



ENERGINET



FUTURE ROLE OF THE GAS SYSTEM

FUTURE ROLE OF GAS SYSTEM TO BE DETERMINED THROUGH DIALOGUE

Like the electricity system, the gas system has huge energy capacity. The gas system's two storage facilities can store energy equivalent to about one third of Denmark's annual gas consumption, while the North Sea pipeline can transport energy corresponding to Denmark's total electricity, gas and oil consumption.

So when Danish production in the North Sea peaked in around 2005 at more than twice the current level, it was not the Danish system, but rather the German system, which had difficulty absorbing these large quantities.

The two subterranean storage facilities are strategically located in north Jutland and Zealand. There is only one supply line running to north Jutland, which supplies all distribution grids north of Egtved. The storage facility in north Jutland is a 'cavern' facility with seven caverns in a salt dome deep underground. The advantage of the salt caverns is that gas can be quickly added and withdrawn. In the future, when more biogas and hydrogen are integrated into the natural gas system, different caverns could also potentially store different gases. The storage facility in Stenlille in mid-Zealand is located in a classic aquifer and is thus a single large storage area. Like north Jutland, Zealand has only one supply line, and the storage facility is therefore critical not only for normal supply purposes, but also to have sufficient capacity to meet consumption in Denmark and Sweden on a cold winter's day.

While the electricity grid has to balance every 20 milli-seconds, in principle, the gas system only has to balance for every 24-hour period. This is because gas is moved and compressed via pressure, and the gas system and gas storage facilities simply require sufficient gas to move it to where it needs to be used. In relation to the more fluctuating future for production, consumption and energy exchange, the gas system is thus a stabilising factor.

However, with declining consumption onshore and falling production

offshore, transport capacity is not being fully utilised today and this trend is continuing.

The gas system is thus a powerful energy source, and it is worth retaining it and seeking to maximise its utilisation in a future with greatly fluctuating electricity generation. In the coming years, the gas system must transform to new usage patterns and ensure that it remains sustainable in terms of technology and economics, so it can contribute to the green transition. As an integrator of wind and solar

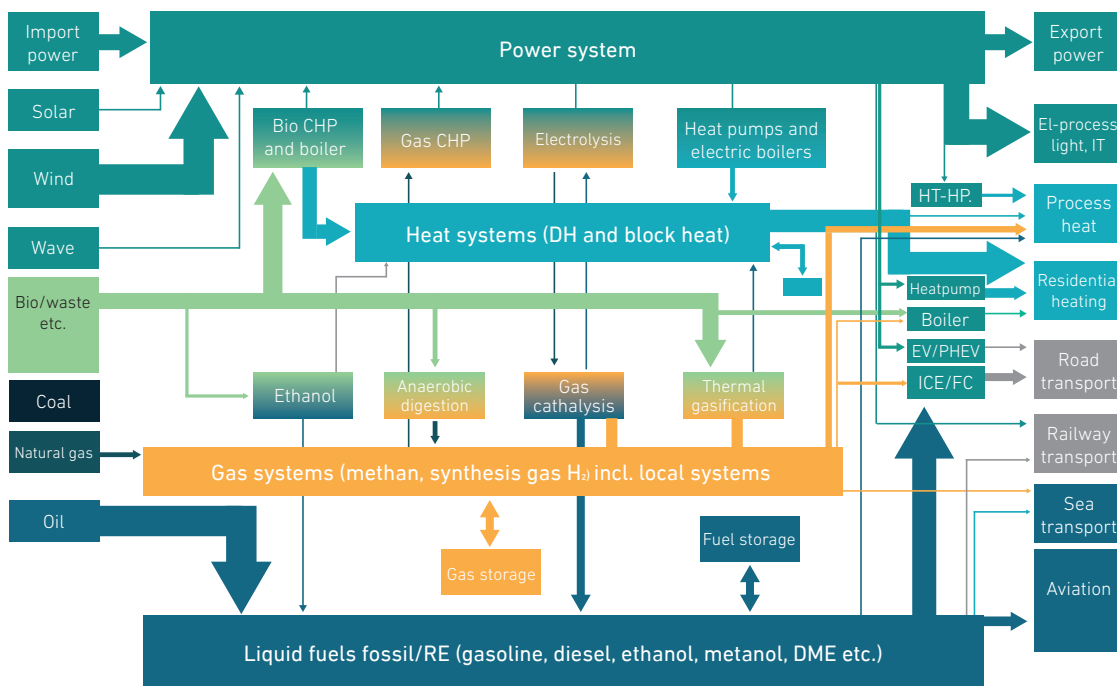
"But even with a further reduction in utilisation of the gas system in 2035, it can still save the nation DKK 2-3 billion annually compared to a situation where the natural gas grid has not been retained"

power as well as a supply of fuel for the industry and transport sector, the value of the gas system is very high. In the shorter term, the gas system can reduce CO₂ and NO_x emissions from the transport sector, particularly within heavy transport and shipping.

The gas system faces challenges

Even though political energy agreements have led to a considerable amount of biogas being upgraded and injected into the gas system in recent years, most of the gas in the system is still fossil natural gas. Biogas currently meets approx. 2.5% of energy consumption. While there is still considerable

FIGURE 1: 2035 SANKEY DIAGRAM FOR GAS OPTIONS



untapped biogas potential in Denmark, this potential is still too small to meet all the gas consumption, now or in 2035. Gas therefore still faces transition challenges, now and in the future, whereby other renewable gases based on gasification and electrolysis or imported RE gas must be exploited in order to match consumption.

In addition to declining consumption and hence utilisation, the gas system also faces other challenges. DUC's large Maersk Oil operated North Sea production and infrastructure hub – Tyra – could close as early as in 2018. Tyra and the linked North Sea fields have provided more than 90% of Denmark and Sweden's gas consumption to date. Tyra and the future of the Danish North Sea production is thus a factor that will have a major impact on the gas system. It was the prognosis for North Sea production that led Energinet.dk to initiate an 'open season' process in 2009, involving market players and the EU to finance an alternative expansion towards Germany, so that the gas supply remains secure, even without North Sea gas. The system was extended in Denmark in 2013 and Germany in 2015, so that Denmark and Sweden (which is almost totally

dependent on the Danish supply) can be supplied from Germany with optimal utilisation of the storage facilities. However, since the EU security of supply regulation stipulates that two sources of supply are required, there are still challenges to be addressed.

The cessation of North Sea exports to Germany also represents an economic challenge to the system. Since 2009, gas has essentially cost the same in Denmark as in the other markets in north-west Europe. But if congestion arises, the Danish-Swedish market prices can easily become higher and more volatile. Depending on whether Tyra is overhauled and returns to full production again, gas faces challenges in relation to the EU security of supply requirements, economics and gas prices.



Gas filling station in Skive, Jutland. Photo: HMN Naturgas

The challenges facing gas are not just seen in Denmark, but throughout Europe. For example, Norway is experiencing declining consumption on the increasingly well connected and diversified western European markets, of which Norway is connected to the UK, France, Belgium and Germany.

The Norwegians are thus facing a demand challenge. This has led Statoil, for example, to phase out oil-indexed contracts and accept the current exchange price for gas in north-west Europe. The opposite situation applies in countries like Poland, Latvia and Finland, where the supply is largely dependent on major long-term oil-indexed agreements with Russia. Giving coal priority over gas in the Polish energy mix therefore continues to seem reasonable, as long as there is no genuine diversity in the gas supply. Lithuania and Poland have therefore established LNG (Liquefied Natural Gas) import facilities for liquid gas cooled to -162°C . This is very costly

“As transmission system operator for gas, Energinet.dk therefore needs to be in dialogue with – and have demand from – both existing and potential users in order to identify the needs and optimally develop the Danish gas system”

compared to piped natural gas. Yet despite the cost level, LNG has already led to overnight gas price savings of 30% in Lithuania, and Lithuanians can hope for further savings in the coming years when the global LNG market could potentially be flooded with cheap LNG from Australia, Africa and USA. LNG is attractive compared to the current alternative, but seems less sustainable within a broader

context, given that these countries lie on a potential supply route between Europe's two largest suppliers of piped natural gas – and possibly renewable gases based on the huge wind and natural resources in the region in the longer term.

Demand, diversity of supply and conversion from fossil to RE gas are therefore also European challenges.

Challenges handled through dialogue

Wind power and electrification is a form of energy and a system which Denmark is basing its energy future on. The gas system, in contrast, has only just begun its transition, and this transition is still uncertain. Natural gas has only just over 400,000 consumer customers in Denmark. Even though a number of these consumption sites supply multiple district heating customers, gas does not have as many consumers as the electricity supply. The transition from fossil gas to

FIGURE 2. A FORUM FOR EACH LINK OF THE VALUE CHAIN



renewable gas, and the future applications of the gas system in general, are also more uncertain.

As transmission system operator for gas, Energinet.dk therefore needs to be in dialogue with – and have demand from – both existing and potential users in order to identify the needs and optimally develop the Danish gas system.

Shippers' Forum

The negotiation language used says a lot about developments in gas. Shippers' Forum arose in 2002 when the Danish gas market was to be deregulated. Initially, the dialogue could be handled in Danish, as the primary issues related to Danish consumers' metered data, distribution and gas suppliers. The practical issues to do with metering, reconciliation, allocation, consumer changes etc. were quickly resolved with the distribution companies, gas suppliers and other players. The main challenge then became

to ensure outside competition and hence an independent north-west European gas price and supply. This required a change to English as the negotiation language, in order to build bridges between players in Denmark, Sweden, Germany and the rest of north-west Europe.

Shippers' Forum has solved the biggest challenges in gas trading by now, and the daily price of gas in Denmark correlates with the prices in the other north-west European gas markets. However, with the challenges related to the possible closure of Tyra in 2018, Shippers' Forum and Energinet.dk will face the major new challenge of securing supply and ensuring market prices remain correlated. Dialogue on how to handle Tyra began before summer 2016. And the solutions? They are now being worked out through dialogue.

One of the major topics in the ongoing dialogue will be how to ensure that the market and Energinet.dk fill the storage facilities sufficiently to ensure that Danish-German congestion does not lead to unnecessarily high Danish-Swedish gas prices or supply crises. The dialogue is therefore primarily about how the market needs can be unified, and how the market can meet these needs. Without such dialogue, there is a risk that the best market-based solutions will not be realised.

Bilateral forums

In addition to Shippers' Forum, dialogue with neighbouring TSOs in Sweden and Germany is also important – in relation to expansion, security of supply plans and the daily allocation of gas to players. It is important that these plans are

coordinated, for example to ensure Sweden's gas needs are also met in an emergency situation and that the Danish expansion toward Ellund is matched on the German side. Bilateral dialogue with neighbours several times a year is thus also important. For example, Swedegas, the Swedish TSO, expects slightly increasing Swedish gas consumption and more Swedish RE gas. This may mean less need for Danish natural gas, but a greater need to exploit the Danish gas storage facilities.

ENTSOG, GIE and EU

As a small open economy – including in relation to gas – Denmark is highly dependent on the exchange of gas with other countries and the creation of efficient markets and systems for gas. Energinet.dk has therefore invested heavily in the ENTSOG and GIE (Gas Infrastructure Europe) collaboration forums. GIE facilitates cooperation and partnership among all of Europe's gas transmission, gas storage facility and LNG infrastructure operators.

As one of the EU's smallest transmission companies, Energinet.dk cannot make all the decisions, but through active participation in selected working groups and boards and secondment of employees to the EU, IT departments and executive positions, Energinet.dk has nonetheless made much progress, through modest means, in relation to common gas issues Energinet.dk, Denmark and Europe

face. Perhaps the best example is in relation to renewable gases, where a conservative gas industry and many players with coal interests etc. have not been conducive factors. Yet Energinet.dk successfully managed to establish cooperation on things like the promotion of green gas, experience sharing and green gas certificates. Some of these things were initially impossible in the large organisations, but through small initiatives with like-minded people and perseverance, we are now almost there. As a small player in a large industry, you can certainly make a bigger impact by joining forces, and you can learn from the other players.

In addition to the conversion from fossil fuels to green gas, the EU's biggest challenge is diversity of supply in Central and Eastern Europe. Polish Gaz System and Energinet.dk are working together right now, with support from the EU, to realise a possible connection from Norway to Poland via Denmark. Successfully creating a healthy



business case for the expansion will require extensive cooperation with numerous stakeholders in Norway, Denmark, Poland, Eastern Europe and the EU. So Energinet.dk is also making a focused effort in this area at present.

Green Gas Forum

Green Gas Forum is a forum where stakeholders in the green transition meet to discuss how to promote the production and expansion of green gas. Biogas declarations are currently an important issue, in order to increase

“As a small open economy - also in the gas sector - Denmark is strongly dependent on gas exchange with other countries and the creation of efficient markets and systems for gas”

the value of biogas for producers. Biogas marketing and more extensive use in local transport are expected to provide a basis for increased production and consumption.

Offshore Forum focuses on optimising North Sea operations

Within Offshore Forum, producers in the North Sea, Energinet.dk and other stakeholders have discussed how to optimise the value chain for gas and oil from 'sea to shore' in 2014 and 2015. Examples of the issues discussed include whether it is possible to save on gas treatment, whether pressure and energy consumption can be reduced and whether it would be beneficial to install offshore electricity cables to the producers, as has been done in Norway and the Middle East.

The challenges are many, and some of the development options may be included as recommendations in the new North Sea Strategy report from the sector and the Danish Ministry of

Energy, Utilities and Climate in 2016. Players and stakeholders will have the opportunity to discuss how realisation of these recommendations can be supported. This will take place on an Offshore Forum scheduled for 2017.

ENERGINET

Tonne Kjærvej 65
7000 Fredericia
Tlf. +45 70 10 22 44

info@energinet.dk
www.energinet.dk

