

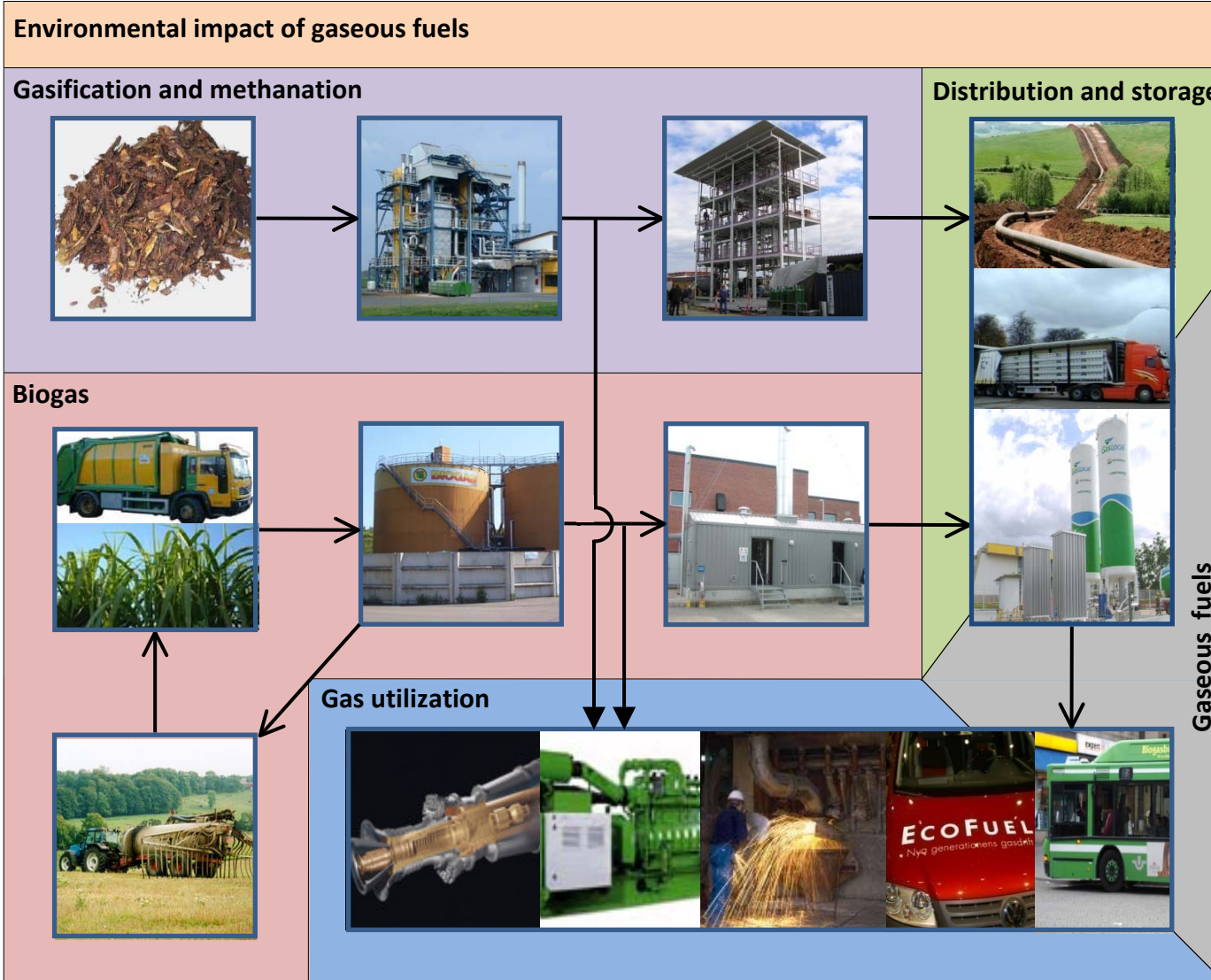
Long term experince with biogas upgrading



Anneli Petersson, Dr.
Swedish Gas Centre

Anneli Petersson, 2009-10-08

Swedish Gas Centre



Swedish Gas Centre



SGC Svenskt Gastekniskt Center AB

OM SGC EXJOBB PUBLIKATIONER NYHETER LÄNKAR ENERGIGASER **Gas OnLine** GasAkademien

Svenskt Gastekniskt Center

Välkommen till Svenskt Gastekniskt Center AB! Vi samordnar den tekniska utvecklingen inom energigasområdet och främjar ett brett och effektivt utnyttjande av energigas.

Svenskt Gastekniskt Center AB
Scheelegatan 3 Hitta till oss
212 28 Malmö

Telefon: 040-680 07 60
Fax: 040-680 07 69
info@sgc.se

**International Seminar on Gasification
– Gas Clean-up and Gas Treatment
22-23 October, 2009 Clarion Hotel Sign, Stockholm**

*Du har väl inte missat SGCs nyhetsbrev??
Klicka här och läs mer!*

2009-09-25
SGC och SGC Väster samarbetet

2009-09-23
Nyutvärdering av energigas på WSC/2009

2009-09-15
SGC Nyhetsbrev nr 3 2009

2009-09-07
SGC på ICFB-konferensen om förgasning i Wien

2009-09-07
SGC deltar på ICFB-konferens i Kanada

2009-08-31
Ny SGC Rapport 210 - Hydrogen Produktion för Refining Applikation

2009-08-28
Rekordnytt för SGC för gasanvändning

2009-08-10
SGC väntar ICG in Aachen

2009-07-29
Ny rapport - SGC Rapport 212 Marknadsförhållningar för SGC i Sverige och i Europa

2009-07-18
SGC anordnade studiebesök

Nyhetsarkiv

Sök på

SÖK

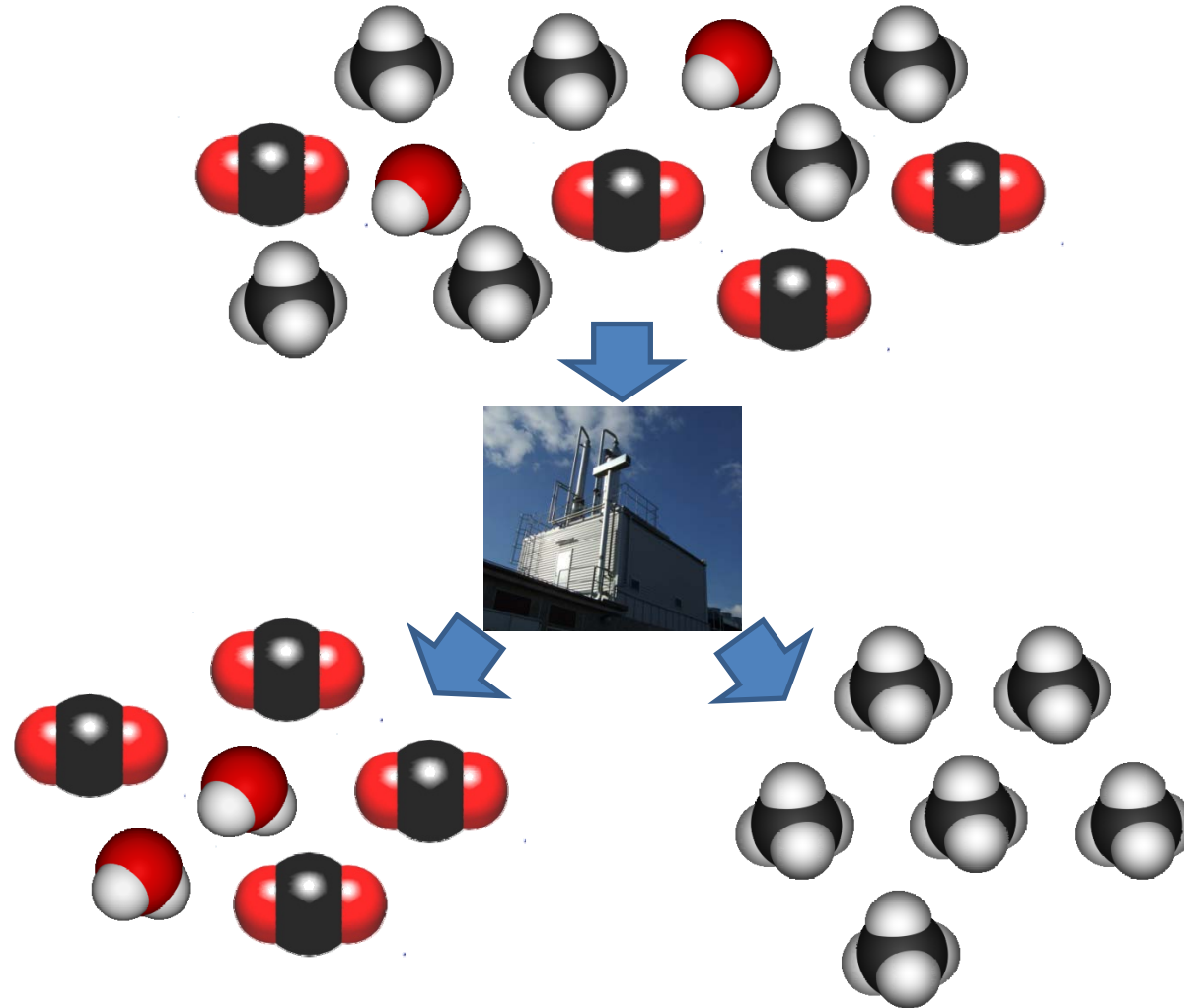
Anneli Petersson, 2009-10-08

Swedish experience of biogas upgrading

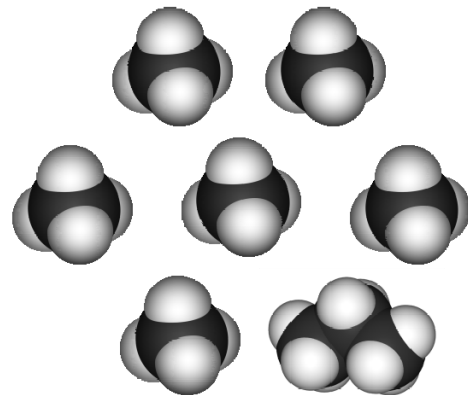
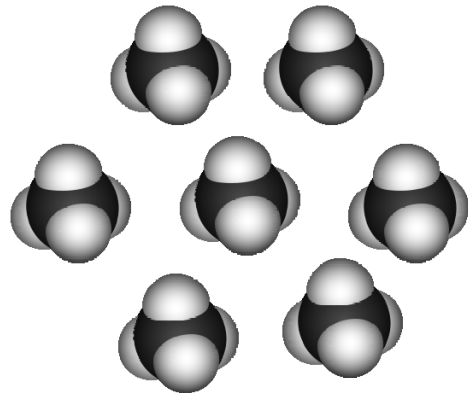


Anneli Petersson, 2009-10-08

Biogas upgrading



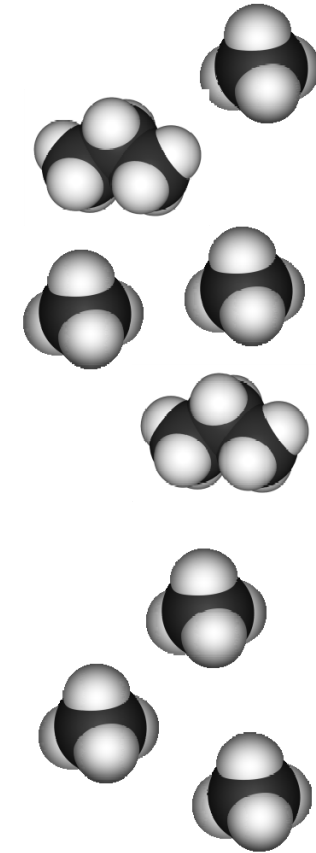
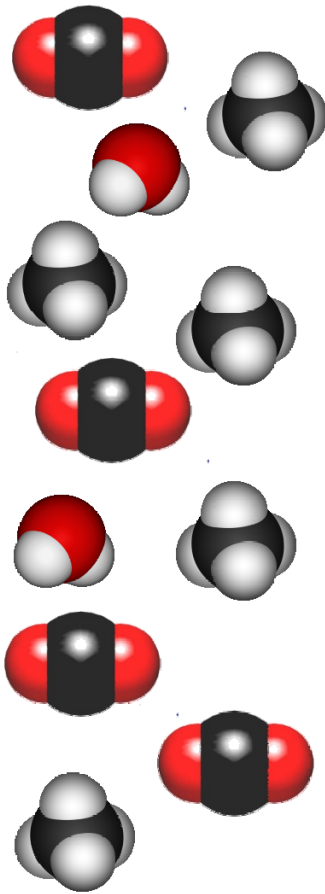
Utilization of upgraded biogas



Environmental benefits – biogas as vehicle gas

- Biogas is renewable – low CO₂-emissions
- 25 % less CO₂-emissions for natural gas compared to petrol
- Lower emissions of: NO_x, SO_x, particles
- Simultaneous production of biogas and fertilizer
- Decreased methane emissions compared to traditional manure storage

Gas composition



		Biogas	Landfill gas	Natural gas (Danish)
Compounds	Methane (vol-%)	60-70	35-65	89
	Other hydrocarbons (vol-%)	0	0	9.4
	Hydrogen (vol-%)	0	0-3	0
	Carbon dioxide (vol-%)	30-40	15-50	0.67
	Nitrogen (vol-%)	~0.2	5-40	0.28
	Oxygen (vol-%)	0	0-5	0
	Hydrogen sulphide (ppm)	0-4000	0-100	2.9
	Ammonia (ppm)	~100	~5	0
Lower heating value (kWh/Nm ³)		6.5	4.4	11.0

Swedish standard

- Particles < 1 μm
- Methane 97+/- 2 %
- Water < 32 mg/Nm³
- CO₂, O₂, N₂ < 5%
- Oxygen < 1 vol %
- Sulphur < 23 mg/Nm³
- N (except for N₂) expressed as NH₃ <20 mg/Nm³
- Odorised
- Compressed to 200 bar

For grid injection: Addition of propane to reach the energy content of the Danish natural gas (around 7-9 vol% is added)

Biogas upgrading

- In Sweden today:
 - Water scrubber (27)
 - PSA (7)
 - Chemical absorption (4)
- In the near future:
 - Cryogenic



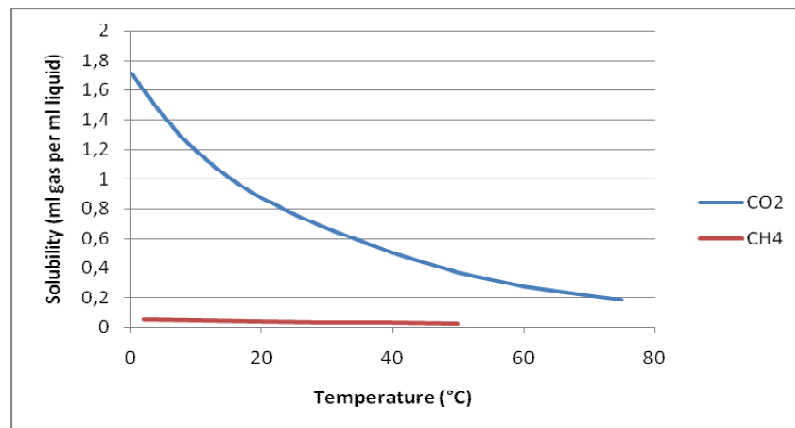
PSA

- Pressure Swing Adsorption
- Activated carbon or zeolites
- Regeneration by decrease in pressure
- Several vessels in parallel



Water scrubber

- Carbon dioxide dissolves in water
- Methane dissolves to a much lower extent
- Dissolved methane recovered in flash tank
- Water regenerated by pressure decrease



Anneli Petersson, 2009-10-08



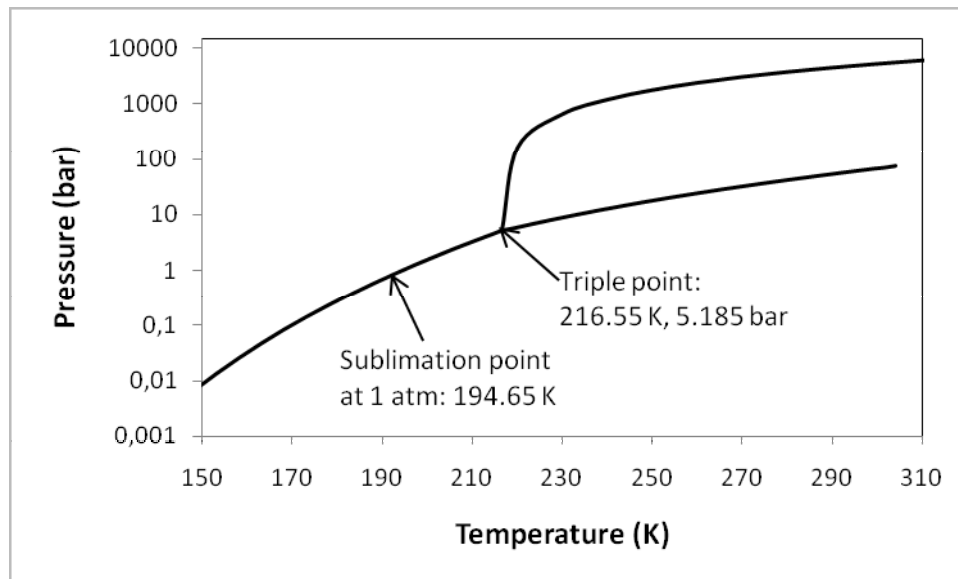
Chemical absorption

- Carbon dioxide binds chemically
- Selective reaction
- Low methane losses
- MEA or DMEA in the liquid
- Regeneration by heating

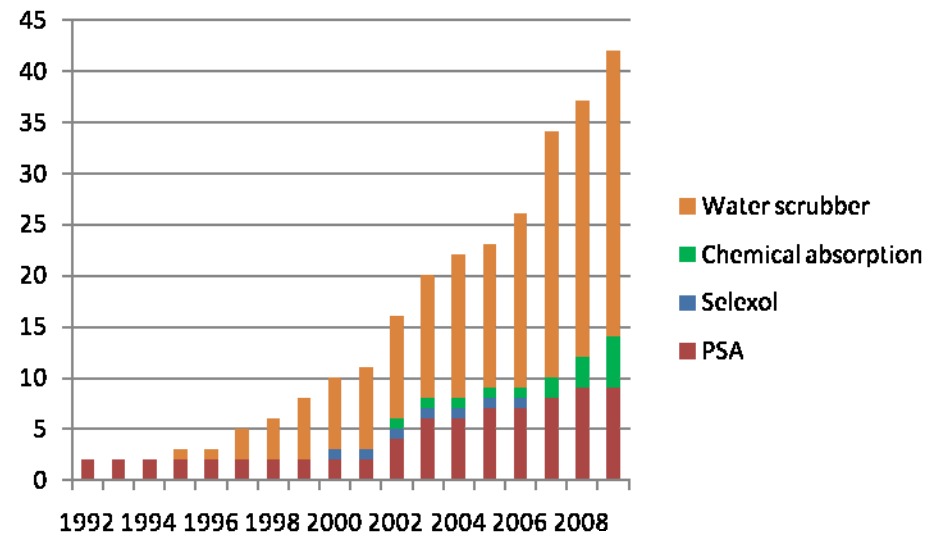


Cryogenic

- Separation by cooling
- Carbon dioxide removed as solid or liquid
- If cooled further liquid methane gas is formed

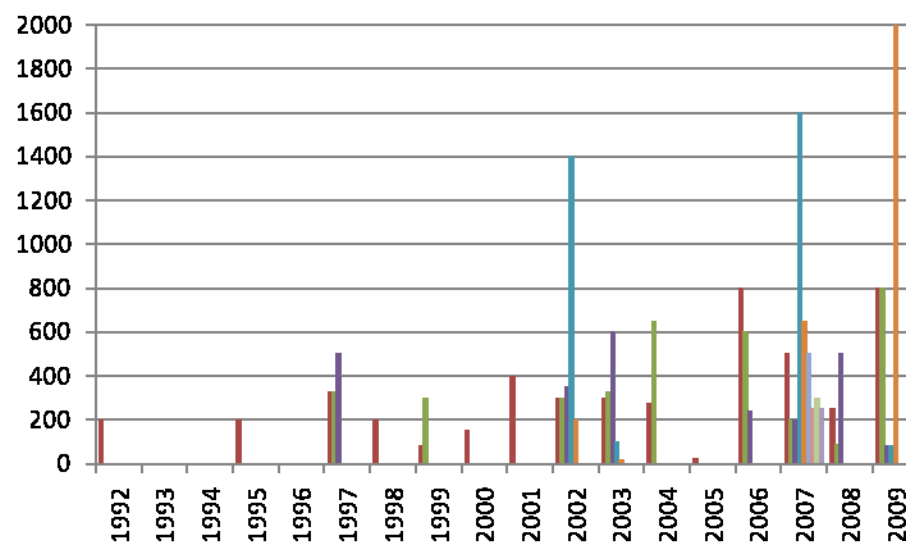


Building year

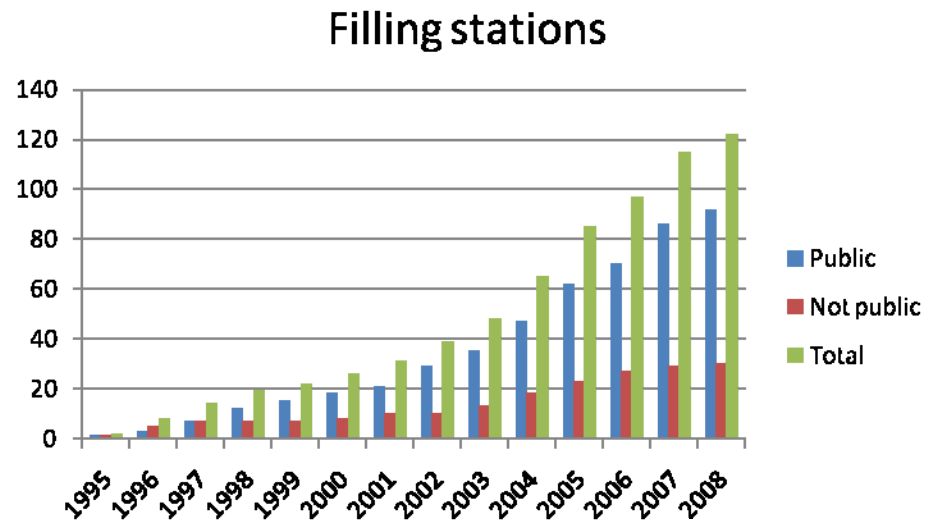


38 plants in operation today.
4 taken out of operation.
Pilotplants not included.

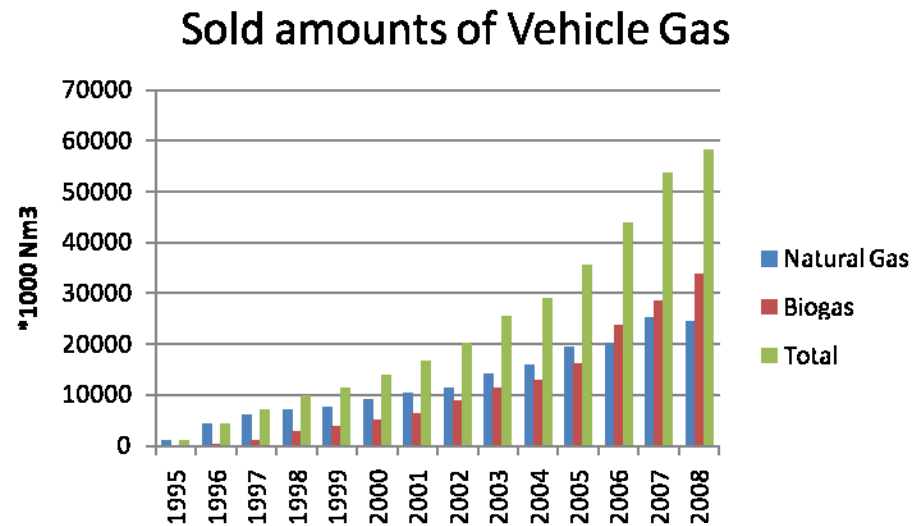
Size distribution



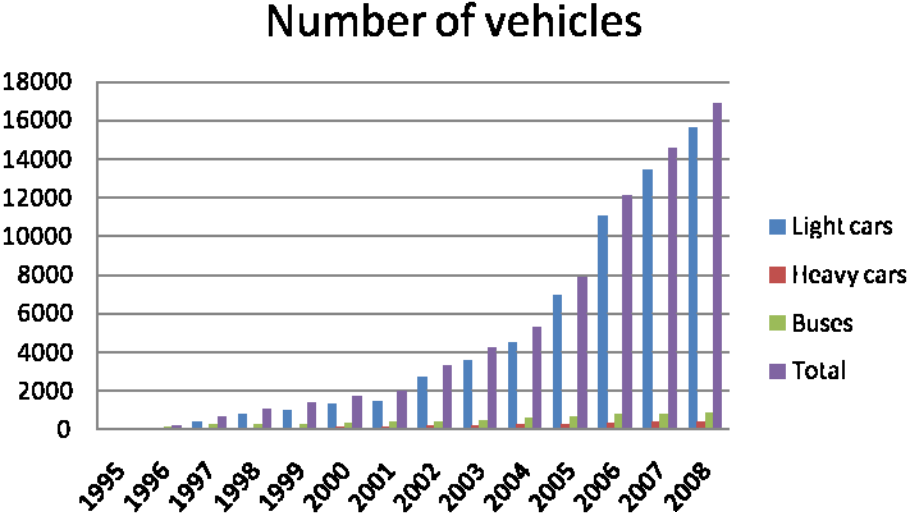
Filling stations



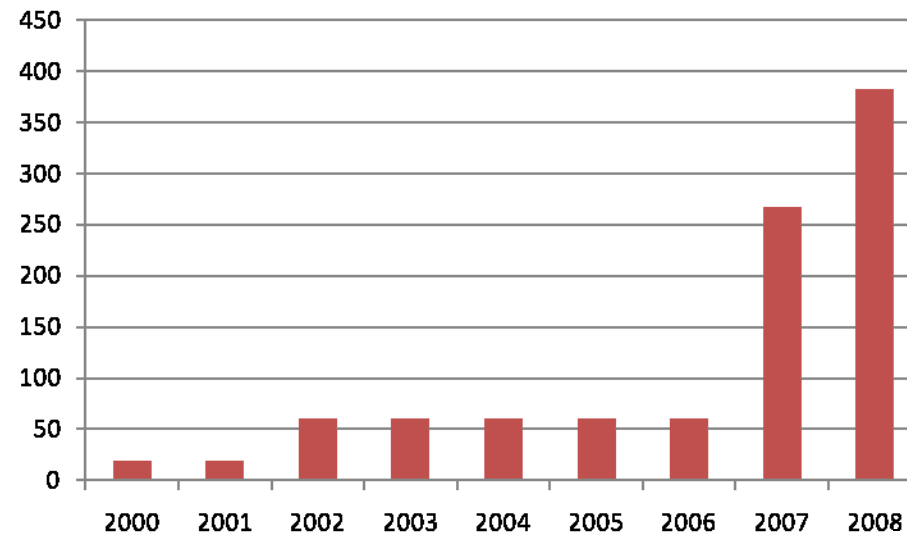
Sold volumes of vehicle gas



Gas vehicles



Capacity grid injection



The Swedish gas grid



Source: Swedish Gas Association

Anneli Petersson, 2009-10-08

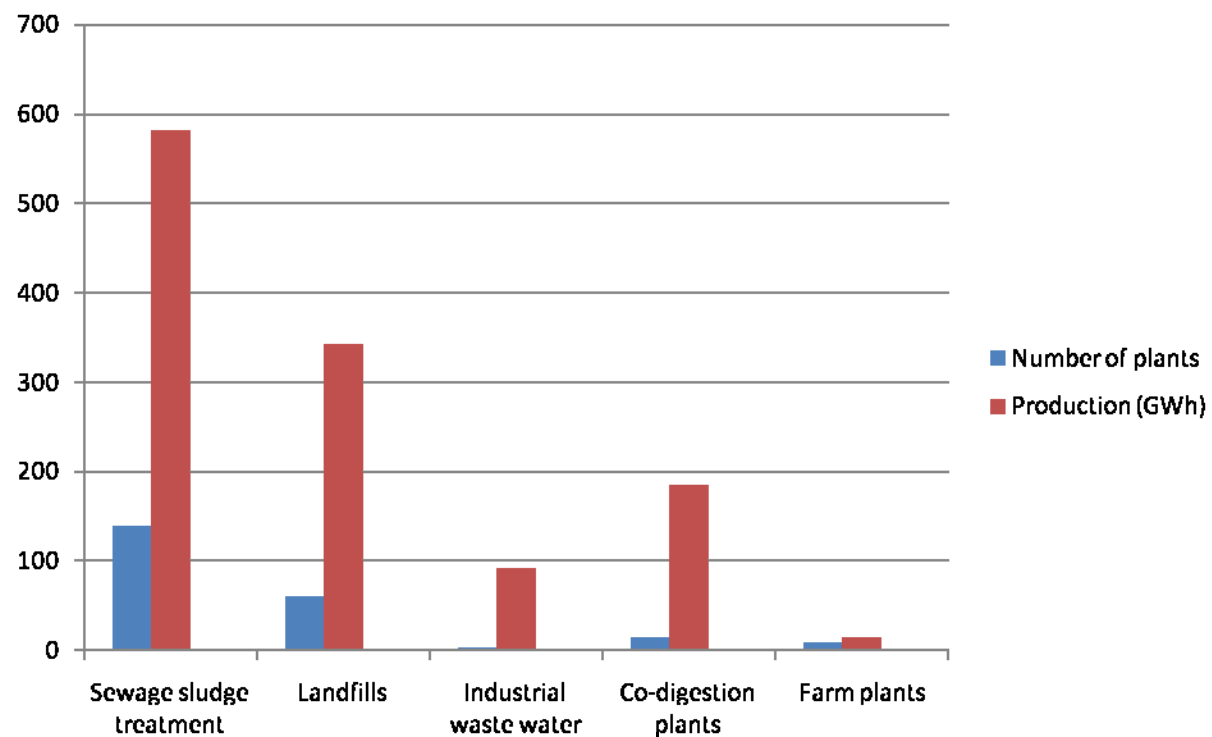
Statistics for 2006

- 1.2 TWh produced per year
- 223 plants
 - 138 municipal sewage treatment plants
 - 60 landfills
 - 3 Industrial wastewater treatment plants
 - 14 Co-digestion plants
 - 8 Farm plants

Source: Swedish Energy Agency, ER 2008:02

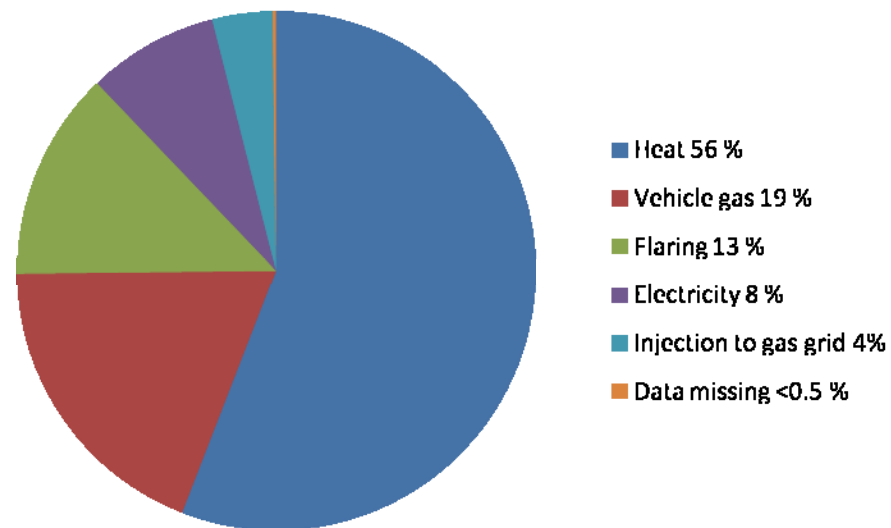
New statistics for 2007 and 2008 will be available Q3 2009

Biogasproduktion i Sverige 2006



New statistics for 2007 and 2008 will be available Q3 2009

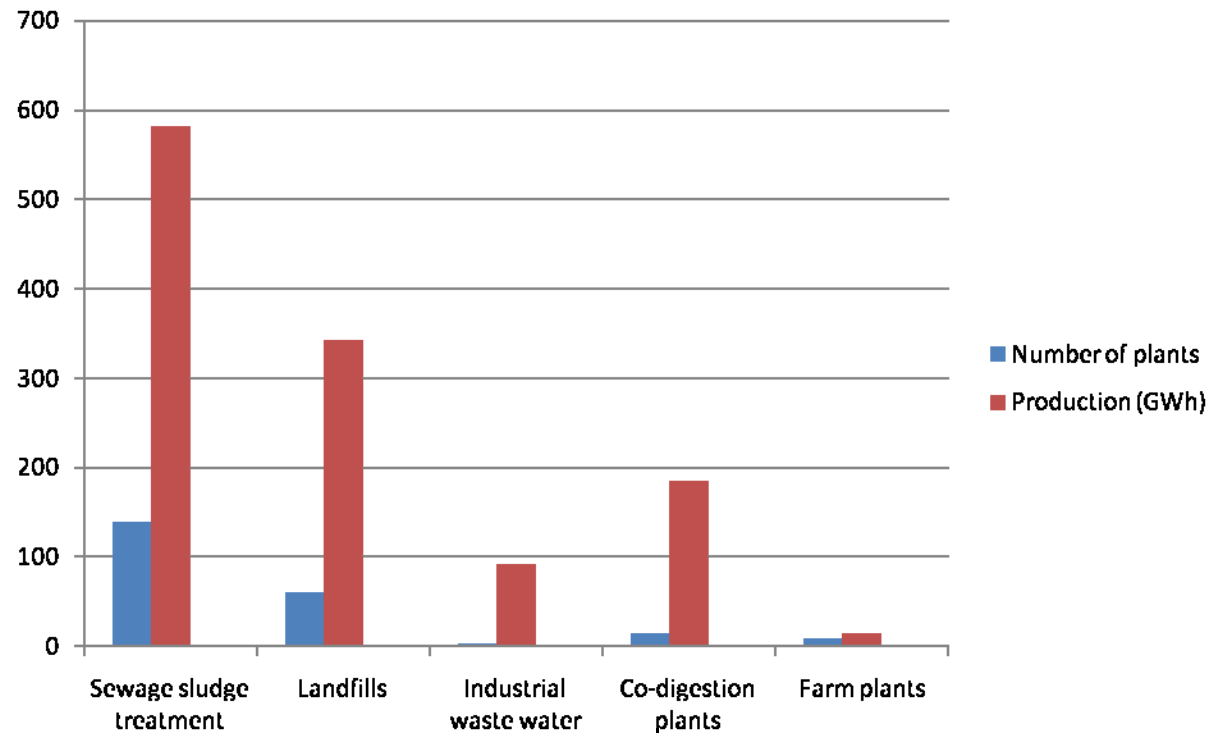
Utilization of biogas in Sweden (2006)



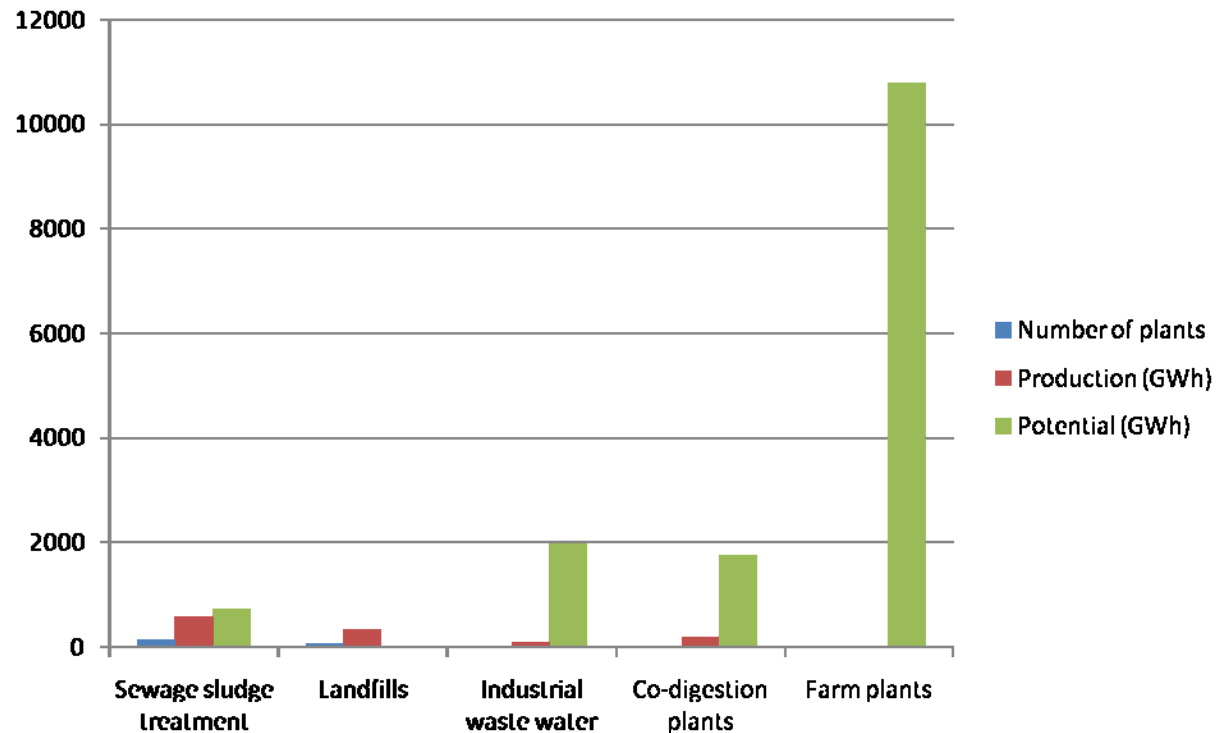
Source: Swedish Energy Agency, ER 2008:02

New statistics for 2007 and 2008 will be available Q3 2009

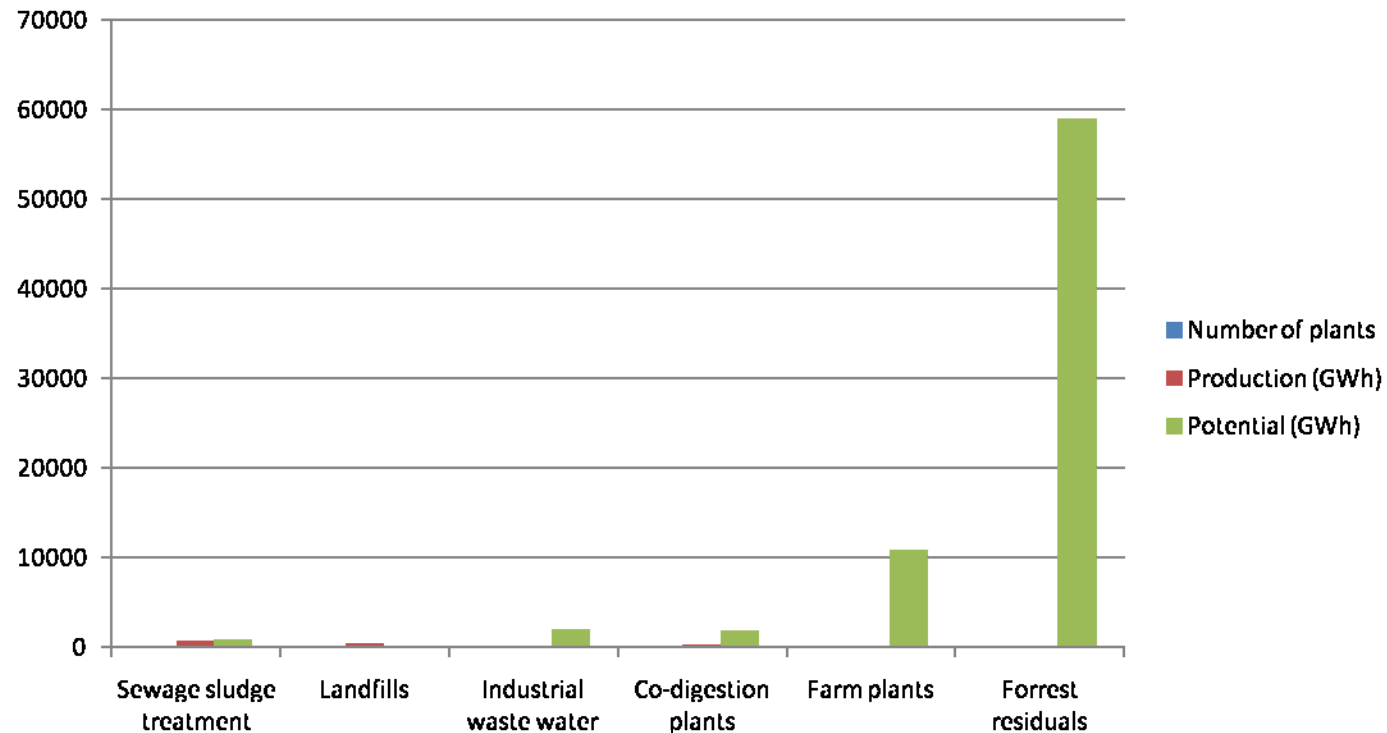
Biogas production in Sweden 2006



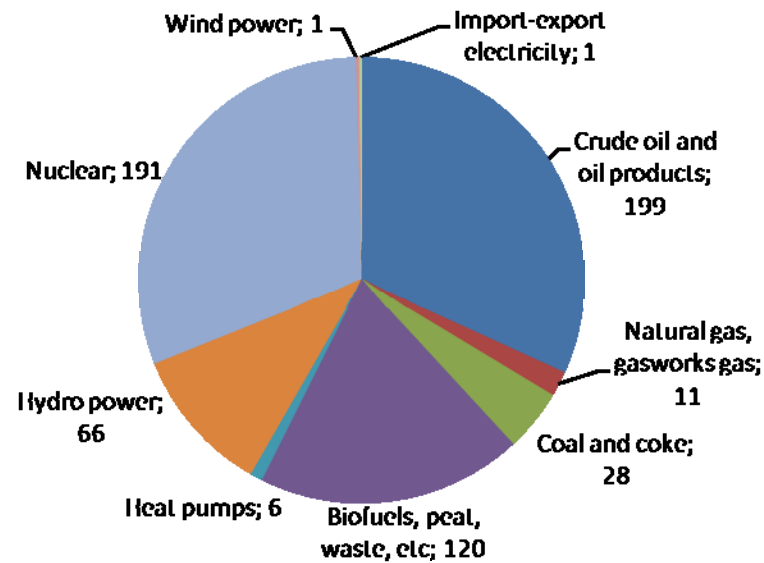
Biogas production i Sweden 2006 and biogas potential



Biogas production i Sweden 2006 and biomethane potential

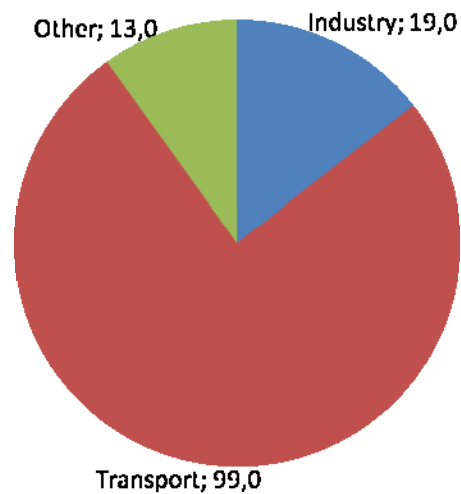


Energy supplied to Sweden (TWh)



Oil products

- Utilization of oil products in Sweden 2007:
131 TWh



Background to the development

For example:

KLIMP (Climate Investment Programme) 2003-2008

LIP (Local Investment Programmes) 1998-2002

No tax on biogas

Free parking in many cities

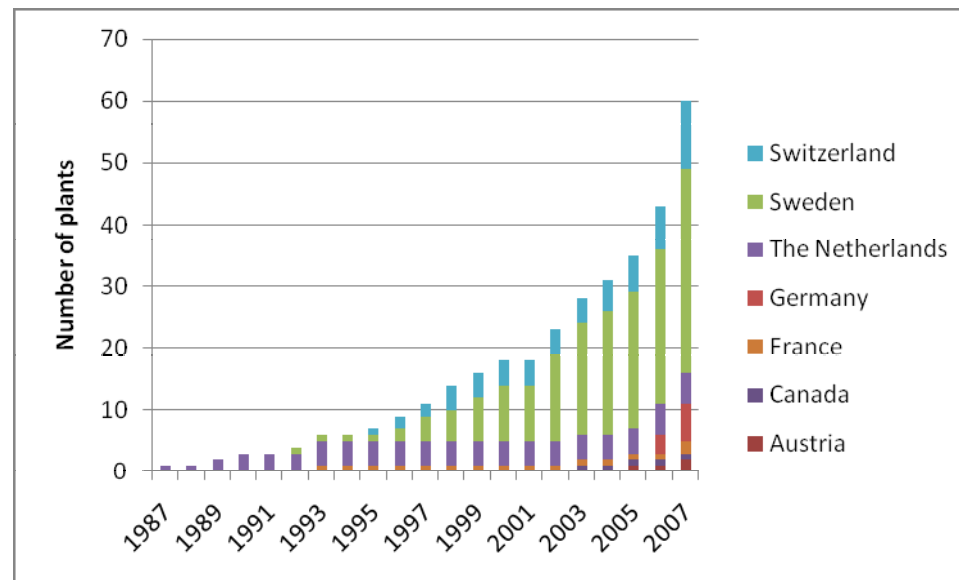
Eco car subsidy 1100 €

Now: Investment programs for agricultural biogas (200 millions SEK) and biogas production plants (150 millions SEK).

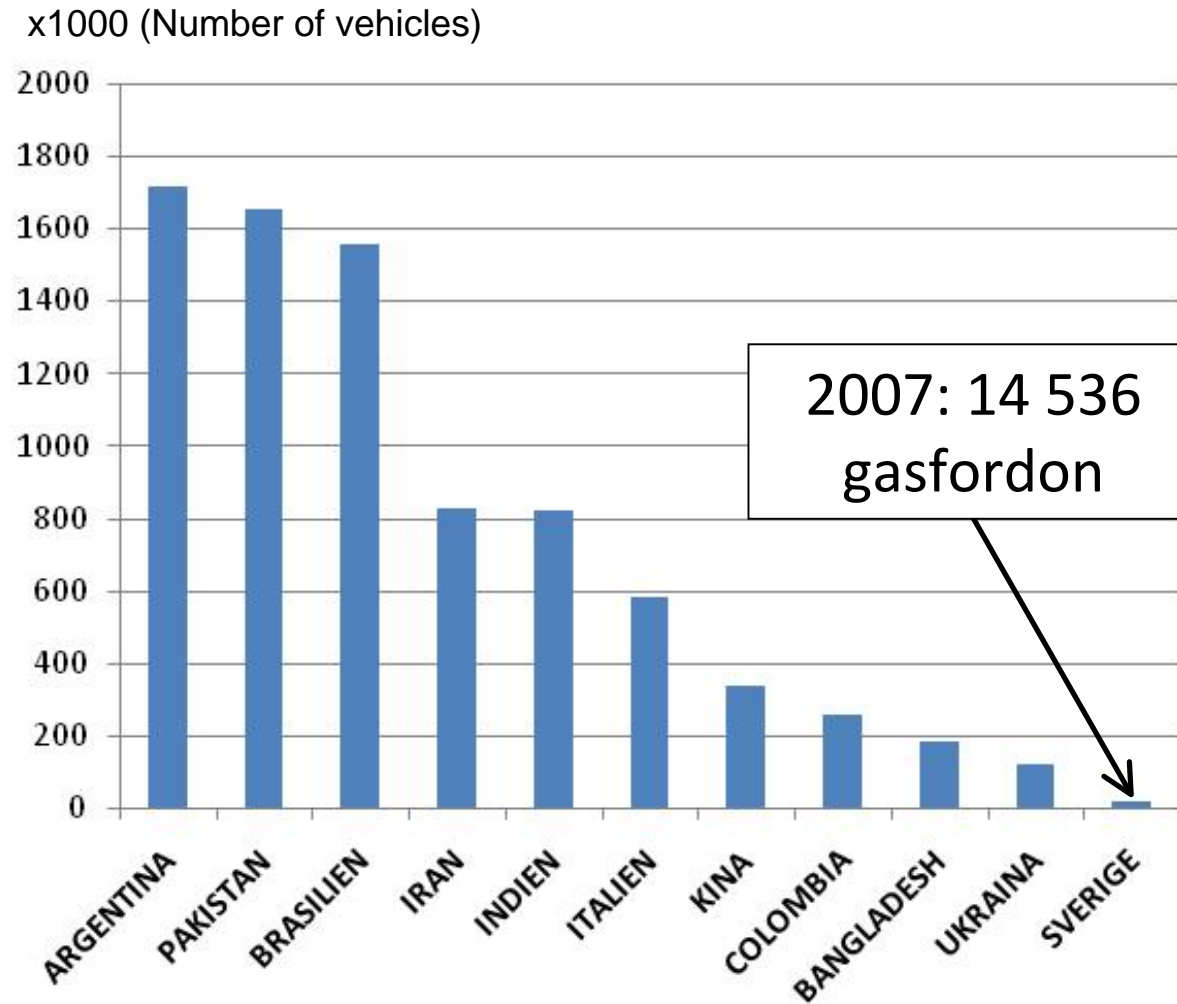


Biogas upgrading internationally

- Plants for biogas upgrading in the Task 37 countries



Vehicles in Sweden and in the world...



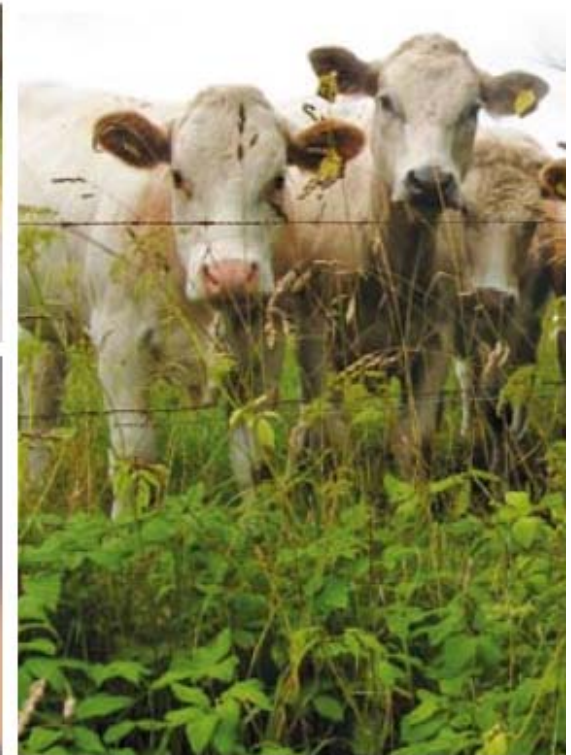
Conclusions

- Biogas upgrading in Sweden started in 1992
- Many environmental benefits with using biogas as a vehicle fuel
- Today 38 upgrading plants (water scrubber, PSA and chemical absorption)
- Cryogenic upgrading and LBG production during 2009
- The upgraded gas is used as vehicle fuel and for grid injection
 - 65% biogas in vehicle gas
 - Injection of upgraded biogas to the grid at 7 locations
- The Swedish biomethane potential is around 74 TWh
 - 99 TWh oil is used in the transport sector



Nordic Biogas Conference

Oslo, 10 – 12 March 2010



Get your update on Nordic biogas

The 3rd Nordic Biogas Conference will be held at Oslo Congress Center
10th – 12th March 2010.



Anneli Petersson, 2009-10-08

Thank you for your attention!



anneli.petersson@sgc.se

www.sgc.se