entsog

european network
of transmission system operators
for gas

Brussels 28-09-2017

Joint CEN-ENTSOG workshop

Wobbe Index and Gross Calorific Value in the European gas value chain

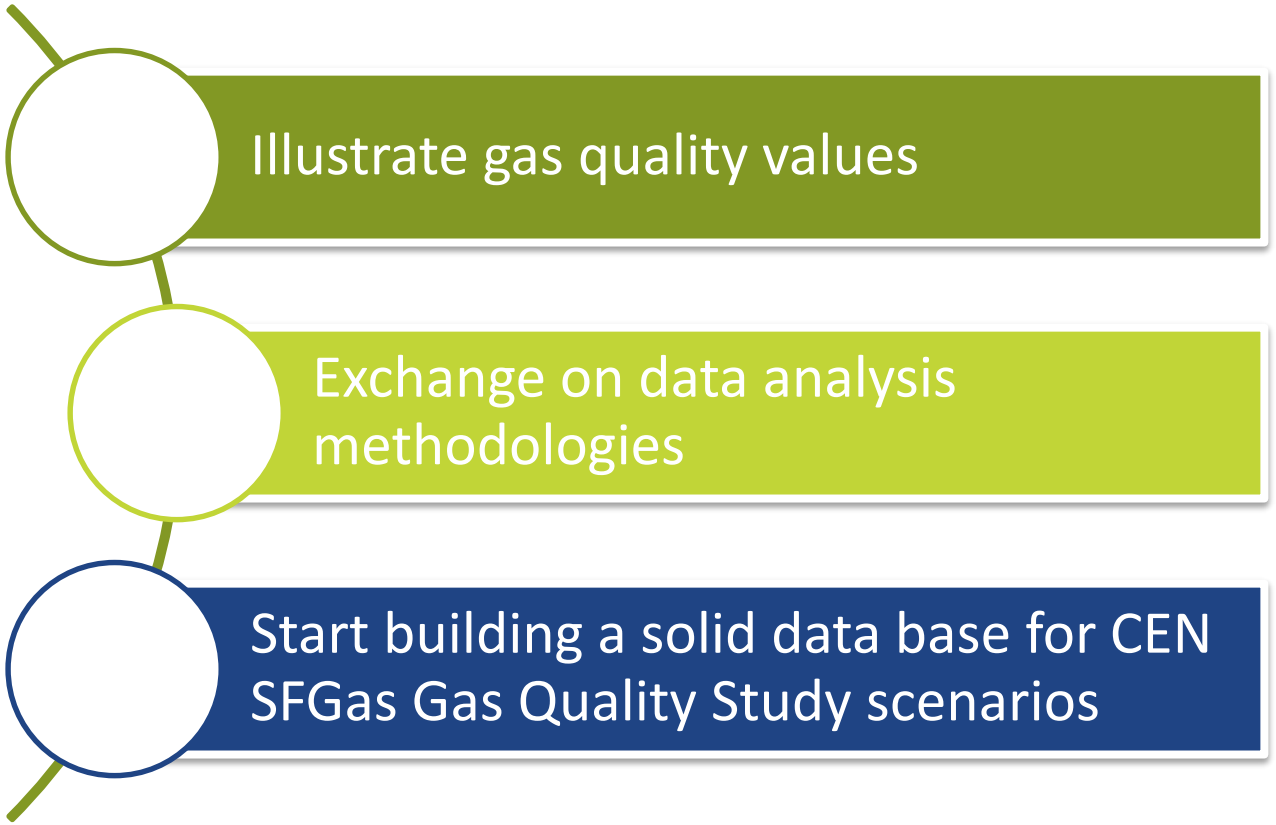
Image Courtesy of Thyssengas

1 Opening and aim of the workshop

Kris de Wit - CEN
Hendrik Pollex - ENTSOG

WI and GCV in the European gas value chain

Aims of the workshop



4 Presentation of methodology and TSO results

Antonio Gómez Bruque - ENTSOG

WI and GCV in Europe – TSO results

Context and scope of the survey

- Voluntary ENTSOG contribution to the standardization work of CEN
- Focused on gas quality delivered at TSO exits
- Focused on Wobbe index and gross calorific value
- Hourly resolution or 15 min when available
- Complementary approach for ENTSOG's Gas Quality Outlook
- Both points with high and low variability
- MJ/m3 (15/15) and kWh/m3 (25/0)
- Covering 2015 and 2016 data

WI and GCV in Europe – TSO results

Disclaimer

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WI and GCV in Europe – TSO results

Participation summary

Points by country	
Belgium	9
Denmark	8
France	8
Germany	25
Hungary	14
Ireland	4
Italy	15
Netherlands	9
Poland	14
Slovakia	4
Slovenia	3
Spain	10
Ukraine	5
United Kingdom	8
Total	136

Points by supply origin	
Algerian	3
Biomethane	3
LNG	8
Libyan	1
Mix	76
National production	18
Norwegian	4
Russian	23
Total	136

WI and GCV in Europe – TSO results

Participation summary

By type of point	
Biomethane injection	3
City gate	55
EU import point	11
Industrial - combustion	3
Industrial - non combustion	3
Interconnection point	27
LNG terminal	7
Power generation	4
Production point	6
Transit	14
UGS (underground storage)	3
Total	136

By resolution	
15 min	37
hourly	99
Total	136

4 Presentation of methodology and TSO results – Wobbe index ranges

Antonio Gómez Bruque - ENTSOG

WI and GCV in Europe – TSO results

Timed series of data

- Each data set is categorised by country, type of point and supply origin
- Each pair of WI and GCV values is labelled with a time stamp

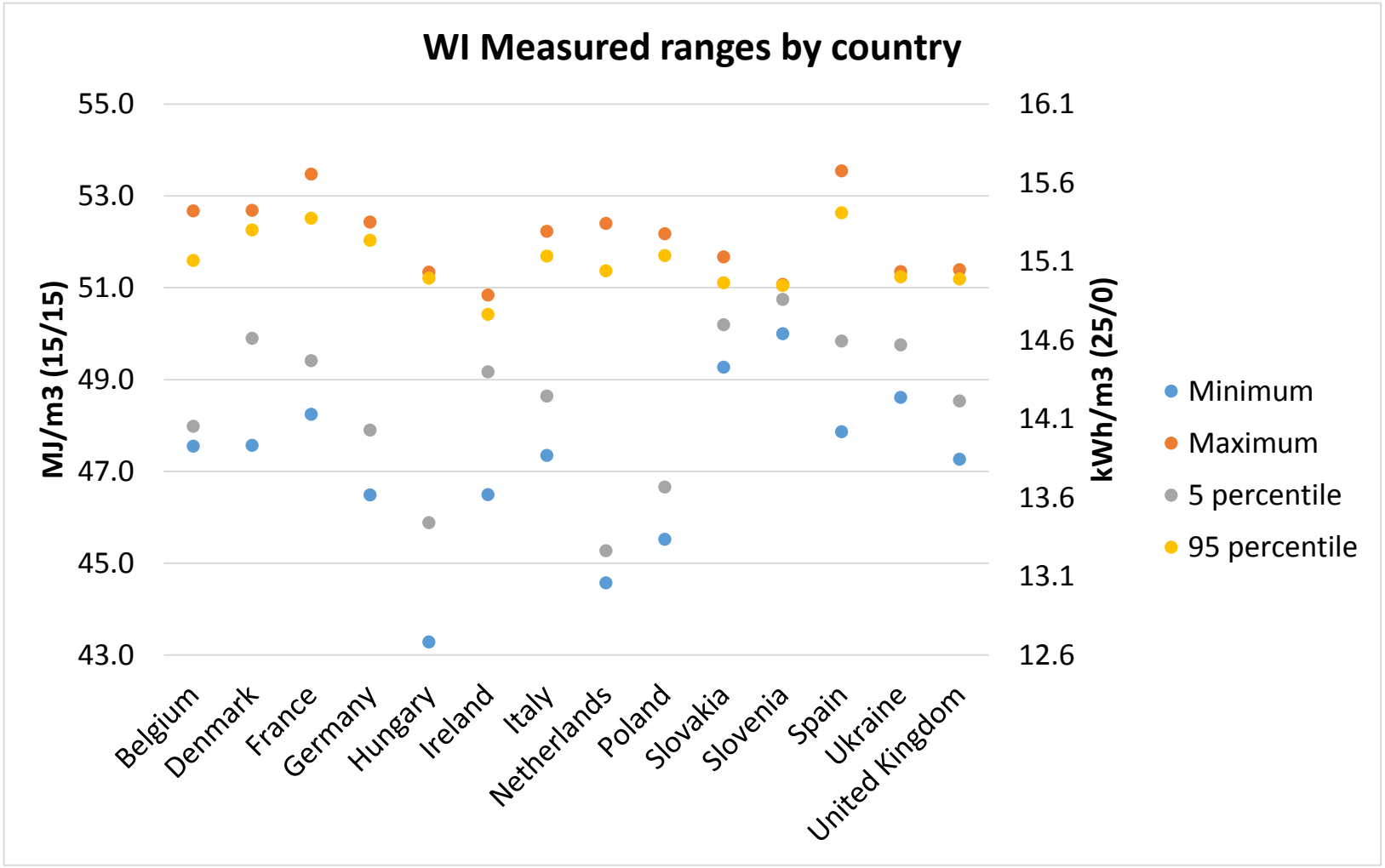
Basic treatment and statistics

- For each data set the following calculations are done:
  - Maximum value
  - Minimum value
  - 95 percentile
  - 5 percentile
- Values outside EN-437 (from 45.7 to 54.7 MJ/m3 (15/15)) are discarded
- Values known (e.g. calibrations) or suspected to be wrong are also taken out

Point master data	
MS	Netherlands
TSO	GTS
Province/region (NUTS 3)	NL339
Unique code	NL339-001
Units	MJ/m3
Ref. cond. (comb./vol.)	25/0
Granularity	15 min
Type of point	City gate
Type of gas	National production

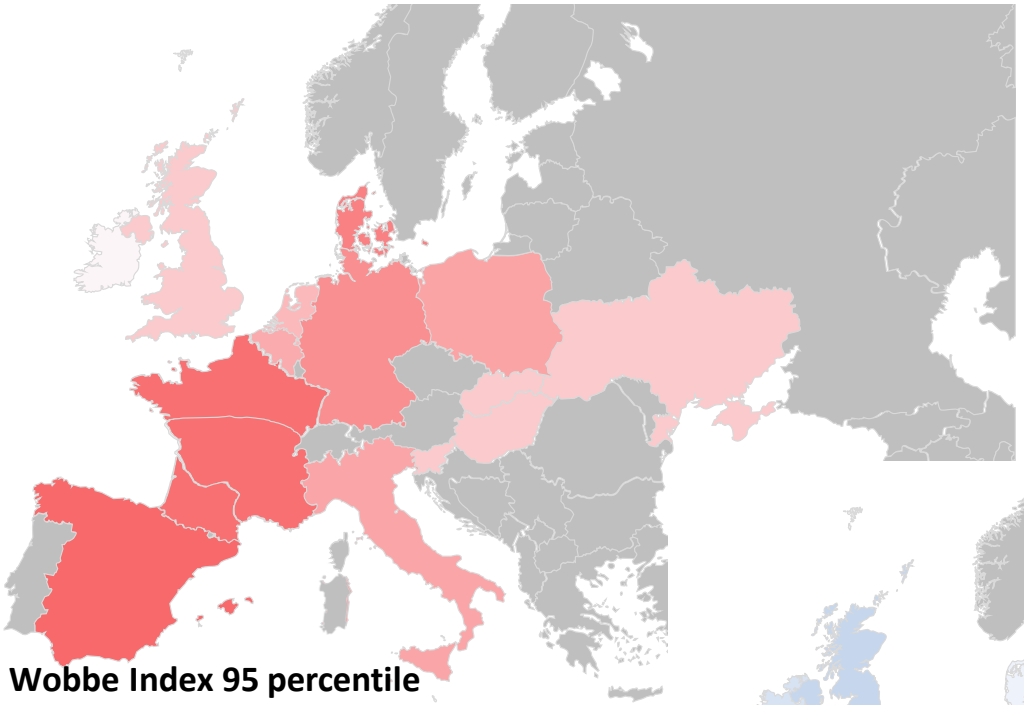
Gas quality values from last 2 years			
Date	**Time**	**WI**	**GCV**
01-01-2015	00:15	54.1621	42.236
01-01-2015	00:30	54.18	42.243
01-01-2015	00:45	54.1524	42.225
01-01-2015	01:00	54.1422	42.217
01-01-2015	01:15	54.1735	42.238
01-01-2015	01:30	54.1691	42.238

WI and GCV in Europe – TSO results

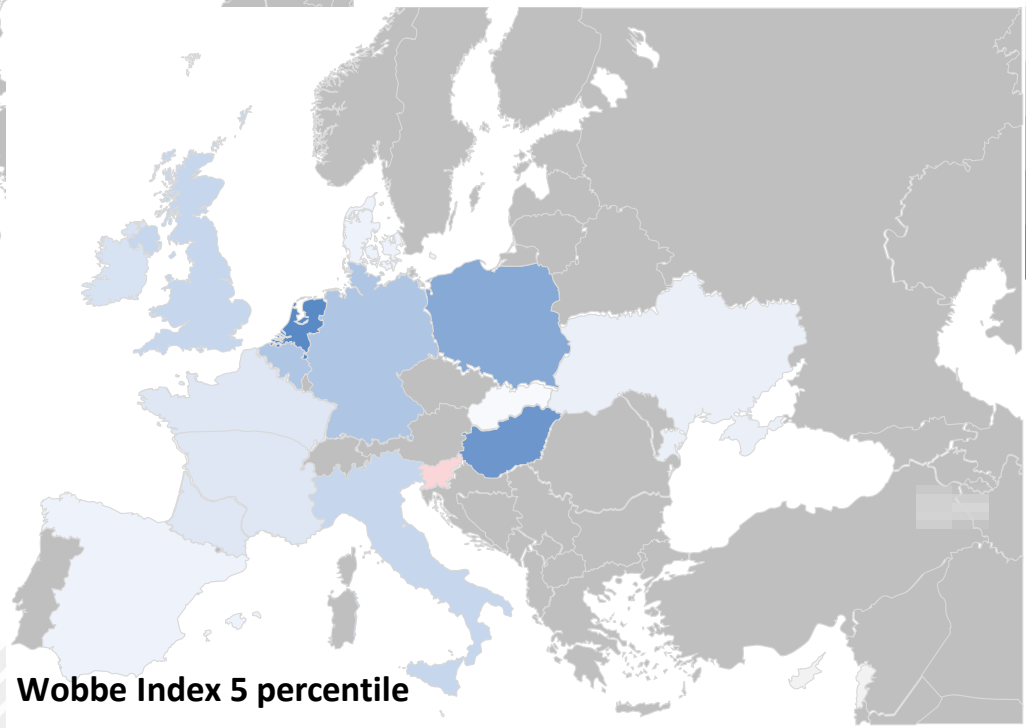


For a given category, the maximum value represents the highest maximum of all datasets, same applies for the 95 percentile; similarly, the minimum value represents the lowest minimum of all datasets, same applies for the 5 percentile.

WI and GCV in Europe – TSO results



Wobbe Index 95 percentile

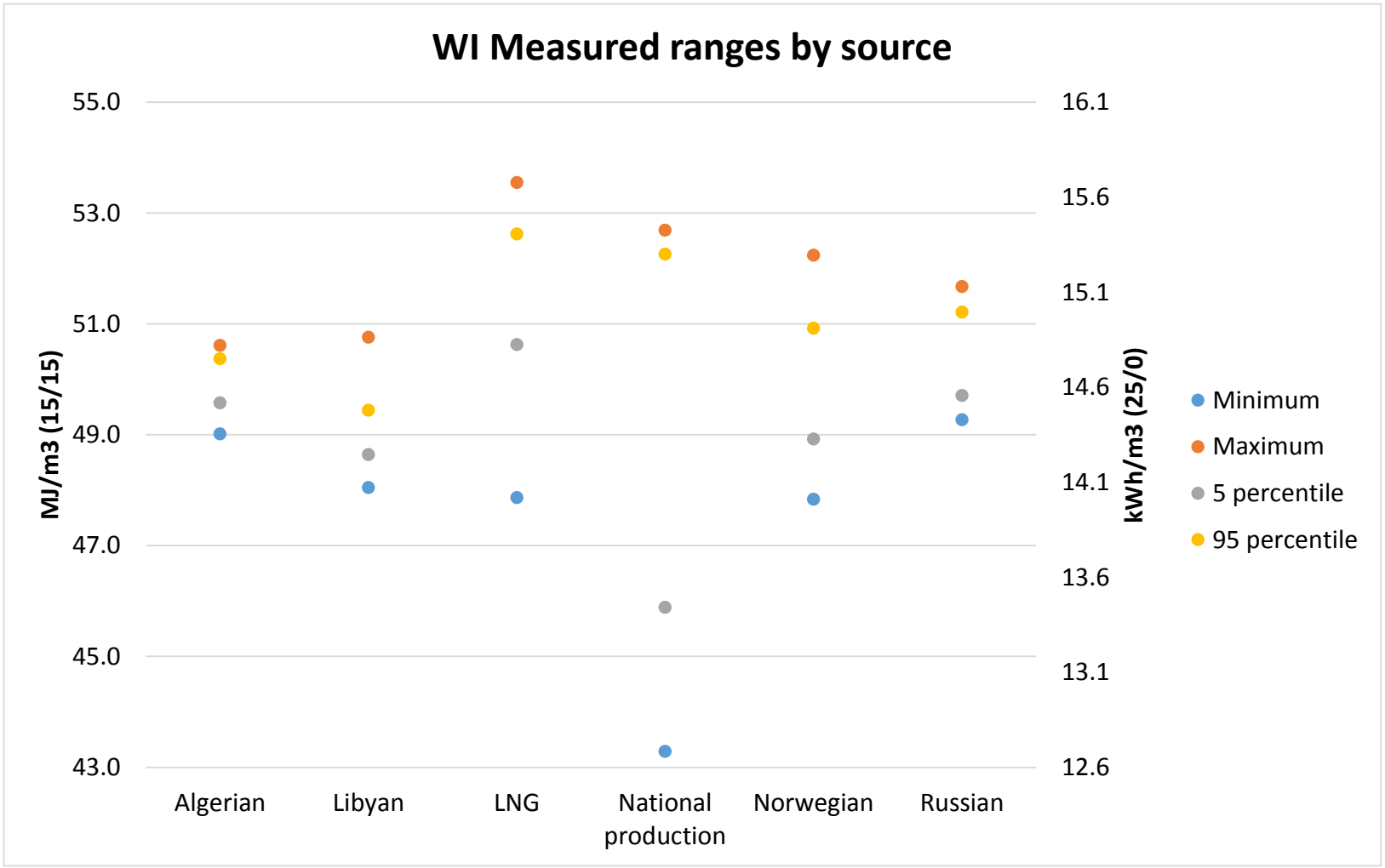


Wobbe Index 5 percentile

MJ/m^3 (15/15)

- 52.75
- 52.00
- 51.25
- 50.50
- 49.75
- 49.00
- 48.25
- 47.50
- 46.75
- 46.00
- 45.25

WI and GCV in Europe – TSO results



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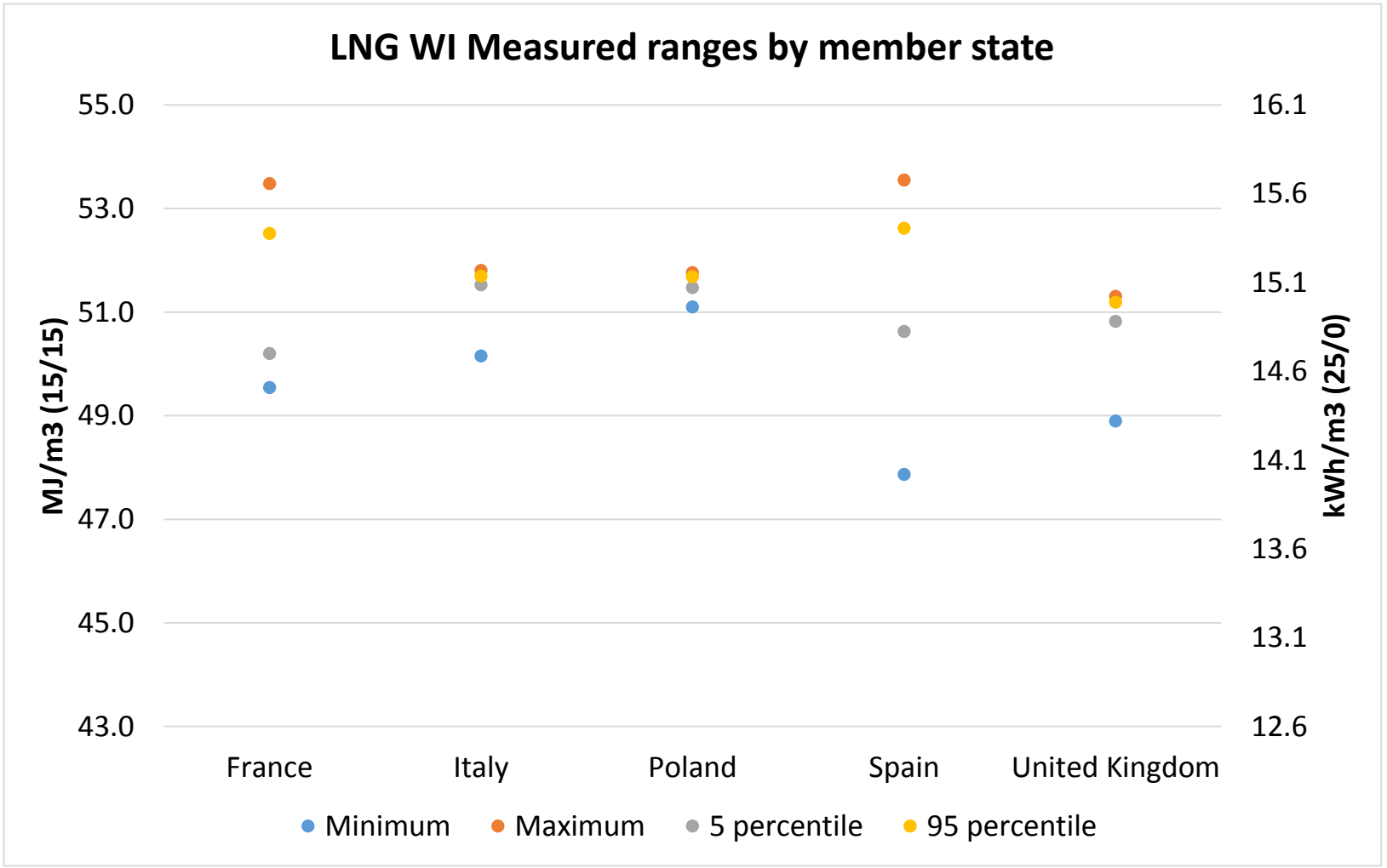

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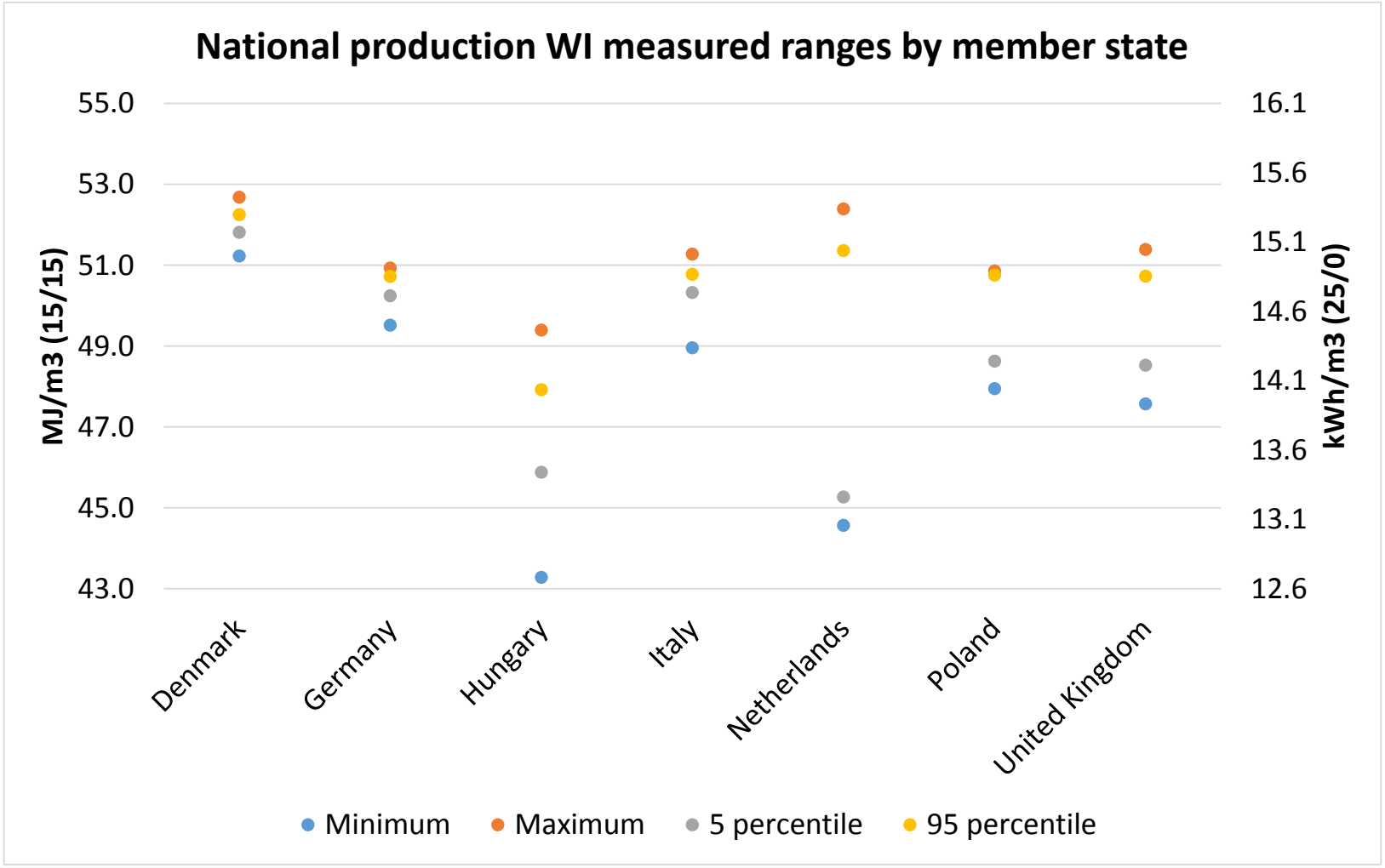

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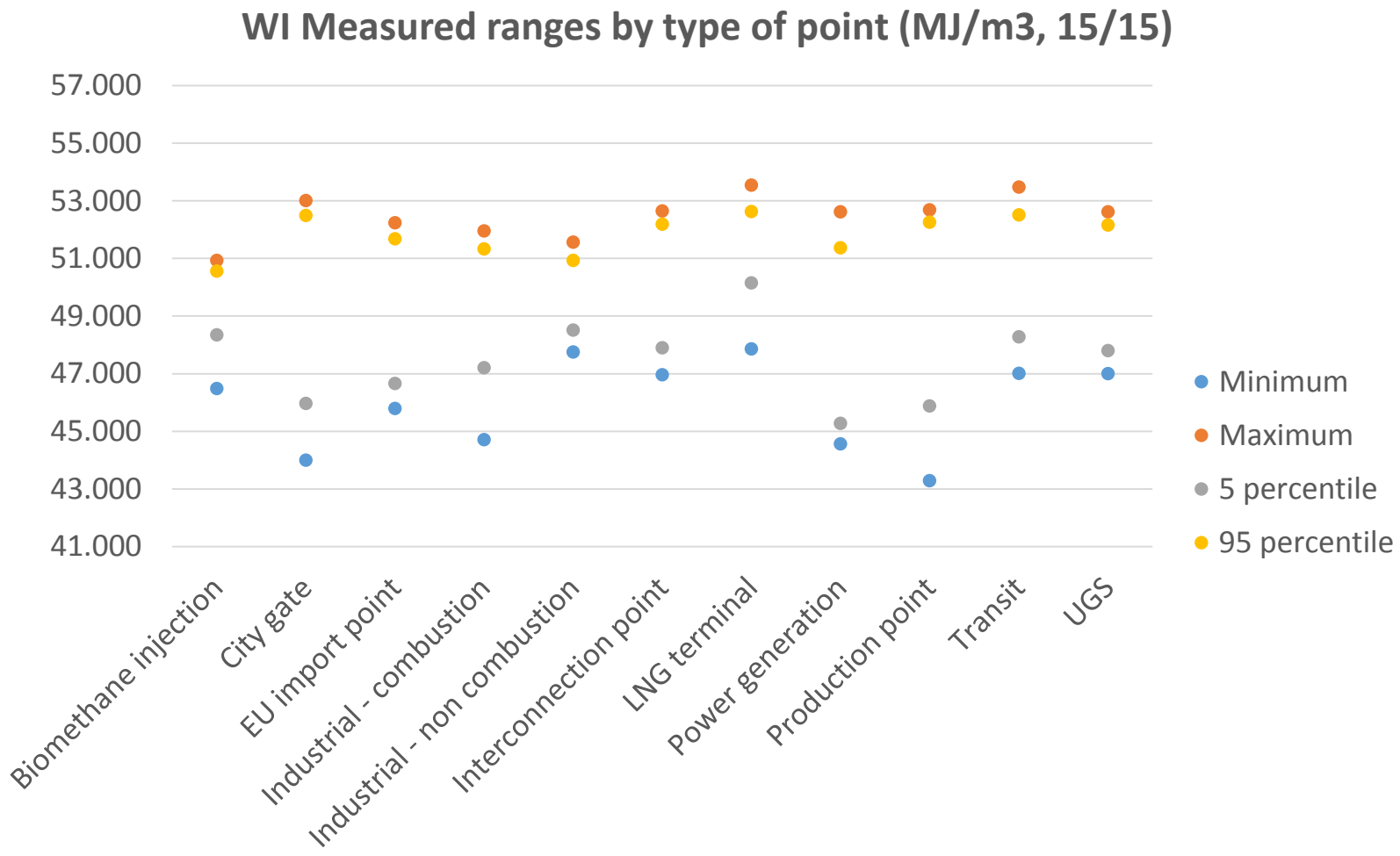

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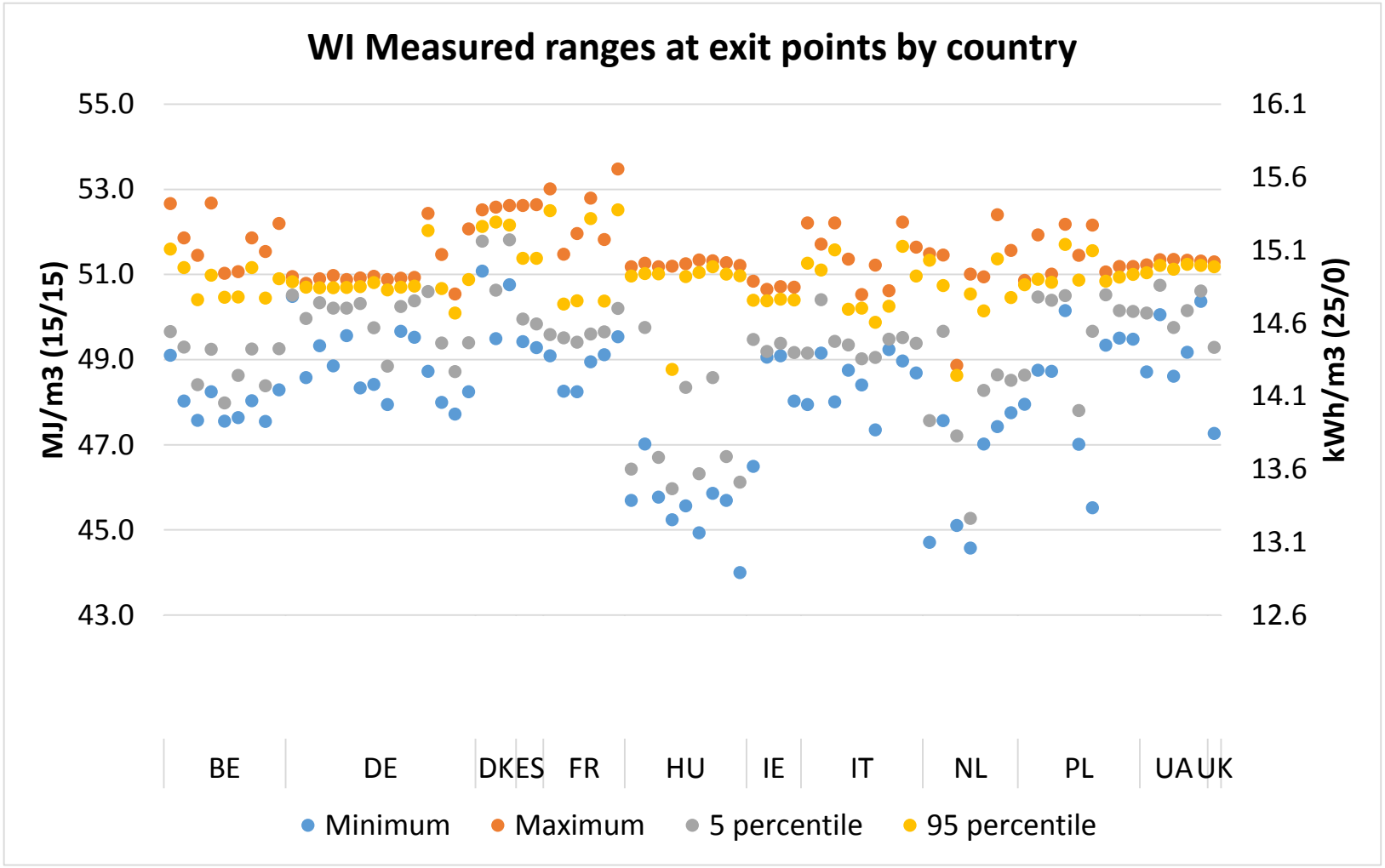
WI and GCV in Europe – TSO results



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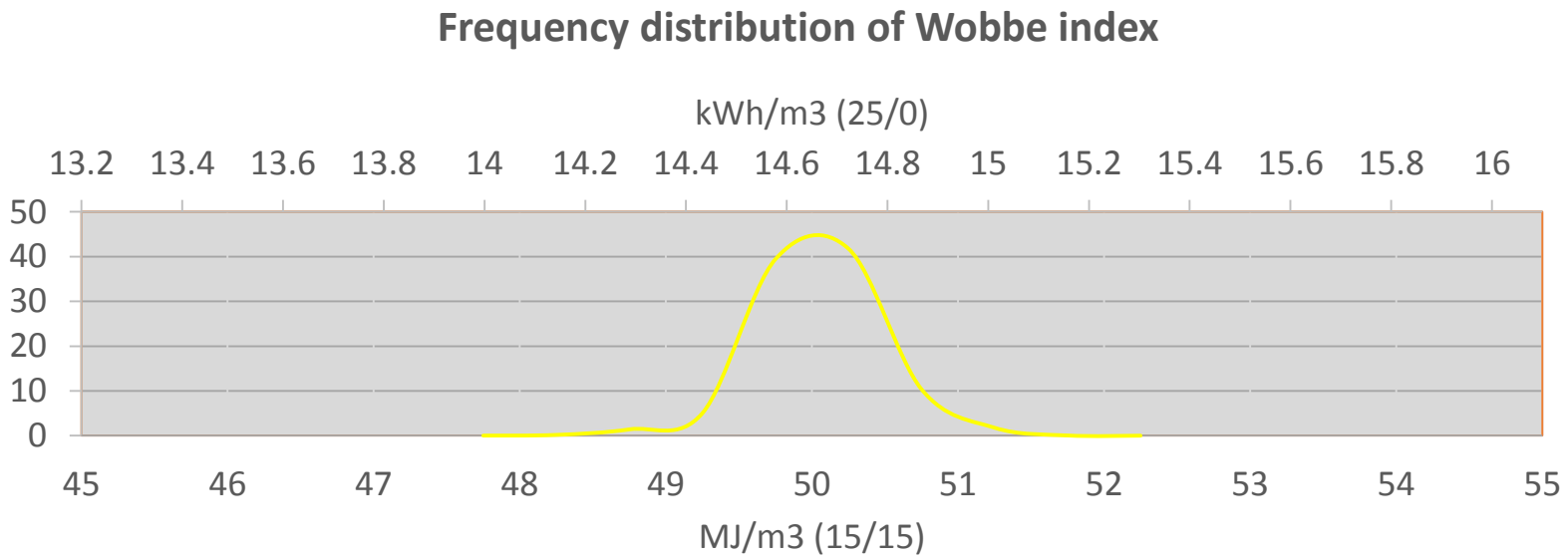
4 Presentation of methodology and TSO results – WI frequency distribution

Peter van Wesenbeeck - GTS
(ENTSOG Gas Quality KG member)

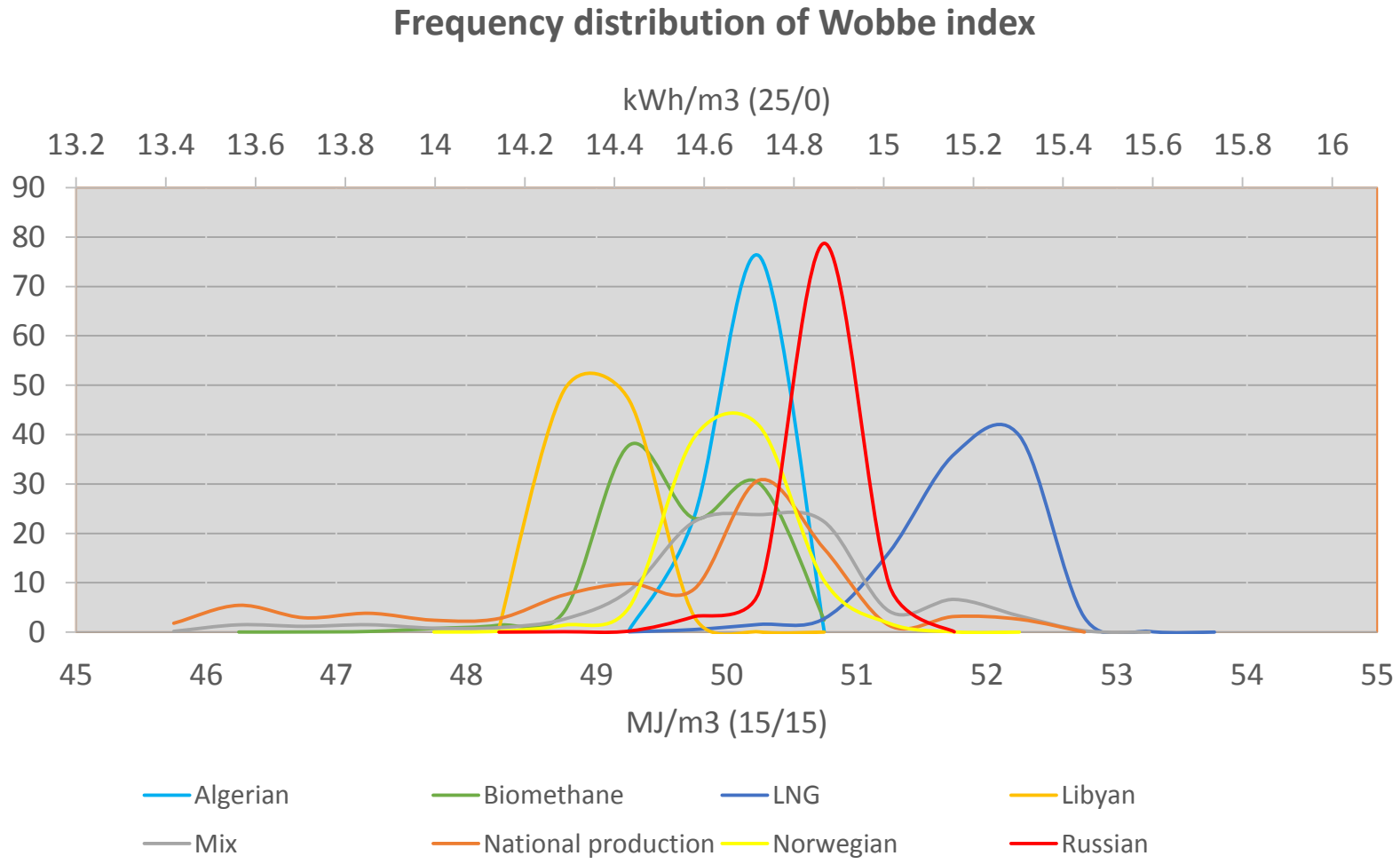
WI and GCV in Europe – TSO results

Frequency distribution

- The EN 437 range has been divided in steps of 0.5 MJ/m^3.
- For each data set, the number of values found within each step is calculated.
- By grouping data sets with a common feature (supply source) an approximate frequency histogram can be derived.



WI and GCV in Europe – TSO results



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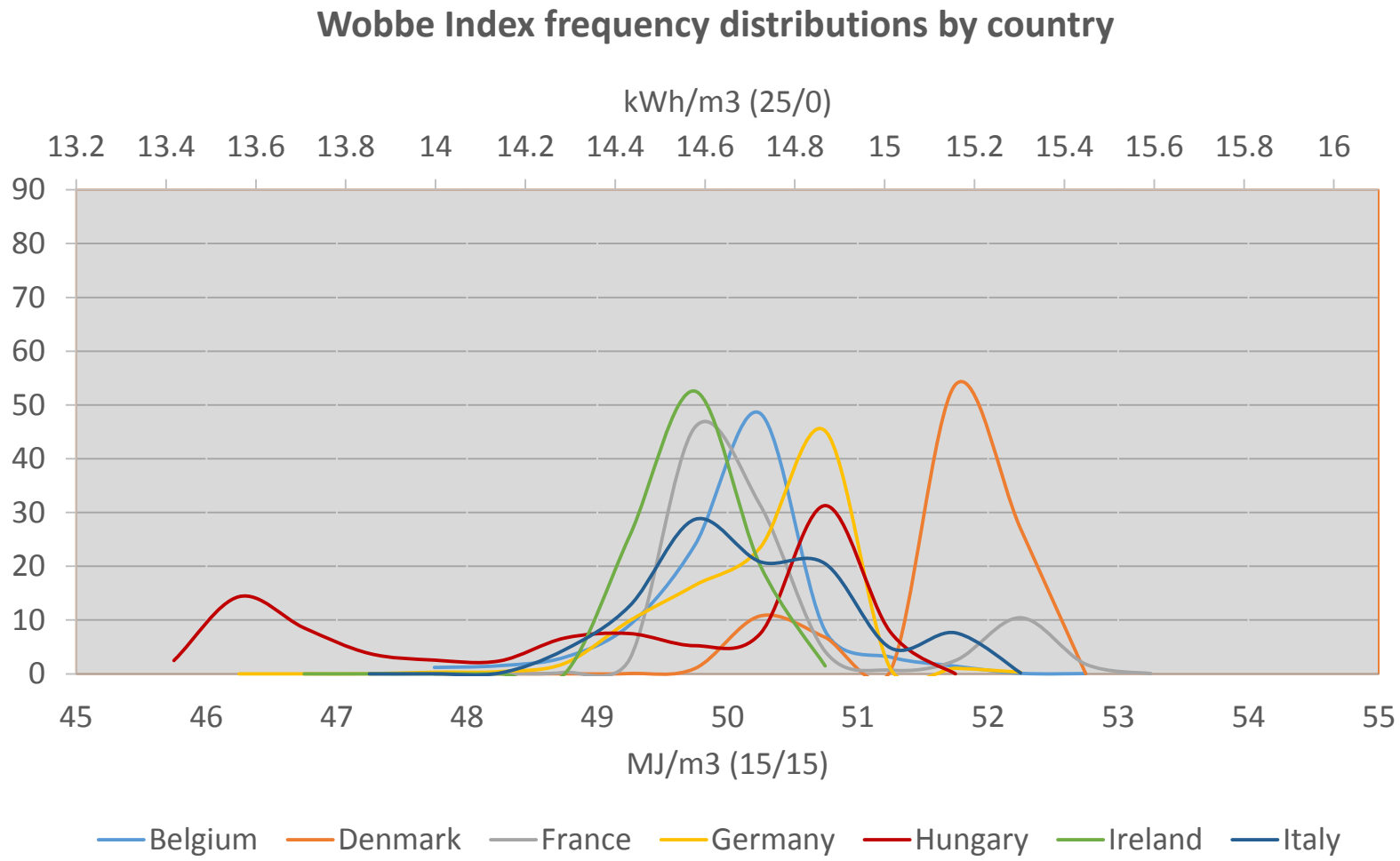
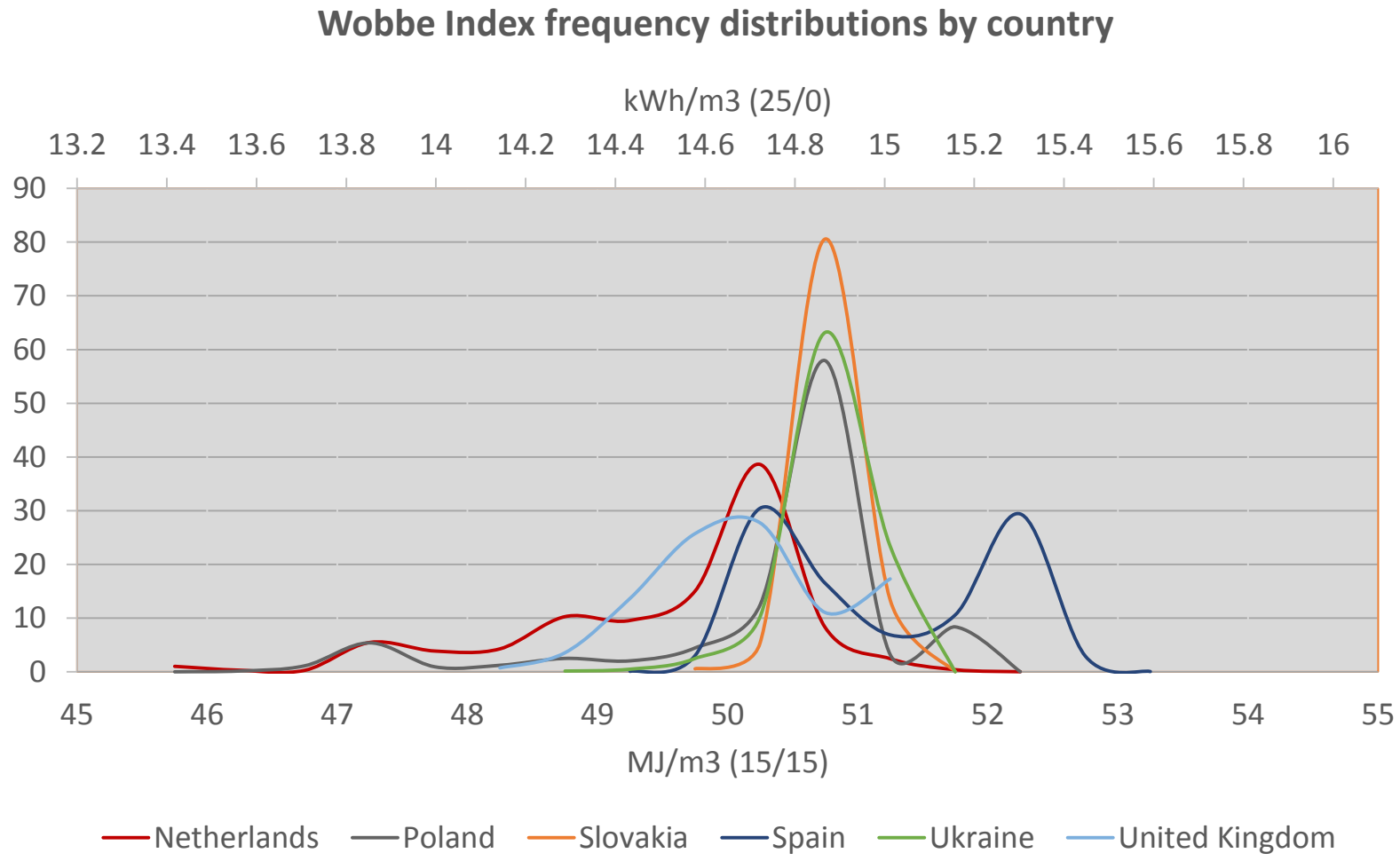


WI and GCV in Europe – TSO results



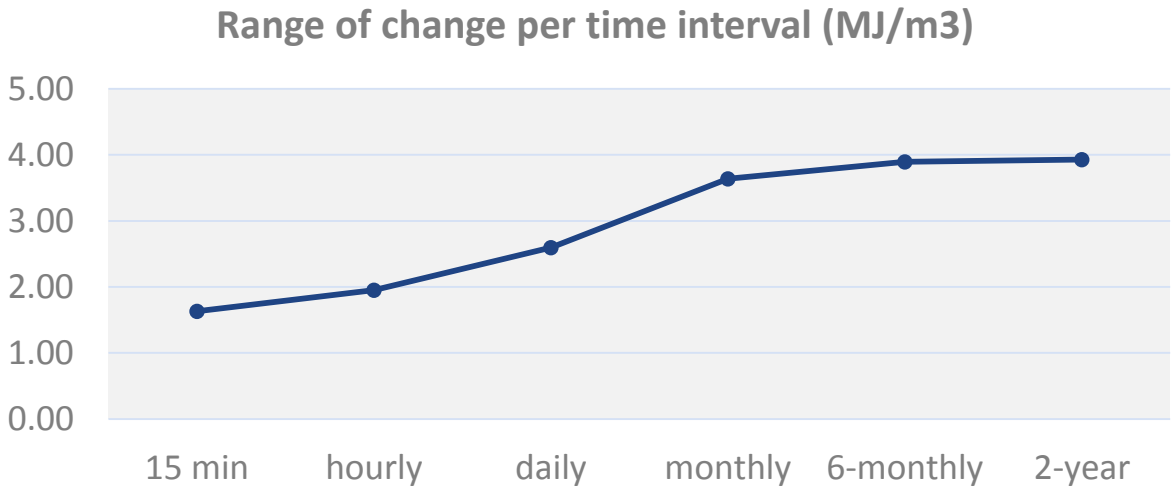
4 Presentation of methodology and TSO results – WI range of change

Peter van Wesenbeeck - GTS
(ENTSOG Gas Quality KG member)

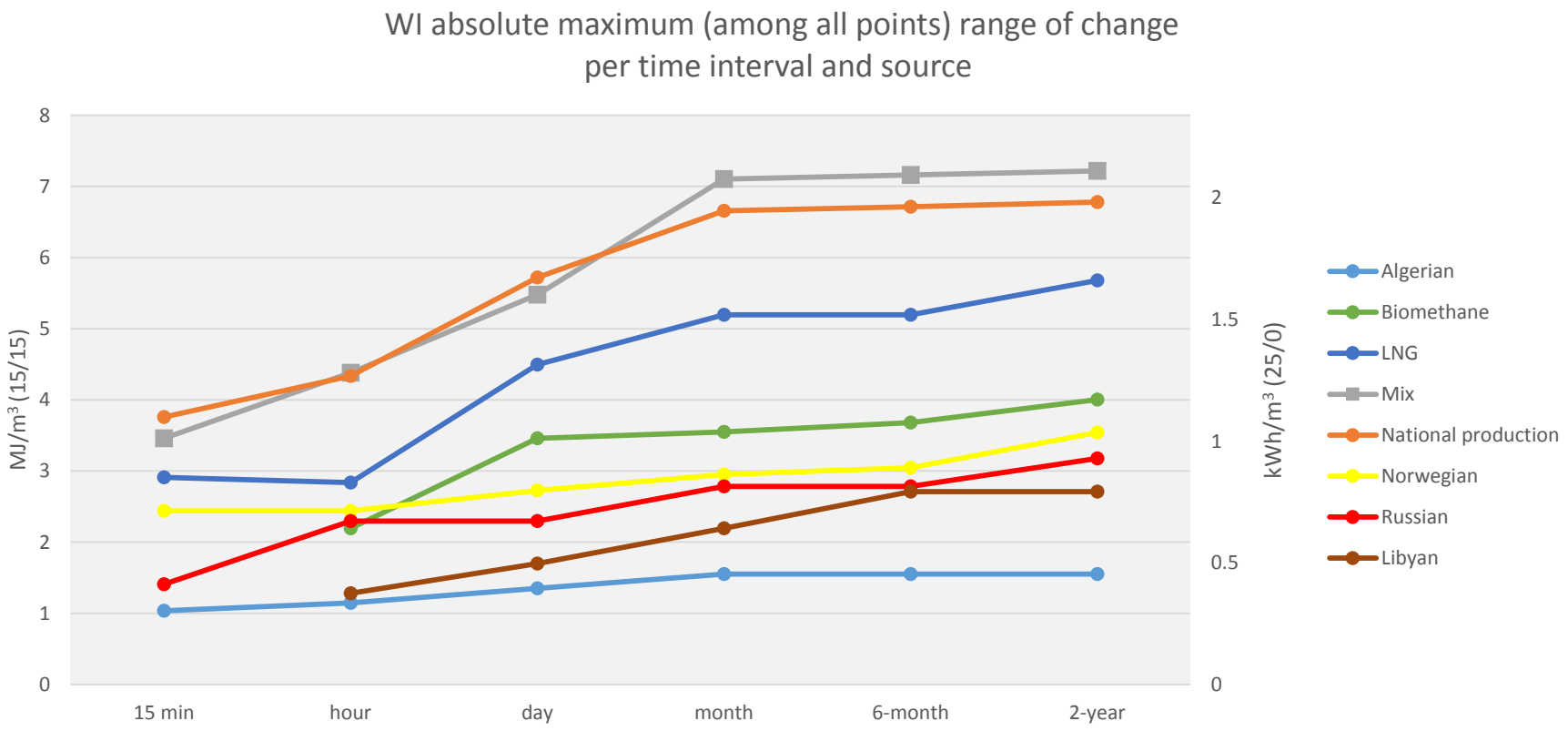
WI and GCV in Europe – TSO results

Range of change analysis

- For each data set, changes in WI are calculated as the maximum value minus the minimum value, using different moving time windows: 15 min, 1 hour, 1 day, 1 month, 6 months and 2 years.
- For each time window, the widest change ever registered is recorded.
- Then, data sets sharing a common feature (e.g. supply source) are grouped. The maximum values among all data sets are displayed.



WI and GCV in Europe – TSO results



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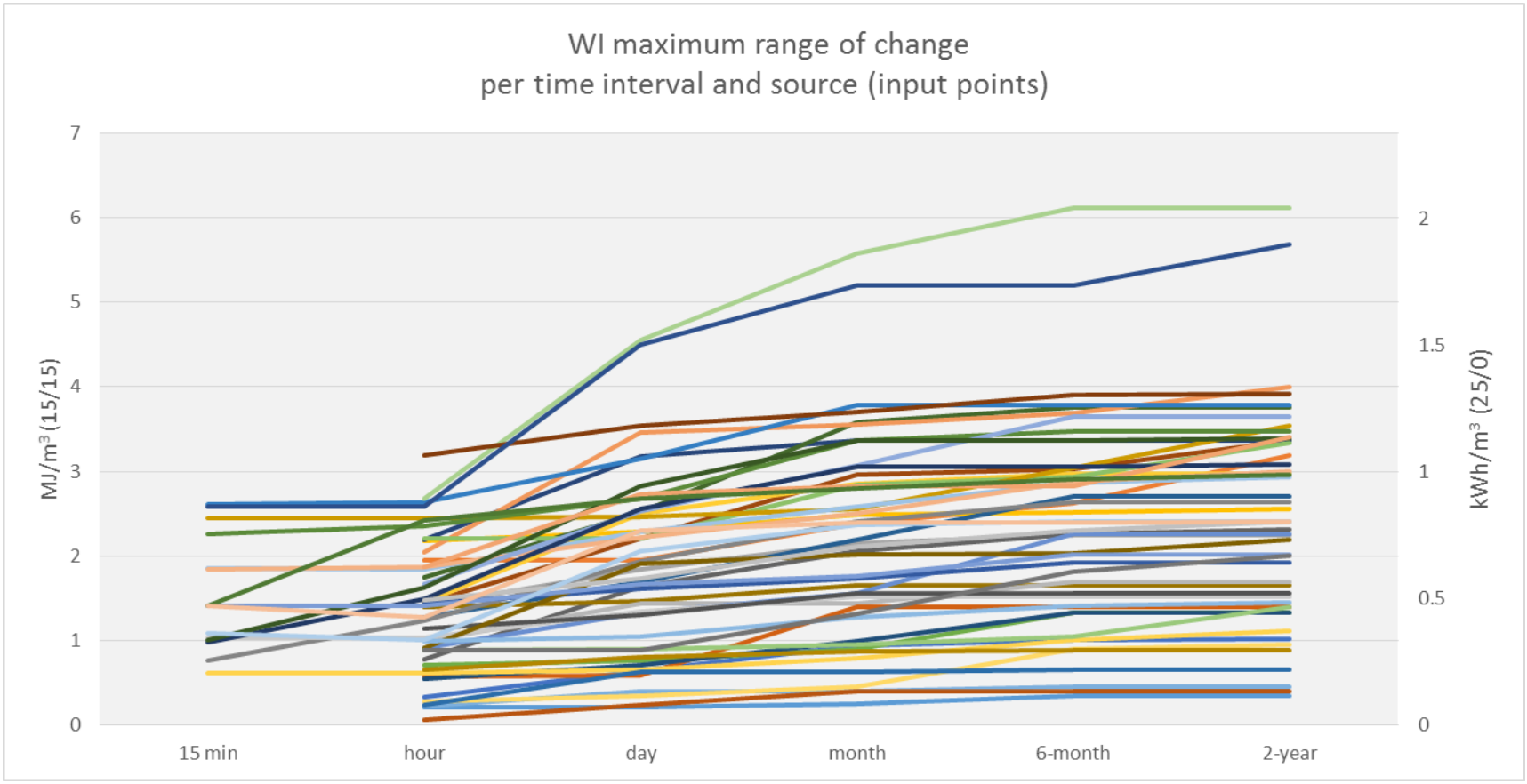

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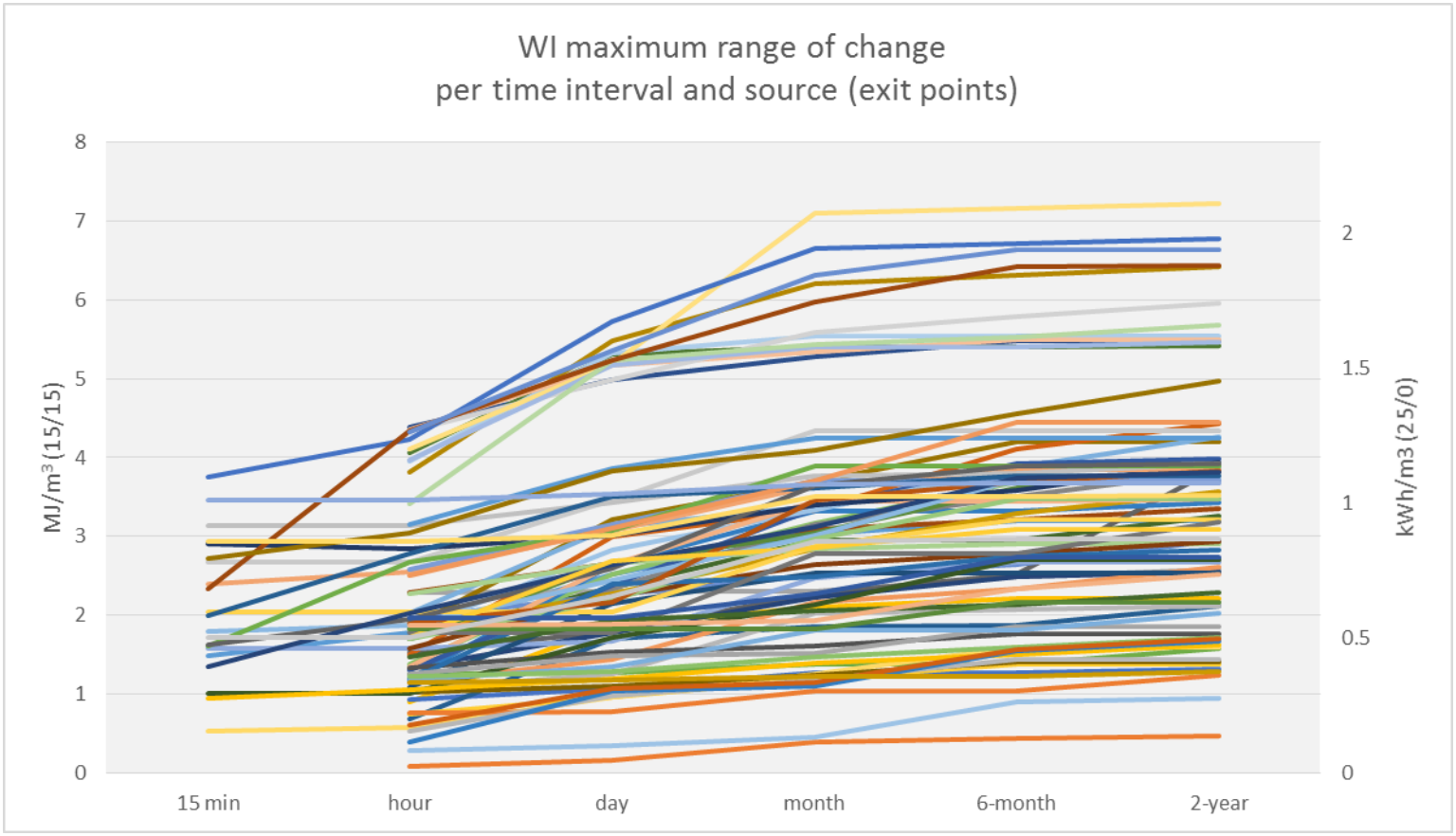
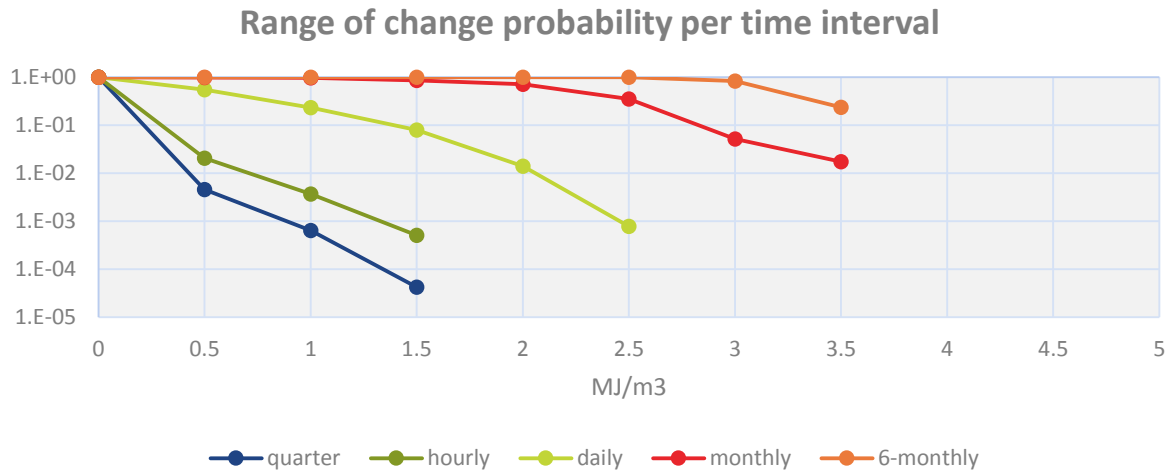


WI and GCV in Europe – TSO results

Range of change probability analysis

- For each data set the variations in WI are calculated as the maximum value minus the minimum value within a given time window (e.g. 15 min).
- Variations are classified in different steps of 0.5 MJ/m3
- The number of variations greater than a given step is divided by the total number of variations. The result reflects the probability of a given change.
- The exercise is repeated for different time windows (1 hour, 1 day, 1 month…)



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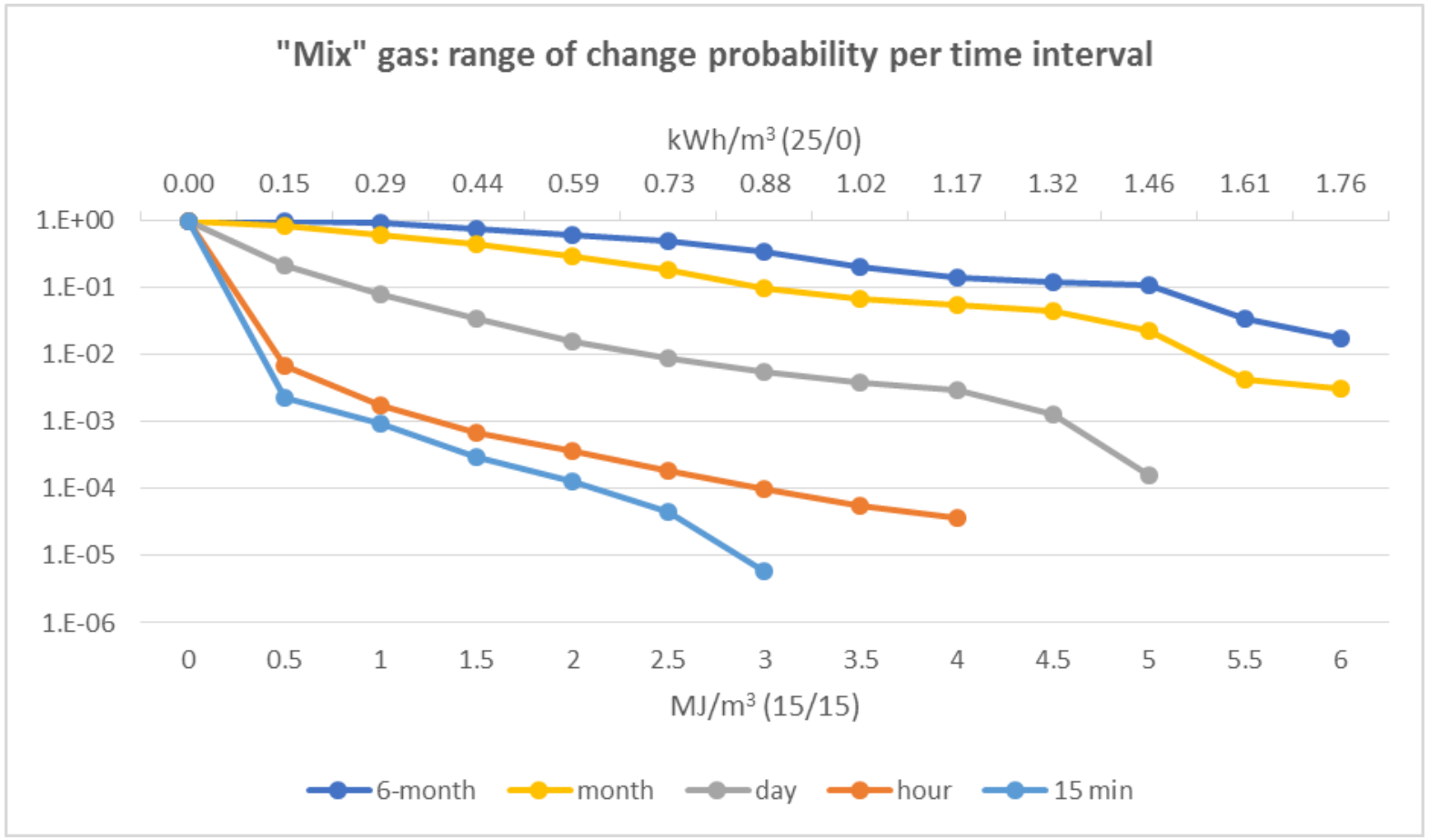

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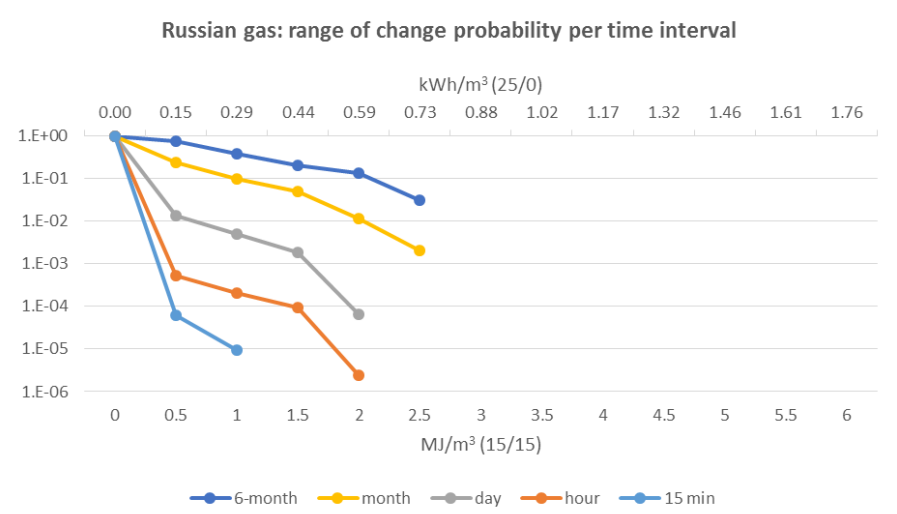

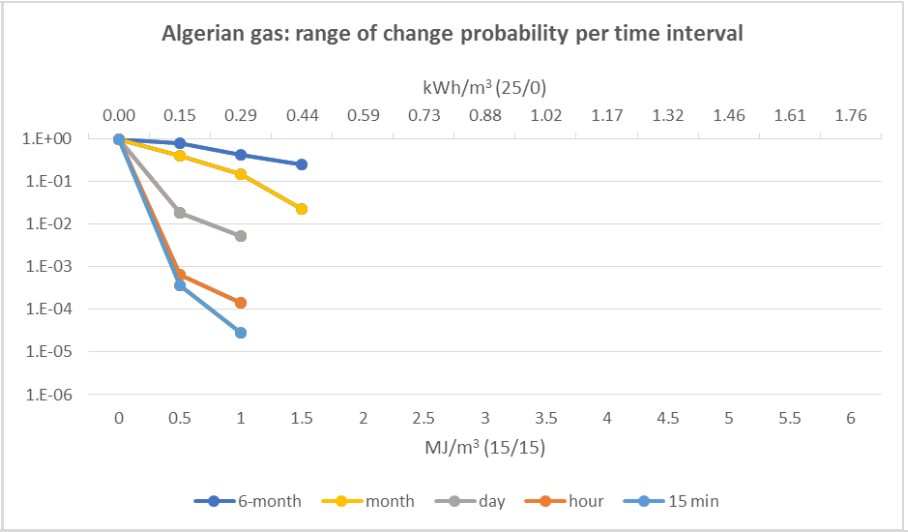

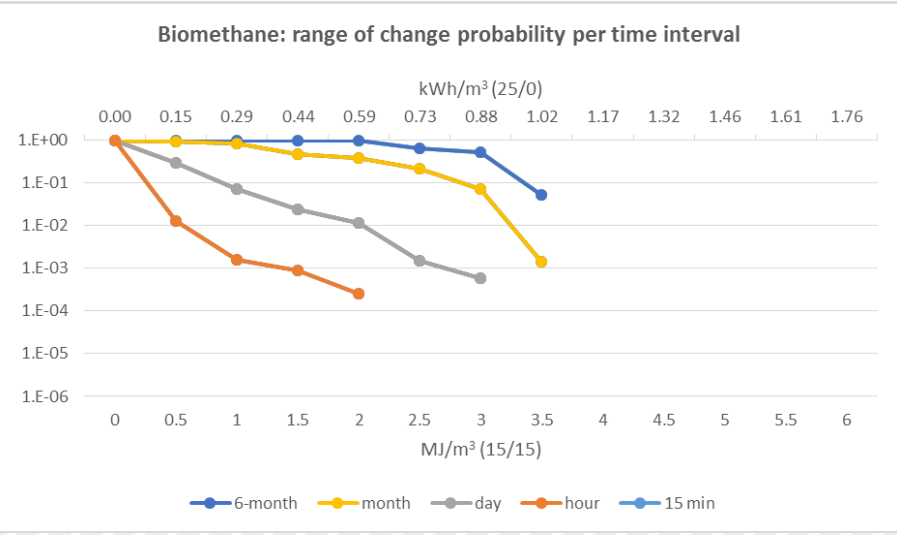

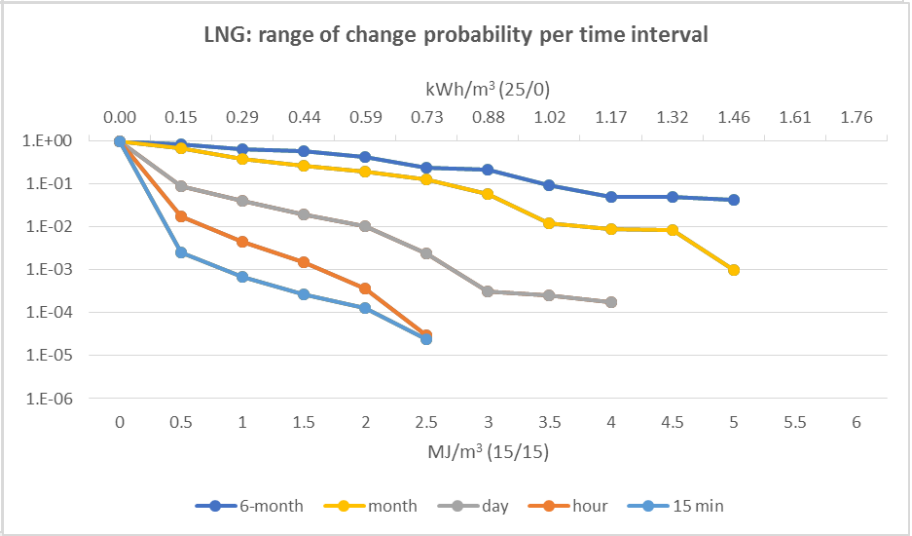

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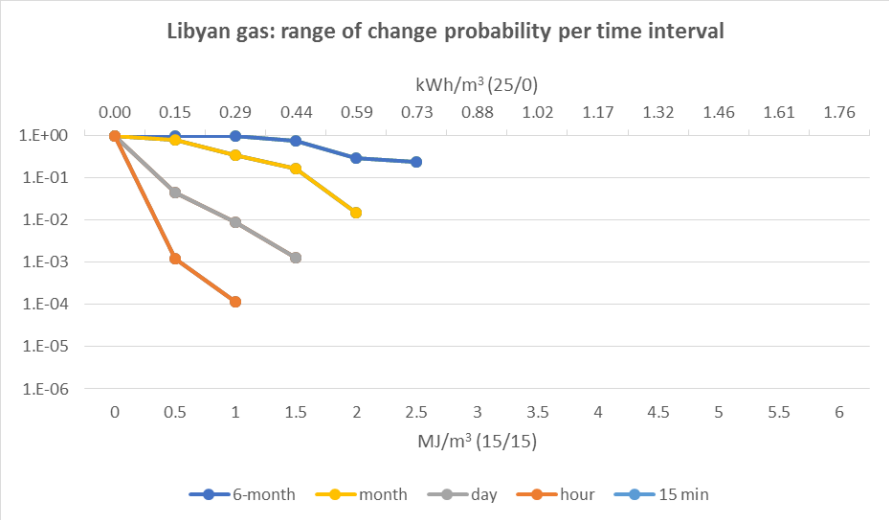

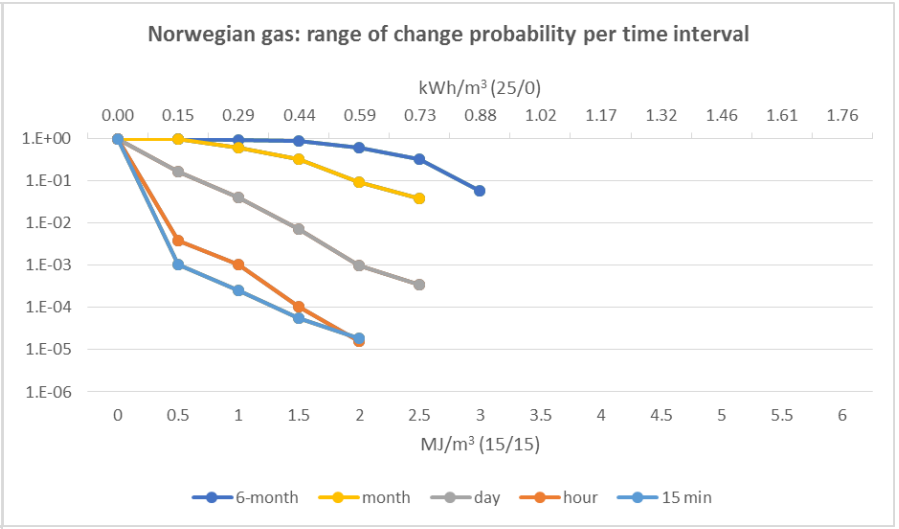

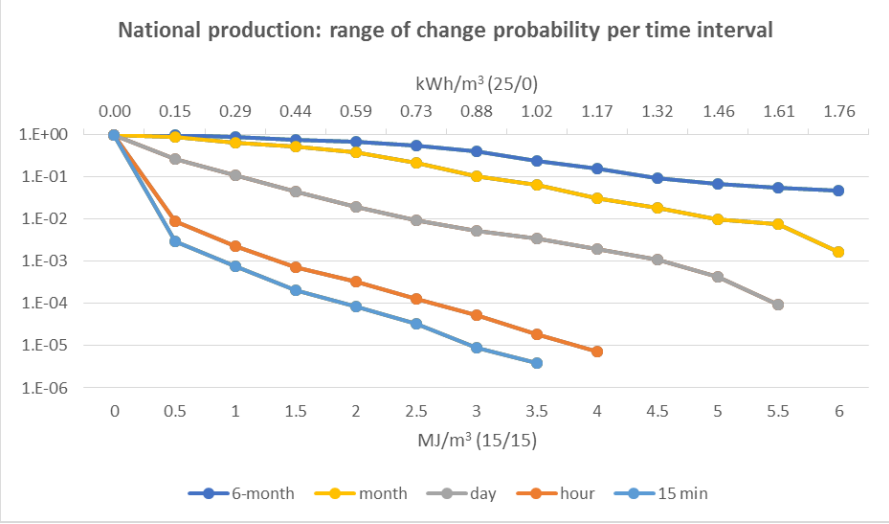

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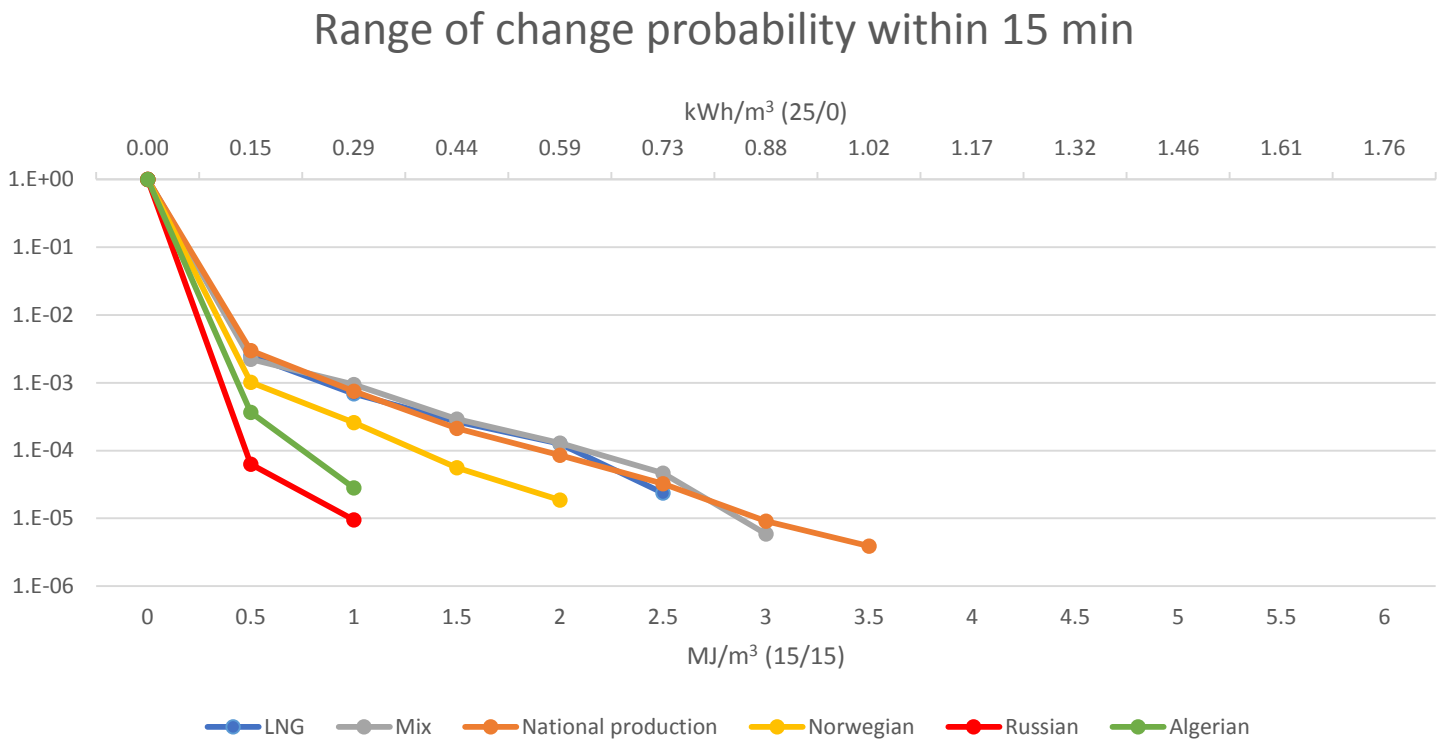

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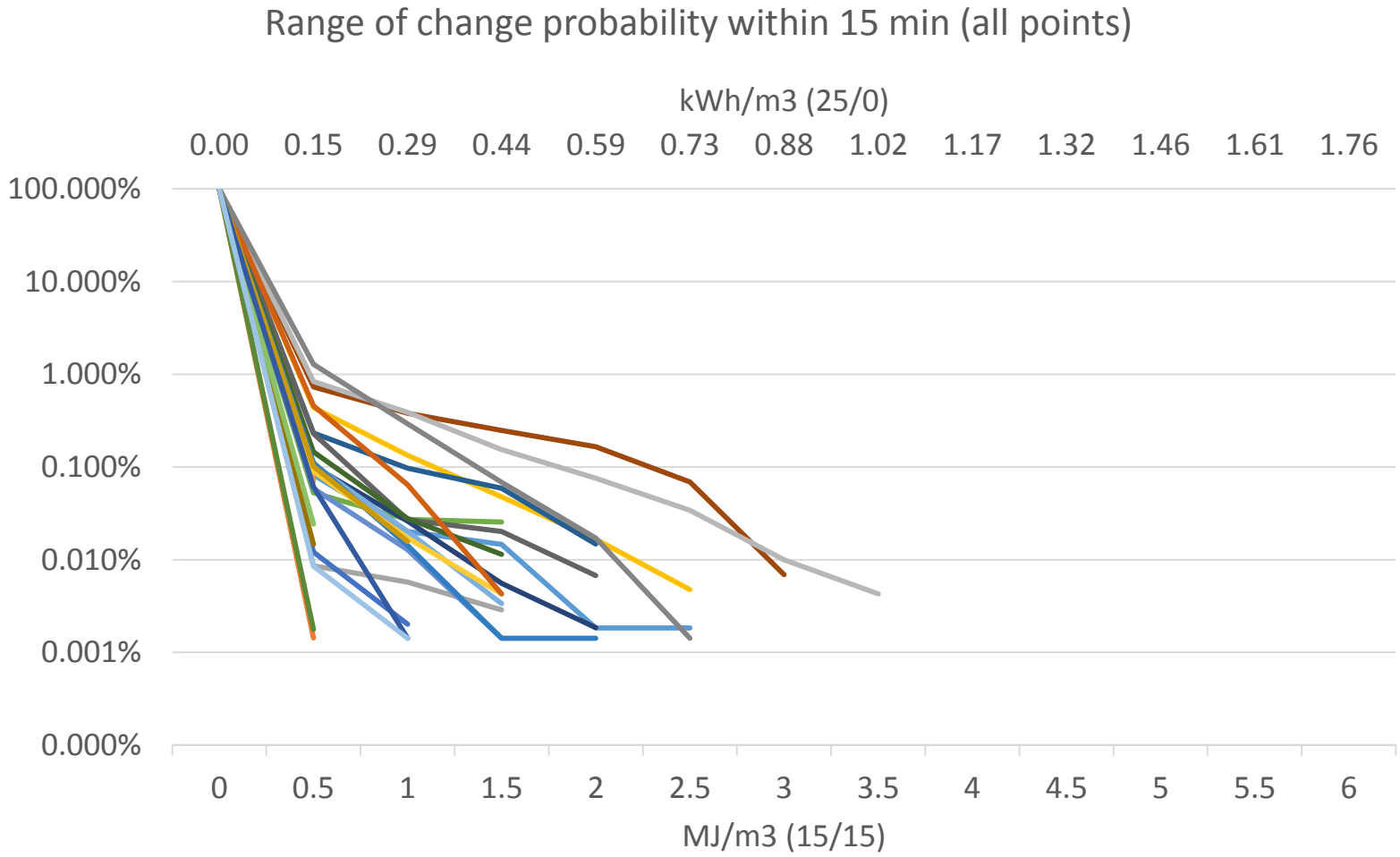
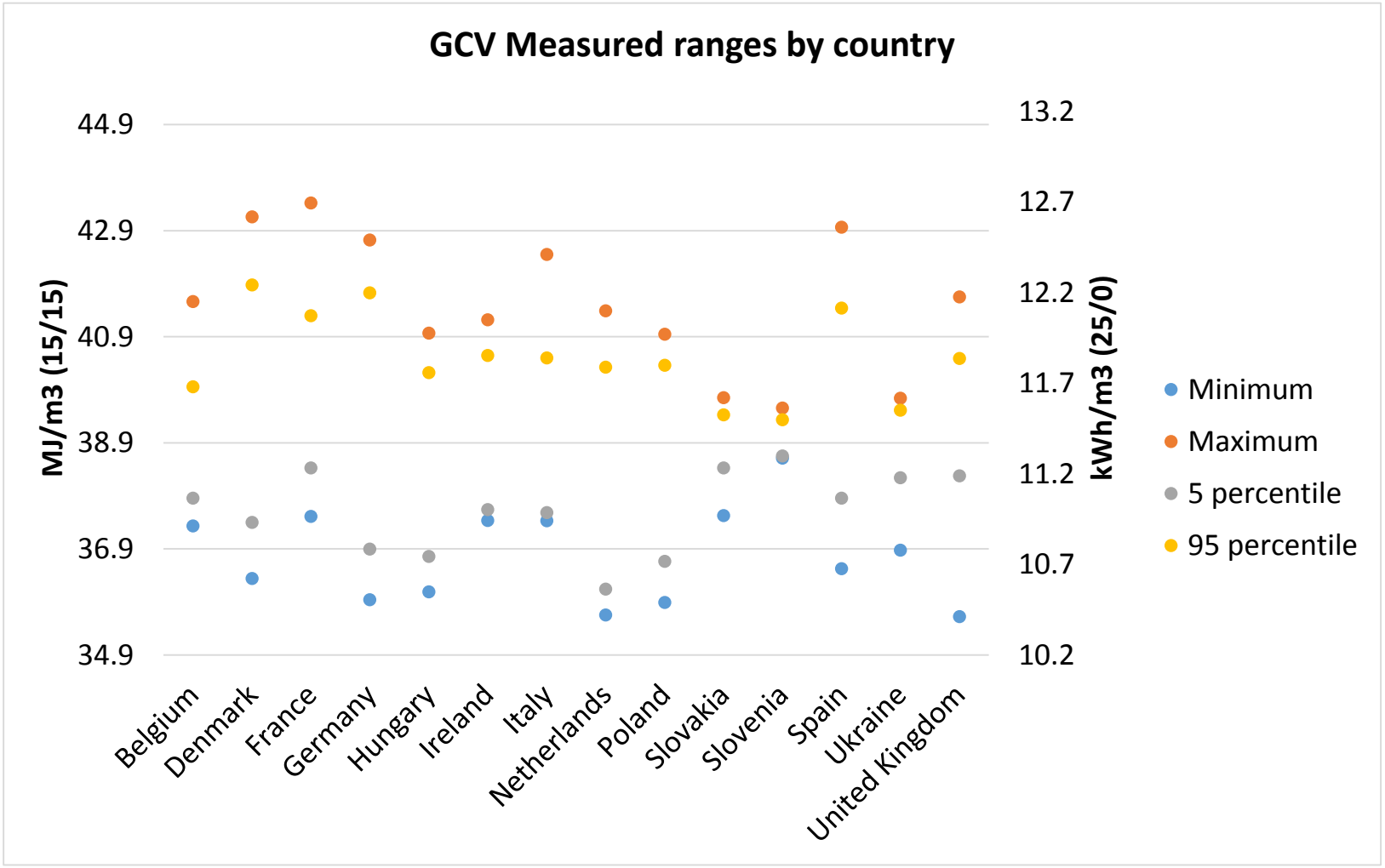


4 Presentation of methodology and TSO results – A few figures for GCV

Antonio Gómez Bruque - ENTSOG

WI and GCV in Europe – TSO results



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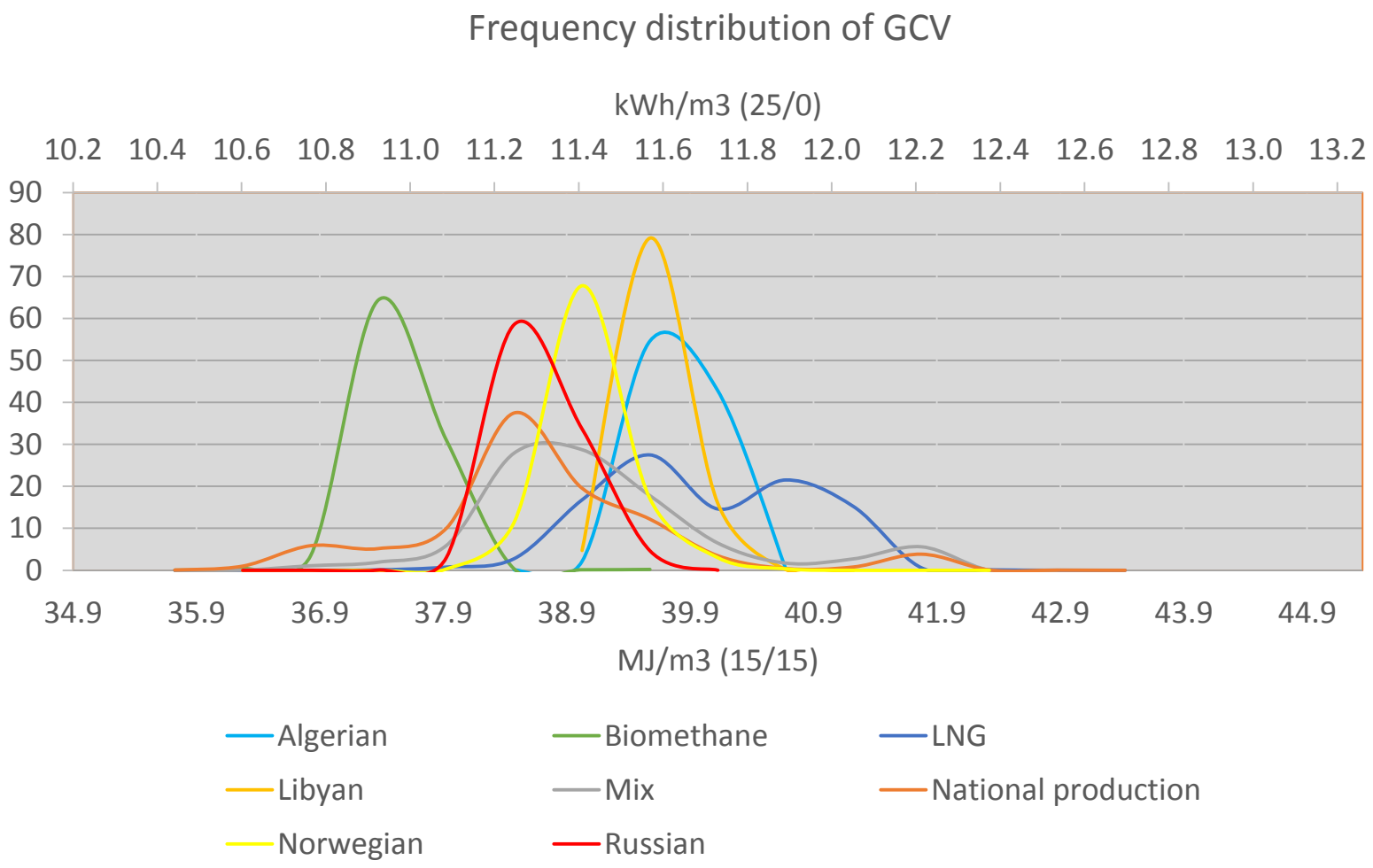

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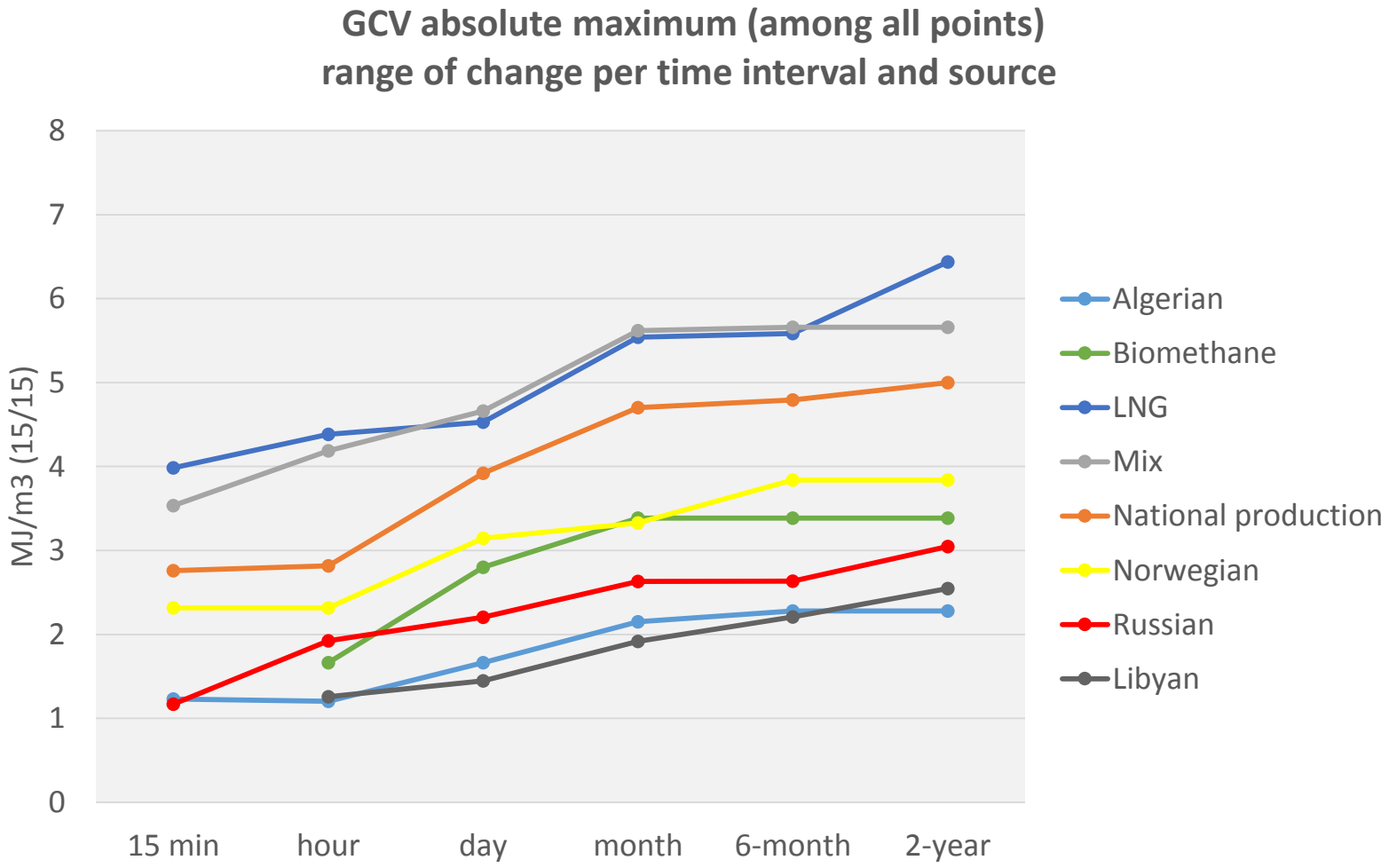


4 Presentation of methodology and TSO results – Preliminary remarks

Antonio Gómez Bruque - ENTSOG

WI and GCV in Europe – TSO results

Preliminary remarks on WI TSO results

- A representative sample: more than 130 data sets from 17 TSOs across 13 countries
- Great variety of WI ranges, also at individual exit points, often supplied with mixes
- While imports to EU may be within a 5 MJ/m3 range, national production has a wider range
- Frequency distribution of WI strongly influenced by the source(s)
- Range of change: the longer the period observed the wider the change
- Range of change: some supply sources within 3 MJ/m3 but others within 5 MJ/m3
- Very wide variations on (exit) points supplied with mixes of gas or indigenous production: above 6 MJ/m3

6 Introduction to long term gas quality monitoring outlook 2018

Antonio Gómez Bruque - ENTSOG

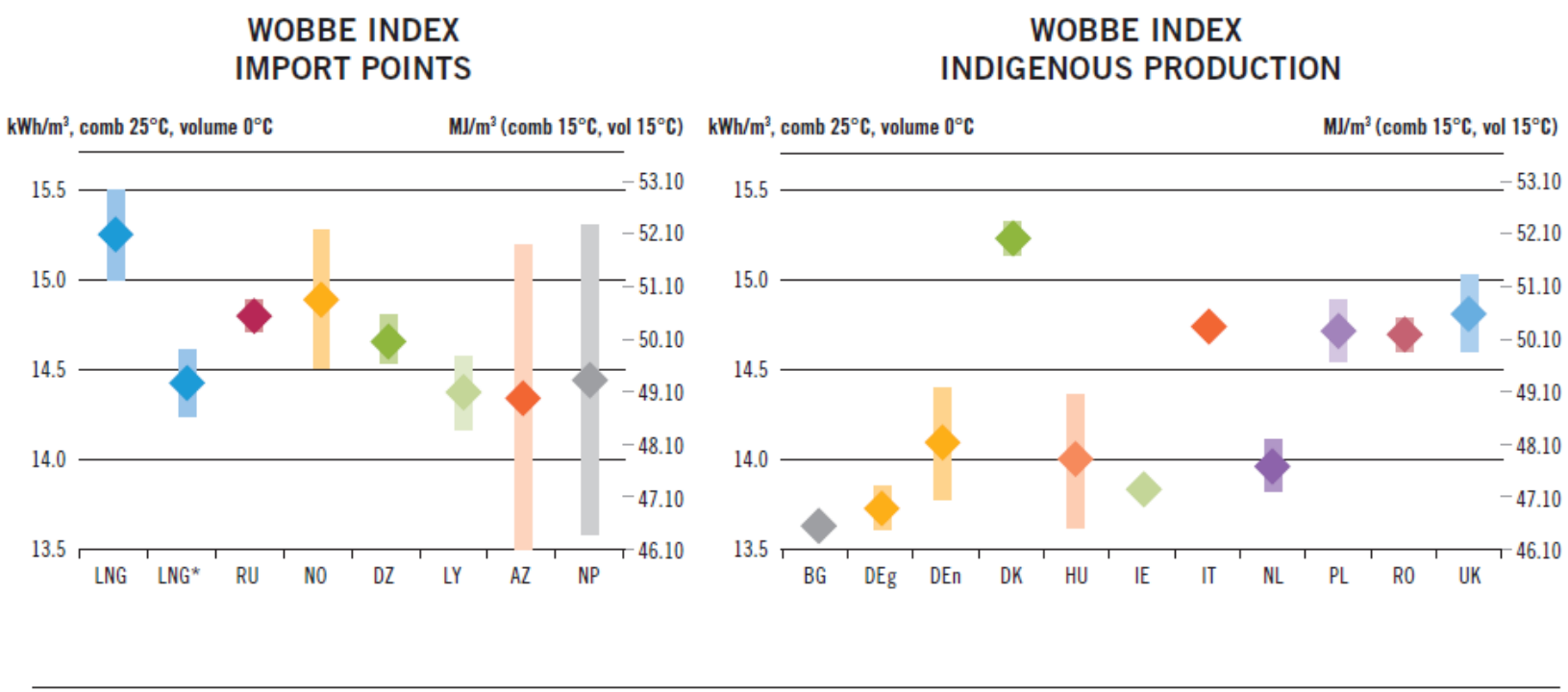
Gas Quality Outlook

Regulatory basis: EU REG 703-2015, article 18:

- ENTSOG shall provide a „Long Term gas quality outlook in order to identify potential trends of gas quality parameters and respective potential variability within the next 10 years“
- The GQ-Outlook shall:
  - include at least Wobbe-Index (WI) and Gross Calorific Value (GCV) as gas quality parameters
  - include new supply sources
  - published consistent and aligned with the Ten Year Network Development Plan
  - for every gas quality parameter and region include a range in which the parameters are likely to evolve
  - define reference values of gas quality depending upon an analysis of the previous years

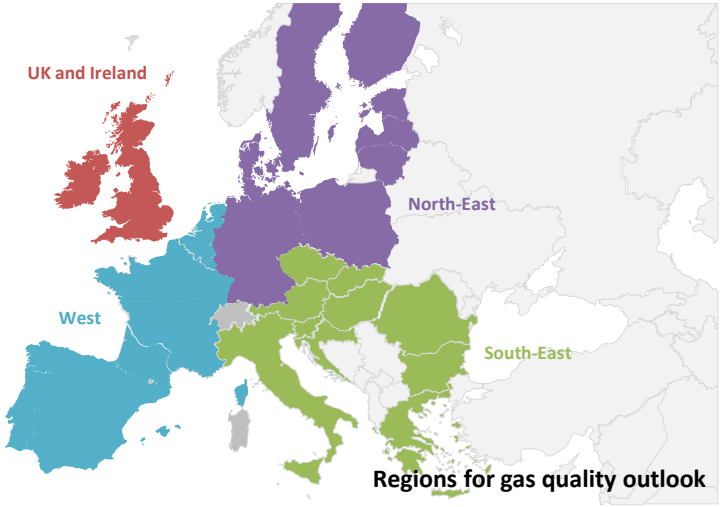
Gas Quality Outlook

Edition 2017 – Gas quality reference values

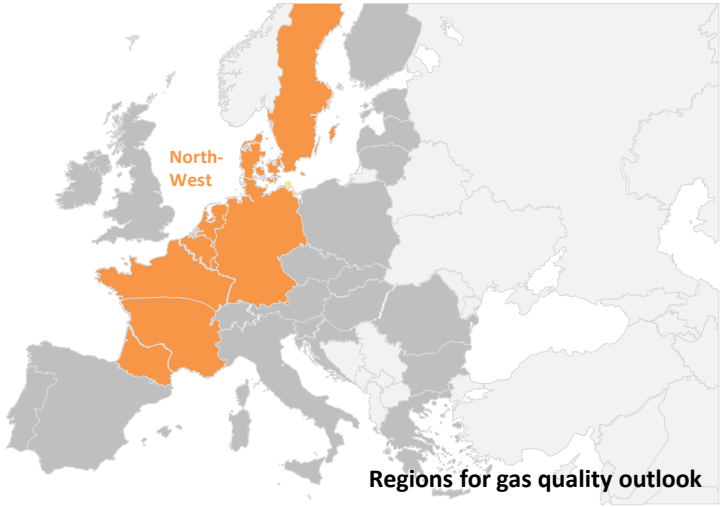


Gas Quality Outlook

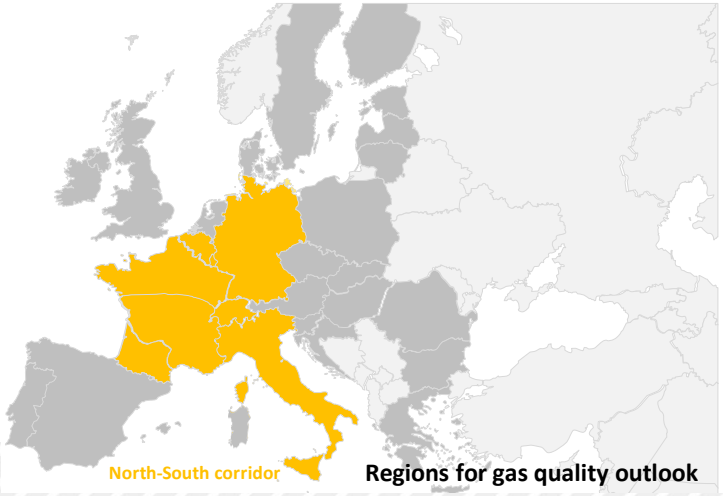
Edition 2017 – Regions (remove footnote)



Regions for gas quality outlook



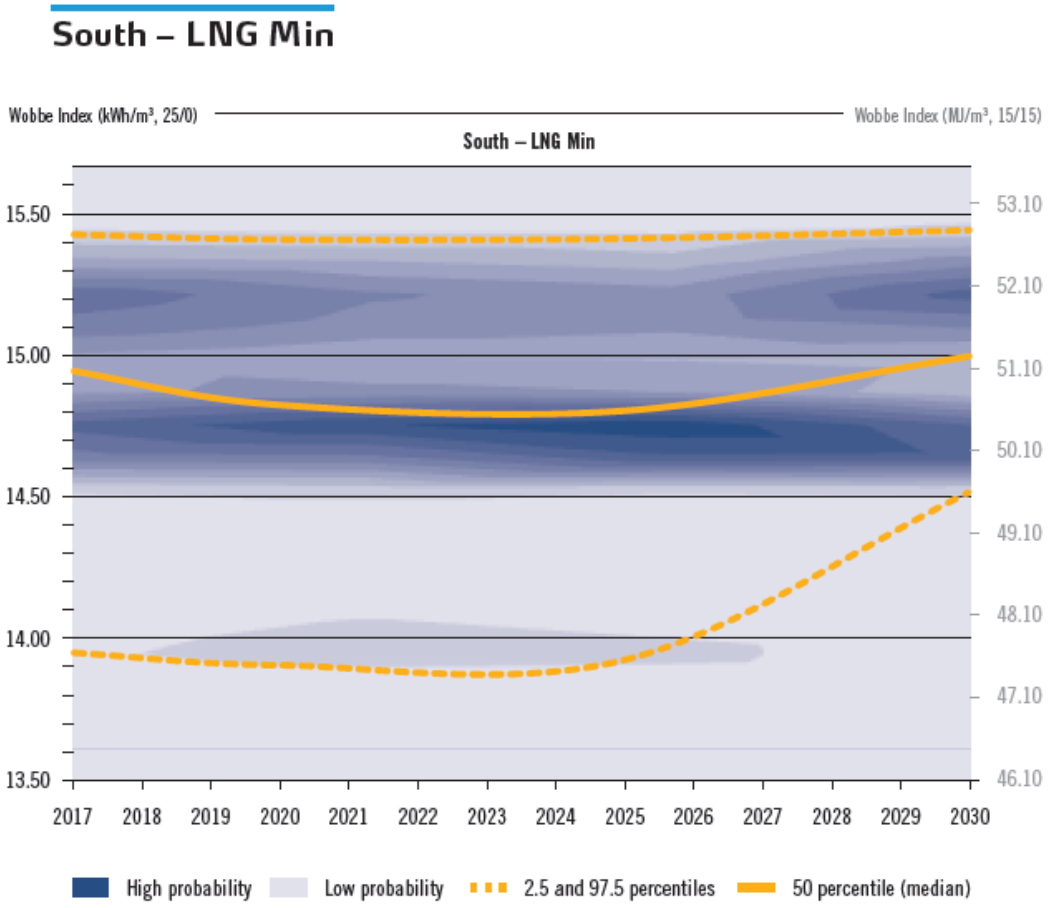
Regions for gas quality outlook



Regions for gas quality outlook

Gas Quality Outlook

Edition 2017 – Example of regional outlook



Gas Quality Outlook

Relation to the CEN survey

- Gas Quality Outlook focuses on how the evolution of supply patterns may affect quality ranges in different regions
- CEN survey has added a focus on individual (exit) points, including not only value but changes per time interval

Improvements for 2018 edition

- Revision of composition of the regions
- General update of reference gas quality data:
  - Inclusion of reference values for biomethane
  - Revision of LNG values in view of LNG supplies from US and new values from UK

Next steps

- Gas reference values will be publicly consulted within the TYNDP 2018 process.
- Publication by mid 2018

Thank You for Your Attention

Antonio Gómez Bruque
Interoperability Adviser

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