New gas supply routes to Germany – Impact on gas quality

ENTSOG Gas Quality and Hydrogen handling workshop
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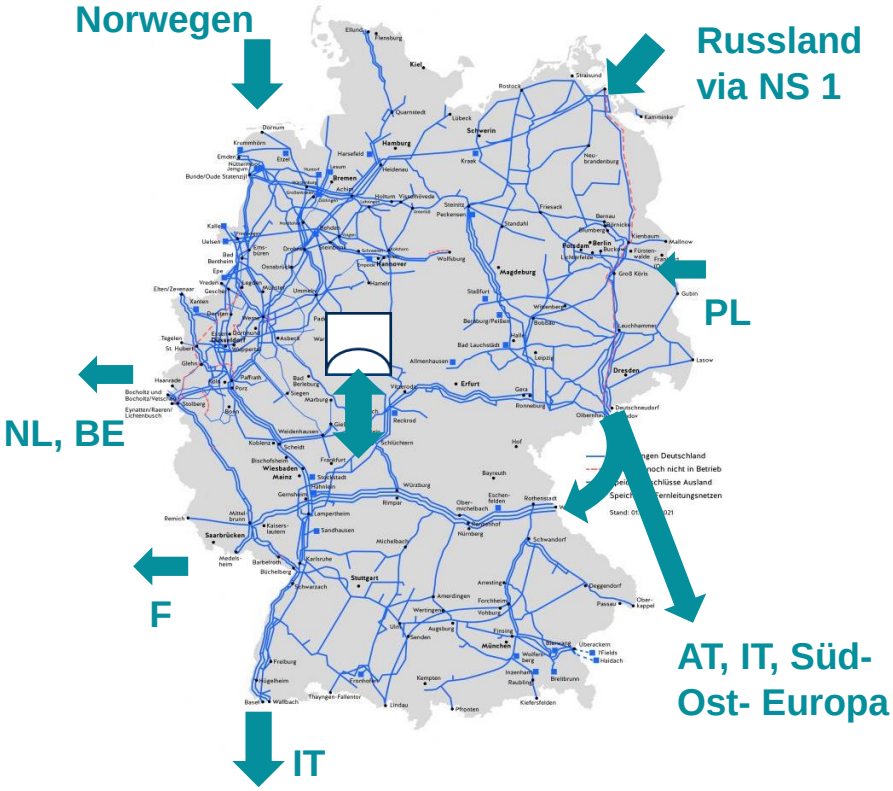
Transport in DE (2021)



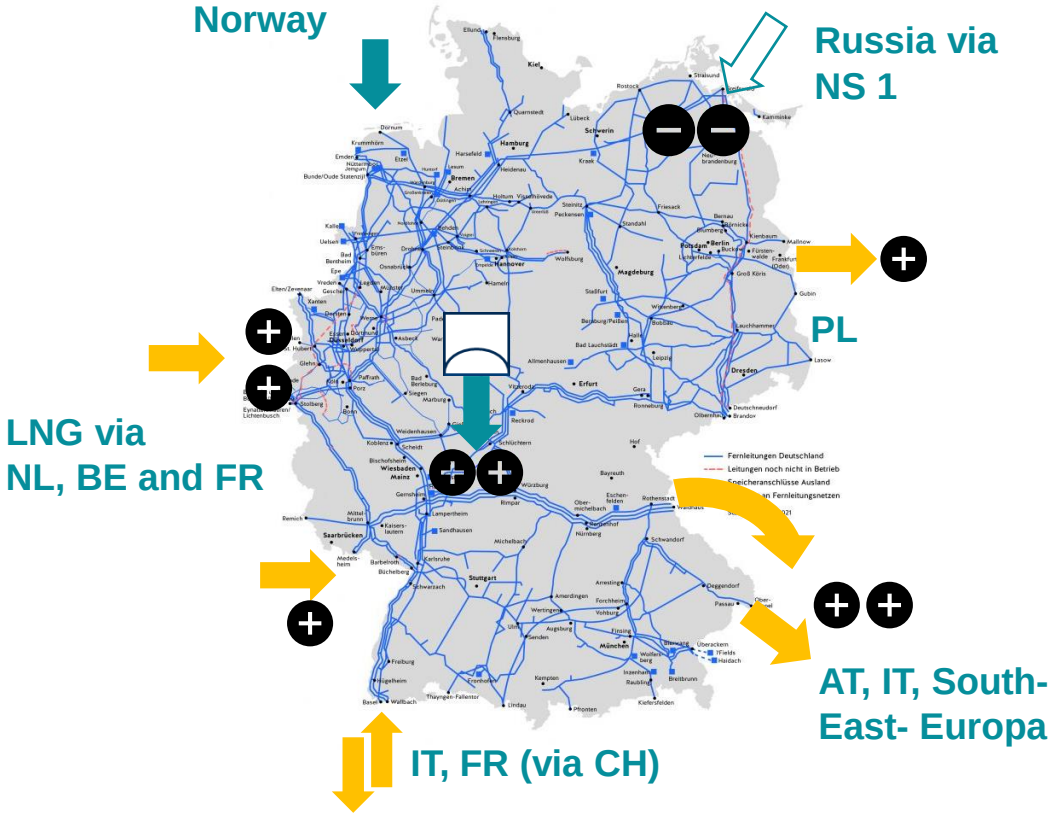
Transportwege

- Ost-West-Transport
- Nord-Süd-Transport

Ausgleich

- Speichereinsatz
- Transite nach Bedarf

Transport in DE in case of failure delivery from Russia



Replacement by

- UGS
- LNG

Changed transport routes

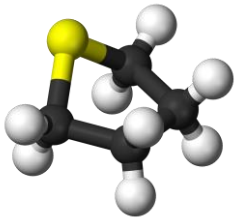
- Maximum West-East-Transport
- Maximum North-South-Transport

Risiken

- Zu geringe LNG-Lieferungen
- Speicher relativ leer
- Regionale Transportengpässe

Gas odorization in France

- Décret n°2004-251 (Gesetz)
- RSDG 10 (Industry requirement)
- Odorization of TSO-grid in striking contrast to Germany



Tetrahydrothiophene (THT)

Odorant	Min. [mg/m³]	Mean [mg/m³]	Max. [mg/m³]
THT	15	25	40
Sulfur from THT	5,5	9,1	14,5

Depending on how the networks are operated, it cannot be ruled out that natural gas containing up to 14.5 mg of sulfur from THT enters the German network via Medelsheim.

Comparison: Odorization in Germany according to DVGW-Code of Practice G280:
min. 10 mg/m³ THT (3,6 mg S from THT).
max. 28 mg/m³ THT (10 mg S from THT).

International / national standards on gas quality

Parameter	DIN EN 16726:2019	DVGW G260:2021
Total Sulfur (excl. odorization)	21 mg/m³	6 mg/m³ **
Total Sulfur (incl. odorization)	30 mg/m³ *	10 mg/m³ **
Sulfur from mercaptans	6 mg/m³	6 mg/m³
Sulfur from H_2S and COS	5 mg/m³	5 mg/m³ **

* If p > 16bar

** According to DIN EN 16726, sulfur contents of up to 21 mg/m³ for non-odorised natural gas H can apply to grid coupling and grid connection points that are influenced by cross-border gas transport. In justified cases (e.g. odourization according to DVGW G 280), other values may apply to network coupling and network connection points that were or will be commissioned before a binding European standard on gas quality came into force, if the specifications in Annex F are complied with.

Valuation

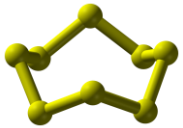
— Taking over odorized gas from France should not cause any fundamental problems:

- Odorization level is not significantly higher than in Germany (max. values: 10 vs. 14.5 mg/m³ sulfur)
- Footnotes in G260 in conjunction with Appendix F allow for higher sulfur contents in justified cases
- In a European comparison, sulfur limits are higher than in Germany
- Up until 2013, higher permissible sulfur concentrations also applied in Germany

— **But:** According to the 10th BImSchV, table D.1 according to DIN EN 16723-2:2017, applies to CNG

Total sulfur: 10 mg/m³ (=> desulfurization before CNG filling station if necessary)

Concentration of Oxygen

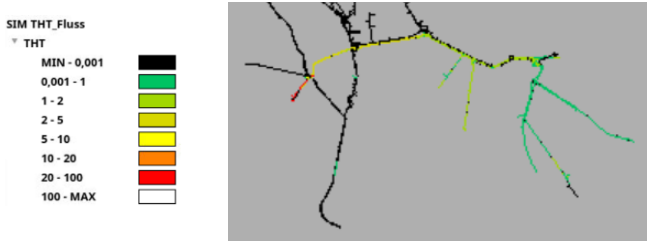


- DVGW-Code of Practice G260 and EN 16726 are identical
  - 1 mol-% bzw. 0,001 mol-%, if UGS are involveld
  - Up to 100 mol-ppm are expected at Medelsheim

- **Oxygen causes severe trouble within gas infrastructure**
  - Oxidation of trace components, e.g. formation of elemental sulfur (S_8) and Black Powder
  - Oxygen induced corrosion
  - Influencing microbiological process (e.g. in storages)
    - Acidification / Clogging
    - Corrosion

Measurement of Gas Quality (THT, O_2, S_8)

- Construction of an online THT measurement technology at all affected interconnection points
- Additional measurement is installed downstream in the grid
- In addition: random sampling by our chemical laboratory, possibly also in downstream networks
- Based on this: simulation of the THT concentration according to ReKo
- Measurement of O_2 und elemental sulfur
- Installation of an addition O_2-measurement downstream



New construction of LNG-Terminal in Wilhelmshaven

LNG comprises far less components than „pipeline-natural gas“

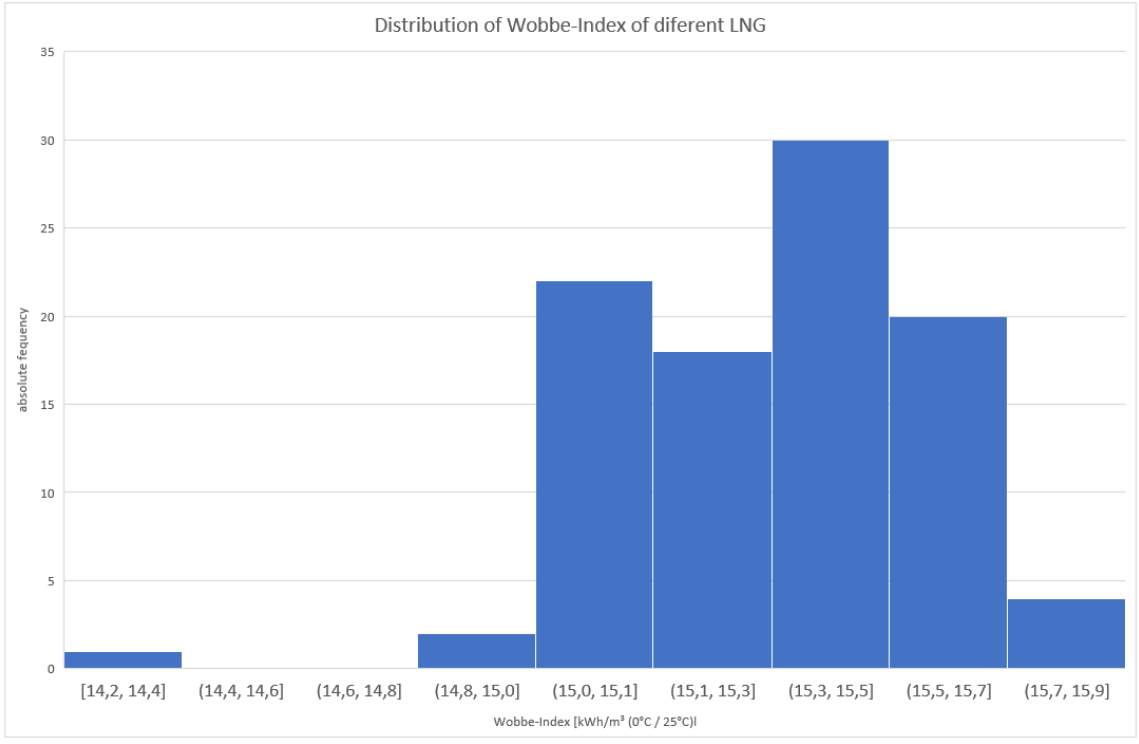
- Methane
- C_2 – C_4-Hydrocarbons
- Nitrogen
- Exhibits quite high Wobbe-Index

Wobbe-Index: limits and values

— Wobbe-Index: Limits according to DVGW G260: **13,6 – 15,4 kWh/m³ (0°C/25°C)***

* at Interconnection Points 15,7 kWh/³ (53,6 MJ/m³) are possible.

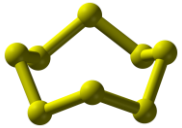
46,44 – 52,6 MJ/m³ (15°C/15°C)

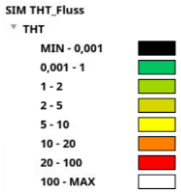


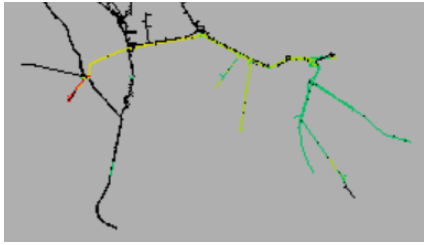
- Literature research for approx. 100 LNG-Qualities from all over the world
- Few would be “off-spec” with respect to DVGW G260
- No practical experience in Germany yet.
- Ballasting system not yet planned
- Close monitoring of Gas Quality will be necessary

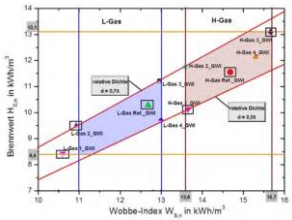
New gas sources – new challenges

- **Measuring and monitoring of new components in TSO grid in Germany**
  - THT, O_2
- **Trace analysis of yet uncommon constituents**
  - Elemental sulfur
- **Determination of physico-chemical properties**
  - Wobbe-Index
- **Subsequently: simulation of grid parameters**









Thank you for your attention - Questions?

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