

DATA SHEET FOR GAS QUALITY IN THE TYRA REDEVELOPEMENT PERIOD WITH BALTIC PIPE

The 4 years period of redevelopment of the Tyra-complex, starting September 2019, will reduce the supply of gas from the Danish North Sea significantly. This means that the Danish and Swedish gas market will be supplied from other sources in the redevelopment period compared to previously.

From the 1st of October 2022, the Baltic Pipe connection will be commissioned, connecting Europipe II¹ to Poland through Denmark. This enables a large flow of Norwegian gas through the Danish system. In practice, this will mean that both Danish and Swedish consumers can experience a gas supply of larger quantities of Norwegian gas under certain supply situation. In other cases, the gas will be a mixture from the supplies that currently supply the Danish and Swedish markets, i.e., gas from Germany, Danish North Sea gas and biomethane. This will at times create variations in the gas quality whenever the supplies change.

The change in gas supply to the Danish and Swedish gas markets can lead to a shift in gas quality. During the period, the gas can come from 5 supply sources:

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

The primary source of gas is expected to be Norwegian gas from Baltic Pipe as well as imports from Germany via Ellund. Gas from Germany will either be gas from Russia or German mixed gas. The Russian gas is chemically characterized by a lower mole-% content of propane, butanes and pentanes than the German mixed gas. This results in a lower gross calorific value.

The Norwegian gas is produced in Norway and is transported from the process facility I Kårstø through Europipe II, from which the Danish gas network is connected. Due to the processing method in Norway the gas quality can be expected to be very stable.

The mixed German gas consist of local produced gas, and other H-gas, which can be of Dutch or Norwegian origin. The gas quality of mixed German gas will have greater variations, due to the underlying supply sources.

During the redevelopment of Tyra, biomethane will contribute to a better supply situation in the Danish and Swedish gas market. Biomethane in the gas net represents around 20% of the Danish gas consumption. This share is expected to increase in the future. The combustion of biomethane is technically similar to that of natural gas.

¹ Pipeline from Norway to Germany operated by Gassco.

The Danish gas storage facilities have a capacity equally to approximately 25% of the yearly consumption in the Danish and Swedish gas market. This means, that for the coming winter periods 2021-2023, the supply from the storages will be mainly gas imported from Germany.

The legal basis for gas consumption in Denmark is stipulated in requirements for the gas quality made by "Bekendtgørelse om gaskvalitet". Also "Rules for Gas transport" sets specifications for transport of gas. Gas transported in Energinets transmission system will always stay within the legal limit. The technical combustion requirements can be seen in table [1]

	Min Value	Max Value
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 absences of gas from the Tyra-platform.

The expected variations of upper calorific value and Wobbe index for the period until 2023 can be seen 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 difference supply sources

Changed gas qualities are expected to occur in the redevelopment period. Furthermore, greater variations may be expected, due to 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/Nm³ to 55,8 MJ/Nm³ (13,9-14,1 kWh/Nm³) to be imported

Table [3] shows examples of supplies gas qualities, for the period of Tyra redevelopment.

		Example of expected gas quality of German gas at import	Example of expected gas quality of Russian 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	96.19	85.67	98.30	90.1
Ethane	mole - %	5.01	2.82	7.87	0	6.4
Propane	mole - %	1.01	0.15	3.61	0	0.4
I-butane	mole - %	0.10	0.048	0.26	0	0.028
N-butane	mole - %	0.12	0.032	0.73	0	0.035
I-pentane	mole - %	0.021	0.0074	0.087	0	0.003
N-pentane	mole - %	0.017	0.0047	0.0976	0	0.002
Hexane+	mole - %	0.016	0.0061	0.0370	0	0.001
Nitrogen	mole - %	2.53	0.34	0.3909	0.33	0.79
Oxygen	mole - %	0	0	0	0.21	0
Carbon dioxide	mole - %	1.33	0.40	1.30	0.33	2.2
Gross calorific value	kWh/Nm ³	11.30	11.27	11.98	10.87	11.36
Gross calorific value	MJ/Nm ³	40.67	40.57	44.86	39.15	40.88
Wobbe index	kWh/Nm ³	14.38	14.83	15.31	14.52	14.47
Wobbe index	MJ/Nm ³	51.78	53.40	55.13	52.29	52.09
Relative density	-	0.617	0.577	0.662	0.556	0.6157
Normal density	kg/Nm ³	0.798	0.746	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.

As can be seen from table [3], variations of gas quality may occur, due to different supplies. Data for the gas qualities can be found via [Energidataservice.dk](https://energidataservice.dk).

References

Regler for Gastransport (RFG) <https://en.energinet.dk/Gas/Rules>

Bekendtgørelse om gaskvalitet Can be found at Sikkerhedsstyrelsens (SIKs) website <http://www.sik.dk/>

Further questions can be asked at: gaskvalitet@energinet.dk

Energi data service Data for gas can be found via Energi data service website <https://www.energidataservice.dk/>