



ENERGINET



REPORT ON
**SECURITY OF GAS
SUPPLY 2022**

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1. The report in brief

This paper is Energinet's report on security of gas supply for 2022. Energinet publishes a report on the supply situation each year, aiming to explain the overall perspectives of the past year concerning security of gas supply. The report describes the gas situation during the past year and expectations for the coming winter. It does not look far into the future. The report is primarily based on historical data and analyses for the future. This year, the report will initially explain the gas storage situation in Denmark in a focus article. The aim of the focus article is to give the reader insight into the challenges associated with the Danish gas storage facilities and how to handle these.

Security of supply in Denmark has been good in recent years, but was put to the test during the past year in a way that has not previously been seen. This was despite low temperatures up until May 2021 and high demand for gas throughout much of Europe. However, the supply situation looks very different now compared to the same time last year. Several factors, including Russia's invasion of Ukraine in February, have had an impact on security of supply in Europe. Furthermore, the sabotage carried out against Nord Stream 1 and 2 in September 2022 has left the gas market with the expectation that Russia will not export natural gas to the EU in future either.

There has been a strong focus on security of supply in 2022 throughout Europe, and thus also in Denmark. There has been great awareness throughout the EU of the importance of gas supplies to consumers and companies, and the role the European and Danish gas storage facilities play in security of supply.

Despite a high level of security of supply in recent years and a general decline in gas consumption in Europe, in 2022, Europe and Denmark are experiencing the most serious energy crisis since the oil crisis of the 1970s. Russia's invasion of Ukraine, high inflation and rising demand for gas in parts of Europe have all contributed to driving gas prices up substantially.

In 2022, the supply situation and the still high and fluctuating gas prices have made it necessary for EU countries to jointly develop measures to prevent a deterioration of the energy crisis. Instead of Russian gas, the EU now purchases LNG, primarily from the USA and Qatar, although this is not sufficient to completely replace Russian gas. The EU has therefore ensured that the European gas storage facilities were filled at the beginning of winter 2022. If winter 2022/2023 sees average temperatures, the EU will be able to get through the winter without supply failures.

One consequence of rising gas prices has been an increase in biogas production. Energinet estimates that production from existing biogas plants is being increased at present. In addition, new biogas plants are being brought online. As gas consumption decreases, the proportion of biogas in the Danish gas system is thus increasing faster than expected. Energinet estimates that more than 30% of the total gas consumption in Denmark is currently met by biogas.

2. Focus article: Gas storage facilities in Denmark are full for winter 2022-2023

The Danish gas storage facilities in Stenlille and Lille Torup are handling the supply situation without Russian gas.

Each year, Gas Storage Denmark (GSD) sets the storage capacity for the gas storage facilities in Denmark. This is set conservatively, to ensure that the storage is not oversold. This mechanism made it possible this year for GSD to improve the security of gas supply.

How do the gas storage facilities work?

Basically, GSD sells the storage capacity available in the gas storage facilities. Storage customers – purchasers who serve as a link between gas producers and gas customers – purchase storage capacity from GSD.

Storage customers add gas to the gas storage facilities when they can buy it cheaply on the European markets, and withdraw it again when it has risen in value. The capacity they buy is not ‘physical’ space, but rather space corresponding to a quantity of energy (kWh). A given quantity of energy occupies varying physical space depending on the gas quality in the system on the day the gas is added to storage.

How does GSD handle a changed supply situation?

GSD has a target level for when the gas storage facilities are deemed to be physically full. For a long time, the target for ‘full’ storage has been 9,231,600,000 kWh. Once the storage facilities are full, GSD can determine the composition of the gas contained. In recent years, most gas has been Russian, and Russian gas is a relatively ‘thin’ gas in terms of kWh/m³. There is up to 16% difference in energy density between Russian, US, Middle Eastern and Danish gas once it is in underground storage.

When GSD calculated how much space was taken up by the 9.2 TWh, they found that the sold capacity was fully utilised, but storage space remained for many more m³ and hence more kWh. Gas prices had also fallen at the time, and GSD was able to open for day-to-day auctions of storage capacity in the gas market.

The price in the day-to-day auctions could be based entirely on the difference between the day-ahead price, which was low, and the coming winter price, which was high, as gas storage facility customers can buy cheaply tomorrow and sell at a high price in winter, as long as they have a place to store the gas in the meantime. Over just a few days, GSD added gas to supplies corresponding to the annual consumption of around 40,000 households.

3. Gas security of supply – background

Gas is an important part of the Danish energy mix and is used for domestic heating, in industry and for electricity and district heating generation. Some Danish gas customers are vulnerable to gas supply failures in specific situations, for example private households on cold winter days.

3.1 Gas security of supply in Denmark

Energinet is responsible for ensuring sufficient transport capacity in the transmission system. Energinet is also responsible for ensuring robustness, including interaction with adjacent systems. However, responsibility for the availability of gas supplies to gas customers on the day of consumption lies with the market players, that is, players who purchase gas at the wholesale stage of distribution and gas suppliers who sell the gas to consumers. If an emergency situations occurs, where market players are unable to fulfil their obligations, then Energinet ensures gas supply to protected customers, including solidarity-protected customers in Denmark. To do so, Energinet uses emergency storage to cover imbalances for the players who are unable to supply their Danish gas customers in an emergency supply situation.

The responsibilities of the various players are laid down in the Danish Consolidated Gas Supply Act (Gas Supply Act) and the Danish preventive action and emergency plan, prepared pursuant to the regulation of the European Parliament and of the Council concerning measures to safeguard security of gas supply (Security of Gas Supply Regulation).

The Security of Gas Supply Regulation for Denmark and the EU is described in detail in section 7.

Energinet continuously monitors the supply situation and ensures that the market players are kept up to date, so that they can take the necessary precautions to prevent any critical supply situations.

4. Gas security of supply in Denmark and the EU

The EU's well-developed gas infrastructure ensures high supply capacity between member states and supports the gas market, which ensures trade between the European countries. In practice, this means that the Danish security of supply is closely linked to the security of supply in the EU today. This means that if the EU experiences gas shortages, there will also be greater pressure on the supply to Denmark.

The Baltic Pipe strategic gas infrastructure project creates a new supply connection in the European market, and will reduce carbon emissions in Poland when coal is replaced by natural gas. Baltic Pipe makes it possible to transport gas from Norway to the Danish and Polish markets, and to end users in neighbouring countries. Baltic Pipe commenced full operation on Wednesday 30 November 2022.

The construction work has taken three years. After a very intense process, the project has been completed – and this new infrastructure improves security of supply in Poland and in countries connected to Poland by gas pipelines. Baltic Pipe is also contributing to the security of supply in Denmark during the energy crisis, brought in part upon Europe due to Russia's invasion of Ukraine.

4.1.1 ENTSOG's winter outlook for the EU

Each year, ENTSOG (European Network Transmission System Operators Gas) produces a report on the supply situation for the coming winter in the EU, called Winter Outlook. The report is available on ENTSOG's website ([ENTSOG Outlooks & Reviews](#)).

In this year's report, ENTSOG concludes that it is possible to get through the 2022/2023 winter without supply failures with an average historical winter offtake. If a 20-year event occurs leading to extremely high gas offtake due to low temperatures (cold winter, two weeks or one day of extremely cold weather), there will be a risk of gas shortages across EU member states due to the limited supplies to the EU from Russia.

The supply shortage will be more pronounced if Russian gas imports to Europe totally cease, ie if gas from Russia via 'Turkstream' (transit through Turkey) and 'Brotherhood' (transit through Ukraine) is also shut down.

The supply shortfall from Russia may be partially replaced by LNG, to the extent that LNG is available in the global gas market. A 15% reduction in the EU's gas offtake would also reduce the risk of shortages considerably. At the start of the winter, an average 6% drop in the EU's gas offtake has been observed. This is expected to be higher over the winter.

ENTSOG's Winter Outlook predicts that gas storage facilities in the EU risk being close to empty by the end of winter, depending on how mild or cold the winter is. It is possible to offset the missing supply from Russia through increased LNG imports and a reduction in the EU's gas offtake, see Figure 1. If gas storage facilities are empty at the end of winter, the strategic storage filling will have been used, and it will be a challenge to fill the gas storage facilities to a similar level during the summer in preparation for winter 2023/2024.

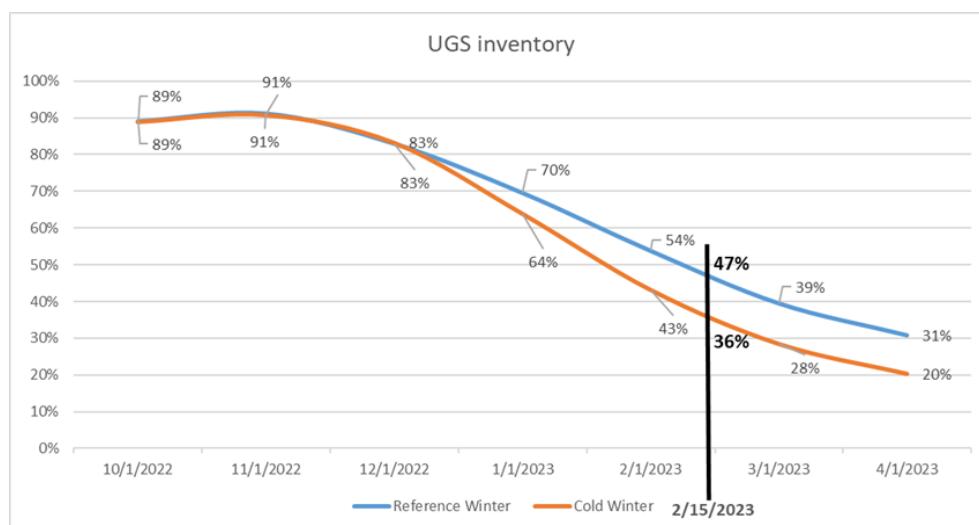


Figure 1 Simulation of EU gas storage levels in winter 2022/2023 with a 15% reduction in the EU's gas offtake (ENTSOG Winter Outlook 2022/2023).

4.1.2 EU measures to secure the gas supply

In response to the risk of gas shortages during the winter on the EU gas market, the European Parliament and the European Council adopted the REPowerEU political initiative in summer 2022 (EU Regulation 2022/1032), under which member states are obligated to fill the EU gas storage facilities to 80% before winter, and to 90% for the following winter in 2023/2024. The

aim was also to achieve a collective level of 85% across member states before winter 2022. On 1 October 2022, the EU's gas storage facilities were 20% more full than the previous year, see Figure 2, at 89%. At the same time, the gas level in Denmark was at 97.7%.

On 1 November 2022, the gas storage facilities were full or close to full: For the EU, the level was 94%. In Denmark it was 100%, and both Poland and Germany had levels of 98%.

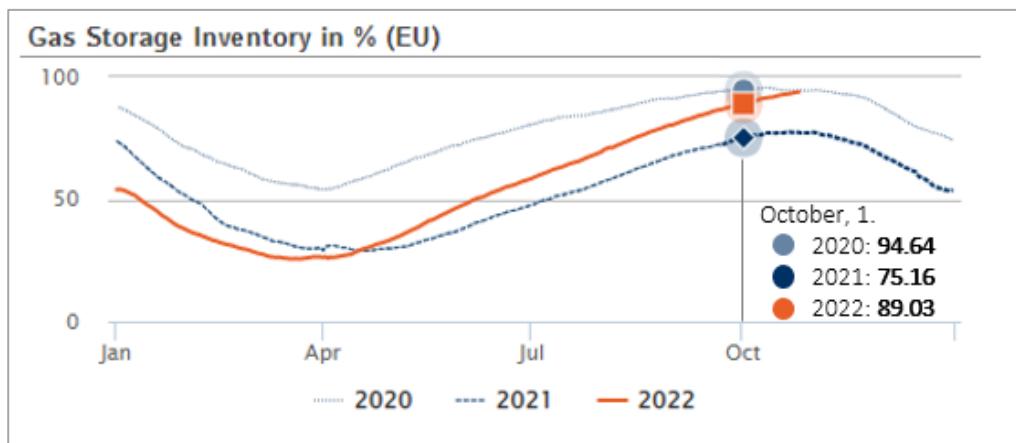


Figure 2 EU gas storage level over the past three years.

To further safeguard supplies, the European Council has adopted measures in the 'Save Gas for a Safe Winter' Regulation, to coordinate a voluntary reduction of the EU's gas offtake by 15% compared with average consumption over the past five years. The measure applies from 1 August 2022 to 31 March 2023 (EU Regulation 2022/1369). If the necessary reduction in gas offtake does not occur, or a significant risk of a gas shortage arises, the European Commission or a minimum of three member states can request the Council to declare a *Union Alert*. A *Union Alert* will obligate member states to reduce their gas offtake by 15%.

Exceptions to this include member states with limited connections to gas networks in other member states, and member states with gas storage facility levels that surpass the requirements. Member states are free to choose the means by which they limit gas consumption, but will prioritise means which do not impact households and essential services such as the health service and defence forces. Recommended ways of reducing gas consumption include reducing heating and cooling, for example by placing limits on this in large buildings, or information campaigns aimed at households.

To secure gas supplies in the long term, the EU will accelerate the green transition through both financial and legal means. The European Council will also raise the EU's energy efficiency target for 2030 as part of the 'Fit for 55' plan for the green transition.

4.2 Importance of Danish and European gas storage facilities to security of supply

4.2.1 Significance of EU gas storage facilities for supply

The primary purpose of the gas storage facilities in the EU, including those in Denmark, is to supply the gas market during the winter period where gas demand is highest due to the heating demand. It is therefore vital for security of supply in the EU that the gas storage facilities are full ahead of each winter in order to smooth out the seasonal imbalance between consumption and supply.

Figure 3 shows the levels in gas storage facilities in the EU. For winter 2022/2023, the strategy of using the gas storage facilities will be of vital importance to the EU.

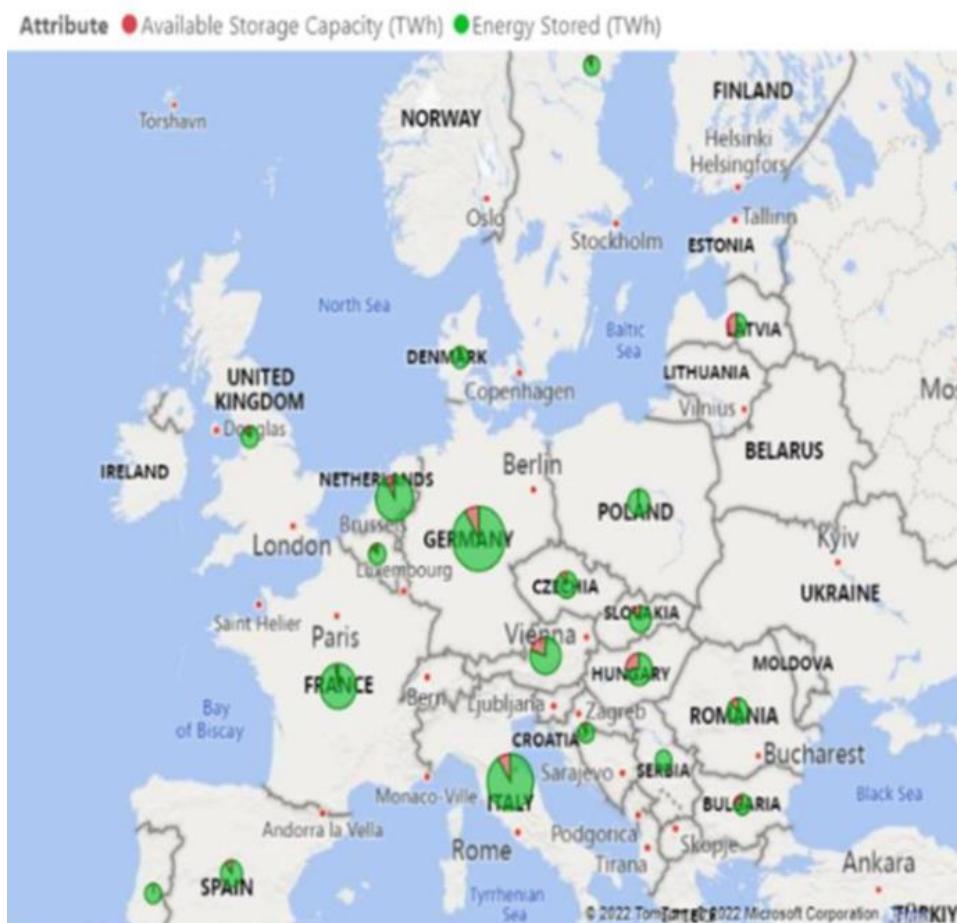


Figure 3 Gas storage levels in the EU on 1 October [ENTSOG Winter Outlook 2022/2023].

The average EU-wide consumption in the 2022/2023 winter period is approx. 3,300 TWh (2020/2021: 3,319 TWh). Total gas production in the EU and imports are not expected to meet the forecast demand during the winter period. The EU gas market will therefore depend on supplies from the storage facilities.

The gas storage facilities in the EU have a total working volume¹ of 1,111 TWh, which means they have the potential to be the largest source of supply to the market during the winter period. Historically, the highest drawdown from the gas storage facilities into the EU market has been 717 TWh (65%), which was in winter 2020/2021. In Denmark, the winter of 2020/2021 was also the year with the largest historical drawdown.

5. The previous gas year (October 2021 to October 2022)

Gas prices had already risen in summer 2021, leading to low inflow into storage facilities in both Denmark and the EU. This meant that the gas year² ended with historically low storage levels and record-high gas prices, leading to a growing focus on supplies during the coming winter in the EU.

¹ The working volume (Nm³ in volume units) is the amount of gas (TWh in energy units) that can be withdrawn from the storage facility.

² The gas year runs for 12 months, starting in October.

Three years ago, the Tyra complex was shut down temporarily for renovation, and Denmark has primarily been supplied with gas via Germany since then.

The reduced diversification in sources of supply to the Danish market has increased the need to have gas storage facilities filled in Denmark – as without supply from the Tyra complex, there is insufficient import capacity to meet Danish consumption during the coldest part of the year.

In the 2021/2022 gas year, the total capacity sold in the two Danish storage facilities came to 7,546 GWh. Of the capacity sold, 3,800 GWh was emergency storage, and the remaining 3,746 GWh was sold for commercial use. Emergency storage is used to bolster Danish supply in a supply-critical situation. The commercial volume (around 50% of the total capacity sold) does not necessarily contribute to Danish security of supply, as commercial customers can freely decide how to make use of their capacity.

In comparison, 9,940 GWh of capacity was sold in the 2022/2023 gas year, of which 3,202 GWh was emergency storage. The share sold for commercial use was thus 6,738 GWh (68%).

To keep players in the Danish gas market informed about the necessary and current capacity available in the gas storage facilities during the year, Energinet publishes an ongoing assessment of the storage level required to secure supply in Denmark and Sweden during the winter on a dedicated page on its website. Figure 4 shows this graph. It is available in the English section of Energinet's website, which is updated continuously (Safe Storage Level).

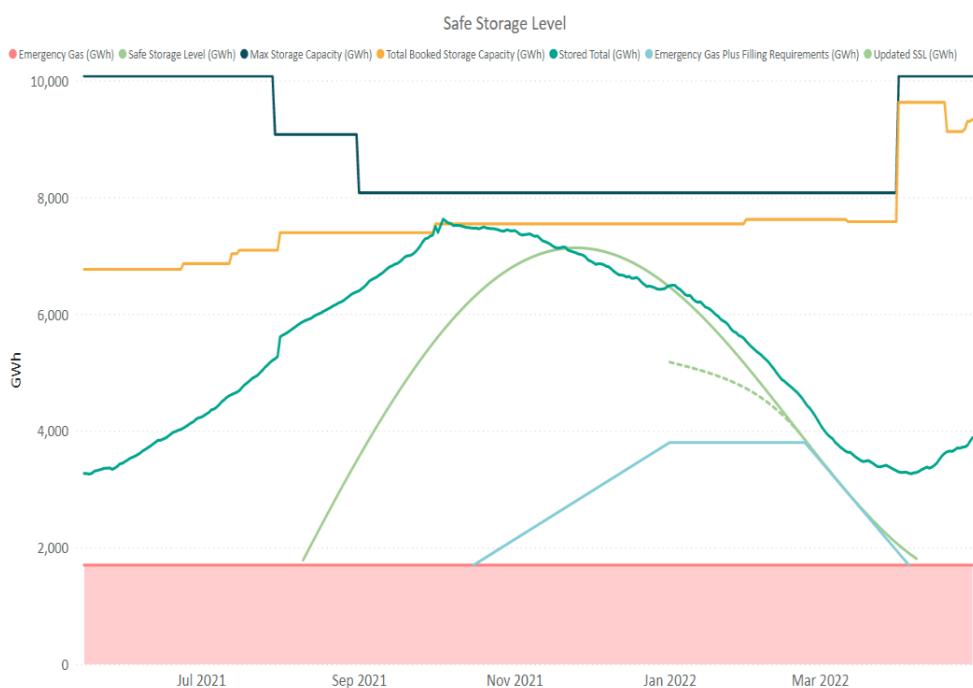


Figure 4 Safe Storage Level – the calculated quantity of gas that needs to be stored in order to supply Denmark and Sweden during winter 2021-2022.

Prior to Russia's invasion of Ukraine on 24 February 2022, there was already heightened awareness of Russian gas supplies to the EU. Gas storage levels were already low in the EU at the time, as high gas prices over the summer had meant there was little incentive to fill the gas storage facilities. Combined with a gradual reduction in supplies from Russia, this was the

rational for a number of EU initiatives to support security of supply leading up to the coming winter.

Storage levels in Europe only reached around 77% in 2021/2022, compared to 96% the year before.



Figure 5 Gas prices began their ascension towards the historically high level already in spring 2022. Prices have also fluctuated greatly, which has affected the market's incentives to deposit gas in storage.

The sabotage against the Nord Stream 1 and 2 pipelines on 26 September 2022 has left the market with the expectation that Russian gas supplies will probably remain very low or be reduced to zero in the future. In previous years, Russia has supplied up to around 40% of the EU's gas consumption. The dramatic decline in gas supplies from Russia has led many European countries to accelerate investments in LNG terminals, which can receive liquefied gas from countries such as USA and Qatar. Several LNG terminals are expected to be ready for commissioning already this winter. However, LNG supplies cannot fully replace the normal gas supplies from Russia in the short term. There has therefore been a strong focus on filling the European gas storage facilities as much as possible before winter. At the start of winter, most countries had managed to fill their gas storage facilities to close to 100%.

In spring and summer 2022, the EU presented several measures that aim to support the supply in the EU through winter 2022/2023 and towards next winter 2023/2024. The measures have resulted in European gas storage facilities being filled and the expected commissioning of LNG terminals in several European countries during the winter.

The EU LNG terminals are located in the north and west. Transporting gas from the LNG terminals to central and eastern Europe will presumably be a challenge this winter. Baltic Pipe, which can supply Norwegian gas to Poland, is therefore of extra importance to European security of supply this winter. Poland can pass on the gas to countries such as Slovakia, Lithuania and Ukraine via new gas pipelines.

5.1.1 IT incidents

There have been no IT incidents that impacted the gas supply in the gas system during the past year.

5.2 Contingency drills

Due to the strained supply situation in Europe, a European partnership between the TSOs, the Regional Coordination Group (ReCo), under ENTSOG, has performed regular drills.

The scenario for all drills has been interruption of Russian supplies – via Nord Stream 1, and most recently via TurkStream also, which still supplies Russian gas to Europe. The purpose of the drills was to simulate how to best meet the demand for gas in Europe by using the maximum transport capacities available at border points. In the event of surplus volumes, the gas has been injected into storage in the respective countries.

In all the drills leading up to winter, it was possible to cover Danish and Swedish gas consumption with gas from the domestic market – the Syd Arne field, biogas and imports from Germany.

5.3 Use of the gas transmission system network

In 2021, only one of the peak day volumes exceeded the assumed capacity limits:

- Ellund Entry (imports from Germany): In 2021, the peak day volume for Ellund Entry (imports to Denmark) was 14 million normal cubic metres per day (Nm³/day), which exceeded the capacity limit of 10.8 million Nm³/day.

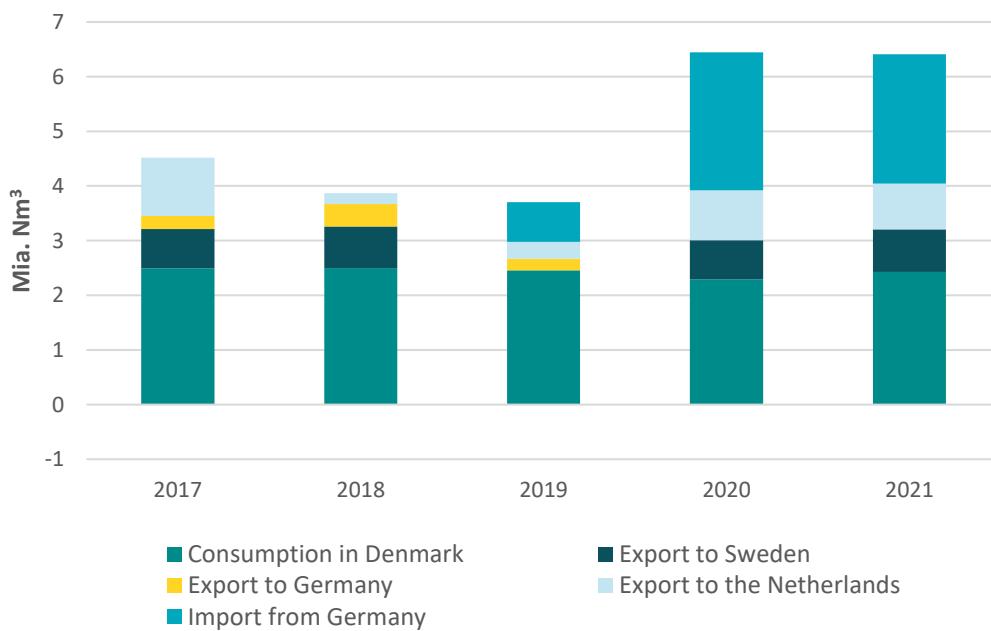


Figure 6 Gas consumption in Denmark and imports/exports 2017-2021.

5.3.1 Gas supplies from the North Sea

In the Danish North Sea region there are two fields producing gas which is supplied to Denmark. One is the Tyra complex, which was shut down in September 2019 due to renovation work. The other is the Syd Arne field, which still produces and supplies gas to the Danish transmission system. The Syd Arne field supplied approx. 520 GWh to Denmark, which is a decrease of 59% compared to supplies in 2020. The drop in supplies was expected and is not considered to be supply critical for Denmark, as the primary supply sources in 2021 were Ellund/Germany,

biogas and the two Danish gas storage facilities. Supplies from Syd Arne met only 2% of total consumption in Denmark in 2021.

5.3.2 Ellund

The flow direction between Denmark and Germany in 2021 was only northbound, i.e. gas imports to Denmark. In 2021, the total northbound flow via Ellund was 2,369 million Nm³. The peak day volume of 14 million Nm³/day occurred on 6 December 2021.

Average imports via Ellund in December 2021 were 9.7 million Nm³/day, compared to average imports of 6.1 million Nm³/day in November 2021. November was characterised by stable, but high prices, whereas there were high and fluctuating gas prices during most of December.

The peak daily volume of 14 million Nm³/day was above the commercial Ellund Entry capacity limit.

		Capacity million Nm ³ /day	Peak daily flow		
			2019 million Nm ³ /day	2020 million Nm ³ /day	2021 million Nm ³ /day
Nybro	Entry	32.4 (note 2)	12.3	1.1	2.2
Lille Torup storage facility	Injection/withdrawal	3.6/8.0 (note 3)	2.9/8.3	3.4/3.9	3.8/5.8
Stenlille storage facility	Injection/withdrawal	4.8/8.2 (note 3)	4.3/5.4	4.6/4.8	2.9/7.0
Supplies DK	Exit	25.5 (note 5)	14.0	11.4	16.7
Ellund	Entry/exit	10.8 (note 4) / 20.0	14.2/4.5	9.1/0	14/0
Dragør Border	Exit	8.6 (note 1)	4.0	3.4	5.5

Figure 7 Capacities and utilisation in the Danish system in million Nm³/day.

Note 1:

The Swedish system is not able to receive these volumes at the assumed minimum pressure in Dragør of 44 bar. The firm capacity is stated at 7.2 million Nm³/day. The Danish and Swedish balance zone was merged on 1 April 2019.

Note 2:

Total capacity of the receiving terminals in Nybro. The potential supplies are smaller today as the Tyra-Nybro pipeline is subject to a capacity constraint of approximately 26 million Nm³/day, and large quantities cannot be supplied from the Syd Arne pipeline.

Note 3:

Guaranteed capacity. The Danish gas storage company dimensions the commercial injection capacity conservatively in relation to pressure in the transmission grid. When the pressure in the transmission grid occasionally increases, it is possible to inject more gas into the storage facilities than the specified injection capacity.

Note 4:

At a calorific value of 11.2 kWh/Nm³.

Note 5:

Supplies for distribution and power stations.

5.3.3 Use of gas storage facilities

European gas prices have a major impact on the use of the gas storage facilities – it impacts when market players choose to inject gas for storage, and when they choose to withdraw gas³. Market players purchase storage capacity, which entitles them to store gas. In connection with withdrawal and injection, gas storage facility customers must also purchase withdrawal and injection capacity.

Each year, Gas Storage Denmark, which operates the Danish gas storage facility, calculates the volume of gas that storage customers can inject into and withdraw from the facilities in the form of peak day volumes. In 2021, the peak day volume for injection at the Lille Torup gas storage facility was 3.7 million Nm³/day, which exceeded the maximum commercial capacity limit of 3.6 million Nm³/day.

In 2021, the two Danish gas storage facilities in Stenlille on Zealand and Lille Torup in Jutland saw historically high withdrawals, with approx. 6 TWh being withdrawn between 1 January and 1 May 2021. In comparison, there were 53% less withdrawals from the storage facilities in 2020 during the same period. 2020 was a year with historically low withdrawals, both in Denmark and across Europe.

On 1 May 2021, only 6.76 TWh of the storage capacity had been sold, including the quantity Energinet purchased as emergency gas for use in an emergency supply situation. In comparison, 10.6 TWh was sold during the same period in 2020.

In 2021, the storage volume was written down twice – by 2 TWh in total, ie from 10.08 TWh to 8.08 TWh.

Prior to winter 2021, 7.5 TWh storage capacity was sold. It was the first year in which Gas Storage Denmark had not sold out, so there was still capacity available in the Danish gas storage facilities at the time.

The maximum storage level of 7.6 TWh was reached at the start of October 2021, and the storage level was 6.5 TWh at the end of the gas year – below Safe Storage Level.

No projects were conducted in 2021 that involved capacity adjustments.

³ A gas storage year runs for 12 months from 1 May.

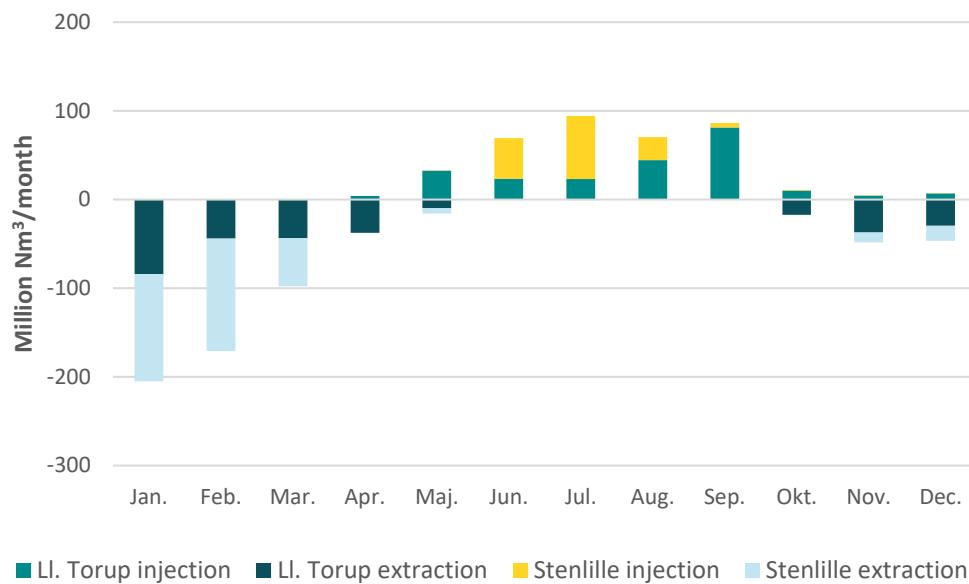


Figure 8 Shows storage withdrawals and injections per month in 2021.

5.3.4 Biogas in the grid

The volume of biogas being added to the gas system continues to increase. In 2021, this was able to meet around 22% of Danish gas consumption.

This proportion has since increased to more than 30% at the end of 2022. The high biogas proportion has been driven by major reductions in consumption and gas conversions, as well as the connection of new biogas plants during the year.

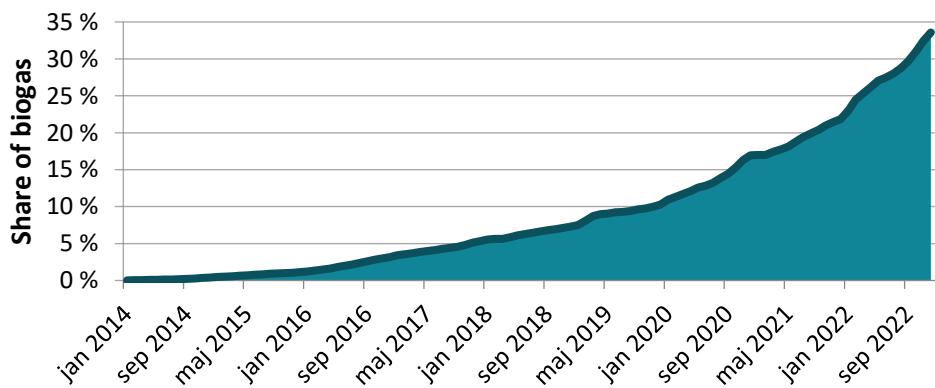


Figure 9 Share of biogas relative to consumption in Denmark, calculated as a 12-month average ending at the end of 2022.

Since 2013, 53 biogas facilities have been connected to the gas system. One plant, at Bevtoft, is connected directly to the transmission system, while all other plants are connected to the distribution system. The combined maximum connection capacity of the plants is more than 98,000 Nm³/hour.

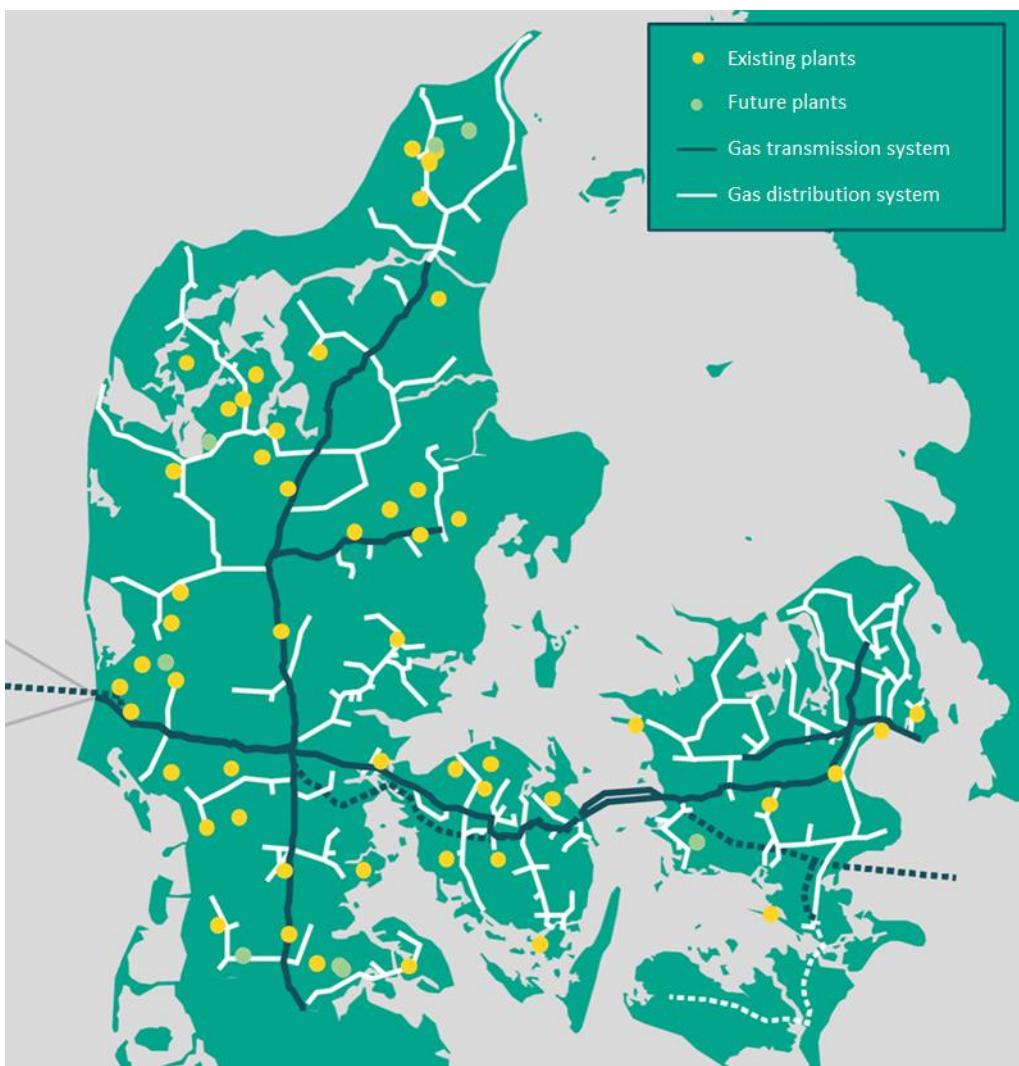


Figure 10 Location of grid-connected biogas plants in Denmark.

5.4 Gas consumption

Between 2015 and 2020, gas consumption remained stable at around 30 TWh/year – after correcting for weather, where only the central and local CHP plants had lower consumption in reality.

The significant increase in the gas price in Europe in second half of 2021 and in 2022 resulted in a drop in consumption in Denmark. It is still uncertain how much the higher gas prices and the threat of interruptions to gas supply have affected consumption, but it is estimated that there has been a drop of 15-20% since mid-2021, and it is still falling. The Danish Energy Agency's analysis assumptions (AF 2022) for Energinet – a data set used by Energinet to calculate consumption and production etc.⁴ – forecasts gas consumption of 21.8 TWh in 2022, corresponding to a drop of 17 %.

5.4.1 Drop in consumption and biogas pockets

The rising gas prices have contributed to an increase in biogas production. Since summer 2022, it has been observed that production from existing biogas plants is rising week by week, while new biogas plants are also being connected. Combined with the decline in consumption, this

⁴ [The Danish Energy Agency's analysis assumptions for Energinet | Danish Energy Agency \(ens.dk\).](#)

means that the proportion of biogas relative to consumption is increasing much faster than forecast in Energinet's Long-term Development Plan 2022⁵. The Long-term Development Plan predicted that biogas production would not reach a point that requires increased investment in plants for biogas return until 2025. With the current trend, this is already expected to be necessary from the summer of 2023.

The positive thing about this is that a higher proportion of gas consumption can be met by green gas. The challenge is that the declining gas consumption creates a situation in which biogas pockets are forming in parts of the gas distribution system. A biogas pocket is a geographical area in the distribution system where there is high production of biogas, but no equivalent gas consumption or sufficient infrastructure to utilise all the biogas.

This issue is particularly pressing during the summer months, when gas consumption is low in industry and for heating purposes, while biogas production is relatively stable throughout the year. The biogas pockets are primarily found in central Jutland and on Funen, but could also arise on Zealand. Unless a solution is found, biogas production will have to be reduced in local biogas pockets. Reverse-flow plants to handle the imbalances are not expected to be completed until late 2024 and early 2025.

It is necessary to transfer the produced biogas from the distribution system to the transmission system in six locations in Denmark. This is via a 'reverse flow' of surplus biogas. In 2022, 715 GWh of biogas is expected to be added to the transmission system from these plants, including production at the biogas plant in Bevtoft.

In relation to the overall security of supply, the consequence of reducing biogas production is not major. Even though biogas is important to security of supply in Denmark, reducing production in one area does not affect security of supply, as it merely helps balance the given area, without affecting the transmission system.

5.5 The gas market

The gas market has been through a period of historically high prices and major fluctuations during the past gas year. Prices on the Danish gas market are closely linked to prices on the German market. The Danish gas market has therefore also been affected by the dramatic reduction in gas supplies from Russia to Europe during the gas year.

The lowest gas price was EUR 65/MWh on 1 November 2021. The highest gas price was EUR 320/MWh on 30 August 2022. The average price for the entire gas year was approx. EUR 125/MWh.

This is 5-6 times higher than the historical average.

⁵ [Energinet's Long-Term Development Plan 2022](#)

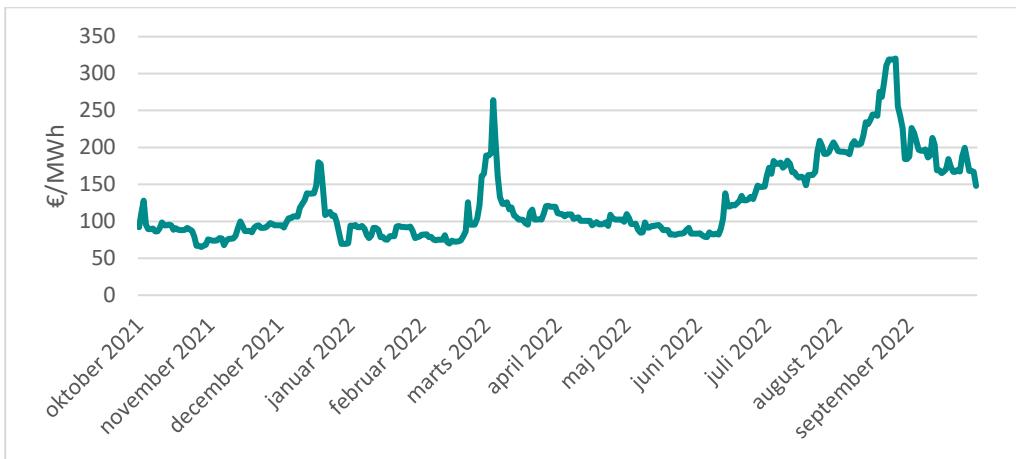


Figure 11 Gas prices in the Danish gas market (ETF).

It has primarily been events in the European gas market that have affected the Danish gas market. In particular, Russia stopping gas supplies to north-western Europe made gas prices skyrocket over the summer. The missing Russian supplies to Europe have been particularly replaced by increasing supplies of LNG.

The gas market has attracted considerable political focus over the past gas year as a result of the high prices and missing supplies from Russia. This has led the European Commission to lay down rules to help secure gas supplies for winter.

Baltic Pipe, which supplies Poland with Norwegian gas via Denmark, opened on 1 October 2022. Baltic Pipe opened with a reduced capacity of 2.6 GWh/hour, because parts of the project have been delayed.

The entire capacity was utilised by the market on the first day. Baltic Pipe also makes it possible to import Norwegian gas for delivery in Denmark, which helps to improve security of supply.

5.5.1 Trades on the Danish gas exchange

The volume of gas traded on the Danish Exchange Transfer Facility (ETF) declined from 2021 to 2022. 25% less volume was traded on the ETF in 2022 than in 2021. However, this decline is relative to the high level of trading in 2021, where 50% more was traded than in 2020. The drop in liquidity is partly because the 2022 gas year was historically mild, resulting in low gas consumption. The lower gas consumption has led to less need to trade the same volumes as in 2021.

6. Winter 2022/2023

6.1 Capacity orders

Shippers must book capacity from Energinet when they want to transport gas in the transmission grid. An overview of capacity orders at the various points of the gas market model is shown below, three of which are new points established with Baltic Pipe.

Annual orders for the 2022/2023 gas year:

- **New point** – North Sea Entry, gas imports from Norway, which opened in October 2022: In the Open Season for Baltic Pipe, approx. 10.6 million kWh/h was sold, or approx. 80% of the total capacity from Norway. No additional capacity was sold on an annual basis for the coming gas year.
- **New point** – Faxe Exit, exports of gas to Poland, which opened on 1 October 2022: In the Open Season for Baltic Pipe, approx. 10.6 million kWh/h was sold, or approx. 80% of the total capacity to Poland. No additional capacity was sold on an annual basis for the coming gas year.
- **New point** – Faxe Entry, imports of gas from Poland, which opened on 1 October 2022: No long-term or annual capacity has been sold in this direction.
- Ellund Exit, exports of gas to Germany: A small annual order of approx. 0.1 million kWh/h was placed for the 2022/2023 gas year.
- Ellund Entry, imports of gas from Germany: As in recent years, virtually no additional capacity was sold for the coming gas year. There is still approx. 3.5 million kWh/h left from the 2009⁶ Open Season. The total capacity at Ellund Entry on the Danish side is 7.7 million kWh/h.
- Joint Exit Zone⁷, supply of gas to end customers in Denmark and Sweden: This annual capacity can be ordered all year round, which means that bookings are not necessarily placed near the start of the gas year on 1 October.
- Nybro Entry, natural gas from the North Sea: For the first time ever, no annual bookings have been made from the Danish North Sea.
- RES Entry, biogas upgraded to natural gas quality and injected into the transmission system: Like the Joint Exit Zone, annual capacity at RES entry can be purchased throughout the year.

6.2 Capacity assessment for the meter and regulator stations and distribution system

In a supply crisis, it is important to maintain gas supplies to individual consumers, but non-protected customers are not guaranteed supplies during a supply crisis. The gas system must therefore be dimensioned so that it has the necessary capacity to supply the distribution areas, and hence individual consumers, at all times. This is ensured by assessing the gas offtake from each meter and regulator station, which adjusts the gas offtake in each area. The assessments are performed by Energinet on the basis of reporting from the Evida distribution company.

Energinet deems that the meter and regulator stations and the distribution system throughout Denmark have sufficient capacity to cover the supply requirement for winter 2022/2023.

6.3 Gas quality

Conceivably, Energinet is responsible for ensuring that the quality of the gas supplied from the gas transmission system complies with the Conditions for Gas Transport and the Executive Order on Gas Quality⁸.

⁶ Energinet has expanded the transport connection from Ellund in the northbound direction. Prior to the expansion, Energinet invited tenders for capacity in a bidding process (Open Season) to determine the interest in the project. In the Open Season process, the companies must submit financially binding bids and may thereby acquire connection capacity.

⁷ In connection with implementation of the Joint Balancing Zone with Sweden in 2019, the exit points towards Danish end users and Sweden have been gathered in one point, called the Joint Exit Zone.

⁸ Executive Order no. 230 of 21 March 2018 in the Danish Gas Supply Act.

The gas in the Danish gas system is supplied from different sources (the North Sea, Germany, the Danish gas storage facilities and biogas), with varying gas quality. Biogas added to the gas system is similar to the existing gas in the system and consists primarily of methane with small quantities of carbon dioxide, nitrogen and oxygen. Under normal supply conditions, it is a requirement that the upper Wobbe index⁹ for gas is in the range of 14.1-15.5 kWh/Normal cubic metre (Nm³) (50.76 to 55.8 MJ/Nm³). The relative density of gas must be between 0.555 and 0.7. The transported gas complied with the quality requirements in 2021/2022.

Gas quality can impact on the plants using the gas, and thus on gas consumers. In recent years, gas has primarily been supplied via Germany, as the Tyra complex is still undergoing renovation.

The quality of gas supplied to Danish consumers has varied greatly during this period. Like the rest of Europe, the war in Ukraine and Russia's limited gas supplies to Europe have meant that gas now primarily comes from other sources. Even though Denmark has imported gas from Germany commercially, it has primarily been of Russian origin. This has been clearly evident in the gas quality parameters, such as the Wobbe index (see Figure 12), which have fluctuated greatly. Following the commissioning of Baltic Pipe in October 2022, and when the Tyra complex is operational again in 2023, gas quality is expected to stabilise again. Despite variations in gas quality, this did not cause any major challenges for consumers in 2022.

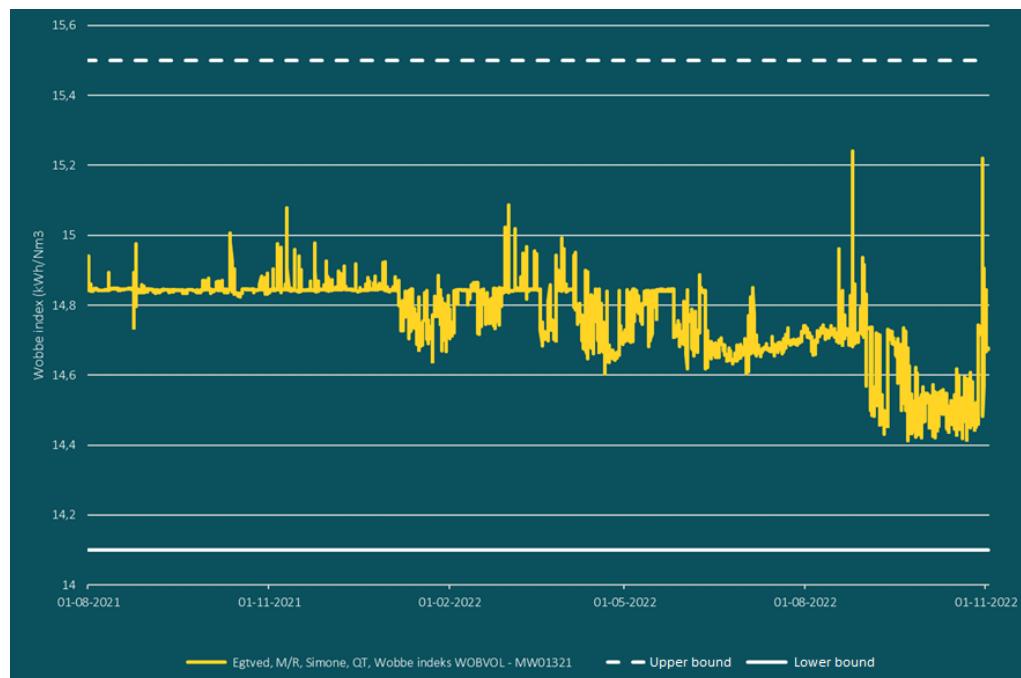


Figure 12 Gas quality during the coming winter. Wobbe index in the Danish gas system for 2022 – measured at Egtved East.

⁹ The Wobbe index is used to calculate calorific values for combustible gases.

7. Developments in the Danish gas system

7.1 Expected use of the gas system

The future development of the gas system is analysed to assess whether there is a need for long term initiatives. The Danish Energy Agency's AF 2022 for Energinet 2022 provides the best estimate of how the supply and demand situation might look on an annual basis in the 2022-2050 period.

7.1.1 Supply projections 2022-2040

During renovation process of the Tyra complex, gas imports from Germany have been Denmark's largest source of gas supply. The import capacity from Germany and the gas storage facilities have maintained the necessary system capacity to supply Danish and Swedish gas consumers.

Following the commissioning of Baltic Pipe and connection to Europipe II in October 2022, Danish import capacity increased considerably.

The import capacity will increase further when the Tyra complex is re-commissioned in winter 2023/2024. Following reopening of the Tyra complex and commissioning of the connection to Europipe II, the connection to Europipe II is likely to be the largest source of gas supply to Denmark.

These changes to the supply picture combined with the expected reduction in gas consumption and increased biogas production mean that the current net imports from Germany will probably turn into net exports from Denmark to Germany in the future. According to AF 2022, this change is expected to take place in 2027.

AF 2022 also assumes that all of the imported gas from Norway will be fully transited through Denmark and exported to the Polish market. However, the technical import capacity from Norway permits larger imports than shown in Figure 13, leaving the way open for gas imported from Norway to be used to supply Danish and Swedish customers or exported to Germany. AF 2022 also assumes that some of the exports to Poland will be imported from the Danish North Sea following re-commissioning of the Tyra complex.

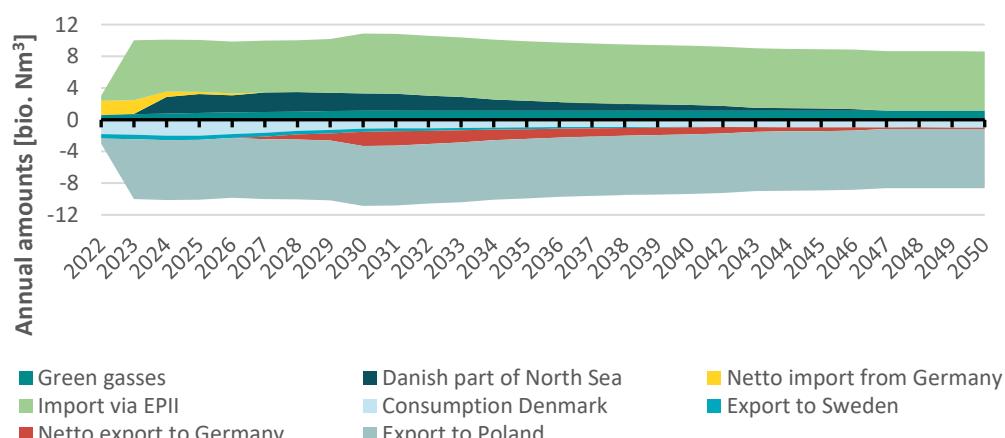


Figure 13 Supply situation for 2022-2040 based on Analysis Assumptions 2022 (AF 2022). Positive figures indicate imports, while negative figures indicate exports and

consumption. Imports equal the sum of exports and consumption for each year. The volumes have been converted from energy units (kWh) to Nm³ using a fixed gross calorific value of 12.1 kWh/Nm³ for all points.

7.1.2 North Sea supplies in the long term

Gas supplies to Denmark from the Danish North Sea region via Nybro are determined by North Sea production and export distribution to the Netherlands (via the North Sea) and Denmark. From Denmark, the gas supplies can be further transited to Germany, Poland and Sweden. The market players will decide the distribution, and the forecast in AF 2022 is that 80% of the Danish gas from North Sea production will be sent to Denmark after the Tyra complex is re-commissioned. Until the Tyra complex is re-commissioned, 8% of North Sea production is expected to flow to Denmark through the Syd Arne pipeline. This corresponds to the actual volume of North Sea supplies in 2020. The annual supplies from the Danish North Sea region to the Danish gas transmission grid projected in AF 2022 are shown in Figure 13 for the 2022-2050 supply situation.

7.1.3 Biogas production

The quantity of biogas added to the gas system is expected to rise from 6.9 TWh in 2022 to 13.8 TWh in 2030, corresponding to an annual share¹⁰ of 32% of Danish gas consumption in 2022 and 100% in 2030 (AF 2022). The rise in the biogas share is due to the combination of increasing volumes of biogas being injected into the Danish gas system and gas consumption being considerably reduced.

Danish biogas production contributes significantly to the security of supply, both in relation to the rising share of biogas in the gas system relative to gas consumption, and in relation to the locations of the biogas production facilities. Biogas benefits

Danish gas consumers by supporting decentralised and dispersed gas supply. Decentralisation of supply protects consumers to some extent in the event of supply failures.

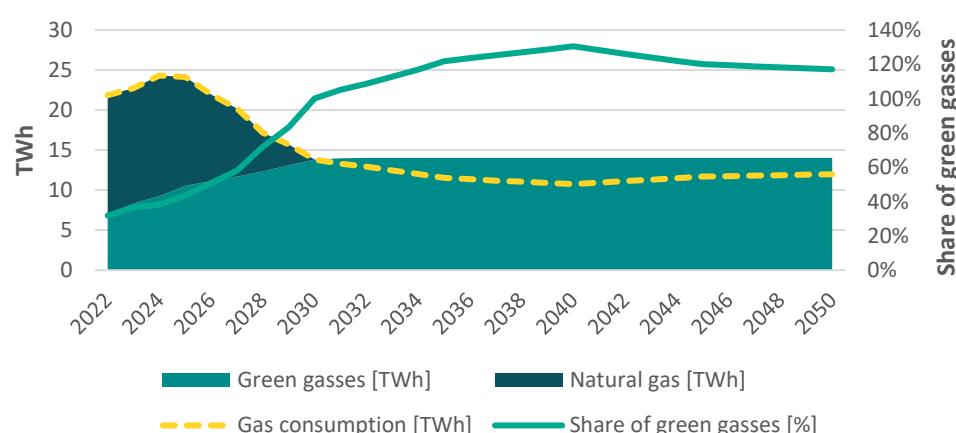


Figure 14 Changes in gas consumption and biogas production from AF 2022.

7.2 Consumption trend

By 2030, gas consumption is expected to fall to 63% of the level in 2022 (stated in AF 2022). This corresponds to a gas consumption of 13.8 TWh in 2030, which is expected to meet total

¹⁰ The annual share expresses the total biogas production as a proportion of total consumption over a calendar year. The annual share will be lower than the current share mentioned in section 2.2.4.

Danish gas consumption. The expected trend in gas consumption over the next 30 years (see Figure 14) is based on AF 2022, which reflects the current political goals of a 70% reduction in carbon emissions in 2030 and climate neutrality in 2050.

7.2.1 Trend in consumer segments

The business sector uses gas for heating and for process purposes. A reduction in gas consumption is expected towards 2030. The primary reduction in the business sector, approx. 55%, is expected in gas consumption for space heating. In relation to total gas consumption, the business sector will account for approx. 74% of consumption in 2030.

AF 2022 predicts that gas consumption in the business sector will increase in the short term as a result of the conversion from coal to gas. Examples of this include the connection of Aalborg Portland and Nordic Sugar to the gas system¹¹. Due to the high energy prices, especially for gas, there is uncertainty about the short-term projection of gas consumption for business and industry. Energinet is aware that much of industry already has or is converting from the use of gas to alternatives such as oil, LPG and heat pumps. Depending on whether gas prices are higher or lower than the oil price, this may lead to either higher or lower gas consumption in industry.

In 2030, the consumption of gas for heating in households is expected to be only one third of the level in 2022. Gas consumption for individual household heating will decline due to rising energy prices, the effect of subsidy pools for electric heat pumps and new political climate agreements¹² involving faster roll-out of district heating. In the climate agreement on green power and heating of 25 June 2022, the aim is for gas consumption for heating in households to be completely phased out by 2035.

Gas consumption for combined heat and power (CHP) and district heating is expected to decline by 75% towards 2030. This decline in consumption is partly because local CHP units using gas are expected to have difficulty making a profit on electricity production, but they are also impacted by political aims.

In the long term, gas is expected to primarily be used for combined heat and power and district heating in peak-load situations, for example when it is very cold, or if electricity prices are high due to low RE-based electricity generation from wind and solar power. In a normal year, peak-load consumption does not amount to much energy, but there may occasionally be very high gas consumption, primarily for high consumption periods for heat generation.

Unlike other segments, the transport sector's use of gas is expected to increase in step with greater interest in the use of biogas for road transport. The increase is projected to be approx. 50% in 2030 compared to the 2022 level.

The Danish Energy Agency's projection notes that the future gas consumption for transport is highly uncertain.

¹¹ Aalborg Portland is expected to be connected in 2023 and Nordic Sugar in 2024.

¹² [Climate agreement on green power and heating 2022 \(regeringen.dk\)](https://regeringen.dk)

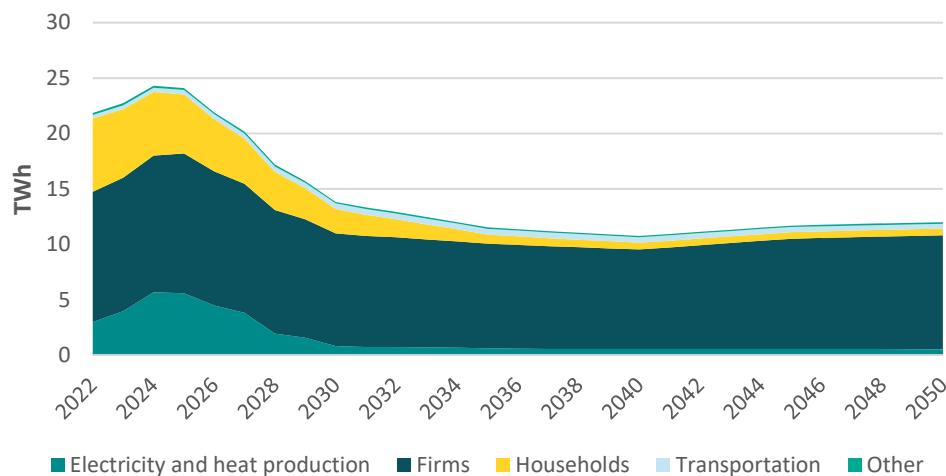


Figure 15 Changes in gas consumption per sector from AF 2022.

7.2.2 Consumption trend in Sweden

The consumption trend in Sweden is based on AF 2022. Generally, Sweden has had limited gas production. The forecasts for Swedish gas consumption are therefore usually assumed to match the forecasts for gas transport to Sweden via the Danish gas infrastructure, as Sweden is primarily supplied with gas from Denmark.

According to the Swedish Energy Agency, Energimyndigheten, the long-term forecast for Swedish gas consumption is stagnation during the 2020-2050 period. The Swedish Energy Agency bases this forecast on an expected decline in gas consumption, counterbalanced by increased LNG consumption in Swedish industry. Danish gas transit to Sweden is thus expected to gradually reduce. Approx. 6,953 GWh of gas is expected to be supplied to Sweden in 2022. This is expected to drop to around 4,612 GWh in 2030.¹³

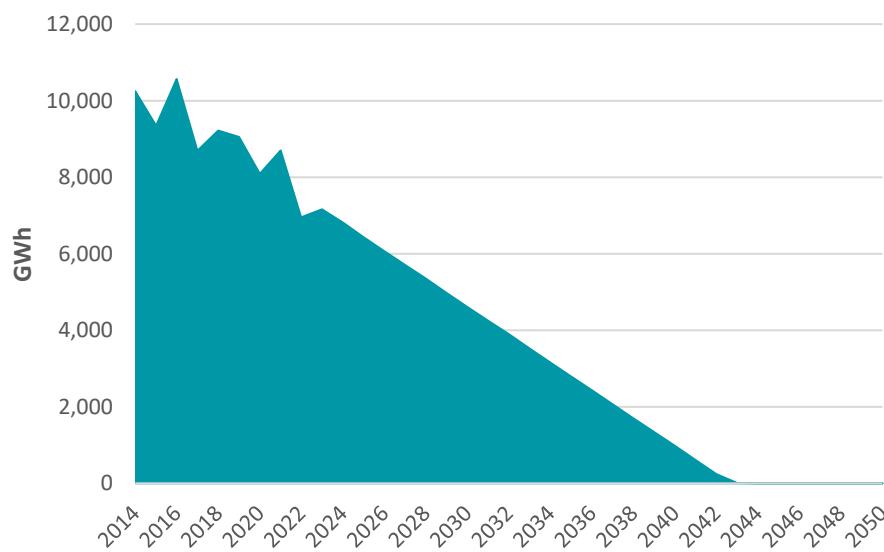


Figure 16 Expected gas transit from Denmark to Sweden.

¹³ This data is based on AF 2022, where the Swedish Energy Agency has submitted data to the Danish Energy Agency.

7.3 Gas market trend

Following the commissioning of Baltic Pipe, the Danish gas market is no longer dependent on one primary source of supply. The Danish gas market can now be supplied from Norway, Poland and Germany. Biogas now also makes up a significant part of the supply to the Danish gas market.

The Danish gas market will continue to be impacted by prices on the North West European gas market. The gas market in Denmark will be particularly affected by the situation in Germany, where sources of supply are under pressure. There is available capacity in the Danish gas system, which the Danish market can utilise to import Norwegian gas.

The majority of the gas is still expected to come from Germany, as the Ellund connection is still central to the Danish gas supply. Later – presumably in winter 2023/2024 – the Tyra complex will also be back in operation. This will lead to an even more robust situation for the Danish gas market, as it will have access to yet another source of supply. This may allow more active shippers into the Danish gas market, as Denmark will be a gateway for access to both the central and eastern European gas markets.

7.3.1 The European gas market

Even though much has been done in the European gas market to replace the normal Russian gas supplies, the supply situation still looks set to be tight this winter. Much will depend on how cold it gets in Europe during the winter, as a large proportion of the gas is used for heating. A key factor in getting through the winter smoothly will be to save as much gas as possible, so the European storage facilities maintain a certain minimum level at the end of the winter, providing the best starting point for refilling for the next winter.

Figure 17 illustrates that during the past ten years, Europe's gas market has been supplied from five different import sources during the winter periods, in addition to national production in the member states (approx. 450 TWh) and their gas storage facilities: Algeria (DZ), LNG (Global), Libya (LY), Norway (NO) and Russia (RU). For the past two years, the EU has also been supplied with gas from the Caspian region (CA), which is primarily gas from Azerbaijan.

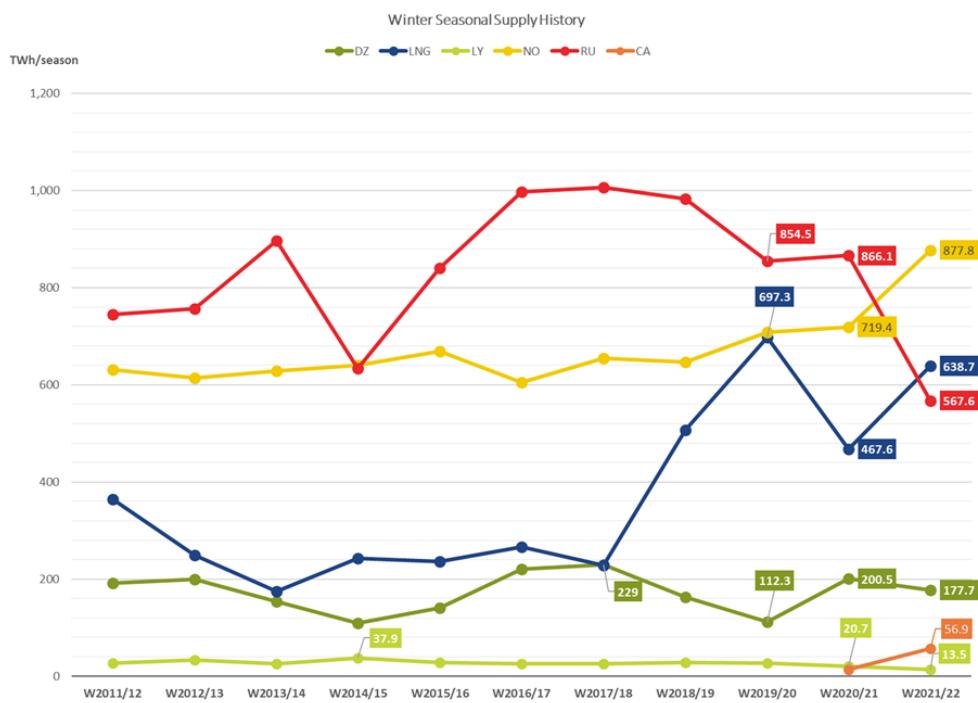


Figure 17 Historical gas supplies to the EU during the past 10 years [ENTSOG Winter Outlook 2022/2023].

Figure 17 shows that the proportion of LNG in the EU's supply mix has risen over the past five years, as more LNG terminals have become operational in the EU. It will be LNG that has to largely replace the missing supply from Russia. However, it should be noted that Norway was the EU's largest source of supply last winter, following optimisation of gas production from existing gas fields and new gas fields being brought online.

7.4 Development of Danish gas infrastructure

Energinet is working to develop the transmission system, so it is technically optimised and cost-effective, based on holistic planning. This means that solutions must be found which can handle the short-term needs, while also supporting the long-term development of the gas system.

Efforts to develop the infrastructure is being investigated in connection with Energinet's analysis of the long-term development needs for the gas system¹⁴. Various factors drive the changes in the gas system, such as changed capacity requirements in industry and political aims associated with higher volumes of green gas. The ongoing maintenance of the gas system and the need for reinvestment are also considered.

7.4.1 Development of the gas system

A rise in biogas production and a drop in gas consumption are expected towards 2030, based on the political climate objectives. This trend means that the transmission system must be adapted to better handle biogas production and ensure balance in the gas system. Adaptations to the gas system are made in close cooperation between Evida and Energinet. For Energinet, these adaptations involve reverse-flow plants being established to ensure that the biogas can

14 <https://energinet.dk/Om-publikationer/Publikationer/Langsigtede-udviklingsplaner-gas-systemet-2021>

be transported via the gas transmission system, stored in the large gas storage facilities, and used anywhere in the gas infrastructure.

Due to the current energy crisis, the rise in biogas production and the drop in gas consumption have accelerated. Energinet's Supervisory Board has therefore approved seven new construction projects around Denmark which will ensure biogas can be handled and integrated in the gas transmission system going forward. The first plant is expected to be commissioned in spring 2025.

Energinet has also launched several construction projects which are the result of third-party enquiries. This involves relocating certain sections of gas transmission pipelines near Kildedal on Zealand and in west Funen to make room for urban expansions and a new railway line, respectively. Construction of the new gas pipeline on Lolland-Falster is also expected to commence in spring 2023.

As gas consumption decreases, and a larger proportion of consumption is met by local biogas plants, the need to transport gas from the gas transmission system to the gas distribution systems through Energinet's gas pipelines and meter and regulator stations is reduced. More distribution systems will also be connected. This will increase security of supply, as a local area can then be supplied from multiple meter and regulator stations. Given the decreasing need to transport gas through Energinet's meter and regulator stations towards 2030, Energinet is investigating the future need for selected meter and regulator stations in the transmission system.

7.4.2 Maintenance of the gas transmission grid

Most of the Danish gas system was established in the 1980s and has been continually monitored and maintained to ensure efficient operations and that it is available with sufficient capacity for commercial players.

To maintain a robust gas system, it is therefore to be expected that large parts of the gas system will require major reinvestments in the years ahead. The basic life span of most of the physical assets is 30-50 years. The need has been calculated based on the regular condition assessments conducted for the various plant types, based on their condition, age and importance to the gas system. The general framework for the construction and maintenance of the owner's physical assets is provided by the executive order on safety provisions for natural gas plant.¹⁵ Actions are also guided by the GPTC guide, with the Danish Working Environment Authority's F.O.1 supplementary provisions.

Energinet operates, maintains, expands and adapts the Danish gas transmission grid to present and future needs, according to principles from the management system (ISO 55001 Asset Management). The ongoing operation and maintenance of the gas system is managed by prioritising and highlighting critical assets, justifying the activities, and identifying and addressing the risks that must be mitigated.

The purpose of introducing asset management is to ensure a uniform, high standard for management of the physical assets – from design and establishment to operation and maintenance and final asset disposal. This also involves working more systematically with condition-based maintenance, through an effort to explore the potential for transitioning even more from

¹⁵ <https://www.retsinformation.dk/eli/ita/1988/414>

schematised maintenance at fixed intervals, to condition-based maintenance with dynamic intervals.

A maintenance strategy sets the framework for achieving efficient operation, including the Asset Management goals at any time. The maintenance strategy thus also provides a common framework for the Asset Management Plans (AMP) related to each type of plant, and ensures cohesion between these and the Strategic Asset Management Plan (SAMP) – and hence the fulfilment of the owner's goals.

A future Asset Management certification must improve the common framework for asset management across the organisation and in relation to our business partners.

7.4.3 International infrastructure projects

Energinet has just completed an international infrastructure project – Baltic Pipe – which is now in full operation as part of the overall gas system.

7.4.3.1 Baltic Pipe

Energinet, together with Polish gas TSO GAZ-SYSTEM, completed the Baltic Pipe project in late 2022. This is a new gas transport route which will allow up to 10 billion Nm³ of gas per year to be transported from Norway to Poland via Denmark.

The capacity at the new points – Entry North Sea from Norway and Faxe (Exit and Entry) to and from Poland – was opened in three main stages:

- 1 October 2022. Partial opening of capacity from Denmark to Poland: A small part of the capacity was available by the original project date. About one fifth of the total capacity from Denmark to Poland thus opened on 1 October, with the first gas also being detected through that part of the pipeline. The first gas flowed through the pipeline before it had been opened to Norway, and before the new compressor station in Everdrup in south Zealand was operational.
- 1 November 2022. Partial opening of capacity from Norway to Denmark: Due to a delay in the newly built complex in Nybro, the gas from Norway began flowing a month later than initially planned, at half capacity.
- 1 December 2022. Full opening of Baltic Pipe: The delay resulting from revocation of the environmental permit for the Baltic Pipe project from May 2021 was reduced by one month. The delayed part of the onshore pipelines, the last parts of the Nybro complex and the Everdrup compressor station were ready at this time – the last outstanding elements of the total project.

You can read more about the Baltic Pipe project on Energinet's website:

<https://energinet.dk/anlaeg-og-projekter/projektliste/balticPipe#Milepaele>

8. The Security of Gas Supply Regulation

8.1 EU Security of Gas Supply Regulation

The EU member states face a common challenge, in that they consume far more energy than is produced within the EU. The EU is therefore dependent on importing large volumes of energy, and Russia has been the EU's largest source of gas supply. With the war in Ukraine and the limitations on gas supplies from Russia, security of gas supply in the EU has high political priority,

and the framework for security of gas supply is defined in European legislation. The Security of Gas Supply Regulation sets the framework for cooperation.

The purpose of the Security of Gas Supply Regulation is to help ensure that all necessary measures are taken to secure an uninterrupted supply of gas to gas customers on cold days with unusually high gas consumption (the '20-year event', which in Denmark is defined as a 24-hour period with a mean temperature of -13°C during a peak-load period of seven days) and in the event of an extended gas system disruption.

One of the fundamental elements in the Security of Gas Supply Regulation is to maintain a well-functioning internal market in the event of situations with gas supply shortages. This means that the market – at national, regional and European levels – helps to strengthen security of supply throughout the EU.

As a result of the current supply situation, the Security Of Gas Supply Regulation was amended in 2022 to introduce mandatory storage filling targets. This means, among other things, that the Danish gas storage facilities must be 80% full on 1 November 2022.

From 2023 onwards, the mandatory storage filling target will be 90% on 1 November of the given year.

Danish and European legislation on security of gas supply

DANISH CONSOLIDATED GAS SUPPLY ACT (THE DANISH GAS SUPPLY ACT)

Energinet's tasks

Section 12(1) of the Danish Gas Supply Act states that a transmission company must:

- Connect, as required, plants to upgrade biogas (upgrading plants), distribution systems and consumers.
- Ensure the quality of the gas supplied to or from the transmission system.
- Handle tasks concerning security of gas supply in Denmark.
- Cooperate with other transmission companies towards the efficient interchange of gas.
- Develop plans to meet future transmission capacity needs.
- Ensure that there are sufficient volumes of gas in the overall gas supply system to maintain the physical balance in the grid.
- Use transparent, non-discriminatory, market-based methodologies to procure the amount of energy necessary to perform its duties.
- Ensure a safe physical balance in the company's transmission system.

Energinet's contingency arrangements

Under the Danish Gas Supply Act, Energinet is responsible for making reasonable contingency arrangements. This means that Energinet must:

- Prepare risk and vulnerability analyses.
- Prevent risk, were possible.
- Prepare contingency plans.
- Rehearse the key elements in the contingency planning.
- Evaluate and learn from exercises and events.

As a transmission company, Energinet also has a coordinating role in the sector, both on a daily basis and during crises.

DANISH EXECUTIVE ORDER ON MAINTAINING SECURITY OF NATURAL GAS SUPPLY

Energinet's tasks

- Performing the general planning and operational functions required for maintaining security of gas supply in accordance with the Regulation of the European Parliament and of the Council concerning measures to safeguard the security of gas supply.
- Monitoring the security of gas supply. For this purpose, Energinet prepares and submits an annual report on security of gas supply to the Danish Energy Agency.

Protected customers

The Executive Order contains a description of protected customers in Denmark in accordance with the Regulation concerning measures to safeguard the security of gas supply.

Solidarity-protected customers

Solidarity-protected customers comprise the most vulnerable customers. It must always be possible to supply solidarity-protected customers with gas, even during an extreme supply crisis where it is necessary to ask neighbouring member states to supply gas under the solidarity mechanism.

REGULATION 2017/1938 CONCERNING MEASURES TO SAFEGUARD THE SECURITY OF GAS SUPPLY

The regulation primarily establishes a legal framework for the following:

- Definition of protected customers and solidarity-protected customers.
- Definition of infrastructure standard, supply standard and crisis levels.
- Division of responsibilities, solidarity, planning and coordination concerning preventive measures and in response to actual disruptions to supplies at member state level, regional level and EU level.
- Preparation of regional and national risk assessments, preventive action plans and emergency plans, including exceptional measures that can be introduced when the market is no longer able to satisfy gas demand. The documents must be updated every four years.
- A well-functioning internal market, even if there is a shortage of supply.
- Solidarity in supply crises.

8.1.1 Crisis levels

A crisis situation arises in cases where a normal supply situation cannot be maintained and there is a risk of insufficient gas to supply gas consumers. The escalation of a crisis situation is divided into three crisis levels, which must be used in all EU member states: Early Warning, Alert and Emergency. The declaration of the given crisis level depends on the volume of gas available in the system and on whether the market can handle the crisis on its own. Depending on the situation, either the Danish Energy Agency or Energinet declares the crisis level.

Early Warning and Alert are declared if there is a risk of an incident resulting in a deterioration of the supply situation.

- An Early Warning is declared if there is a presumption that an incident may occur which will result in a deterioration of the supply situation, which may lead to an Alert or an Emergency being declared.
- Alert is declared if an incident occurs that causes a significant deterioration of the supply situation, but where the market can handle the situation.

In Early Warning and Alert situations, the market is able to handle the crisis situation on its own, and Energinet may make use of a number of market-based tools to support the market, including higher imbalance payments. If the crisis situation deteriorates to such a degree that the market is unable to handle the crisis on its own, Energinet or the Danish Energy Agency may declare an Emergency.

- An Emergency is declared when all relevant market-based tools have been used up and the gas supply is still not sufficient to meet demand.

In an Emergency, Energinet obtains access to ‘non-market-based’ tools which are to help maintain supplies to protected customers. Use of emergency storage and interruption of non-protected gas consumers are examples of non-market-based tools.

In addition to the Early Warning, Alert and Emergency crisis levels, the EU adopted a regulation in July 2022 on coordinated measures to reduce demand. Under this regulation, the EU may declare an EU crisis level called ‘Union Alert’, which triggers a mandatory obligation to reduce gas demand in all EU member states and aims to uphold security of gas supply.

8.1.2 European or regional supply crisis

The crisis levels can also be used by the European Commission, which makes crisis level decisions in the event of European or regional supply crises. After receiving the European Commission’s decision, the Danish Energy Agency passes it on in the Danish system. Energinet and the Danish Energy Agency then handle the situation according to the Danish security of supply model.

In the event of a supply crisis at EU or regional level, Denmark must not utilise tools that unduly restrict the flow of gas in the internal European market. The European solidarity principle ensures that the flow of gas is not restricted on an unjustified basis in an Emergency at EU level.

8.1.3 Protected, non-protected and solidarity-protected customers

Under EU legislation, not all gas customers are guaranteed to be supplied with gas if a crisis arises in the gas system. Non-protected customers are not guaranteed to have their gas needs met in the event of a serious supply crisis. In the event of a supply crisis in the Danish gas system, the Danish Energy Agency or Energinet will decide whether the specific conditions make it necessary to fully or partially disconnect the gas supply to non-protected customers.

8.1.3.1 Protected customers

In accordance with the Security of Gas Supply Regulation, ‘protected customers’ must be guaranteed gas supply for at least 30 days in the event of unusually high demand or of disruption of the largest single gas supply infrastructure. Gas customers which are not protected customers may risk having their gas supply interrupted in a crisis situation where Energinet or the Danish Energy Agency declares an Emergency crisis level.

All private gas customers (households) are protected, but other customer types may also be included. In Denmark, the Danish Energy Agency makes these decisions. In addition to households, it is possible to include key social services (such as hospitals and educational institutions) and small and medium-sized enterprises, as long as their consumption is not more than 20% of total Danish gas consumption, and district heating installations, as protected customers.

The protected customers comprise around 400,000 private customers, public enterprises, CHP and district heating plants and small enterprises, which together account for around 70-75% of Danish consumption.

8.1.3.2 Non-protected customers

Non-protected customers are typically large enterprises. The need for disconnection of non-protected customers will depend on the specific situation, and a minimum notice of three days will be given to allow the enterprises an orderly shutdown of processes for which gas is used.

An Emergency will not automatically trigger interruption of gas supplies to Danish non-protected customers. A model may be used according to which non-protected customers in Denmark and Sweden may be partly (pro rata) disconnected, in proportion to the volume of gas available after protected customers have been supplied. In such a situation, the supply of gas to non-protected customers in Denmark will be based on a priority model. Non-protected customers with consumption that is critical to society will be prioritised before non-protected customers with non-critical consumption.

To reflect the differential treatment of the different customer groups in an Emergency, two different tariffs apply to security of supply. There is one tariff for protected customers and another lower tariff for non-protected customers. In the event of an emergency supply situation in which non-protected customers are not allocated relatively equal volumes of gas, an ex post calculation of the emergency supply tariff will be made for non-protected customers.

Up until 1 August 2022, non-protected gas customers could make a request to Energinet to become protected gas customers for the gas year, which began on 1 October 2022 and runs to 1 October 2023 (the 2022/2023 gas year). In their request, non-protected gas customers had to document that their future annual gas consumption would be significantly reduced compared

to consumption data for the past three years, as a result of changed production conditions or the company's transition to other energy sources.

Compared to previous years, Energinet has experienced considerable interest from non-protected gas customers wanting to change their status to become protected gas customers. Energinet has received 18 requests from non-protected gas customers who want to be protected for the 2022/2023 gas year.

Energinet has granted 3 of the 18 requests from non-protected gas customers.

The non-protected customers comprise around 70 large industrial enterprises and central power stations.

8.2 The cubic metre limit

A cubic metre limit is set and published each year by the Danish Energy Agency prior to the gas year, and is used to decide which customers are protected. For the 2022/2023 gas year, the limit for protected customers is 2.3 million Nm³/year (equivalent to 28 GWh/year), compared to 2.6 million Nm³/year (equivalent to 31 GWh/year) last gas year. Due to the decrease in the cubic metre limit, the number of non-protected customers has risen compared to the 2021/2022 gas year.

8.2.1.1 Solidarity-protected customers

Solidarity-protected customers are defined in the Security of Gas Supply Regulation and comprise the most vulnerable customers. It must always be possible to supply solidarity-protected customers with gas, even during an extreme supply crisis where it is necessary to ask neighbouring member states to supply gas under the solidarity mechanism.

All households are solidarity-protected customers. In addition, a few key social services such as hospitals (not educational institutions) and some district heating installations which supply heating to households and essential social services are also solidarity-protected customers.

Under the Security of Gas Supply Regulation, gas customers who are protected, but not solidarity-protected, must have access to financial compensation for the loss they may incur as a result of an interruption of their gas supply resulting from activation of the solidarity principle. This will typically be small and medium-sized enterprises as well as some district heating installations and essential social services. The non-protected customers, which already may be disconnected in an Emergency, are not entitled to compensation.

8.2.2 Solidarity

The EU's objective is that non-protected gas customers must be ensured gas in cases where insufficient gas supplies are available. In the Security of Gas Supply Regulation from 2017, this has resulted in a formalised solidarity principle between the EU member states. The member states may, as a last resort in an Emergency, request a neighbouring member state to take solidarity measures. This provides access to extra gas in situations where there is a risk that vulnerable gas customers cannot be supplied.

The member state requesting solidarity must pay financial compensation to the neighbouring member states which supply gas under the solidarity mechanism. The compensation is

calculated based, among other factors, on the loss incurred by enterprises due to disruption of their gas supply.

The Danish Ministry of Climate, Energy and Utilities has negotiated an international agreement on gas solidarity with Germany, and an agreement with Sweden is expected soon. Under the Security of Gas Supply Regulation, Sweden is exempt from showing solidarity with Denmark, as Denmark is Sweden's only source of supply. In connection with Baltic Pipe and the interconnection between the Danish and Polish gas transmission systems becoming operational, it is expected that a solidarity agreement will also be concluded with Poland.

BOX: The Danish security of supply model (in danish)

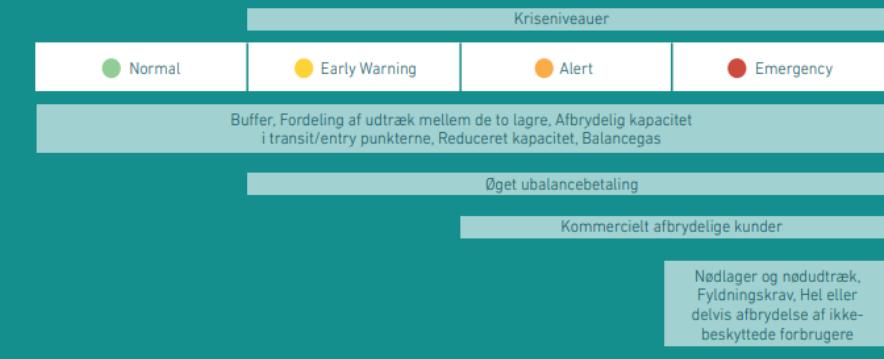
DEN DANSKE FORSYNINGSSIKKERHEDSMODEL

Energinet understøtter forsyningssikkerheden ved brug af den danske forsyningssikkerhedsmodel, som er opbygget indenfor rammerne i Gasforsyningssikkerhedsforordningen.

Gasmarkedet spiller en væsentlig rolle for den danske gasforsyningssikkerhed, og forsyningssikkerhedsmodellen indeholder konkrete markedsbaserede værktøjer så vel som ikke-markedsbaserede værktøjer. Værktøjerne kan tages i brug af Energinet i de forskellige kriseniveauer. Tilgængeligheden af værktøjerne afhænger af, hvilken situation, der skal håndteres, og valg af værktøjer afhænger af både værktøjets effekt og omkostning. Derudover er det forskelligt, hvornår de enkelte værktøjer må anvendes.

Det har naturligvis stor betydning for Energinets vurdering af situationen, under hvilke øvrige omstændigheder hændelsen indtræffer. Det vil være mere alvorligt, hvis en hændelse opstår om vinteren end om sommeren, da gasforbruget er temperaturafhængigt.

VÆRKTØJER I DEN DANSKE FORSYNINGSSIKKERHEDSMODEL



8.3 Documentation of security of supply

The EU Security of Gas Supply Regulation requires that the individual member state must prepare a number of documents describing the way crisis situations are handled: Risk assessment, preventive action plan and emergency plan. The aim is to ensure uniform handling of supply crises in the EU. These documents must be regularly updated as required, and at least every four years. Changes have been made to the emergency plan twice during 2022. The risk assessment is currently being updated, while the preventive action plan and emergency plan are expected to be revised in 2023.

8.3.1 Risk assessment

Each member state in the EU must prepare a national assessment of all relevant risks to security of gas supply. Joint regional risk assessments must also be prepared for the most important cross-border risks to security of gas supply for the regional risk groups defined in the Security

of Gas Supply Regulation. The results from the risk assessments in the regional risk groups are incorporated in the national risk assessment.

8.3.1.1 National Risk Assessment

In the risk assessment, an assessment is made of whether the gas infrastructure is designed to supply total gas demand on a day with unusually high demand due to breakdown of the largest infrastructure in Denmark. Examples of two types of scenarios which could affect supplies to Danish gas consumers during the Tyra shutdown are given below.

Scenarios affecting the supply to Denmark:

- Technical incidents in the North German gas transmission system
- European supply crisis.

Scenarios affecting operation of the Danish gas transmission system:

- Outage of the Stenlille gas storage facility
- Outage of Egtved compressor station
- Rupture in the pipeline from Egtved to Dragør.
- Cyber attacks

The national risk assessment forms the basis for the following conclusions:

Supplies from Germany

Supplies from Germany may be interrupted as a consequence of a European supply crisis, which could result from the war between Ukraine and Russia. Technical disruptions in the north German gas transmission system are also possible. The German TSO, Gasunie Deutschland, has assessed that, in all likelihood, it will always be possible to maintain at least 65% of the anticipated supplies in Ellund in connection with the lowering of the supply pressure, which is acceptable to Energinet. Together with an expansion of the withdrawal capacity in the Lille Torup gas storage facility, this will provide sufficient security of supply for the Danish gas market. However, there is low probability that it will be necessary to declare an Emergency and thus gain access to non-market-based tools.

Stenlille gas storage facility

In the event of an emergency shutdown at Stenlille gas storage facility in a situation with unusually high gas demand, a bottleneck will occur in the transmission system between the supply sources in the west and the gas consumers in the east. In this case, it may be necessary to use the market-based tools in the security of supply model, as action must be taken relatively quickly. As a last resort, it may be necessary to declare an Emergency and thus obtain access to non-market-based tools.

Cyber attacks

IT-related attacks on our infrastructure are a heightened risk due to the current security policy situation in the EU. Both as a result of the war between Ukraine and Russia, but also a heightened threat from China.

Preventive action plan

A preventive action plan must be prepared containing the measures needed to eliminate or mitigate the risks identified in the national risk assessment and the relevant regional risk assessments. Regional sections have been incorporated in the individual national action plan

Emergency plan

An emergency plan must be prepared containing the measures to be taken to eliminate or mitigate the impacts of a gas supply disruption. Regional sections have been incorporated in the individual national emergency plan.

8.3.1.2 The joint risk assessment for risk group Denmark

The regional risk groups are defined in the Security of Gas Supply Regulation. Denmark is in the following three groups: Denmark, Norway and Baltic Sea. The Danish Energy Agency coordinates risk group Denmark, where a joint risk assessment is prepared for the Danish and Swedish gas markets. As stipulated by the Security of Gas Supply Regulation, the Danish Energy Agency has coordinated the regional risk assessment with the authorities in the neighbouring member states, i.e. in particular the German Federal Network Agency and the Swedish Energy Agency, but also the Netherlands and Luxembourg. The Danish Energy Agency participates actively in the other two groups. Now that Baltic Pipe is operational, Denmark will also participate in the Ukraine, Belarus and the North East regional risk groups in 2022, and Poland will join risk group Denmark.

The scenarios which affect the supply in Denmark also affect the supply in Sweden. This is because the Swedish gas system is connected to the Danish gas system, and Sweden is completely dependent on the Danish gas system. An outage of the Egtved compressor station in Central Jutland, for example, will affect the gas supply to Eastern Denmark as well as the gas supply in Sweden.

In risk group Denmark, it was decided to focus on the most likely scenario for outage of the largest infrastructure for the region: A technical incident at the Quarnstedt compressor station in Northern Germany, which is critical in order to supply gas to Denmark. Gasunie Deutschland has stated that, in the event of an outage of the compressor station, it will still be possible to supply 65% of the firm capacity in Ellund, which will be sufficient to supply both the Danish and Swedish gas markets.

8.4 Emergency planning

In the field of energy, the purpose of contingency planning is to ensure that the most important parts of society's energy supply are maintained and continued in crisis situations. Emergency planning is thus different from security of supply in that it does not target normal operation. In the gas sector, emergency planning also focuses on the safety of the surroundings. Gas is highly flammable, making it important for the contingency arrangements to work preventively and to react quickly to contain accidents.

Contingency planning in the Danish electricity and gas sector is organised in relation to the sector responsibility principle. This means that the player with day-to-day responsibility for a given sector also has responsibility in the event of a crisis. Emergency incidents are rare but can have major impacts on society, unless there is an appropriate rapid response.

Emergency incidents often require cooperation with organisations outside the gas supply sector, such as the police, fire department and national emergency response services.

8.5 Information security

The world is changing, and thus the reality cyber security must respond to is also changing.

Tomorrow's information systems will be more data-centric and digitalised. This will place new demands on how our data is secured, while daily operations must continue to be secure and stable, and are becoming increasingly dependent on information and system availability.

Energinet also conducts large-scale construction projects with a high degree of international attention and cooperation. This creates new risks that stakeholders with conflicting agendas will seek to impact Energinet's ability to carry out critical projects.

Finally, the war in Ukraine and the transition to a hybrid war far from Ukraine's borders have had an impact and have increased awareness of the role cyber security has in securing critical infrastructure. Particularly within Energinet's area of supplying both electricity and gas.

These changed requirements impact on the traditional perceptions and protection mechanisms in various ways. Energinet is therefore in the process of implementing a number of strategic initiatives aimed at supporting and improving the measures already in place, to ensure that Denmark can continue to have a stable and secure energy system in the future.

BOX: Energinet Winter Outlook 2022-2023 and 2023-2024

To assess the supply situation, a reliability evaluation of the gas system is carried out. This evaluation looks at whether the system capacities are able to ensure supplies to consumers during each 24-hour period, ie an assessment of entry capacities, including storage volumes, in relation to consumption. The Winter Outlook assessment examines whether the system is able to provide the necessary capacity to meet an unusually high consumption based on a winter day with a mean temperature of minus 13°C.

Assessment for the coming winter 2022/2023

The assessment indicates that there is sufficient capacity in the gas system to meet demand on a very cold day, while the Tyra complex is under renovation. The Europipe (EP) II tie-in has been completed and was commissioned on 1 November 2022, allowing imports from Norway via EP II. Baltic Pipe has also been completed in the Baltic Sea. The Tyra complex is expected to be finished in the second half of 2023.

Exit Zone: Consumption in Denmark is 19.2 million Nm³/day. For the exit zone, the demand corresponds to Energinet's expectations at a daily mean temperature of -13°C.

Ellund: Ellund has net imports of up to 10.3 million Nm³/day.

Dragør: Dragør has exports of 7 million Nm³/day.

Storage facilities: Total withdrawal of gas from the storage facilities is estimated at 16.2 million Nm³/day, with 8.2 million Nm³/day coming from Stenlille and 8.0 million Nm³/day from Lille Torup. In special operating situations, 18.5 million Nm³/day can be supplied, with 8.2 million Nm³/day coming from Stenlille and 10.3 million Nm³/day from Lille Torup.

Nybro: Supplies in Nybro, which only come from the Syd Arne field, are estimated at 0.4 million Nm³/day.

RES: 1.7 million Nm³ biogas/day is supplied to the gas system.

EP II: Up to 27.4 million Nm³/day is imported at Nybro.

Assessment for winter 2023/2024

The assessment shows that there is sufficient capacity in the gas system to meet demand on a very cold day. The EP II tie-in and Baltic Pipe are in full operation. The Tyra complex is expected to be finished in the second half of 2023.

Exit Zone: Consumption in Denmark is 19.2 million Nm³/day. For the exit zone, the demand corresponds to Energinet's expectations at a daily mean temperature of -13°C.

Ellund: Ellund has net imports of up to 10.3 million Nm³/day.

Dragør: Dragør has exports of 7 million Nm³/day.

BP: Up to 27.4 million Nm³/day will be exported at Faxe.

Storage facilities: Total withdrawal of gas from the storage facilities is estimated at 16.2 million Nm³/day, with 8.2 million Nm³/day coming from Stenlille and 8.0 million Nm³/day from Lille Torup. In special operating situations, 18.5 million Nm³/day can be supplied, with 8.2 million Nm³/day coming from Stenlille and 10.3 million Nm³/day from Lille Torup. A distribution of withdrawals is used which supports the highest possible system pressure.

Nybro: Supplies in Nybro, which only come from the Syd Arne field, are estimated at 0.4 million Nm³/day.

RES: 1.9 million Nm³ biogas/day is supplied to the gas system.

EP II: Up to 27.4 million Nm³/day is imported at Nybro.