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^3:
One Nm^3 (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^3 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.

Front page picture: St. Andst

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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 biomethane 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

St. Andst

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 oversupply 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 reconstructed, 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 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.

On 6 November 2020, Total E&P Denmark announced that the re-opening will be postponed from 1 July 2022 until 1 June 2023. It is vital that market participants respond appropriately and book sufficient storage and transport capacity to supply Danish gas consumers.

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

The high gas prices never materialised, and prices have been historically low for most of the period following the shutdown of the Tyra complex. There was even an expectation of negative gas prices at times.

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 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.

"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.


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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.


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1. SECURITY OF GAS SUPPLY

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, for example private households on cold winter days.

1.1 Security of gas supply in Denmark

Energinet is responsible for ensuring sufficient transport capacity in the transmission system. Energinet is also responsible for ensuring system integrity. However, the responsibility for the availability of gas for supply of gas customers on the day of consumption rests with the market players, i.e. purchasers of gas on the whole sale gas market and gas suppliers which sell the gas to consumers. Only in an emergency where the market no longer functions Energinet can step in and handle the gas supply. However, only to the extent that the market players are unable to meet their obligations, to avoid a breakdown of the transport system. At the same time, Energinet ensures continued gas supply to protected customers, for example private households, in an emergency supply situation.

The individual market players' responsibility is, for example, laid down in the Danish preventive action plan and emergency plan.

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

1.2 The security of gas supply regulation

The EU member states face a common challenge in that they consume far more energy than is produced in the EU. This is a strategic challenge, which has become particularly evident at a time when political relations with Russia are strained, given that Russia is the EU's largest source of supply. Security of gas supply in the EU is therefore a high political priority, which means that the framework for security of gas supply is defined in European legislation. The Security of gas supply regulation concerning measures to safeguard the security of gas supply (the 'Security of Gas Supply Regulation') sets the framework for the members states' cooperation.

The purpose of the Security of Gas Supply Regulation is to safeguard that all necessary measures are taken to ensure gas customers uninterrupted supply of gas on cold days with unusually high gas consumption (the so called once-in-20-years event) and in case of disruption in the gas system. 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 shortage. This means that the market – at national, regional, and European levels – helps to strengthen security of supply throughout the EU.

1.2.1 Crisis levels

If a normal supply situation cannot be maintained and there is a risk of insufficient gas to supply gas customers, this constitutes a crisis situation. The escalation of a crisis is divided into three crisis levels: Early Warning, Alert and Emergency. The declaration of the individual crisis level depends on the

DANISH AND EUROPEAN LEGISLATION ON SECURITY OF GAS SUPPLY

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

Energinet's tasks

The Danish Natural Gas Supply Act, primarily section 12(1), states that a TSO must:

- Connect, as required, plants to upgrade biogas to natural gas quality, distribution grids and consumers
- Ensure the quality of the natural gas supplied from the transmission grid.
- Handle a number of tasks concerning security of gas supply in Denmark.
- Cooperate with other TSOs towards the efficient interchange of natural gas.
- Develop plans to meet future transmission capacity needs.
- Ensure that there are sufficient volumes of natural gas in the overall natural gas supply system to maintain the physical balance in the grid.

Energinet's contingency arrangements

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

- Prepare risk and vulnerability analyses.
- Prevent risk, where possible.
- Prepare contingency plans.
- Practise the key elements in the contingency planning.
- Evaluate and learn from drills and incidents.

As a TSO, 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 natural 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 natural 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.

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

The Security of Gas Supply Regulation primarily establishes a legal framework for the following:

- Definition of protected customers and solidarityprotected customers.
- Definition of infrastructure standard, supply standard and crisis levels.
- Distribution of responsibilities, solidarity, planning and coordination, both concerning preventive measures and reactions to actual disruptions of gas supplies at member state level, regional level and EU level.
- Preparation of risk assessments, preventive action plans and emergency plans, including establishment of 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
- Wellfunctioning internal market, even in situations of shortage of supply.
- Solidarity in supply crises.

volume of gas available in the system and on whether the market can handle the crisis on its own.

Energinet may declare Early Warning and Alert if there is a risk of an incident resulting in a deterioration of the supply situation.

- 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 Alert or 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 on its own without the need to resort to non-market-based tools.

In Early Warning and Alert situations, the market can handle the crisis situation on its own, and Energinet may make use of a number of market-based tools to support the market. If the crisis deteriorates to such a degree that the market is unable to handle the crisis on its own, Energinet may declare Emergency.

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

In Emergency, Energinet obtains access to 'non-market-based tools' in order to help maintain supplies to the protected customers.

1.2.2 Protected and non-protected costumers

In accordance with the Security of Gas Supply Regulation, 'protected customers' must be guaranteed gas supply for minimum 30 days, regardless of crisis level, in the event of unusually high demand or in the event of disruption of the largest single gas supply infrastructure. The Ellund pipeline is the largest single gas infrastructure, and the period in which protected customers are guaranteed supply has now been reduced to 30 days.

All private customers (households) are protected, but other customer types may also be included. In Denmark, the Danish Energy Agency determines which gas customers are protected customers. Today, essential social services such as hospitals and educational institutions, small and medium-sized enterprises and district heating installations have the status of protected customers. The enterprises which are categorised as protected customers will depend on the cubic metre threshold set by the Danish Energy Agency each year. The cubic metre threshold is set based on the criteria that a maximum of 20 % can be protected customers.

The purpose of the Security of Gas Supply Regulation is to safeguard that all necessary measures are taken to ensure gas customers uninterrupted supply of gas on cold days with unusually high gas consumption

Nonprotected customers are typically large enterprises. The need for disconnection of nonprotected 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 natural gas is used.

To reflect the differential treatment of the different customer groups in an Emergency, two different tariffs apply to the security of supply. There is one tariff for protected customers and another lower tariff for nonprotected customers.

The protected customers comprise around 400,000 private customers, public enterprises, CHP and district heating plants and small enterprises, which together account for approx. 75 % of the consumption. The nonprotected customers comprise approx. 45 large industrial enterprises and central power stations.

1.2.3 Solidarity

The EU's objective is that vulnerable natural gas customers must be ensured gas in cases where insufficient gas supplies are available. In the latest version of the Security of Gas Supply Regulation, this has resulted in a formalized solidarity concept between the countries in the EU. The member states may, as a last resort in an Emergency, request a neighboring member state to take solidarity measures.

The member state requesting solidarity must pay financial compensation to the neighboring member states which supply gas under the solidarity concept. The compensation is calculated based, among other factors, on the loss incurred by enterprises because of the disruption of their gas supply.

In the course of 2020, negotiations have been conducted on international agreements for use when requests are made for gas under the solidarity concept. The agreement between Denmark and Germany is expected to be signed by the ministers before the end of the year. According to the security of gas supply regulation, Sweden is exempt from showing solidarity to Denmark, as Denmark is the only source of supply to Sweden. The agreement on solidarity from Denmark to Sweden is expected to be signed in 2021.

1.2.3.1 Solidarityprotected costumers

Solidarity protected customers is defined in the Security of Gas Supply Regulation, and it includes the customers which must be supplied with gas, even during an extreme supply crisis

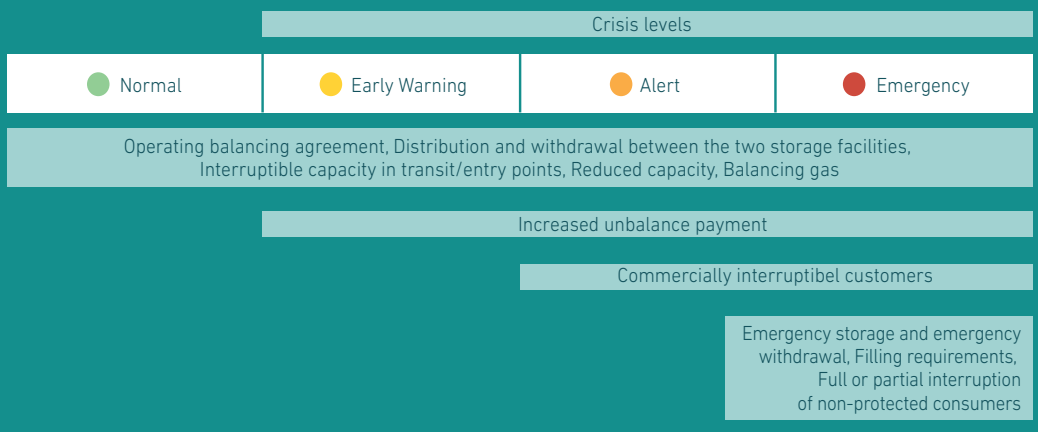
THE DANISH SECURITY OF SUPPLY MODEL

The gas market plays a key role in the Danish security of gas supply. Energinet supports security of supply by using the Danish security of supply model. The security of supply model is structured within the framework of the Security of Gas Supply Regulation

The model contains specific marketbased and non marketbased tools, which Energinet can use at the various crisis levels. The use of these tools will largely depend on the type of situation to be dealt with. The choice of tools therefore depends on both the effect and cost of the individual tool. Certain tools can only be used in certain situations.

Of course, Energinet's decision will take account of the wider circumstances in addition to the incident itself. It will often be more serious if an incident occurs in winter than in summer because gas consumption is highly temperature dependent.

TOOLS IN THE DANISH SECURITY OF SUPPLY MODEL



where it is necessary to ask the neighbouring member states to supply gas under the solidarity concept.

All households are solidarity protected customers. In addition, some significant 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. The likelihood that the national supply is reduced to the consumption level of solidarity protected customers' consumption is very small.

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

1.2.4 European or regional supply crisis

The crisis levels can also be used by the European Commission, which adopts 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 Denmark. From then on, Energinet handles 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 use tools excessively restricting the flow of gas in the internal market. The European solidarity principle ensures that the flow of gas is not restricted on an unjustified basis in Emergency at EU level.

1.3 Documentation of security of supply

The Security of Gas Supply Regulation requires that the individual member state prepares some documents describing the way crisis situations are handled. The documents are to contribute to ensuring uniform handling of supply crises in the EU. The documents have been updated in 2019 and covers the period 2018-2022, i.e. they do not include the reopening of the Tyra complex in 2023 and the commissioning of the Europipe II connection and the Baltic Pipe in 2022.

- Risk assessment
  Each Member State in the EU must prepare a national assessment of all relevant risks affecting security of gas supply. In addition, the member states also prepare regional assessments to cover the main cross-border risks. The national risk assessment must consider the relevant regional risk assessments. The national risk assessment and the regional risk assessment for the group "Denmark" are described in further detail in section 1.3.1 below. In the national risk assessment, the results of the risk assessments in the regional risk groups have been incorporated and vice versa.

- Preventive action plan
- A preventive action plan is prepared with measures necessary 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. In July 2019, the Danish Energy Agency received comments on the preventive action plan, which must be handled before the final plan is available.

- Emergency plan
  An emergency plan is prepared with measures to be taken to eliminate or mitigate the consequences of a gas supply disruption.

The EU's objective is that vulnerable natural gas customers must be ensured gas in cases where insufficient gas supplies are available. In the latest version of the Security of Gas Supply Regulation, this has resulted in a formalized solidarity concept between the countries in the EU.

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Regional sections have been incorporated into the individual country's emergency plan. The European Commission has a number of questions for the plan, including interruption of Sweden in crisis situations, which is being discussed between the Danish Energy Agency and the European Commission.

1.3.1 Risk assessment

1.3.1.1 National risk assessment

The risk assessment assesses whether the gas infrastructure is designed to cover total gas demand on a day with unusually high demand due to outage of the largest infrastructure. The scenarios with the greatest consequence for the supply can be summarised as follows:

Incidents which affect the supply to Denmark:

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

Incidents affecting the operation of the Danish gas transmission system:

- Stenlille gas storage facility
- Egtved compressor station
- The pipeline from Egtved to Dragør

The national risk assessment forms the basis of these conclusions:

- Supplies from Germany
  Supplies from Germany may be interrupted both because of a European supply crisis and in the event of technical disruption in the North German gas transmission system. The German TSO Gasunie Deutschland has assessed that it most likely will always be possible to maintain at least 65 % of the anticipated supplies in Ellund, when the supply is lowered to what is accepted by 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 a 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 grid

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.

1.3.1.2 The joint risk assessment for risk group Denmark

The regional groups are defined in the Security of Gas Supply Regulation. Denmark is placed in the following groups: Denmark, Norway, and Baltic Sea. The Danish Energy Agency coordinates the 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 leads 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 in the two other groups.

Scenarios which affect the supply in Denmark will also affect the supply in Sweden. The reason is that Denmark is the only source of supply to Sweden, and Sweden thus depends on gas supply via Ellund as well. In addition, the Swedish gas system is located east of the Egtved compressor station, and the same challenges of ensuring gas supplies to Eastern Denmark in situations with unusually high gas consumption are also relevant for Sweden.

In the 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 a compressor station in Northern Germany (Quarnstedt). 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.

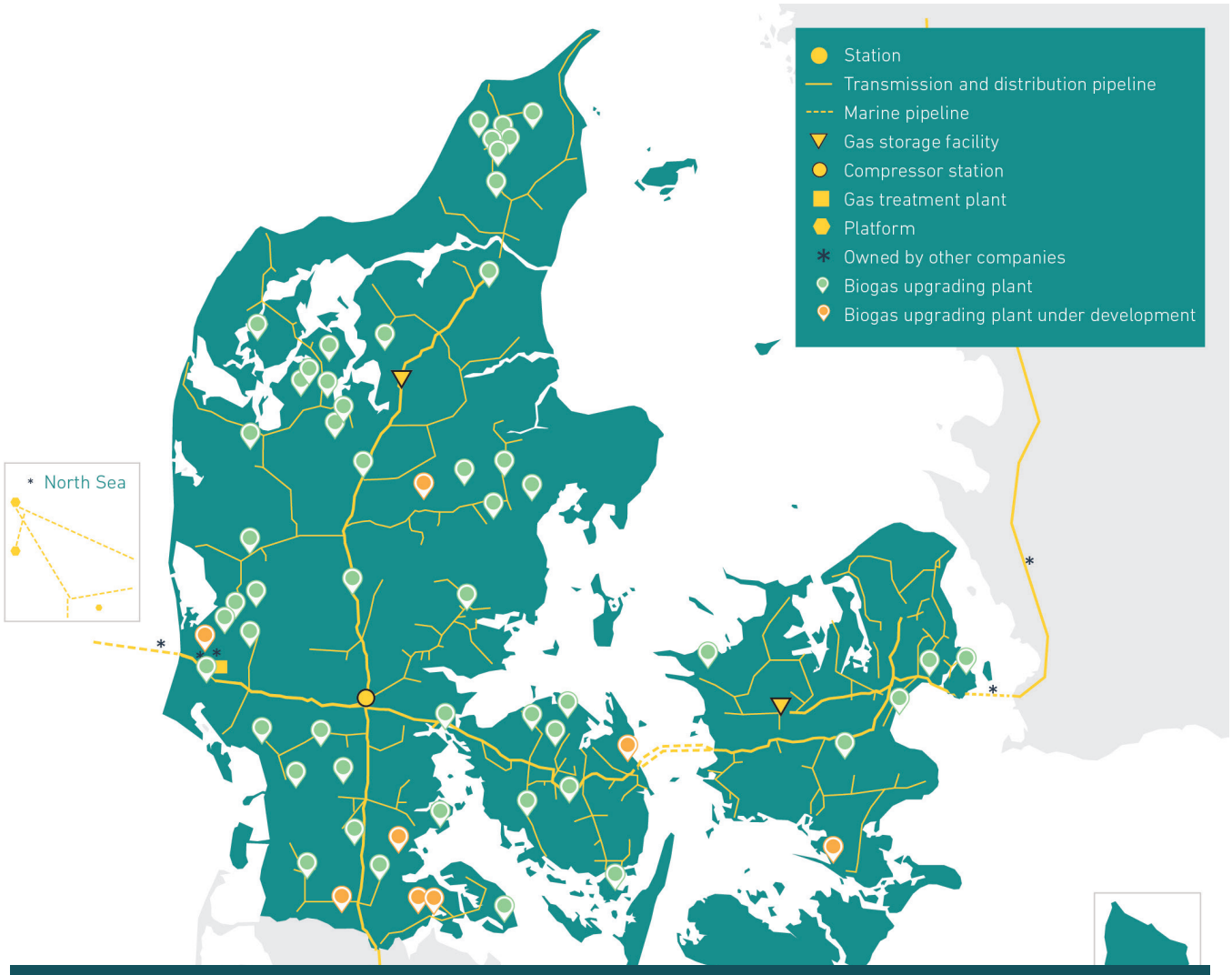
1.4 Contingency planning

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. Contingency planning is different from security of supply in that it does not concern normal operation. In the gas sector, contingency planning also concerns the safety of the surroundings. Natural gas can ignite and burn, 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, e.g. the police, fire department and emergency response.

THE DANISH GAS SYSTEM



- Transmission grid, lenght: approx. 900 km.
- Distribution network, lenght: approx. 17.000 km
- The transmission grid is connected to the distribution network via 43 M/R stations, which regulate the pressure down to the level of the distribution companies' pipiline systems.
- Number of gas consumers: approx. 400.000 private households and companies
- City gas networks: Copenhagen, Frederiksberg and parts of Aalborg
- Gas transmission company: Energinet
- Gas distribution company: Evida
- Storage company: Gas Storage Denmark

2. THE GAS YEAR 2019/2020

The security of supply has been high in the first year without Tyra, as there has been sufficient gas to supply gas consumers.

2.1 Security of supply incidents

There has been no security of supply incidents in the past year.

2.1.1 IT incidents

There has been no IT incidents in the gas system impacting the gas supply in the past year.

2.2 Use of the transmission grid

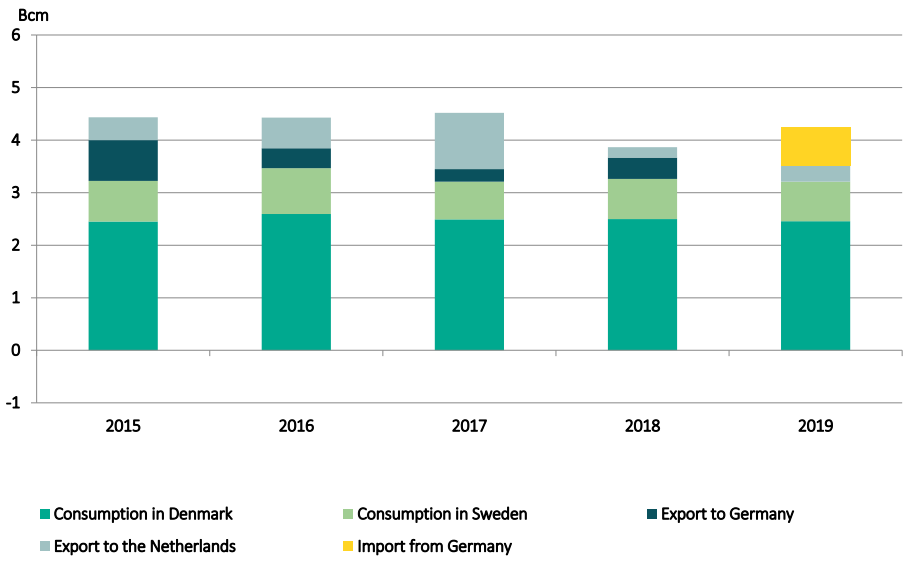
In 2019 two of the daily volumes exceeded defined capacity limits:

- Lille Torup gas storage facility: The withdrawal of 8,2 million Nm^3 on 9. January 2020 exceeded the withdrawal capacity of 8 million Nm^3/day[1]. The limit for physical withdrawal capacity in Ll. Torup depends on the daily grid condition and can under the right circumstances reach 10,3 million Nm^3/day.
- Import from Germany: The import from Germany of 14.2 million Nm^3 on 6. November 2019 exceeded the defined capacity of 10.3 million Nm^3/day

These observations do not give reason to any changes. It is sometimes possible to increase the physical capacity but since this cannot be guaranteed it is not offered to the market.

1. See glossary for elaboration of Nm^3 and energy content.

FIGURE 1: ANNUAL NET PRODUCTION FROM THE NORTH SEA DISTRIBUTED ON FLOW 2015-2019



2.2.1 Gas supplies from the North Sea

The gas supplies from the North Sea has decreased significantly in 2020 due to the shutdown of the Tyra-complex in September 2019. A small volume of gas from the Syd Arne-field is still delivered in Nybro. The supply in 2020 from the Syd Arne-field is expected to be approximately 100 million Nm^3, which can be compared to a total delivery from the North Sea of 3,500 million Nm^3 in 2018. The reduced supply at Nybro have not had any consequences on the security of supply.

2.2.2 Ellund

The flow direction between Denmark and Germany has Since 10 September 2019 exclusively northbound as a consequence of the decommissioning of Tyra. Until then Denmark was net exporter of gas.

The change in flow direction means that the majority of the gas in the Danish gas system is gas imported from Germany. Via Germany, Denmark is connected to the entire European market, which is supplied by a mixture of gas from all over the world, including Russia, Norway, Africa, the USA etc. There may therefore be periods when the gas is primarily supplied from

TABEL 1: CAPACITIES AND UTILISATION IN THE TRANSMISSION SYSTEM, 2017-2019

			Maximum daily flow		
		Capacity Mcm/d	2017 Mcm/d	2018 Mcm/d	2019 Mcm/d
Nybro	Entry	32,4 [2]	14,0	9,7	12,3
Lille Torup Gas Storage Facility	Injection/ Withdrawal	3,6/ 8,0 [3]	3,8/ 7,6	4,2/ 8,3	2,9/ 8,3
Stenlille Gas Storage Facility	Injection/ Withdrawal	4,8/8,2 [3]	4,8/ 6,3	4,1/ 8,2	4,3/ 5,4
The Danish Exit zone	Exit	25,5	16,7	16,6	14,0
Ellund	Entry/ Exit	10,8 [4]/ 20,0	4,9/ 5,2	5,9/ 5,4	14,2/ 4,5
Dragør Border	Exit	8,6 [1]	4,7	5,7	4,0

Note 1: The Swedish system is not designed to receive these volumes at the assumed minimum pressure at Dragør of 44 bar. The firm capacity is stated at 7.2 million Nm^3/day. 1th of april the danisk and swedish exit zone were joint into one.

Note 2: Total capacity of the receiving terminals at Nybro. The potential supplies are smaller today as the Tyra-Nybro pipeline is subject to a capacity constraint of approx. 26 million Nm^3/day, and large volumes cannot be supplied from the Syd Arne pipeline.

Note 3: The Danish storage company dimensions the commercial injection capacity conservatively in relation to the pressure in the gas transmission grid. When the pressure 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/Nm^3.

FIRST YEAR WITHOUT TYRA SAW AN OVERSUPPLY OF GAS, HISTORICALLY LOW PRICES AND STORAGE EXPANSION

LOW GAS PRICES LED TO CHALLENGES BALANCING THE GAS SYSTEM

Danish gas prices are generally closely linked to gas prices to the south – in the Netherlands and Germany. This has been true both before and after the Tyra complex shut down.

Before the Tyra complex shut down, the gas price in Denmark was lower than European gas prices. This was due to an oversupply of gas in Denmark, which drove gas south to Germany. After the shutdown, prices remain closely tied to the European market, but as expected, there was a price jump in Denmark, since we are now importing gas from Germany.

The European gas market has been in a downward price trend since December 2019, and in June 2020, the price level in Denmark dropped to around 4-6 EUR/MWh. The Netherlands and Germany have had days where the price was even lower – around 3 EUR/MWh. As a result of this trend, a real perception arose in the market that gas prices could fall to zero, or even become negative.

The reason for the low-price level is an oversupply of gas in the European market, which is receiving large volumes of both LNG and pipeline gas. The gas storage facilities had also already reached historically high levels in June, compared with previous years, due to a combination of the mild winter and COVID-19, leading to a lower spring demand than usual in the EU.

The situation has stabilised since the end of June, and prices have risen to a higher level of around 10-11 EUR/MWh. This is because the supply in the EU has fallen again – due to extensive maintenance in the Norwegian gas system, where gas fields, pipelines and onshore treatment plants are being taken out of operation in turn, extraordinary maintenance on some of the Russian export pipelines, and a drop in the supply of LNG due to low European prices.

The potential for negative prices meant that Energinet Gas TSO had to introduce new measures for the calculation of incentives for shippers' balancing. Paradoxically, there was a risk of Denmark being flooded with gas when the gas storage facilities in Germany and Denmark were close to being full. This was far from expectations the year before, during the period when the Tyra complex was shut down.

LONG DIFFERENCES IN SEASONAL PRICES MADE IT POSSIBLE TO EXPAND ONE GAS STORAGE FACILITY

Much of the value of a gas storage facility is expressed in the difference between summer and winter gas prices, as the facility can be used to store gas purchased cheaply in the summer, which can then be sold at higher prices during the winter.

In the current situation, gas prices during summer 2020 were historically low, while gas prices for the 2020/2021 winter have not dropped nearly as much. This meant that the summer/winter gas price differential was relatively high compared to what had been seen on the gas market the past many years.

The price differential led to a high demand for storage capacity in spring and allowed Gas Storage Denmark to sell some of the capacity at prices significantly higher than the starting price in the capacity auctions.

In late May and early June, the price differential was so great – a high price for gas delivered in Q1 2021 and a low price for gas delivered DA (Day Ahead) – that a new possibility arose for expanding the storage capacity in Stenlille in order to meet the market's great need for storage capacity. Put briefly, this opportunity involved selling storage capacity (800 GWh) and buying 'cushion' gas (1200 GWh) on a 'gas for capacity' auction held on 16 June 2020. At the auction, participants purchased storage capacity from Gas Storage Denmark in exchange for the obligation to generate this storage capacity themselves by supplying cushion gas within 120 days, starting on 1 July 2020.

The price for the storage capacity Gas Storage Denmark received from the storage customers (measured using the daily Q1-DA price differential) could pay for most of the cushion gas purchased (at the DA price). If the Q1/DA price ratio tipped during the expansion, Gas Storage Denmark had reserved the right to postpone or stop the injection of gas at three days' notice.

The price situation was thus so favourable, that it was profitable to expand the storage facility, despite the fact that 60 % of the gas had to be used as cushion gas. The result of the auction was positive. About 63 % of the potential new capacity was sold, corresponding to around 500 GWh. The remaining 300 GWh (up to 800 GWh) were sold after the auction under bilateral agreements on unchanged terms.

The 'expansion product' lasted from July until October, and the result was that approx. 37 % of the 800 GWh expansion has been completed. The expansion was stopped in August, when DA began to rise because of production shutdown in the Norwegian sector. The Danish storage capacity has thus been expanded by approx. 295 GWh or 3 % of the total storage capacity in Denmark.

Russia. When the Tyra complex opens again and Baltic Pipe enters operation, the share of gas imported from Germany is expected to decline.

2.2.2.1 Capacity orders at Ellund

On 6. July 2020, annual auctions were held for capacity at PRISMA, where calls for tenders were invited for the Ellund capacity from Germany to Denmark. The auction was for annual products the next five years. The auction was held before the announcement from Total E&P Denmark on 6. November 2020, that the re-opening of the Tyra-complex has been postponed to 2023.

Overall, this means that approx. 80 % of the total capacity from Germany towards Denmark has now been sold to the market players for gas years 1 and 2 during the Tyra reconstruction (approx. 4 GWh/h out of approx. 5 GWh/h, see also graph below). The remaining capacity of 1 GWh/h consists of the capacity which the German TSO Gasunie Deutschland has a statutory obligation to retain for short-term contracts (10 %) as well as capacity at the other German TSO at Ellund, Open Grid Europe, which still has unused capacity. The two TSOs have a total unused capacity of approx. 1.5 GWh/h for year 3.

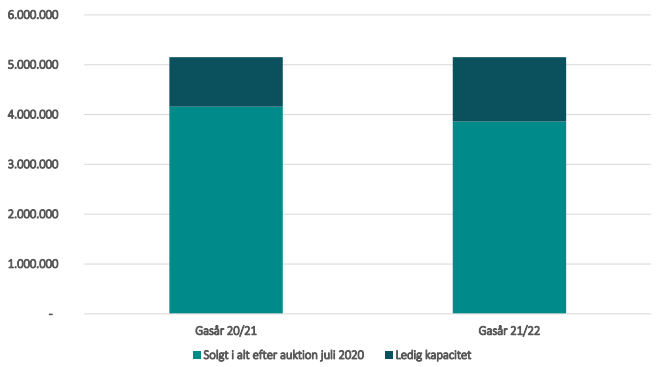
Capacity was also sold for the next gas year 2021/2022: 0.3 GWh/h or approximately 25 % of the offered volume on yearly contracts. Including this sale 75 % of capacity (3.8 out of 5 GWh/h) is booked for year 3 during the Tyra reconstruction. Capacity for gas year 2021/2022 will also be offered on next year's auction.

TABEL 2: TENDERED AND SOLD BUNDLED CAPACITY FROM GERMANY TO DENMARK 2019-2023

Mio. kWh/h					
Ellund entry	Gas year 2019	Gas year 2020	Gas year 2021	Gas year 2022	Gas year 2023
Tendered bundled capacity	1,1	1,4	1,7	2,1	2,1
Sold bundled capacity	0,5	0,8	0,5	-	-

*Only capacity tendered by the German TSO Gasunine Deutchland.

FIGURE 2: CAPACITY FROM GERMANY TO DENMARK



2.2.3 Use of gas storage facilities

The two Danish gas storage facilities, Lille Torup and Stenlille, have a total volume capacity of approximately 900 million. Nm^3, or 10.500 GWh, after the volume expansion at Stenlille in 2020. Energinet expects demand for withdrawal capacity in normal situations to vary between 12 million Nm^3 /day and the current maximum withdrawal capacity of just over 16 million Nm^3/day or 8 GWh/h.

Gas consumption varies over the year and over each 24-hour period. Market players can use the Danish gas storage facilities to store gas to exploit price differences, for example across seasons and markets, and balancing of their portfolios. During the summer, when gas consumption is low, gas is injected into the gas storage facilities. In winter, when the supplies from Germany can no longer cover Danish consumption or exports to Sweden,

gas is withdrawn from the storage facilities again; see figure 3. The two gas storage facilities can also provide storage capacity for emergency supplies, for example in the event of a major supply failure.

Especially in the period without the Tyra-complex, the gas storage facility capacity will be of great importance to the security of supply, as gas imported from Ellund cannot cover consumption on an average winter day. The market players are updated on the security of supply on Energinet's home-page, showing the "Safe Storage Level".

In 2019, a test of the withdrawal capacity at Ll. Torup gas storage facility confirmed that the facility can deliver up to 10.3 million Nm^3/day. This gives a total storage withdrawal capacity of 18.3 million Nm^3/day, or 9 GWh/h. Gas Storage Denmark, which owns and operates the storage facilities, does not offer the extra withdrawal capacity on the market, as it is only available under certain circumstanes, but it is available in the event of an emergency supply situation.

In Sweden, the Swedish TSO, Nordeon Energi, has decided to reopen Skallen gas storage facility, which has been in commercial operation since May 2019. The gas storage facility, which is the only one in Sweden, can thus again be used in normal situations or emergencies. The gas storage facility has a total volume of 10 million Nm^3, or 120 GWh.

FIGURE 3: STORAGE WITHDRAWAL AND INJECTION PER MONTH, 2019

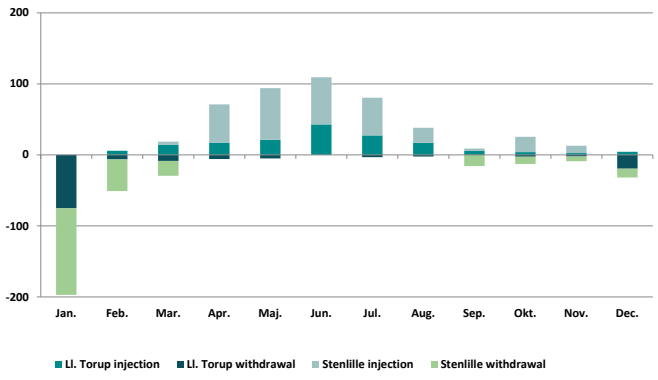
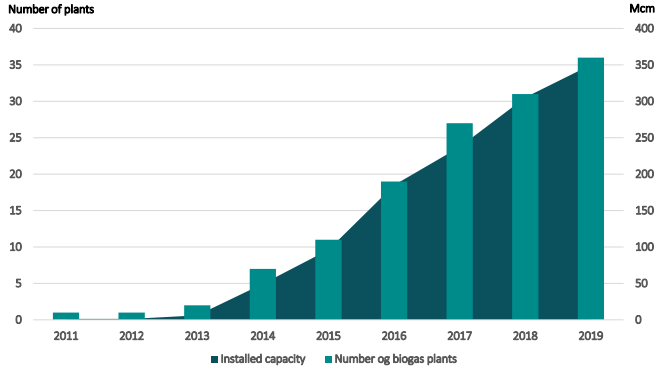


FIGURE 4: CONNECTED BIOGAS PLANTS AND INSTALLED CAPACITY (ACCUMULATED), 2011-2019



2.2.4 Biogas in the grid

The volume of biogas injected into the gas system continuous to increase. Biogas amounted to 11 % of Danish gas consumption from the grid at the end of 2019 and is expected to exceed 20 % at the end of 2020. In summer, when gas consumption is low, biogas constitutes an even higher share. On a single day in July, the biogas share reached over 40 %.

Since 2013, 48 biogas plants have been connected to the gas grid[2]. One plant is connected directly to the transmission grid at Bevtoft, while the other plants are connected to the distribution grid. The maximum connection capacity of the plants is approx. 84,000 Nm^3/h.

2.3 Gas consumption

After many years with decreasing gas consumption, the consumption has since been at a level of approx. 2,500 million Nm^3/year.
2020 also looks set to be a warm year.

2. As at 1/10 2020

FIGURE 5: THE GAS PRICE (DAY-AHEAD) ON THE DANISH GAS MARKET

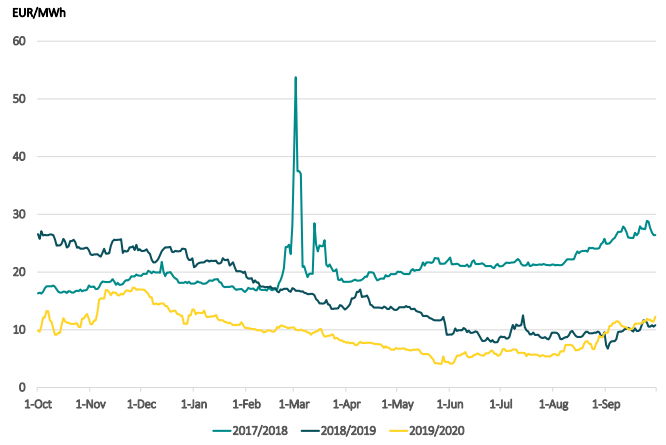
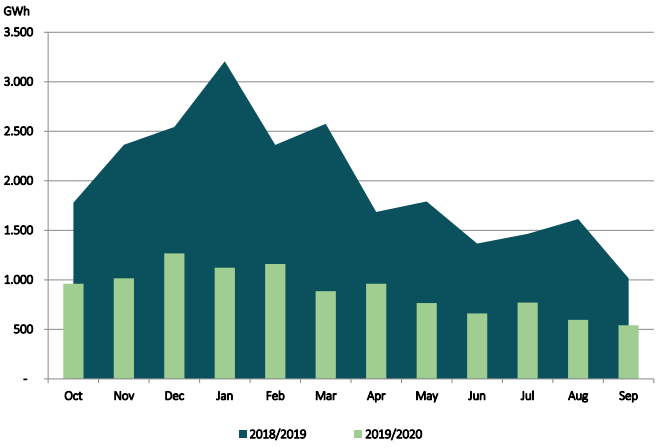


FIGURE 6: GAS SOLD AT GASPOINT NORDIC



In the first six months of 2020, there have been 14 % fewer degree days than in a normal year. A warm year is defined as having 13 % fewer degree days than a normal year.

2.3.1 Peak day consumption

The temperature has a major impact on peak day consumption and hence on the load on the transport systems. In the first six months of 2020, the peak day consumption in Denmark was 10.7 million Nm^3. This was on 26. February 2020, when the daily mean temperature was 1°C. For comparison, in 2019, the peak day consumption was 14 million Nm^3 .

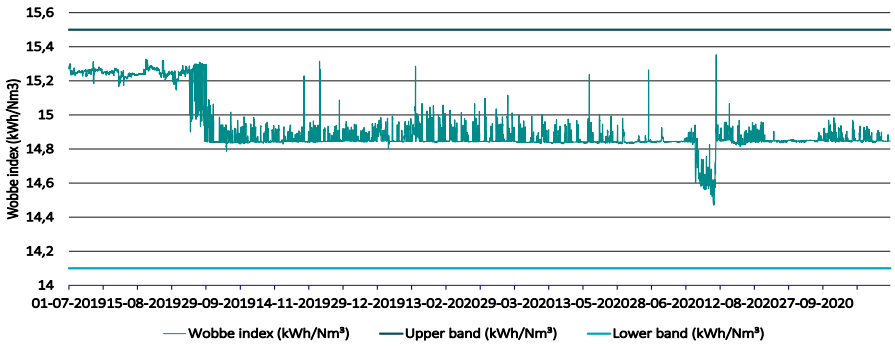
The wholesale price on gas in Denmark has as expected been a little higher than the price in Germany for most of the time. One of the reasons is the tariff for transporting the gas from Germany to Denmark.

2.4 The gas market

The gas market has been through the first winter with the Tyra-complex out of operation and with the main source of gas supply from Germany. From September 2019 there has been a stable import of gas from Germany. The wholesale price on gas in Denmark has as expected been a little higher than the price in Germany for most of the time. One of the reasons is the tariff for transporting the gas from Germany to Denmark.

The winter of 2019/20 was very mild for most of Europe, and gas prices in the North-Western European markets were, for this reason amongst others, unusually low. In January and February, the average price in Denmark was approx. EUR 11/MWh. In comparison, the average price in the same period last year was approx. EUR 19.5 per MWh. After the mild winter, there was plenty of gas in the storage facilities. For this reason, gas prices continued to decline, and on 26 May 2020 gas prices in Denmark fell by EUR 4.1/MWh, which is the lowest level ever

FIGURE 7: WOBBE INDEX IN THE DANISH GASSYSTEM FOR 2020 MEASURED AT EGTVED EAST.



Note: Furthermore, the figure states the legal upper limit (15.5 kWh/Nm^3 – blue line) and the lower limit (14,1 kWh/Nm^3 – red line)

seen. For a period of time, there was also a risk of negative gas prices in Denmark and the EU. This led to the cancellation of LNG supplies to Europe as well as extra maintenance on supply sources from Norway and Russia, reducing gas supplies and increasing gas prices.

2.4.1 Trades on the Danish gas exchange

The volumes traded on the Danish trading point Exchange Transfer Facility (ETF) have decreased during 2020 as was the case in 2019.

The fall in liquidity from 2019 to 2020 is primarily caused by the shutdown of the Tyra-complex where a lower gas volume is offered on the exchange. Several transport customers have also entered into agreements of firm gas delivery, probably to reduce the risk of not having access to gas.

The winter 2019/2020 was also mild, which caused a lower gas demand. At the same time gas storage facilities was still full at the end of the winter season, which also meant that there has been less activity on the gas exchange.

2.5 Gas quality

Energinet is responsible for ensuring that the quality of the gas supplied from the gas transmission system complies with the Rules for Gas Transport and the Executive Order on Gas Quality at all times[3].

The gas is supplied from different sources of supply (the North Sea, Germany, the Danish gas storage facilities and biomethane) with different gas quality. Upgraded biogas is similar to chemical natural gas 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 index for natural gas is in the range of 14.1-15.5 kWh/Nm^3 (50.76-55.8 MJ/Nm^3). The relative density of natural gas must be between 0.555 and 0.7. The transported gas complied with the quality requirements in 2020. The quality of the gas may have an impact on the plants using the gas and thus on the gas consumers. In the course of the past year, less gas has been supplied from the North Sea and more gas via Germany. This has changed the gas quality for the Danish consumers during this period. In general, this has not given rise to challenges for consumers.

2.6 Drills

Gas system drills are organised so that drills are performed in respect of all significant elements over a fiveyear period. No major drills have been performed in the transmission system in 2020.

3. Act nr. 230 as of 21/03/2018

3. THE COMING WINTER 2020/2021

It is expected that there will be sufficient capacity in the system to supply the Danish Gas consumers in the coming Winter

3.1 Market initiatives during the Tyra complex reconstruction

Energinet has implemented a number of market measures to prepare for the period in which the Tyra complex is being rebuilt. Some measures should strengthen communication and general rules, while other initiatives should not be taken into play unless a supply crisis occurs. All measures will apply to the coming winter 2020/2021.

Seasonal tariffs for gas years 2020/2021 and 2021/2022 have been introduced from 1 October 2020. Seasonal tariffs will help strengthen the incentive to book long-term capacity on an annual basis. The method for seasonal tariffs was approved by the Danish utility regulator in December 2019 and only includes Ellund.

In addition, there is a possibility for seasonal tariffs to strengthen the incentive for the market to book long term capacity on an annual basis. However, this will potentially only become a reality in 2020/2021, as it requires method approval from the Danish Utility Regulator.

3.2 Capacity orders

Shippers must book capacity in the grid from Energinet when they want to transport gas in the transmission grid. Capacity can be booked as annual, quarterly, monthly, daily or within day products.

Annual orders for the 2020/2021 gas year:

- Ellund Exit, exports of gas to Germany: Annual orders have not been placed for the 2020/2021 gas year. This is completely expected in the coming period, with a constant need for gas imports
- Ellund Entry, imports of gas from Germany: Approx. 4 million kWh/h has been sold in advance (Open Season contracts and capacity sales last year)[1]. The total capacity at Ellund Entry on the Danish side is 7.7 million kWh/h. The capacity order at Elland Entry is described in further detail in section 2.2.2.1.
- Joint Exit Zone[2], supply of gas to end customers in Denmark and Sweden: Annual capacity can be ordered all year round, which means that bookings are not necessarily placed towards the start of the gas year on 1 October.
- Nybro Entry: Only a minor booking has been placed, which concerns supply of gas from the Syd Arne-field, which still supplies gas.
- Renewable Energy Source (RES)

1. Energinet has expanded the transport connection from Ellund in the northbound direction. Prior to the expansion Energinet tendered the capacity in a bidding round (Open Season) to determine the interest in the project. During Open Season the companies must submit financially binding bids and thus be able to secure capacity on the connection.

2. In connection with the implementation of a common balancing zone with Sweden in 2019 – Joint Balancing Zone is the exit points towards Danish end-users and Sweden together in a single point, called the Joint Exit Zone.

ENERGINET'S WINTER OUTLOOK

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

Assessment for the coming winter 2020/2021:
The assessment indicates that there is sufficient capacity in the gas system to meet demand on a very cold day, during the reconstruction of Tyra platform.

Exit zone: Consumption in Denmark is 19.8 million Nm^3/day. For the exit zone, the offtake corresponds to Energinet's expectations at a daily mean temperature of -13°C.
Ellund: Ellund has net imports of 10.3 million Nm^3/day.
Dragør: Dragør has exports of 5.6 million Nm^3/day.
Storage facilities: Total withdrawal of gas from the storage facilities is estimated at 16.2 million Nm^3/day, with 8.2 million Nm^3/day coming from Stenlille and 8.0 million Nm^3/day from Lille Torup. In special situations the Ll. Torup storage facility can deliver up to and 10.3 million Nm^3/day giving a total of and 18.5 million Nm^3/day. A distribution of withdrawals is used which supports the highest possible grid pressure.
Nybro: Supplies at Nybro are estimated at 0.5 million Nm^3/day.
RES: 1.0 million Nm^3 biogas/day is supplied to the gas system.

Assessment for winter 2021/2022
The assessment indicates that there is sufficient capacity in the gas system to meet demand on a very cold day. The Tyra complex is still under reconstruction.

Exit zone: Consumption in Denmark is 19.8 million Nm^3/day. For the exit zone, the offtake corresponds to Energinet's expectations at a daily mean temperature of -13°C.
Ellund: Ellund has net imports of 10.3 million Nm^3/day.
Dragør: Dragør has exports of 5.6 million Nm^3/day.
Storage facilities: Total withdrawal of gas from the storage facilities is estimated at 18.5 million Nm^3/day in normal situations, with 8.2 million Nm^3/day coming from Stenlille and 10.3 million Nm^3/day from Lille Torup. The distribution of withdrawals is optimised to achieve the highest possible grid pressure.
Nybro: Supplies in Nybro, which only come from the Syd Arne field, are estimated at 0.5 million Nm^3/day.
RES: 1 million Nm^3 biogas/day is supplied to the gas system.

St. Andst

Entry, biogas upgraded to natural gas quality and injected into the transmission system: In the same way as with the exit zone, annual capacity at RES Entry can be purchased throughout the year. The level has increased since last year from approximately 0.3 million kWh/h to approximately 0.45 million kWh/h.

3.3 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 2020/2021 gas year, the limit for protected customers is 2.4 million Nm^3/year compared to 3.6 million Nm^3/year. In practice, this means that industrial enterprises and gas fired CHP plants will be protected if they have an annual gas consumption of less than 2.4 million Nm^3/year.

3.4 Gas quality during the coming winter

Energinet expects that gas quality in the coming winter will still be based on a combination of gas from Germany, North Sea gas and biogas injected into the gas grid, where gas from Germany represents the highest share. Gas from Germany typically has a lower calorific value and a lower Wobbe index than Danish North Sea gas.

In the coming winter, Energinet expects gas quality to vary as follows:

- Energinet estimates that the average Wobbe index for gas from Germany will be 14.7 kWh/Nm^3, varying from 13.9 to 15.5 kWh/Nm^3.
- The Wobbe index for the Danish North Sea gas is expected to vary from 14.7 to 15.5 kWh/Nm^3.
- The Wobbe index for upgraded biogas injected into the gas system typically has a Wobbe index at the lower half of the variation range permitted in the Gas Regulation, i.e. from 14.1 to 14.8 kWh/Nm^3.

3.5 Distribution

Gas supplies to the individual consumers must be maintainable at very low temperatures in crisis situations, where demand is expected to be unusually high. The gas system must therefore be dimensioned so that it always has the necessary capacity to supply the distribution areas. This is ensured by assessing natural gas offtake from each meter and regulator station. The assessments are performed by Energinet based on reporting from the distribution company.

Energinet assesses that the meter and regulator stations and the distribution system throughout Denmark have sufficient capacity to cover the supply requirement for winter 2020/2021.

Energinet has acquired the three distribution companies, which are now legally combined in one company under the name Evida. The Danish Ministry of Finance takes over the ownership of Evida at the end of 2020 as the last step in the process.

RISK ASSESSMENT OF THE EUROPEAN GAS MARKET

The European Network of Transmission System Operators for Gas (ENTSOG) prepares outlooks for the supply situation in Europe for the coming summer and winter (Summer Supply Outlook and Winter Supply Outlook) each year. In addition, ENTSOG prepared an analysis of the security of supply in Europe to identify where and when problems with maintaining supplies to gas consumers may arise in the individual countries. The analysis is updated every fourth year.

ENTSOGS OUTLOOK FOR THE COMING WINTER 2020/2021

- The European indigenous production keeps on following a decreasing trend
- The storage level is the one of the highest of the last 9 years because of a high storage level at the beginning of the injection season and relatively high seasonal price spread during the injection season
- LNG play an important role in natural gas demand satisfaction as a flexible gas source; LNG terminals utilisation has been significantly higher than observed over the last 9 years
- The European gas system offers sufficient flexibility across the season in Europe
- South-East Europe reduced risk of demand curtailment developing new infrastructure. Exposition to risk decreased in case of a transit disruption through Ukraine under high demand situations.

ENTSOGS LATEST ANALYSIS OF THE SECURITY OF GAS SUPPLY IN EUROPE (CONCLUSIONS FROM 2017 - NOT UPDATED IN 2020)

- If there is a cold winter, none of the European countries face the threat of supply failure.
- During a two-week period and a single day of exceptionally high demand in a cold winter, Denmark and Sweden may risk having to disconnect some gas consumers.
- In the event of outage of Ellund and exceptionally high demand during a two-week period or a single day, Denmark and Sweden may risk having to disconnect a major part of the gas consumers.

The result of ENTSOG's simulation cannot be compared directly with Energinet's own analyses. The reason for this is that ENTSOG's simulation runs over four years. The simulation does not consider that extra firm capacity has been offered in OGE's grid at Ellund from 2019 and that consumption is expected to decline. ENTSOG's simulation thus paints a more negative picture than Energinet's own analyses, as described in the preventive action plan and emergency plan at the end of 2019.

4. DEVELOPMENT IN THE DANISH GAS TRANSMISSION SYSTEM

The future development of the gas system is analysed to assess whether there is a need for long term initiatives

4.1 Expected use of the gas system

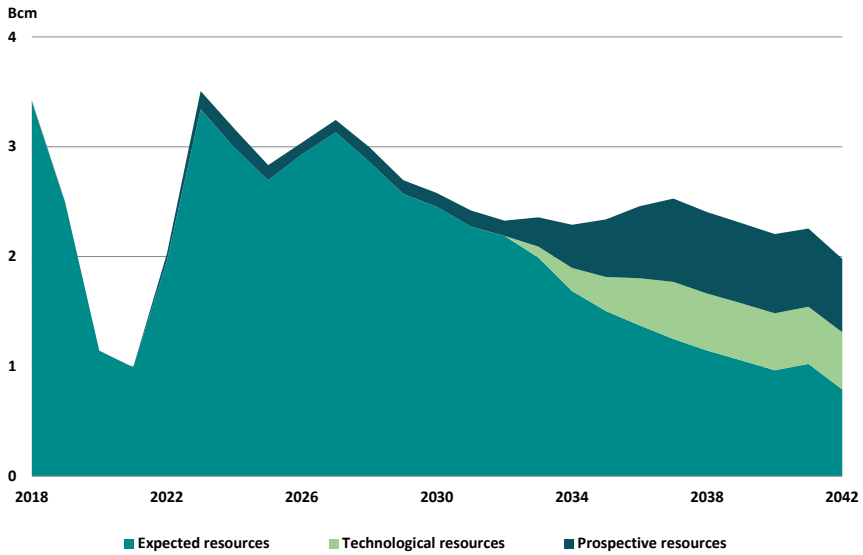
4.1.1 North Sea production in a long-term perspective

The main part of the Danish North Sea production is out of operation temporarily. When the Tyra platform reopens, expected 1 June 2023, it will no longer be the largest and only source of supply from the North Sea to Denmark. As a part of the Baltic Pipe project, the Danish gas system will be linked to the Norwegian gas pipe Europipe II.

The link to Europipe II and the reopening of the Tyra platform were both expected in 2022. Until then gas import from Germany is the main supply source to the Danish and Swedish gas market. Total W&P Denmark has announced that the reopening of the Tyra platform is postponed to 1 June 2023.

Each year, the Danish Energy Agency composes a statement of Danish oil and gas resources (North Sea forecast) as well as Analysis Assumptions for Energinet 2020. Natural gas supplies to Denmark are determined by the proportion of North Sea production which is exported to the Netherlands (via the North Sea) and Germany (via Denmark),

FIGURE 8: EXPECTED RESERVES, 2018-2042



Note: The figure us based on data from the Danish Energy Agency from september 2020. The expected development is a forecast for extraction from existing fields and new sources with existing technology. The technological resources are an estimate of the extraction potential through the use of new technology. The exploration resources are an estimate of the extraction from future new sources as a result of ongoing exploration activities and future new calls for tenders.

respectively. The market players decide the distribution. The latest North Sea forecast from September 2020 is not included in the latest Analysis Assumptions 2020.

4.1.2 Biogas production

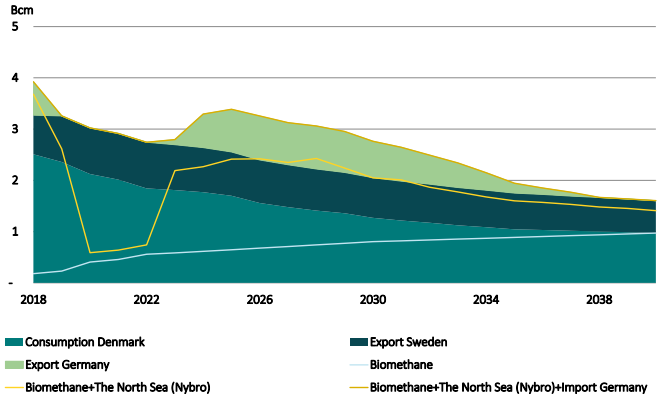
The contribution to security of supply from the biogas production is beginning to become more noticeable as the share of biomethane in the gas system has increased. Energinet has knowledge of a number of projects which comprise either the expansion of existing or the establishment of new biogas plants which are likely to be realised and connected to the Danish distribution grid in the coming years. The Danish Energy Agency estimates that the total annual production may increase to DKK 510 million Nm^3 in 2021, which will correspond to 20 % of the Danish gas consumption according to the Analysis Assumptions.

4.1.3 Gas storage capacity

The shippers are responsible for balancing their portfolios and thus safeguarding the supply of their connected Danish consumers (via gas suppliers). They have the responsibility to ensure there is sufficient gas in the system to prevent an Emergency declaration. It is therefore important for the security of gas supply that the storage customers ensure that sufficient gas volumes are stored to safeguard the supply of their connected Danish and Swedish consumers – even during prolonged and unusual cold spells.

In a situation with an interruption of the gas supply from Germany, the market must instead be able to supply protected customers from the storage facilities and the gas supplies coming from the Syd Arne pipeline and from biogas.

FIGURE 9: SUPPLY SITUATION, 2018-2038



Note: Nordsøen er excl. Trym og Nordsøprognosen fra august 2019, Forbrug i Danmark er inkl. bionaturgas

Energinet purchases gas for emergency storage to be able to supplement supplies to protected customers in Emergency situations. While Tyra is being reconstructed, the emergency storage volume will be determined by a situation in which no gas is supplied from neither Tyra-Nybro or Germany. Energinet's emergency storage is 2.000 GWh (ca. 170 mio. Nm^3). In addition, Energinet has purchased 1,850 GWh in filling requirements for the withdrawal season 2020/21.

The gas storage filling was relatively high in 2020 (due to the warm winter) and the storage facilities thus holds more gas from the North Sea than expected for the coming winter. If the storage facilities only were filled with gas from Germany, the working volume would decrease by 10-12 %, equal to approx. 100 million Nm^3 compared with today.

4.1.4 Supply situation 2019-2040

The supply situation outlook is Energinet's best estimate of how the supply situation may be. The supply situation during the period 2019-2022 requires special attention, and Energinet will regularly update the supply situation outlook.

Even though the Danish gas system is more vulnerable during the reconstruction of the Tyra complex, the capacity between Germany and Denmark has been expanded sufficiently, which, together with the gas storage facilities, provides the requisite flexibility in the system to supply Danish and Swedish gas consumers.

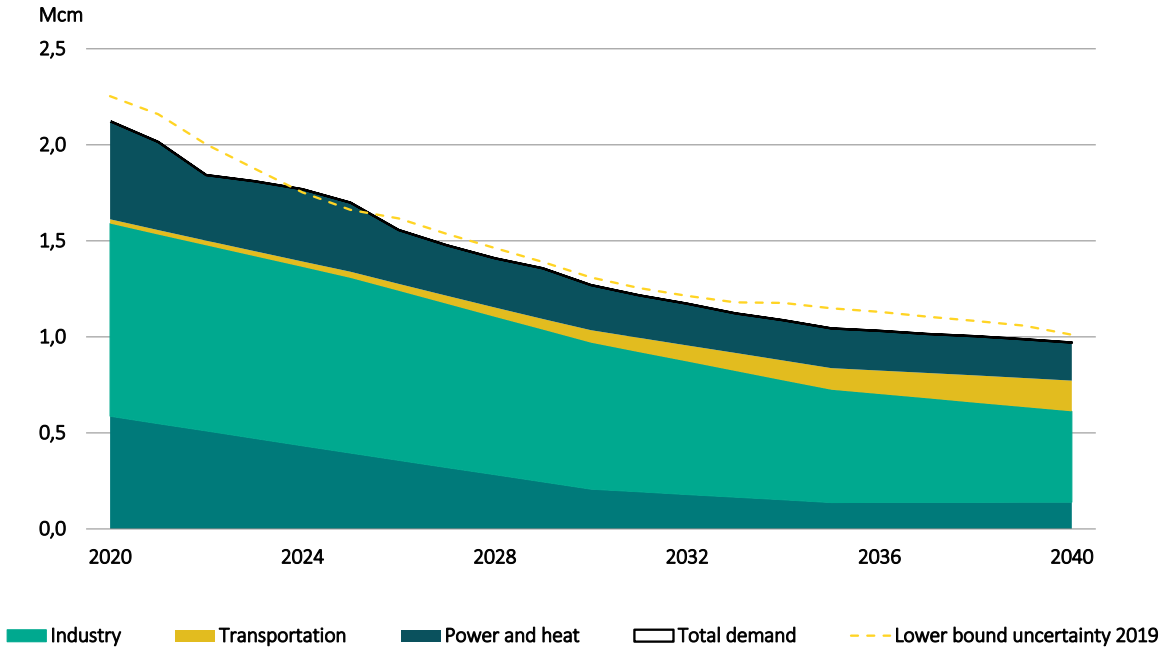
In 2022, when the transmission system is expanded with supplies from Norway and the supply to the Baltic Pipe, security of supply is expected to be just as high as before the reconstruction of the Tyra complex.

Energinet has most recently updated the analysis of the supply situation based on the latest 'Analysis Assumptions 2020' from the Danish Energy Agency and North Sea forecast 2019. The Danish Energy Agency has published the new North Sea forecast for 2020.

4.2 Development and consumption in Denmark and Sweden

The total gas consumption in Denmark, excluding field consumption in the North Sea, is expected to decrease to approx. 1.275 million Nm^3 in 2030. Where natural gas accounts for 475 Nm^3 in 2030 and 'green gas', including biogas added to the gas grid, accounts for 800 million Nm^3 in 2030. A comparison of the Security of Gas Supply Report 2019 is expected to result in markedly lower gas consumption and a significant amount of green gas. The difference is attributable to the agreed objective of 70 % CO_2 reduction in Denmark as well as the Danish Parliament's climate agreement from June 2020.

FIGURE 10: EXPECTED GAS CONSUMPTION DISTRIBUTED ON APPLICATIONS, 2020-2040 AS WELL AS AN INDICATION OF THE EXPANSION ROOM ON THE PROJECTION



Note: Gross calorific value 12.1 kWh/Nm^3. Businesses include the service industries and comprise gas for heating and process heating.

4.2.1 Development in consumer segments

The Climate Agreement sets a higher tax on heat based on gas and simultaneously lowers the tax on electric heating. In conjunction with subsidy schemes for the phasing out of oil and gas boilers, the consumption of gas for heating in 2030 is expected to be reduced to a third of today's consumption.

The Climate Agreement also sets a framework which will reduce the gas consumption for electricity and heat generation. Higher taxes on heat based on gas as well as free fuel choice mean that the incentive to switch from gas to, for example, electric heating increases. The expectation is that gas consumption for combined heat and power (CHP) and district heating is halved towards 2030.

Gas consumption by businesses is expected to decrease slowly towards 2030 due to energy efficiency improvements. The use of gas in industry is sensitive to market conditions and may vary due to conversions or changes to the number of manufacturing companies.

The transport sector's gas consumption is expected to increase slowly in the entire period up until 2040. The expected development is, however, subject to considerable uncertainty.

4.2.2 Consumption in Sweden

Swedish gas consumption is based solely on supplies from Denmark and a small proportion of biogas produced in Sweden. An LNG receiving terminal in Gothenburg has opened with possible connection to the transmission grid, but Denmark is expected to remain Sweden's primary source of supply.

Maximum 900 million Nm^3 gas is expected to be delivered to Sweden in 2020, and it is assessed that the consumption will be reduced slowly in the period up until 2040. The assessment of the Swedish consumption is based on outlooks from Nordeon Energi and from the Swedish Energy Agency.

4.3 Gas market development

4.3.1 The Danish gas market

If the market is dependent on one primary source of supply from Northern Germany, the Danish gas market will be affected to an even greater extent than previously by the price development on the north western European gas market. There is an expectation in the market that the price level in Denmark will be on a par with European prices plus an extra charge for gas transport. However, in the case of capacity shortage at the German border, situations may arise where the gas price in Denmark will increase.

4.3.2 The European gas market

It is uncertain how the supply situation will develop. In summer 2020 three large supply sources to Europe (Russia, Norway an LNG) were willing to deliver gas at a very low market price before the supplies were reduced. The great difference from earlier years is the import of LNG from USA to EU, which increases its share of the total supply each year. If the LNG share continues to increase at the same time the demand decreases, it is expected that gas price will continue to remain low.

Another supply source to the EU, North Stream II, was scheduled to be commissioned on 1 January 2020. Nord Stream II is primarily built so that Russia can supply gas to the EU without having to go through Ukraine. However, it is uncertain whether this deadline can be met.

4.4 Long-term development of Danish gas infrastructure

In Energinet, work is being done on grid planning aimed at economically efficient development of the transmission system and with focus on solutions that can be used now in connection with the growing development in the biogas production and in the long term. It is important in this connection that the solutions chosen to create as much value as possible for the gas system. To ensure timely and effective development of the transmission system, there is also a need to focus on the overall gas system. Energinet Gas TSO has published the first analysis of 'Long-term Development needs in the Gas System' in October 2020.

The development of the gas system is based both on maintenance of the existing gas system, such as reinvestments and conversions, as well as new development needs, such as the need for new capacity and green transition.

EMISSIONS

Methane gas (CH_4) is a greenhouse gas which has a significant impact on the climate compared to if the gas has previously been burnt, where the emissions are water vapour and carbon dioxide (CO_2).

However, a certain level of emissions cannot be avoided in connection with the operation and maintenance of the gas transmission system. Energinet has carried out annual measurements of methane emissions at its own facilities since 2017. The emissions account for approx. 0.005 % of the total gas transport. In comparison, Marcogaz (Technical Association of the European Natural Gas Industy) states methane emissions in the European transmission grid at 0.05 % of total gas sales.

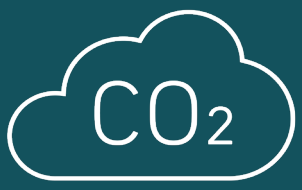
In 2020, Energinet has formulated targets, that in 2030 the impact on climate from the energy consumption should be none; and in 2050 the impact on climate from methane emissions should be none. Emissions, which cannot be removed will be climate compensated.

In total, all emissions of greenhouse gases can be converted into an equivalent volume of CO_2, which represents Energinet's CO_2 footprint. Electricity consumption can also be converted into CO_2 equivalents. In 2019 the CO_2 footprint was approximately 9.000 tons CO_2- equivalents. Gas TSO has a continuous focus on reducing its total CO_2 footprint and in 2020 attention was given to reduce the pressure in the transmission grid, which reduces the use of electricity for compressor and gas for pre-heating.

The primary sources of Energinet's CO_2 footprint are:

- Own consumption of gas for heating of gas supplied via the meter and regulator stations. Gas is used for heating because the gas is cooled when the pressure is reduced from transmission line pressure to distribution line pressure
- Fugitive methane emissions from unplanned leaks from gas facilities
- Maintenance activities and rerouting of transmission lines which require that plant sections be emptied of gas.
- Electricity consumption in operations of the gas system mainly for running compressors

The European Commission launched their strategy to reduce methane emissions for the whole gas value chain in October 2020. It is expected that the Commission in 2021 will follow up on the subject with new legislation which among other things include new monitoring tolls and increased requirements for the gas operators.



4.4.1 Condition of the transmission grid

The condition of the gas system is regarded as good, but due to its age, increasing maintenance costs must be expected in the years ahead.

In 2019, Energinet Gas TSO has been recertified in ISO 55001 Asset Management. To be certified, Energinet Gas TSO must be able to show that it has an effective management system for maintaining a uniform, high standard for the management of its assets. The certification means that Energinet Gas TSO is subjected to an annual audit by external certified auditors. Most recent KPMG exercised a two-days surveillance-audit in May 2020.

Asset management must contribute to ensuring that we manage our physical assets effectively from commissioning to disposal, with the lowest possible service life costs.
The ongoing operation and maintenance of the transmission grid are therefore controlled via Gas TSO's asset management system. This is, for example, based on an annual cycle for preventive and remedial maintenance, where:

- The former is based on statutory requirements, technical standards, supplier recommendations and ongoing status reports. The condition assessment is based on the condition and age of the plants and facilities and their importance to system operations.
- The latter entails a risk-based approach because technical faults in plants and facilities may have major consequences for system operations.

This ensures that investments are constantly made based on the condition of the grid and the requirements for security of supply. Examples of reinvestments in the transmission system in the past year include replacement of actuators for remote control of line valves and a project to modernize the meter and regulator station in Sorø.

4.4.2 Incremental capacity process

The incremental capacity process is a mechanism from the EU regulation, where the European gas TSOs collect nonbinding bids for any expansion of capacity at border point, every other year.

In summer 2019, Energinet chose to expand the concept for the whole gas system and included all capacity points. Energinet has received signals about three potential needs for new capacity on the market

4.4.2.1 Ellund Exit (capacity from Denmark to Germany)

In 2019, Energinet and Gasunie both received a signal from the market that there is still a need for southbound capacity in the future.

At the border point, the German TSO, Gasunie Deutschland, decreased capacity on the German side last year, as the capacity is to be utilized for new LNG terminals in northern Germany. In addition, the German TSO has assessed that there will be no need for southbound capacity in the future. Energinet does not share the conclusions of the German assessment.

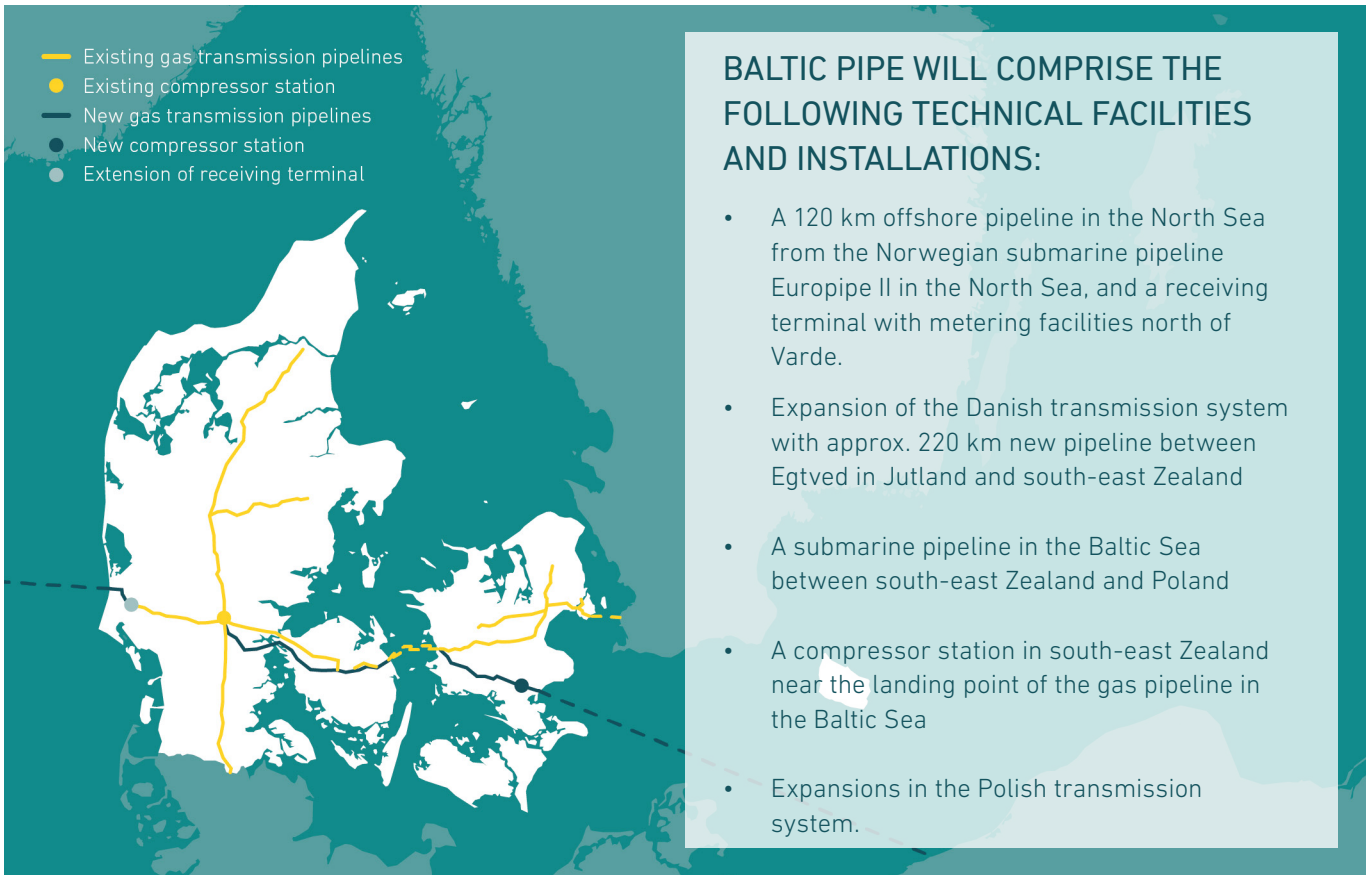
The need for southbound capacity at the Danish-German border has been assessed in the context of all potential capacity expansions in Germany. A market consultation on the potential expansion was conducted in September. If it is assessed that the project is still demanded, the new capacity will be offered in next year's capacity auction for Ellund.

At the same time, Energinet is in dialogue with Gasunie Deutschland about the (re) establishment of part of the reduced capacity, regardless of the outcome of the incremental process.

4.4.2.2 Green Gas Lolland-Falster

In 2019, Energinet received non-binding bids for an expansion of the transmission system to Lolland-Falster, which is not part of the gas system today.
The need relates to gas deliveries to Lolland-Falster and biogas production on the two islands, which can be consumed locally and delivered to the rest of Zealand. To meet the need, a distribution network must also be established.

In the first quarter of 2020, Energinet carried out an Open Season process to test whether binding commitments could be obtained from the market, and it could. Thus, capacity contracts were signed with the interested players. However, the capacity contracts, and thus also the project, are conditional on the project being approved by the Danish Ministry of Climate, Energy and Utilities. If the project is approved, the capacity will be established autumn



2024 at the earliest. Energinet's Board of Directors has assessed that the socioeconomics in the Green Gas Lolland-Falster project in base case is negative. The Board has informed the Ministry of Climate, Energy and Utilities that if the gas pipeline is constructed, it is based on political considerations for e.g. CO_2 reduction in local industries, expansion of biogas production on Lolland-Falster and maintenance of local jobs.

The project enables local companies, including not least the sugar factories on Lolland-Falster, to replace their current coal and oil-based energy supply with climate-friendly biogas. In the future, the gas pipeline between Zealand and Lolland-Falster can also be used to transport hydrogen or green gases.

4.4.2.3 Entry LNG

In 2019, Energinet received a non-binding offer on a potential LNG entry point, which does not exist in the Danish gas system today. At this point there has been made no further activities regarding this possible project.

4.4.3 International infrastructure projects

Energinet is involved in two international projects: the Baltic Pipe project and the North Sea Wind Power Hub project, which is a development project.

4.4.3.1 Baltic Pipe

Together with the Polish TSO, GAZ-SYSTEM, Energinet is implementing the socalled Baltic Pipe project. The Baltic Pipe project is a new gas transport route which makes it possible to transport up to 10 billion Nm^3 of gas per year from Norway through Denmark to Poland. The project, which will result in an expansion of the existing gas system in Denmark and Poland, must be commissioned by October 2022 due to the Polish gas supply situation.

The final investment decision was made in 2018, and the construction project has begun. In the summer of 2020, the pipeline was laid across the Little Belt. The excavation of the pipeline is also underway on land, where a compressor station is also being built.

In relation to the construction work, Energinet is very aware of organizing the construction so that it affects nature and landowners as little as possible, which is supported by supervision from various authorities.

One of Denmark's interests in the Baltic Pipe project is to ensure low and stable gas tariffs in the years ahead. The Danish consumption is expected to decline in the coming years, and there will therefore be fewer consumers to cover the costs of operation and maintenance of the gas grid. Without the Baltic Pipe, the tariffs would increase. When the project is realised, the flow of gas in the Danish gas system will increase

INFRASTRUCTURE DEVELOPMENT IN EUROPE

Every two years, ENTSOG publishes a European Ten Year Network Development Plan (TYNDP). The plan provides an overview of the long-term challenges for the European gas system up until 2040.

The most recent European network development plan (TYNDP2020) will be published by the end of 2020. The ENTSO's for electricity (ENTSO-E) and gas (ENTSOG) have worked together to develop joint scenarios, which are used in the analyses.

ENTSOG's TYNDP contains one Danish project, the Baltic Pipe project, which also has PCI status.

Long-term gas consumption and production in the EU
The expected development in European gas consumption is described in ENTSO-E and ENTSOG's joint scenario report (TYNDP 2020 Scenario Report). It describes three scenarios for the energy system, where the overall trend is a lower European gas consumption in the future in all scenario. However, the development in demand varies from country to country. For example, Denmark is one of the countries with the strongest decline in demand and opposite in Earstern Europe where the gas consumption is increasing. From year to year major differences will be observed given the markets for CO_2 quotes and electricity. When the price of CO_2 I high, the competitiveness of natural gas increases compared to coal, which switches the electricity production from coal fired to gas fired power plants.

The gas supply to Europe is safeguarded through the countries' own production, imports from Russia and Norway in particular, LNG imports and gas in the storage facilities. It is assumed in TYNDP2020 that Europe's own natural gas production will come to approx. 92,000 million Nm^3 in 2020. Own production is expected to decline to just over 33,000 million Nm^3 in 2040. The lower amount of own production will be compensated by a lower demand for gas in general and an increased production of green gas: Power-to-X and biogas. In the long term the need for import of gas is expected to fall.

significantly, resulting in stagnation in tariffs. Thus, it will remain be cost-effective to e.g. use the Danish gas system for the transport of green gases, which is essential for the green transition.

Access to Norwegian gas is a positive supply solution for Poland and other countries in Central and Eastern Europe, which are today predominantly dependent on gas from Russia. It also helps to create a basis for a change from coal to gas, which has a significantly lower CO_2 emission per. energy unit. Thus, the project is expected to have a significant positive impact on CO_2 emissions in the region.

The Baltic Pipe project has gained status as a project of common interest (a PCI project), as it boosts the diversification of European gas supplies and the integration of European markets. PCI projects must be prioritised nationally, and they can receive economic funding from the EU, for example for preparatory work. The project has already benefited from this.

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

4.4.3.2 North Sea Wind Power Hub

To meet the European climate targets, there is a need for massive development of offshore wind in the North Sea. This can be done through installation of energy hubs connecting connecting offshore wind parks. Energy islands are also a part of the Danish Governments' climate deal.

The North Sea Wind Power Hub (NSWPH) development project is an international vision project for largescale coordinated expansion of renewable energy production in the North

HYDROGEN AND POWER-TO-X BECAME MAINSTREAM IN 2020

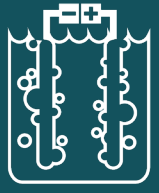
Energinet's analysis, 'System perspectives for the 70 % target and large-scale offshore wind power', shows that Power-to-X and sector coupling using gas, including hydrogen, will be important for efficient utilisation of the large Danish offshore wind resources around 2035. Power-to-X and sector coupling can reduce congestion in the electricity grid and contribute to the conversion of sectors such as transport and industry. Timely expansion of Power-to-X will therefore have an impact on whether Denmark can deliver on its 70 % target in 2030.

The Danish Government's July 2020 climate agreement paves the way for a further 5 GW of offshore wind power and the establishment of energy islands, with the possibility of integrating Power-to-X in connection with one of the tenders. The Danish Government has also entered into an agreement with the Netherlands on investing DKK 1 billion in a 100 MW electrolysis plant on Danish soil, in return for a statistical transfer of renewable energy from Denmark, so that the Netherlands meets its EU targets for RE in 2020. The Danish Government is starting work on a national PtX strategy in Denmark in autumn 2020.

The energy and transport sector has highlighted the need for Power-to-X in recent years. This can be seen in the recommendations from the Danish Government's climate partnerships and the creation of a consortium consisting of Ørsted, Maersk, DSV, Copenhagen Airport, and others, with the vision of establishing a 1.3 GW electrolysis plant in 2030. The goal is to produce up to 250,000 tonnes of green fuels for the marine and airline industries.

Serious interest is developing around Europe in Power-to-X, hydrogen and sector coupling. A number of countries launched specific hydrogen strategies in 2020. For example, Germany has set a target of 5 GW in 2030 and a further 5 GW in 2035. It is also expected that much of the demand in Germany will have to be met by hydrogen imported from regions with access to abundant RE, such as the North Sea. In order for a European hydrogen market to become large scale, cross-border infrastructure will be required. With the publication of the European Hydrogen Backbone Study, a number of European TSOs, including Energinet, have formulated the first vision for what a European hydrogen grid might look like in 10, 15 and 20 years, in part by utilising elements of the existing gas grid.

The European Commission's strategies for offshore wind, sector coupling and hydrogen, all published in 2020, will have a decisive impact on the development of Power-to-X in Europe. In its hydrogen strategy, the Commission sets a target of establishing 6 GW in 2024, and 40 GW electrolysis in 2030.



Sea region. The NSWPH is one of the first example of developing an energy island. The project was initiated by a consortium, which today includes Energinet (Danish electricity and gas TSO), TenneT (electricity TSO in the Netherlands and Germany) and Gasunie (gas TSO in the Netherlands and Germany).

The NSWPH project takes its offset in how to use the renewable resources in the North Sea most effectively:

- Development of concepts that make it possible to combine that the produced electricity can be transported both to Denmark (landing) and directly to other countries via inter-connectors in the North Sea.
- Integration and landing of energy in the form of both electricity and hydrogen helps to ensure that the renewable energy resource can be utilized even with bottlenecks in the electricity grid and that electricity from offshore wind has a commercial value.

In addition, the NSWPH project is also investigating how the massive amounts of renewable energy in the form of both electricity and hydrogen can be integrated into the European energy system.

In 2020, the consortium received funds from the Connecting Europe Facility (CEF) to support the development work. The support is made possible by the fact that NSWPH is included in the PCI list

4.4.4 Green transition

The gas market is changing due to decreasing trend in gas consumption and an increasing trend in the biogas production. This creates new challenges in the gas system.

4.4.4.1 Surplus amounts of biogas in the gas distribution system

In line with the establishment of more biogas plants and decreasing consumption, there will be cases in which biogas production exceeds local gas consumption.

This usually occurs in the summer when gas consumption is generally at a low level but in some cases, it also occurs the rest of the year.

The biogas surplus can be handled in different ways. In some cases, by connecting distribution grids, while, in other cases, there is a need to be able to transport the biogas to the transmission grid so that it can be used to supply a larger area. This means a completely new way of operating the gas system, as excess gas in the distribution system must be compressed into high pressure (from 40 to 80 bar) to be transported in the transmission system.

Today, facilities have been established at Aalborg, Brande and St. Andst meter and regulator stations which can handle this process. Investments decisions has been made to establish facilities at three additional meter and regulator stations at Højby, Terkelsbøl and Viborg.

At the time of writing, Energinet and Evida are also working together on a project at Ll. Selskær. Some of the solutions that are being investigated are that Energinet establishes a compressor station to transport gas to the transmission grid or reduce the pressure in one of the pipelines between Egtved and Frøslev or that Evida establishes a gas connection between existing distribution areas. Connecting more distributions areas will reduce the need for building compressor stations.

4.4.4.2 Collaboration with Evida about gas grid planning

The green transition and development needs in the gas system has made a close cooperation between Energinet and Evida necessary, to ensure that the most effective solutions are found across the gas system; from connection of gas producers to operation of Energinet's transmission system. For this, Energinet and Evida have established a grid planning collaboration. The grid planning collaboration focus on changes in the outside world which affect the gas system, to ensure that the system can handle the issues and to exploit the opportunities that it will face in the future.

One of the central topics in the collaboration is the increased need to return surplus gas to the transmission grid. The return of gas creates new challenges. For instance, the amount of oxygen in the gas system increases when more biogas is supplied to the gas grid. In addition, the return of gas to the transmission grid entails a need to be able to remove odorant[1] from the gas. Energinet is responsible for developing the grid so that biogas is integrated effectively and contributes to a socioeconomic green transition of the gas system.

4.4.4.3 Oxygen from biogas in the gas grid

Biogas supplied to the Danish gas grid contains a higher level of oxygen relative to the other gas. Oxygen is a by-product from sulphur removal from biogas before it is injected into the gas grid. The permitted oxygen content in the gas grid is primarily regulated via national rules and, to some extent, standards, and the requirements may vary between different countries.

In Denmark, it is a requirement that the oxygen content in biogas supplied to the gas grid must not exceed 0.5 %. In Germany there are other requirement to the oxygen content. the North German gas storage facilities refuse to receive gas with an oxygen content above 0.001 %. The increasing biogas volumes in the Danish gas system represents a challenge for the gas export to Germany.

In relation to the Baltic Pipe project, Energinet is rebuilding its facilities at the compressor station in Egtved. The rebuilding is carried out so that biomethane in the transmission system can be handled more easily. Thus, making it possible to continue to export gas to Germany after the commissioning of the Tyra complex despite the different requirements for the gas content of oxygen.

Energinet is working to find a flexible European gas quality solution, together with European partners, which ensures the continued expansion of green gases without compromising the wellfunctioning internal gas markets in the EU. Among other measures, a task force has been set up under the European standardisation body CEN, which works with the limit value for oxygen in gas.

1. Odorant is an odorous substance which is added to the gas when it is routed from Energinet's meter and regulator stations out into the distribution system. The odorant is added for safety reasons, so that any gas leaks can quickly be detected by persons in the vicinity.

4.4.4.4 Reduced use of meter and regulator stations

As gas consumption decreases and a larger share is covered locally by biogas supplied to the gas system, the need for transport of gas from the transmission system to the distribution system decreases. One challenge is that the meter and regulator stations, which supply the distribution system with gas, are built to supply a much higher gas consumption than will be necessary in the future. Therefore, the stations must be adapted so they also work when there is a need for a lower gas supply to the distribution system

4.4.5 Other Danish gas infrastructural projects

4.4.5.1 New rail line across west Funen

The Road Directorate is planning to construct a new rail line across West Funen. The project is described in Law on the construction of a new rail line across West Funen, which states that Energinet must rebuild the gas transmission system on the section for the new rail line between Spedsbjerg and Nørre Aaby.

In the budget proposal from 2019 the project has been allocated 147 MDKK in 2023. It is expected the Energinet must rebuild the concerned part of the transmissions system in 2023 and 2024.

4.5 Tariffs for use of the transmission system

Energinet's financial breakeven principle means that income and expenses must balance. Differences in income and expenses are called excesses or deficits and are, as a main rule, transferred to the budget for the coming year. Most of the income is collected in the form of tariffs.

The transport tariffs are set so that they cover costs for the operation of the transmission system and grid expansion and consist of a fixed part (capacity tariff) and a variable part (volume tariff). The transport tariffs are charged to shippers which use Energinet's gas transmission infrastructure. In addition to the transport tariffs, an emergency supply tariff is charged, which covers Energinet's costs for security of gas supply. This tariff is charged directly to end customers on the gas market via the distribution companies.

4.5.1 Transport tariff

Energinet had a new tariff method approved in 2019. This is the implementation of the network code on harmonised transmission tariff structures for gas (TAR NC), which was published in mid-March 2016. The aim of the network code is to strengthen the internal gas market by harmonising tariff methods across national borders, increasing transparency and reducing transaction costs for consumers. The current method is valid until 30 September 2022, after which a new method must be approved. However, it is expected that the new method will contain only minor changes to the current one.

The accepted tariff method entails:

- Uniform capacity tariffs in all points of the transmission system.
- A division of the transmission tariff into a capacity share and a volume share, which is distributed with 70 % on the capacity tariff and 30 % on the volume tariff, respectively.

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- A 100 % discount on the transmission tariff to and from the Danish virtual storage point.
- Energinet's tariff method must be assessed by the Danish Utility Regulator every third year.

In the longer term, the transport tariffs are expected to increase as a result of decreasing volumes[2]. If the Baltic Pipe project is realised, larger volumes of gas in the Danish gas system will contribute to stabilising consumer transport tariffs.

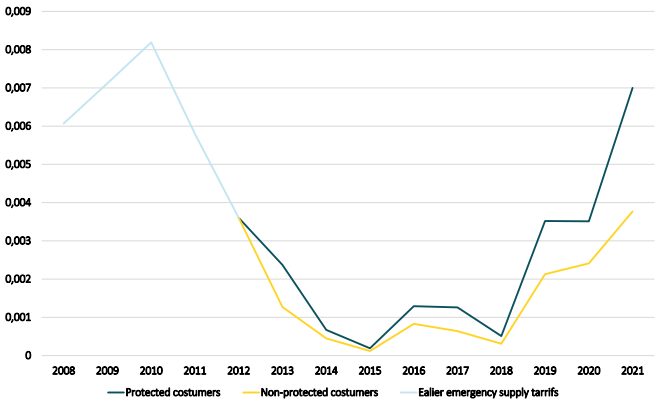
The increase in tariffs for the 2020/2021 gas year is being limited, despite the falling volumes and increasing costs. This is due to the inclusion of excess revenue of DKK 75 million. The tariffs for the gas year are capacity tariff DKK 27.16 kWh/hour/year and volume tariff DKK 0.00291/kWh, respectively.

4.5.2 Emergency supply tariffs

End customers are charged an emergency supply tariff as payment for the tools that Energinet makes available during a crisis situation. There are two different tariffs – one tariff for protected customers and another lower tariff for nonprotected customers – as there are differences between the security of supply for the two customer groups in an Emergency.

2. As a result of construction of Tyra.

FIGURE 11: EMERGENCY SUPPLY TARRIFS



Egtved

The overall cost of tools which can be used in an Emergency will be allocated between protected and nonprotected customers in a ratio of 85/15. The emergency supply tariffs will still be different for the two customer types.

The weighted emergency supply tariff was DKK 0.00329/kWh in the 2019/2020 gas year, and it is DKK 0.00620/kWh in 2020/2021. The significant increase is primarily due to the inclusion of excesses, from writing down the value of Energinet's emergency storage the annual account from 2019.

4.6 Information security

Increased use of IT has created major development opportunities in the energy sector, in terms of both business and technology. The use of IT is one of the most essential preconditions for the ability to operate a cost efficient and reliable energy system. The stronger dependence on IT also means that the gas system becomes more vulnerable if IT disruptions or faults occur in the systems and to cyberattacks.
Information security is defined as all security measures aimed at protecting information assets, whether these are physical, electronic, or oral information. Energinet has three information security objectives:

- Availability: Systems, data and information are available when needed.
- Integrity: Data and information are complete and reliable and have not been distorted by unintended changes.
- Confidentiality: Data and information may be confidential and require protection from unauthorised access.

All three information security objectives are important. Data integrity and the availability of critical control systems are crucial to security of supply. Historically, information security breaches or IT uptime has not had serious impacts on Danish gas supply. Information security is a strategic focus area, and, for several years, Energinet has had a special focus on safeguarding supply critical IT systems and training in contingency situations where systems are unavailable. Various system tests, controlled hacker attacks and information campaigns have been regularly conducted internally at Energinet.

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