Biomethane Quality
& distribution

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alliander

Overview

Biomethane ambitions and market

Growth biomethane volume and facilitating growth

Gas grid and gas quality and standards

Biomethane

- Biomethane
  - Upgrading of biogas from anaerobic digestion of wet biomass.
  - Gasification of solid dry biomass.
  - Plant size 20Nm3/hr – 10000Nm3/hr
- Quality of gas fit for public distribution

Gasquality

- Different gas quality standards in EU countries
- Biogas from sources such as sewage sludge and industrial waste is forbidden in some countries
- EU standardization on Nat Gas & Bio methane

Biomethane ambition & market

Ambitions

- Biomethane could deliver more than a third of Europe's natural gas production or around 10 % of the European consumption
- Ambitions Countries: increase production with subsidy schemes, first CHP more & more Biomethane

Economics

- Side effect: Increase in biomass prices
- Biomethane business case competes with CHP and BioLNG
- 40-60 Cts cost of production Nm3
- No subsidy, no biomethane

Country	Biomethane plants	Biomethane plants feeding the grid
Austria	10	7
Croatia	-	-
France	3	1
Germany	84	82
Hungary	1	-
Italy	-	-
Netherlands	13	13
Poland	-	-
Slovakia	-	-
UK	2	2
Sweden	47	8
Switzerland	17	15

Biomethane ambition & market

Market

Search for feasible business cases

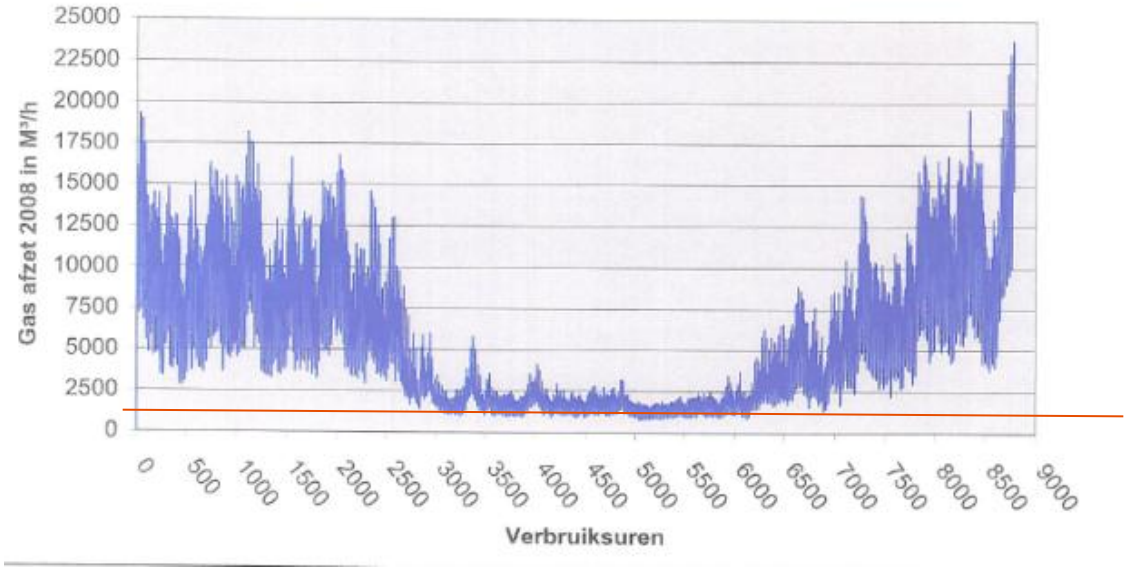
Winning cases

- Organic Waste households
- Organic waste food-industry
- Manure + waste streams
- Production Green Gas + CNG or LBG for transport + CO2

Technical Developments

  - Manure digestion on micro scale (20m3-60 m3 hour), farm scale (200 cows)
  - Upscaling: Biogas hubs + larger plants
  - Upgrading technologies (cryogenic)
  - Biogas hubs: seperate biogas grid with central upgrading unit to create biomethane

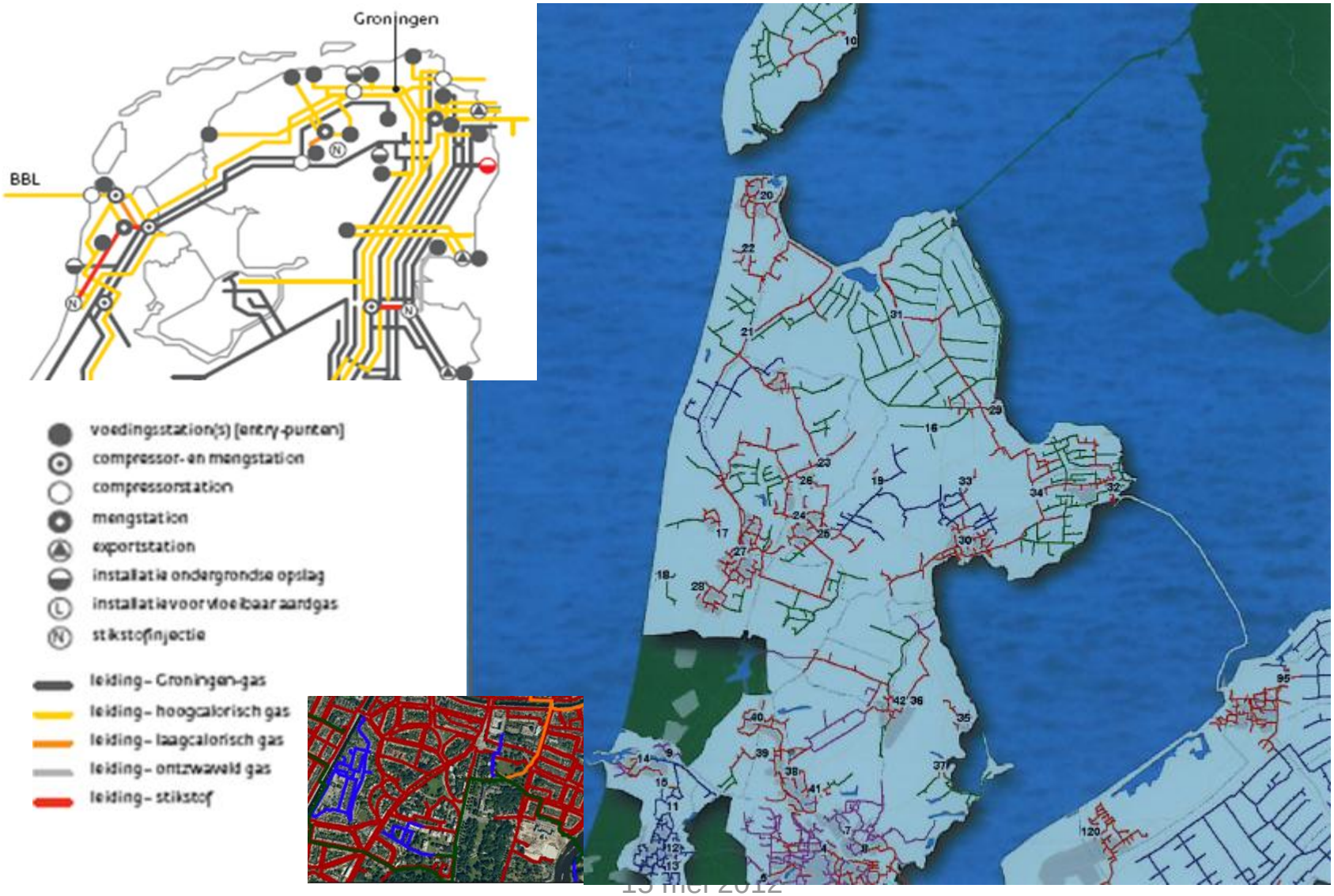
Growth biomethane volume DSO Grid



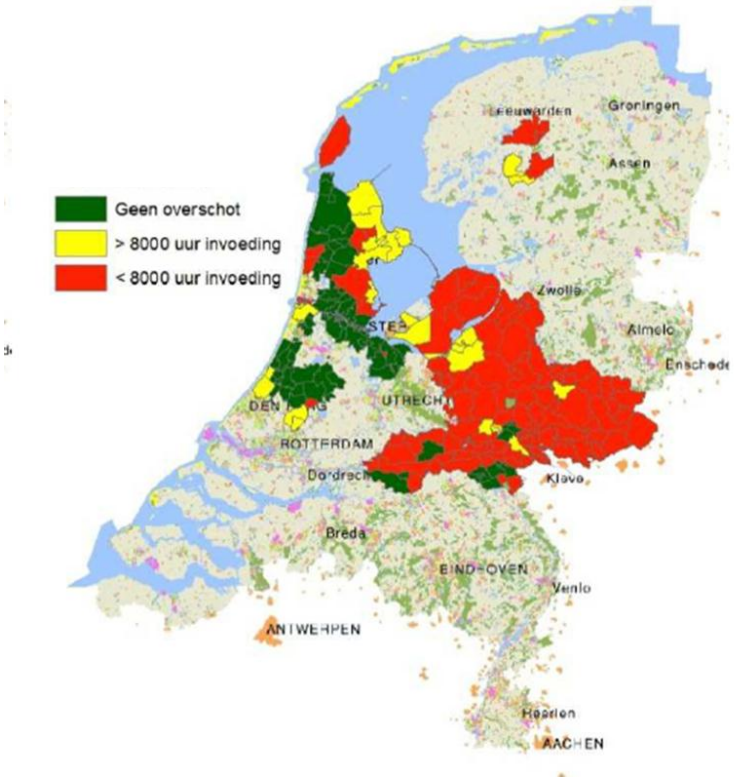
1200 m3/hr

Feed in: for example Max 1200 M3/hr. (small City)
Agricultural area's much lower.
Average size plant ca. 300-400 m3/hr.
Feed-in capacity is limited, often one or two per Gate Station grid

Growth biomethane volume
DSO Grid:View on current Grid structure



DSO Grid and growth injection: View on current Grid structure Make a Scenario Analysis

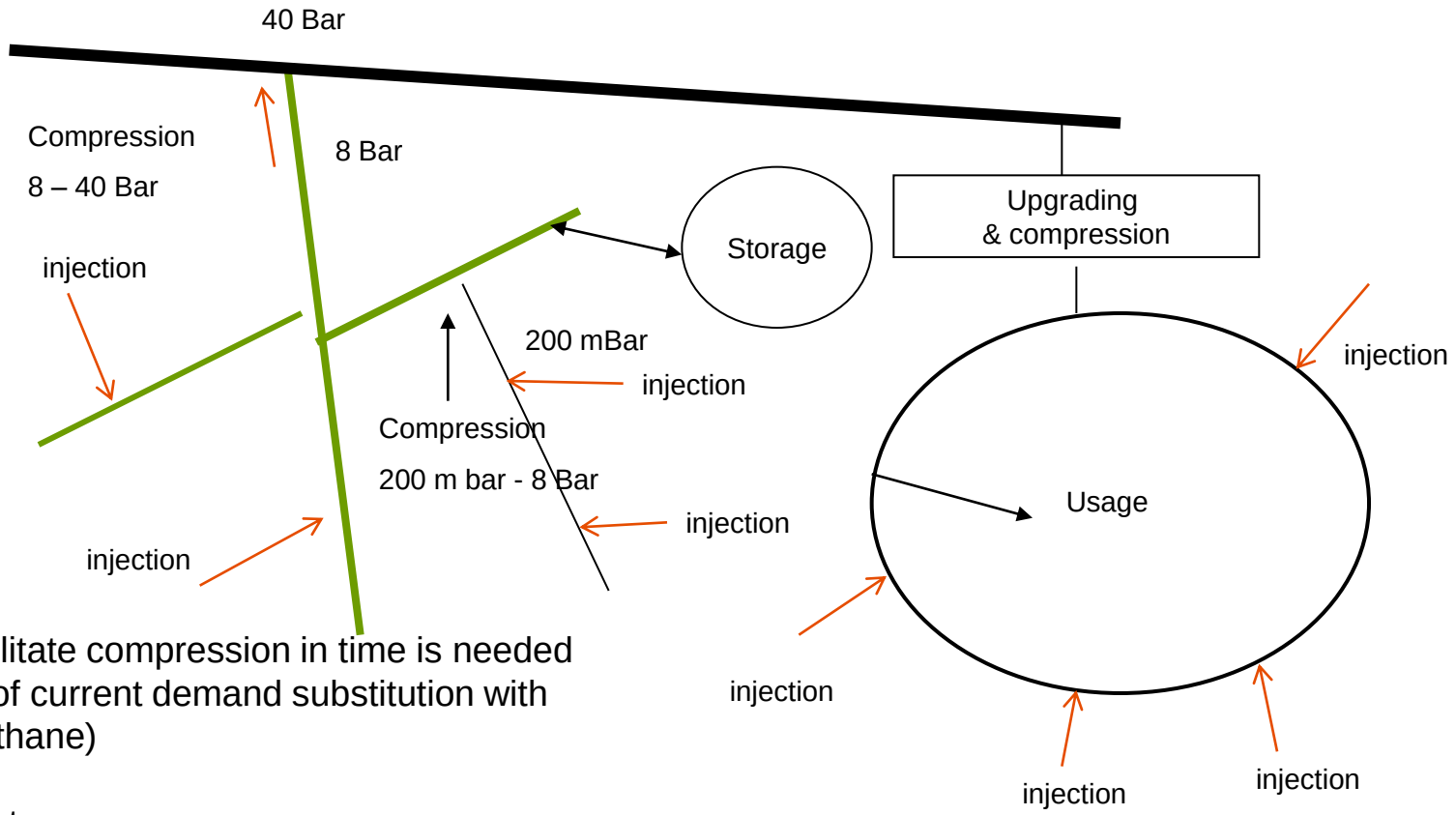


Will yearly growth of volume with subsidy scheme fit with current infrastructure in place? (connecting feed-in on current grid)

Capacity is limited in area's where production of biomethane is foreseen (agricultural area's)

EU wide same cap. limitation expected, withholding growth of biomethane feed-in

Facilitating Growth: Compression & central upgrading Biogashub

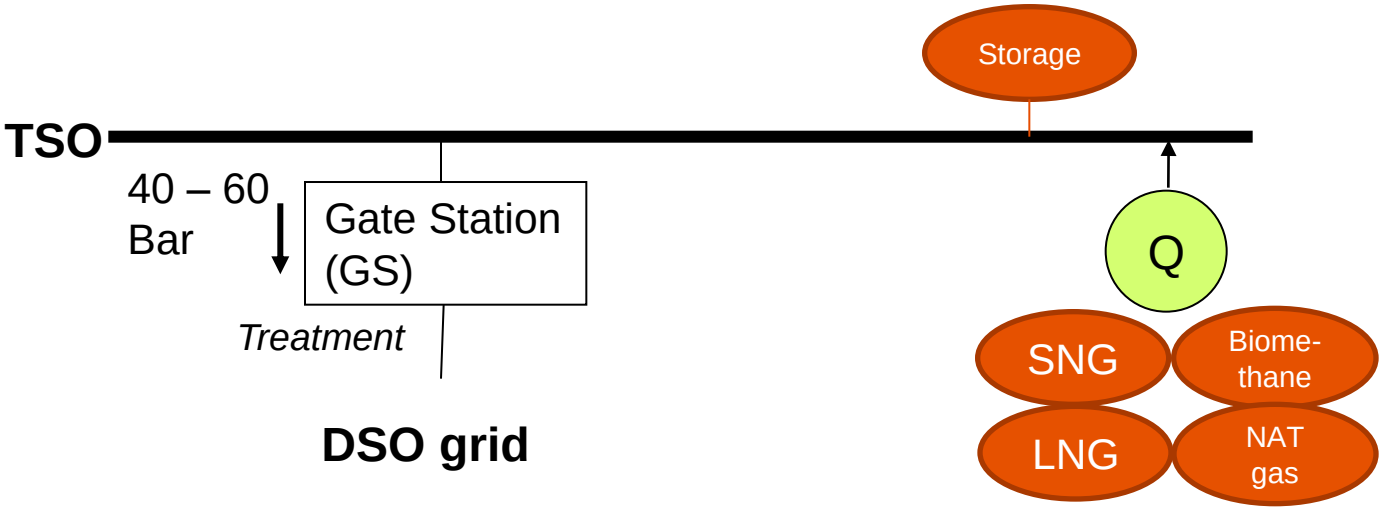


To facilitate compression in time is needed (10% of current demand substitution with biomethane)

But first:

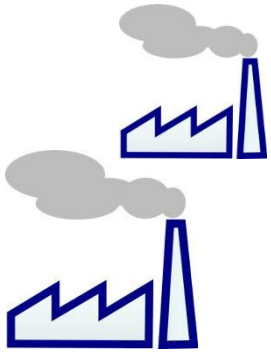
- Can you create more local demand?
- Is a biogashub more cost efficient?

Gas: New sources will be introduced



- As a DSO you will receive a specific type or blend of gas, depending on geographical aea
- Quality Gas: Complies with National Standards (bandwidth wobbe)
- For Power to Gas: Also feed-in in local DSO grid

Facilitating Growth:
A new business model for the DSO
Resulting in a Smart Gas Grid



TSO

Storage

40 – 60 Bar

Gate Station (GS)

Compressor station (CS)

DSO

Q

Gas producers

SNG

Biome-thane

LNG

NAT gas

User

Treatment

16 - 4 Bar distr. grid

User

Demand managenent

DSO

Storage

Gas producer

Q

DSO

user

Gas producer

Q

DSO

GS

CS

200 mBar grid

Raw Biogas Network

Q

DSO

Demand managenent

mixing

Treatment

Power to Gas

Q

DSO

CNG station

Grid connection (for pressure quality)

Q = a gas with a specific quality

New DSO tasks:

Gas Mixing, Upgrading. Treatment

Compression, Storage

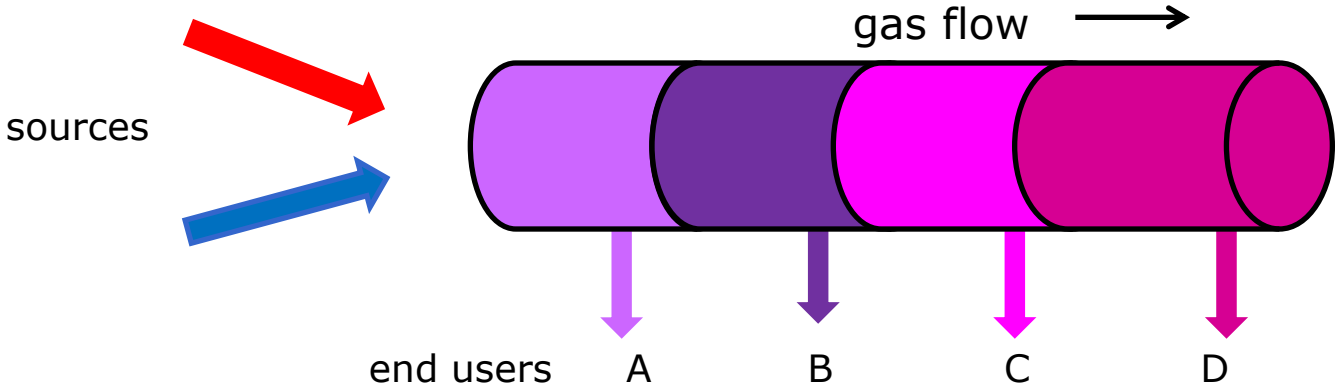
Dynamic Pressure Management

Quality monitoring

Handling Quality Change: Composition changes at end-user locations

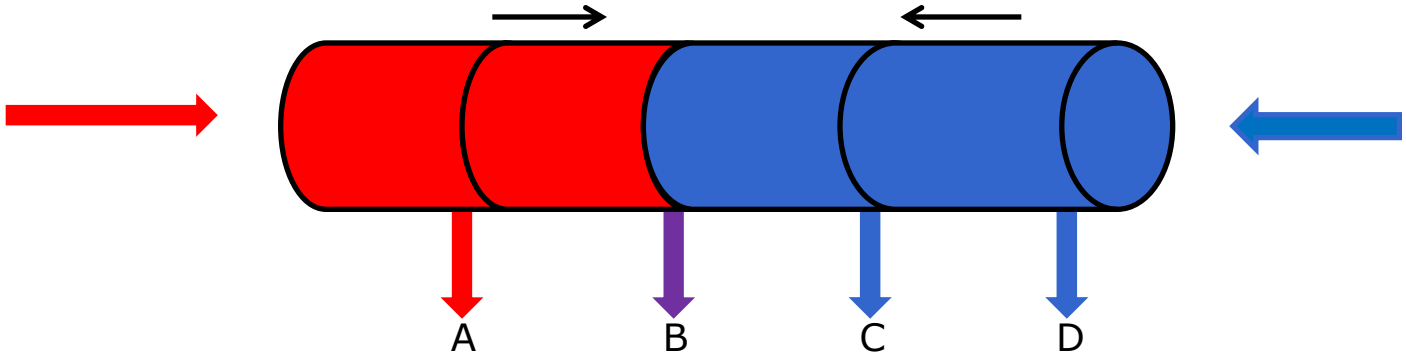
- Single direction section

  (all see the same changes, but at different moments)



- Frontal flow encounter

  (your quality depends on where you are and what all parties do)



But what about the gasquality? DSO perspective

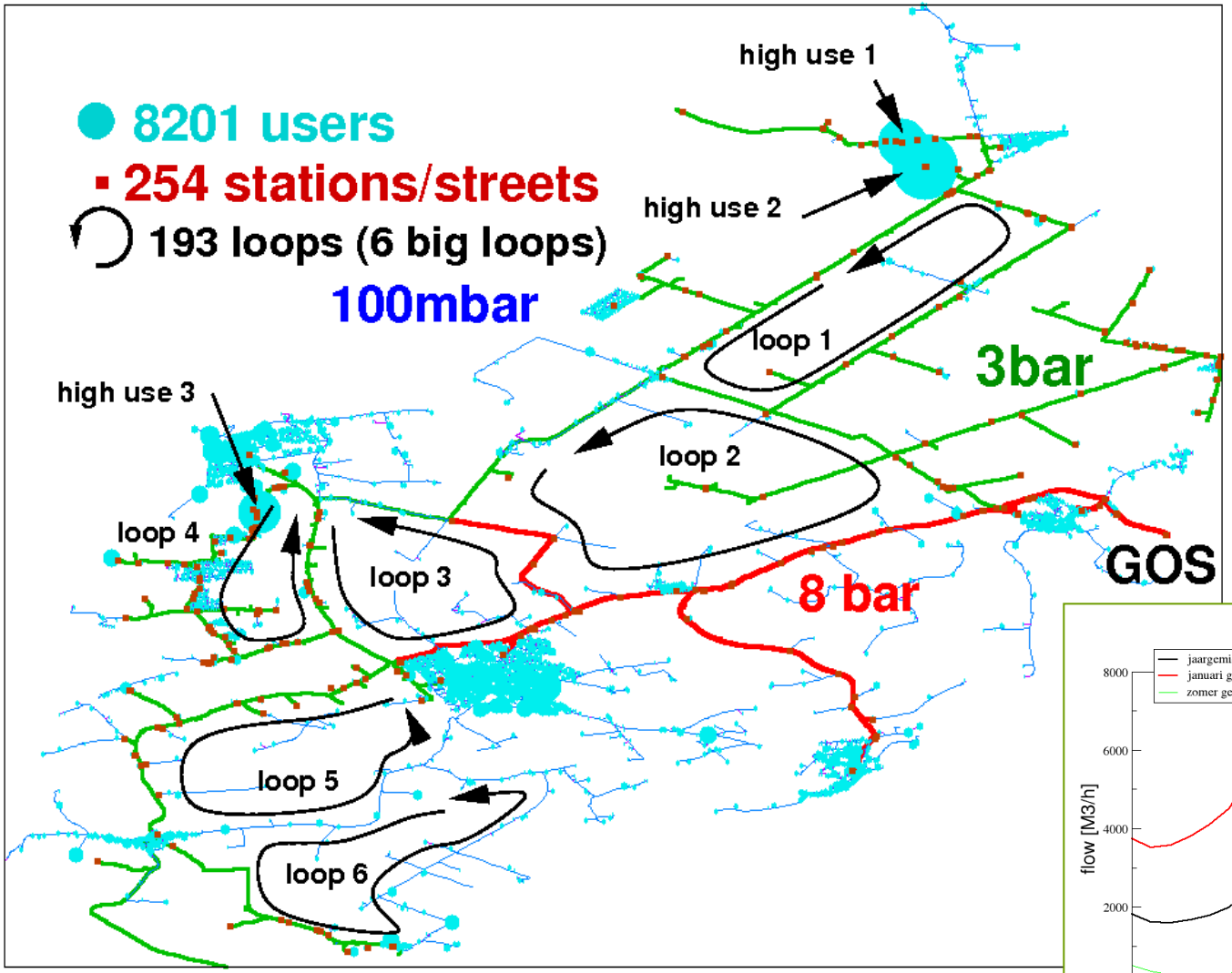
Introduction wider Wobbe band in EU

- Gas received from TSO: LNG terminal, International connections
- Local production of Biomethane (also TSO)
- Introduction upstream operability (compression TSO (16 bar higher grid)
- Local production of SNG (TSO?)

Gasquality treatment : Interchangeability DSO grid and upstream (Different gasqualities?)

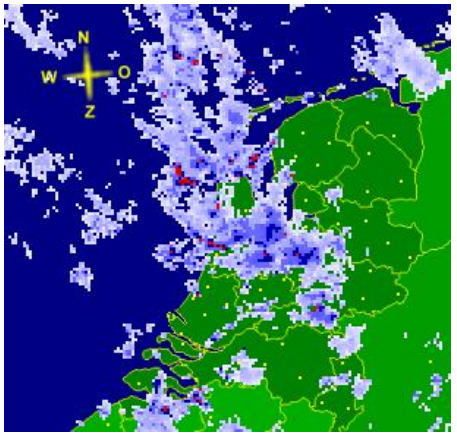
- Biomethane: Wobbe setpoint
- Methane number higher than >100 (AVL 3.2) vs 70?
- Calorific value
- Alignment Gasquality DSO/TSO and local injection

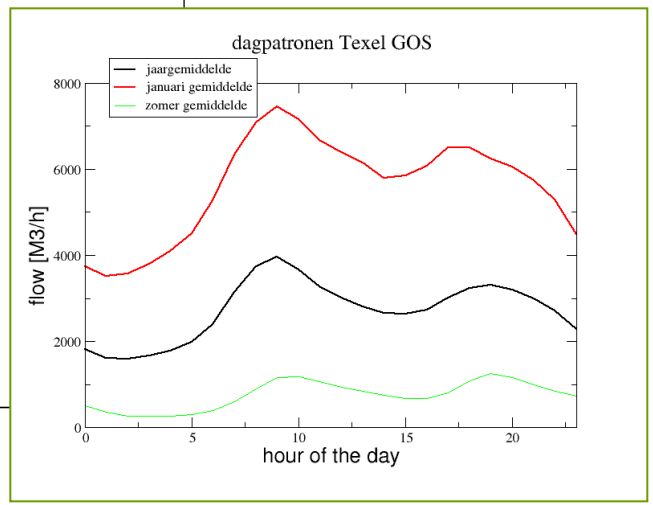
Simulation : Gasnet Texel (MPC)



MPC

Model Predictive Control
(impact 8-24-48 uur)

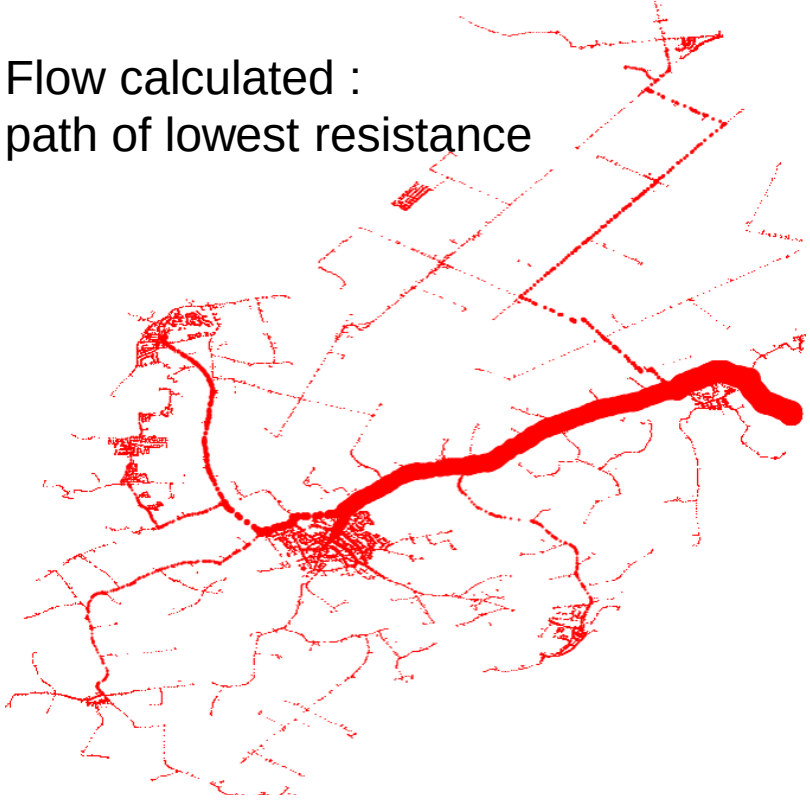


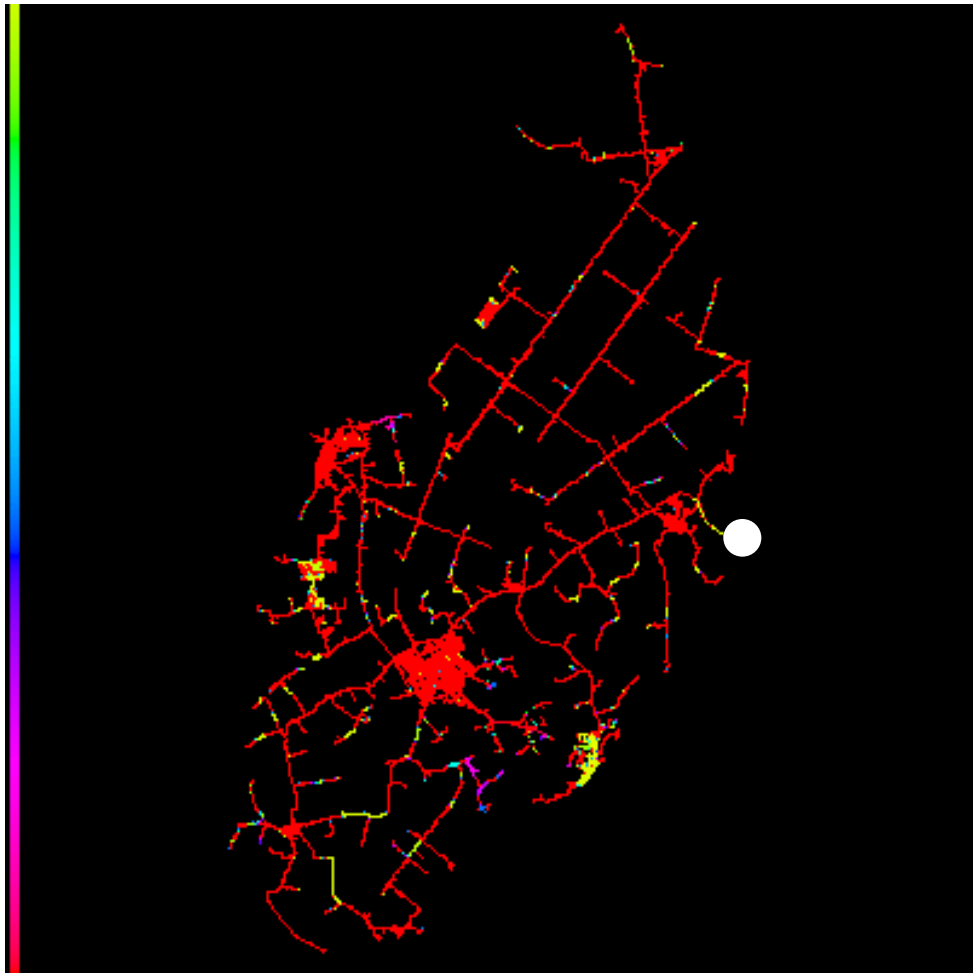


Product liability:
Where is the product you distribute ?

flow results *10 minutes (yellow) in 50 minutes*

Flow calculated :
path of lowest resistance

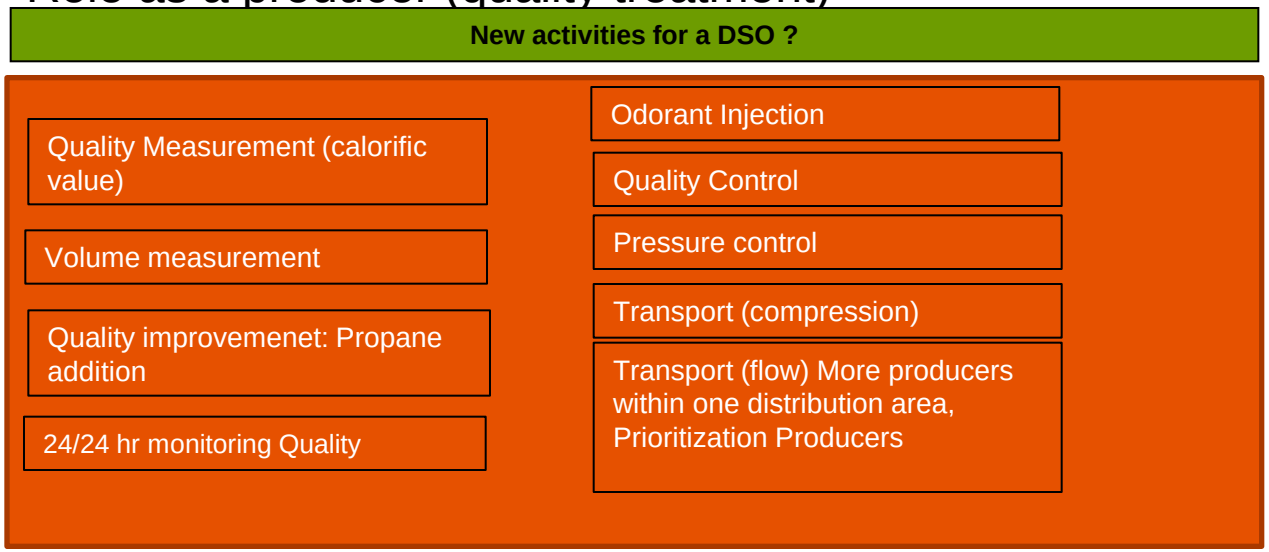




gebalanceerde flow

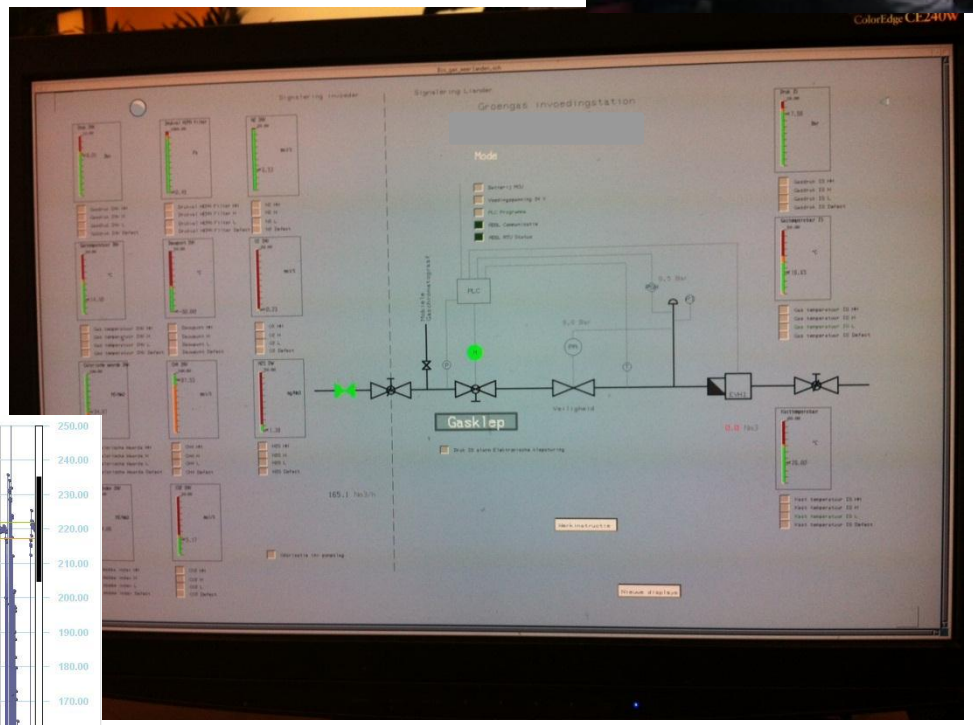
Gasquality roles: old and new parties fullfilling a (new) gasquality role

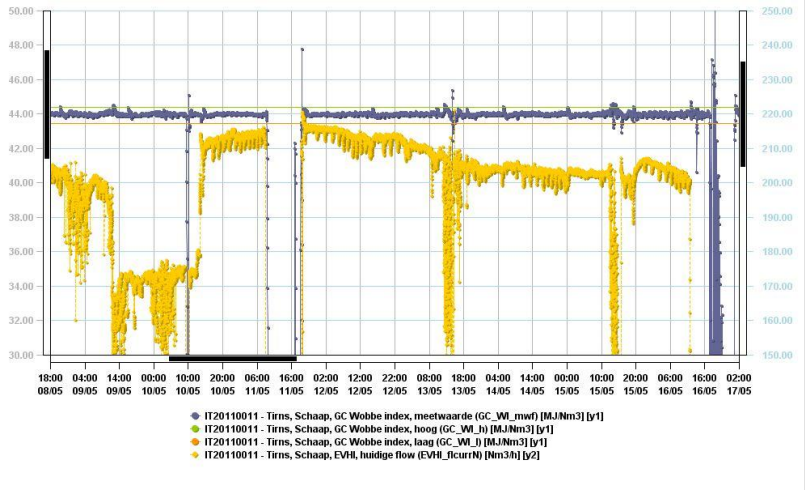
- The (Professional) Producer: Exit = entry or blending specs? DSO as a contractor on gasquality & monitor
- The DSO: Quality improvement, propane addition (right calorific value), : Role as a producer, caloric value & quality measurement
- DSO legal: product liability, safety, more producers within one area, monitoring gasquality 24/24h: Role as a productowner
- The TSO and DSO: Pressure settings, Quality upstream, downstream:
- Role as a producer (quality treatment)



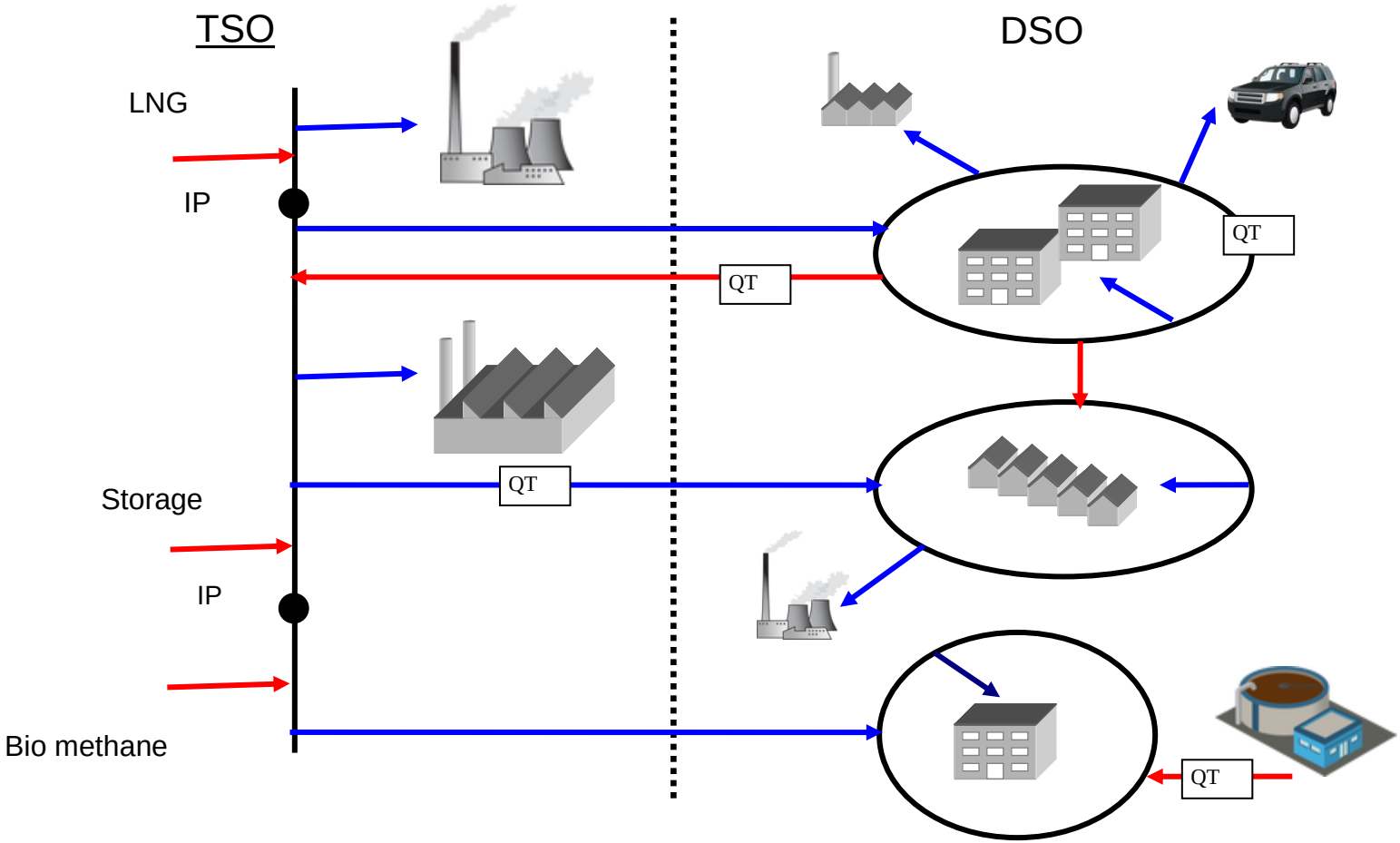
Gasquality & roles:
24 h monitoring gasquality

Main Properties
CaloroificValue
Wobbe-index
Gas composition
CH4
H2S
CO2
O2
N2
Properties
Temperature
Pressure
Waterdewpointr
Odorant Pump
Volume/flow
Nm3
m3(n)/h





Gasquality & roles



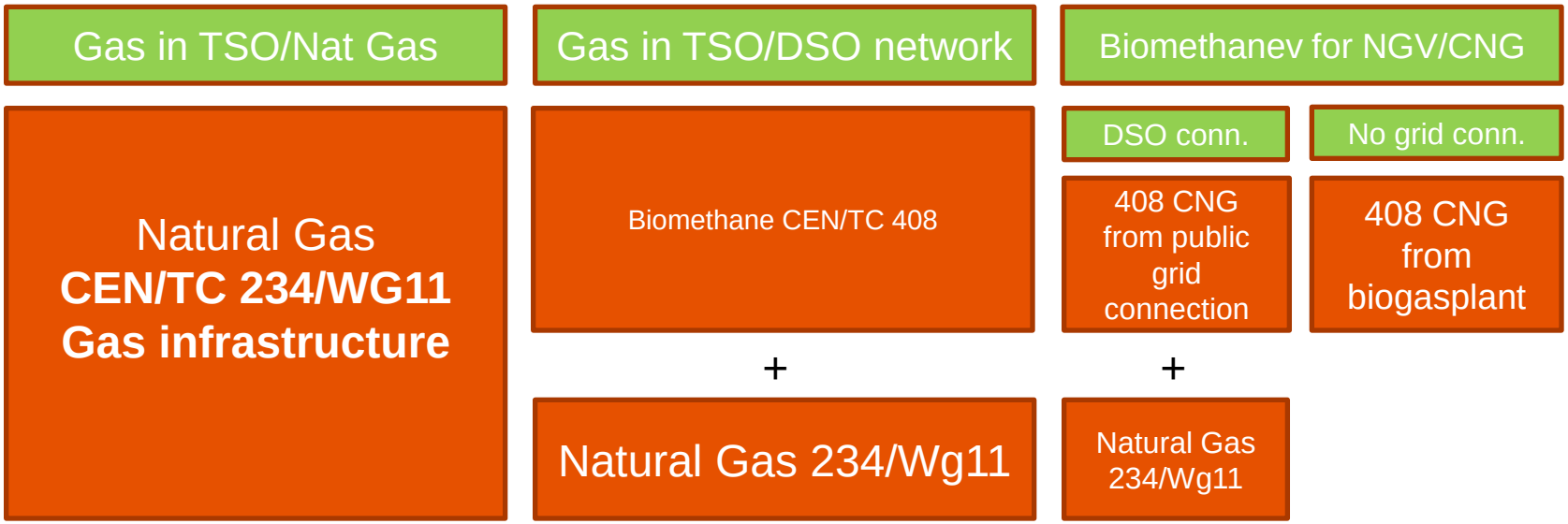
Specs for LNG ≠ Storage ≠ Bio methane ≠ Power plants ≠ large users ≠ small user ≠ CNG

Right quality right purposes

Right specs for LNG ≠ Storage ≠ Bio methane ≠ Power plants ≠ large users ≠ small user ≠ CNG

For GAD and Non GAD Appliances

Normalisation on gas quality:



Migration of current and new appliances to handle a new wider Wobbe bandwidth

Gasquality Biomethane

Natural gas (234/WG11)
Wobbe Index
Higher Heating Value
Relative density
Methane number
CO2
Temperature
Hydrocarbon dewpoint
Water content
Water dew point
Oxygen
COS
H2S
S total
Hydrocarbons dew point
Dust Impurities
Mercaptan

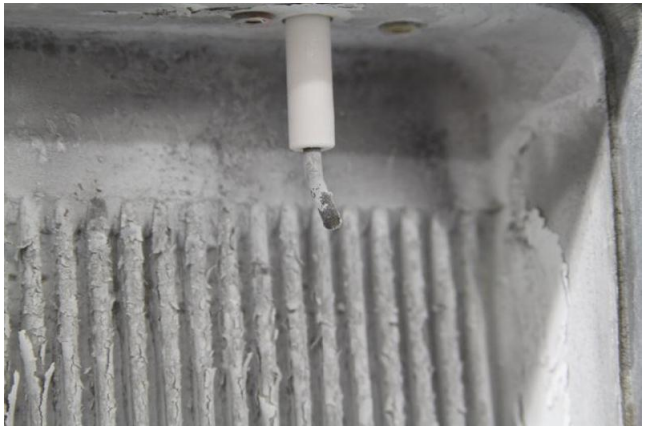
+ Biomethane specific (408)
- Wobbe Index (setpoint)
- Higher Heating Value (propane addition)
- Methane number (>100) (jump)
- Temperature (feed in point) (steel, PE)
- Sulfur total (Odorisation)
- Silicon (issue)
- (aligned with local nat gas spec)

+ Gassification
Benzene
Carbon monoxide

CNG
Methane number
Water dew point (200 Bars)
Silicon
Total Sulfur: Desulphirisation?

Drafts: First quarter 2013

Siloxanes



5 ppm D5 Siloxanes effect

Heat exchanger effect
(siloxanes 5 ppm D5)

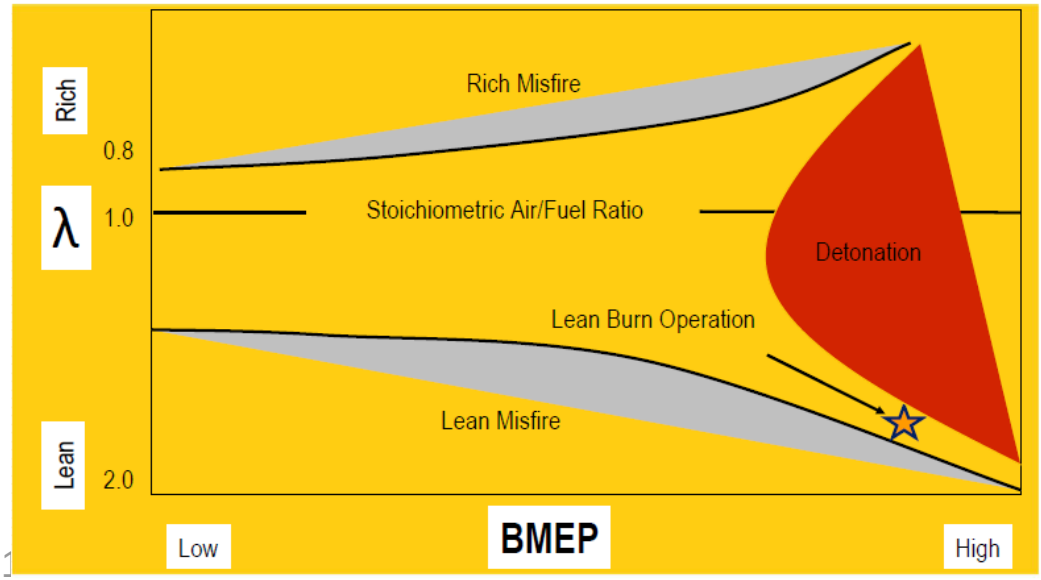
Methane number

Methane number: > 85 (Avl 3.2), minimum of stationary gas engines, speed of change 0,3 MN/s; Possible solutions: Forecast, only TSO grid

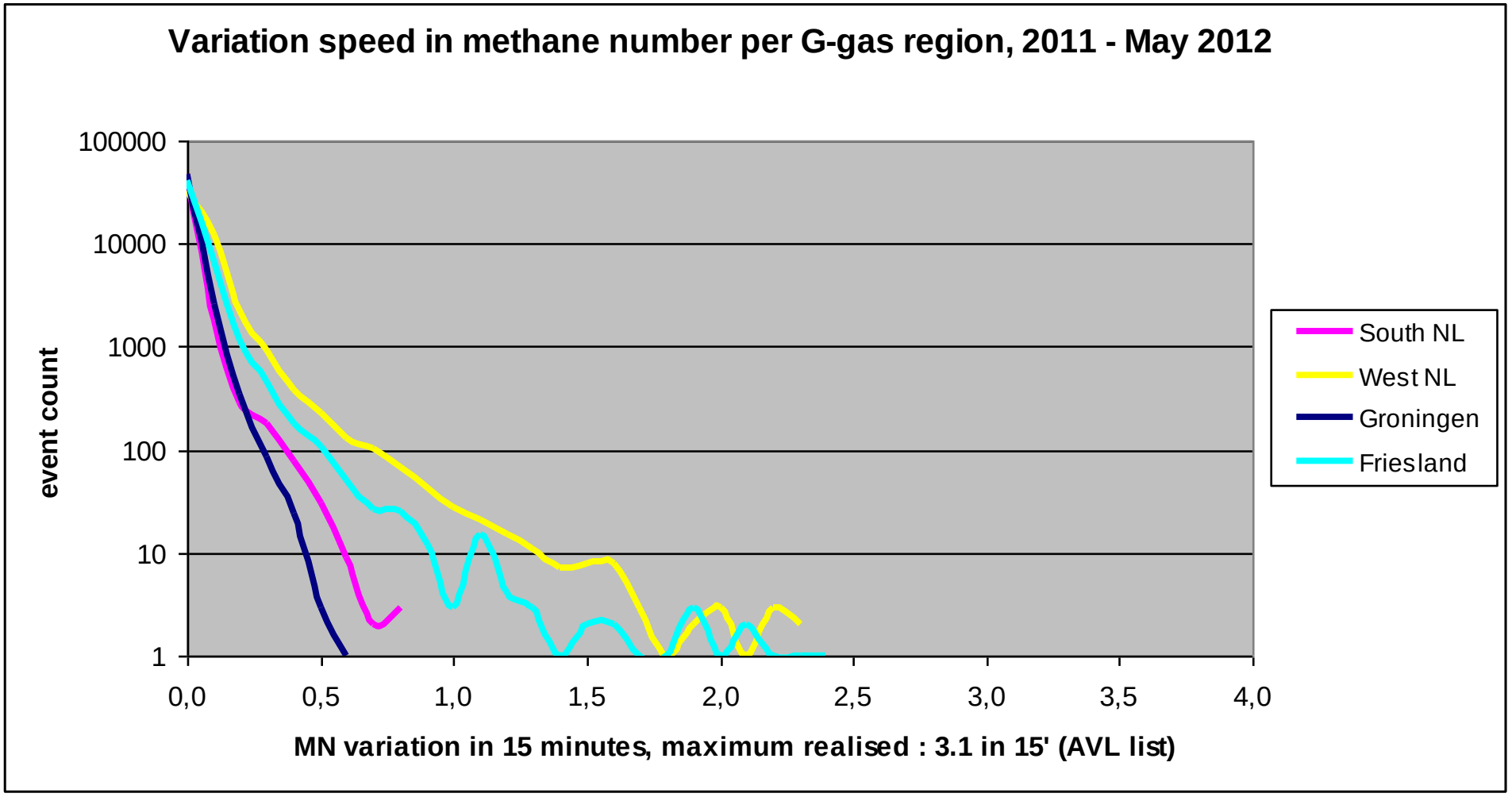
CAT:
Big fast changes are a serious problem for all current engines.
trade-off between:
- Tolerance to gas composition change
- Efficiency
- Reliability
- Stability of Engine Load or

Engine speed
- Investment
- Emissions

NG supply in NLD: Groningen
NG (MN~84)
Dk: Danish NG (MN 70-72)
GER: North GER: MN 72-90+,
South GER: 85+
AUT: 85+
FRA: 72 - 90
ESP: 72 – 80+
ITA: 72 - 90 Europe today

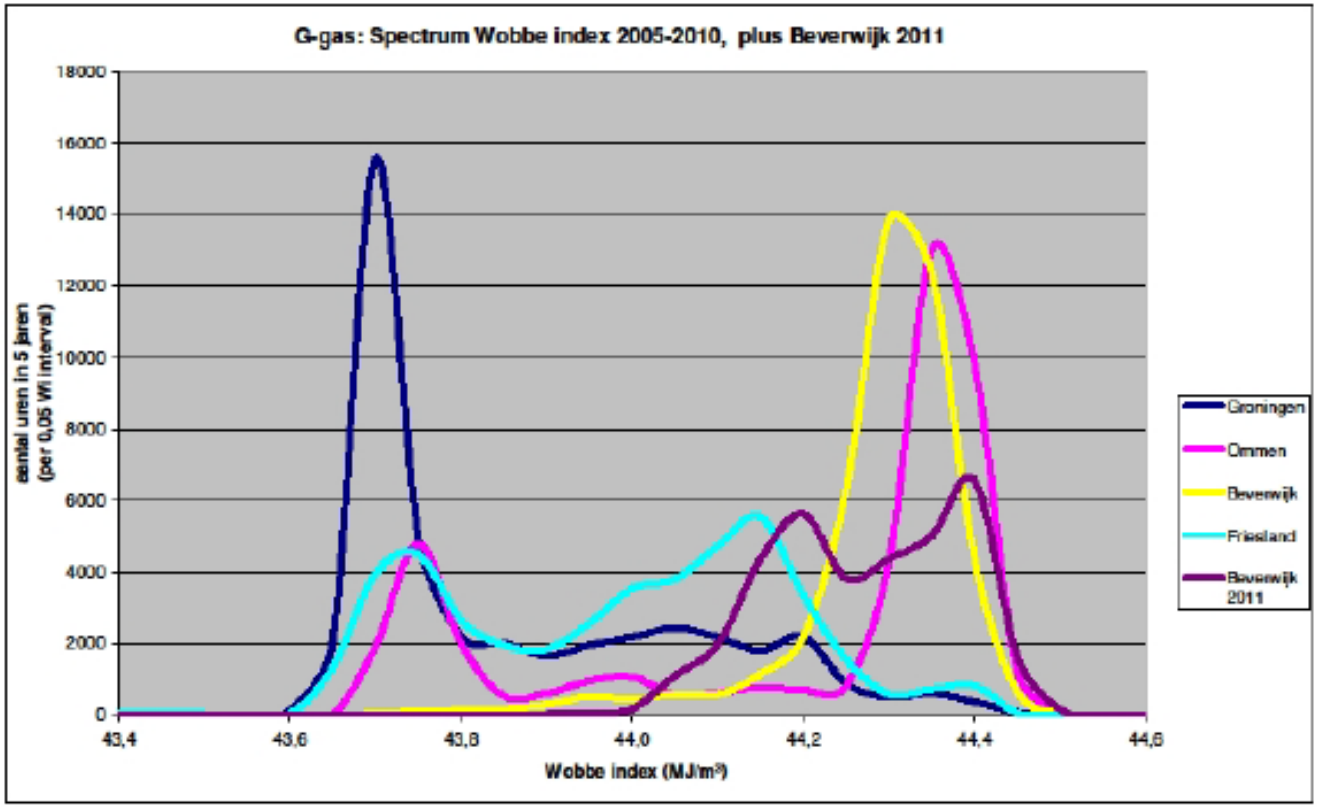


Speed of change Methane Number



TSO, what about the DSO situation with biomethane feed-in?

Speed of change Wobbe



Quality change is a current ongoing process, installations can handle a specific bandwidth, with additional extra safety margins

Summary

Change in quality: EU Standard

- Migration of current and new appliances to handle a new and wider Wobbe bandwidth

New Gases entering the network

- A ‘blend’ of gases will be distributed

New DSO tasks:

- Gas Mixing, Upgrading, Treatment
- Compression, Storage
- Dynamic Pressure Management
- Quality monitoring

Product Liability

- You have to know exactly what is and has been distributed.

Is the regulatory framework in place to fullfill these new tasks?
Are the TSO’s and DSO’s aligned (gasquality, roles) ?
Do TSO and DSO’s work together towards one goal ?

Questions?

To help create a better society in the regions in which we operate and to contribute to social and economic growth.

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