

# LBG infrastructure in Sweden

Ragnar Sjödahl  
AGA Gas AB,  
ragnar.sjodahl@se.aga.com



## Since year 2006 AGA is a part of The Linde Group

2000: Linde bought AGA

2006: Linde bought BOC and formed The Linde Group

**2008: 50 000 employees in 100 countries**



## January 2005

- AGA takes over the gas distribution from Stockholm Water in Bromma
- One gas producer
- Three filling stations
- 200 000 Nm<sup>3</sup>/year



## September 2009

- AGA delivers to 14 public filling stations
- AGA has built eleven new stations in cooperation with Preem, OKQ8, Statoil, Shell and Uno-x
- AGA distribute biogas in swap bodies
- Six gas producers
- 5.1 million Nm<sup>3</sup> biogas 2008



**AGA is a Biogasmax partner**

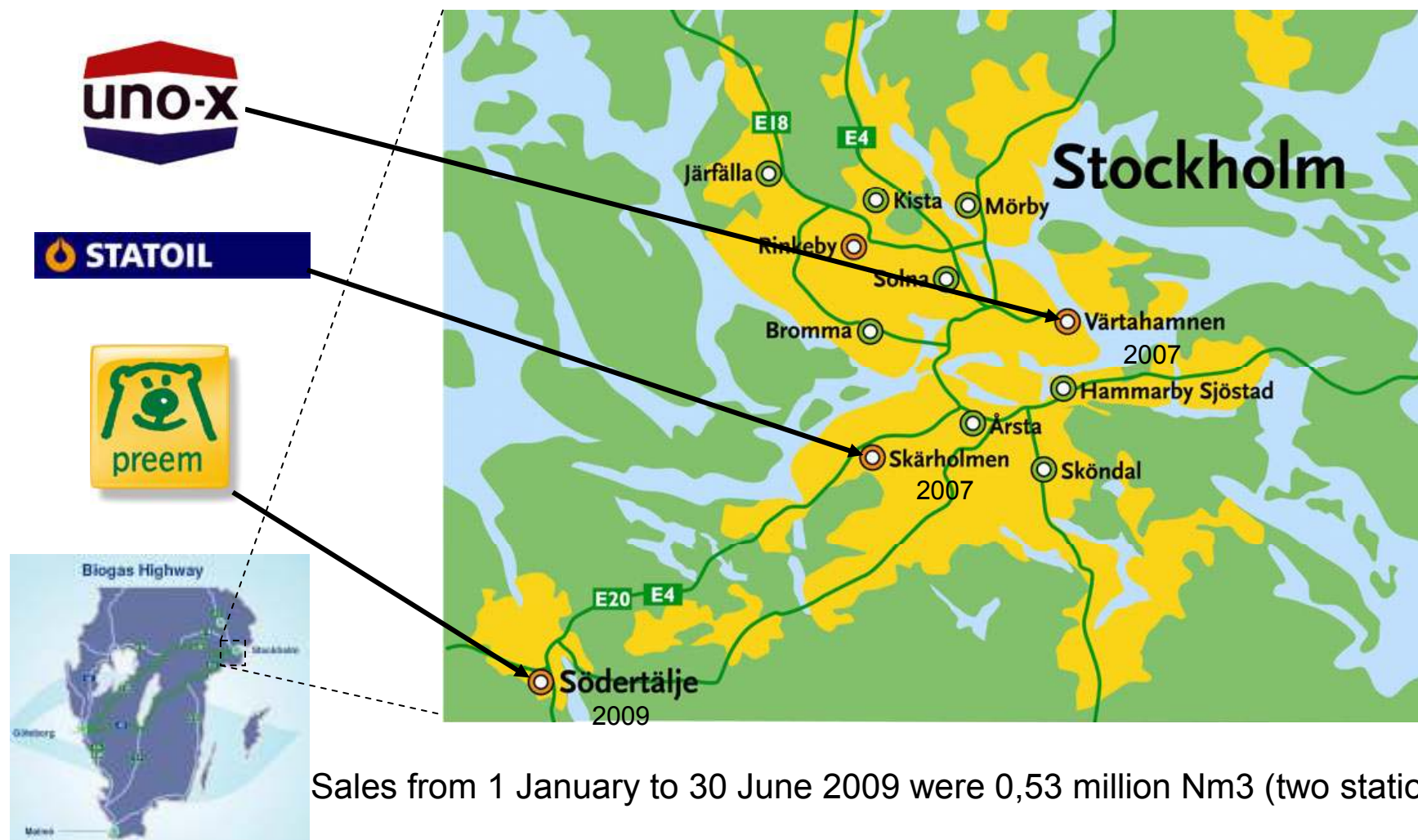


## Quantified objectives for distribution in Stockholm

-Building of 3 filling stations with a total supply of at least 0.5 million Nm<sup>3</sup> of biogas.

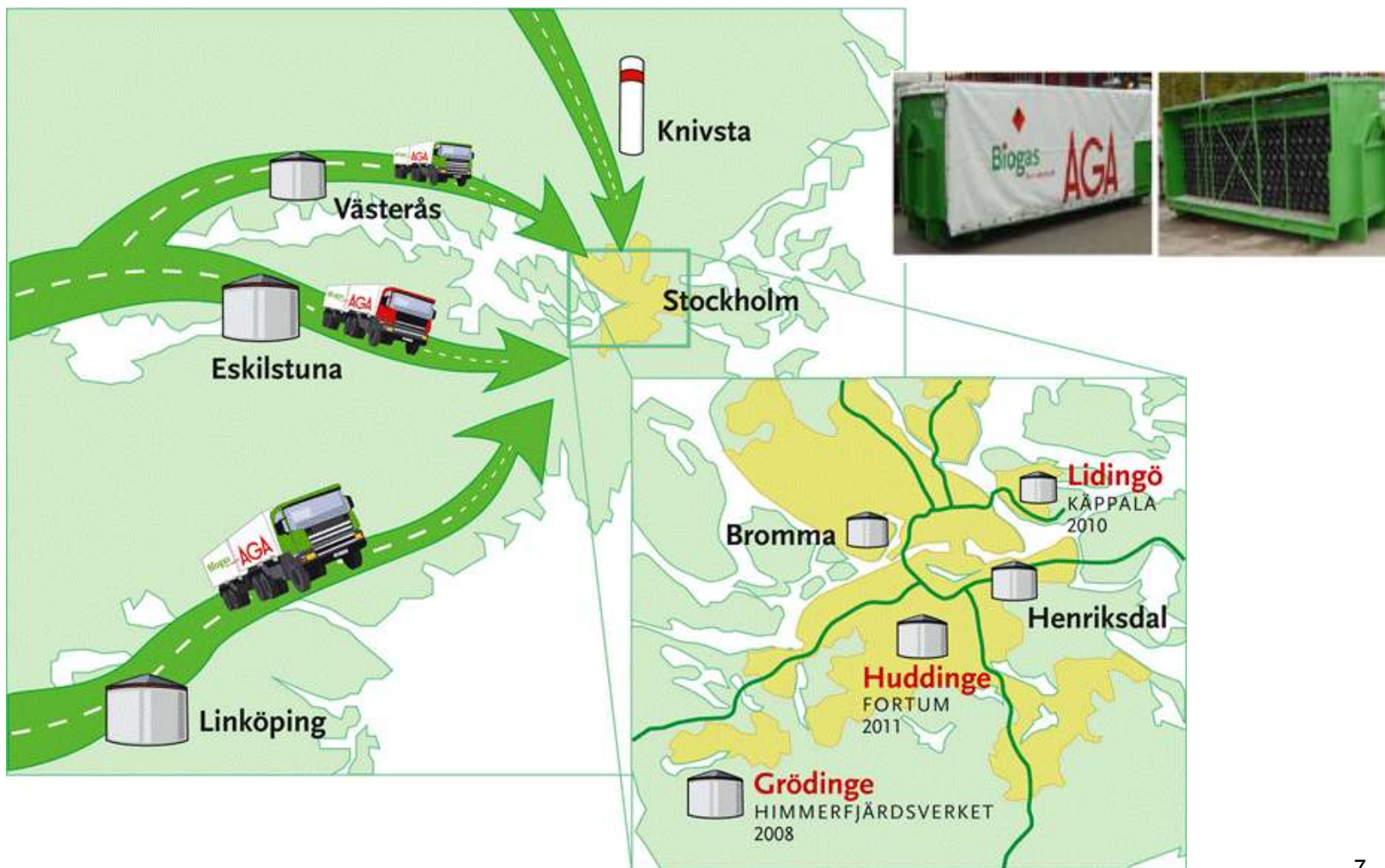


## Deliverables in Biogasmax



Sales from 1 January to 30 June 2009 were 0,53 million Nm3 (two stations)

## Existing and planned suppliers of biogas to Stockholm



## CNG delivery area

CNG 3.5 – 3.8 ton per transport  
 LBG 20 - 25 ton per transport



Today 0,5% biogas cars in Sweden  
 2020 5%



## Distribution with LBG

LBG can be transported 5 times as long distance as CBG (i.e. 500- 900 km)

Access to production source in other parts of the Sweden.

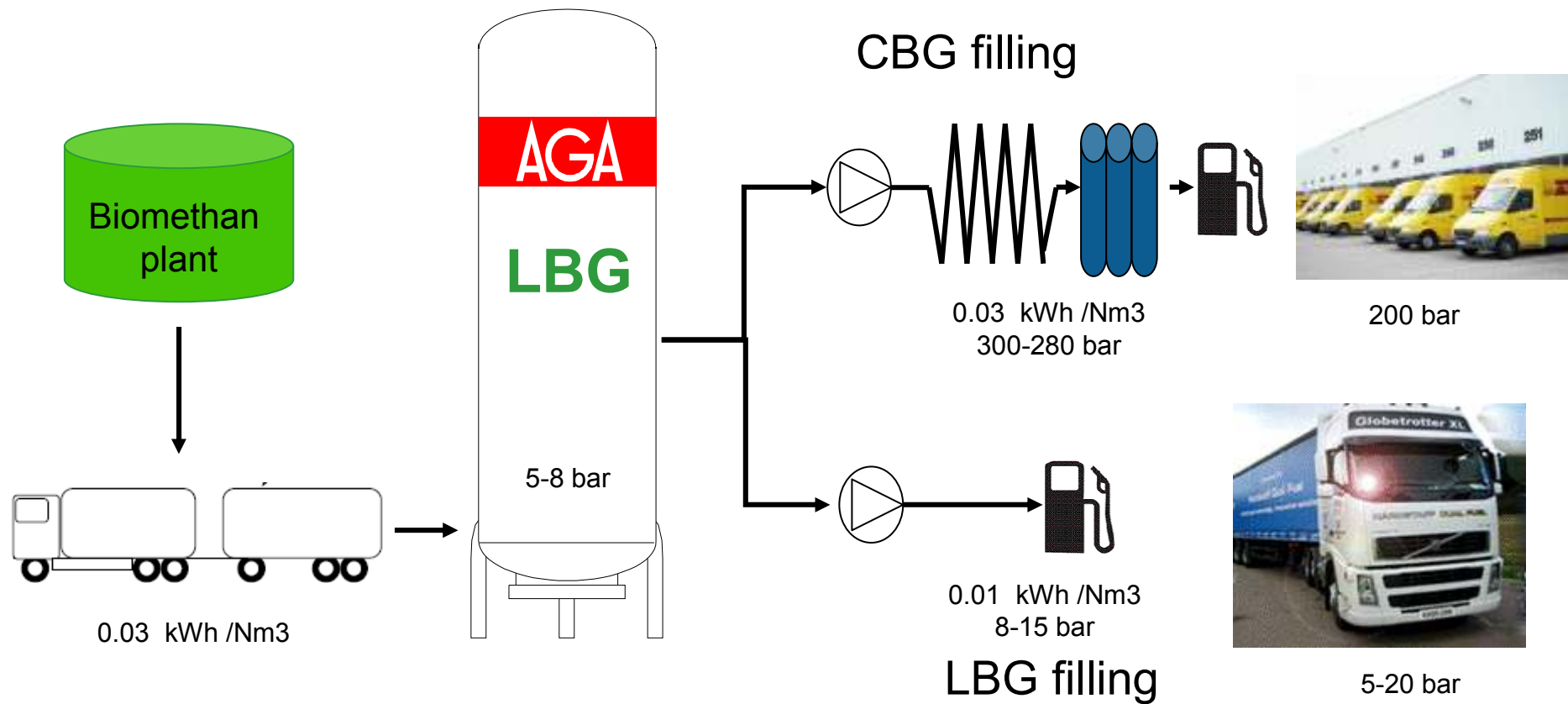
Filling stations without local production



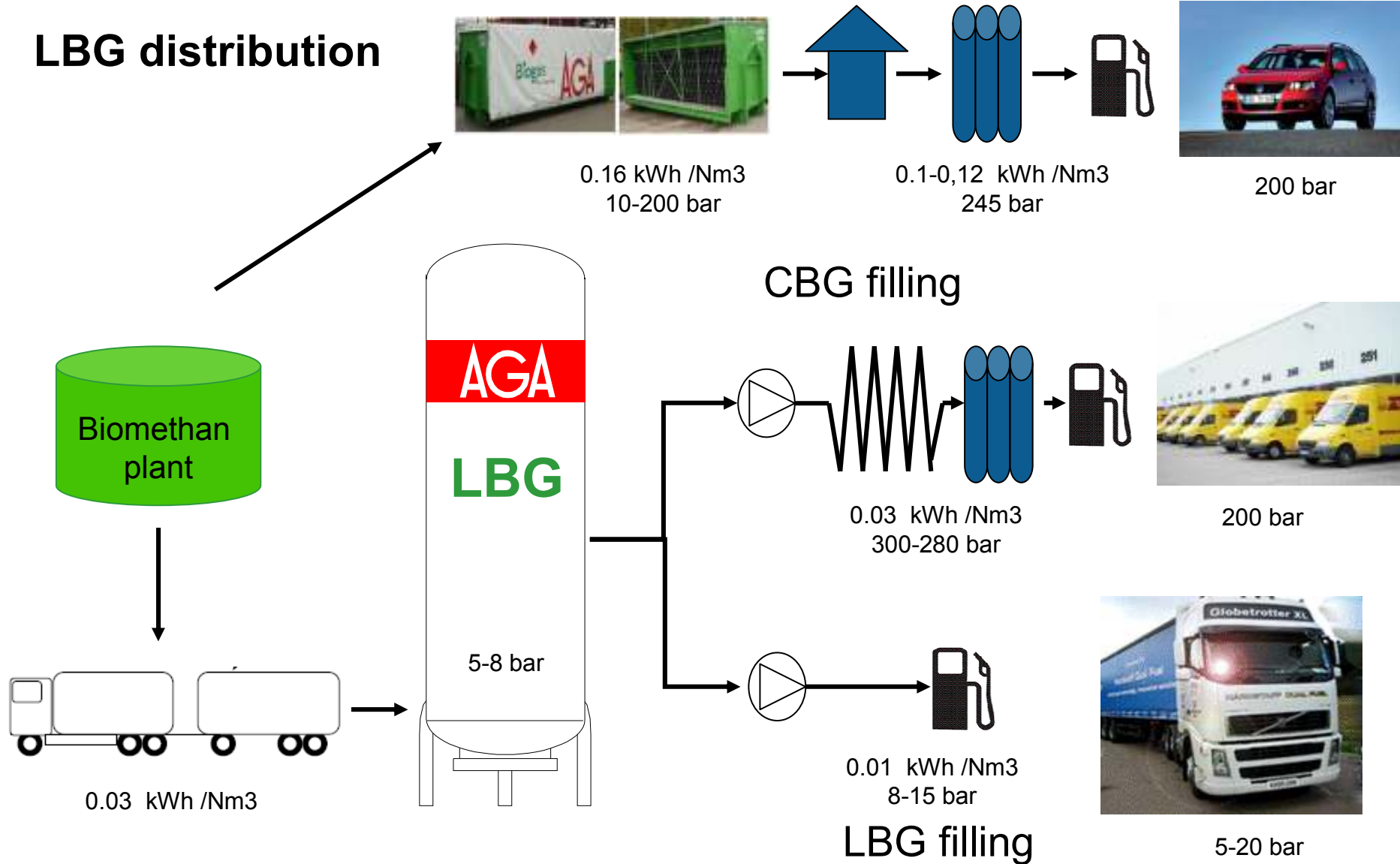
## New Markets



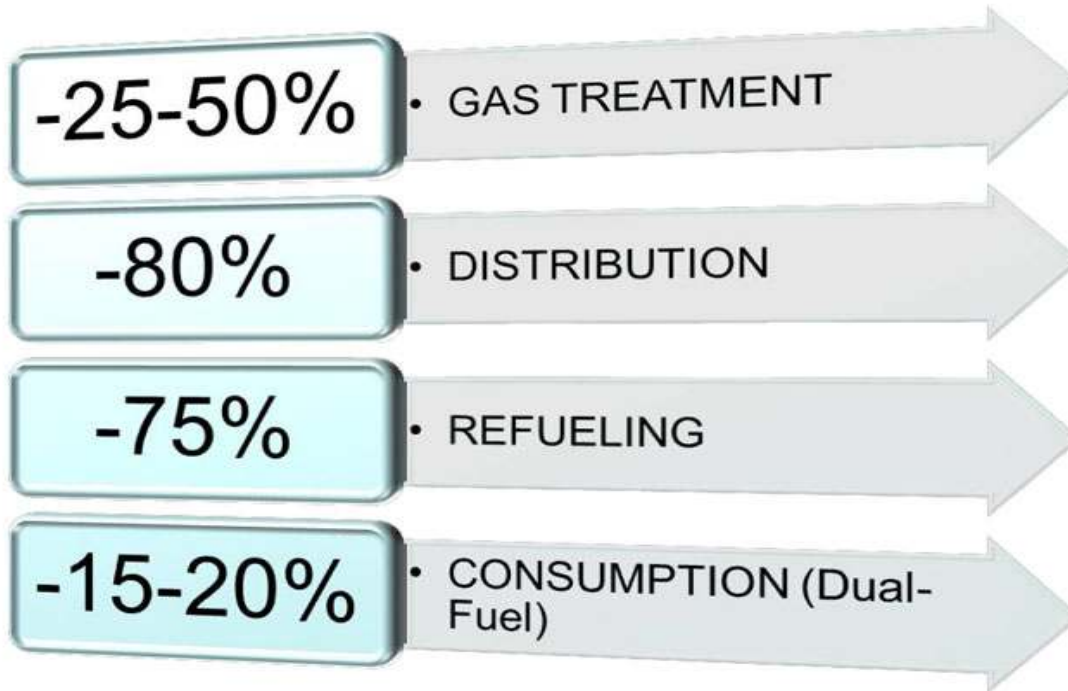
# LBG distribution



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## Energy savings LBG vs. CBG



kWh/ Nm<sup>3</sup>

LBG vs. CNG

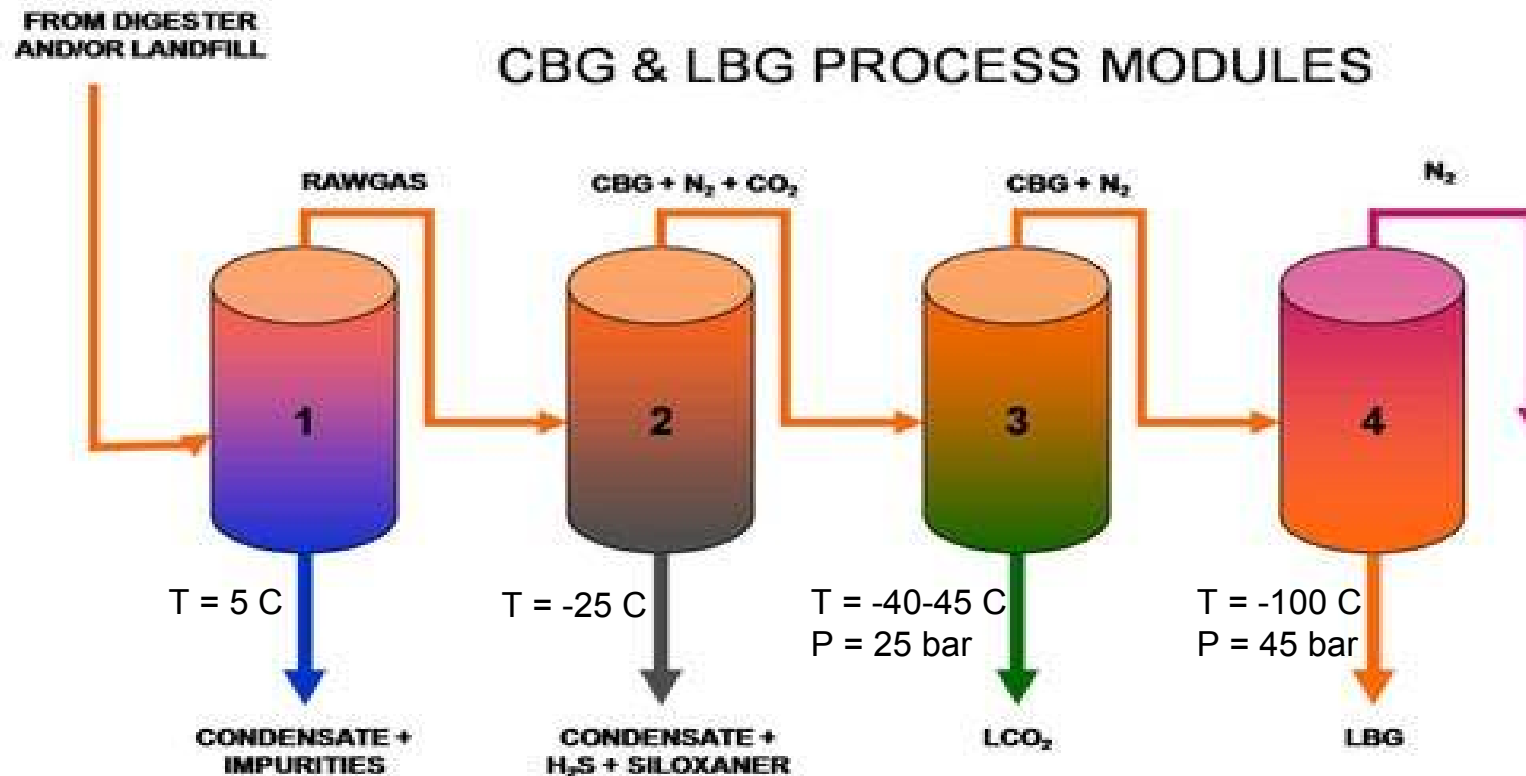
0.45    0.50-0.65

0.03    0.16

0.01/0,03    0.12

Deisel vs. Petrol

Source: Scandinavian GtS



### Overview of the technology

The technology is composed of four modules, based on cooling the gas step by step. The number of steps to be applied depends on the requirements of the end product.

**Module 1:** removes water and impurities

**Module 2:** dries the gas further and removes siloxanes,  $\text{H}_2\text{S}$  and other contaminants

**Module 3:** separates the  $\text{CO}_2$ , upgrading low-caloric biogas into a clean, high-caloric biomethane (natural gas quality) and yields liquid  $\text{CO}_2$  as a valuable by-product

**Module 4:** produces liquid biogas (LBG)

## Production plant



Source: Scandinavian GtS

## LBG/LNG filling station in Sundsvall, Sweden

**Swedens first public biogas refuelling station supplied by Liquid BioMethane**

9th of July AGA:s refuelling station for biogas (methan) was opened by the Mayor of Sundsvall, Sweden.



## Dual-fuel technique

- Liquid as well as gas biomethane can be used
- Up to 90 % of the diesel can be replaced with biomethane

### Projects in Sweden during 2010

- Clean Truck (Stockholm) 30 Trucks  
(one filling station)
- Bime Trucks (Gothenburg, Malmö and Stockholm) 60 Trucks  
(three filling stations)
- Regional Busses (Uppsala) 8-12 busses



## Conclusion for LBG logistics

- Efficient distribution saves energy, you don't have to produce your biomethane next to your market.
- Produce the LBG where the conditions are best (and transport it to the market)
- Filling stations at locations with no local production
- Fuel for heavy transports – “dual-fuel”- and shipping industry



# Thank you for listening

Ragnar Sjö Dahl  
AGA Gas AB,  
[ragnar.sjodahl@se.aga.com](mailto:ragnar.sjodahl@se.aga.com)

