Gas security of supply report 2015

ENERGINET.DK

Contents

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The report can be downloaded in Danish at:
www.energinet.dk/gasforsyningssikkerhed-2015

The report can be downloaded in English at:
www.energinet.dk/security-of-supply-2015

Brief status report on security of gas supply in Denmark

The aim of this report concerning security of gas supply is to assess the security of supply in the Danish gas system in accordance with the Danish Executive Order on maintaining security of natural gas supply.

The assessment focuses primarily on last year, the coming winter, and the next ten years. It also describes the principal risks and the relevant tools available to Energinet.dk in order to safeguard a high level of security of supply.

General assessment
Energinet.dk assesses that the Danish gas transmission system is sufficiently robust to cope with high gas demand as well as supply chain failures. The sources of supply from the North Sea, Germany and the gas storage facilities are assessed ample to meet demand. The increase in transmission capacity from Germany means that the Danish gas system also in future is safeguarded from the long-term decline in North Sea gas production.

Under this assessment, the security of supply model indicates that in almost all circumstances it will be possible to avoid declaring an Emergency crisis level, which potentially involves full or partial disconnection of non-protected consumers. This is because the market tools are expected to maintain balance, with no need for additional measures to handle the situation.

In most circumstances, the Emergency crisis level is declared after a period at the Alert crisis level during which the market mechanisms are expected to have aligned the market with the available sources of supply. At the Emergency crisis level, supply to the non-protected consumers will be maintained unless it is deemed necessary to disconnect them fully or partly in order to safeguard the supply to protected consumers.

Closer links to Europe means that to an extent, the European supply situation influences the Danish supply situation. European security of supply is strong thanks to falling gas demand combined with an increasing gas supply, and for this reason closer links to Germany play an important part in creating a more robust Danish system.

Reduced risk of disconnection of non-protected consumers
In recent years, improving the way the market works in crisis situations has been given a lot of attention, thereby reducing the risk of disconnection of non-protected consumers. In 2014, it was decided that non-protected consumers would not necessarily be disconnected in Emergency crisis situations, and since October 2015 it has been possible to gradually step down supplies to non-protected consumers in Denmark and Sweden in an Emergency, instead of disconnecting them.

Declining North Sea production
North Sea production is expected to meet demand in Denmark and Sweden until at least 2020. In terms of the market, however, Danish and Swedish consumers are expected to be supplied with gas from Germany as well as the North Sea.

In 2014, summer maintenance work put the North Sea production fields out of action for a longer period of time in previous

years. This did not present any challenges as the Danish gas system is sufficiently flexible and robust to handle variations of this kind.

Biogas will contribute to the supply situation in the long term
In the longer term, once it has reached the quality of natural gas, biogas will also make a contribution to the supply situation. If facilities are built as the Danish Energy Agency expects, in a few years 5% of the gas in the Danish gas system could be produced on the basis of biogas.

European security of gas supply – Ukraine and LNG
Security of gas supply is increasingly becoming an issue for Europe as a whole. This is a strategic challenge, which has become particularly evident at a time when political relations with Russia are strained. Russia is also the EU's largest gas supplier.

Russia and Ukraine have long disagreed on the price of the gas delivered by Russia to Ukraine. This is difficult to untangle from the considerable political tensions between the two countries as a result of the armed conflict in the eastern part of Ukraine.

Transit gas continues to flow unaffected to the EU through the Ukrainian pipelines. The situation between Russia and the Ukraine has potential implications for the Western European supply situation:

- The EU and/or Russia may introduce trade sanctions involving gas.
- Supplies transiting through Ukraine may be partially or completely cut off.

Against this background, the EU has launched a number of initiatives to safeguard security of supply in Europe, focusing particularly on the most vulnerable regions in the EU.

One of the main initiatives is the proposed Energy Union. The aim of the Energy Union is to ensure security of supply independent of third countries and minimise risks to security of supply, as we have seen in connection with the conflict between Russia and Ukraine.

Growing global LNG volumes constitute a future source of supply, and it will be interesting to observe how this will affect the European market.

1 Introduction

Danish Natural Gas Supply Act
Energinet.dk is responsible for the security of gas supply in Denmark.

Danish Executive Order on maintaining security of natural gas supply
- Performing general planning functions.
- Performing operational functions.
- Monitoring the security of supply of natural gas.

Danish security of supply is ranked among the highest in Europe. For many years, Danish electricity and gas consumers have thus enjoyed a very high security of supply, meeting their energy needs round the clock. In its Strategy Plan 2014, Energinet.dk guarantees Danish society that the security of supply will remain at its current high level.

A high level of security of supply for electricity and gas is of great economic value to society as a whole, just as it is an important foundation for many of the functions in society that are fundamental in the Danish welfare society. The consequences of insufficient supply of electricity and gas vary depending on sectors affected. If the vital social structure suffers supply problems, the consequences are severe in terms of contingency planning and economic activity.

Since the natural gas grid was created, Denmark has never experienced gas shortages. However, declining gas production in the North Sea and instability in terms of the overall European gas supply have focused attention on the Danish-Swedish supply situation.

Historically, Denmark has had a high level of security of gas supply. Continuous expansion and operational improvements have minimised the technical risks relating to security of supply. As a result, technical faults have never caused failure to the Danish gas transmission system. Therefore, Energinet.dk aims at keeping the number of supply failures which can be attributed to Energinet.dk, and where the consumer is not supplied with gas, at zero.

The increase in import capacity across the Danish/German border significantly improves security of supply – Denmark can now receive gas from domestic sources in the North Sea and also import it from the Northwest European gas market. In the longer term, domestic green gas production will further boost security of supply.

Security of supply for gas consumers often depends on the market or on international circumstances. Although Denmark is self-sufficient in gas from the North Sea, much of the gas produced there can be supplied to either the Netherlands or Denmark without restrictions – only the commercial considerations of the market players determine where the gas goes.

Security of gas supply is about safeguarding the necessary infrastructure and gas supply. The short- and long-term assessment of security of supply is based on:

- System adequacy: Adequate capacity to cope with abnormally high gas demand or a significant disruption of supply.
- System security: Coordination in the physical system – in other words the operational functionality of the system from production to consumer.

- Fuel supply: The gas supply must be sufficient to meet Danish consumer demand during normal as well as extreme weather conditions.

Consumption: Annual gas consumption depends on factors such as the temperature, ie the number of degree days. Other factors include the competitive situation in the electricity and heating market. Over a longer time scale other parameters are important, such as the share of gas in the electricity and heating sector, economic growth, the sale to companies using gas, and the amount of gas used in transport.

Production: In Denmark, natural gas is produced from the natural gas fields in the Danish section of the North Sea. The natural gas from the North Sea can either be transported to Denmark via the Tyra-Nybro pipeline or to the Netherlands via the NOGAT pipeline. Gas can also be imported from the European gas market via the transmission link with Germany. A small amount of biogas is also supplied.

Gas storage: Gas consumption varies over a 24 hour period and over a year by far more than supplies from the North Sea. To even out the difference between consumption and production, the market players can use the two Danish gas storage facilities in Lille Torup and Stenlille or they can import/export gas via the link with Germany. The storage facilities also play an important role in crisis situations for storage customers and for Energinet.dk.

Grid capacity: The capacity of the transmission and distribution system is a crucial factor in the system's ability to supply gas to consumers. To assess the capacity of the system it must be viewed as a whole, ie the relationship between entry and exit volumes plus supplies from gas storage facilities. Current volumes at specific points may affect capacity at other points. And viewed separately, the entry and exit points as well as the meter and regulator stations have their own physical limitations.

Market situation and market development: The Danish gas market players are responsible for supplying gas to Danish consumers. This is based on bilateral agreements or trading in the gas exchanges, and transport is arranged over the physical gas system.

As the market becomes increasingly internationalised, the market players are better able to safeguard supplies to their consumers on the basis of cross-border trading.

Future market developments, such as new international market rules and product development in the exchanges, may make it easier for the market players to safeguard supplies to consumers.

1.1 Legal basis at EU level

Directive 2004/67/EC was the first legal framework to be established at EU level, aimed at maintaining security of gas supply and helping to keep the internal market working if supplies are disrupted.

EU Regulation on the security of natural gas supply

- Solidarity, planning and coordination concerning preventive measures and responding to actual disruptions to supplies.
- Well-functioning internal market, even if there is a shortage of supply.
- Protection of vulnerable consumers.

Danish Executive Order on the security of natural gas supply

- Defined responsibilities and division of labour.
- Categorisation of protected and non-protected consumers.

The 2004 Directive gave the individual member states the freedom to make their own arrangements regarding security of supply. This created the risk that unilateral arrangements made by one member state in an actual supply crisis could jeopardise the operation of the internal gas market and ultimately gas supplies to consumers.

To keep the internal market working well despite supply shortages, a legal framework was needed which guaranteed solidarity and coordination during a supply crisis, in terms of preventive measures as well as the response to actual disruptions in supply.

EU Regulation

The result was EU Regulation 994/2010 concerning measures to safeguard security of gas supply (the 'EU Regulation').

The primary concern of the EU Regulation is to maintain a well-functioning internal market in the context of gas shortages. This means that the market – at national, regional and European level – helps to strengthen security of supply throughout the EU.

The EU Regulation primarily establishes a legal framework for the following:

- Well-functioning internal market, even if there is a shortage of supply.
- Risk assessments, preventive action plans and emergency plans, including exceptional measures that can be introduced when the market is no longer able to satisfy gas demand.
- Definition of supply standard and crisis levels.
- Division of responsibilities, solidarity, planning and coordination concerning preventive measures and in response to actual disruptions to supplies at member state level, regional level and EU level.
- Protection of vulnerable consumers.

In early 2015, the European Commission issued a consultation paper on the revision of the EU Regulation. The document contains the European Commission's thoughts on possible changes.

Following the consultation, the European Commission is expected to submit a draft of a new EU Regulation to all member states in early 2016 for consultation.

The European Commission has identified a number of challenges:

- Security of supply should be a regional/European issue rather than a national issue.
- Increased regional cooperation, including solidarity in crisis situations.
- There is no uniform definition of protected consumers, which can cause problems when it comes to solidarity.

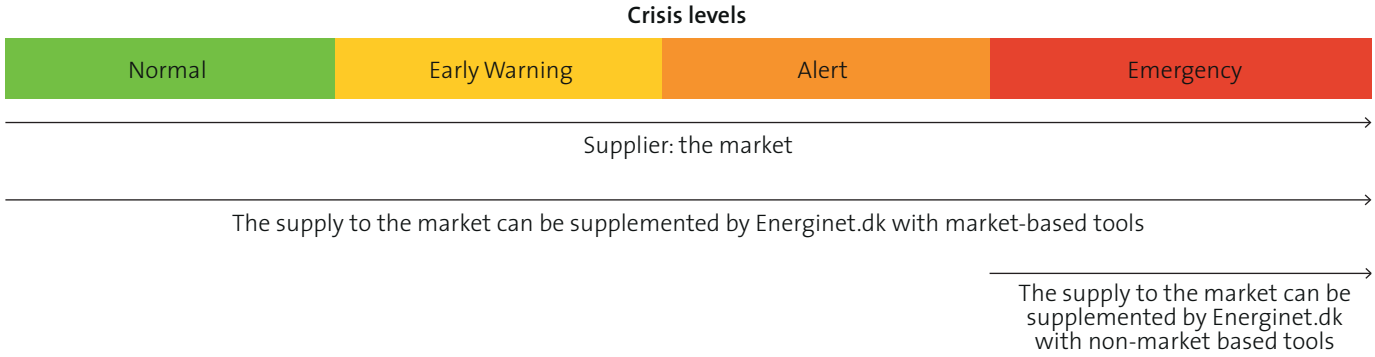


Figure 1: The Danish security of supply model

- The N-1 criterion is intended as an indicator of the level of security of supply. The question is whether it is sufficiently binding.
- Differences in the way the member states allocate responsibilities and verify compliance with the supply standard.
- No uniform preventive action plans and emergency plans, making comparisons difficult.
- Possibly, increased powers for the European Commission in EU crisis situations.
- Possibly, protection from crisis situations lasting longer than 30 days.

1.2 Legal basis at national level

According to the Danish Natural Gas Supply Act, Energinet.dk, as transmission system operator (TSO), is responsible for security of supply in the Danish gas market together with its TSO responsibility. This is set out primarily in section 12 (1), which states that the TSO must:

- To the extent necessary, connect facilities to upgrade biogas to natural gas quality, distribution grids and consumers,
- Ensure the quality of the natural gas supplied from the transmission grid.
- Provide security of supply in Denmark.
- Cooperate with other TSOs in Denmark and other countries with a view to efficient exchange of natural gas.
- Develop plans to meet future transmission capacity needs.
- Ensure that there are sufficient quantities of natural gas in the overall natural gas supply system to maintain the physical balance in the grid.

Energinet.dk's responsibility for security of supply is described in more detail in Danish Executive Order no. 962 of 27 September 2012 on maintaining security of natural gas supply.

Specifically, Energinet.dk is responsible for ensuring adequate capacity in the gas transmission system, including imports/exports from/to the European market, capacity to and from the storage facilities and to the distribution systems via meter and regulator stations.

Availability of gas for the Danish market is a matter for the market players in normal situations and also in the three crisis levels. If necessary, Energinet.dk can support the market in an Emergency by using the reserved volume and withdrawing gas from the storage facilities.

1.3 The Danish security of supply model

In the Danish security of supply model which came into force on 1 October 2012, the market plays a much more important role than before. The model is founded upon the EU Regulation. The model is illustrated in Figure 1.

The overriding intention is to avoid situations in which the market is unable to supply gas to the consumers. The model contains a number of tools which Energinet.dk can use to increase the likelihood that the market will continue to supply consumers when there is a gas shortage. Wherever possible, Energinet.dk will keep the system operating normally by using security of supply tools.

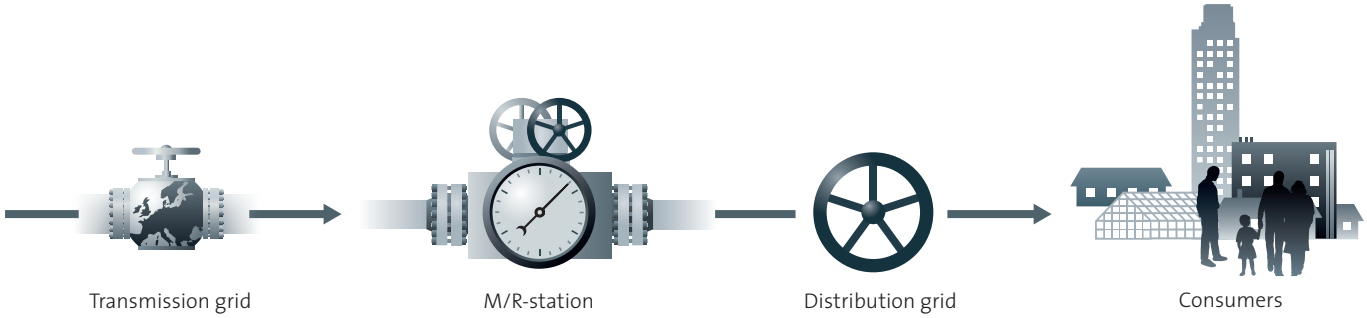


Figure 2: Illustration of the journey from the transmission system to the consumer.

Crisis levels
There are three crisis levels beyond normal operation: Early Warning, Alert and Emergency.

- An *Early Warning* is declared if an incident occurs that could cause a significant deterioration of the supply situation and could potentially trigger an Alert or Emergency later.
- An *Alert* is declared if an incident occurs that causes a significant deterioration of the supply situation, but the market is still able to manage that disruption or demand without the need to resort to non-market measures.
- An *Emergency* is declared when all relevant market measures have been deployed and the gas supply is still not enough to meet demand. In this situation it is considered necessary to use non-market measures to safeguard the gas supply to protected consumers.

At the Emergency crisis level, there is a distinction between protected and non-protected consumers with regard to gas supplies. Only protected consumers are guaranteed a gas supply in an Emergency.

Protected and non-protected consumers
All residential consumers are protected consumers. Small and medium-sized enterprises, district heating installations and consumers providing social services are also protected consumers. Non-protected consumers are typically large enterprises which consume a lot of gas.

Non-protected consumers can be disconnected in an Emergency. The disconnection depends on the particular circumstances, and 72 hours' notice will be given to allow processes using natural gas to be shut down in an orderly way.

A 'cubic metre limit' is determined and published each year by the Danish Energy Agency on the basis of a recommendation from Energinet.dk, and it is used to decide which consumers are protected. In 2015/2016, the limit is 5.4 million Nm^3. In practice, this means that all industrial enterprises with an annual gas consumption of less than 5.4 million Nm^3 and most gas fired CHP plants will be protected[1].

To reflect the different treatment of the two customer groups in an Emergency, there are two different tariffs relating to security of supply. There is one tariff for protected consumers and another lower tariff for non-protected consumers.

Crisis management
In Denmark, for example, the three crisis levels could be triggered if supplies to Denmark are interrupted from the North Sea, the largest source of supply. In this situation, Danish and Swedish consumers can still be supplied with gas from various sources including the two Danish gas storage facilities and imports from Germany. This happens mainly because the prices are set to provide an incentive to the relevant market players to boost deliveries to the Danish market.

1 Go here for a list of non-protected consumers for the winter of 2015/2016: energinet.dk/SiteCollectionDocuments/ Danske%20dokumenter/Gas/Ikke-beskyttede%20forbrugere%202015-2016_revideret.pdf

A gas crisis in another country can also trigger one of the three crisis levels in the Danish gas system. Of course, Energinet.dk's decision will take account of the wider circumstances in addition to the incident itself. It is often more serious if an incident occurs in winter than in summer because consumption in Denmark is highly temperature dependent.

Serious incidents rarely occur in the Danish gas system. In the last five years, there have only been two Early Warnings. They were declared immediately after each other in 2013. The situation occurred before the gas system was upgraded with the compressor station in Egtved and the pipeline looping to Germany. It was caused by an unseasonably cold spring combined with two unforeseen technical incidents causing various problems including a 10-day interruption to the North Sea supplies. Neither of the Early Warning situations triggered an Emergency.

Purpose of the report and reading instructions

This report meets the statutory reporting obligations and describes the following:

- Supply and demand.
- Envisaged extra capacity in planning or during construction, grid quality and maintenance level.
- Arrangements to cover periods with particularly high demand and to deal with the loss of one or more suppliers.
- Description of how security of supply has been maintained in the previous one-year period.
- A forecast of the anticipated cubic metre limit for protected and non-protected consumers in the next one-year period.
- The security of supply is based on a 10-year horizon.

2 Brief description of the gas system

2.1 Infrastructure

The Dainsh parliament Folketinget, voted to establish the Danish natural gas project in 1979. The Danish gas infrastructure was established in the 1980s in order to exploit the North Sea reserves of natural gas and to cushion the Danish people and the Danish economy from the international energy crises of the 1970s. The infrastructure is now more or less the same as when it was built.

Today, the gas system transports a considerable quantity of energy around Denmark and Sweden. Not counting transit to Sweden and Germany, about 2.5 billion Nm^3 of natural gas is transported to consumers in the Danish market. This is the equivalent of about 30 TWh of energy.

Links to the Danish gas system
The Danish gas system is an integral part of the European infrastructure. It is designed to receive gas from both the North Sea and Germany.

The Danish gas system also operates as a transit country for natural gas to the Swedish market and the wider European market via Germany.

With regard to transit from the North Sea to the European market, the Danish system is in competition with the Dutch gas infrastructure, which is also linked to the fields in the Danish section of the North Sea. The gas is transported using the route with the lowest transport costs. It is therefore crucial that the cost of using the Danish infrastructure is kept competitive. Looking further ahead, it is possible that the Danish system could be used to transport gas from the Norwegian gas fields to Denmark and Poland. The project to create a new transmission link from the Norwegian gas fields via Denmark to Poland is called Baltic Pipe, and it has been identified by the EU as a project of common interest (PCI). The EU is currently part-funding a preliminary study.

Gas transmission system
The backbone of the gas infrastructure is the transmission system which links the North Sea to the distribution grids connecting to consumers. The transmission grid in Denmark is owned and operated by Energinet.dk. In total, the pipelines in the transmission grid are about 900 km in length. The transmission grid is connected to the distribution grids via 43 meter and regulator stations which reduce the pressure for the pipeline systems of the distribution companies.

The transmission grid in Denmark is owned and operated by Energinet.dk. In total, the pipelines in the transmission grid are about 900 km in length. The transmission system provides access to the two Danish gas storage facilities.

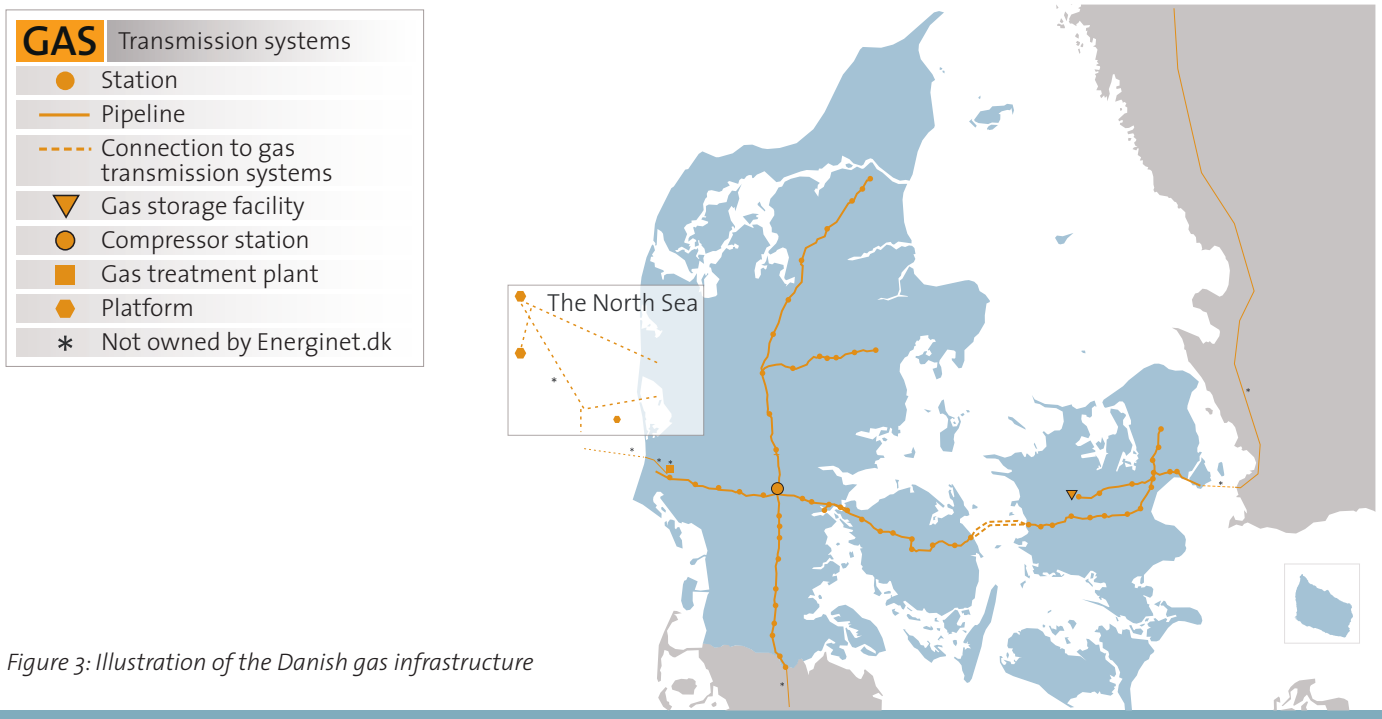


Figure 3: Illustration of the Danish gas infrastructure

The transmission system also provides access to the two Danish gas storage facilities now united under Energinet.dk. The gas storage facilities are used to compensate for seasonal fluctuations in consumption and for commercial reasons to reduce gas price differences. They are also used as a tool to maintain security of supply.

Gas distribution system
The part of the infrastructure which is closest to the consumers is the distribution system, which consists of distribution lines and service lines. The gas is carried from the distribution lines to the individual customer in service lines.

The distribution grid is owned and operated by the four Danish distribution companies. The distribution grid has a total line length of about 17,000 km and is connected to more than 400,000 supply points, in other words households and businesses. In Copenhagen, Frederiksberg and part of Aalborg, there is also a network supplying consumers with modern town gas – a mixture of natural gas and air.

The distribution grid was originally designed only to receive natural gas from the transmission grid, but now, biogas upgraded to natural gas quality is supplied to the distribution grid from biogas plants.

2.2 Players and roles

The companies in the Danish gas market have different roles. This means that different companies own and operate the physical installations, transport the gas and trade the energy until it is available to individual consumers.

The owners of the physical infrastructure occupy three roles:

- *Gas transmission system:* In Denmark, the transmission system operator (TSO) is Energinet.dk which operates and owns the gas transmission system. Energinet.dk is responsible for volume balancing in the Danish natural gas system and for managing security of supply in Denmark.
- *Distribution system:* DONG Gas Distribution, HMN Naturgas, NGF Nature Energy Distribution and Naturgas Net in Aalborg own and operate the distribution system in their respective distribution areas, delivering gas to individual consumers. The distribution areas are shown in Figure 4.
- *Gas storage facilities:* Energinet.dk owns Energinet.dk Stenlille Gaslager A/S and Energinet.dk Lille Torup Gaslager A/S. The storage facilities are operated on commercial terms. The products on offer allow storage customers to store, inject and withdraw gas. The storage facilities are in competition with other European facilities.

The commercial users (market players) of the physical infrastructure occupy three roles:

- *Shippers* are Danish and international commercial players that arrange the wholesale transport of gas in the transmission system. The shippers purchase transport rights in Energinet.dk's transmission system in order to supply the gas to gas suppliers in the distribution systems. The shippers arran-

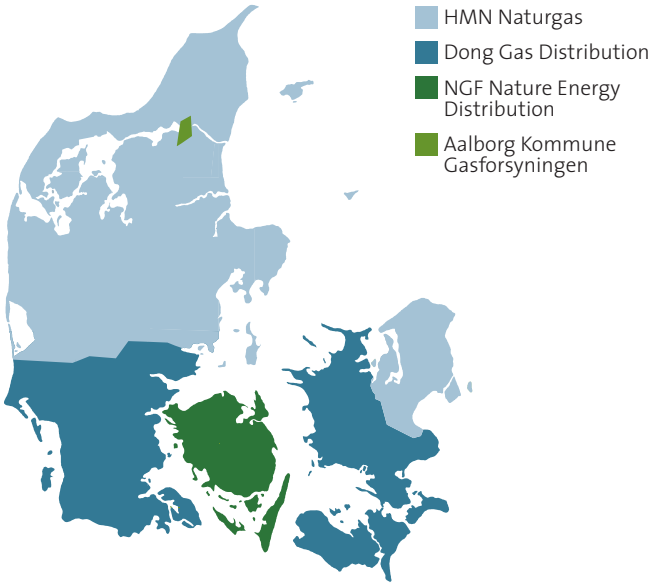


Figure 4: Illustration showing the geographical location of the four Danish distribution companies

ge the delivery of natural gas into the transmission system from Danish or foreign producers or shippers in adjacent systems. At present, there are 39 registered shippers, of which 13 are active[1].

- *Gas suppliers* provide the consumers with natural gas and bill them for the offtake. There are currently 15 gas suppliers registered in Denmark[2].
- *Storage customer* purchase the right to use the storage facilities to inject, store and withdraw gas. A storage customer is able to sell the gas in the storage facility to a shipper or to another storage customer.

Consumers are everyone who purchases and uses natural gas for their own use. There are two types of consumer:

- *DM consumers* are business users with remotely read meters, typically using 300,000 m^3 per year per consumption site. There are just under 1,500 DM consumers.
- *Non-DM consumers* make up the majority of the 400,000 or so consumers. The typical annual consumption of a detached house is 1,500 – 2,500 Nm^3/year for heating and hot water.

2.3 The European gas market

As EU gas production declines, the EU has become more dependent on gas imports from other regions. For example the European gas system is linked to Russia and Norway, which are major suppliers. Liquefied natural gas (LNG[3]) is imported from overseas by ship.

In 2013, the EU imported about 40% of the gas it used from Russia. The EU is Russia's biggest gas customer, creating a relationship of mutual dependence.

To date there have been no failures in supply from the Russian gas fields to the EU. There have been shortages in situations where transit countries (Belarus and Ukraine) have prevented the free transit of gas as part of a conflict with Russia.

In order to reduce the vulnerability of supplies, both Russia and the EU have introduced measures to make the gas infrastructure more robust. A Gas Coordination Group has been established, consisting of the European Commission, ENTSOG[4], ACER[5] and players from the gas industry. The Group's mission is to coordinate the action taken when gas supplies are disrupted.

The inauguration of Nord Stream in 2011 increased the options for delivering gas from Russia to the EU. Nord Stream passes from Russia to Germany through the Baltic Sea.

Meanwhile, parts of the European infrastructure have been optimised to make it easier to move the gas to where demand is highest.

1 http://www.energinet.dk/EN/GAS/Det-danske-gasmarked/Sider/Transportkunderi DK.aspx
2 To find out the number of gas suppliers go to gasprisguiden.dk, where consumers can also compare products and suppliers.
3 Natural gas which is liquid because it has been cooled to -160°C.
4 European Network of Transmissions System Operators for Gas
5 Agency for the Cooperation of Energy Regulators

3 Last year

	EarlyWarning	Alert	Emergency
2013	2	0	0
2014	0	0	0
2015	0	0	0

Table 1: Overview of security of supply incidents between 2013 and 2015 (November).

Last year, there were no problems with supplies to the Danish market. There were no significant incidents causing an Early Warning, Alert or Emergency to be declared. This section provides a brief historical overview of important elements concerning security of supply. For 2015, the data available at the time of publication is used.

3.1 Incidents in the gas system

In 2014 and the first 10 months of 2015, no Early Warning, Alert or Emergency were declared. The most recent such incidents happened in 2013, when Early Warnings were declared in March and April. Table 1 shows the number of incidents between 2013 and 2015 (November).

Two Early Warning incidents occurred in 2013. Both incidents were resolved without recourse to the security of supply tools made available by the security of supply model. However, mechanisms from the "Rules for Gas Transport" were used for the very first time. The measures increased the flow of gas from Germany to Denmark.

The first Early Warning incident in 2013 was caused by very low temperatures combined with low levels in the gas storage facilities, with no prospect of an increase in temperature. The second Early Warning incident happened because a failure of two supply sources coincided with low levels in the gas storage facilities.

Energinet.dk can declare an Early Warning if there is a prospect of gas shortages in Denmark. In such situations the market players are called upon to balance their portfolios more precisely than normally. An Early Warning is a signal to the market to do so. In more urgent situations, an Alert or an Emergency is declared.

3.2 Gas consumption

Gas consumption in Denmark has been falling since 2010. The

The three crisis levels

- *An Early Warning* is declared if an incident occurs that could cause a significant deterioration of the supply situation and could potentially trigger an Alert or Emergency later.
- *An Alert* is declared if an incident occurs that causes a significant deterioration of the supply situation, but the market is still able to manage that disruption or demand without the need to resort to non-market measures.
- *An Emergency* is declared when all relevant market measures have been deployed and the gas supply is still not enough to meet demand. In this situation it is considered necessary to use non-market measures to safeguard the gas supply to protected customer.

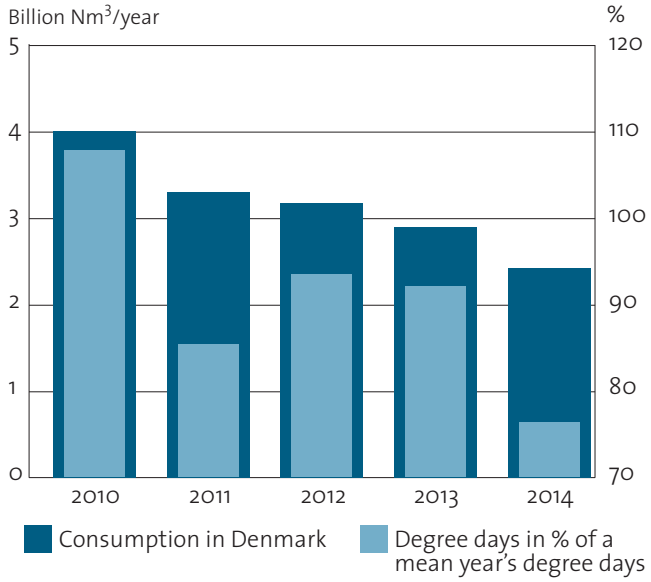


Figure 5: Natural gas consumption in Denmark in the period 2010-2014

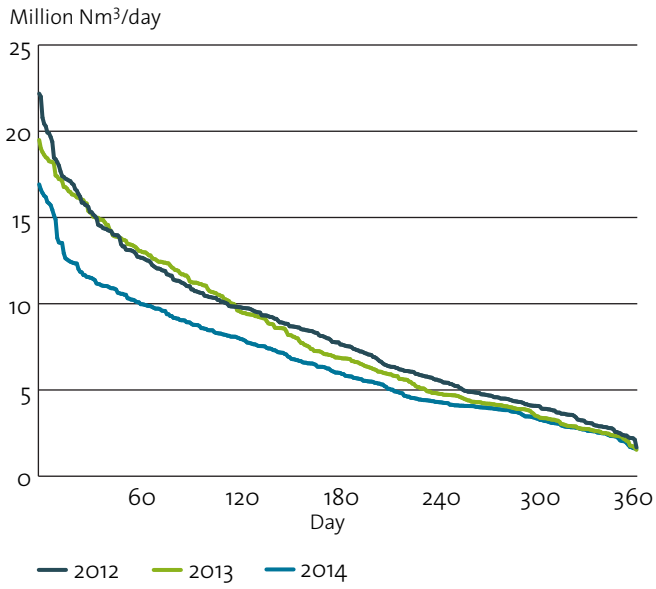


Figure 6: Duration curves for daily consumption for the period 2012-2014

consumption of gas in the period 2010-2014 is illustrated in Figure 5.

In 2014 gas consumption in Denmark was 2.4 billion Nm³. 2014 was a relatively warm year, with 23 percent fewer degree days than a normal year[6].

Consumption in 2015 is expected to be 2.5 billion Nm³. The reason for this low figure is that 2015 looks like being another warm year. So far there have been 6 percent fewer degree days than in a normal year.

2010 was a cold year with 9 percent more degree days than in a normal year, so consumption was relatively high. If the weather is cold and the water levels in the Norwegian reservoirs are low, gas consumption by the central CHP plants is particularly high.

Peak day consumption

The temperature has a major impact on peak day consumption and hence on the load on the transport systems. Figure 6 shows duration curves for daily consumption compared for the period 2012-2014.

In 2015 so far, the peak day consumption in Denmark was 15.6 million Nm³. That happened on 4 February 2015, when the daily mean temperature was -2.8°C. For the winter of 2015-2016 Energinet.dk expects a peak day consumption of 20.4 million Nm³ with a daily mean temperature of -13°C, which is the 20-year winter design temperature calculated by the Danish Meterological Institute.

3.3 Gas supplies from the North Sea

Most of the gas supplied to Denmark comes from the North Sea. At the national level, Denmark continues to be a net exporter of gas, but sometimes the flow is reversed and natural gas is imported from Germany.

The gas from the Danish fields is taken onshore via the Tyra and Syd Arne pipelines, where it is sold in the Danish exit zone or exported to Sweden and Germany. Natural gas is also exported from the North Sea to the Netherlands via the NOGAT pipeline.

Figure 7 shows net production, which is taken onshore to Denmark or the Netherlands. Net production equals gross production minus field consumption. In 2013 there was a net import of gas from Germany, turning into a net export in 2014. There are several explanations for this turnaround. North Sea production increased, the volumes transported to the Netherlands fell, and consumption in 2014 was lower than 2013.

In the first 10 months of 2015, Nybro supplied about 3.1 billion Nm³. For the whole of 2015, the figure is expected to be about 4 billion Nm³.

6 Degree days are a measure of how cold it has been. The degree days in a 24 hour period are the differ-ence between the average daily temperature and 17°C. If the average temperature over the 24 hours is 4°C, for example, there are 13 degree days in the day in question. If the average temperature is 17°C or higher, there are zero degree days, and at -5°C, for example, there are 22 degree days. In the period 2005-2014, the average number of degree days as a percentage of the normal year is 89%.

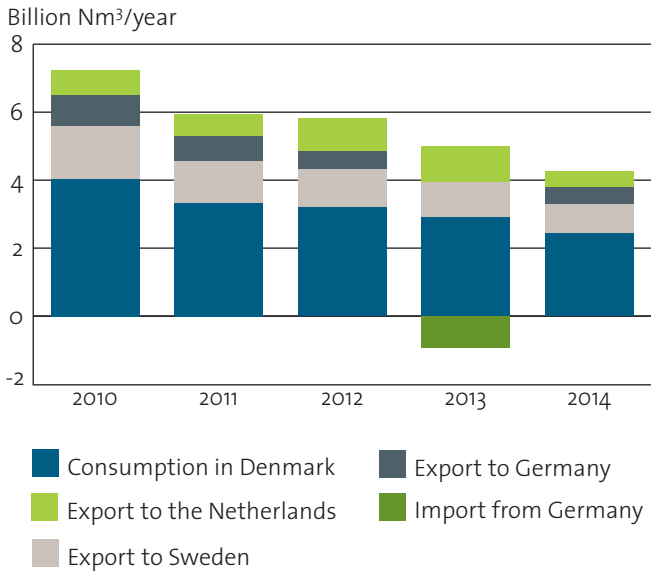


Figure 7: Annual net production from the North Sea 2014-2015

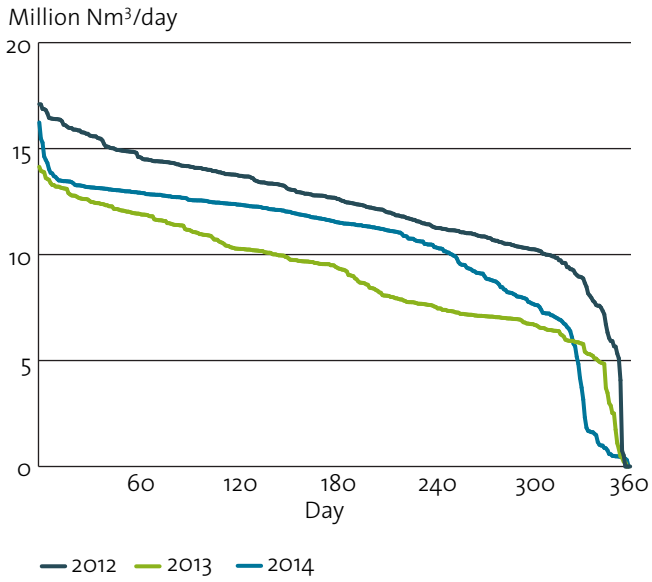


Figure 8: Duration curves for daily production for the period 2012-2014

In 2015, the maximum supply at Nybro was 14.6 million Nm³/day. This was on 10 August 2015. The duration curves for the annual supplies from 2012 to 2014 are shown in Figure 8.

3.4 Use of the transmission grid

Last year, too, the physical gas infrastructure managed to maintain supplies to the consumers in the Danish market.

3.4.1 Import from Germany

On 1 October 2013, additional physical imports from Germany via Ellund-Egtved were made possible.

Figure 9 shows the imports and exports at the Ellund border point in 2014.

3.4.2 Capacity utilisation

Table 2 shows present-day capacities at the transmission system entry and exit points and the storage withdrawal capacity compared to the actual peak day volumes during the past three winters.

In 2014, none of the peak day volumes even came close to the capacity limits.

Capacity on the Danish-German border
Until 1 October 2013, the transmission system was physically capable of importing up to 200,000 Nm³/hour from Germany. Since then, it has been possible for Germany to export 310,000 Nm³/hour or 7.4 million Nm³/day. By end of 2015 this figure will have increased to 450,000 Nm³/hour. Since 1 October 2013 the

Point		Capacity	Max flow 2012	Max flow 2013	Max flow 2014
Nybro	Entry	32.4 [7]	17.1	14.1	16.2
Lille Torup Gas Storage Facility	Withdrawal	8.0 [8]	7.4	6.0	4.5
Stenlille Gas Storage Facility	Withdrawal	8.2	10.8	9.3	7.8
The Danish Exit zone	Exit	25.5	22.2	19.5	16.9
Ellund	Entry/Exit	7.4 / 20.0	5.1/6.8	5.1/2.1	4.6/6.0
Dragør Border	Exit	8.6 [9]	7.7	7.4	6.1

Table 2: Capacities at the transmission system entry and exit points compared to actual peak day volumes. The capacity at the Ellund entry point in 2012-2013 was 4.8 million Nm³/day. The capacity at the Stenlille gas storage facility in 2012-2013 was 9.7 million Nm³/day.

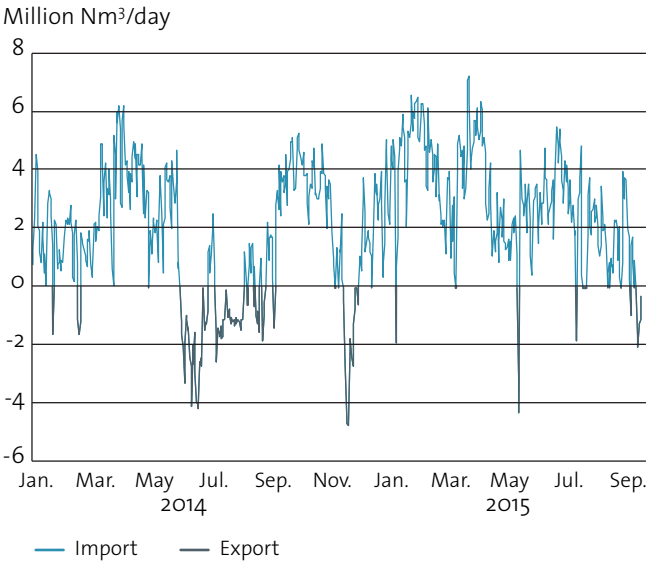


Figure 9: Imports and exports at the Danish-German border point in the period 2014-2015 (September).

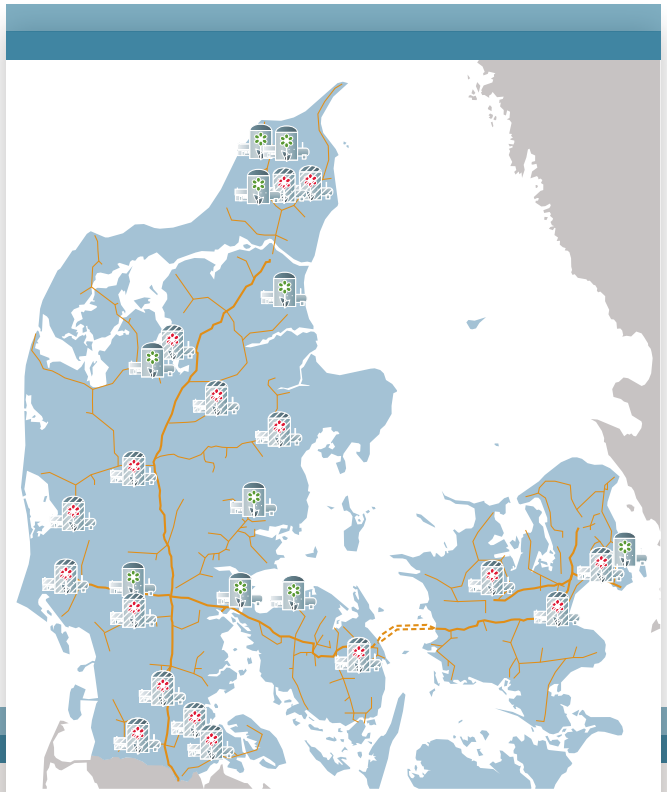


Figure 10: Green plants are existing upgrading plants connected to the gas network. Red shaded plants indicate upgrading plants, which may be realised within the next couple of years.

Danish system is capable of importing 700,000 Nm³/hour. For comparison, the system can export 823,000 Nm³/hour or 19.8 million Nm³/day across the Danish-German border.

3.5 Bio natural gas production

Since 2011 a total of ten new biogas upgraders have been connected to the Danish gas system with an annual capacity of about 45 million Nm³ of bio natural gas[10] and a total annual production of about 33 million Nm³ in 2015, corresponding to about 1.5 percent of expected consumption.

In 2014 and 2015, liquid manure based biogas from plants in Jutland and Funen was upgraded to natural gas quality and injected into the natural gas grid. All commissioned plants have been connected to the distribution grid. In 2016 one additional plant is expected to be connected to the transmission grid.

Around 10 biogas upgrader projects are ongoing, possibly connecting to the Danish distribution and transmission grid in the next few years.

The Danish Energy Agency expects that the growth in biogas in Denmark up to 2020 will mainly be in the form of plants upgrading biogas and injecting into the grid.

3.6 Use of gas storage facilities

Gas consumption varies with the seasons and over each 24 hour period. These variations are far greater than the fluctuations in the North Sea supplies. In addition to imports/exports to Germany, the market players use the two Danish storage facilities at Lille Torup and Stenlille to store gas between seasons and to supply the necessary daily capacity.

During the summer, when gas consumption is low, gas is injected into the gas storage facilities. During the winter, when supplies from the North Sea can no longer cover Danish consumption or exports to Sweden and Germany, gas is withdrawn from the storage facilities again.

If supplies from the North Sea or Germany are disrupted, the two gas storage facilities also act as a backup.

7 Total capacity of the receiving terminals at Nybro. The potential supplies are today smaller, as the Tyra-Nybro pipeline is subject to a capacity constraint of about 26 million Nm³/day, and large volumes cannot be supplied from the Syd Arne pipeline.
8 Guaranteed capacity.
9 The Swedish system is not designed to receive these volumes at the assumed minimum pressure at Dragør of 45 bar. The firm capacity is stated at 7.2 million Nm³/day.
10 Bio natural gas is the term used to describe biogas that has been upgraded to natural gas quality and injected into the natural gas grid.

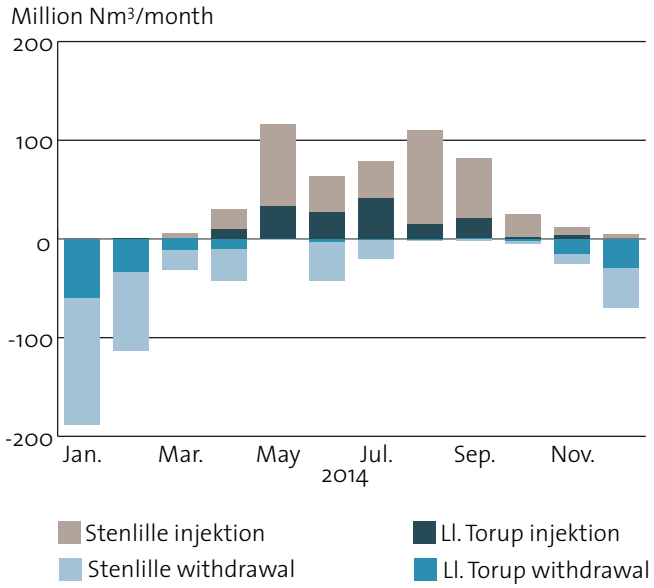


Figure 11: Monthly distribution of withdrawals from and injections into the storage facilities in 2014

Figure 11 shows the monthly withdrawals from and injections to the storage facilities in 2014.

The two storage facilities have different geological characteristics, which means they must be operated differently. Energinet.dk took over Stenlille gas storage facility in 2015. The takeover allows the two storage facilities to be interoperated, which makes is it easier to operate them, taking the geological characteristics of the into account.

3.7 Gas quality

Energinet.dk is responsible for ensuring that the gas in the transmission system complies with the Rules for Gas Transport[11] and the Gas Regulation[12] at all times. Under normal supply conditions, it is a requirement that the upper Wobbe index for natural gas is in the range 14.1 to 15.5 kWh/Nm³ (50.76 - 55.8 MJ/Nm³). The specific gravity of natural gas quality must not be below 0.555 or above 0.7.

The gas transported in Energinet.dk's transmission system is supplied from:

- The Danish section of the North Sea via the Nybro treatment plant.
- The German market via Ellund.
- The Lille Torup and Stenlille gas storage facilities.

11 www.energinet.dk/DA/GAS/Regler-for-gastransport/Sider/default.aspx
12 www.sik.dk/Virksomhed/Gas-kloak-vand-og-afloeb-for-fagfolk/Love-og-regler-om-gas-og-vvs/Gasreglementet.

Variation in gas quality in 2014-2015
In 2014-2015, the Danish market was supplied with gas from the North Sea and from Europe, imported via Ellund.

In the period from 1 June 2014 to 1 June 2015, gas quality varied as follows:

- The Wobbe index[13] for natural gas varied from 14.45 kWh/Nm³ to 15.49 kWh/Nm³, averaging at 15.21 kWh/Nm³.
- The relative density (specific gravity) varied from 0.566 to 0.690.

The upper calorific value varied between 10.87 kWh/Nm³ and 12.86 kWh/Nm³, averaging at 12.14 kWh/Nm³.

3.8 Gas market 2015

In the winter of 2014/2015 there was plenty of gas in the Danish market. Gas consumption in Denmark and Sweden was low due to the relatively high temperatures; meanwhile there was a high flow from the North Sea.

As a result, the direction of flow between Germany and Denmark was mainly southbound all winter through the Ellund border point.

The need for the market to send gas south meant that Energinet.dk more than doubled the commercial capacity. This

13 The Wobbe index indicates the heat effect to which a burner is exposed during combustion of a fuel. The higher the Wobbe index, the higher the heat effect, resulting in a higher load on the burner.

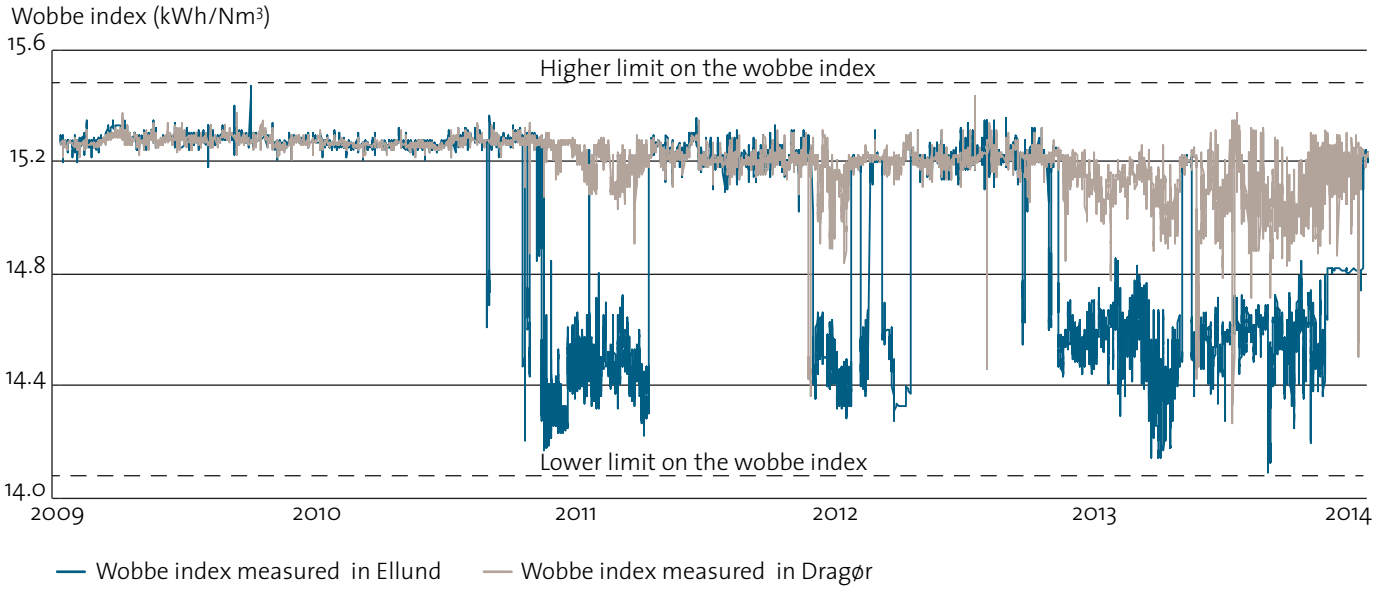


Figure 12: Changes in gas quality in the period 2010-2014. The figure shows the variation in gas quality in the Danish gas system brought about by imports from Germany via Ellund.

increased capacity was immediately used by the market players.

The increase in available capacity to the south was based on a recalculation of southbound capacity on completion of the Ellund-Egtved expansion.

Increased trading on the gas exchange
In the first nine months of the year, the gas traded on Gaspoint Nordic was on average equivalent to a turnover of about 60% of Danish consumption. This is a significant increase compared to 2013 and 2014, when the percentage after the first nine months was about 20%. Figure 13 shows a volume corresponding to the proportion of Danish consumption traded on Gaspoint Nordic, as a percentage for the period 2014-2015 (September).

Day-ahead trade still accounts for the great majority of the total trade on Gaspoint Nordic. The price differential has fallen, and the price is now stable and low due to the increased capacity to Germany.

In the bilateral market (gas transfer facility, GTF), there was a significant drop in the traded volumes in 2013. The trend continued in 2014. The drop is probably explained by the increased trading on Gaspoint Nordic. Despite the drop, the GTF nevertheless traded gas corresponding to a turnover of about 70% of Danish consumption.

3.8.1 Challenges facing the gas market

In contrast with the day-ahead market on Gaspoint Nordic, the within-day market has not experienced the same increase in traded volumes.

On 1 October 2014, Energinet.dk introduced a new balancing system. Among the aims of the balancing system is to use within-day trading wherever possible to maintain balance in the gas system. This may also help to improve liquidity, although this aspect has failed to meet the high expectations at the launch of the balancing system.

At the end of 2015, Energinet.dk will join with the market players to review the new balancing system. The review will put forward concrete proposals to improve within-day liquidity. The improvements are expected to be implemented in the first half of 2016.

3.8.2 Gas market development

ENTSOG, the European Network of Transmission System Operators for Gas, has now completed four of the major gas network codes (NCs) at European level. These are:

- CAM NC: Capacity allocation procedures
- CMP NC: Congestion management procedures
- BAL NC: Gas system balancing procedures
- INT NC: Procedures for data exchange and technical cooperation between TSOs.

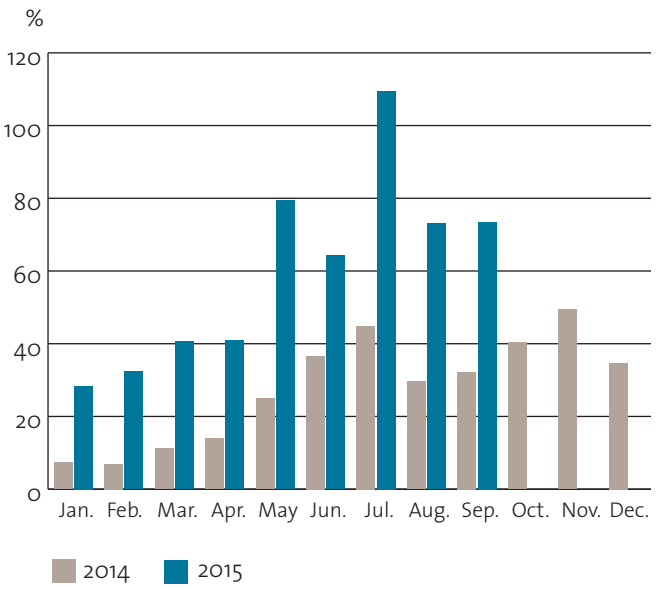


Figure 13: Share of Danish gas consumption traded on Gaspoint Nordic - comparison of the years 2014-2015 (September)

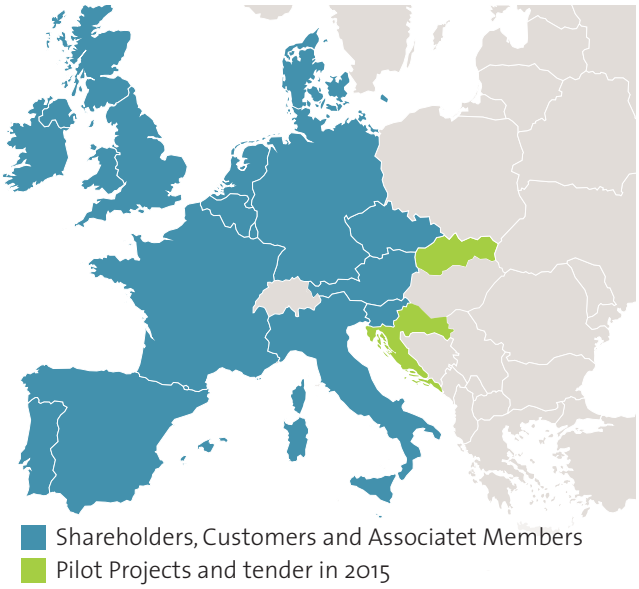


Figure 14: The countries participating in PRISMA

The following network codes are also expected to come into force in 2017:

- TAR NC: Procedures for harmonising tariff structures in Europe.
- INC Proposal: Capacity auction procedures at expanded and existing border points.

As far as Denmark is concerning, most of the capacity allocation procedures were introduced back in April 2013 when Energinet.dk and a number of other European TSOs went live with the common European capacity trading platform PRIMSA.

The only thing remaining to be done this year was the introduction of auctions for within-day capacity, which took place before the deadline of 1 November 2015. Energinet.dk has offered within-day capacity since early 2014, although only on a first come, first served basis.

The procedures for a more market-based balancing system (BAL NC) were introduced at Energinet.dk on 1 October 2014. These procedures give the shippers a greater role in balancing the physical system. Energinet.dk will only intervene, by way of trading in the gas exchange, if the total market imbalance exceeds the calculated flexibility on the day.

As of 2015, Energinet.dk provides daily forecasts for non-DM consumers, meaning that all parts of the balancing procedures have been implemented.

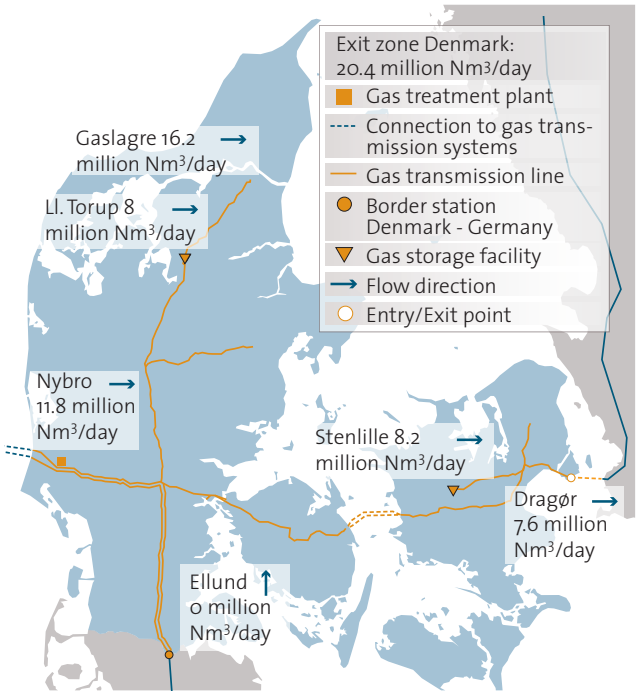
PRISMA

Energinet.dk was one of the initiators of the PRISMA capacity trading platform, which was established as an early implementation of the Network Code on Capacity Allocation Mechanisms (CAM NC). The PRISMA platform opened in April 2013, allowing shippers to purchase capacity at border points in seven countries. A total of 23 TSOs joined the platform when it was launched.

More TSOs have come on board since then as PRISMA shareholders and/or users. As a result, PRISMA now connects 16 markets with a total of 37 TSOs and more than 1,500 border points. There is an ongoing dialogue with European TSOs on participation in PRISMA.

PRISMA is therefore the tool of choice for the majority of European TSOs to implement the CAM NC procedures that came into force on 1 November 2015. In total, PRISMA now has more than 480 shippers with more than 1,700 users. There have been more than 200,000 auctions on PRISMA since launch.

4 Next winter



4.1 Winter Outlook 2016-2017

Energinet.dk calculates the offtake in Denmark (the exit zone) and in transit, and the supplies from the North Sea, from Germany and from storage facilities based on a winter's day with a temperature of -13°C. The calculations are for an updated winter outlook 2015, to be used for planning for the period 2015-2017.

- *Total transport:* Total net transport has been estimated at 28.0 million Nm³/day.
- *Exit DK:* Consumption in Denmark is 20.4 million Nm³/day. For the exit zone, the offtake corresponds to Energinet.dk's expectations at a daily mean temperature of -13°C.
- *Ellund:* Ellund has net imports of 0 million Nm³/day.
- *Dragør:* Dragør has exports of 7.6 million Nm³/day corresponding to 317,000 Nm³/hour.
- *Storage facilities:* Total withdrawal of gas from the storage facilities is estimated at 16.2 million Nm³/day, with 8.2 million Nm³/day coming from Stenlille and 8.0 million Nm³/day from Lille Torup. The distribution of withdrawals is optimised to achieve the highest possible network pressure.
- *Nybro:* Supplies at Nybro are estimated at 11.8 million Nm³/day.

The meter and regulator stations of the transmission system have the capacity necessary to cover the maximum offtake of the regional distribution companies.

Energinet.dk makes annual assessments of the possible offtake by all stations. Any consumption increases or pipeline configurations changes in the distribution grids, which may change consumption patterns at individual stations, are coordinated with the distribution companies on an ongoing basis.

The assessment for this year shows that the calculated capacities for the individual meter and regulator stations meet the distribution companies' expectations for offtake at a daily mean temperature of -13°C, which is the 20-year design temperature according to the Danish Meteorological Institute.

4.2 Capacity bookings 2015-2016

In order to transport gas in the transmission system, shippers must book grid capacity from the transmission companies. Capacity can be booked as annual, quarterly, monthly, daily or within-day products.

Long-term capacity products show how much the gas shippers expect to transport hour by hour next year.[14] Short-term capacity products (within-day) can now be purchased within the gas

day. The short-term products are an important part of the shippers' optimisation strategy, and their importance is growing all the time. These products are sold right up to, or even within, the gas day when they will actually be used. Here, we only consider the sale of capacity on the basis of annual products.

In the PRISMA capacity trading platform, capacity at Ellund and Dragør is sold in the same way as in all the other countries that have joined the collaboration.

Ellund expansion complete by the new year
On 1 January 2016, the Ellund expansion will be complete on the German side northbound. This will boost the firm capacity on the German side by more than 1 million kWh/h to around 4.2 million kWh/h. The capacity has already been allocated to the shippers participating in Gasunie Deutschland's Open Season.[15]

On the Danish side, the expanded northbound capacity was already in place by October 2013.

Annual booking in the southbound direction again increased, from 1.1 million kWh/h to 1.4 million kWh/h. This suggests that the transit volumes will continue to flow from the North Sea to Germany in the coming gas year.

14 Annual products for capacity bookings run from 1 October to 1 October. This is a 'gas year'.
15 Open Season contracts are use to ascertain demand for future transport capacity. Infrastructure users can purchase new or additional transport capacity if the operator provides it.

Sweden virtually unchanged
At Dragør exit, the sale of annual capacity was virtually unchanged from the last gas year. About 2.38 million kWh/h was sold this year, compared to 2.44 million kWh/h last year.

Striking fall in annual capacity at Nybro
At Nybro there was a striking fall in the sale of annual capacity, from around 5.4 million kWh/h in the gas year 2014/2015 to 4 million kWh/h in the gas year 2015/2016. This fall may be due to planned maintenance in the North Sea for 2 ½ months from 1 December to the middle of February. This resulted in significantly lower production from the North Sea during that period.

Exit zone and BNG entry
Capacity at the exit zone (consumption) and BNG entry (bio natural gas entry point) is normally booked later than in the rest of the system. However, an annual contract can be booked throughout the year.

The bookings for the gas year 2015-2016 are not yet known because most contracts run from 1 January. Last year, the annual bookings in the exit zone were about 6.7 million kWh/h and about 20,000 kWh/h for BNG entry.

It is expected that sales of BNG entry capacity will increase quite dramatically based on the many biogas projects currently in progress across Denmark. In order to supply bio natural gas to the grid, BNG entry capacity must be booked.

4.3 Distribution and dimensioning

Supplies to the individual meter and regulator stations in the transmission system and to the individual consumers must be maintained in normal situations as well as in crisis situations with very low daily mean temperatures. This is ensured by analysing the systems and assessing natural gas offtake from each meter and regulator station. The analyses include the three largest distribution companies NGF Nature Energy Distribution A/S, Dong Gas Distribution A/S and HMN Naturgas I/S.

4.3.1 NGF Nature Energy Distribution A/S

The meter and regulator stations supplying NGF Nature Energy Distribution are assessed to have sufficient capacity to cover the supply requirement for the winter of 2015-2016.

NGF Nature Energy Distribution's expected capacity requirement in the 'Station capacities adjacent to NGF Nature Energy Distribution' table has been calculated for the distribution company based on historical data and a review of customers' capacities (see appendix 1 for the tables). NGF Nature Energy Distribution then adjusted the numbers taking into account the simultaneity of various types of consumption.

The offtake from the Højby meter and regulator station was reduced to 25,000 Nm^3/hour because the pipeline supplying gas to Fyn Power Station was put out of service.

By the end of 2015, NGF Nature Energy Distribution expects to receive the first biogas upgraded to natural gas quality in the gas grid. Bio natural gas will be received from two independent biogas facilities on the island of Funen. As a result of these connections, the expected offtake from the Koelbjerg meter and regulator station will be reduced by 3,000 Nm^3/hour to 35,000 Nm^3/hour.

In addition, connection options are under discussion for three more biogas projects, with possible commissioning in early 2016.

Starting in 2016, the pressure in the supply lines will be reduced from 18 bar in the winter period to 12 bar in the summer period to make space for biogas by exploiting line pack in the pipelines, and to cut the cost of energy used to run the compressor equipment in the summer period.

4.3.2 DONG Gas Distribution A/S

The meter and regulator stations and distribution system in DONG Gas Distribution's distribution area are assessed to have sufficient capacity to cover the supply requirement for the winter of 2015-2016.

DONG Gas Distribution's expected capacity requirement in the table 'Station capacities adjacent to DONG Gas Distribution' is calculated from the customers' actual and expected capacities (see appendix 2 for the tables). The development in gas consumption and the consequences of changes, for example con-

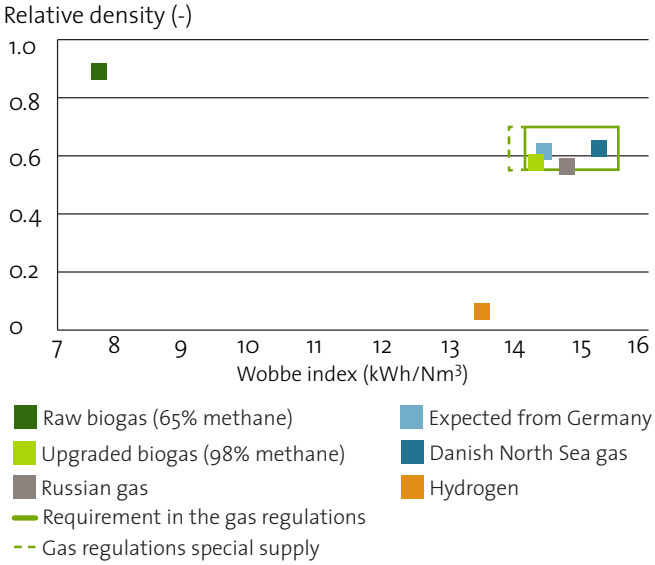


Figure 16: Illustration of gas quality for different types of gas. Biogas must be upgraded to natural gas quality before it can be injected into the natural gas grid.

sumers switching from gas to district heating, are analysed on an ongoing basis. The gas volume recorded for a single meter and regulator station shows that gas consumption halved in 2014-2015.

In 2015, DONG Gas Distribution received biogas upgraded to natural gas quality from one additional biogas facility. On 1 October 2015, contracts were signed with four bio natural gas producers to supply a total of 4,500 Nm³/hour of bio natural gas to the gas grid starting mid-2016.

4.3.3 HMN Naturgas I/S

The meter and regulator stations and distribution systems in HMN Naturgas' licence area are assessed to have sufficient capacity for the winter of 2015-2016.

The capacities stated in the 'Station capacities adjacent to HMN Naturgas' table represent the company's forecast for 2015-2016 (see appendix 3 for the tables). The development in gas consumption and the consequences of changes in the gas quality are analysed on an ongoing basis.

Since 2014, HMN Naturgas has been receiving biogas upgraded to natural gas quality from biogas plants where biogas production is based on livestock manure and energy crops. On 1 September 2015, contracts were signed with eight biogas producers to supply an annual volume of 43 million Nm³, corresponding to a total of around 5,000 Nm³/hour of bio natural gas.

More facilities are expected to be connected in the period 2016-2017, bringing the total annual capacity of bio natural gas to around 80 million Nm³, corresponding to around 10,000 Nm³/hour of natural gas.

4.4 Gas quality

Gas quality in the coming winter is expected to be based on a combination of Danish North Sea gas and gas from Germany imported via Ellund.

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

- The Wobbe index of the Danish North Sea gas is expected to vary from 14.7 kWh/Nm³ to 15.5 kWh/Nm³.
- Gas imported from Germany is expected to have a lower Wobbe index than that of Danish North Sea gas.
- Energinet.dk estimates that the average Wobbe index of gas from Germany will be 14.7 kWh/Nm³, varying from 13.9 kWh/Nm³ to 15.5 kWh/Nm³.
- Bio natural gas injected into the gas system is expected to have a lower Wobbe index than that of Danish North Sea gas.

Changes in gas quality

Danish North Sea gas belongs to the group H of the second gas family and is characterised by a highly uniform composition and gas quality. Danish natural gas has always had a high Wobbe index compared to the gas in adjacent systems. This is due to the fact that Danish gas has a relatively high content of

ethane, propane and butane, which are not extracted from the natural gas.

The gas from Germany also belongs to the H group. This will remain the case in the long term, whether or not future supplies will come from Norway, Germany, the Netherlands or Russia, or in the form of LNG or a mixture from Germany.

Bio natural gas has similar combustion characteristics to natural gas and normally consists of a mixture of methane and CO_2. Bio natural gas typically has a gas quality located at the lower end of the variation range permitted in the Gas Regulation. In section C-12 of the Gas Regulation, the Danish Safety Technology Authority lays down requirements for the quality of bio natural gas that is to be fed into the gas system. This will ensure that bio natural gas can be used safely by consumers on an equal footing with natural gas.

In future, new types of RE gases are expected to be introduced into the Danish gas system. These include hydrogen produced by electrolysis or methane produced from hydrogen and CO_2 from for example biogas in a methanation process. In the coming years, Energinet.dk will prepare for the new RE gases by examining the extent to which the gas system is ready for them.

Common EU specification
Work is ongoing to define a common European specification for natural gas quality to facilitate cross-border gas transport.

5 Future development

The transmission system is available to the commercial players and has the capacity necessary to supply Danish gas consumers. In addition, the required capacity must be made available for transit on non-discriminatory conditions.

To help meet the above requirements, as well as the requirement to maintain security of gas supply for Danish and Swedish consumers, the long-term development of the gas system as a whole must be assessed. This assessment covers a period of 10 years.

5.1 Development in consumption

The Danish gas infrastructure supplies natural gas to Danish and Swedish consumers. The expected future development in gas consumption will therefore be described for both Sweden and Denmark.

5.1.1 Development in consumption in Denmark

The total natural gas, biogas and bio natural gas consumption in Denmark, excluding field consumption in the North Sea, is expected to decline to around 2.2 billion Nm³/year in 2025.

In Denmark, natural gas consumption, in other words total consumption excluding biogas and bio natural gas, is expected to fall to just under 2 billion Nm³/year in 2025. Consumption of biogas and bio natural gas is expected to increase from about 0.2 billion Nm³/year in 2015 to about 0.3 billion Nm³/year in 2025.

The projection of natural gas consumption is based on these consumption segments: Central, local and industrial CHP plants, district heating boilers, other businesses, transport and households[16]. Figure 17 illustrates the development in consumption in Denmark

There has been a sharp fall in natural gas consumption for CHP in recent years. This is mainly due to low prices in the electricity market, but also an incipient transition to renewable energy in the CHP sector. CHP plants are expected to continue switching to alternative fuels in the future.

Consumption by individual heating systems is expected to fall slightly thanks to energy savings and conversion to district heating, heat pumps and wood pellets.

Gas consumption by businesses is expected to remain more or less unchanged. Gas usage by industrial consumers, however, is sensitive to market conditions and may fall if facilities convert to electricity and biomass.

16 The assessment uses annual Danish gas consumption projections based on Energinet.dk's analysis assumptions for 2015 (http://www.energinet.dk/EN/El/Udvikling-af-elsystemet/Analyseforudsaetninger/Sider/default.aspx) and the Danish Energy Agency's 2014 energy projection. The assessment of gas consumption in central, local and industrial CHP plants and peak load boilers is based on model simulations of operations in the electricity and heating sector.

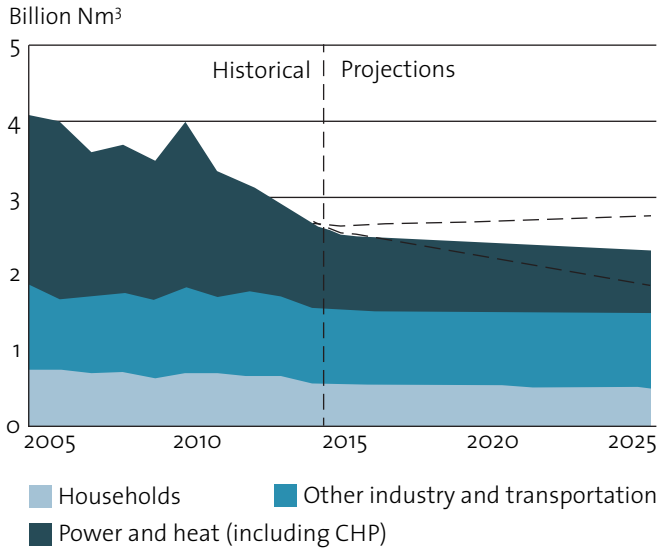


Figure 17: Development in overall gas consumption 2005-2025 subdivided into consumption sectors. The hatched area for 2015-2025 represents the total projection uncertainty

There is much greater uncertainty around development in the transport sector. By 2025 there is expected to be a modest increase in consumption for transport, reaching about 25 million Nm³/year. The growth will mainly come from buses and refuse collection vehicles.

5.1.2 Sensitivities in gas consumption

Any assessment of future gas consumption is fraught with uncertainty, especially around CHP, transport and the process industry.

For gas consumption, the range of possible outcomes is analysed using a number of alternative scenarios for CHP, transport and heating.

The following trends potentially point to a lower gas consumption than the projections suggest:

- The risk that the more gas fired CHP plants will change their operating patterns or close down due to economic factors.
- The transition to renewable energy in the process industry.
- Low consumption in the transport sector.
- Faster reduction in natural gas consumption for heating.

Conversely, these trends may pull in the direction of higher gas consumption:

- Slower reduction in gas consumption to heat homes.
- Faster rollout of gas in the transport sector.
- Improved terms and conditions for gas fired CHP. For example CO_2 prices and electricity prices.

Analysis indicates that gas consumption can vary by +/- 0.5 billion Nm³/year in 2025. This means that the range of possible outcomes is about 1 billion Nm³.

5.1.3 Development in consumption in Sweden

Sweden currently receives natural gas exclusively from Denmark via Dragør. Denmark is expected to remain Sweden's only source of supply.

Sweden is currently working on biogas, gasification gas and LNG projects for injection into the natural gas grid. This makes it hard to assess the impact on consumption and the proportion of local supply in future.

Natural gas consumption increased dramatically in 2009 and 2010 in Sweden, due in part to the new CHP plant in Malmö becoming operational. In 2016, consumption is expected to total around 0.9 billion Nm³/year.

There is also uncertainty around projections for Swedish natural gas consumption. This is mainly because power plants and industry account for much of the consumption. Energinet.dk expects natural gas consumption in Sweden to decline gradually in line with Danish consumption.

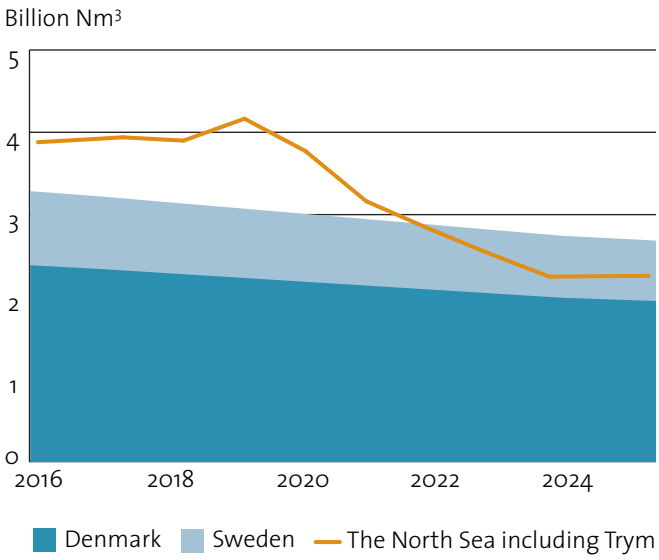


Figure 18: Development in total natural gas consumption for Sweden and Denmark in the period 2015-2025

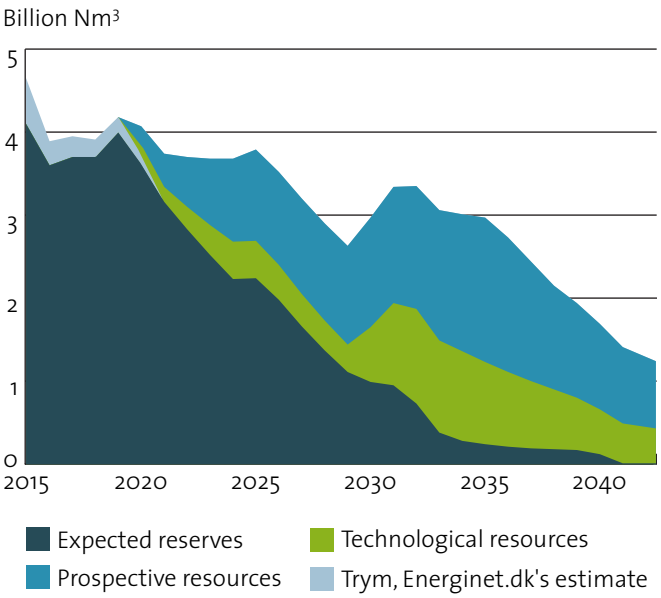


Figure 19: Gas supplies from the North Sea 2015-2042. Source: The Danish Energy Agency and Energinet.dk 2015

5.2 Gas supplies to Denmark

There are several sources of supply to the Danish gas market. Natural gas from the North Sea is the main source, but recent years have seen increasing gas imports from Germany and growing biogas production in Denmark.

5.2.1 North Sea production

Until 2010, Denmark was supplied with gas from the North Sea only. North Sea production peaked in 2005-2006.

In 2010, the first supplies from Trym, a small Norwegian gas field, were sent through the Danish offshore pipelines. Supplies from Trym are currently being used to supply the Danish, Swedish and Dutch gas markets.

The Danish Energy Agency estimates that gas supplies from the North Sea will decline between 2019 and 2042. Based on the current knowledge of North Sea reserves, supplies are likely to be exhausted in 2045-2050. North Sea production may be increased in the long term by leveraging technological resources (new extraction technologies) and prospective resources (new fields). Energinet.dk uses the expected reserves in its security of supply assessment. Gas supplied from the North Sea in the period 2015 to 2042 are illustrated in Figure 19.

Supplies to Denmark
Natural gas supplies to Denmark are determined by the proportion of North Sea production that is sent to the Netherlands and Germany (via Denmark). For the total supplies to the Danish and Swedish markets, it is therefore assumed that the second expansion stage in Germany will be completed in 2015, and that the Danish Hejre gas field will enter into production in 2017. However, the commissioning of Hejre is expected to be postponed, but the time schedule is unknown at this point. A postponement would not have a significant effect on the assessment of the Danish supply situation.

The flow to the Netherlands after 2018 is uncertain, so the assessment assumes that all gas from the North Sea will be supplied to Denmark and not the Netherlands. Capacity is available in the NOGAT pipeline[17], allowing 4-5 billion Nm³/year to be delivered to the Netherlands. Higher exports to the Netherlands mean lower supplies to Denmark at Nybro, which in turn means lower commercial exports to Germany.

5.2.2 Bio natural gas production

Up until 2025, bio natural gas is expected to be the only method of production of RE gases. On the basis of the analyses in the energy agreement published in spring 2014, the Danish Energy Agency estimates that biogas production will grow from about 5 PJ in 2013 to about 12 PJ in 2025. Most of it is expected to be upgraded and injected into the grid.

17 Via the Tyra F3 pipeline

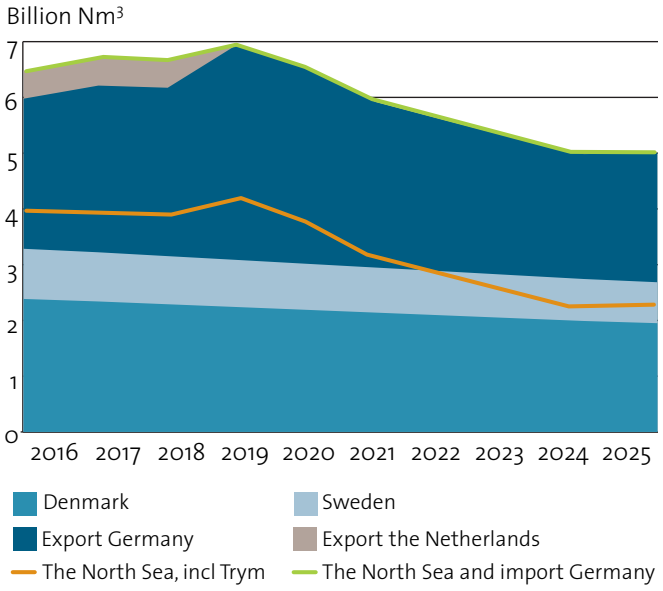


Figure 20: Consumption and supplies in the period 2016-2025

If facilities are built as the Danish Energy Agency expects, in a few years 5 percent of the gas in the Danish gas system could be produced on the basis of biogas.

5.3 Gas supply situation

Energinet.dk continuously monitors the supply situation and ensures that the market is informed of the expected development. Examples of the factors monitored include the Ukrainian crisis and potential reductions in North Sea supplies. Energinet.dk thus provides the market players with a common information basis, which allows them to take the necessary precautions to avoid critical supply situations.

The assessment of the supply situation 2016-2019 is based on the Danish Energy Agency's gas production forecast for the Danish section of the North Sea and Energinet.dk's gas consumption forecast in Denmark and Sweden.

5.3.1 Expected supply situation 2016-2019

It is estimated that in 2016-2020 the volumes in the North Sea will be able to cover the needs of the Danish and Swedish gas markets, but it is expected that the markets, as in 2015, will be supplied with gas on a commercial basis from both the North Sea and Germany. Consumption and supplies in the period 2016-2025 are illustrated in Figure 20.

Work on the German expansion is still underway at the end of 2015, and the Danish Hejre gas field is scheduled to come on stream in 2017. Opportunities for supplies to Denmark and Sweden will have been created in 2016-2019, as is assumed in Table 3.

Billion Nm³	2016	2017	2018	2019
Import Germany	2.580	2.760	2.760	2.760
Export Germany	-2.680	-2.980	-3.010	-3.850
Netto import Germany	-0.100	-0.220	-0.250	-1. 090

Table 3: Supply situation in the period 2016-2019.

Billion Nm³	2016	2017	2018	2019
The Netherlands	0.500	0.500	0.500	0.000
Export Germany	2.680	2.980	3.010	3.850
Sweden	0.900	0.880	0.860	0.850
Denmark (natural gas)	2.390	2.350	2.300	2.250
Import Germany	2.580	2.760	2.760	2.760
The North Sea, incl Trym	3.900	3.950	3.910	4.180

Table 4: Imports and exports from/to Germany in the period 2016-2019.

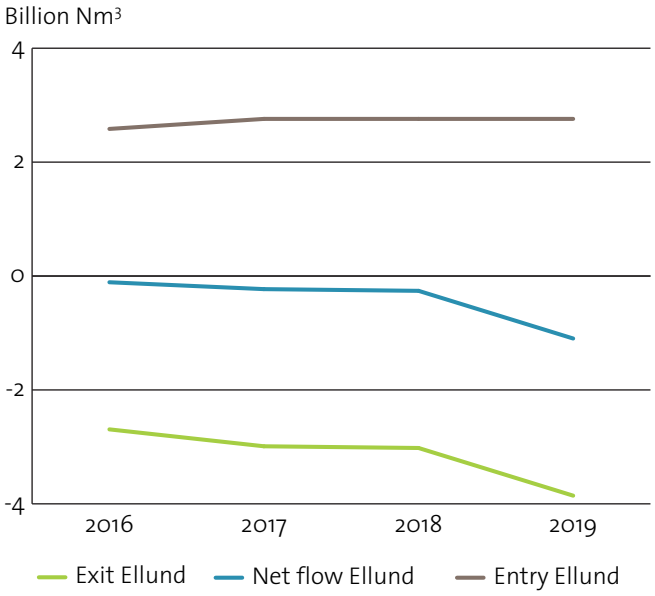


Figure 21: Supplies at the Ellund point in the period 2016-2019

In 2016, to supplement supplies from the North Sea, gas will be imported from Germany to meet demand in the Danish and Swedish markets, and these imports are expected to increase further in 2017. This is illustrated in Table 4.

Supply issues

- In 2016, it is estimated that the volumes of gas from the North Sea can meet demand in the Danish and Swedish gas markets; however, substantial gas imports from Germany are expected.
- In 2016, the German gas system is expected to have been expanded further, increasing the current 310,000 Nm³/hour to 365,000 Nm³/hour of firm capacity and 85,000 Nm³/hour of interruptible capacity.
- The Hejre gas field is factored into the 2017 supply situation. The commissioning of Hejre is expected to be postponed, but it is not expected to be of any importance.

5.3.2 Sensitivity in the supply situation 2016-2025

The future supply situation could take a number of different paths with regard to consumption as well as supplies to Denmark. For this reason, an additional sensitivity assessment has been carried out for supplies to Denmark, based on large and small transport volumes in the Danish transmission system.

In the low estimate, some of the natural gas from the North Sea is diverted to the Netherlands via the NOGAT pipeline. The high estimate assumes higher natural gas production in the North Sea aided by technological reserves and exploration reserves.

5.4 Gas storage capacity

The Danish gas storage facilities are an essential and integral part of the Danish gas system – in relation to the market, capacity, security of gas supply and daily operation. Most of the total storage facility volume of around 1 billion Nm³ is utilised by commercial users. This corresponds to around one third of the total Danish and Swedish annual gas consumption.

Storage requirements in the medium and long term

Capacity is now fully developed on the German side of the border, allowing Germany to help to balance the Danish market, but even so, it is still necessary to use the existing storage facilities. Not just in crisis situations but in normal situations too.

Energinet.dk expects demand for withdrawal capacity in normal situations to vary between 10 million Nm³/day and the current capacity of around 16 million Nm³/day.

In 2015 Energinet.dk estimates that the storage requirements of commercial users for seasonal adjustments will be 300- 400 million Nm³.

The purchase of gas for the additional supply of protected consumers in Emergency situations will fall in 2016 once reliable supplies from Germany are in place.

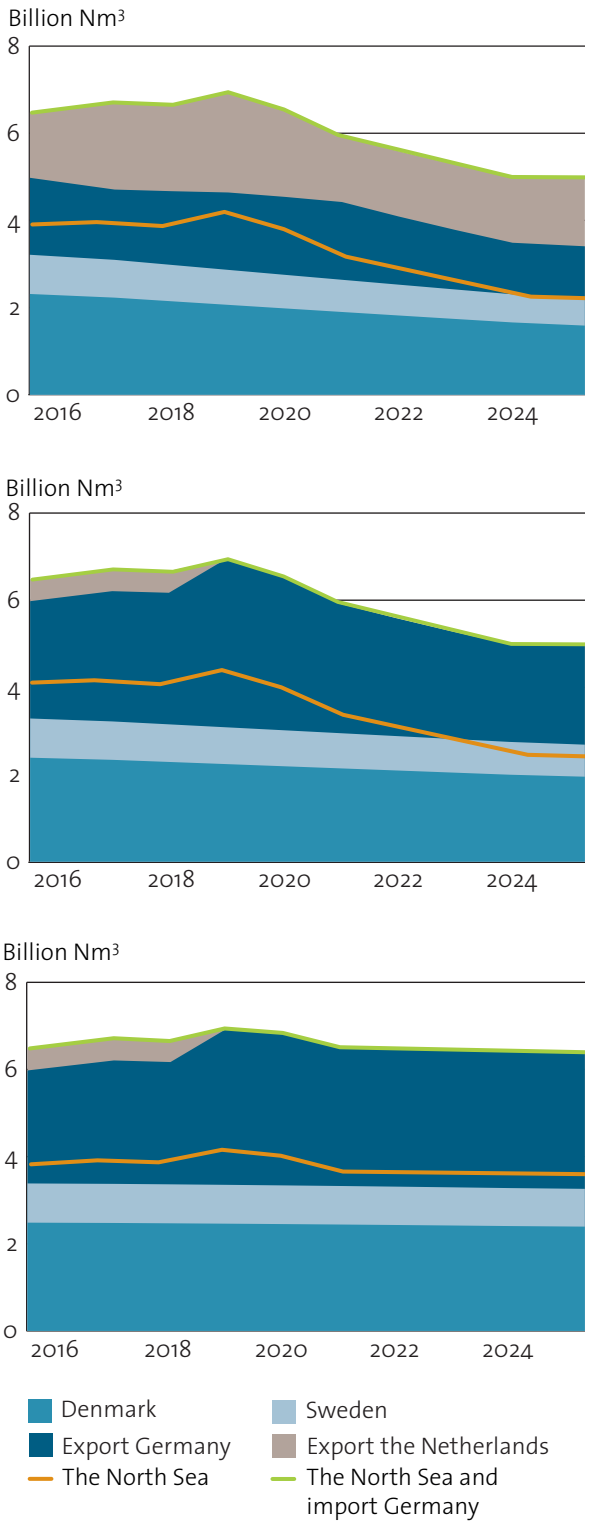


Figure 22: Sensitivity in supplies to Denmark in the overall supply situation. Top: Low supplies. Bottom: High supplies

In 2014, the tense situation between Russia and Ukraine prompted the European Commission to request all member states to conduct a risk analysis, which showed that Danish security of supply was fundamentally high because the Danish storage facilities were full. Security of supply is now further enhanced due to increased capacity from Germany.

A large number of other factors may change storage needs in the medium (2018-2020) and long term (2020-2050). For example:

- Energinet.dk's choice of methods to fulfil the security of gas supply obligations for the Danish market and to meet the security of gas supply needs in the Swedish market.
- Storage supply and demand from other markets such as the German market.
- The production of biogas and other renewable gases.
- The extent to which the gas system will be used in the long term as a reserve and peak load source to ensure security of supply in the electricity and heating system.
- The security of gas supplies from the North Sea

5.5 Infrastructure after 2015

The Danish gas transmission system consists of 924 km of gas pipes, 43 meter and regulator stations, one compressor station and two gas storage facilities. The system is only connected to the European gas grid via the link to Germany.

Unlike most of our neighbours, Denmark has had the privilege of being self-sufficient in gas for many years. For this reason,

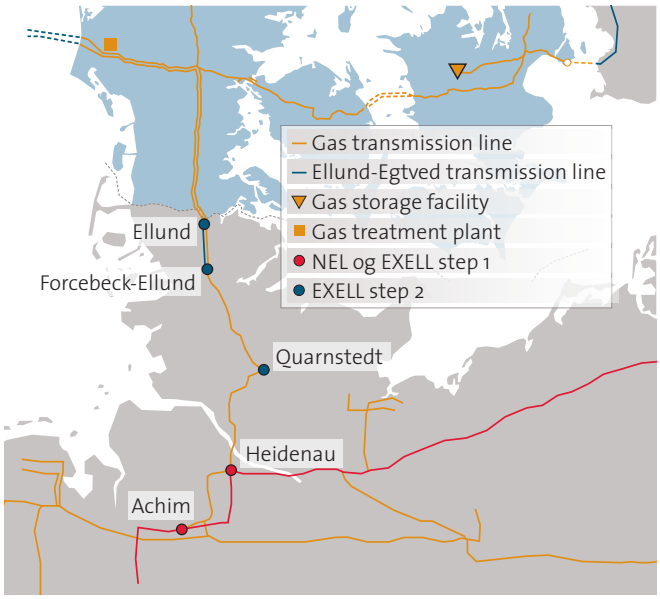


Figure 23: Stage 2 expansion of the North German natural gas system

the transmission links to neighbouring countries are designed with exporting in mind. The European transmission grid, on the other hand, is primarily set up for transit and importing from major producers in Algeria, Norway, Russia and LNG facilities.

Stage 2 in Germany
Gasunie Deutschland is carrying out further expansions to increase the capacity and flexibility of the North German system.

The stage 2 expansions are expected to become operational at the end of 2015. The final size and distribution of capacity between domestic consumers and the Ellund border point will depend on demand signals and German legislation. The capacity is expected to be at least 450,000 Nm³/hour to Denmark (365,000 Nm³/hour on a firm basis and 85,000 Nm³/hour on an interruptible).

More gas from Germany in the future
As North Sea production decreases, Denmark will become more dependent on gas imported via Germany. The Danish and Swedish gas market has access to ample gas reserves for many years to come via the connection to the European gas grid at Ellund. The gas in the North German system consists of a mixture of Norwegian, Dutch, Russian and German gas (including bio natural gas) and liquefied natural gas (LNG).

The Norwegian fields supplying the European market have reserves for the next 50 years. Russian reserves are estimated to be many times larger and adequate to maintain existing production for the next 100 years.

Energinet.dk's investments in import capacity from Germany have improved the long-term security of gas supply, but, depending on the development, it may still be necessary to evaluate other alternatives after 2020.

Prospective expansions, including a connection to Norway
In the long term, as North Sea production wanes and Germany represents the largest supply source, fulfilment of the EU Regulation on the security of natural gas supply may need new infrastructure to guarantee supplies in the event of failure of the single largest gas infrastructure (the N-1 criterion). Alternatively, storage facilities could be expanded or steps could be taken to rapidly disconnect consumers.

A Norwegian tie-in solution may help ensure that the North Sea resources are exploited optimally. Energinet.dk therefore continually assesses the options for establishing a connection from Norway to Denmark before 2020.

In 2015 Energinet.dk joined with the Polish TSO Gaz System to launch a preliminary study into a possible link between Denmark and Poland, part-financed by PCI project funding from Europe. The study also investigates a link connecting the Norwegian and Danish offshore infrastructures. The study is due to complete in 2016.

Its terms of reference include identifying design options, running financial analyses, developing a concept for a regional market model, and carrying out initial technical investigations. The aim of the preliminary study is to establish a sound basis

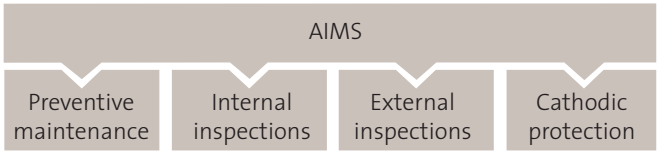


Figure 24: Asset Integrity Management System (AIMS)

upon which the decision can be made as to whether to proceed with a project maturation phase.

It will also involve Polish and Norwegian players in order to prepare the ground for joint agreements on design, routing, investment forecasts and business models for the link.

Gas imports from Norway are a supplement to supplies for the Danish and Swedish markets. However, the imported capacity can also be passed on to the Northern European market, including the Baltic states.

The European Commission funds initiatives for diversification of the gas supply to Northern Europe and the Baltics. The EU is therefore favourable towards looking into a Norway-Denmark and a Denmark-Poland connection.

Baltic Pipe has been discussed by Danish and Polish players on several occasions but no investment decisions have yet been made. The project is being looked at again because a number of factors have come together, including:

- Internal market: At present, Poland has a long-term supply agreement with Gazprom. The price of the gas is indexed to the oil price, meaning that Polish gas prices are much higher than in the free market in its western neighbours.
- Security of supply: Baltic Pipe and a new pipeline between Poland and Lithuania puts the Polish infrastructure in a position to support regional solidarity and deal not only with technical or political disruption to supplies in individual member states but also with a total outage of the dominant Russian supplier.
- The Danish gas system: Transit is increasingly important in stabilising tariffs. A Norwegian link would also support Danish North Sea extraction, for example by handling varying gas quality from marginal fields and by giving greater access to a larger and more liquid regional market.

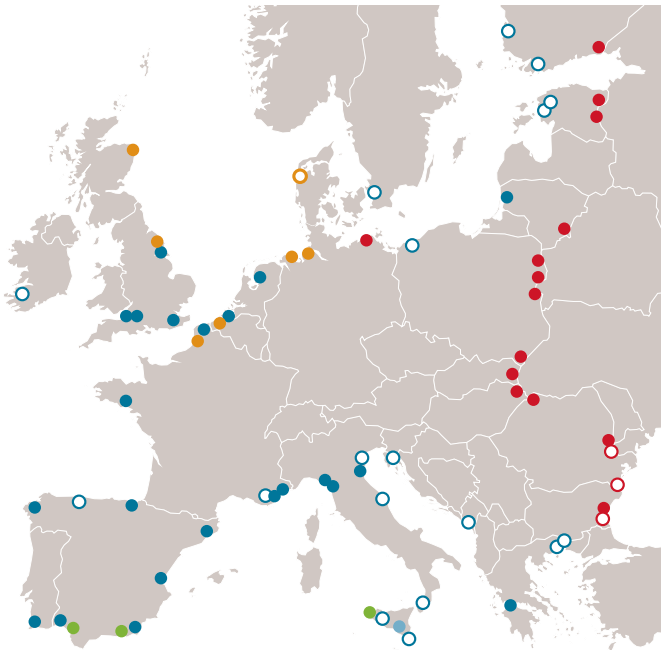
The Danish-Polish link – Baltic Pipe – gained PCI status (Project of Common Interest) in November 2015. The list of PCI projects will receive the final approval from the European Parliament and the Council of the European Union in early 2016.

PCI status opens up various funding options for projects, allows cross-border cost allocation and speeds up approvals processes.

5.5.1 Condition of the transmission grid

Most of the Danish transmission grid was constructed between 1982 and 1984. The system has seen more than 30 years of service. To safeguard an adequate and secure gas infrastructure into the future, it is important that timely and cost-effective maintenance work is carried out.

The gas infrastructure is covered by a comprehensive Asset Integrity Management System (AIMS) to guarantee that the gas transmission system is operated in a secure and cost-effective way. Many service operations in gas facilities are mandated by law and are carried out in accordance with the law. AIMS is illustrated in Figure 24.



Existing import points

- LNG
- Norway
- Russia
- Algeria
- Libya

Planned import points

- LNG
- Norway
- Russia

Figure 25: Illustration of supply sources in Europe at present and possible sources in future. Source: TYNDP15.

Asset management is a methodology designed for companies that are highly dependent on their assets, for example infrastructure companies like airports, energy companies, transport companies etc.

Energinet.dk is ISO 9001 certified for gas and expects to complete implementation of the ISO 55001 asset management system in 2016. The methodology is partly based on an asset's life cycle, which must be defined with descriptions of the underlying processes.

Asset management has three focus areas:

- Risk-based approach: We are dependent on our assets and outages can have serious consequences.
- Effectiveness: Focus on making things smarter and constantly improving what we do.
- Methodology: Supporting effective procedures and transparency, and reducing the risk of outages.

Overall, this approach is expected to improve planning of initiatives and investment, rationalise maintenance costs, and ultimately improve security of supply by always having the right measures in place.

5.6 Development in Europe

Every two years ENTSOG publishes a TYNDP plan (Ten Year Network Development Plan). The relevant rules are set out in the TEN-E Regulation[18].

TYNDP 2015[19] was published in March 2015. There was then a period of consultation, and comments were received from the European regulators (ACERs) in October 2015.

The plan contains an overview of the long-term challenges facing the European gas market, looking not just ten years ahead but through to 2035. TYNDP 2015 recommends developing the gas markets and the gas infrastructure that links countries.

5.6.1 Demand in Europe

The report's main conclusion concerning demand is that European demand for gas is expected to level off towards 2035. The annual increase in demand is just + 0.4 percent per year. There are considerable differences between countries however – for example Denmark is one of the countries with more sharply falling demand.

5.6.2 Production and imports to Europe

European gas imports are expected to be covered largely by Russian gas and LNG (liquefied natural gas, generally carried

18 Regulation (EU) No 347/2013 on guidelines for trans-European energy infrastructure. This Regulation places great importance on the 10-year plan as part of the PCI selection process (PCI = Projects of Common Interest). For a start, each potential PCI project must be included in the latest version of the TYNDP. The 10-year plan also contains an introductory assessment of the gas infrastructure and the supply and demand situation, forming the basis of the project-specific cost-benefit analysis (CBA).

19 The 10-year plan can be downloaded from the ENTSOG web site: www.entsog.eu.

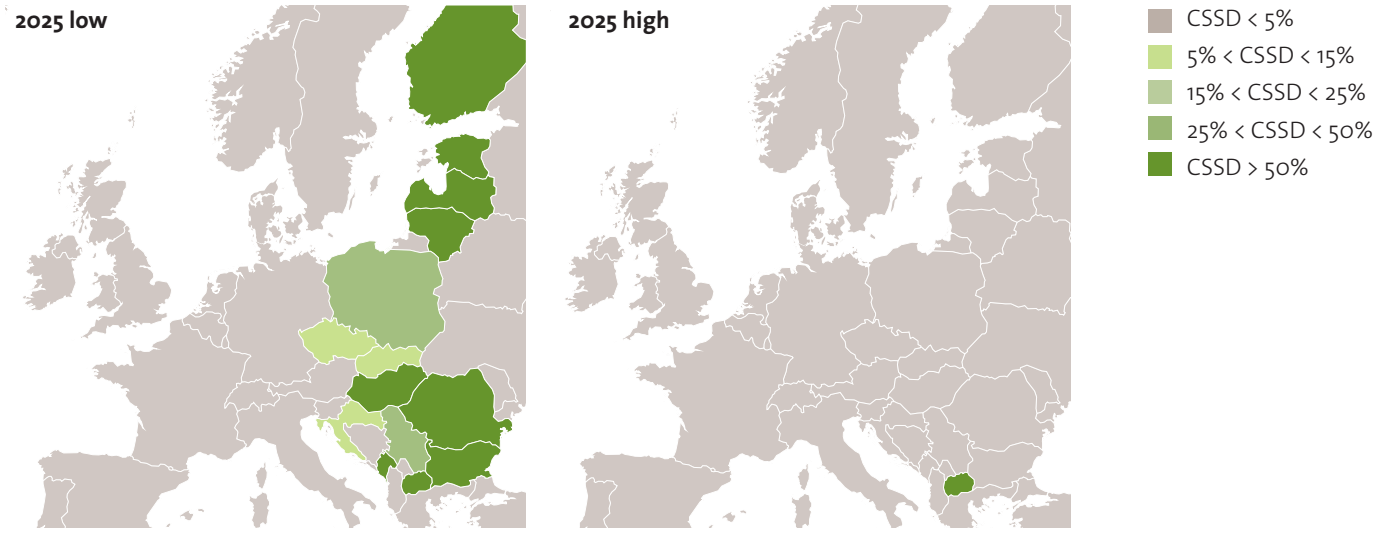


Figure 26: Example of consequences on supply in 2025 following a disruption to Russian gas supplies to Europe. Based on the 'green' scenario and 'low' and 'high' infrastructure development. The situation shown is where there is cooperation between the member states in a standard winter. The darker the colour, the higher the likelihood of a disruption to supplies in February. Source: ENTSOG. CSSD stands for 'Cooperative Supply Source Dependency '.

by ship). Dependence on these sources will increase as a result. This remains the case even if the infrastructure is developed as assumed in the TYNDP for the various scenarios analysed.

5.6.3 Infrastructure in Europe

In Europe, a key motivation behind new investments in infrastructure is to improve integration of isolated countries and connect them to the European gas network.

TYNDP15, published in March 2015,confirms this trend with a list of more than 259 European projects, 68 percent of which involve new transmission links. The projects include national pipelines, links to neighbouring countries, storage facilities and LNG terminals. They are designed to support security of supply and a well-functioning internal market.

A map of the whole of Europe, showing developments through to 2030 and based on TYNDP15, is available for download/purchase on the ENTSOG web site[20].

5.6.4 European risk assessment

On the basis of the individual countries' submissions to TYNDP15, ENTSOG has created an overall assessment of security of supply in Europe.

In its analysis, ENTSOG looks at different situations with varying flow, consumption and disruptions from various sources.

The assessment is based on three different dimensions for the years between 2015 and 2035:

- Variation in electricity generation ('green' and 'grey' scenarios from ENTSO-E).
- Three different levels of transmission development ('low', 'PCI' and 'high' with up to 259 projects throughout Europe).
- Situations exploring the impact of:
- disruptions to sources of supply
- disruptions to transport routes, eg via Belarus or Ukraine.

Figure 26 shows an example of how the countries are affected by different levels of transmission development if Russian gas supplies were disrupted in 2025. The example assumes that all countries show solidarity, in other words they share gas with each other before non-protected consumers are disconnected.

The findings of the test show that going forward, the Danish security of gas supply is high. The only situation in which non-protected consumers in Denmark could have problems with their gas supply is if the gas from Russia is cut off in 2035 and there has been little development the European infrastructure.

In all risk scenarios, the Danish risk of disruption is the same as the European risk. This is due to the close physical link between the Danish and European infrastructure.

20 www.entsog.eu/maps/system-development-map/2014.

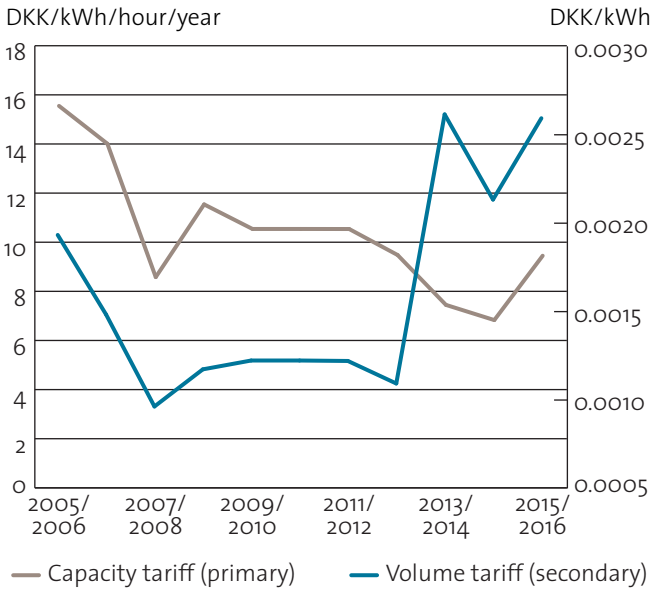


Figure 27: Transport tariffs for the period 2005-2015 (gas year)

5.7 Transmission tariffs

Energinet.dk's finances are based on a break-even principle. This means that income and expenses must balance. Differences between income and expenses are called excess or deficit and are transferred to next year's budget. Most of the income is collected in the form of tariffs.

The transmission tariffs paid by the customers cover all necessary costs involved in the efficient operation of the transmission grid. This means that the tariffs cover costs incurred in connection with:

- Operation of the gas system
- Expansion of the transmission network
- Security of gas supply

The Danish Energy Regulatory Authority approves the tariffs.

5.7.1 Transport tariffs

Transport tariffs collected from shippers have decreased during the period Energinet.dk has operated the transmission grid. Lately, however, they have increased because less account is taken of excess revenue. In the slightly longer term, the transport tariffs are expected to rise as the volume of gas transported falls. Transport tariffs for the period 2005-2015 are illustrated in Figure 27.

Tariff structure harmonisation in Europe
Work on a common European tariff method has been delayed, and a regulation is not expected until late 2016. The aim is to strengthen the internal gas market by harmonising tariff structures across national borders, increasing transparency and reducing transaction costs for consumers.

In 2016, Energinet.dk will carry out a thorough review of the current tariff method to make it compliant with the European legislation and to support a competitive Danish gas transmission system.

Until the tariff method is overhauled in 2016, Energinet.dk has asked the Danish Energy Regulatory Authority to maintain the current tariff system with differentiated capacity tariffs at entry and exit points until 1 October 2017 with minor adjustments.

5.7.2 Emergency supply tariffs

In addition to the transport tariff, the end users also pay emergency supply tariffs. End users are divided into two customer groups, which each pay a differentiated emergency-supply tariff:

- Non-protected consumers are about 20 industrial companies and central power stations, which together account for around 21 percent of the annual gas consumption in Denmark.
- Protected consumers are approximately 400,000 private customers, public enterprises, CHP and district heating plants and small businesses with a consumption of less than 5.4 million Nm^3 per year (applicable for the 2015-2016 gas year), which together account for approximately 79 percent of consumption.

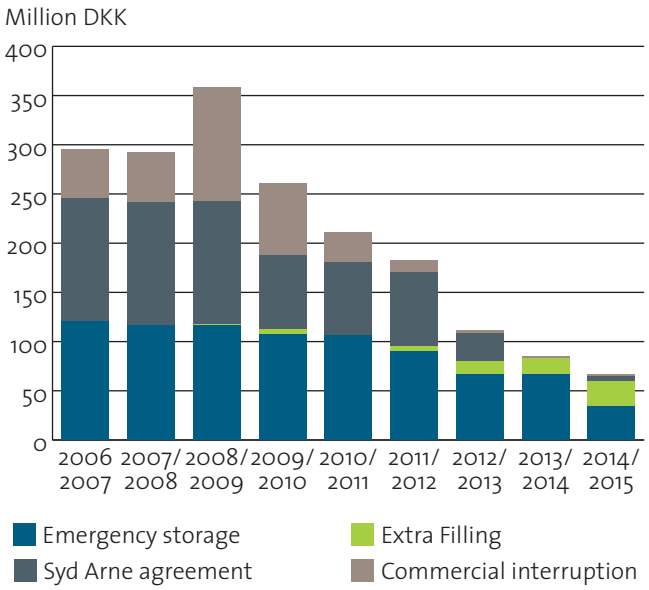


Figure 28: Costs of purchase of services for handling crisis situations

There are differences between the reliability of supply to the two customer groups in an Emergency, which means there are two different tariffs. There is one tariff for protected consumers and another lower tariff for non-protected consumers.

On 29 September 2014, the Danish Energy Regulatory Authority approved a new principle for calculating emergency supply tariffs. The new principle means that the cost allocation no longer changes.

The overall cost of tools that can be used in an Emergency will in future be allocated between protected and non-protected consumers in a ratio of 85/15. The emergency supply tariffs will still be different for the two user types.

The weighted emergency supply tariff in 2014/2015 was 0.00018 DKK/kWh. In 2015/2016 this will go up to 0.00119 DKK/kWh. This is an almost seven-fold increase.

The reasons for this sudden jump include these two important factors:

- The year before, the emergency supply tariff was extremely low – virtually zero – making the change seem more dramatic.
- The very low amount the year before was the result of cost savings and a substantial reversal of excess revenue. Now that the excess revenue has been almost completely reversed, the tariff has to rise if all the other factors remain the same.

The cost base of the emergency supply tariff consists of the cost of purchasing services to handle emergency situations. These costs are illustrated in Figure 28

As shown in Figure 28, the costs have fallen considerably since 2009. This is partly because the security of supply has improved, allowing more alternative tools to be used, and partly because the market is increasingly expected to play a more active role in crisis situations.

5.8 Information security

Increased use of IT systems and information has created major development opportunities in the electricity and gas sector, both in terms of business and technology, and is one of the key reasons it is possible to integrate large quantities of renewable energy cost effectively, while also maintaining security of supply.

However, the stronger dependence on information technology also means greater vulnerability is built into the gas system. A modern energy system must be designed to prevent and withstand malicious data attacks, which could potentially lead to a critical situation for the energy supply.

Information security is defined as all security measures aimed at protecting information assets, whether these are physical, electronic or oral information. Information security is thus more than IT security, but as information technology is used in more and more situations, the majority of the work with information security will relate to IT security.

Energinet.dk has three information security objectives. These are:

- Availability
- Integrity
- Confidentiality

The three overall goals for information security are to ensure availability, integrity and confidentiality:

- Availability means that systems, data and information about a transaction and its background must be accessible when needed. This is the most frequently occurring problem. An example is the loss of IT tools for monitoring the gas system due to technical faults in the control system.
- Integrity means that no unauthorised person has made changes.
- Confidentiality means that no unauthorised person has had access to systems, data etc.

All three goals are important. Viewed narrowly in relation to security of supply, what is particularly important is availability of the critical control systems, and being able to rely on data integrity.

Information security breaches have historically not had serious consequences for the Danish gas supply. However, there is a need for greater focus on the issue along the entire gas system value chain, to minimise the future risk.

5.8.1 Information security as a strategic focus

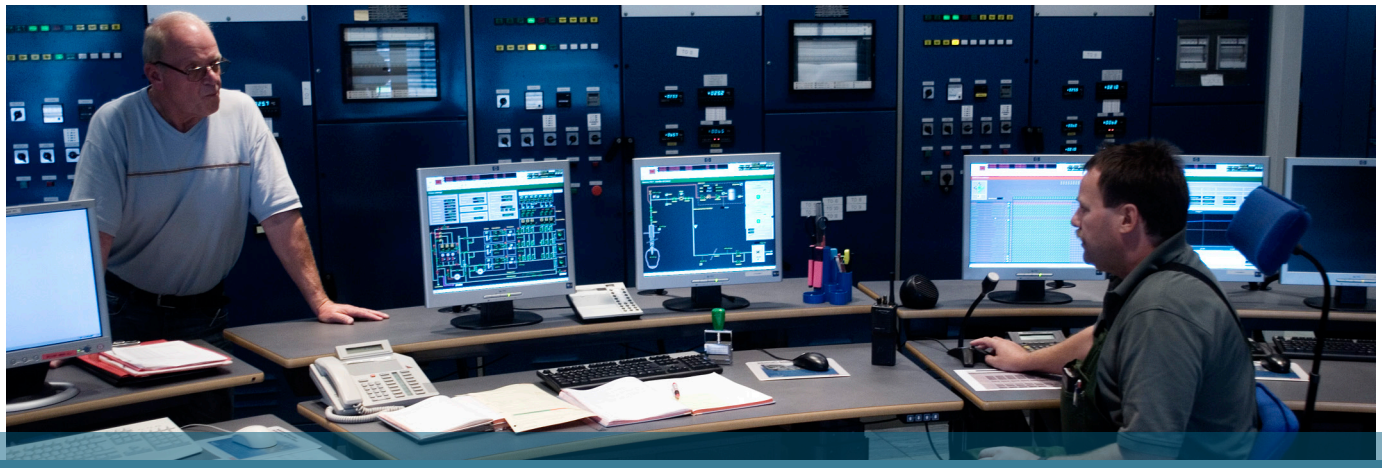
Energinet.dk has had a focus on securing IT systems and training in contingency situations where systems are not available for several years. Various system tests, controlled hacker attacks and information campaigns have been regularly conducted internally at Energinet.dk, including testing of the critical SCADA system.

Energinet.dk sees the need for an even stronger focus on information security, because information technology is vital to operation of energy systems today, and because the threat situation has changed in recent years.

As part of Strategy Plan 2014, Energinet.dk decided to measure security based on the ISO 27001 IT security standard. The results of the tests were not satisfactory, and the initiative therefore has key significance. Energinet.dk has made a clear plan and allocated significant resources in order to ensure that the strategic goals are achieved.

The strategy has the goal that maturity at Energinet.dk should be above average by the end of 2015. The long-term strategy goal is for maturity to be high at the end of 2017. Energinet.dk is of the view that much progress has already been made.

The Danish Energy Agency conducted an investigation into the 'maturity and security level of cyber security and information security among Danish electricity and natural gas companies' during the first half of 2015.



The result for all electricity and natural gas companies is 2.8 on the CMMI scale, which goes from 1 to 5. The CMMI scale (Capability Maturity Model Integration) is used to measure the maturity of IT security in different business sectors. Generally speaking, the study shows that Energinet.dk is in line with the rest of the sector and that maturity of the gas sector is above average.

6 Safeguarding security of supply

Security of supply in the gas sector is increasingly a European issue, with the physical infrastructure and the market becoming more and more interconnected. This also means that the Danish approach to safeguarding security of supply is affected by the arrangements made at European level.

All EU countries must work within the framework of the EU Regulation. The EU Regulation is aimed at protecting the most vulnerable gas consumers in Europe. It does this by reinforcing security of gas supply in the EU and the individual countries through cooperation and increased solidarity between the member states. Solidarity in this context means that if they can, countries send gas to the countries where vulnerable consumers are affected by a supply crisis.

6.1 The Danish security of supply model

In the Danish security of supply model created in 2012 on the basis of the EU Regulation, the market plays a much larger role than previously.

The overall intention is to avoid serious supply crises. The Danish security of supply model contains a number of security of supply tools that can be used by Energinet.dk, the transmission system operator.

The tools are designed to make it more likely that the market will be able to continue supplying consumers in normal situations, Early Warnings, Alerts and Emergencies.

The fundamental principle of the security of supply model is that it is the market's job to maintain supplies in the Danish gas market. Energinet.dk is not allowed to support supplies to consumers until an Emergency is declared in the system. This is the situation shown in red in Figure 29.

EU or regional supply crisis
The crisis levels can also be used for EU or regional supply crises. It is up to the European Commission to decide on crisis levels at EU or regional level. After receiving the European Commission's decision, the Danish Energy Agency passes it onto the Danish system. From then on, Energinet.dk handles the situation according to the Danish security of supply model.

If a crisis situation has been declared at EU or regional level, the requirement to safeguard emergency supply to Danish protected gas consumers is reduced from 60 to 30 days.

Transit
Articles 10(4) (national crisis) and 11(5) (EU and regional crisis) of the EU Regulation state that Denmark must not use tools unduly restricting the flow of gas in the internal market.

European solidarity ensures that the flow of gas is not restricted in an Emergency situation at EU level. In a national crisis situation, capacity restrictions may be applied to guarantee supplies to protected consumers.

Supplies to Sweden
Denmark is Sweden's only source of gas. The Swedish transmis-

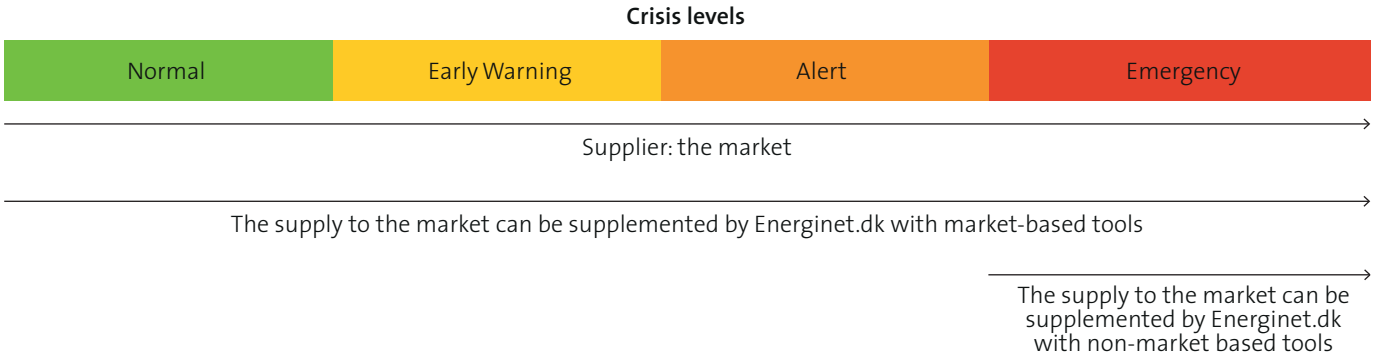


Figure 29: The Danish security of supply model.

sion system is therefore physically dependent on the Danish system.

Sweden does not have its own market-based security of supply tool, but Swedish consumers are eligible to participate in Energinet.dk's commercially interruptible supply concept. This means that participating Swedish gas consumers can help stabilise the transmission system in Denmark and Sweden.

More market tools may be introduced in the Swedish market in the years to come to keep Swedish consumption constantly aligned with the supply capacity at Dragør.

Documentation to the European Commission
The EU Regulation requires a number of documents to be prepared describing the way crisis situations are handled. This is to ensure that supply crises in the EU are dealt with in a uniform way.

The documents in question are as follows, to be created by Energinet.dk and submitted to the European Commission every two years (next at the end of 2016):

- Risk assessment
- Preventive action plan
- Emergency plan

The risk assessment documents compliance with infrastructure and supply standards, and forms the basis of the preventive action plan.

The preventive action plan contains the measures needed to remove or mitigate the risks identified.

The emergency plan contains the measures to be taken to remove or mitigate the impact of a gas supply disruption. The emergency plan is based on the risk assessment and the preventive action plan.

6.2 Risk assessment

Article 9 of the EU Regulation concerning measures to safeguard security of gas supply states that a full assessment must be made of the risks affecting the security of gas supply in Denmark.

The aim of the risk assessment is to ensure that Denmark meets the infrastructure standard (Article 6) and the supply standard (Article 8).

The risk assessment uses the criteria set out in the EU Regulation. In other words, risk assessments are made for situations of exceptionally high gas demand and/or disruption lasting up to 30 days. In Denmark the worst event may last up to 60 days. This is because it would take an estimated 60 days or so to repair offshore pipelines in the North Sea.

The assessment of critical events is therefore based on an assessment of the capacity of the gas infrastructure to satisfy total gas demand when the single largest event occurs. According to the EU Regulation, this is when the single largest

gas infrastructure is disrupted during a day of exceptionally high gas demand (N-1). Exceptionally high demand is defined as an event occurring with a statistical probability of once in 20 years.

In addition to the N-1 incident, the risk assessment must also determine whether protected consumers can be supplied for a period of at least 30 days in the case of an event under average winter conditions.

Energinet.dk has produced a risk identification analysis of the transmission system[21] for the purpose of identifying the relevant risks. It covers all sources of supply and the associated gas infrastructure.

As part of the risk assessment process, meetings were held with the German Federal Network Agency, the Swedish Energy Agency and the Danish Energy Agency. The purpose of the meetings was to coordinate the risk assessments of the three countries.

6.2.1 Conclusions of the risk assessment

For the Danish and Swedish markets, the risk assessment shows that the most serious consequences result from disruptions to the four main sources of supply in Denmark:

- The North Sea.
- Germany (via Ellund).
- The two gas storage facilities.

Depending on the prevailing supply conditions on a particular day, any of these sources could be the main source of supply.

Possible scenarios in one of the four main sources of supply:

- Explosion, fire or similar event on the Tyra platform.
- Explosion, fire or similar event at the Stenlille gas storage facility.
- Extreme waves in the North Sea.
- Commercial events affecting deliveries from Germany.
- Damage to the pipeline between Tyra and the Nybro gas treatment plant.

An analysis of the consequences of a major event or non-transient high consumption in the gas system concluded the following:

- *High demand for an extended period:* In 7 and 30 day periods of exceptionally high gas demand, the gas supply will be more than sufficient to cover all protected consumers in Denmark and Sweden. There may be enough gas to fully or partly supply Danish and Swedish non-protected consumers.
- *Disruption of the largest source of supply combined with high consumption:* In the event of disconnection from one of the four main sources of supply during one day of exceptionally high gas demand, the gas supply will be sufficient to cover all protected consumers in Denmark and Sweden.

21 www.energinet.dk/SiteCollectionDocuments/Danske%20dokumenter/Gas/Risikovurdering%20af%20det%20danske%20gassystem%202014.PDF

- *Disruption of the largest source of supply for an extended period in a normal winter:* In the event of disruption of the single largest gas infrastructure for a period of 30 days under normal winter conditions, the gas supply will be more than sufficient to cover all protected consumers in Denmark and Sweden. There may be enough gas to fully or partly supply Danish and Swedish non-protected consumers.

6.3 Preventive Action Plan

The Preventive Action Plan contains a description of the tools needed to remove or mitigate the risks identified. Establishment of a preventive action plan is laid down in Article 4 of the EU Regulation.

According to the EU Regulation, the Danish national Preventive Action Plan[22] must include the following:

- The results of the risk assessment.
- The tools, volumes, capacities and the timing needed to fulfil the infrastructure and supply standards.
- Obligations imposed on natural gas undertakings and other relevant bodies, including for the safe operation of the gas system.
- Description of cooperation with other member states.
- Information on existing and future infrastructure with relevance to crisis situations.
- Information on all public service obligations that relate to security of gas supply.

6.4 Emergency Plan

The Emergency Plan[23] includes the following:

- Definition of roles and responsiblities.
- Detailed procedures and measures to be followed for each crisis level, including the corresponding schemes on information flows.
- Description of tools and cooperation with other member states and natural gas undertakings for each crisis level
- Description of reporting obligations imposed on natural gas undertakings at Alert and Emergency levels.
- Description of possible tools that can be used to supply gas consumers in the event of an Alert or Emergency.

Appendices are attached to the emergency plan describing how crisis situations are handled[24].

In 2014 the emergency plan was changed so that gas supplies to non-protected Danish consumers will not be cut automatically when an Emergency is declared. This considerably improves security of supply for non-protected consumers.

22 http://energinet.dk/SiteCollectionDocuments/Danske%20dokumenter/Gas/Forebyggende%20handlingsplan%202014.pdf

23 http://www.energinet.dk/SiteCollectionDocuments/Danske%20dokumenter/Gas/Energistyrelsens%20nødplan%20dec%202014.pdf

24 http://energinet.dk/SiteCollectionDocuments/Danske%20dokumenter/Gas/Bilag%20nødplan%202014.pdf

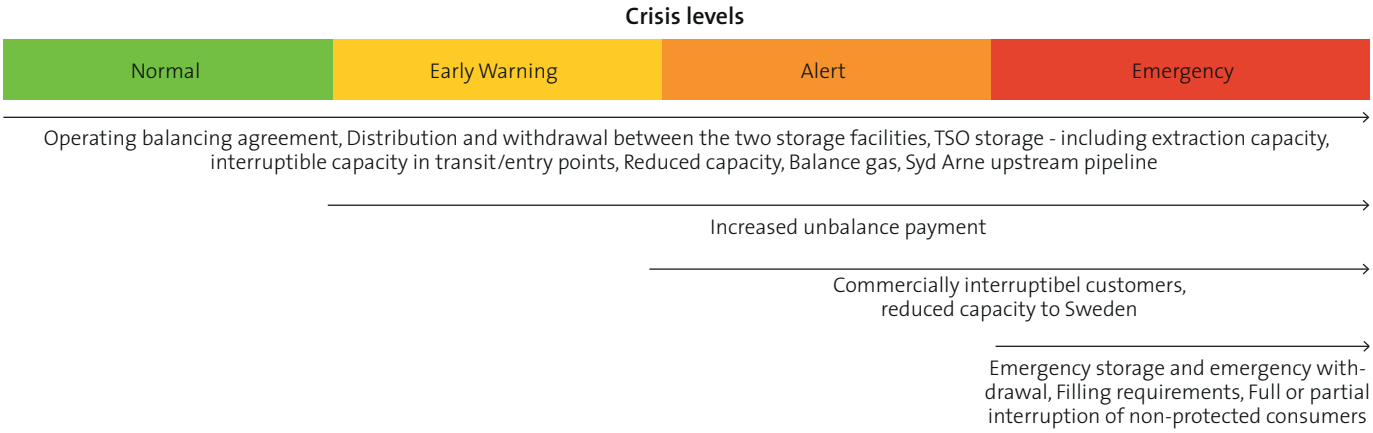


Figure 30: Balance and emergency supply tools grouped by applicable crisis level.

The emergency plan was changed again in late 2015, mainly to account for implementation of a mechanism allowing the partial disconnection of non-protected consumers (the pro-rata model).

6.5 Security of supply tools

The Danish security of supply model contains a number of tools that Energinet.dk can use at each crisis level. The security of supply tools are illustrated in Figure 30. Some of the tools can also be used for balancing during normal operation.

The particular situation being dealt with will largely determine the way the tools are used. The decision whether to use particular tools therefore depends on effectiveness as well as cost.

Certain tools can also only be used in certain situations. For example, higher payments during imbalances can be used at Early Warning level and above, ie, also in Alerts and Emergencies. The Syd Arne tool can be used regardless of the crisis level but only if there is reduced capacity in the Tyra-Nybro pipeline.

At Alert level and, if the situation escalates, Emergency level, activation of the commercially interruptible consumers in Denmark and Sweden (Hyper3) becomes possible. And at the Emergency crisis level, emergency storage and emergency withdrawal can be implemented in the storage facilities.

As an absolute last resort it may be necessary to disconnect the non-protected consumers fully or partly.

The various tools are described in more detail below.

6.5.1 Operating balancing agreement

Operating balancing agreement limits describe the permitted difference between physical supplies and commercial bookings. It may be possible to make technical use of the variability between bookings and supplies (operating balancing agreement) to help balance the physical system.

Operating balancing agreement limits are defined in the cooperation agreements with the adjacent systems (Ellund, Dragør, Nybro, Stenlille storage facility, Lille Torup storage facility). The system operating balancing agreement can be used during normal operation and at the three crisis levels.

6.5.2 Sharing of withdrawal and injection between the gas storage facilities

The combined storage bookings can be shared between the physical storage facilities in the northern and eastern parts of the transmission system (Lille Torup and Stenlille).

In certain situations, the different physical characteristics and geographical locations of the two storage facilities can contribute to east-west stabilisation of the transmission system.

Sharing of withdrawal and injection between the two gas storage facilities can be used during normal operation and at the three crisis levels.

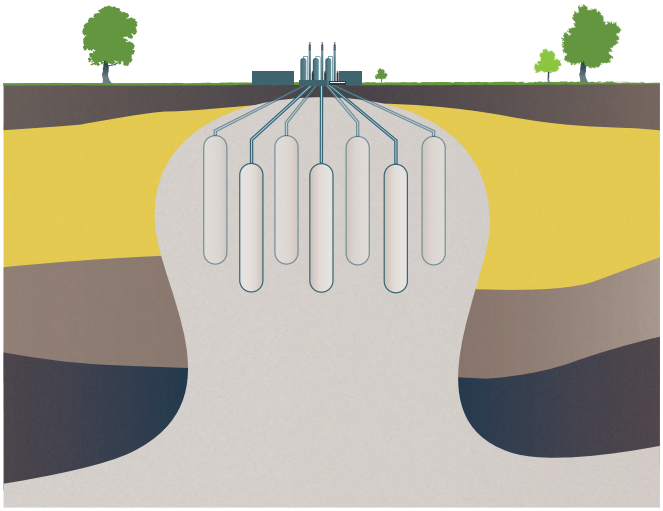


Illustration of Lille Torup gas storage facility

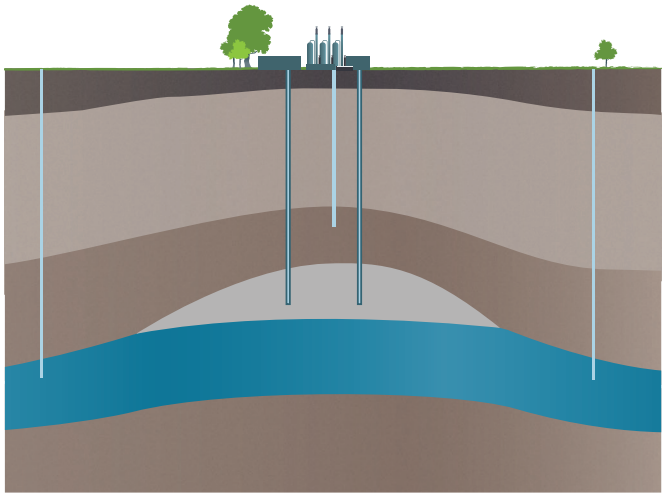


Illustration of Stenlille gas storage facility

For example, low pressure in the east of Denmark could be mitigated by replacing withdrawals from the Lille Torup gas storage facility with withdrawals from Stenlille gas storage facility.

6.5.3 System operator storage

Energinet.dk keeps gas in storage in order to manage the physical balance in the transmission system. The stored gas can be used to deal with differences between physical and commercial supplies and to optimise the system pressure.

Volume, injection and withdrawal capacity for balancing is purchased from storage companies on ordinary market terms.

System operator storage can be used during normal operation and at the three crisis levels.

6.5.4 Interruptible capacity at exit and entry points

The 'Rules for Gas Transport' define interruptible capacity as capacity that can be fully or partly interrupted if Energinet.dk is short of capacity.

Interruptible capacity is only offered if there is a shortage of firm capacity in the transmission system.

Interruptible capacity can be used during normal operation and at the three crisis levels.

6.5.5 Reduced capacity

Reduced capacity can be used in parts of the system for example if firm capacity that has already been sold becomes unavailable because of an event. The event could be a pipeline rupture in a defined geographical area where other security of supply tools are ineffective[25].

Reduced capacity can be used during normal operation and at the three crisis levels.

6.5.6 Balance gas

The reason why balance gas is billed is to give shippers an incentive to use market mechanisms to restore balance. This means the market players can help keep the overall system in balance.

The principle is this: for each gas day, the shippers are obliged to supply a quantity of gas to the system corresponding to the total offtake.

If the day's supply differs from the total offtake, the imbalance is billed by Energinet.dk at a price set to cover Energinet.dk's balancing costs. The price charged for imbalances is based not only on the particular shipper's imbalance for the gas day but also on the overall system imbalance.

25 The precise mechanisms for this tool are described in the 'Rules for Gas Transport'.

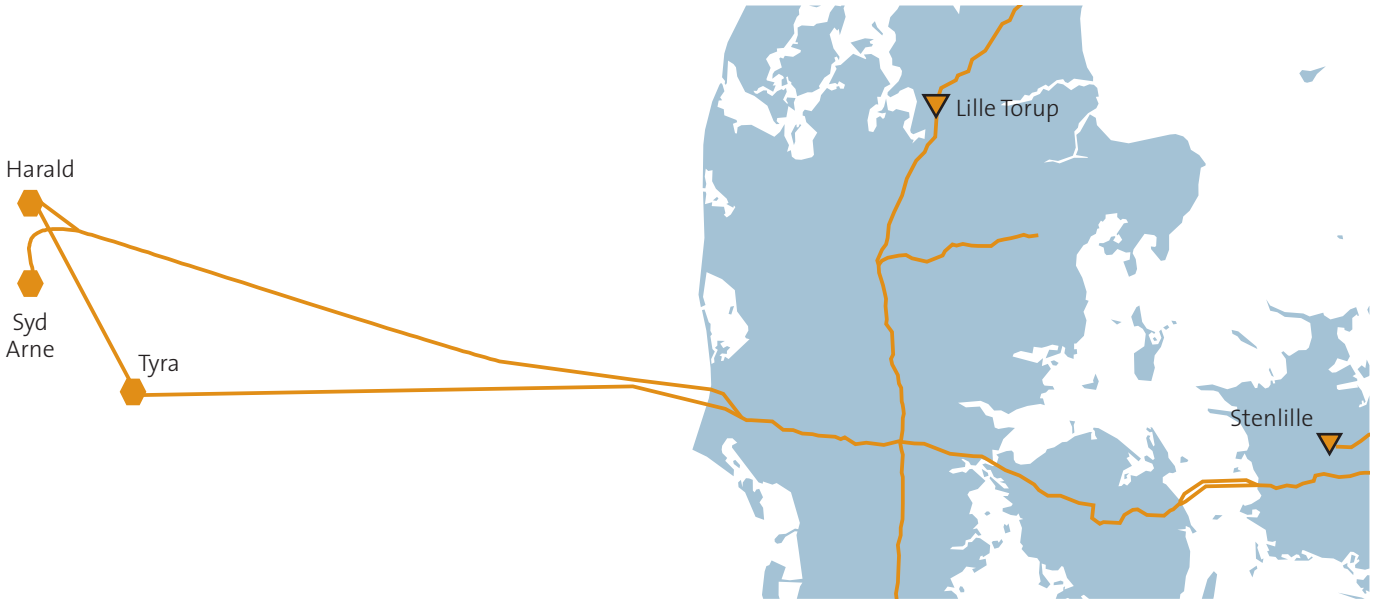


Figure 31: Illustration of the gas infrastructure between Tyra, Syd Arne and Harald platforms.

The use of balance settlement is a fundamental market measure and can be used in normal operation and at the three crisis levels.

6.5.7 Syd Arne offshore pipeline

Energinet.dk has entered into an agreement concerning supplies from the Tyra field via the Tyra-Harald pipeline and the Syd Arne-Nybro upstream pipeline.

Usually the gas is transported via the Tyra-Harald pipeline from the Harald field to the Tyra platform where it is processed before being taken onshore via the Tyra pipeline.

If supplies through the Tyra-Nybro pipeline fail, the gas from the Tyra field is instead taken onshore by the Tyra-Harald pipeline via the Syd Arne pipeline along with gas from the Syd Arne field – see Figure 31.

The Syd Arne agreement can be used in normal operation and at the three crisis levels, but only if there is reduced capacity in the Tyra-Nybro upstream pipeline.

6.5.8 Increased imbalance settlement

The shipper must be in balance within the gas day[26]. If the market players' incentive to keep the system in balance is insufficient in the balance settlement, the imbalance price can be increased.

26 A gas day lasts from 06:00 to 06:00 the next day.

Increased imbalance settlement can be used at the three crisis levels.

6.5.9 Commercially interruptible consumers

Commercial interruptibility (Hyper3) can only be used to restore balance in case of loss of pressure and a reduction in consumption may help to increase the pressure.

Commercially interruptible consumers in Denmark and Sweden have entered into an agreement allowing their consumption to be reduced or suspended with three hours' notice and for a period of 69 hours.

Energinet.dk used to offer a different product (Hyper72) for use in longer lasting crisis situations. The increase in northbound capacity at the Ellund border point has changed the need for commercial interruptibility. As a result, Energinet.dk has decided to discontinue the Hyper72 product.

The commercially interruptible consumers can be disconnected at the Alert and Emergency crisis levels.

6.5.10 Reduced capacity to Sweden

There may be crisis situations in which Energinet.dk is able to maintain supply to the protected consumers in Sweden, but not to all non-protected consumers in Sweden.

In this case, capacity to Sweden can be reduced in order to maintain supply to the Danish protected consumers. This reduces the risk that an Emergency will have to be declared for the Danish gas system as a whole.

Reduced capacity to Sweden is available at the Alert and Emergency crisis levels.

6.5.11 Emergency storage and emergency withdrawal

Energinet.dk needs volume, injection and withdrawal capacity in the gas storage facilities in order to manage Emergency situations, and this is why it reserves the necessary capacity in the storage facilities.

Emergency storage and emergency withdrawal can only be used at the Emergency crisis level.

6.5.12 Filling requirements

To guarantee the availability of gas in the storage facilities, some storage customers enter into a filling requirement agreement with Energinet.dk.

Energinet.dk pays the storage customers to keep gas in the storage facilities for a specified period (1 November - 1 April). This option is available to Energinet.dk in an Emergency. The storage customers will usually have filled most of their storage volume by the start of the gas year. It is only at the end of the storage season (March) when the filling requirements have a real impact on the way the storage customer can use their remaining storage volumes.

The filling requirements can only be activated at the Emergency crisis level.

6.5.13 Supply of non-protected consumers

In an Emergency, supplies to non-protected consumers are maintained as much as possible. If it is necessary to disconnected the non-protected consumers, 72 hours' notice is given. The following procedures are followed in respect of non-protected consumers:

- Every year Energinet.dk identifies the non-protected consumers on the basis of metered data from the distribution companies and town gas companies, and the cubic metre limit defined by the Danish Energy Agency.
- The distribution companies and town gas companies keep a physical backup available which can be activated if the non-protected consumers fail to cut the supply at Energinet.dk's request.

The non-protected consumers can only be partly disconnected on the basis of the pro-rata model. In the pro-rata model, for example, 30 percent of consumption for the non-protected Danish and Swedish consumers could be disconnected.

The current supply situation is analysed to determine whether non-protected consumers need to be disconnected to safeguard supplies for the protected consumers.

The gas consumption of the non-protected consumers is cut by the announced percentage, calculated using the company's historical consumption. If a non-protected consumer exceeds the announced maximum consumption, Energinet.dk is allowed to disconnected its gas supply.

The non-protected consumers can only be disconnected, whether fully or partly, at the Emergency crisis level.

6.6 Assessment of security of gas supply

In this security of supply report, Energinet.dk finds that the Danish gas transmission system is robust with regard to high gas demand or supply chain failures. The sources of supply from the North Sea, Germany and the gas storage facilities are also considered to be ample.

In other words the security of supply model indicates that in almost all circumstances it will be possible to avoid declaring an Emergency potentially involving the full or partial disconnection of non-protected consumers. This is because the market mechanisms are expected to regulate the demand or the supplies by means of the gas price so there is no need for additional arrangements to deal with the situation.

In most circumstances, an Emergency is declared after a period at the Alert level during which the market mechanisms are expected to have aligned the market with the available sources of supply. In an Emergency, supply to the non-protected consumers will be maintained unless it is deemed necessary to disconnect them fully or partly in order to safeguard the supply to protected consumers. If it is necessary to disconnected the non-protected consumers, 72 hours' notice will be given.

Closer links to Europe means that to an extent, the European supply situation influences the Danish supply situation. European security of supply is strong thanks to falling gas demand combined with an increasing gas supply, and for this reason closer links to Germany play an important part in creating a more robust Danish system.

7 Emergency preparedness and drills

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

- Create risk and vulnerability analyses
- Create contingency plans
- Perform contingency drills

Emergency preparedness relates to all types of crisis situations, both in peacetime and war, caused by natural, man-made and technological threats, including terrorism.

In the field of energy, the purpose of emergency preparedness is to ensure that the most important parts of society's energy supply are maintained and continued in crisis situations. Emergency preparedness is different from security of supply in that it primarily concerns potential crisis situations rather than normal operation.

In the gas sector, emergency preparedness also concerns the safety of the surroundings, so it is not just focused on maintaining security of supply. Natural gas is flammable, so it is important for the contingency arrangements to work preventively and to react quickly to contain accidents.

Emergency preparedness 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.

Under the Danish Natural Gas Supply Act, Energinet.dk is the concession holder and as such it is responsible for making reasonable contingency arrangements. This means that Energinet.dk must create risk and vulnerability analyses and contingency plans, and must perform drills.

Emergency preparedness are very much about prevention. Prevention makes it possible to minimise or completely avoid incidents which could threaten security of supply or otherwise harm society. Effective contingency planning allows the consequences to be reduced and damage to be limited. It also ensures there is a breathing space in which to re-establish a normal state as quickly as possible.

Contingency situations are therefore rare, but can have major impacts on society unless there is a quick and effective response to prevent supply failure and/or rapid restoration of supply following an outage. Contingency situations also require cooperation with organisation outside the gas supply sector – such as the police, fire department and emergency response services.

Emergency preparedness planning

It is vitally important in a crisis situation that each employee is familiar with the contingency plans and knows how to execute them in practice. For this reason drills must be carried out. The drills provide practical experience of cooperation with local partners, suppliers, the police etc.

Energinet.dk carries out drills several times a year, focusing on different scenarios and instructions. Energinet.dk also practices cooperation with other Danish emergency response services, such as the police, fire department and the Danish Home Guard.

Energinet.dk is one of the largest companies in the gas sector, and several of its installations are approved under the executive orders concerning risk[27]. We therefore carry out several major drills every year including the crisis personnel drill. Energinet.dk also participates in other national and international drills.

Drill in 2014 – Critical supply situation and class 3 alarms
A major gas drill in 2014 was centred around a highly critical supply situation involving a European crisis, the loss of North Sea gas production and the failure of the Stenlille gas storage facility. The aim was to force the players participating in the drill to use the crisis levels defined in the EU Regulation.

The drill was also designed to provide practical experience for the technical staff, so it included a class 3 alarm at a station in Southern Jutland and the outage of the Egtved compressor station. There was also an injury and some press involvement that had to be handled.

The drill went as planned and the challenges facing the people taking part were relevant and instructive. One of the findings was that there should be greater clarity about who is responsible for handling electricity supply problems to the compressor station during operation. During the drill, issues were handled effectively and professionally.

27 Executive Order of the Danish Ministry of the Environment no. 1666 of 14 December 2006 and Executive Order of the Danish Working Environment Authority no. 20 of 12 January 2006.

7.1 Risk and vulnerability analyses

A number of risk analyses and risk and vulnerability analyses are performed as a basis for contingency planning. These are over and above the risk assessments focusing on the supply as described in section 6.2. The purpose of these analyses is to uncover possible risks and vulnerabilities with a view to improving the robustness of the system, either by preventing the risks identified or by improving the way the organisation deals with risks if they occur.

Risk analyses are subject to various legal requirements. For example, risk analyses must be repeated if significant changes are made to the installations covered by the executive orders concerning risk. For Energinet.dk's gas supply activities and the gas sector in general, risk and vulnerability analyses must also be carried out in accordance with the executive orders concerning contingency planning. Energinet.dk coordinates all these analyses as much as possible in order to obtain maximum synergies.

8 Appendix 1:
Station capacities connected to NGF Nature Energy Distribution

Station capacities are stated in the table on the next page, which also lists the presumed offtakes during the peak day and average peak hour. It should be pointed out that the station capacities shown are based on the inlet and outlet pressures stated in the table.

The table includes examples of where the measured peak hour exceeds station capacity. This is because the station inlet pressure is calculated conservatively at a temperature of -13°C whereas the inlet pressure during the measured peak hour is higher. Hence station capacity during the measured peak hour is corre-spondingly higher than indicated in the table.

Utilisation of the meter and regulator stations in 2013 and 2014

The maximum capacity utilisation for each meter and regulator station during the winters 2012/2013 and 2013/2014 is shown in the table on the right, which contains the results for both peak day volume and max-imum flow of gas in one hour. The date and the hour of maximum flow need not coincide.

	Period 01-05-2014 - 30-04-2015		Period 01-05-2013 - 30-04-2014	
	Daily volume	Max hour	Daily volume	Max hour
	Nm^3/day	Nm^3/hour	Nm^3/day	Nm^3/hour
551 - Middelfart	58,109	4,383	100,930	4,835
553 - Billesbølle	47,050	5,881	80,069	4,864
554 - Koelbjerg	414,672	28,780	364,606	24,545
557 - Højby	190,535	20,015	426,750	24,623
559 - Ullerslev	62,683	4,548	92,570	4,747
560 - Nyborg	40,966	2,299	42,417	2,139

The table shows the registered peak day and peak hour offtake at individual meter and regulator stations in the periods 1 May 2013 to 30 April 2014 and 1 May 2014 to 30 April 2015.

Capacities at given inlet and outlet pressures	Expected offtake during a peak day (-13° C)	Expected offtake during an average peak hour (-13° C)	Calculated inlet pressure	Agreed set point	M/R-station calculated capacity (-13° C)	Expected capacity requirements of distribution companies	Measured peak hour 01-05-2014 - 04-30-2015
	Nm³/day	Nm³/hour	Barg	Barg	Nm³/hour	Nm³/hour	Nm³/hour
551 - Middelfart	85,828	4,492	67.1	17.1	10,209	6,000	4,383
553 - Billesbølle	86,545	4,000	66.2	17.1	10,073	6,500	5,881
554 - Koelbjerg	433,599	19,738	65.9	17.1	41,532	35,000	28,780
557 - Højby	432,817	22,890	64.7	17.1	114,850	25,000	20,015
559 - Ullerslev	80,290	3,735	64.2	17.1	8,510	7,500	4,548
560 - Nyborg	42,553	1,879	63.9	17.1	9,731	4,000	2,299
551 - Middelfart	85,828	4,492	67.1	17.1	10,209	6,000	4,383

9 Appendix 2:
Station capacities connected to DONG Gas Distribution

Station capacities are stated in the table on the next page, which also lists the presumed offtakes during the peak day and average peak hour. It should be pointed out that the station capacities shown are based on the inlet and outlet pressures stated in the table.

The table includes examples of where the measured peak hour exceeds station capacity. This is because the station inlet pressure is calculated conservatively at a temperature of -13°C whereas the inlet pressure during the measured peak hour is higher. Hence station capacity during the measured peak hour is correspondingly higher than indicated in the table.

Utilisation of the meter and regulator stations in 2013 and 2014

The maximum capacity utilisation for each meter and regulator station during the winters 2012/2013 and 2013/2014 is shown in the table on the right, which contains the results for both peak day volume and maximum flow of gas in one hour. The date and the hour of maximum flow need not coincide.

The table shows the registered peak day and peak hour offtake at individual meter and regulator stations in the periods 1 May 2013 to 30 April 2014 and 1 May 2014 to 30 April 2015.

	Period 01-05-2014 - 30-04-2015		Period 01-05-2013 - 30-04-2014	
		Max hour	Daily volume	Max hour
	Nm³/day	Nm³/hour	Nm³/day	Nm³/hour
646 Amagerfælled	87,046	5,139	72,855	5,098
653 Slagelse	222,224	11,600	266,168	13,116
658 Sorø	418,151	24,777	507,829	24,205
661 Ringsted	424,308	25,148	531,264	27,416
691 Stenlille MR	21,568	6,880	29,893	8,927
451 Frøslev	391,885	26,045	352,784	30,208
452 Nybro	33,645	2,394	39,766	2,588
453 Terkelsbøl	111,171	11,651	238,336	13,344
457 Ll. Selskær	259,152	17,824	347,920	22,664
458 Pottehuse	84,220	6,926	189,758	17,168
459 St. Andst	258,200	16,384	277,440	16,488
460 Egtved	804,656	45,688	862,090	43,808
462 Varde	96,288	11,698	120,110	7,708
468 Taulov	204,176	9,267	147,733	6,555
481 Nørskov	165,929	13,616	220,747	13,267
496 Lilballe	29,524	2,083	46,582	2,174

Capacities at given inlet and outlet pressures	Expected offtake during a peak day (-13° C)	Expected offtake during an average peak hour (-13° C)	Calcula-ted inlet pressure	Agreed set point	M/R-station calculated capacity (-13° C)	Expected capacity requirements of distribution companies	Measured peak hour 01-05-2014 - 04-30-2015
	Nm³/day	Nm³/hour	Barg	Barg	Nm³/hour	Nm³/hour	Nm³/hour
646 Amagerfælled	53,664	3,578	59.5	16.6	7,415	5,300	5,139
653 Slagelse	963,347	44,229	69.0	35.4	70,475	63,500	45,688
658 Sorø	412,513	19,810	60.0	35.4	39,485	29,600	26,045
661 Ringsted	42,496	1,795	67.9	3.6	9,011	2,500	2,083
691 Stenlille MR	400,778	19,741	60.0	35.4	39,485	26,800	17,824
451 Frøslev	42,800	2,334	69.9	17.1	4,156	2,900	2,394
452 Nybro	222,791	10,244	64.1	35.4	24,254	16,500	13,616
453 Terkelsbøl	236,894	12,361	60.0	35.4	29,266	12,300	6,926
457 Ll. Selskær	557,149	25,858	62.1	25.0	35,138	33,000	25,148
458 Pottehuse	265,609	12,400	63.3	16.7	28,002	17,500	11,600
459 St. Andst	534,440	23,269	62.7	17.7	105,296	38,200	31,657
460 Egtved	353,733	18,451	60.0	35.4	39,488	20,500	16,384
462 Varde	74,340	3,774	67.4	35.4	34,051	17,000	9,267
468 Taulov	291,654	13,611	60.0	35.4	39,485	20,300	11,651
481 Nørskov	127,100	6,422	69.7	35.4	39,698	10,800	11,698
496 Lilballe	53,664	3,578	59.5	16.6	7,415	5,300	5,139

The table shows the expected offtake, calculated inlet and outlet pressure and capacities for meter and regulator stations in the transmission system in normal supply situations at a daily mean temperature of -13°C. The distribution companies' expected capacity requirements are also specified.

10 Appendix 3: Station capacities connected to HMN Naturgas

Station capacities are stated in the table on the next page, which also lists the presumed offtakes during the peak day and average peak hour. It should be pointed out that the station capacities shown are based on the inlet and outlet pressures stated in the table.

The table includes examples of where the measured peak hour exceeds station capacity. This is because the station inlet pressure is calculated conservatively at a temperature of -13°C whereas the inlet pressure during the measured peak hour is higher. Hence station capacity during the measured peak hour is correspondingly higher than indicated in the table.

Utilisation of the meter and regulator stations in 2013 and 2014

The maximum capacity utilisation for each meter and regulator station during the winters 2012/2013 and 2013/2014 is shown in the table on the right, which contains the results for both peak day volume and maximum flow of gas in one hour. The date and the hour of maximum flow need not coincide.

The table shows the registered peak day and peak hour offtake at individual meter and regulator stations in the periods 1 May 2013 to 30 April 2014 and 1 May 2014 to 30 April 2015.

	Period 01-05-2014 - 30-04-2015		Period 01-05-2013 - 30-04-2014	
	Daily volume	Max hour	Daily volume	Max hour
	Nm³/day	Nm³/hour	Nm³/day	Nm³/hour
663 - Køge	458,128	27,408	459,360	24,648
664 - Karlslunde	271,944	19,104	384,792	19,768
665 - Torslunde	223,352	12,280	200,952	10,424
667 - Vallensbæk	435,514	21,568	368,944	17,856
668 - Brøndby	1,310,144	62,112	1,415,728	66,736
672 - Dragør	150,452	8,800	192,756	9,416
682 - Lynge	1,171,888	73,100	1,304,192	67,868
684 - Måløv	1,157,120	52,448	1,376,032	62,720
464 - Viborg	996,768	57,696	1,080,864	73,184
473 - Haverslev	351,179	17,094	380,208	18,256
474 - Ellidshøj	163,180	8,640	164,716	8,812
476 - Aalborg	1,601,248	80,032	1,028,576	68,928
482 - Brande	98,496	4,779	94,676	4,933
483 - Herning	1,145,920	84,608	1,386,496	85,632
484 - Karup	213,392	12,472	217,276	12,920
486 - Ll. Torup MR	53,895	3,328	57,290	3,217

Capacities at given inlet and outlet pressures	Expected offtake during a peak day (-13° C)	Expected offtake during an average peak hour (-13° C)	Calcula-ted inlet pressure	Agreed set point	M/R-station calculated capacity (-13° C)	Expected capacity requirements of distribution companies	Measured peak hour 01-05-2014 - 04-30-2015
	Nm³/day	Nm³/hour	Barg	Barg	Nm³/hour	Nm³/hour	Nm³/hour
Hovedstaden	6,203,136						
Køge	499,638	21,986	61.6	17.9	39,625	40,000	27,408
Karlslunde	467,757	22,437	61.4	17.9	95,016	30,000	19,104
Torslunde	255,880	10,685	61.2	17.9	29,458	20,000	12,280
Vallensbæk	470,321	20,125	60.6	17.9	29,951	25,000	21,568
Brøndby	1,493,474	63,743	60.4	31	141,197	90,000	62,112
Dragør	191,657	8,497	59.7	16.6	23,336	12,000	8,800
Lynge	1,478,427	69,904	59.1	32.7	144,676	90,000	73,100
Måløv	1,345,981	56,792	59.4	17.9	85,546	70,000	52,448
Midt - Nord	5,283,318						
Viborg	1,320,268	61,358	68.7	35.4	106,327	100,000	57,696
Haverslev	301,432	16,432	69.8	35.4	19,252	34,000	17,094
Ellidshøj	188,541	8,615	67.0	35.4	13,623	12,000	8,640
Aalborg	1,375,778	65,986	67.6	40	156,597	90,000	80,032
Brande	92,660	5,043	64.7	35.4	13,502	6,000	4,779
Herning	1,684,950	78,692	65.4	47.4	149,626	120,000	84,608
Karup	261,072	12,158	67.1	35.4	21,250	18,000	12,472
Ll. Torup MR	58,617	2,661	71.9	35.4	11,447	5,000	3,328

The table shows the expected offtake, calculated inlet and outlet pressure and capacities for meter and regulator stations in the transmission system in normal supply situations at a daily mean temperature of -13°C. The distribution companies' expected capacity requirements are also specified.

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