
Development of biomethane production, use and trade in Sweden

Tobias Persson, Energiforsk

Fuels of the Future, 19-20 January 2015, Berlin

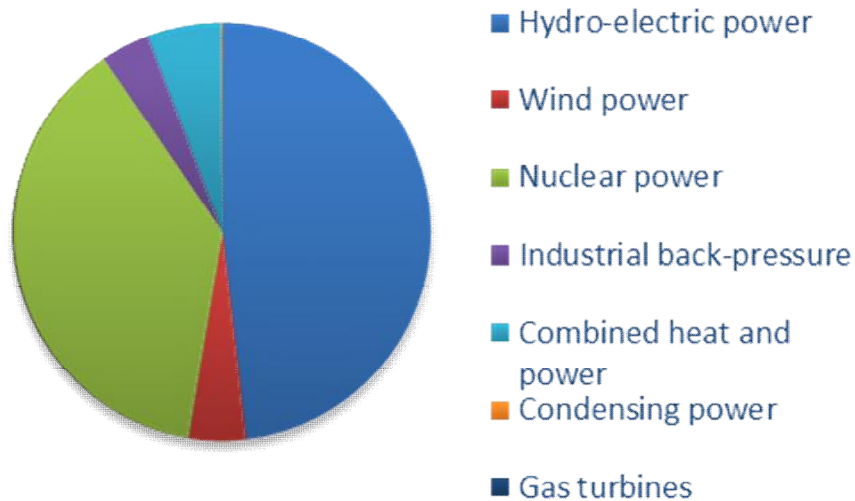


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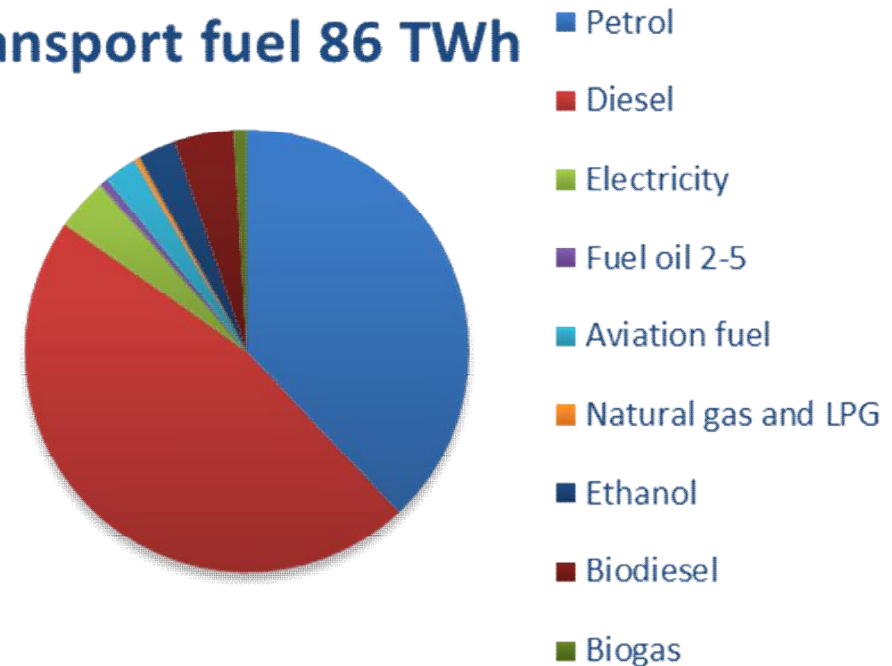
Energy usage in Sweden

Total energy use in Sweden (excl. losses) (2012) – 377 TWh

Electricity production 163 Twh



Transport fuel 86 TWh

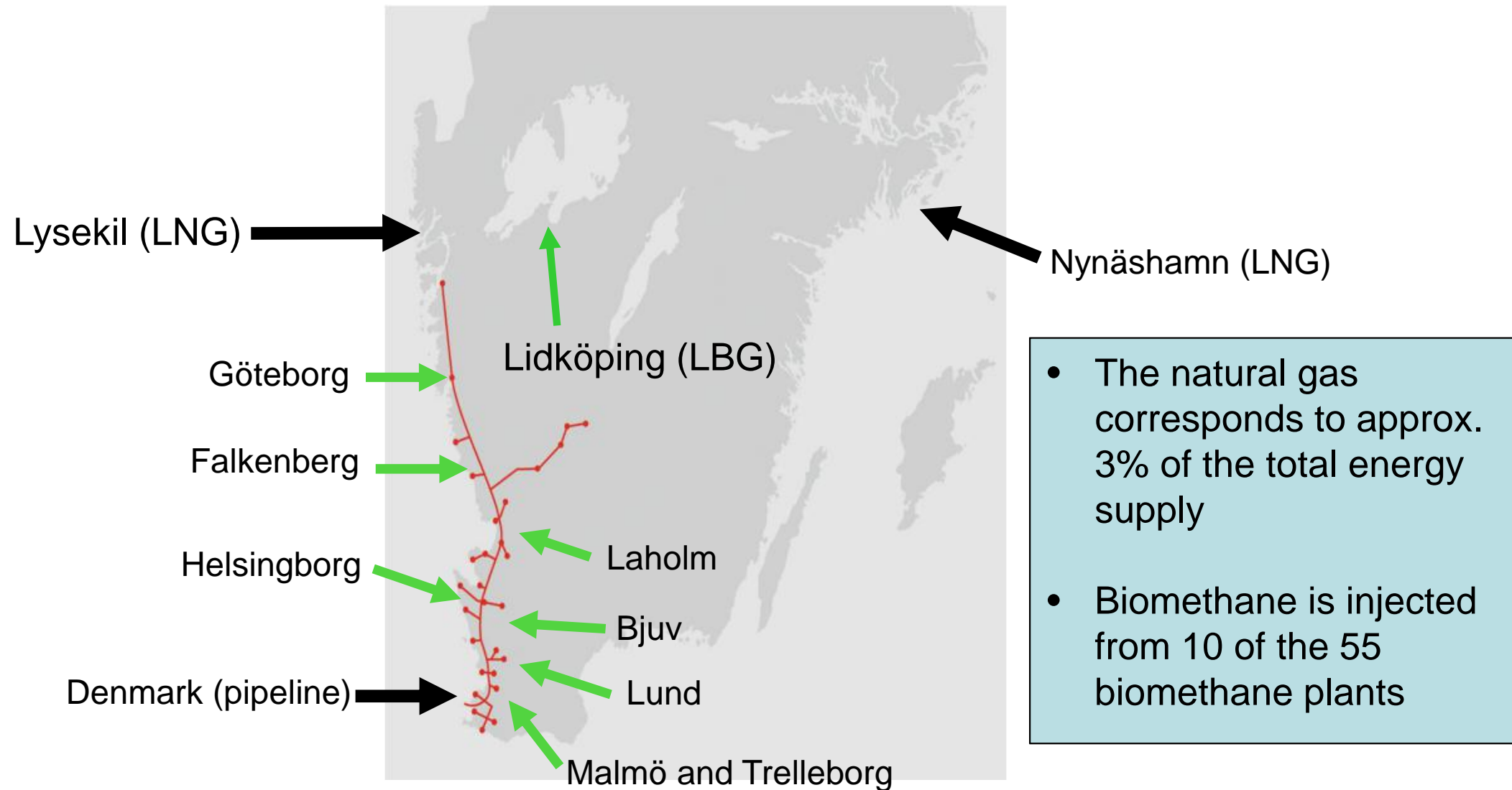


Industry – 25 % fossil fuels (oil, coal, natural gas)

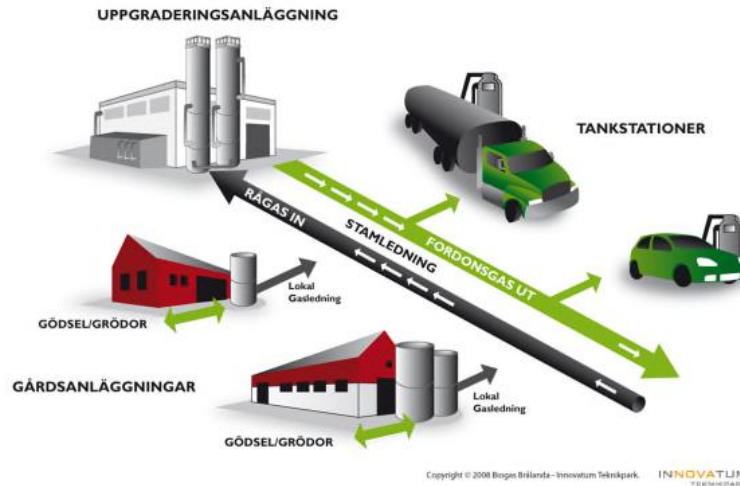
Households – 10 % fossil fuels (oil)

Transports – 92 % fossil fuels

Limited national gas grid



Sweden is world leading in transporting gas off-grid



Transportation in gaseous form

- Compressed to 20–25 MPa and kept in flasks
- Suitable for small scale production
- Transport distance up to ~200 km

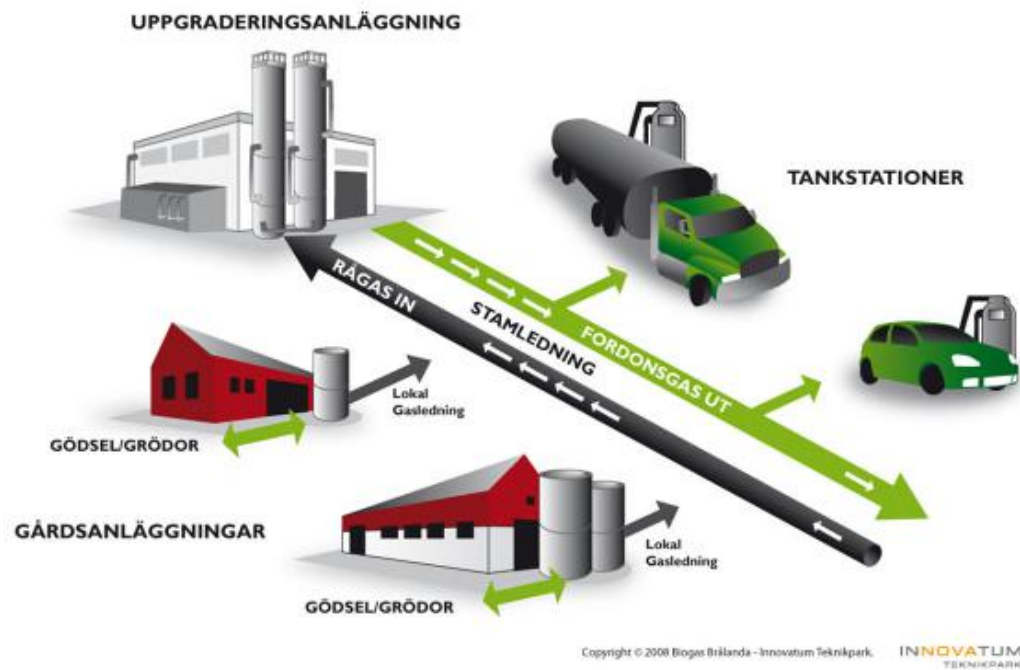


Transportation in liquid form

- Long distance transportation is economically possible
- New possible markets
- High investment and energy consumption

Local grids

- Two or more biogas plants connected to joint upgrading plant
- Many existing examples such as Biogas Brålanda, similar to Paraná in Brazil



Regional grids

- Connect production units, filling stations and customers to an LNG terminal



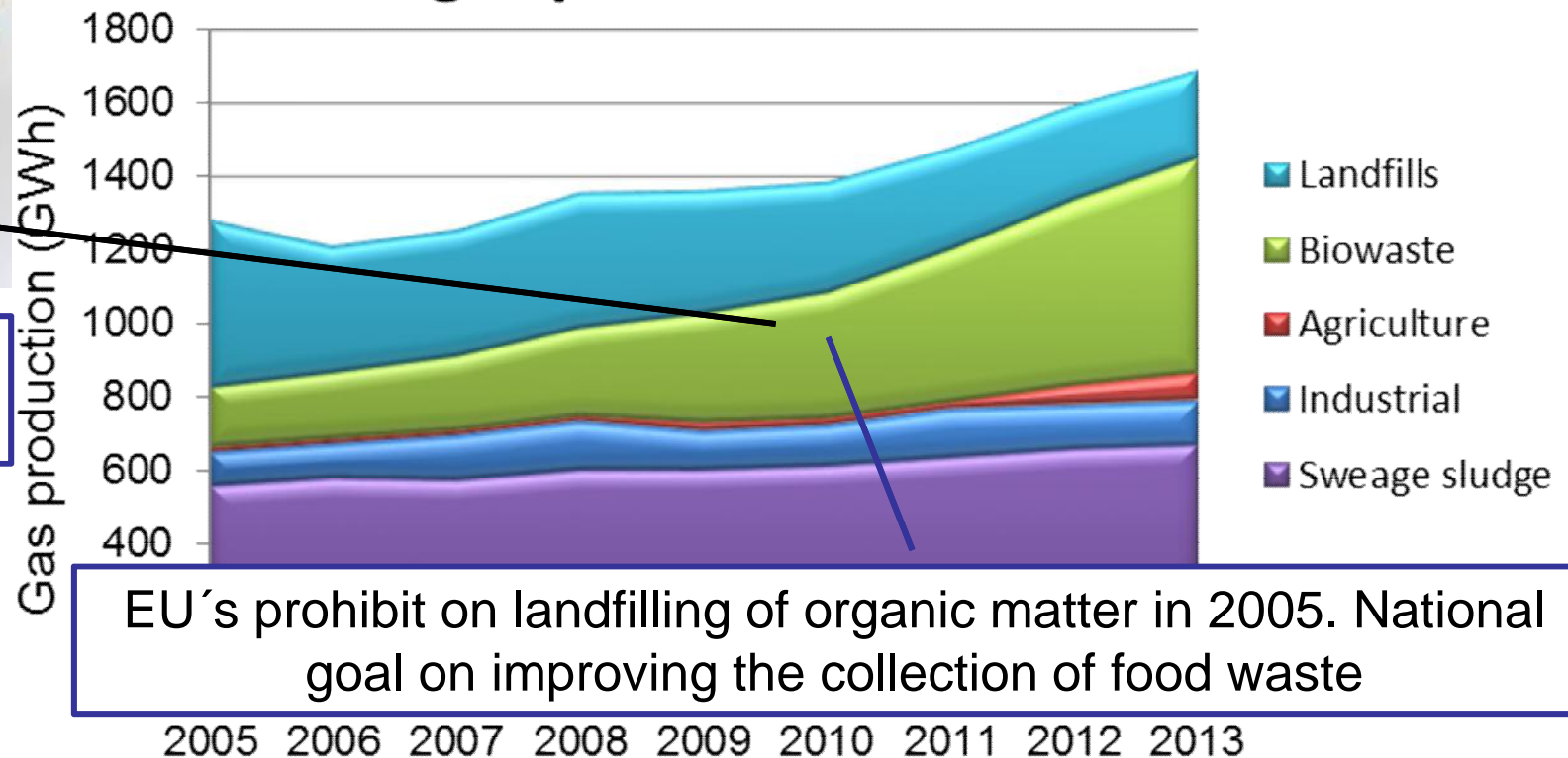
Biogas production 2005-2013

264 biogas plants → 1.7 TWh biogas (2012)



30 000 ton 2005 –
307 000 ton 2013

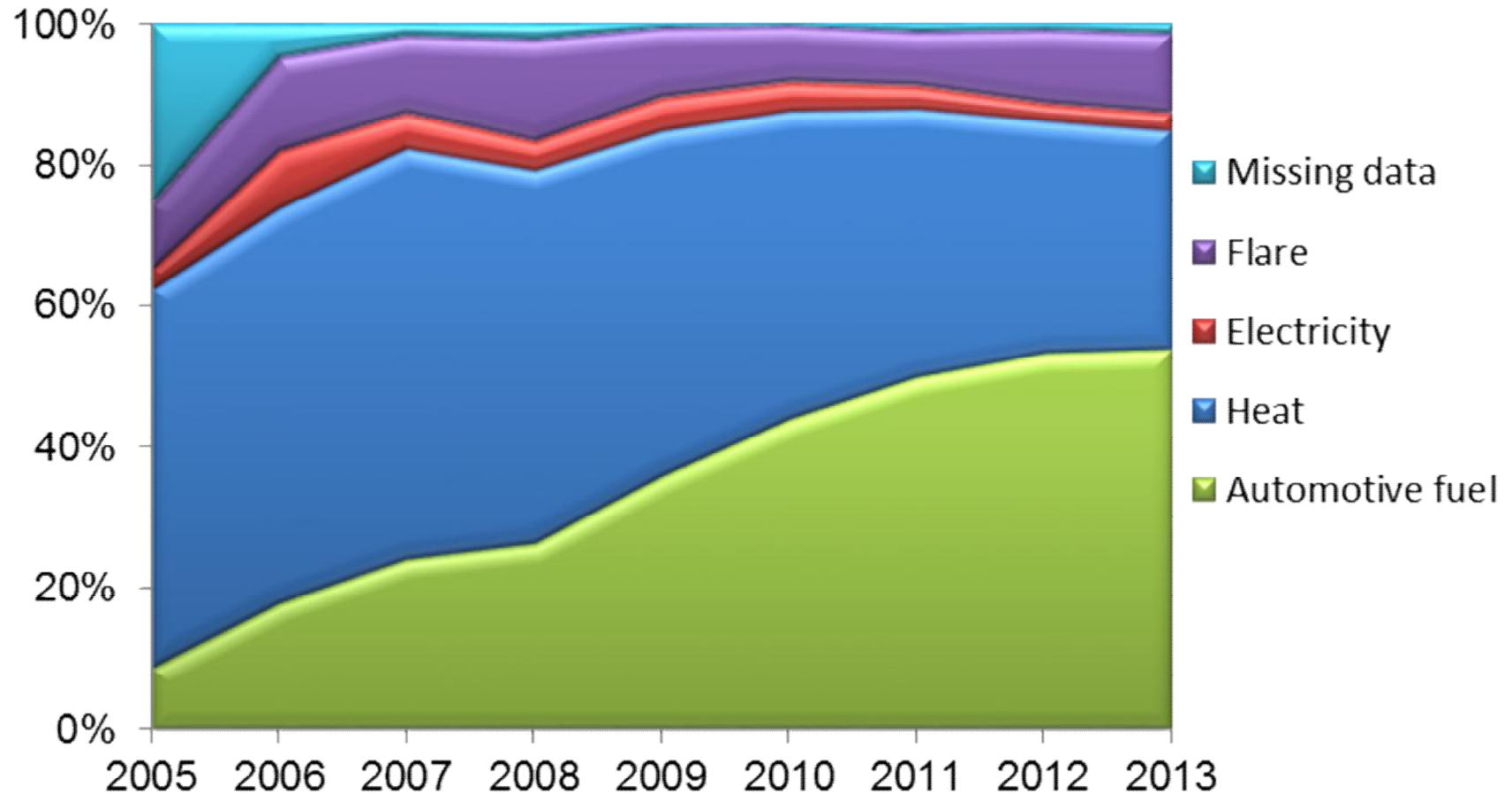
Biogas production 2005-2013



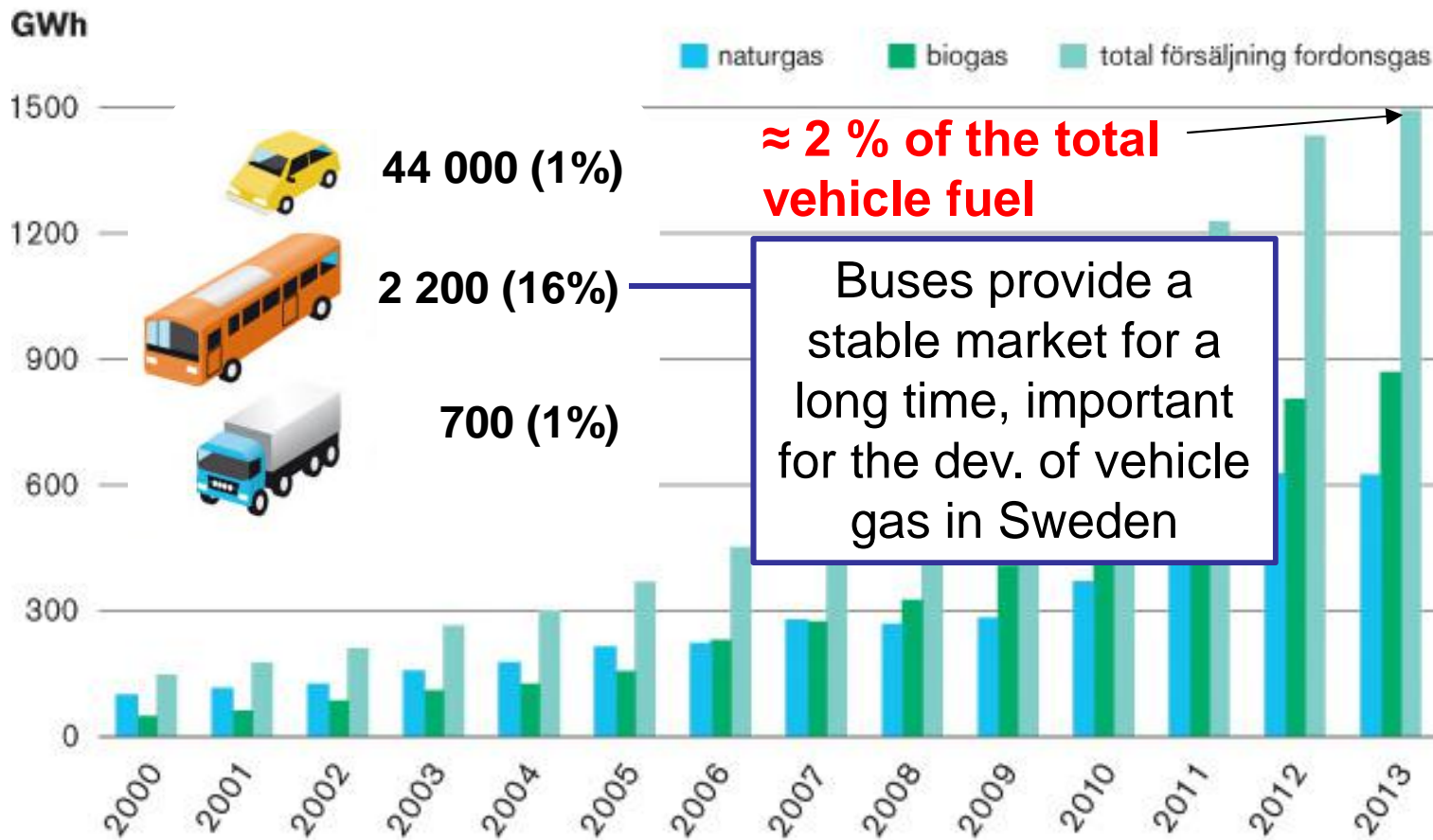
Food waste collection in 190 of Sweden's 290 municipalities

Biogas utilisation 2005-2013

Biogas utilisation 2005-2013



The interest for NGVs is increasing



**205 gas filling stations
(5 with LNG/LBG)**

Source: www.gasbilen.se, SPBI Branschfakta 2014

Biomethane as an automotive fuel

Not only lower emissions of CO₂ but also particles and SO_x and NO_x

Vehicle type	Present fuel	Liquid bio fuels	Electric	Hybrids	Biogas
Cars	Petrol/Diesel	Yes (%)	Yes	Yes	Yes (CBG)
Delievery trucks	Diesel	Yes (%)	No	Yes	Yes (CBG)
Urban busses	Diesel	Yes (%)	Yes (wired)	Yes	Yes (CBG)
Heavy trucks	Diesel	Yes (%)	No	No	Yes (LBG)
Train	Diesel/Electric	Yes (%)	Yes (wired)	No	Yes (LBG)
Ships	Diesel	Yes (%)	No	No	Yes (LBG)

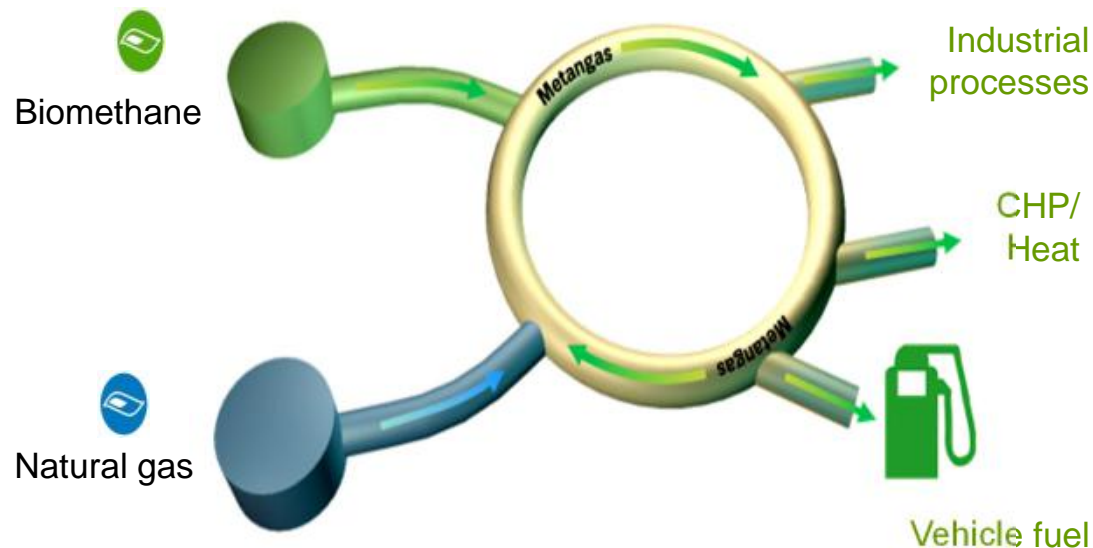


Hybridbuses (biogas/electricity) in Malmö in Sweden



Swedish visions and goals

- The Swedish Gas Industry's visions are:
 - 100 % biomethane in the vehicle gas in 2030
 - 100 % biomethane in the gas grid in 2050

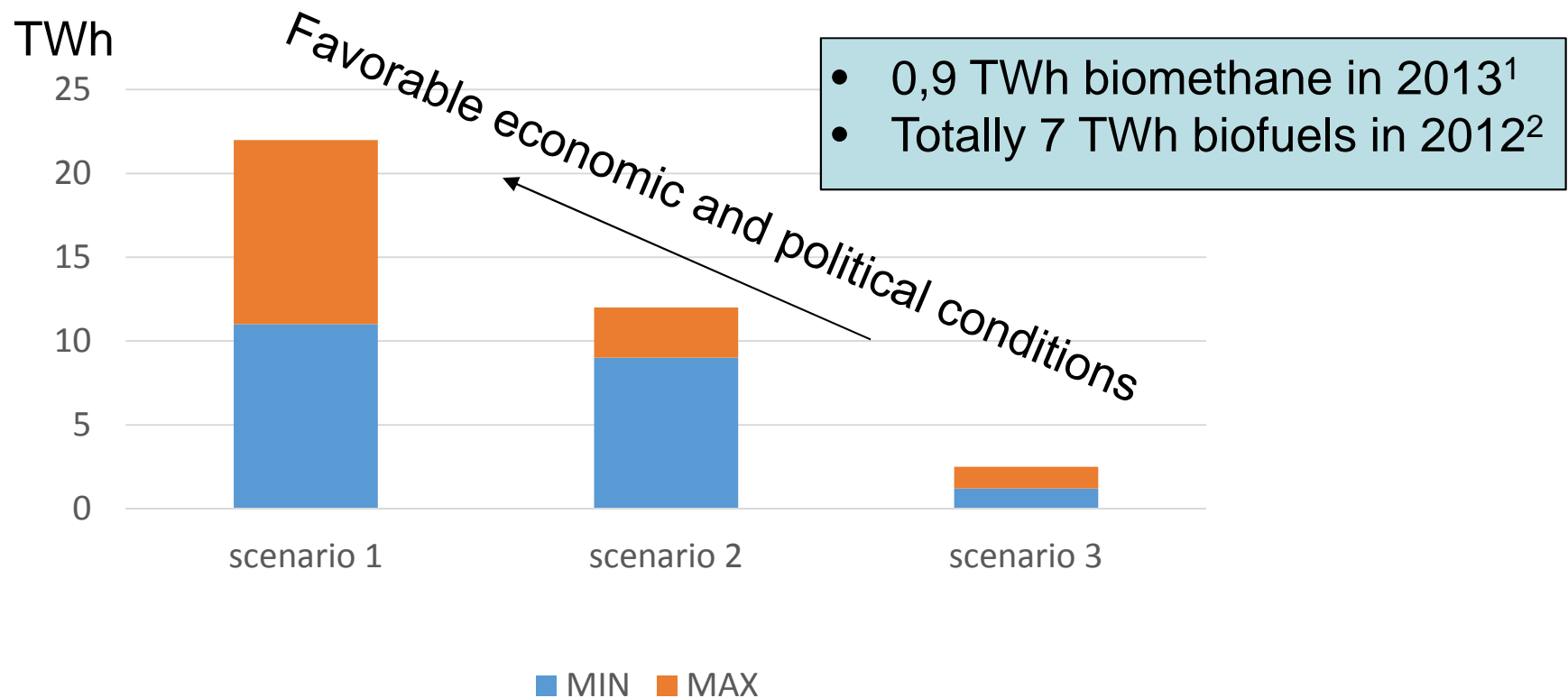


Swedish visions and goals

- Fossil free vehicle fleet in 2050, through the following measures:
 - ↓ Needs for transports
 - ↑ Energy efficient vehicles
 - ↑ Proportion of electricity and bio-fuels



The realizable biomethane potential for the vehicle fleet in Sweden 2030



- (1) Source: Utredningen av Fossilfri fordonstrafik, Dec 2013
(2) Source: Energiläget 2013, Swedish Energy Agency

Biomethane trade

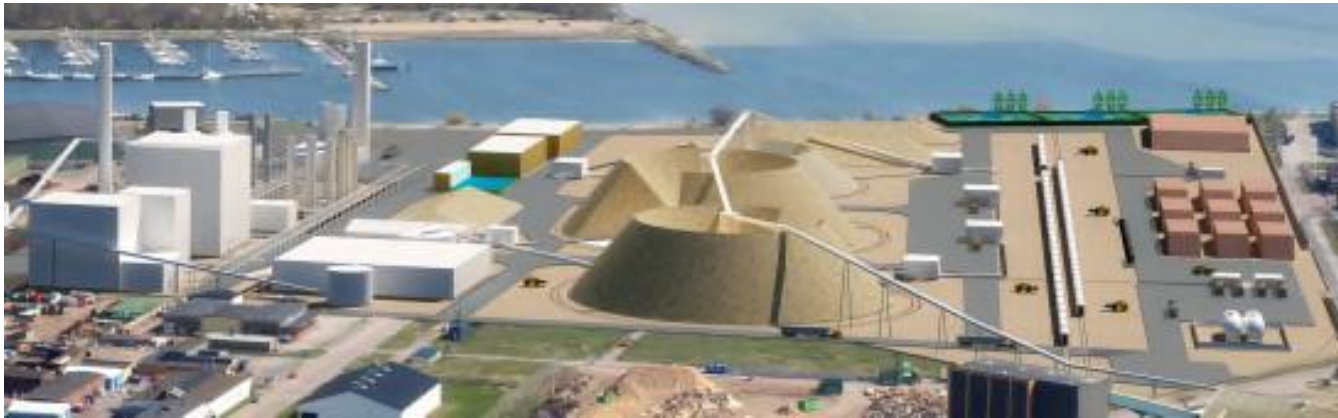
National trade

- Similar to certificate trading but without third party control.

International trade

- The Swedish Energy Agency claims that imported biomethane has to fulfil traceability on mass balance level. Not possible through the European gas grid. Decision is appealed.
- However: One company (Mody) is certified through REDcert recognized by the European Commission and is allowed to import biomethane to Sweden

Large industrial biomethane production plants/projects in Sweden



GoBiGas – Bio-SNG plant in Gothenburg

Producing biomethane by gasification

Injection into the transmission gas grid (30 bars)

Feed stock: Forest residues

Phase 1 - Demonstration

20 MW_{bio-SNG} (160 GWh/yr) + heat

Cost: 160 M€

(24 M€ from Swedish Energy Agency)

Phase 2 – Full scale

80 - 100 MW_{bio-SNG} (640 - 800 GWh/yr) + heat

Cost: 325 M€

(NER300 support 59 M€ available)



Status

Injection into the transmission grid since December 2014

Decision for initializing phase 2 will be taken when phase 1 is proven successful

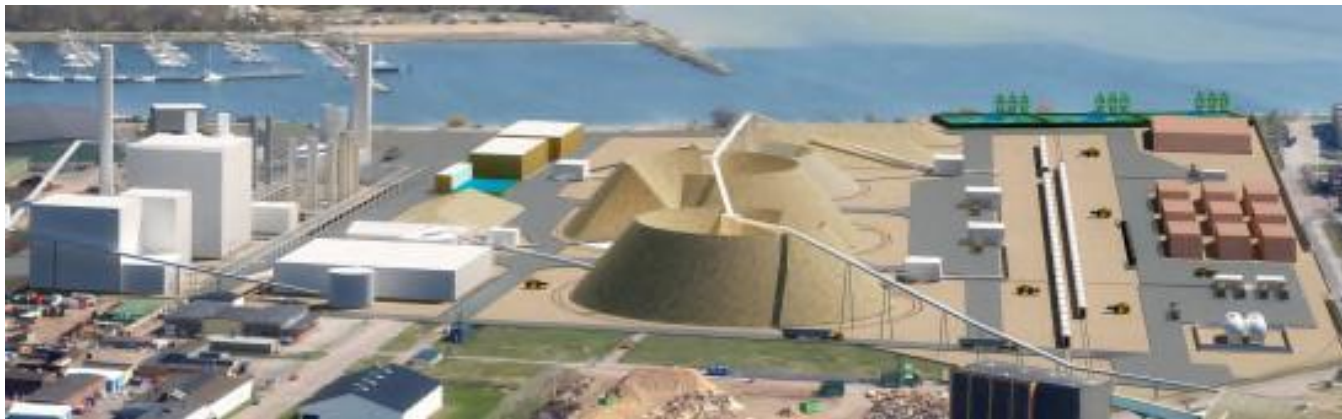
Bio2G – possible future bio-SNG plant

Production capacity: 200 MW_{bio-SNG} (1,6 TWh/yr) + heat & electricity

Feed stock: forest residues

Project owner: E.ON

Investment cost: 450 M€, (NER300 support 203 M€ available)



Project is awaiting decision on the long-term policy instruments for biofuels

Lidköping Biogas – The first LBG-plant in Sweden

Production capacity: 60 GWh/yr

Energy for condensation:
≈ 1 kWh per Nm³ biomethane
(Reverse Nitrogen Brayton Cycle)

Investment cost:
160 M SEK (~ 17-18 M€)

Feed stock:
Residues from local food industry
and grain handling

Operational since: April 2012

Project owner:
Swedish Biogas International,
Göteborg Energi AB and the
community of Lidköping



For more information,
<http://www.lidkopingbiogas.se/>

Examples of larger co-digestion plants

NSR Biogas plant

Production capacity:
80 GWh/yr biomethane

Operational since: 1996

Feed stock:
Household waste, residues from local food industry and manure

Biomethane injection:
To distribution grid for 10 years



Tekniska Verken in Linköping

Production capacity:
100 GWh/yr biomethane

Operational since: 1997

Feed stock:
Household waste and residues from food industry

Jordberga biogas plant

Production capacity:
110 GWh/yr biomethane

Operational since: 2014

Feed stock:
Energy crops

Biomethane injection
To transmission and distribution grid

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www.conference.sgc.se

Conclusions

- Sweden is world leading of utilizing biomethane as vehicle fuel and in transporting the gas off-grid
- 1.7 TWh biogas production, more than 50 % is upgraded to biomethane
- National vision to have fossil free vehicle fleet in 2050
- The Swedish biomethane potential is estimated up to 22 TWh (2030)
- Great need for a variety of short- and long terms politic-economic incentives so the biomethane (biofuel) potential becomes a reality