NL Agency
Ministry of Economic Affairs,

Dutch experience and examples with grid injection of biomethane

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RVO.nl

» *Focus on sustainability, innovation and international*

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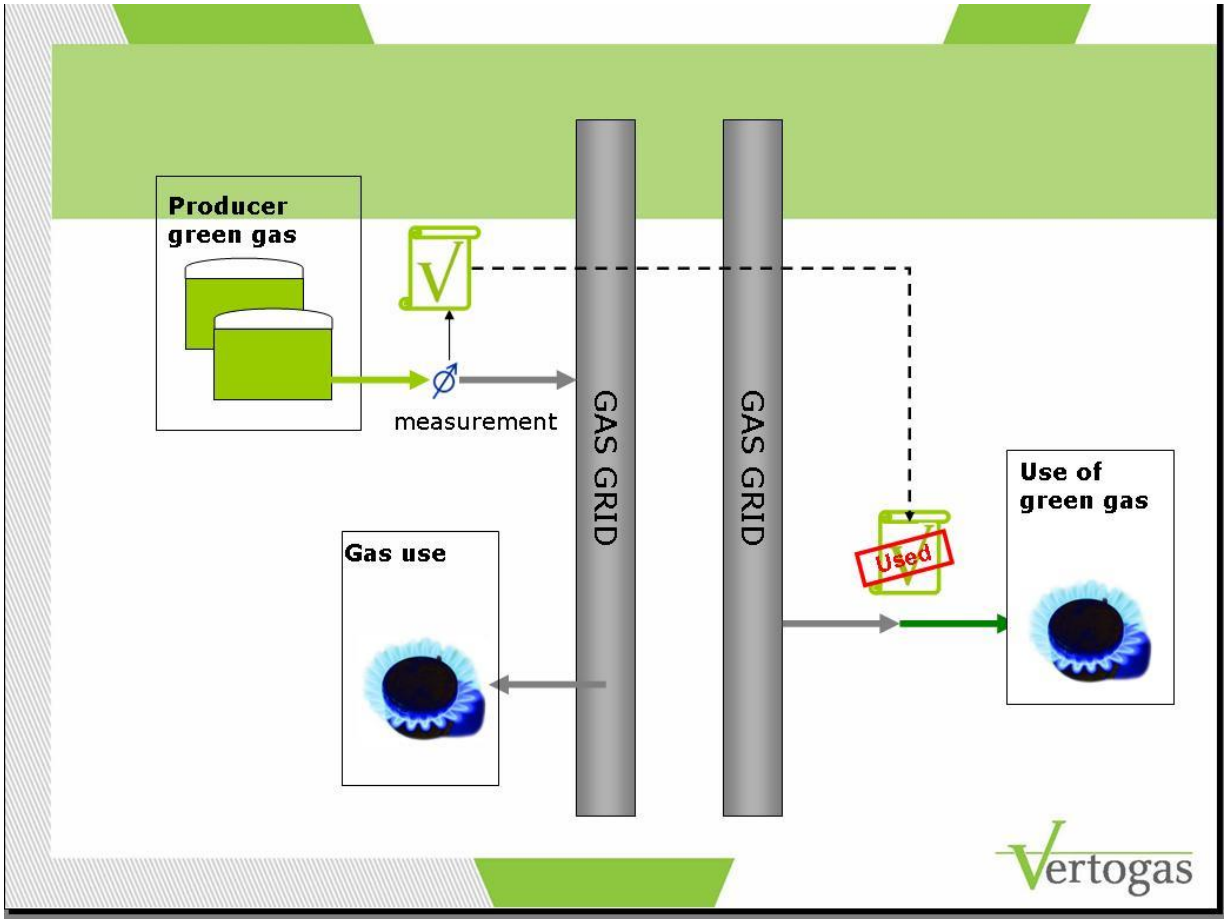
Virtual trade in Green Gas certificates (www.vertogas.nl)



Gas quality requirements for grid injection (L-gas grid)

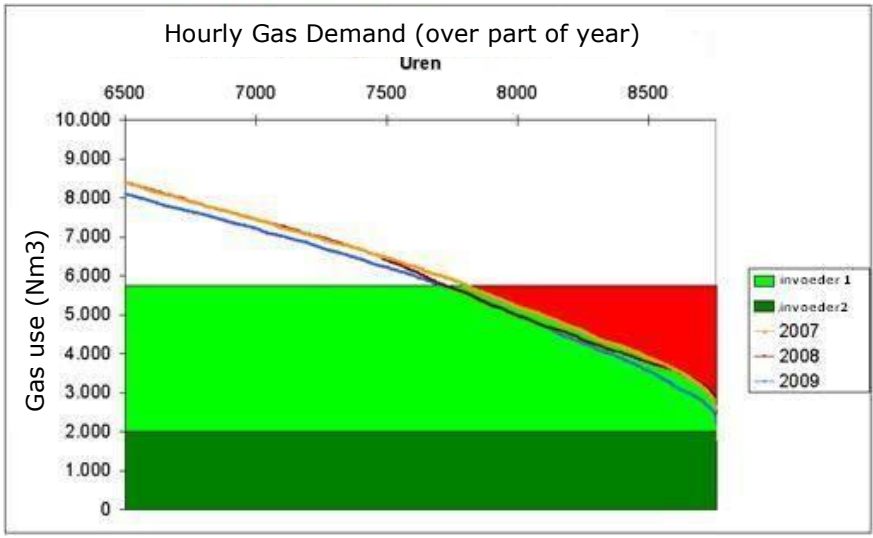
CO2 (0-6%) Wobbe 43.46-44.41
CO2 (6-8%) Wobbe 43.97-44.41
CO2 (8-10.3%) Wobbe 44.10-44.41

G-gas bij invoeding op een aansluiting

Gaskwaliteit		Waarde	Eenheid
Wobbe-index		43,46 – 44,41[1,2]	MJ/m³(n)
Calorische waarde		Zie voetnoot[3]	
Gehalte hogere koolwaterstoffen		≤ 5	mol% PE
Gascondensaat		≤ 80	mg/m³ (n) bij –3 °C bij elke druk
Waterdauwpunt	in RTL en HTL	≤ –8	C (bij 70 bar(a))
	in RNB-net	≤ –10	°C (bij 8 bar(a))
Temperatuur	in RTL en HTL	10 – 30	°C
	in RNB-net[4]	5 – 20	°C
Zuurstofgehalte	in RTL en RNB-net	≤ 0,5	mol%
	in HTL	≤ 0,0005	mol%
Koolstofdioxidegehalte	in RTL en RNB-net	≤10,3[5]	mol%
	in HTL	≤ 3	mol%
Waterstofgehalte	in RTL en HTL	≤ 0,02	mol%
	in RNB-net	≤ 0,1	mol%
Chloor op basis van organochloorverbindingen		≤ 5	mg Cl/m³(n)
Fluor op basis van organofluorverbindingen		≤ 5	mg F /m³(n)
Koolstofmonoxide (CO)		≤ 2.900	mg/m³(n)
Microben met een grootte tussen de 0,3 en 5 µm		≤ 2,5	mg/m³(n)
Stofdeeltjes met een grootte boven de 5 µm		≤ 100	mg/m³(n)
Zwavelgehalte op basis van anorganisch gebonden zwavel (H_2S + COS).		≤ 5	mg S/m³(n)
Zwavelgehalte op basis van alkylthiolen		≤ 6	mg S/m³(n)
Totaal zwavelgehalte	voor odorisatie		
	Piekwaarde	≤ 20	mg S/m³(n)
	Jaargemiddelde	≤ 5,5	mg S/m³(n)
	na odorisatie		
	Piekwaarde	≤ 31	mg S/m³(n)
	Jaargemiddelde	≤ 16,5	mg S/m³(n)
THT-gehalte (odorant)	in HTL: reukloos[6] gas	0	mg THT/m³(n)
	in RTL: ruikbaar[6] gas	10 – 30	mg THT/m³(n)
	in RNB: ruikbaar[6]gas	10 – 30	mg THT/m³(n)
Siliciumgehalte op basis van siloxanen		≤ 0,4	mg Si/m³ (n)

Several Strategies for Gas Grid Injection; Different innovative approaches in cooperation with several grid operators; Basic challenge is: biomethane production capacity doesn't meet gas demand

- Direct injection (limited because of gas demand)
- Development biogas/green gas hubs
- Injection with recompression in gas grid to higher pressure part of grid
- Development of dedicated biogas grids with replacement of standard gas boilers
- Pressure regulation in distribution grid in combination with creation of storage capacity in distribution grid.(www.sg3.nl)



Attero Wijster: renewable natural gas hub

- Biogas sources: two digesters, one landfill and one digester owned by a farmer “at a distance”
- Biogas grid
- Three upgrading systems
- Injection of renewable natural gas in two separate local gas grids (8 bar)
- Project “Green Gas Booster”

- Pilot bio-LNG installation

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Attero Wijster: biogas hub project

Four sources of biogas:

- Landfill
- Digestion of organic waste from integral waste (2012 - 55,000 tonnes - Dranco)
- Digestion of organic waste from households and industry (2013 – 36,000 tonnes - Dranco)
- Digester of agricultural products, owned by a farmer. This biogas is transported via a biogas pipeline (11.5 km)

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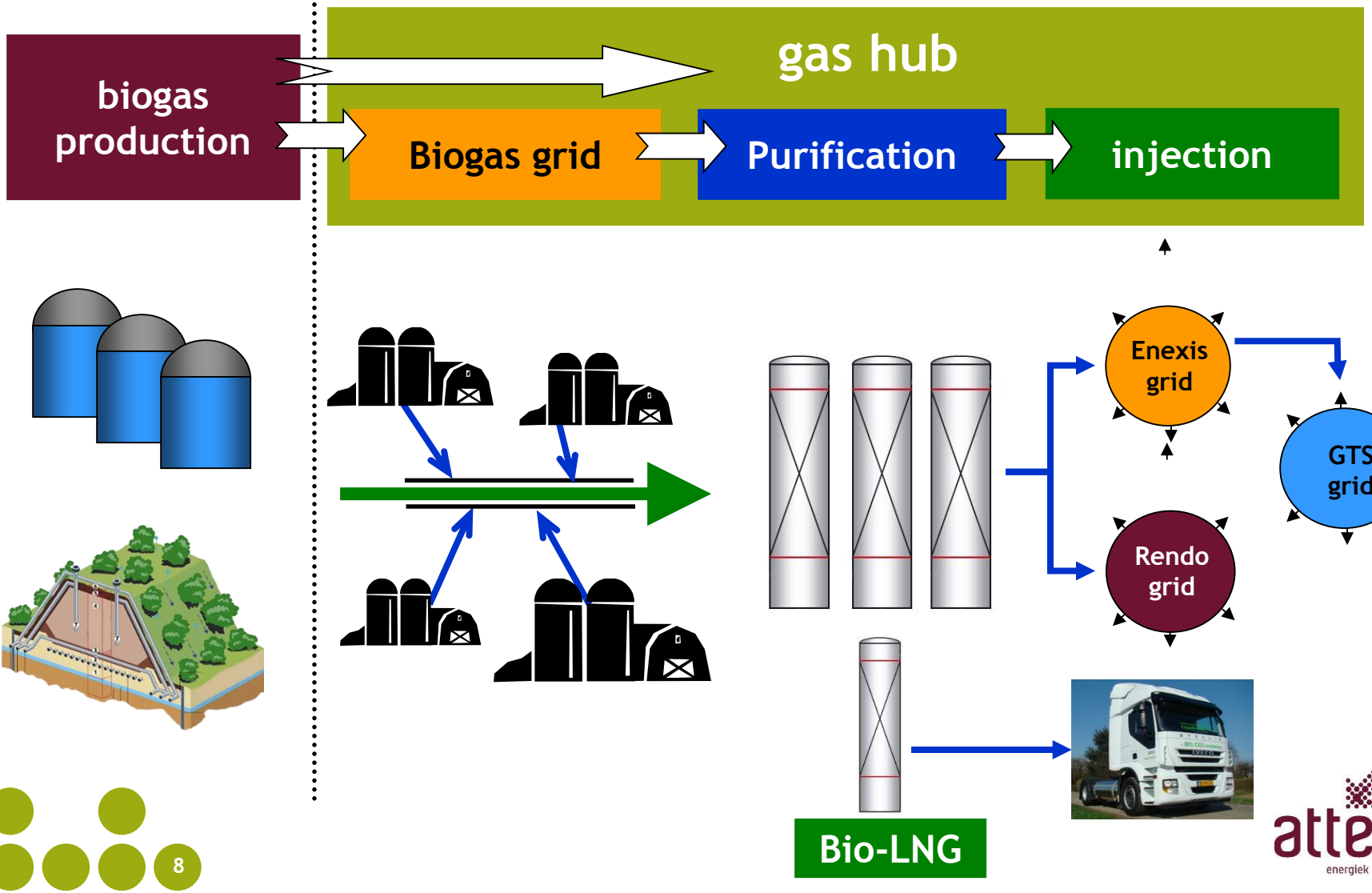
Wijster: gas hub



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Biogas grid

- Financed by Province of Drenthe to boost biogas production in the province
- Constructed and in operation since 2014 with first agricultural biogas producer in Nieuweroord
- Several other potential biogas producers close to the biogas grid
- Owned by Attero
- Operated by Fudura, part of grid operator Enexis
- Future expansion depends on Dutch subsidy system (SDE+) and feed in regulations

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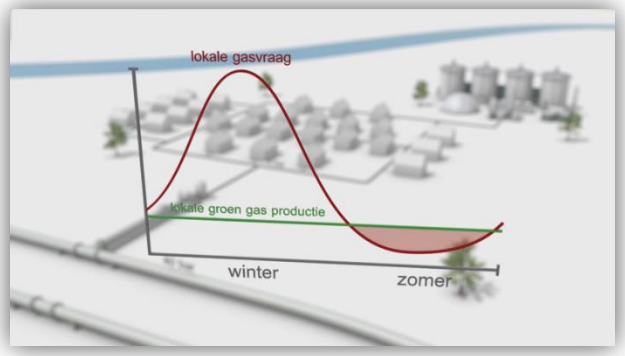
Project “Green Gas Booster”

- Cooperation between Gasunie Transport Services, Enexis and Attero
- Groen Gas Booster compresses renewable natural gas from 8 bar grid to 40 bar grid when demand for natural gas is low in 8 bar grid
- Energy savings as gas only gets compressed when demand is low. In winter, all renewable natural gas is used locally
- Animation



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Project Bio-LNG Wijster

- Initiative of Rolande LCNG in cooperation with GtS and Attero, supported by the Province of Drenthe
- Capacity installation: 475 Nm^3 biogas per hour, output: 177 kg bio-LNG (liquid biomethane)
- Pilot installation, still in commisioning phase

ROLANDE LCNG
LIQUIFIED BIOGAS

provincie Drenthe

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GtS
Gastreatment Services bv

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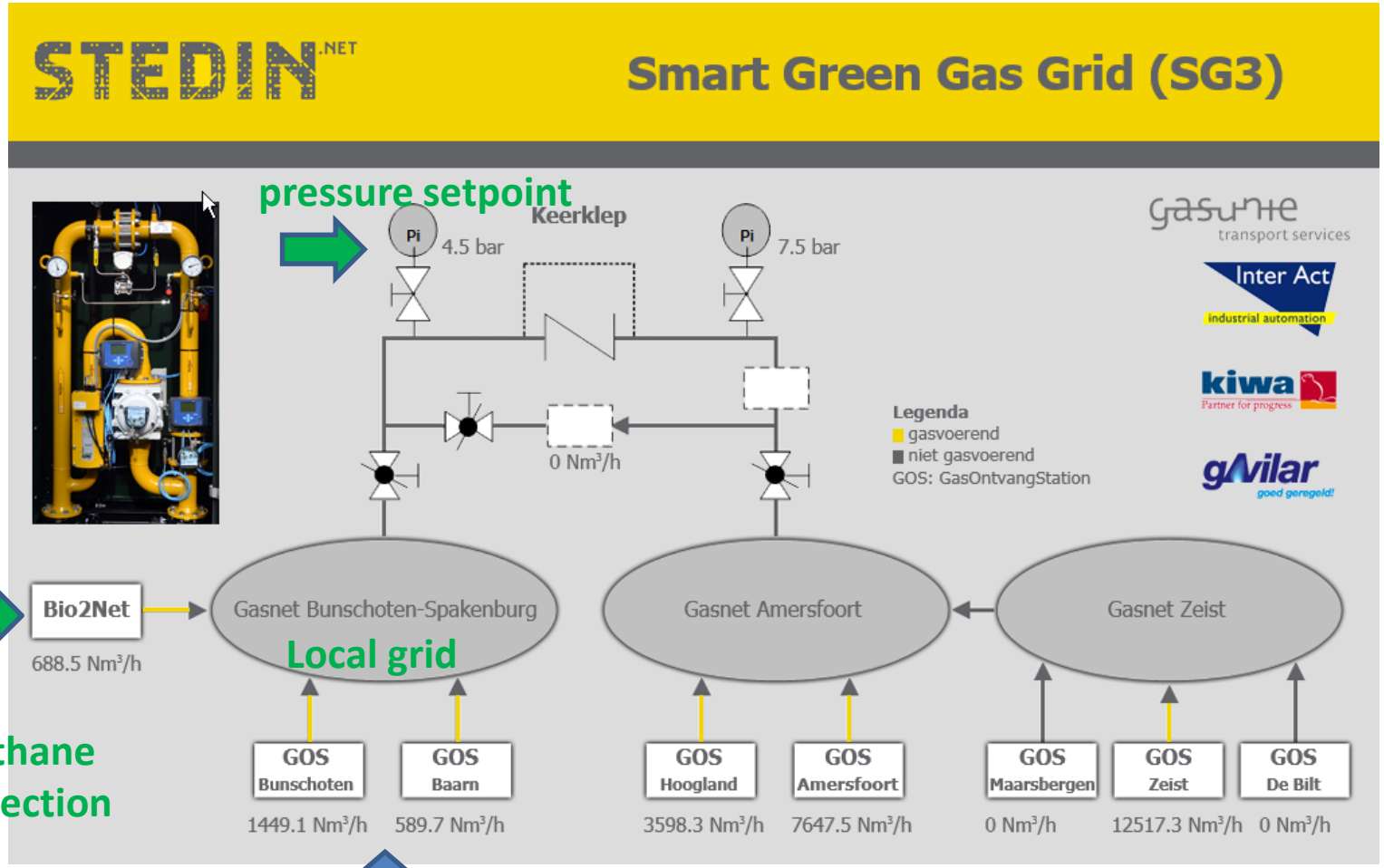
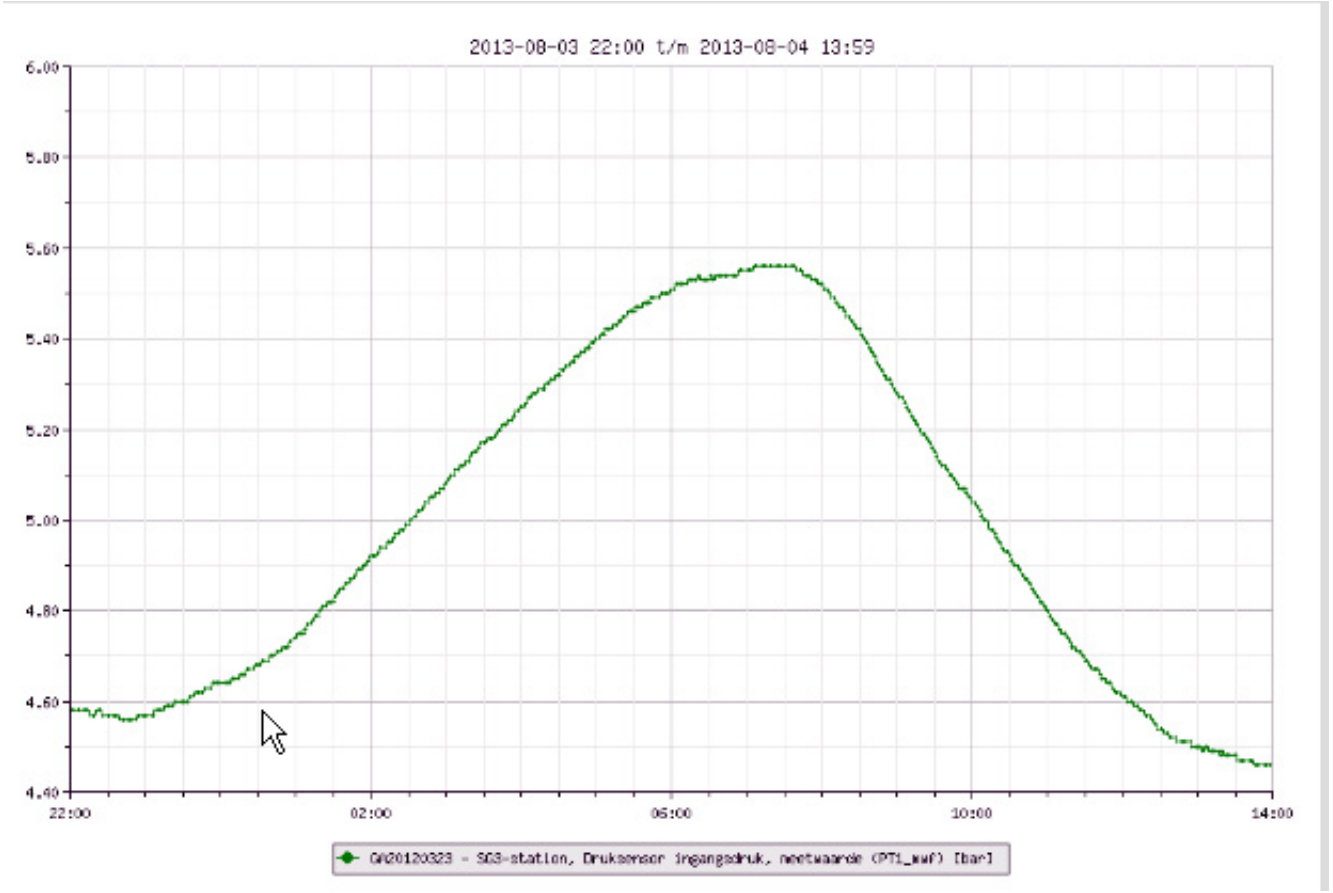
Using storage capacity of local grid by lowering local pressure setpoint during summer

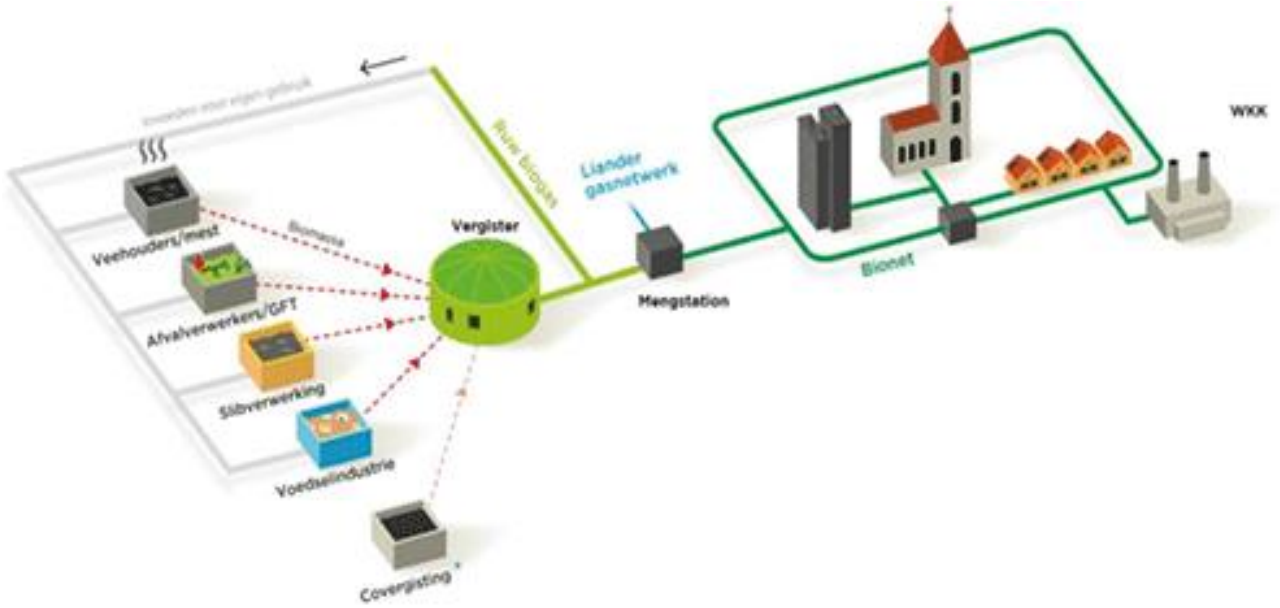


Using distribution gas grid (8 bar) for gas storage

Pressure in local grid during summer day with local pressure setpoint 4.5 barg



Biogas / Biomethane distribution solutions; Development of a **BIONET** with distribution of a mix of biogas and natural gas. This requires to change gas equipment like gas boilers.



Alliander facilitates sustainable gas

Order of usage

1st preference:

Direct consuming (biogas)

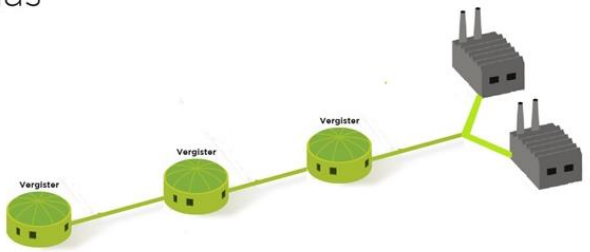
2nd preference:

Biogas mixture (bionet), natural gas as backup

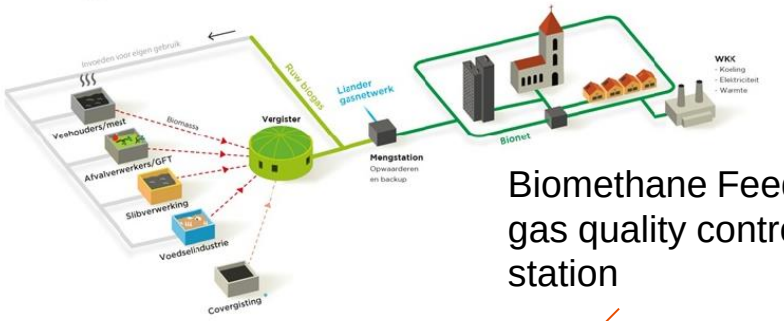
3rd preference:

Upgrading (regular gas network, biomethane)

Biogas

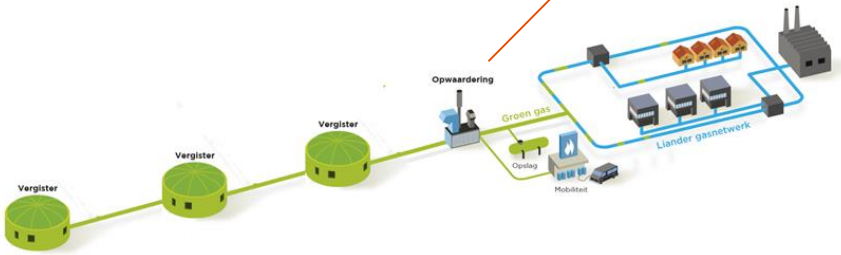


Biogas bionet



Biomethane Feed-in gas quality control station

Biogas Liander gasnetwerk



Bionet

Full automatic autonomous gas quality control residential central-heating boiler 0-100% biogas/natural gas in every connected building, dedicated grid

+

District station: distribution biogas, automatic safeguarding Wobbe Index, if methane <60%, injection of natural gas. No biogas: injection with natural gas: Control range 1 m^3 - 200m^3 / hour. Remote controlled.

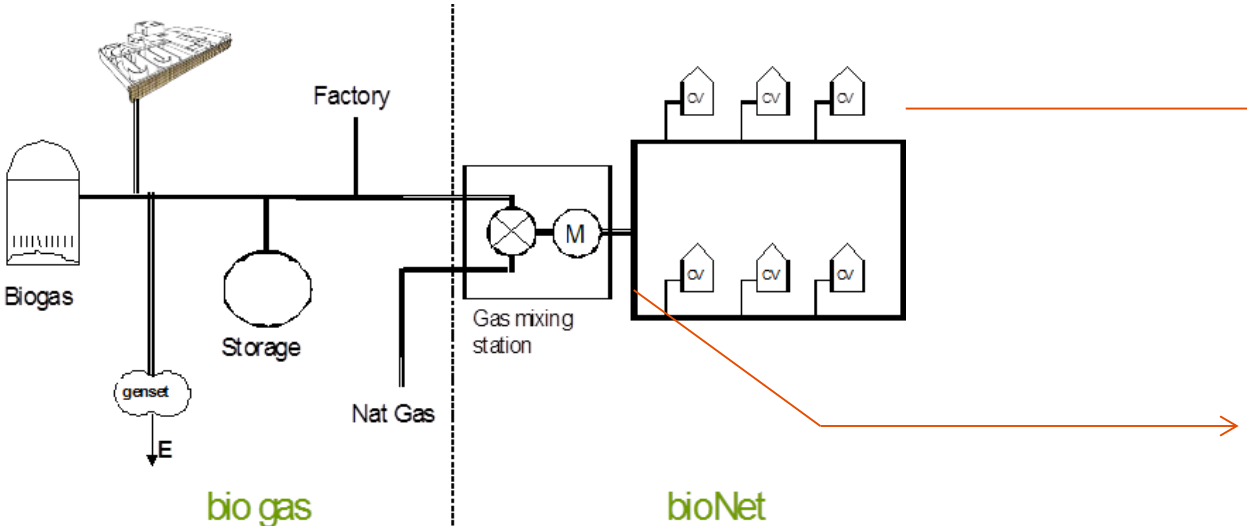
Distribution gas mixture 100% biogas ← → 100% natural gas.

Demonstrated at various locations in The Netherlands

= Low cost distribution biogas, price /m^3 biogas competes with natural gas when energy tax is excluded, <u>better performance than biogas to heat network</u>, user reliability the same as natural gas distribution.

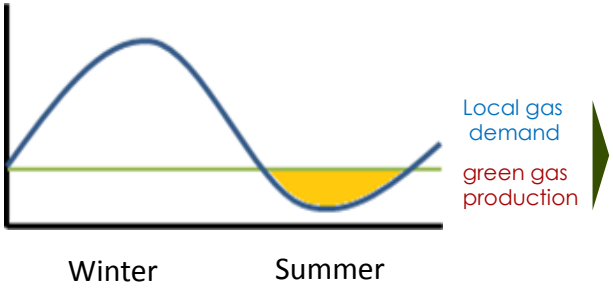
Demonstration site
Public building Haaften

ATAG



Special Issues

Creating a local green gas platform



- Gas demand in the summer decreases significantly. Green gas production on the other hand, is produced continuously. On local level therefore, the supply can easily exceed the momentary gas demand. In such a situation the DSO (e.g. Liander) must , for safety reasons, temporarily cut off the green gas supply.
- With an expected decrease in gas demand in the coming years and a growing green gas market, this situation becomes a serious challenge for existing and new green gas initiatives.
- The pilot 'STIGS' (Short Tem Infrastructure for Gas Storage) aims at solving this issue at a local level. By using existing flexibility at e.g. CNG filling stations, a smart and low cost solution is developed.

Status

- Pilot location in Amsterdam

CNG filling station is adjusted for demand response (±1.000m³ storage capacity per day)

- Liander control room

Operators balance the network by active pressure regulation and demand signaling

- Upscaling and financials

Market consultation and regulatory studies (partly within EDGaR research program)

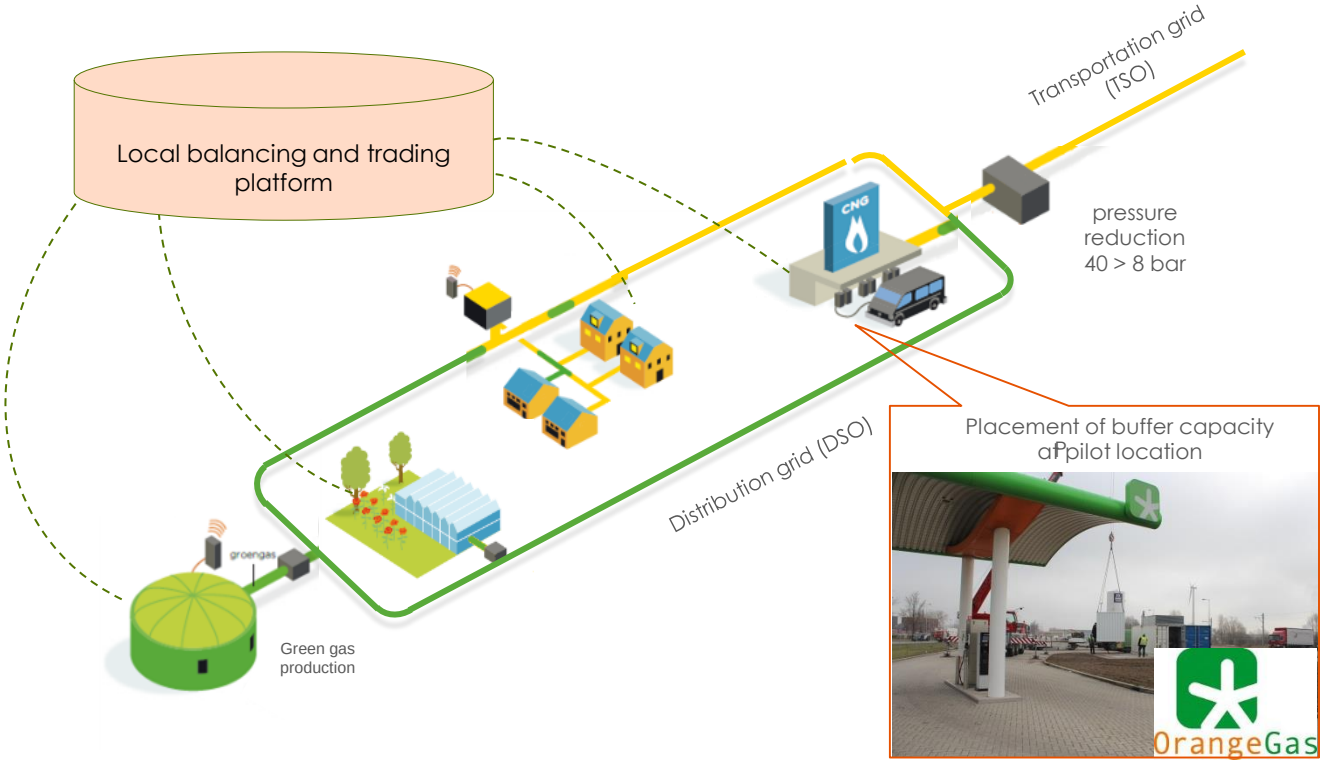
To do

- Roll-out

Application of technology at real-time locations

- Development of a platform

Creation of market for balancing and trade of sustainable gas with local pricing mechanism



Biomethane feed-in station

Cost effective biogas compact biomethane feed-in station for biomethane injection in public gas networks. Volumes 10- 600 m^3/hr

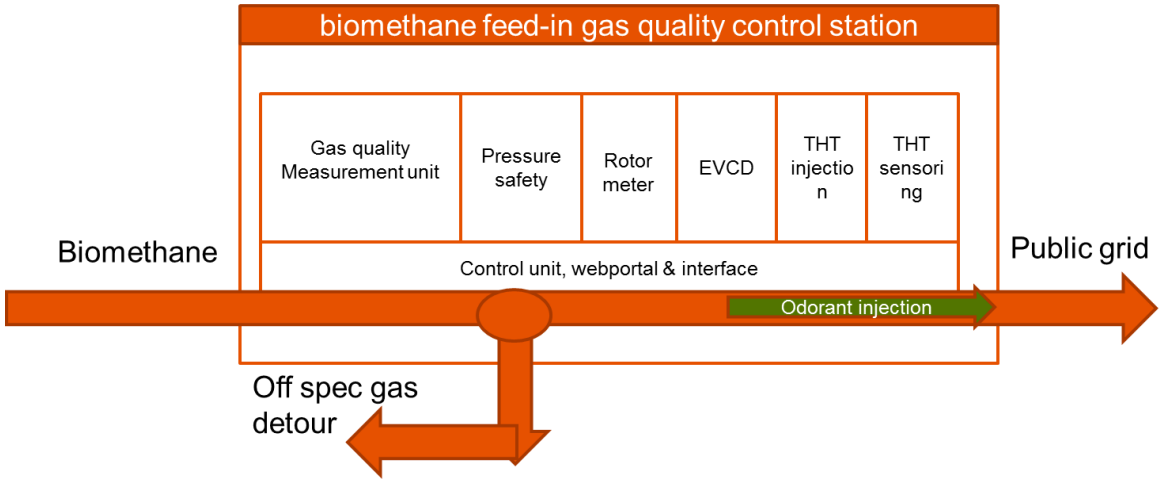
High reliability biomethane injection and gas quality control solution, including sensory based gas quality measurement unit (no gas chromatography) based on patented measurement unit.

Continuous Measurement of: Wobbe Index, Relative Density, Calorific value, Flame stability, Dew point, % methane, N_2, O_2, H_2S, CO_2
EVCU: Pressure, Temperature, Flow,
Stable controlled odorant injection from 10 m^3/hr and higher

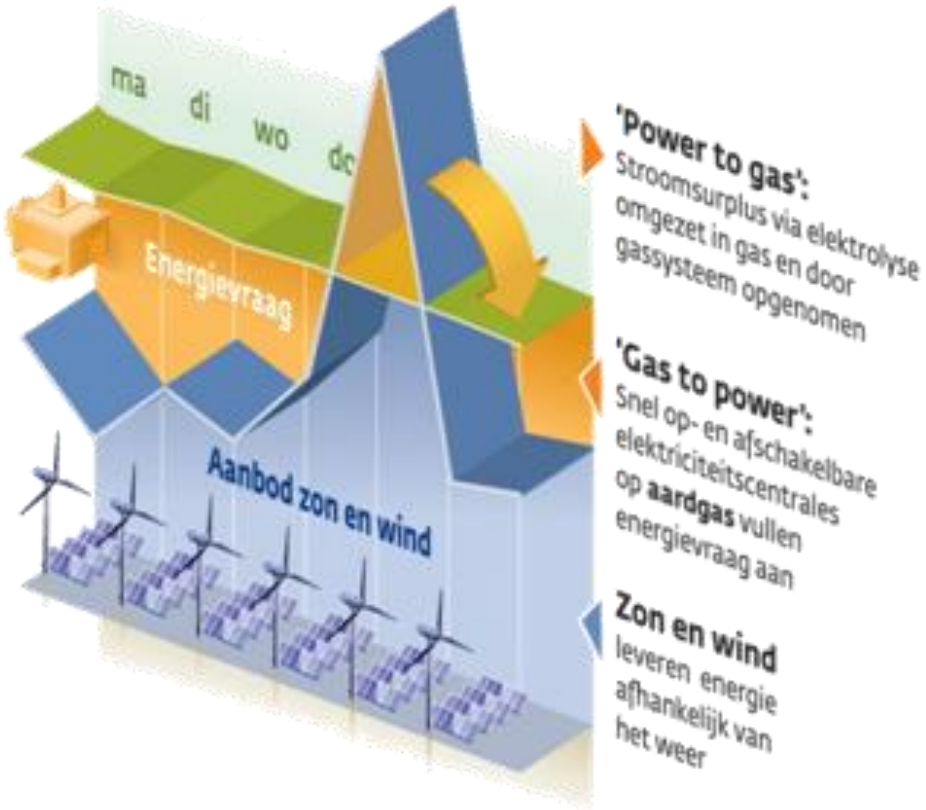
Maintenance interval 12 months, including gas quality measurement unit.

TCO 40% lower than traditional units

Signals to 24/24 DSO control room



Variations in electricity grid and posibility to use overcapacity for P2G



Technical equipment P2G pilot project Rozenburg

- Hydrogen production

- Methanation process (Sabatier)

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