DATA SHEET FOR GAS QUALITY IN THE TYRA REDE-VELOPEMENT PERIOD WITH THE INTRODUCTION OF BALTIC PIPE

ENERGINET

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The gas composition, and thus the gas quality, in Denmark depends on the origin, i.e., the supply source, and the corresponding quantity of gas which is fed into the transmission grid at any given time. Here follows an overview of the gas quality of the current primary supply sources along with a prognosis on the coming gas quality in the Danish grid.

Current status of gas supply

The status of gas supply in the Danish gas transmission grid is currently dominated by the redevelopment of the Tyra-complex and commissioning of Baltic Pipe.

The ongoing redevelopment of the Tyra-complex – a period spanning 4 years starting September 2019 – has significantly reduced the supply of gas from the Danish North Sea. As a consequence, the Danish and Swedish gas market will be supplied from other sources in the redevelopment period compared to previously.

The Baltic Pipe connection was commissioned in the fall of 2022 and now connects Europipe II[1] to Poland through Denmark. Thus, a significant amount of Norwegian gas has been fed into the Danish grid which is now – to a larger extent than prior – to be considered as a transit grid in addition of just supplying Danish and Swedish consumers. In practice, this means that both Danish and Swedish consumers have and will be experiencing a gas supply dominated by the larger quantities of Norwegian gas under certain supply conditions. In other cases, the gas will be a mixture from the supply sources which have thus far supplied the Danish and Swedish markets, i.e., gas from Germany, Danish North Sea gas and biomethane. Thus, variations in gas quality will be apparent compared to previous years and whenever the supply conditions and sources vary.

During the period until the redevelopment of the Tyra-complex have been finalized, the gas introduced into the Danish grid originates from five different supply sources:

1. Norwegian gas from Baltic Pipe
2. Imported gas from Germany
3. Biomethane
4. Gas from Danish gas storage facilities (Lille Torup and Stenlille)
5. North Sea gas from Syd Arne

The primary source of gas is expected to be Norwegian gas from Baltic Pipe as well as imports from Germany via Ellund.

[1] Pipeline from Norway to Germany operated by Gassco.

The Norwegian gas is produced in Norway and then transported from the process facility in Kårstø through Europipe II onto which the Danish gas grid is connected. Due to the consistent processing method in Norway the gas quality is expected to be very stable.

The imported German gas consist of a mix of locally produced gas and other H-gas which is presumed to be of Dutch or Norwegian origin. Thus, the quality of the mixed gas from Germany will show greater variations due to the variations in underlying supply sources.

Biogas produced in Denmark is fed into the grid in an upgraded form as biomethane. Biomethane is expected to contribute to an improved supply situation in the Danish and Swedish gas market during the period of redevelopment of the Tyra-complex. Currently, biomethane in the gas grid represents around 30% of the Danish gas consumption and the share is expected to increase in the future. The combustion of biomethane is technically similar to that of natural gas.

The Danish gas storage facilities have a capacity equal to approximately one third of the yearly consumption of the Danish and Swedish gas market. As gas is primarily stored during the summer, the gas supply from the gas storage facilities during the winter of 2022-2023 will thus mainly consist of gas imported from Germany.

Gas quality in the Danish transmission grid

The legal basis for gas consumption in Denmark is stipulated in requirements for the gas quality made by "Bekendtgørelse om Gaskvalitet." Additionally, "Terms and conditions for Gas Transport" sets specifications for transportation of gas. Gas transported in the transmission grid of Energinet will always comply with the legal limits. The respective technical combustion requirements are listed in **table 1**.

	Lower limit	Upper limit
Wobbe index [kWh/Nm^3][2]	14.1	15.5
Relative density [-]	0.555	0.700

Table 1: Legal requirements for gas quality

Changes of upper calorific value and Wobbe index for North Sea gas in the period of Tyra redevelopment are to be expected. This is due to the absence of gas from the Tyra-platform. The expected variations of upper calorific value and Wobbe index for the five main gas supply sources during this period are available in **table 2**.

	Upper calorific value [kWh/Nm^3]	Wobbe index [kWh/Nm^3]
Imported gas from Germany	11.1-11.6	14.4-15.0
Biomethane	10.8-11.3	14.4-14.9
Gas from Danish gas storages	11.7-12.4	14.8-15.3
North Sea gas	11.8-12.7	14.3-15.3
Norwegian gas (after Oct. 2022)	11.2-11.4	14.4-14.6

Table 2: Expected upper calorific value and Wobbe index for different supply sources

[2] A special preparedness plan for Ellund Border has been approved by the Danish Safety Technology Authority allowing gas with Wobbe index between 50,04 MJ/Nm^3 to 55,8 MJ/Nm^3 (13,9-14,1 kWh/Nm^3) to be imported

The variation in gas quality as it appears in **table 2** is due to the variety of the gas composition across the different supply sources. **Table 3** shows examples of gas composition and corresponding gas quality of gas from specific supply sources during the redevelopment of Tyra, i.e., the example of gas from the North Sea after 2019 is thus dominated by the gas quality of the gas from the Syd Arne-complex.

		Example of expected gas quality of German gas at import	Example of expected gas quality for North Sea after 2019	Example of biomethane quality in transmission	Example of Norwegian gas
Methane	mole - %	89.85	85.67	98.30	90.1
Ethane	mole - %	5.01	7.87	0	6.4
Propane	mole - %	1.01	3.61	0	0.4
I-butane	mole - %	0.10	0.26	0	0.028
N-butane	mole - %	0.12	0.73	0	0.035
I-pentane	mole - %	0.021	0.087	0	0.003
N-pentane	mole - %	0.017	0.0976	0	0.002
Hexane+	mole - %	0.016	0.0370	0	0.001
Nitrogen	mole - %	2.53	0.3909	0.33	0.79
Oxygen	mole - %	0	0	0.21	0
Carbon dioxide	mole - %	1.33	1.30	0.33	2.2
Gross calorific value	kWh/Nm³	11.30	11.98	10.87	11.36
Gross calorific value	MJ/Nm³	40.67	44.86	39.15	40.88
Wobbe index	kWh/Nm³	14.38	15.31	14.52	14.47
Wobbe index	MJ/Nm³	51.78	55.13	52.29	52.09
Relative density	-	0.617	0.662	0.556	0.6157
Normal density	kg/Nm³	0.798	0.856	0.718	0.7961

Table 3: Expected gas compositions and qualities for imported gas from Germany and Norway, North Sea gas and biomethane.

Changes in gas quality in the Danish gas grid is thus expected to occur in the redevelopment period due to varying supply sources. Historical data for gas qualities in the Danish gas grid are available at Energinets dataplatform Energi Data Service.

References

Terms and Conditions for Gas Transport (BfG) https://en.energinet.dk/Gas/Rules/
Bekendtgørelse om gaskvalitet can be found at Sikkerhedsstyrelsens (SIKs) website https://www.sik.dk/
Futher questions can directed at: gaskvalitet@energinet.dk
Energi data service website for historical data for the Danish gas grid https://www.energidataservice.dk/

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