



ENERGINET



REPORT

# SECURITY OF GAS SUPPLY 2020



**Degree days:**

Degree days are a measure of how cold it has been. The degree days in a 24-hour period are the difference between the average daily temperature and 17°C. For example, if the average temperature over the 24 hours is 4°C, there are 13 degree days in the given day. 24-hour periods with an average temperature above 17°C do not count. The degree days for the year are found by adding up the degree days of the individual 24-hour period.

**Gas year:**

A gas year is defined as the period from 1 October to 30 September.

**Nm<sup>3</sup>:**

One Nm<sup>3</sup> (normal cubic metre) is the amount of gas which at 0°C and an absolute pressure of 1.01325 bar takes up 1 cubic metre. 1. mio. Nm<sup>3</sup> equals approx. 11 GWh in 2020.

**Normal year:**

A normal year is defined as and calculated at 3,113 degree days.

**Biomethane:**

Biomethane is upgraded biogas sent into the gas grid.

## SUMMARY

The security of supply has been high the previous year and the danish gas market is well prepared for the coming winter.

### **Security of supply was high during the first year without Tyra**

The first winter without gas from the Tyra complex passed uneventfully, and no incidents have threatened the security of supply. The key reasons for this were a mild winter 2019/2020, and that Energinet and market participants have prepared for the situation beforehand.

Supplies of gas from the Tyra complex ended on 21 September 2019. The Danish gas market continues to receive a small amount of North Sea gas from the Syd Arne field and from biomet-hane but imported gas from Germany will remain the most important supply source until the Tyra complex reopens. On 6 November 2020, Total E&P Denmark announced that the re-opening will be postponed from 1 July 2022 until 1 June 2023.

Denmark is more vulnerable to gas supply disruptions or extraordinary demand for gas while the reconstruction of the Tyra complex continues. Despite

the delay to re-open the Tyra complex, the supply situation in Denmark is still deemed to be robust. It is vital that market participants respond appropriately and book sufficient storage and transport capacity to supply Danish gas consumers.

The mild winter last year and the full storage facilities also mean that the gas market is in a strong position for the coming winter.

### **Fears of high gas prices were never realised**

The reduced gas supply from the North Sea means that less gas is available for sale in the Danish gas market. This led to a price jump in Denmark compared to the price in Germany, as the gas had to be sourced from the south. There were also fears that periods with significantly higher gas prices would arise, in the event of high demand in Denmark and Sweden. However, the high gas prices never materialised, and prices have been historically low for most of the period following the



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shutdown of the Tyra complex. There was even an expectation of negative gas prices at times.

The price level did not rise for the following reasons: The fillings of the gas storage facilities were at historically high levels, due to the mild winter and COVID-19. There was also an over-supply of gas in Europe for the same reasons. Instead of a shortage of gas, abundant amounts of gas have been available, and the expected high gas prices in Denmark never materialized.

#### Fluctuations in gas quality have not caused problems for gas consumers

While the Tyra complex is being re-constructed, less gas is supplied from the North Sea and more gas comes via Germany. This has changed the gas quality for Danish consumers during the period but has generally not given rise to any problems for them. Gas quality

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can impact on the plants using the gas, and thus on gas consumers. The gas quality in the Danish system depends on the mixing ratio between gas from the various sources: North Sea gas, imported gas from Germany and biogas supplied to the gas system – all of which have different characteristics.

#### Biomethane is starting to contribute to the security of supply

The number of biogas plants and the volume of biogas injected into the gas system has been steadily rising for many years. This means that the share of gas consumption being met by methane has also increased. Biogas fed into the gas system is expected to account for more than 20 % of Danish gas consumption from the grid by the end of 2020. The share of biomethane is considerably higher in the summer when gas consumption is low. On a single day in July, the biomethane share exceeded 40 %.

Biomethane already accounts for a significant share of gas consumption, and this share will only increase as consumption of natural gas is phased out. Biomethane is expected to cover 63 % of Danish gas consumption in 2030, and 100 % in 2040. Biomethane has



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become a real source of supply to the Danish gas market. This will reduce dependence on gas imports in the future.

#### **Biomethane and transit gas are changing the principles for security of supply**

Historically, security of supply has been tied to gas from one large central supply source in the North Sea, the gas storage facilities, and later from Germany. This picture is changing due to local supplies of biogas and transit gas in Baltic Pipe.

The supply of biomethane comes from biogas plants scattered throughout most of Denmark. This means that there are many small local sources of supply in many parts of the gas system. As more biogas is injected into the gas system, the need for an emergency gas supply reduces if one of the major supply sources goes offline. The sizes and locations of the biogas plants means that if a few plants drop out, it will not have any impact on security of supply, as only small volumes will need to be replaced.

Baltic Pipe will commence operation in 2022, resulting in considerable volumes of gas transported through Denmark, and the Danish gas system will be operated differently. The large volumes of gas will make the supply in Denmark more robust but will also pose some challenges to the operation of the system. Greater transit volumes lead to a risk of larger imbalances. These can adversely affect the pressure in the gas system and cause security of supply challenges. To avoid this from happening, the right incentives need to be in place to ensure that shippers also deliver gas into the system.

The way the gas system is to be used in the future therefore changes the principles and tools that make up Energinet's security of supply model. Energinet is in the process of ensuring that the security of supply model will be also appropriate for the future.

#### **Energinet is working towards hydrogen opportunities in Denmark**

Hydrogen has received focus as an important element in a successful green transition. The potential for hydrogen, and other green fuels produced from hydrogen, lies particularly in the sectors which cannot be electrified. These fuels will be the new green fuels in Denmark, and Energinet is working to explore hydrogen options in Denmark. For example: Will hydrogen need to have its own infrastructure, or can the existing gas system be used? Are the regulatory frameworks in place? Is there a demand for hydrogen in Denmark?

Interest in hydrogen is being seen in earnest in Europe, where several countries have launched specific hydrogen strategies during 2020. Germany has a goal of adding 10 GW of electrolysis capacity in 2030, combined with a significant volume of imported hydrogen, including from the North Sea. The Danish Government's climate agreement, covering the establishment of two large energy islands, can help to position Denmark as an exporter of green hydrogen.

In collaboration with ten European Gas TSOs, Energinet has prepared a vision paper for a 'European Hydrogen Backbone'. The vision illustrates possible infrastructure development, with a focus on reusing existing gas infrastructure which will become available when natural gas is phased out. The vision estimates that up to 75 % of the hydrogen infrastructure in 2040 may be converted from existing natural gas infrastructure.



## MAJOR CHANGES IN THE GAS SYSTEM

There are major changes in the Danish gas system in recent years: Biogas production is increasing, gas consumption is declining, and Denmark will soon become a transit country for large volumes of gas.

The ambitious Danish climate goals will lead to a marked fall in Danish gas consumption in the coming years. The decline in gas demand is happening at the same time as biogas production is increasing and Baltic Pipe is set to come online. All these factors will radically change the conditions for the Danish gas system over the next 10-20 years.

The Danish aim of reducing greenhouse gas emissions by 70 % in 2030 will have an impact on Danish gas consumption. 'Analysis Assumptions for Energinet 2020' project that gas consumption will be almost halved in 2030. Declining consumption combined with the rapid expansion of biogas production means that green gas can potentially meet the entire Danish gas consumption in 2040.

### Volume of green gas in the gas system is increasing

Biomethane will be able to supply 30 % of Danish gas consumption by 2023, and biomethane production already exceeds local gas consumption in some areas. Energinet Gas TSO has been working closely with distributor Evida over the last three years to integrate the increasing volumes of biomethane into the gas system, so that they can benefit all of society.

"The Danish gas system was designed to receive all the gas from one place. In the past, we had only a central supply of natural gas from the North Sea, which had to be distributed. Now that biomethane is being produced locally,

we have to do the opposite. Unlike power, gas cannot automatically flow backwards into the transmission grid from the distribution grid. We therefore need to work out how to best get the gas back into the transmission grid if we cannot use it locally," says Niels Træholt, Energy System Developer at Energinet Gas TSO.

### Focus on long-term planning

Energinet would like to see the increasing volumes of biomethane to be initially handled locally. One solution for handling the gas locally could be to distribute it across a larger geographical area by connecting distribution grids. From the summer 2021, the distribution grids in central and northern Jutland will be connected, so that gas can flow freely between these areas. Biomethane can also be integrated by pushing gas from the distribution system up into the transmission system via reverse-flow plants. There are many potential solutions, and Energinet is working closely with Evida to find the most cost-effective approach.

One of the ways to find the best solutions for the entire gas system is through Energinet's planning work and analyses of 'Long-term development requirements in the gas system' (Energinet, 2020). These analyses provide a basis for initiating specific business cases where alternative solutions are investigated. Through this work, Energinet seeks to create a qualified basis for early and informed dialogue with stakeholders on an energy system that can support the green transition.





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### Denmark to become a gas transit country

The rising volume of biomethane is not the only major change that is happening now. Energinet is in the process of expanding the gas system through Denmark, so that gas from Norway can be transported to the Polish gas market. The new gas route, called Baltic Pipe, means that Denmark will become a transit country from 2022. Access to gas from Norway will give Denmark a new source of supply at the same time. Baltic Pipe also offers the possibility of importing gas from Poland. When Baltic Pipe commences operation, it will generate increased tariff income. This income can contribute to operation of the transmission system as gas consumption decreases, and to future investment in the green transition for the gas system.

Even though there will be a mix of green gas and fossil gas in the system in the future, Energinet can guarantee that the green gas will be earmarked for those who want it. This is done by buying and selling certificates for the green gas.

### Decentralisation means greater robustness

Decentralisation of the gas supply will make security of the gas supply in Denmark more robust. While we have received gas from two sources of supply in the past (Germany and the North Sea), there will be more sources in the future – the North Sea and Germany, Norway and Poland via Baltic Pipe, and biomethane supplied locally via the distribution

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system. 'Analysis Assumptions for Energinet 2020' presents a possible scenario with 100 % green gas in 2040, where we will go from having two large sources of supply to over 100 small biogas sources.

"If one of the small sources of supply cuts out, it will not have much impact, compared to if the supply from the North Sea or Germany cuts out. There is value in the numbers. Having all these biogas plants spread around the system, contributing to the supply in the distribution grids, will make the system more robust," explains Maria Hjortholm, Strategic Grid Planner at Energinet.

Having more biomethane in the gas system and decentralisation will therefore mean that security of supply in Denmark is more robust.







## NEW SECURITY OF SUPPLY FRAMEWORK

The major changes will have an impact on how Energinet operates the gas system and the concept of security of gas supply.

With Baltic Pipe, Energinet sees a new era approaching for operation of the Danish gas system. Many of the protected household consumers will also disappear, as gas for household heating is phased out. This will significantly change the overall risk profile in the coming years – and hence Energinet's approach to maintaining security of supply.

From October 2022, Denmark will become a transit country for large volumes of gas being transported from Norway to Poland via Baltic Pipe. This will mean more sources of supply for the Danish gas system and Danish customers overall.

"By diversifying Denmark's gas supply across several sources, Danish gas consumers will be less vulnerable to supply failures from single supply sources," says Martin Graversgaard, System Analyst at Energinet.

### **Baltic Pipe is changing the conditions for operation of the gas system**

The conditions governing the operation of the entire gas system will change markedly with Baltic Pipe. The volumes that can flow through Baltic Pipe are so large that in the event of imbalances, they can in principle 'suck the system dry', thereby removing transport capacity. There is less risk of this occurring at present. This will be an unacceptable risk and necessitates a revision of the Danish balance model for market participants.

"Our balance model must ensure that shippers inject just as much gas into the system as is removed. This is currently based on a daily balance mechanism. This will not be sufficient when Baltic Pipe commences operation. With the large volumes flowing through Baltic Pipe, we must be certain that the total system is kept in balance across a period of a few hours," explains Lasse Krogh, Economist in Gas Market Development at Energinet.

In consultation with market participants, Energinet is developing a new balance model which will ensure security of supply when Baltic Pipe commences operation. Energinet is finding that market participants understand the need to introduce hourly restrictions, so that they also have an incentive to keep the total system in balance throughout the day. He also emphasises that the toolbox must be expanded to include other measures:

"There are several market-based tools that we can use when Baltic Pipe commences operation. We are considering offering flow commitments, where shippers are paid to flow in a certain way. This will ensure security of supply when Baltic Pipe puts strain on the gas system. It may be relevant in some situations when there is a lot of gas to be moved to Poland via Denmark. We are also looking at other tools, such as capacity buy-back. In some situations, where the gas system is under strain, it may be necessary to buy back some





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of the capacity in Baltic Pipe. This can be done by offering capacity buy-backs on the market. This is done using a market mechanism, to ensure the best prices for the service.

#### Phase-out of gas for heating is reducing emergency supply requirements

In June 2020, the Danish Government entered into an agreement with the energy accord parties to phase out gas for household heating towards 2040. This covers more than 350,000 Danish households which currently heat their homes using gas and are part of the protected customer group. This customer group has special high priority in relation to security of supply.

"This means, for example, that Energinet Gas TSO has a special responsibility to protect these customers by providing gas from emergency storage facilities in crisis situations, where the market is unable to supply sufficient gas. When it supplies fewer households, Energinet will therefore be able to purchase smaller volumes of gas for emergency supply," explains Martin Graversgaard, System Analyst at Energinet.

Lasse Krogh also explains that the phase-out of gas to households may have an impact on the composition of the emergency supply tariff. However, he notes that it must be matched to the ongoing changes in the market:

"Gas for household heating won't be phased out overnight. However, looking a little further ahead, one can envisage

different tariffs that are better suited to a gas market that has moved away from supplying a lot of households, to primarily supplying industry and serving as a transit country for gas to Poland. We must, of course, consult with industry and the market about this."

#### Robust security of supply during Tyra renovation

The date for recommencing operation of the Tyra platform has been postponed until June 2023. This means that the Danish and Swedish gas markets will have to do without gas from the Tyra field for yet another winter.

"Now that reconstruction of the Tyra platform has entered its second year, we can see that the supply situation in Denmark is stable. The Danish gas storage facilities are full, and capacity has been purchased from Germany to Denmark. Based on the positive experiences to date, we are confident that the market is ready for another winter with no production from the Tyra field," says Martin Graversgaard.

The major increase in biomethane production in Denmark in recent years is expected to continue in the coming years.

"We have witnessed such a major increase over the past few years that it is actually starting to have an impact on security of supply. We did not expect that biomethane would be able to play a role in security of the gas supply ten years ago. It is positive to see that green energy can also help ensure security of supply in the gas market," say Lasse Krogh and Martin Graversgaard.



