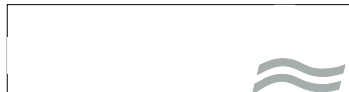




California

October 2009



LWG/PURAC offers...

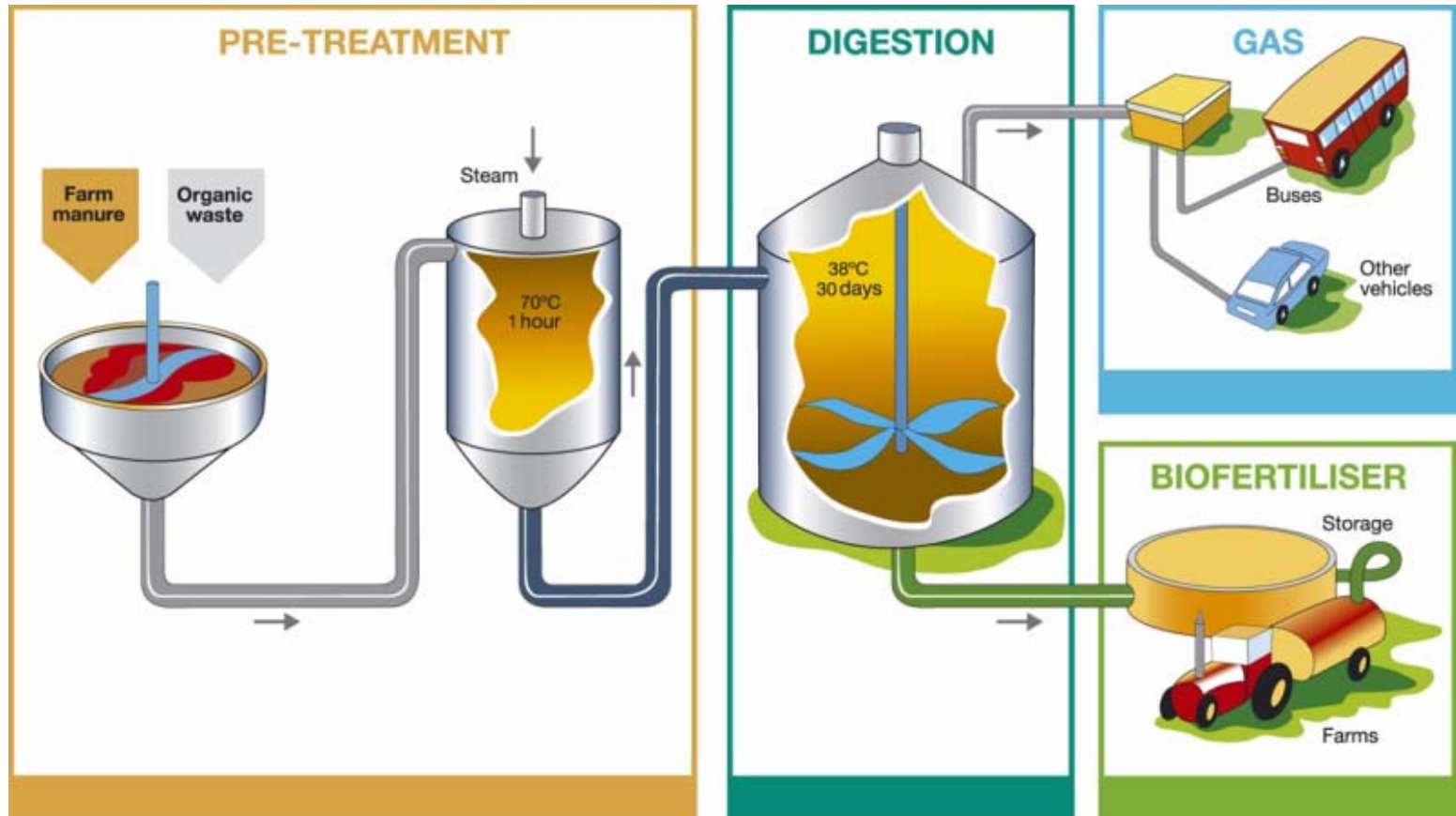
- Municipal waste water treatment
- Municipal drinking water treatment
- Industrial process water treatment
- Industrial waste water treatment
- Biogas plants



Läckeby Water Group in Numbers

- Turnover: 100 million USD
- Number of employees: 180
- Established in 1935

The Biogas Process

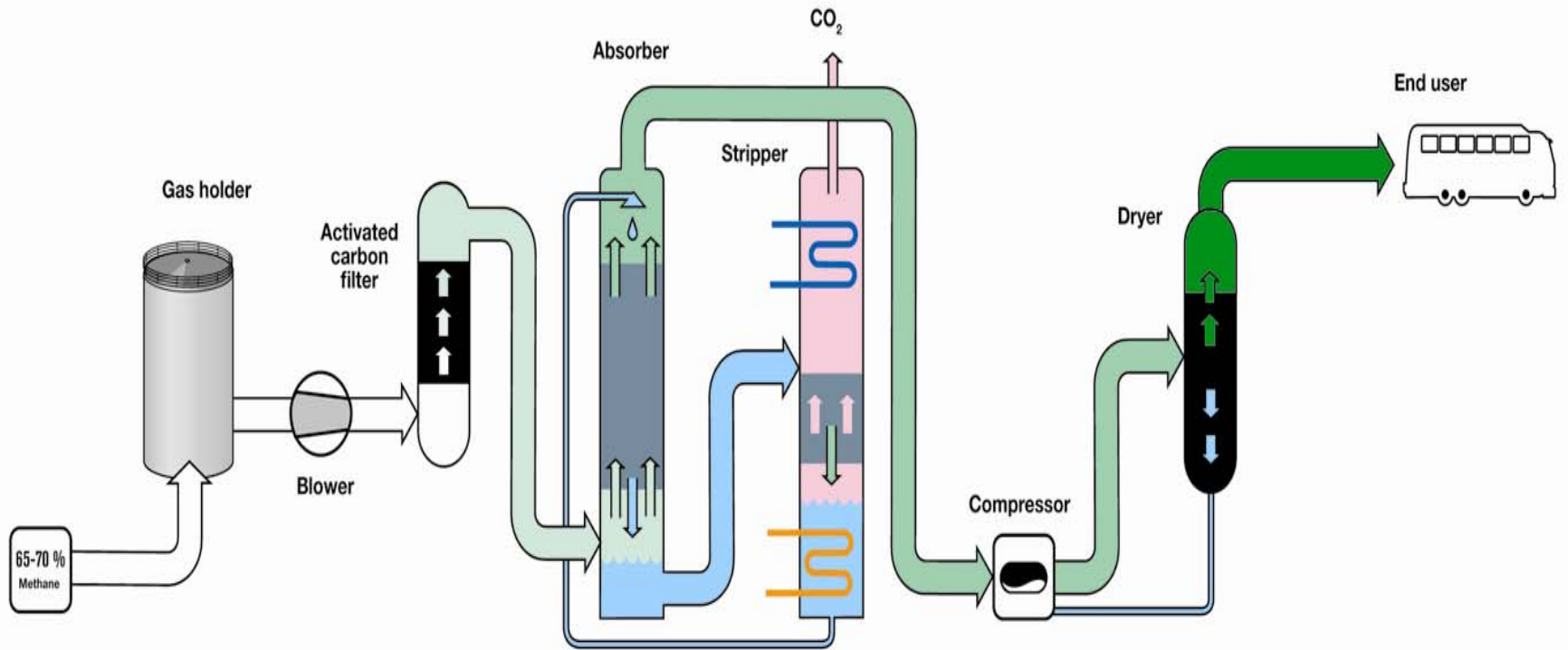


LP Cooab technology

One way of producing vehicle fuel or
Biomethane equal to NG-quality

Biogasupgrading prefabr. module exec. Size 1500 scfm





Energy performance comparision

Biogas upgrading

Technologies Energyfigure	LP Coaab	VPASA		
Electricity use kWh/Nm ³ rawgas	~0,11	~0,35		
Heat use kWh/Nm ³ rawgas	~0,65	Not appl.		
Heat recovery kWh/Nm ³ rawgas	~0,50			
Total Energy kWh/Nm ³ rawgas	~0,26	~0,35		

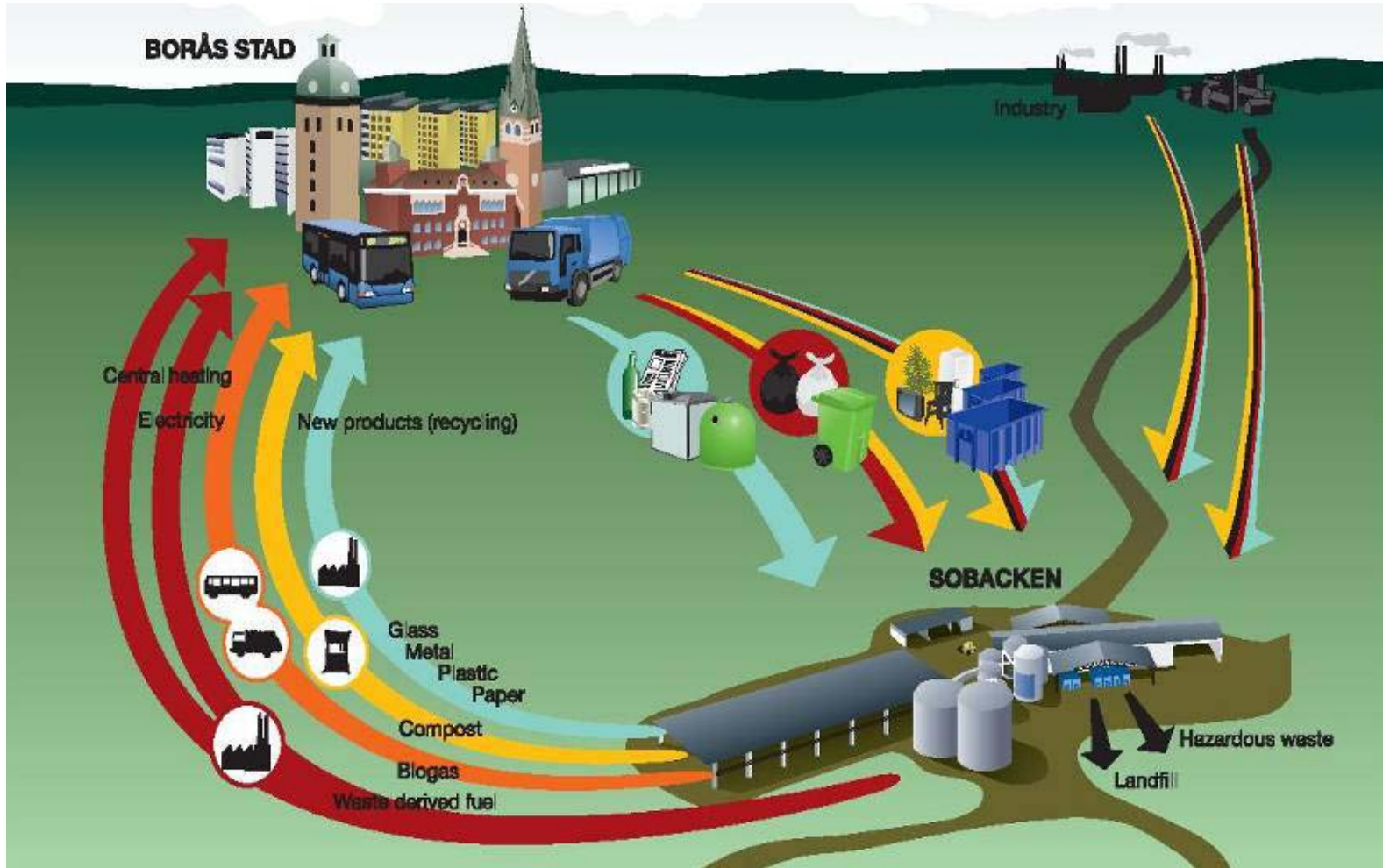
Benefits of LP Cooab technology

- > 99.9 % methane recovery.
- Less than 0.1% methane loss to the atmosphere.
- CH₄ content in upgraded gas > 99%
- CH₄ causes more than 20 times as high effect on global warming than CO₂.
- Upgrading at low pressure
- Low electrical energy consumption due to low pressure and no CO₂ to compress
- CO₂ from the stripper have a value

References LP-Cooab actual September 2009

- Borås in operation since 2002, 300 Nm³/h, 560 scfm, increased to 800scfm
- Gothenburg in operation since 2006, 1600 Nm³/h, 3000 scfm
- Kalmar in operation since 2008, 200 Nm³/h, 375 scfm
- Falkenberg in operation since 2008, 800 Nm³/h, 1500 scfm
- Stockholm in operation since March 2009, 800 Nm³/h, 1500scfm
- Stavanger during start-up, in operation May 2009, 500 Nm³/h, 930 scfm
- Oslo in production, start-up December 2009, 750 Nm³/h, 1400 scfm
- Karlstad new contract, in operation February 2010, 200 Nm³/h, 375 scfm
- Könnern under start-up September 2009, 3400 Nm³/h, 6300 scfm

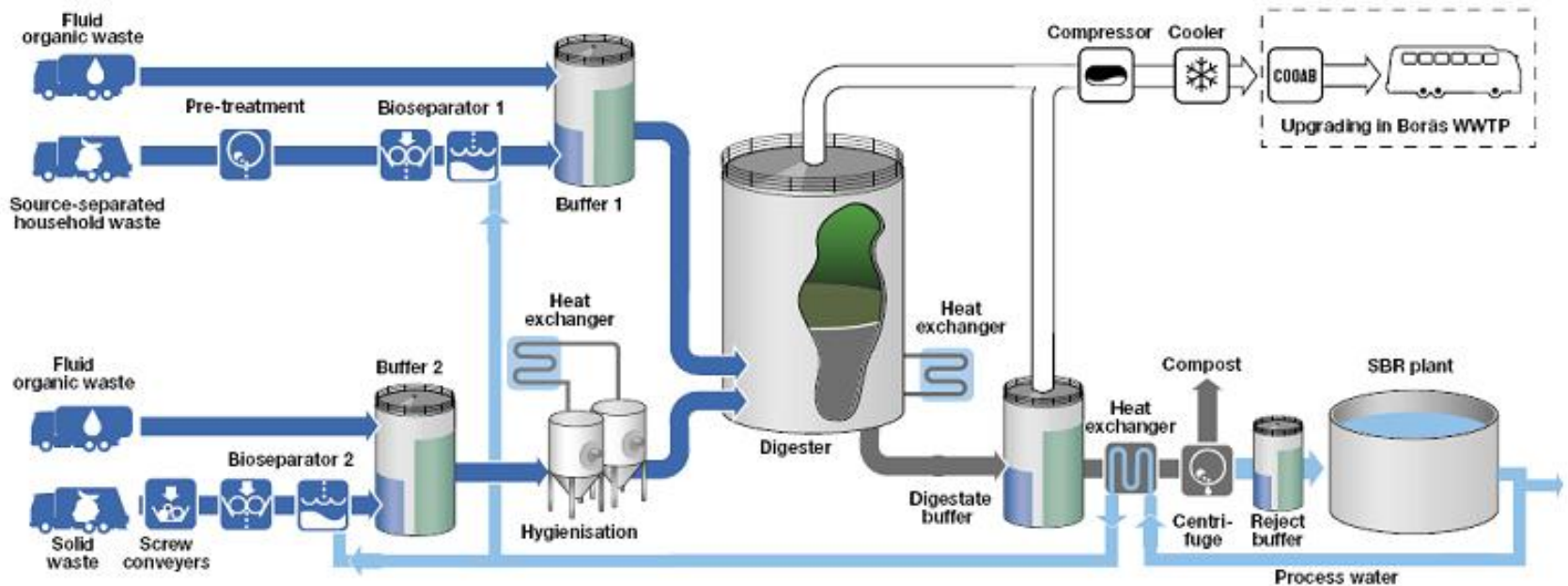
City of Borås – the vision of waste treatment



Biogas Plant Borås, Sweden



From Biowaste to Bio-methane



Biomethane filling station



Reliable performance from Biogas Plants

Agricultural plants

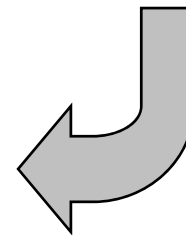
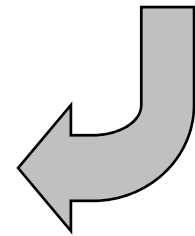
Manure, green crop and farm waste

Plants with liquid substrate

Manure, abattoir and industrial waste

Plants with solid substrate

Restaurant and household waste



Production site at Åby, Linköping Sweden



Agricultural Plants

Lövsta Farm
Gotland



Plants with liquid substrate



Kalmar Biogas Plant

Keys to a successful Biogas Plant

- Select robust mechanical equipment such as receiving unit, conveyors and heat exchangers
- Ensure reliable separation and discharge of unwanted material
- Design plant for reliable internal substrate transport
- Use only equipment proven for this type of application



Göteborgs Energi

The Arendal Biogas Upgrading Plant

Biogas is taken from GRYAAB – the central wastewater treatment plant for the city of Gothenburg.

The biogas is produced during anaerobic digestion of municipal wastewater sludge.

The incoming flow of untreated biogas is 500 – 1 200 Nm³/h.

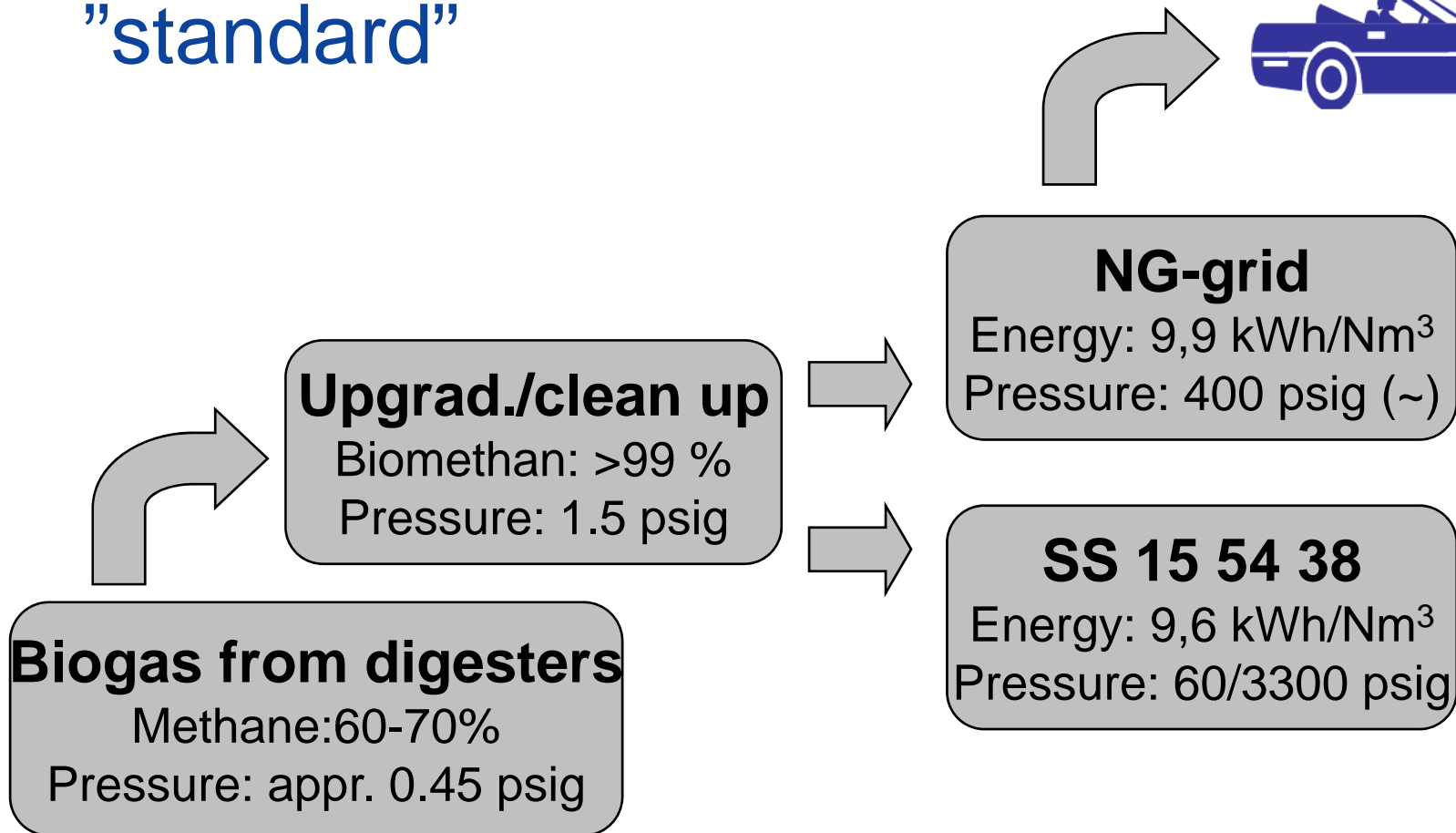
Typical gas composition is:

Methane	62 %
CO ₂	34 %
Nitrogen, oxygen	Traces
H ₂ S	< 10 ppm

H₂S-adsorption



Gasupgrading with LP Cooab to the NG-grid or the vehicle fuel "standard"



Economics of Biogas upgrading

Key issues

- Operational cost (OPEX)
- Availability and methane efficiency
- Capital cost (CAPEX)

This gives total average cost \$ 2,0 /MM BTU
biomethane

(Former target in Sweden has been \$ 4,0 /MM BTU
biomethane)

New achievements is mainly due to higher capacities of
the upgrading plants, ongoing development

3rd Gen: Modular Gas Upgrading Plants





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