production sites available, we still expect a capacity shortfall at times of peak demand. This capacity shortfall could be addressed in various ways: by creating more capacity supply options or by reducing peak demand, or a combination of both.

Several projects are currently underway to create additional capacity supply options, but these are not expected to be realised before the 2023/2024 gas year. For the coming gas year, a capacity shortage can be solved by reducing (industrial) demand during periods of low temperatures.

Groningen capacity recommendations for security of supply for the coming gas years

The planning assumptions can be projected to future years. Here we assume that the circumstances for H-gas supply and demand will not change with respect to the planning assumptions mentioned above. However, we can expect the H-gas supply/demand balance to change in the coming years. After all, we are currently in a supply shortage situation with resulting high prices which also impacts gas demand. We will monitor these trends and take them into account in our future recommendations. Because the future impact of the measures is very uncertain, we have not included them in the current recommendations. Nevertheless, we have modelled various scenarios for future gas years, but given the large degree of uncertainty, these results are purely indicative.

The numbers from the KEV 2022 and Task Force reports form the basis for future L-gas demand forecasts. We are also working on the assumption that gas storage facilities and LNG terminals will continue to be available. This leads us to a capacity forecast for the coming years as shown in the solid blue line in Figure 3. The orange line shows the capacity forecast calculated with a 10% reduction in the demand compared to L-gas demand as stated in the KEV 2022 and Task Force reports. This 10% reduction is based on current market trends: our analyses show that lower consumption has also reduced the capacity required to meet peak demand. Figure 3 also shows that even with an additional 10% capacity reduction on top of the capacity reduction included in the KEV 2022 and Task Force numbers, additional measures still need to be taken to close the Groningen field as soon as possible.

As mentioned above, the planning assumptions have a significant impact on the outcome of the forecast. This year, there is more uncertainty in the planning assumptions than usual. This is because historical data is not always an accurate predictor of future behaviour. We have therefore worked out several scenarios in which we changed some of the planning assumption parameters used in the KEV 2022 and Task Force figures, as shown in figure 3. The boundaries of the uncertainty margin, shown by the yellow area in the chart, are defined as the minimum and maximum capacity in a gas year, and are not necessarily any one specific scenario.

The upper boundary of the uncertainty margin yellow area is formed by scenarios with less supply or more demand. For example, existing LNG terminals that are not being fully utilised or an H-gas import flow with a capacity similar to the Eemshaven Energy Terminal that has been cut off. The lower boundary bottom of the uncertainty margin is determined by reduced demand or greater supply. The Groningen field closure can be brought forward by creating additional capacity supply options, for example with LNG terminals or by reducing neighbouring countries' dependence on gas flows from the Netherlands. Several projects designed to contribute to this goal are ongoing, but the feasibility of these projects is still unclear. Therefore, with all the uncertainty and developments in the gas market, at present we cannot advise you regarding a new date for closing the Groningen field.

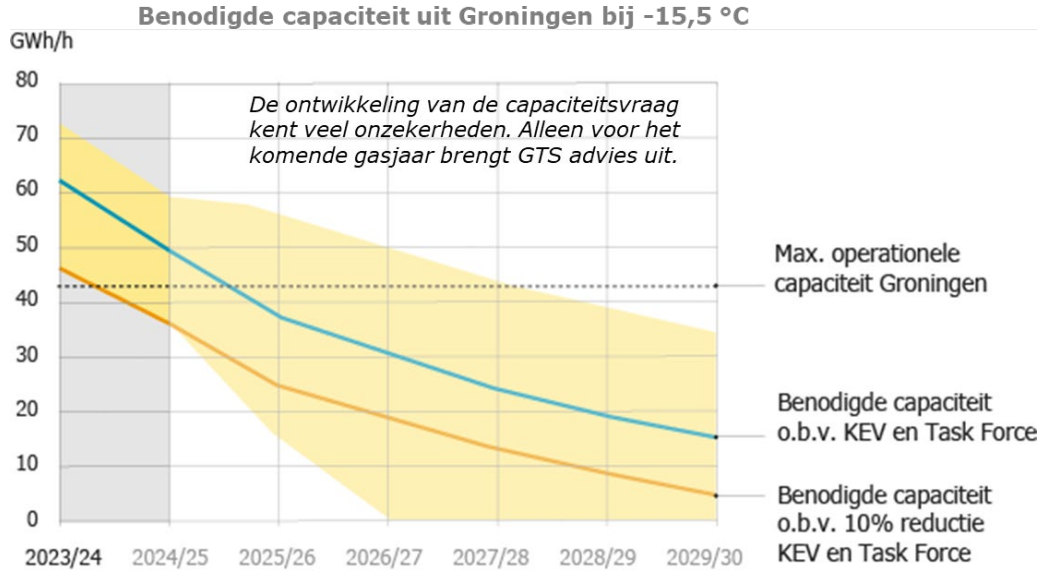

Figure 3: forecast capacity required from the Groningen field for security of supply for gas years 2023/2024 to 2029/2030. This is calculated in accordance with the infrastructure standard, so without the Norg gas storage facility. The figure shows two scenarios fully represented by the solid lines and the variations in the other scenarios examined are represented by the uncertainty margin (yellow area). Further information is provided in the text.

Method and planning assumptions for determining required Groningen field volume

Additional Groningen field volume required for security of supply in the 2023/2024 gas year is derived from a supply and demand balance. This is not calculated for a particular point in time, such as with peak demand, but for an entire gas year. Because demand is partly temperature-related, temperature profiles for the past thirty years were calculated. Temperatures from the 1995/1996 gas year were used for a cold temperature profile, 2004/2005 for an average temperature profile, and 2006/2007 for a warm temperature profile[34].

These temperature-related demand profiles were then filled with the various resources, including L-gas and H-gas resources. The idea is that the total demand, the sum of the L-gas and H-gas demand, is always covered. This means that the H-gas supply is deployed first to meet H-gas market demand. This is in line with the security of supply definition as stated in the Explanatory Memorandum to the Act to minimise gas production from the Groningen field (Wet Minimalisering Groningen)[35]. After all, this states that security of supply means that "end customers of gas are supplied at the right time with the correct quality (low- or high-calorific) gas and with the required quantity, even when demand is high" [36]. The remaining H-gas supply can then be made available for conversion to make pseudo G-gas. As always, the Groningen field is the balancing post in the model so that extraction from the Groningen field is kept to a minimum while still guaranteeing security of supply.

[34] In accordance with description in the Implementation Regulation as part of the Gas Act article 3a, paragraph 4
[35] Act of 17 October 2018, amending the Gas Act and the Mining Act to minimise gas extraction from the Groningen field
[36] Explanatory Memorandum to the bill to amend the Gas Act and the Mining Act to minimise gas extraction from the Groningen field, paragraph 2.1

When determining the required Groningen field volume we have assumed, where possible, maximum use of blending gas with a higher calorific value with gas of a lower calorific value (enrichment)[37], and a maximum annual average nitrogen input of 100%[38]. The latter is in line with the Decrees of the past four years[39,40,41,42]. At the moment, we do not see any opportunity for structurally deploying the nitrogen plants at more than 100% on an annual basis.

The capacity analysis shows that the maximum capacity of 43 GWh/h from the Groningen field will remain necessary to guarantee security of supply if there is a significant failure of other resources. To ensure the required Groningen field capacity is available at times when it is needed, production sites are kept in a state of readiness via the minimum flow strategy. The minister set the principles for this strategy, and the NAM has translated these to formulas for our model[43]. These formulas prescribe that half the clusters required to supply the capacity must operate at minimum flow continually from November to March. During these months, the other half of the clusters are also set to minimum flow if the daily average effective temperature drops below freezing. This below zero correction is also included in the calculation[44]. There is a production site roster for the summer months. The number will depend on the required capacity for security of supply in the winter of the following gas year. This minimum flow is the minimum extraction required from the Groningen field.

Based on the 2021/2022 gas year evaluation[45] we concluded that the model works well. Based on the Dutch Gas Act and its Implementing Regulation, we consult market parties and representative organisations regarding the planning assumptions we intend to use in the forecast[46]. Consultation on the planning assumptions for the 2023/2024 gas year were held at the end of November 2022[47]. Parties were also informed of the intention to include the H-gas supply/demand balance in the estimates. During this meeting, parties were also invited to submit comments based on the planning principles presented. Five parties made use of this opportunity. The comments and GTS's response to these comments are presented together with these recommendations[48]. Based on the comments received, the planning assumptions were modified and scenarios were added to the analysis.

The result is the following list of planning assumptions, which in our view outlines the most realistic scenario:

- The existing baseload plants in Ommen and Wieringermeer will be structurally deployed to generate pseudo G-gas. The Zuidbroek II plant, still under construction,

[37] In accordance with the Dutch Gas Act, article 10a, paragraph 9, subsection b, no. 2
[38] In accordance with the Dutch Gas Act, article 10a, paragraph 9, subsection b, no. 1
[39] Definitief vaststellingsbesluit Groningen gasveld 2019-2020, ref. DGKE-PGG / 19190924, dated 10 September 2019, Annex to Parliamentary Paper 33529, number 803
[40] Vaststellingsbesluit Groningen gasveld 2020-2021, dated 21 September 2020, your ref. DGKE-PGG / 20086572
[41] Vaststellingsbesluit Groningen gasveld 2021-2022, dated 24 September 2021, your ref. DGKE-PDG / 2120765
[42] Vaststellingsbesluit Groningen gasveld 2022-2023, dated 26 September 2022, your ref. PDGGO-DSGG / 22368536
[43] Vaststellingsbesluit Groningen gasveld 2020-2021, dated 21 September 2020, your ref. DGKE-PGG / 20086572
[44] Operationele strategie voor gasjaar 2022-2023, dated 6 April 2022, reference EP202203203317
[45] Rapportage inzet middelen en methoden in gasjaar 2021/2022 dated 31 October 2022, our ref. L 22.0743
[46] In accordance with the Dutch Gas Act, article 10a, paragraph 1, subsection q
[47] For slides of the market consultation, please visit https://www.gasunietransportservices.nl/gasmarkt/marktontwikkelingen/advies-winning-groningen-veld
[48] For further details, see the various responses and consultation matrix, available at https://www.gasunietransportservices.nl/gasmarkt/marktontwikkelingen/advies-winning-groningen-veld

is assumed to be fully available as a baseload plant from the start of the 2023/2024 gas year. The Pernis, Heiligerlee and Zuidbroek I plants serve as backup. This provides a maximum nitrogen capacity of 6.7 GWh/h which can be used from November to March. In the remaining months, 0.6 GWh/h less nitrogen capacity will be available due to planned maintenance.

- The Norg gas storage facility is included in the models with a maximum working volume of 58.6 TWh, Grijpskerk with a volume of 11.7 TWh, Alkmaar with a volume of 4.9 TWh and Bergermeer 45.6 TWh. For Norg and Grijpskerk, the production period runs from October to April and the injection period from May to September. Alkmaar produces from November to March and injects from May to September. At Bergermeer, the injection and production season runs broadly parallel to those at Norg. Bergermeer can also inject during the winter season and produce in the summer season.
- The seasonal storage sites are deployed in a volume-neutral manner during the gas year, which means that the volume produced during the winter is injected back during the summer months. The model for deploying the H-gas storage Bergermeer is similar to the model-based deployment of the L-gas storage facilities: other resources are used first to meet demand, and then the gas storage facility is used to meet any remaining demand.
- For the forecast for this gas year, we expect four caverns to be available[49]: Zuidwending and three G-gas caverns in Epe. These will be deployed according to the current technical specifications. For all calculations, we assume these gas storage facilities are volume-neutral over the gas year and that they are filled with pseudo G-gas.
- The Peakshaver LNG terminal is deployed according to current technical specifications and assuming a capacity of 12.7 GWh/h.
- The model uses temperature profiles from the weather station in De Bilt for gas years 1992/1993 to 2021/2022.
- Estimated domestic demand, for H-gas and L-gas is derived from KEV 2022[50]. This is published by PBL Netherlands Environmental Assessment Agency and Statistics Netherlands (CBS). The KEV outlines the impact of current and proposed government policy on energy consumption and emissions in the Netherlands. A new outlook was published on 1 November 2022, which includes a recap of 2022 as well as expected energy consumption trends until 2030.

  The KEV notes that high gas prices have a significant impact on forecasting expected gas demand for the coming years. Due to high gas prices, chemical companies and refineries are consuming substantially less gas, and many companies with high electricity or gas consumption have (partially) shut down their production facilities. However, the KEV expects that this sector will return to last year's levels in the medium term. Greenhouse horticulture has also been affected by the high prices: a shift to less energy-intensive crops is expected. The KEV also predicts reduced energy demand in the built environment (households and light industry) as people heat more economically. Rising CO2 prices are expected to reduce the use of gas power plants, but the extent to which this will happen will also depend on changes in

[49] In accordance with the Dutch Gas Act, article 10a, paragraph 9, subsection b, no. 3
[50] Climate and Energy Outlook 2022, dated 1 November 2022, as published by PBL Netherlands Environmental Assessment Agency

imports and exports. On balance, KEV 2022 shows an accelerated decline in domestic gas demand compared to the previous edition, KEV 2021[51]. In our calculations, we assumed that all existing and planned measures for the domestic market are implemented as described in the KEV 2022. Sustainability effects are therefore (implicitly) included in the lower market demand[52]. Measures proposed by the government shortly before publication are not included: so any impact on gas and electricity demand due to the temporary price cap has not been taken into account. Compared to the KEV figures, we see a further reduction of ~10% in the actuals, which we have factored into our volume estimate as a scenario.

- To estimate L-gas export volumes to Germany, Belgium and France, we use the Task Force report, which is drawn up twice a year. The Task Force consists of the Ministries responsible for energy in the Netherlands, Germany, Belgium and France, the regulators, the European Commission, ENTSOG and relevant grid operators. The Task Force's objective is to better understand the market transition and the associated decline in L-gas demand abroad. For the 2023/2024 gas year estimates we will use the Task Force Report which will be published in February 2023[53]. Conversion in Belgium, France and Germany is on schedule. The 2023/2024 gas year is the last year that Belgium expects to import L-gas from the Netherlands, the conversion in Belgium will be fully completed on 1 October 2024.
- As indicated in Annex 1, for the conversion of nine large industrial consumers, the Groningen estimate assumes the most recent planning for the four customers not yet converted.
- The expected H-gas supply from Norway is in line with the current flows. Norwegian production is currently at its maximum. This is distributed among different corridors to several European countries, with a large proportion from the one corridor going to Germany, and the remainder to the Netherlands. The forecast supply for the Netherlands is therefore a quarter of the available transport capacity, with hardly any seasonal pattern. As long as Germany has no other sources of H-gas (i.e., LNG), we expect the distribution ratio to remain unchanged.
- Considerable investments to expand LNG facilities have been made during the past year. First of all, there is a new floating LNG terminal at Eemshaven, which came on stream in September 2022. Existing capacity at the GATE terminal has been increased. These investments mean that the total volume of LNG that can be imported for the European gas market has doubled to almost 230 TWh. In our analysis, we assume the maximum capacity of both these LNG terminals will be utilised.
- Domestic gas production consists mainly of extraction from the small fields. As in previous years, gas from these fields is extracted as quickly as possible and with maximum resources. Producers give a forecast of their production, which is included in the estimate. This is adjusted by a factor which is determined based on a statement of past forecasts and actuals.

[51] Klimaat en Energieverkenning 2021, dated 28 October 2021, as published by PBL Netherlands Environmental Assessment Agency
[52] In accordance with the Dutch Gas Act, article 10a, paragraph 9, subsection b, no. 4
[53] Winter Briefing Task Force Monitoring L-gas conversion, publication expected in February 2023

- The supply of H-gas from Great Britain via the BBL is expected in the summer, volumes will be limited by the BBL's transport capacity. Great Britain depends on LNG supply and with low gas demand in the summer and very limited gas storage facilities, in the summer gas is transported to countries that are able to store it. We expect that this supply flow will stop in the winter months as Great Britain will then have sufficient demand for gas.
- A similar pattern applies to the supply of high-calorific gas from Belgium. Surplus gas in Great Britain is transported to Belgium through the Interconnector. In addition, large volumes of gas arrive via the LNG terminals in Belgium and northern France. Because Belgium does not actually need a large proportion of this supply for its own consumption and has no storage facilities, this gas is transported directly to Germany. The remainder enters our network at Zelzate from where it is used for our own consumption and transported to Germany. We can therefore make maximum use of the high-calorific gas supply through Belgium in the summer. In a mild winter, there is also a supply of gas from Belgium to the Netherlands.
- We do not expect to export any H-gas to Belgium or Great Britain. Both countries can meet their own demand through LNG supply.
- Expected H-gas exports to Germany are near maximum throughout the gas year[54]. This is necessary to meet the German H-gas demand and for transport to other countries.
- There are a several German H-gas storage facilities and caverns in the German border area which are expected to be able to meet some of the Dutch demand. This expectation is based on historical data, when there were net exports to German gas storage facilities.

[54] In consultation with German TSOs.

Recommendations for the Groningen field Decree for gas year 2023/2024

The total L-gas market demand that must be supplied from the Netherlands is the sum of the domestic market and export. As indicated in the summary of the planning assumptions, we base our domestic market estimate on the KEV 2022 numbers and use the Task Force data to forecast foreign demand. Compared to these numbers, we see a further reduction of ~10% in the actuals, which we have included when estimating the volumes. Using our models, the total expected L-gas market demand which must be supplied from the Netherlands in the 2023/2024 gas year has been calculated for the temperature profile of the past thirty gas years[55]. For this, we have used a so-called degree-day comparison: the expected L-gas market demand as a function of the number of degree days in the temperature profile.

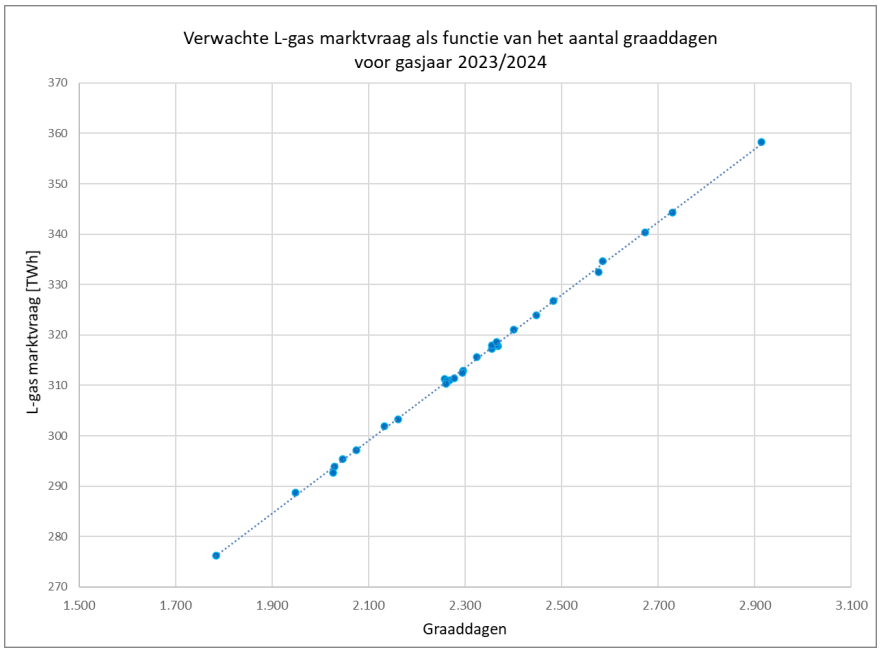

Figure 4: L-gas required to meet demand in 2023/2024 gas year which must be supplied from the Netherlands based on the temperature profiles of the past thirty gas years. The numbers are based on forecasts stated in the KEV 2022 and Task Force with a 10% reduction.

The degree-day comparison of the total L-gas market demand for the 2023/2024 gas year supplied by the Netherlands is formulated as follows:

$$\text{Market demand [TWh]} = 147.5 + 0.072 * \text{dd}$$

where dd represents the number of degree days[56]. This L-gas market demand must be met for the most part with pseudo G/L-gas and if necessary, with gas from the Groningen field.

[55] In accordance with description in the Implementation Regulation as part of the Gas Act article 3a, paragraph 2
[56] In accordance with description in the Implementation Regulation as part of the Gas Act article 3a, paragraph 2, subsection a

Our analysis shows that scenarios can occur where the minimum flow from the Groningen field is sufficient to ensure security of supply in the 2023/2024 gas year. This will be the case in a year with a warm temperature profile and continued low gas demand.
However, there are also scenarios where extraction from the Groningen field in addition to the minimum flow will be necessary to ensure security of supply. This does not only depend on the temperature, but also on the H-gas supply and other planning assumptions. All this is summarised in Figure 5.

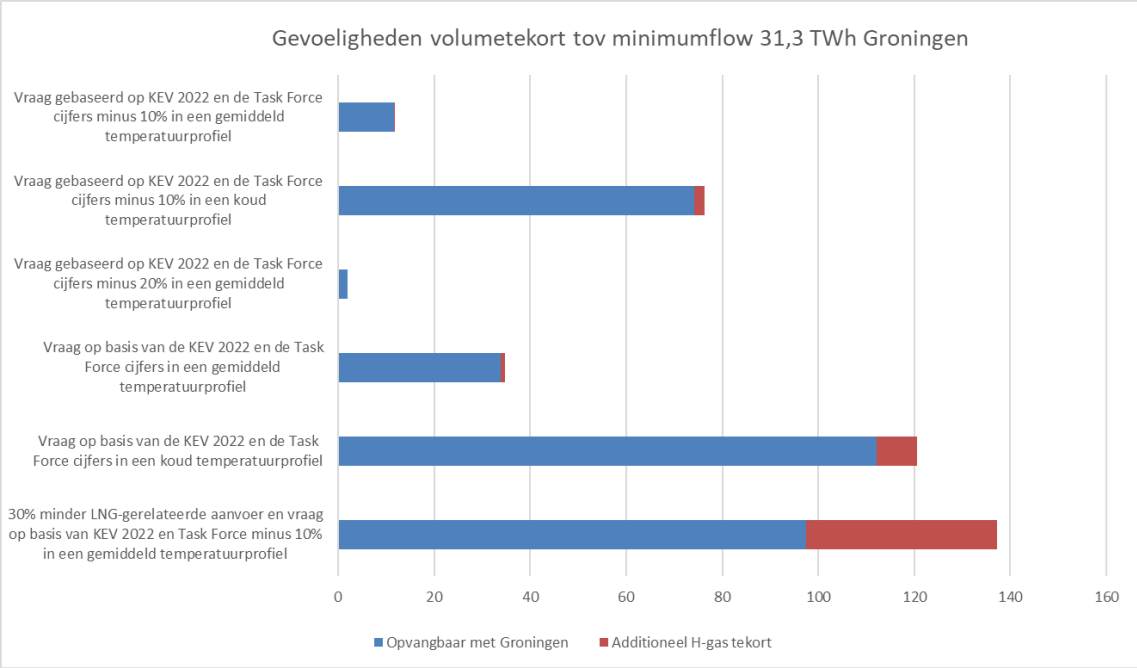

Figure 5: The forecast volume shortfall in the 2023/2024 gas year for various scenarios if Groningen continues to operate at minimum flow. The blue bars indicate which volumes can be compensated by extraction from the Groningen field, the red bars show additional H-gas shortages which cannot be met from the Groningen field.

Although we consulted the market and other parties when determining the planning assumptions, and have used historical data where relevant, there are still many uncertainties. These uncertainties include the expected filling targets for the gas storage facilities at the beginning of the year, the effect of the price cap, and the feasibility of the various LNG projects. Moreover, this winter, it will be apparent whether there is actually sufficient LNG on the world market to supply north-west Europe.
We therefore do not recommend setting a temperature-related production volume for the Groningen field, but a fixed volume for all thirty temperature profiles. This approach is in line with expectations stated in the 'What after zero' bill concerning the end of gas extraction from the Groningen field[57]. This states that "it is proposed to no longer extract a volume on an annual basis depending on temperatures, but to only extract the volume needed to keep a number of production sites operational. Only in specific exceptional circumstances may gas

[57] https://www.rijksoverheid.nl/actueel/nieuws/2021/03/08/wetsvoorstel-wat-na-nul-in-internetconsultatie

extraction be adjusted to more than the minimum flow necessary to ensure security of supply". In addition, these recommendations are in line with the Explanatory Memorandum to the Act to minimise gas production from the Groningen field[58]. With this bill, the government opts for managing gas extraction from the Groningen field in an alternative manner, namely 'no more than necessary'.

> Our recommendation is to allow a production volume in the 2023/2024 gas year equal to minimum flow required to keep all production sites available for security of supply, a volume of 31 TWh.

If the actuals in this winter result in a change to the planning assumptions used for this estimate and affect the expected Groningen production, we will inform you in accordance with our statutory duty[59].

Recommendations regarding required Groningen field volume for security of supply in the coming gas years

Based on the current assumptions, we still foresee a possible shortage of high-calorific gas supply in the medium term, but we also envisage a rise in the LNG import capacity. At the moment, it is unclear what impact this will have on extraction from the Groningen field for the gas years after the 2023/2024 gas year. As the situation on the gas market is completely new and many developments are still uncertain, all trends and projects will be closely monitored. The recommendations will be updated at least annually with the newest insights. Therefore, with all the uncertainty and new developments in the gas market, at present we cannot advise you regarding a new date for closing the Groningen field.

However, we do see an overall decline in the total low-calorific gas market. This can be seen in Figure 6, which shows the trend for the total low-calorific market for the gas years from 2023/2024 to 2029/2030[60]. These figures are based on the KEV 2022 and the Task Force numbers, but reduced by 10% in line with current insights into market demand.

[58] Explanatory Memorandum to the bill to amend the Gas Act and the Mining Act to minimise gas extraction from the Groningen field, paragraph 3.4.1

[59] In accordance with the Dutch Gas Act, article 10a, paragraph 11

[60] In accordance with the Dutch Gas Act, article 10a, paragraph 1, subsection q, no. 2

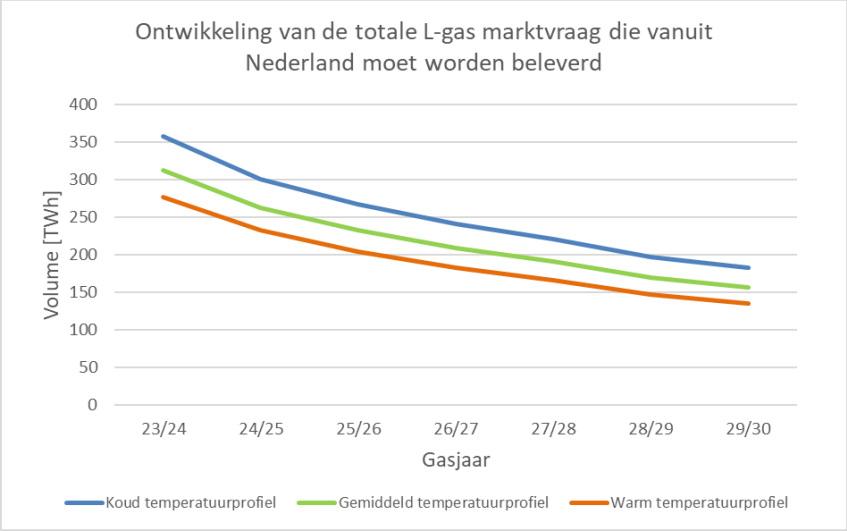

Figure 6: Trend of total L-gas demand to be supplied by the Netherlands under cold, average and warm temperature profiles. The numbers are based on forecasts stated in the KEV 2022 and Task Force with a 10% reduction.

The total L-gas market demand is expected to decline over the years, which will contribute to the Groningen field closure. The total L-gas demand can be divided into several categories: domestic end users with a connection of less than 391 kWh/h, domestic end users with a connection greater than 391 kWh/h, and demand from abroad (exports). This breakdown is shown in Figure 7 for an average temperature profile for the same period[61].

[61] In accordance with the Dutch Gas Act, article 10a, paragraph 9, subsection c

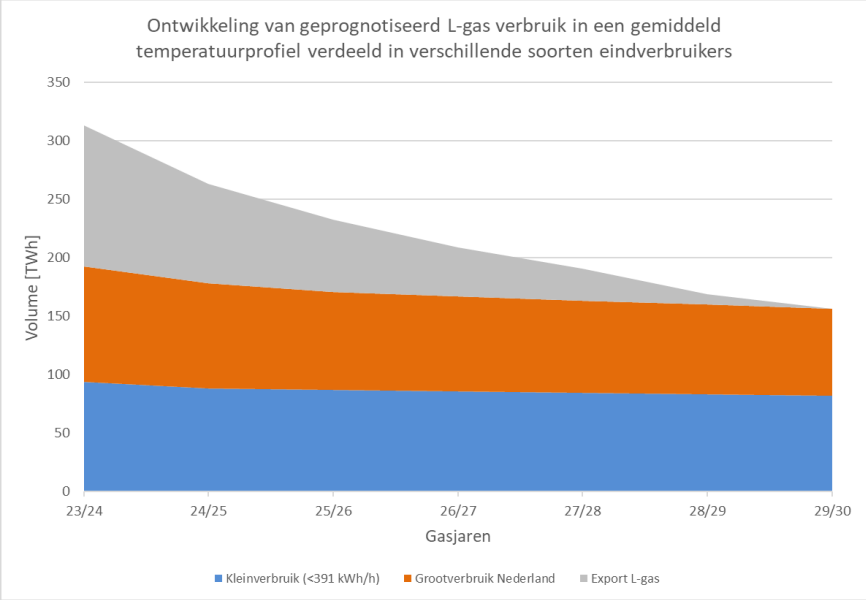

Figure 7: Change in gas demand for an average temperature profile, divided according to different types of users (small domestic end users, industrial consumers and exports). The numbers are based on forecasts stated in the KEV 2022 and Task Force with a 10% reduction.

The total forecast gas demand in the 2023/2024 gas year from domestic users with an offtake of less than 391 kWh/h is 94 TWh, which is similar to the forecast used in the previous estimate. The gas demand in an average year for the domestic users with an offtake of more than 391 kWh/h (industrial consumers) is 99 TWh and for exports, gas demand amounts to 135 TWh.

Required Groningen field volume from a backup perspective in the 2023/2024 gas year

Just as in the current gas year, the Groningen field serves as a backup in the 2023/2024 gas year for extreme situations that may occur in practice. The volume that may be extracted under these acute conditions is called the 'backup volume'. Until midway through the 2021/2022 gas year, these extreme situations were described as unavailability of quality conversion facilities, transportation constraints and unforeseen changes in the composition of H-gas. Based on a modelled unavailability of the nitrogen and mixing plants, we estimated the magnitude of this volume. For this purpose, we used the so-called Monte Carlo simulations, to model the availability of nitrogen plants based on the breakdown curves as a function of nitrogen demand. The nitrogen profiles for the thirty temperature profiles are then removed from the estimate for the gas year in question. For each nitrogen profile, the deployment of the various nitrogen plants and blending facilities is then calculated one thousand times to see if less nitrogen is available due to breakdowns than required to meet demand. If that is the case, then the volume contributes to the backup volume.

Previous Monte Carlo analyses resulted in a volume required to cover these situations in the

2023/2024 gas year of between 5 and 10 TWh[62]. We expect this required backup volume will decline in the coming years due to the lower L-gas demand from abroad. If the existing G/L-gas storage facilities are used in the event of a nitrogen plant failure, the required backup volume will move toward the lower end of the range mentioned above. A repeat of this analysis in a situation where there is sufficient H-gas supply results in similar volumes. In that case, if the Grijpskerk gas storage facilities are filled with the estimated working volume of 12 TWh in low-calorific gas on 1 October 2023[63] and the capacity of the Grijpskerk gas storage facilities would be sufficient, then it would be feasible to close the Groningen field. In the Decree for the 2022/2023 gas year[64] additional conditions are set for producing the backup volume: the actual unavailability of the Norg, Alkmaar and Grijpskerk gas storage facilities and an emergency situation as referred to in Article 4.1.4. of the Transmission Code Gas TSO, as a consequence of which GTS issues an instruction concerning entry or exit points of the national gas transport network, insofar as is necessary to absorb a resulting imbalance for a very short period of time. With these additions to the possible situations which could result in the deployment of the backup volume, we recommend maintaining the volume of 15 TWh, as in previous years. This backup volume can be deployed in the event of a critical supply shortage. At the same time, decisions can then be made regarding the measures to be taken.

Our recommendation is as follows: in the 2023/2024 gas year allow a backup volume of 15 TWh from the Groningen field, only to be extracted under stipulated conditions in accordance with the current Decree.

[62] Rapportage over de omschakeling van gasberging Grijpskerk en de impact op de Groningenproductie, dated 8 June 2021, our ref. L 21.0251
[63] Stand van zaken conversie Grijpskerk, dated 23 November 2022, Annex to the document with your reference PDGGO-DSGG / 22567440
[64] Vaststellingsbesluit Groningenveld 2022-2023, dated 26 September, your ref. PDGGO-DSGG / 22368536