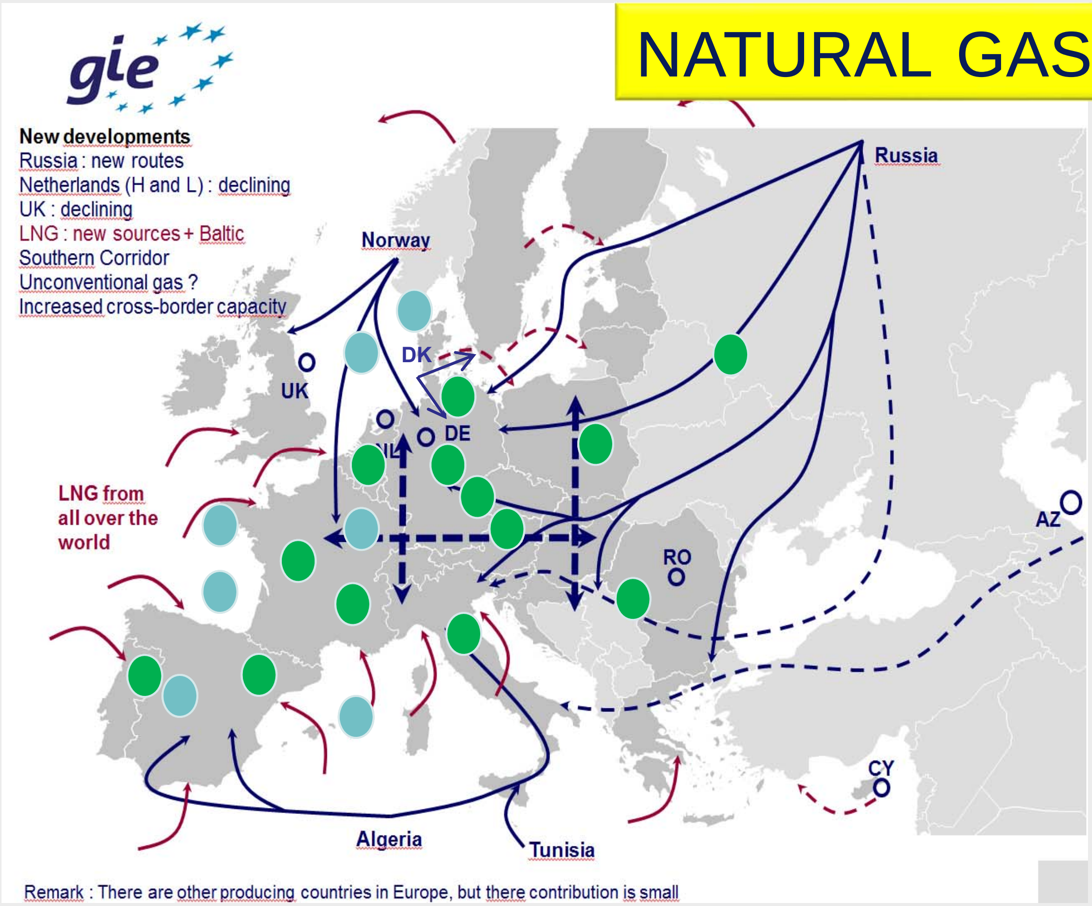
THE CHALLENGE OF GAS QUALITY HARMONISATION

AND IT'S IMPORTANCE FOR NEW GASES

Jean Schweitzer, DGC, April 2017

Natural gases & new gases



NATURAL GAS

BIOGAS / SYNGAS

HYDROGEN

Scenarios (Futuregas project)

HYDROGEN

NATURAL GAS

BIOGAS / SYNGAS

UPGRADED GAS

Dedicated grid

Gas grid?

Gas grid

Dedicated grids

Case3 100% H2

Case2 Extended "Natural gas spec." with 10% H2

Case1 Extended "Natural gas spec." including NG + LNG + partially upgraded biogas/syngas

Case4 Not upgraded biogas

Case5 Not upgraded syngas

Why harmonisation of Natural Gas specification?

A key element for the development of new gases will be their ability to be injected in the grid.

→ Specifications of ”natural gas” shall be as wide as possible to allow the new gases to be injected (without impacting safety and performances of utilisations)

→ The specifications should be harmonised at EU level, because gas market (gas & appliances) is european:

- → Stronger inter-operability of systems in the EU
- → Market of appliances: removing country specific certification

SUSTAINABLE GAS TECHNOLOGY

27 Countries, 27 Natural gas specifications!

Table 3.3. Comparison of gas quality parameters of all EU countries p_n = 101325 Pa, t_c = 15 °C, t_m = 15 °C

Country	Dew point temperature		Total sulphur	H_2S and HCO	Mercaptan	Oxygen	Carb. dioxide	WI	Rel. density
	water °C	hydrocarbons °C	mg/m^3	mg/m^3	mg/m^3	mol %	mol %	MJ/m^3	
EASEE-Gas	-8 (70 bar)	-2 (1 – 70 bar)	30	5	6	0.001	2.5	46.45 – 53.99	0,555 – 0,7
Austria	-8 (40 bar)	0 (work cond.)	100	5 (H_2S)	15	0.02	2	45.42 – 53.62	0.55 – 0.65
Belgium	-8 (69 bar)	0 (69 bar)	150	5	-	0.5	2	46.61 – 53.90	-
Bulgaria	-5	-	20	2 (H_2S)	5.6	0.1	1	-	-
Cyprus	No gas network								
Czech Rep.	-7	0	30	2 (H_2S)	5	0.02	3	45.7 – 52.2	0.56 – 0.70
Denmark	-8 (up to 70 bar)	-2 (up to 70 bar)	30	5	6	0.1	2.7	48.19 – 52.93	0.6 – 0.69
Estonia	-	-5 summer 0 winter (40 bar)	-	-	-	-	1.5	46.65 – 47.31	0.55 – 0.58
Finland	-	-	-	-	-	-		-	-
France	-5 at OP	-2 (0.1 – 70 bar)	30	5	6	0.01	2.5	46.47 – 53.48	0.555 – 0.7
Germany	Soil temperature at OP		30	5 (H_2S)	6	3 dry, 0.5 wet	-	43.62 – 53.46	0.55 – 0.75
Greece	5 (80 bar)	3 (80 bar)	80	54 (H_2S)	-	0.2	3	44.29 – 55.32	0.56 – 0.71
Hungary	0.17 g/m^3 vapour	-	100	20 (H_2S)	-	0.2	-	43.71 – 53.67	0.55 – 0.71
Ireland	50 mg/m^3 vapour	-2 (up to 85 bar)	150	5 (H_2S)	-	0.1	2	45.7 – 54.7	0.55 – 0.7
Italy	-5 (70 bar)	0 (1 – 70 bar)	30	6.6 (H_2S)	15.5	0.6	3	47.31 – 52.33	0.5548 – 0.8
Latvia	-	-	-	20 (H_2S)	35	1	-	39.06 – 51.67	-
Lithuania	-	-	-	-	-	-	-	-	-
Luxembourg	EASEE-Gas requirements							46.45 – 53.99	0.555 – 0.7
Malta	No gas network								
Netherlands	-	-	45	5 (H_2S)	10	0.2	-	41.23 – 42.13	-
Poland	3.7 (55 bar)	-	40	7 (H_2S)	16	0.5	3	42.7 – 51.2	-
Portugal	-5 (84 bar)	-	50	5 (H_2S)	-	-	-	45.7 – 54.7	0.555 – 0.7
Romania	-15 (work cond	0 at OP	100	6.8 (H_2S)	8	0.02	83	-	-
Slovakia	-7 (39.2 bar)	0 at OP	20	2 (H_2S)	5.6	0	1.575	-	-
Slovenia	-7 (39 bar)	-5 (39 bar)	105	6.3 (H_2S)	15.57	0	2.5	-	-
Spain	2 (70 bar)	5 (70 bar)	50	15 (H_2S)	17	0.01		45.65 – 54.70	0.555 – 0.7
Sweden	-3 (80 bar)	-3 (80 bar)	10	5 (H_2S)		-		43.73 – 53.60	-
UK	-		50	5 (H_2S)		0.2		47.20 – 51.41	-

NATURAL GAS QUALITY CHANGES ANALYSIS AND ESTIMATION OF TRANSMISSION SYSTEM VALUES SUITABLE FOR SC "LIETUVOS DUJOS" USERS. POSSIBILITIES STUDY Final report Dr. J. Tonkonogij 17 December, 2012

Common specification = security of supply

The European approach

- Europe faces a stronger external dependency with respect to gas delivieries in the future
- Goal of creating one internal market for energy rather than 25 liberalised, but separated national markets
- Gradual market opening and competition potentially brings along **more diversity of supply sources due to new market entrants**
- This implies a need of **even stronger interoperability of systems**
- Which results in an **enhanced short term security of supply as the systems** and the market actors can respond to disturbances in a more flexible manner

Directorate General for Energy and Transport

What are the main parameters for Inter-cheangeability / Inter-operability

- **Wobbe index and calorific value**, *utilisation involving combustion with burners.*
  - Boilers and water heaters
  - Cooker etc...
- **Methane number** *,engines*
  - Power production
  - Transport
- **Gas composition / components** *industrial use & other*
  - Gas as feedstock
  - CO2 & Oxygen content (fuel cells)
  - H2 content (turbines, engines, etc.), etc.

Some Natural gases. Category H

Table 1. Gas qualities of different natural gases (pipeline), LNG and biomethane.

Gas composition	Symbol	Unit	Russian Group H	North Sea Group H	Danish Group H	Libya LNG (rich)	Nigeria LNG (mean)	Egypt LNG (lean)	Bio-methane	Bio-methane +LPG
methane	CH_4	mol%	96.96	88.71	90.07	81.57	91.28	97.70	96.15	90.94
nitrogen	N_2	mol%	0.86	0.82	0.28	0.69	0.08	0.08	0.75	0.69
carbon dioxide	CO_2	mol%	0.18	1.94	0.60				2.90	2.68
ethane	C_2H_6	mol%	1.37	6.93	5.68	13.38	4.62	1.80		
propane	$C3H_8$	mol%	0.45	1.25	2.19	3.67	2.62	0.22		5.00
n-butane	$n\text{-}C_4H_{10}$	mol%	0.15	0.28	0.90	0.69	1.40	0.20		0.50
n-pentane	$n\text{-}C_5H_{12}$	mol%	0.02	0.05	0.22					
n-hexane	$n\text{-}C_6H_{14}$	mol%	0.01	0.02	0.06					
hydrogen	H_2	mol%								
oxygen	O_2	mol%							0.20	0.19
total		**mol%**	100	100	100	100	100	100	100	100
superior calorific value	H_{sv}	MJ/m^3	40.3	41.9	43.7	46.4	44.0	40.7	38.3	41.9
superior calorific value	H_{sv}	kWh/m^3	11.2	11.6	12.1	12.9	12.2	11.3	10.6	11.6
relative density	d	–	0.574	0.629	0.630	0.669	0.624	0.569	0.587	0.641
Wobbe Index	W_s	MJ/m^3	53.1	52.9	55.0	56.7	55.7	53.9	50.0	52.3
Wobbe Index	W_s	kWh/m^3	14.8	14.7	15.3	15.8	15.5	15.0	13.9	14.5
methane number	MZ	–	92	79	73	65	71	92	103	77

Ref:

Development of natural gas qualities in Europe

Altfeld /Schley GWF S2/2011

What should be the harmonised range of variations?

Manufacturers: as narrow as possible

Gas industry: as wide as possible

The compromise:

Harmonisation: a complex process monitored by the CEN with the mandate of the EU

SFGas WG pre-normative H-GQ Study
Participation of stakeholders

Nomination by NSB:

AENOR (E)
AFNOR (F)
ASI (A)
[BSI (UK)]
DIN (G)
DS (DK)
ELOT (GR)
NBN (B)
NEN (NL)
NSAI (IRL)
MSZT (HU)
PKN (PL)
SIS (S)
UNI (I)

Encouragement of Eastern countries in process

Nominations by 17 Associations:

afecor
CECOF
C.E.F.A.C.D.
CEFIC
EASEE-gas
EHI
ELVHIS
ENTSOG (Observer)
EURO-AIR
Euromot
EUTurbines
FARECOGAZ
GIE
IFIEC
IOGP
Marcogaz
[NGVA Europe]

+ related CEN Committees

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What scenarios for natural gas?

Proposed scenarios

PARAMETER	UNIT	SCENARIO MAX	SCENARIO LNG	SCENARIO BIO	SCENARIO MIN
WI high limit	MJ/m^3 [15,15]	54	53	52	52
WI low limit	MJ/m^3 [15,15]	46,44	49	46,44	48
Speed of variation	MJ/30 min	1,5	1,5	1,5	1,5

HYPOTHESIS :

- Large range based of **EASEE GAS CBP specifications**
- Narrow range taking into account variations observed on the french grid.
- Scenario min **centered on G20** (methane – 50,7 MJ), reference gas of group H, so as not to favorise one industry or another (LNG vs Biomethane injection)
- Speed of variation : **1,5 MJ in 30 minutes** → Data from the french grid at exit points. big amplitude that can happen occasionnaly on the grid – NOT an unusual, abnormal value (ie high limit).

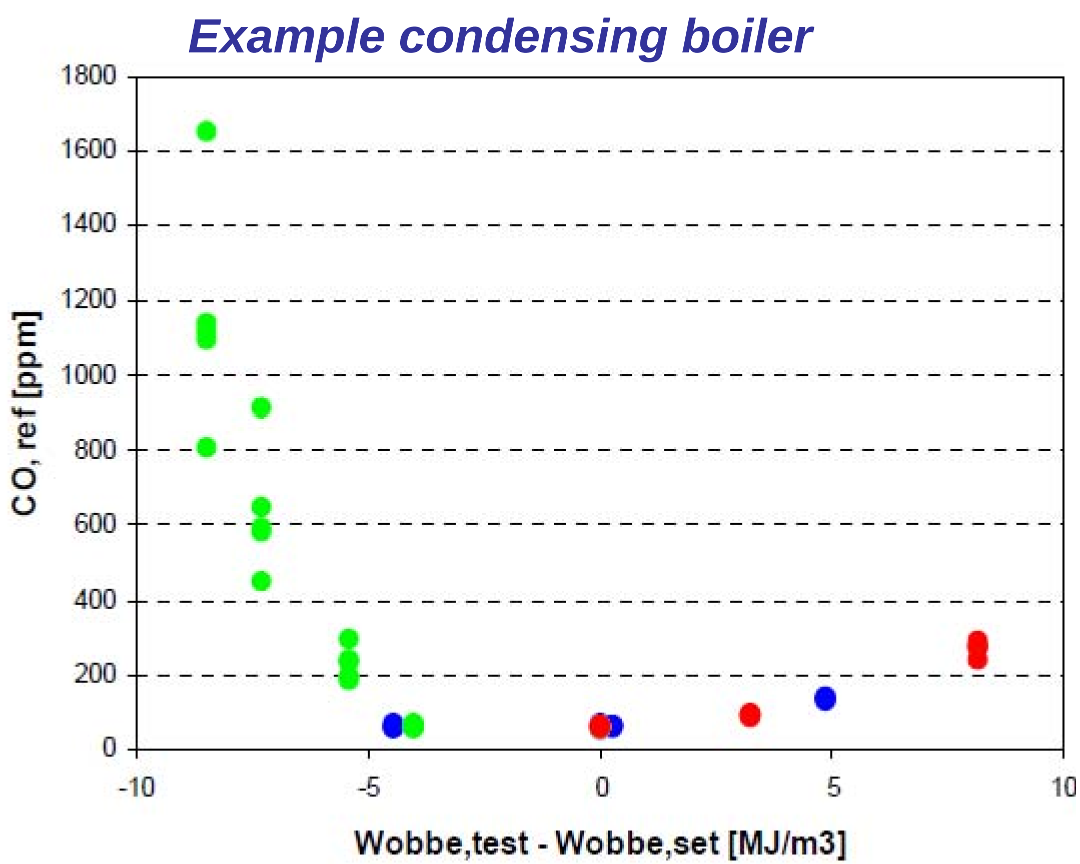
Document CEN /AFG

What are the implications of the various scenarios for the end-use?

Wider Wobbe =

- Potential increase of CO (safety), NOx (environment)
- Potential increase of knocking (engines)
- Other

Finding the acceptable range of variation



For all appliances there is a range of Wobbe that is acceptable =

- not compromising the safety
- not compromising the operation

This may have slight impact on performances (efficiency, emissions etc.)

Widening the acceptable range of variation

New technologies, **combustion controls**, sensors, etc. are more and more used on gas appliances making those more tolerant to gas quality variations.

Therefore the harmonisation shall be seen as a **dynamic process**

FUTUREGAS WP2: what are we doing

Q : Which gas applications and utilisations are compatible with the future gases scenarios and specifications?

- Assesement of the present danish population of appliances segment by segment and evolution of it.
- Detailled assesement of the tolerance of each segment to gas quality variation (including) new gas technolgies (not yet on the market)
- Evaluation of the future tolerance of each segment. Combustion controls etc.

Harmonisation process & Futuregas

Harmonisation of gas quality

- Scenarios for the Wobbe index variations
- National investigations in the EU and out of EU.
- Conversion L to H (NL etc.)

Futuregas

- Impact of gas quality segment by segment
- Combustion Control systems
- Etc.

Conclusion

- New gases are one of the causes of gas quality changes
- The present gas quality harmonisation process (and FUTUREGAS project) should bring a picture on the tolerance of various applications to gas quality change (and possible remedies)
- Therefore present gas quality harmonisation process will pave the way to the integration of new gases.
- The future gas applications will be different from what we know today: Tolerance to gas quality variations is clearly a positive criteria in the choice of tomorrow gas applications/utlisations.