EBA
European Biogas Association

EBA Biomethane Workshop
3 September 2015 Brussels

The present status and future prospects of biomethane production through biomass gasification

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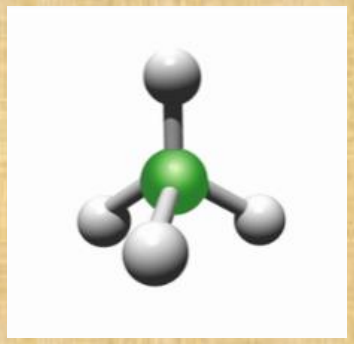
(Renewtec AB)

BioSNG

SNG may refer to Substitute Natural Gas, Sustainable Natural Gas or Synthetic Natural Gas.



In this presentation bioSNG refer to a synthetic gas of natural gas quality (typically CH_4 > 95%) produced by thermal gasification of feedstock of renewable origin

Large scale SNG from lignite coal

Great Plains, USA

Owner: Dakota Gasification Company

Capacity: 16,000 tons of lignite coal per day, 14 Lurgi Mark IV gasifiers

1.4 billion Nm^3 SNG corresponding to 14 TWh per year

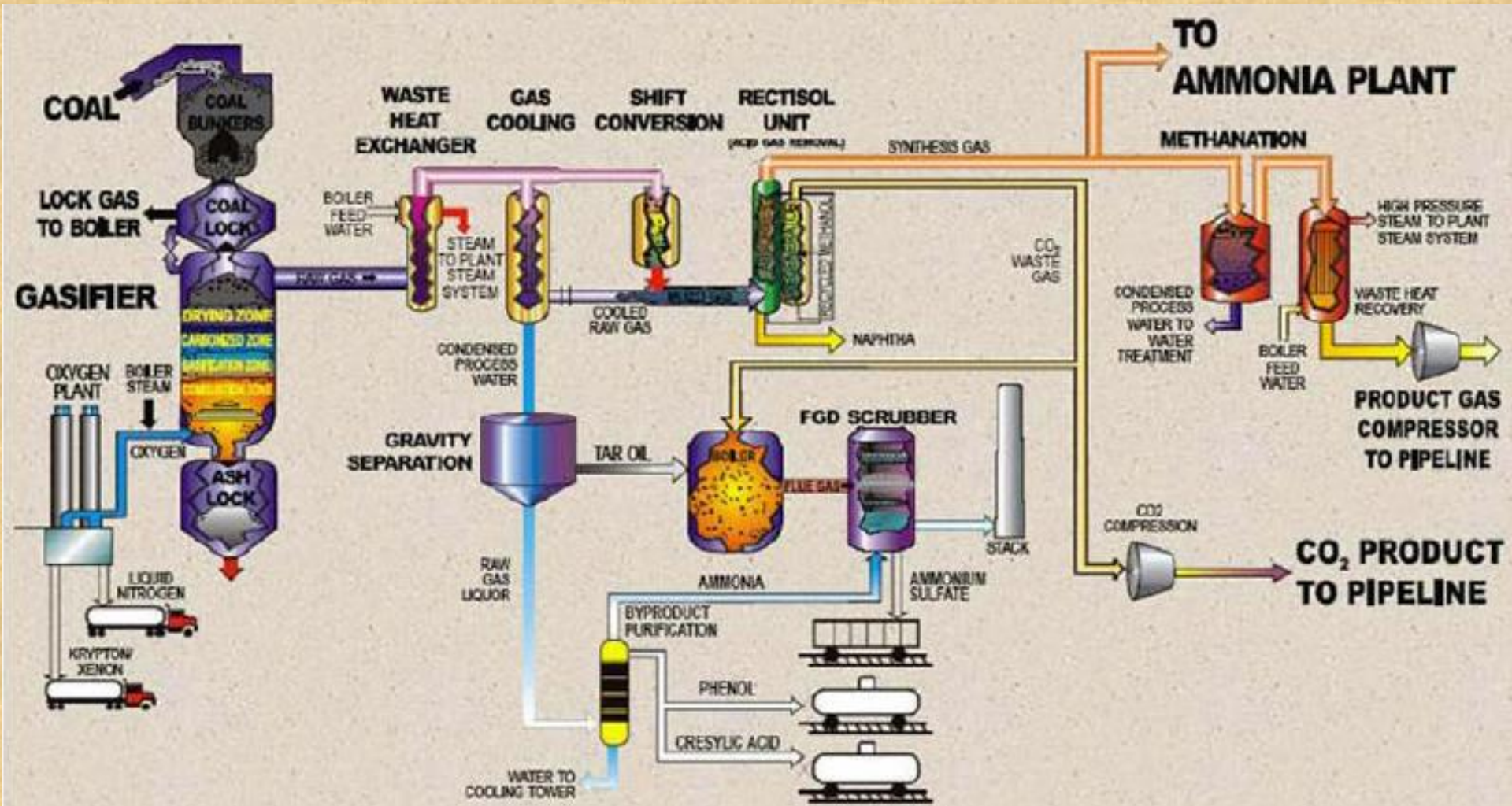
Products: SNG, CO_2 (for EOR), anhydrous ammonia, ammonium sulfate, krypton, xenon, dephenolized cresylic acid, liquid nitrogen, phenol and naphtha

Status: In operation since 1984. Injects SNG into the natural gas grid

www.dakotagas.com

Large scale SNG production

Great Plains, USA



Why not use biomass in that type of plant?

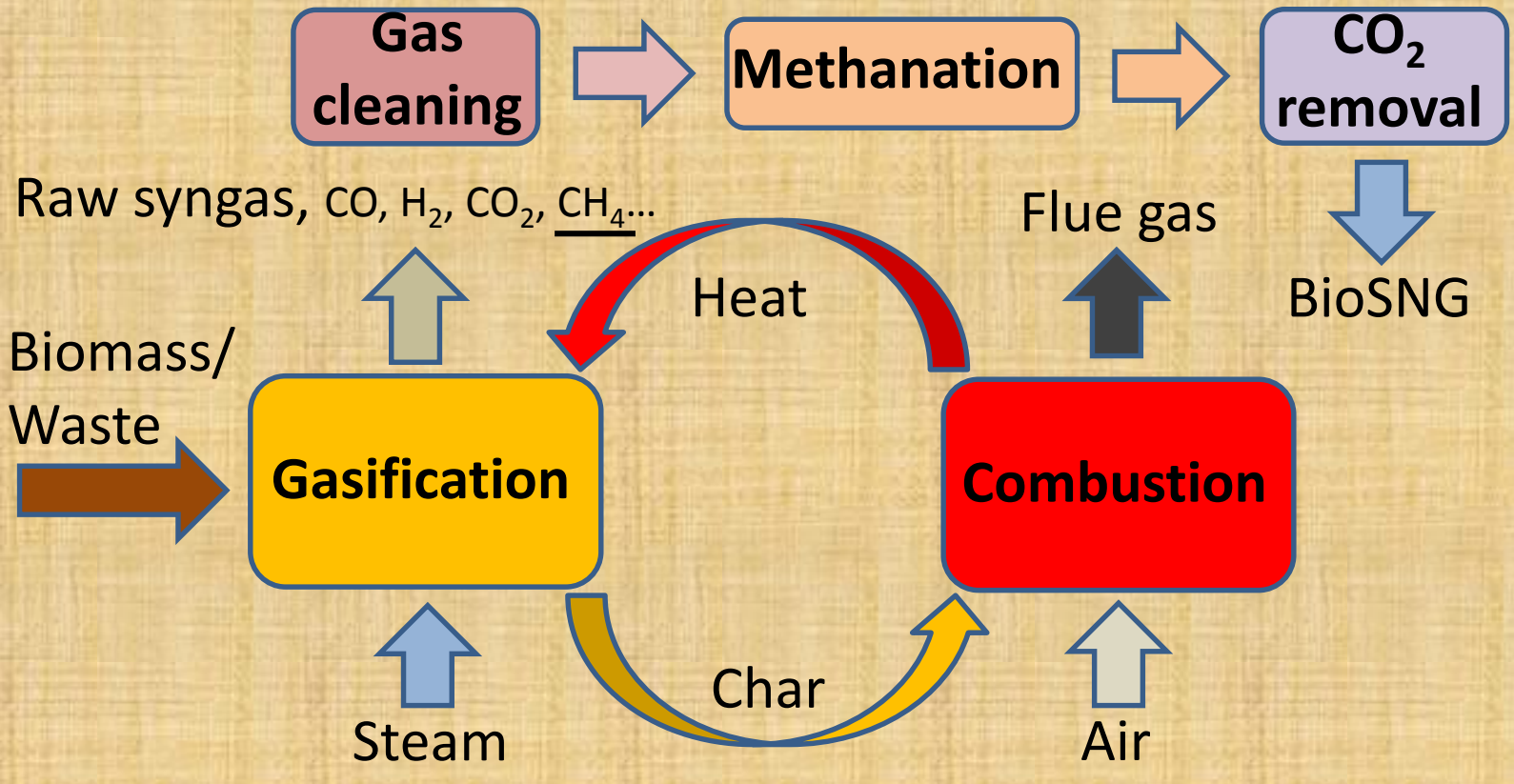
The capacity corresponds to ~2,000 MW and the largest biomass fired plants in the world are roughly 10 times smaller – the biomass supply and the logistics are not feasible! 

Down-scaling makes the specific investment cost too high! A 10 times smaller plant, ~200 MW_{th}, is only ~4 times cheaper.

To build oxygen-blown pressurized gasification plants below 100 MW_{th} is not economically feasible! 

Indirect gasification

Indirect gasification opens up the possibility to produce nitrogen free syngas from biomass in small and medium scale plants (<100 MW_{th}). Typical bioSNG efficiency ~60-70%.



Indirect gasification – industrial scale plants

Location/ Technology	Usage or product	Fuel/Product MW/MW	Start up	Status
Güssing, AUT FICFB	Gas engine/ BioSNG demo	8_{fuel} / 2_{el} 1 MW_{SNG}	2002 2009	Operational -
Oberwart, AUT FICFB	Gas engine/ORC	8.5_{fuel} / 2.8_{el}	2008	Operational
Senden, DE FICFB	Gas engine/ORC	14_{fuel} / 5_{el}	2011	Operational
Burgeis, IT FICFB	Gas engine	2_{fuel} / 0.5_{el}	2012	Operational
Gothenburg, SWE FICFB	BioSNG	32_{fuel} / 20_{SNG}	2013	Comissioning/ Operational
Grassau, DE Heatpipe reformer	Gas engine	1.3_{fuel} / 0.36_{el}	2012	Operational?
Alkmaar, NL MILENA	BioSNG	4_{fuel} / 2.8_{SNG}	2017?	Planned

FICFB = Fast Internally Circulating Fluidised Bed

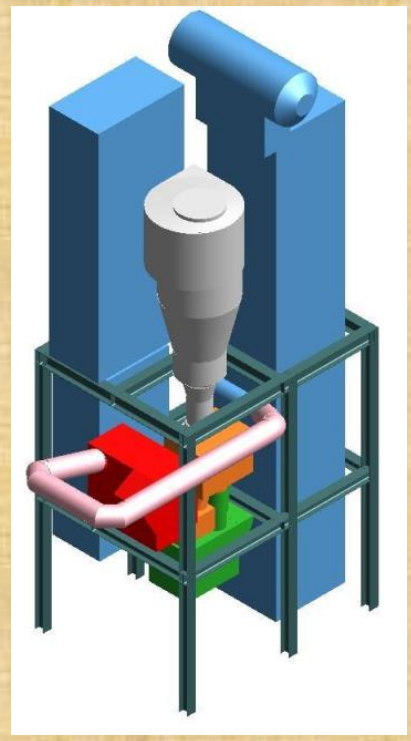
MILENA = Multipurpose Integrated Lab-unit for Explorative and Innovative Achievements in biomass gasification

Indirect gasification - BioSNG pilot plants

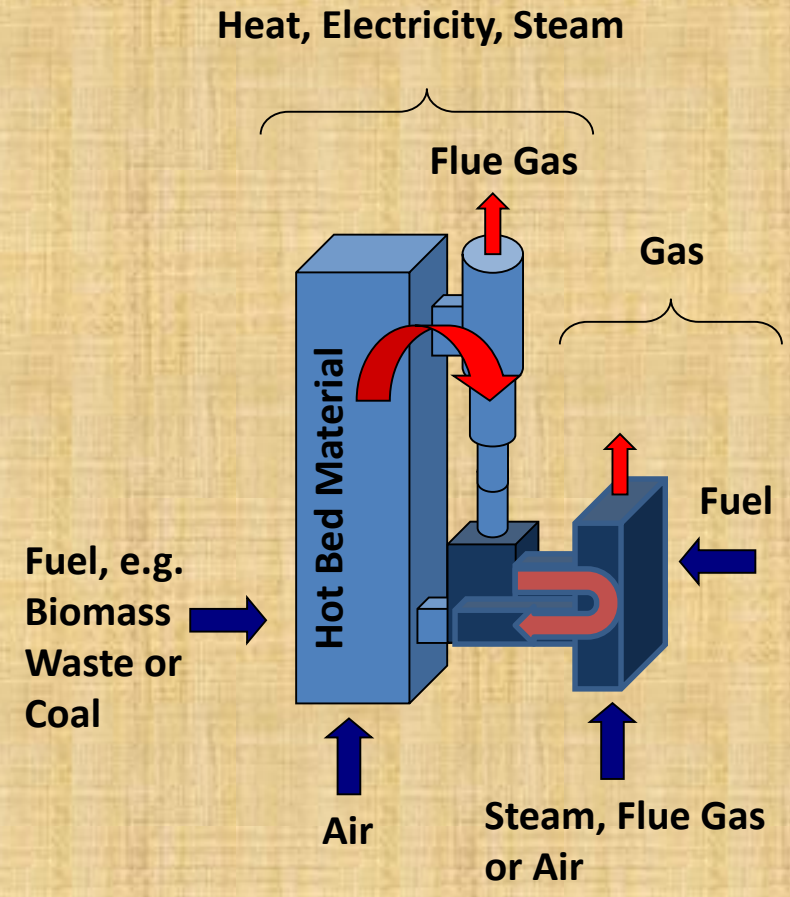
Location/ Technology	R&D	Capacity	Start up	Status
Petten, NL MILENA	ECN - R&D	800 kW_{fuel}	2008	Operational
Pfaffenhofen, DE Heatpipe Reformer	Gas engine/tar reforming and BioSNG R&D	500 kW_{fuel}	2009	Operational?
California, US FICFB	Woodland project - R&D fluidized bed methanation	1 MW_{fuel}	2013	Commissioning
Lyon, FR FICFB	GAYA project - R&D platform	500 kW_{fuel}	201?	Under construction
Gothenburg, SWE Dual bed	Chalmers R&D	2 MW	2009	Operational
Köping, SWE WoodRoll®	Ultraclean syngas – R&D	500 kW_{fuel}	201?	Commissioning/ operational

Chalmers University of Technology

Active R&D work at Chalmers, a 12 MW_{th} CFB boiler complemented with a 2 MW indirect gasifier.



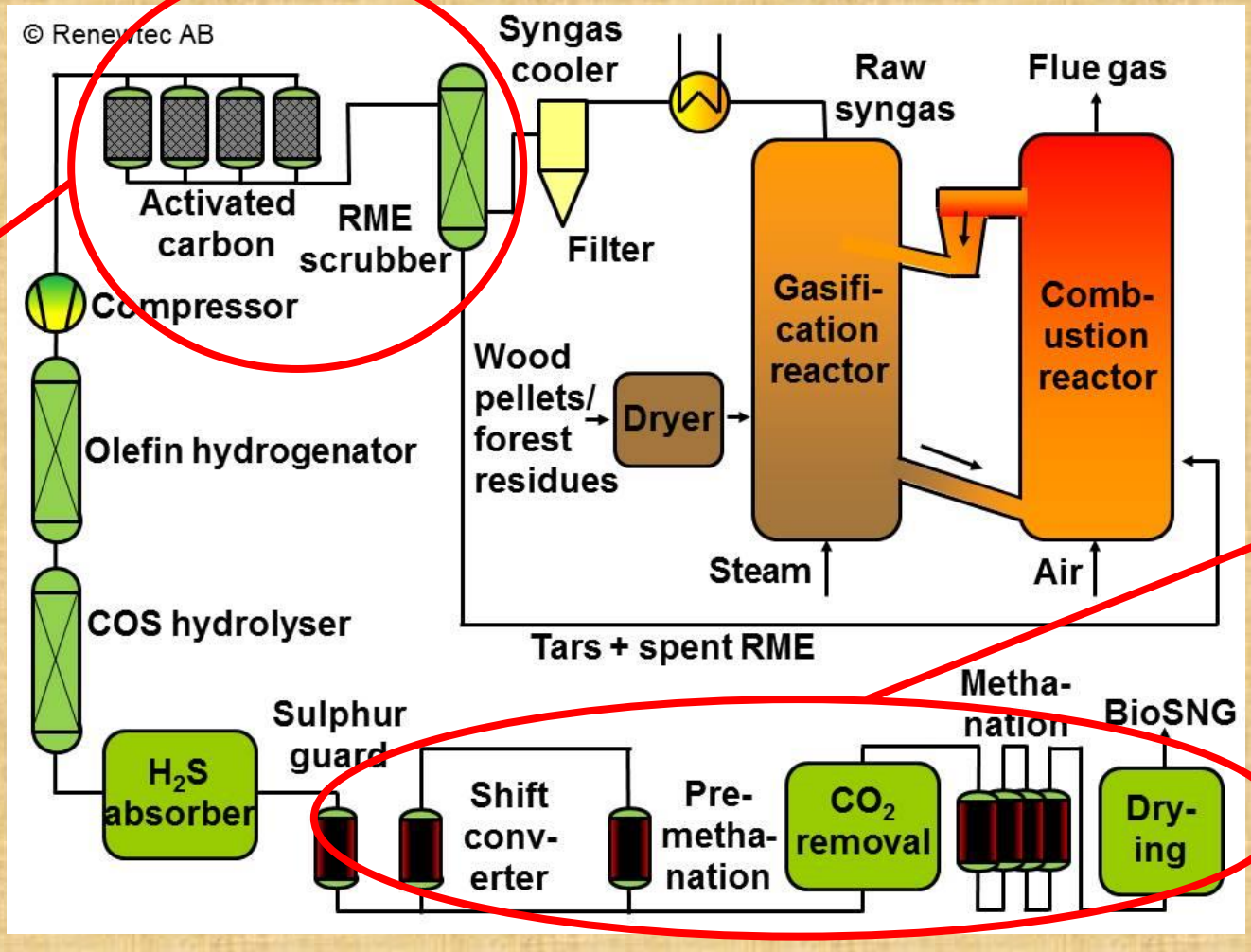
Chalmers 12 MW CFB boiler



The GoBiGas project

GoBiGas I, industrial scale demo plant, 20 MW_{SNG}, www.gobigas.se

Tar removal and its implications
- High operational cost
- High investment cost



Large scale technology

Remarks

GoBiGas I is a technical demonstration aiming at 65% conversion efficiency from biomass to bioSNG and an overall efficiency of 90%. The total project cost so far ~170 Meuro.

The planned GoBiGas II will be a commercial demonstration

- scale-up to 80-100 MW bioSNG
- cost efficient gas cleaning and methanation
- lessons learned
- a small step from a FOAK* towards a NOAK** plant

* FOAK = First-of-a-kind

** NOAK = N_{th}-of-a-kind

BioProGReSs

BioProGReSs – a 5.3 Meuro European project on advanced syngas cleaning, chemical looping reforming, www.bioprogress.se

Project partners: Gothenburg Energy (coordinator), Chalmers, TU Berlin and Renewtec AB

Objective:

- 30% reduction in overall investment cost
- 10% reduction in variable cost
- 10% increase of the amount of biofuel produced in the process

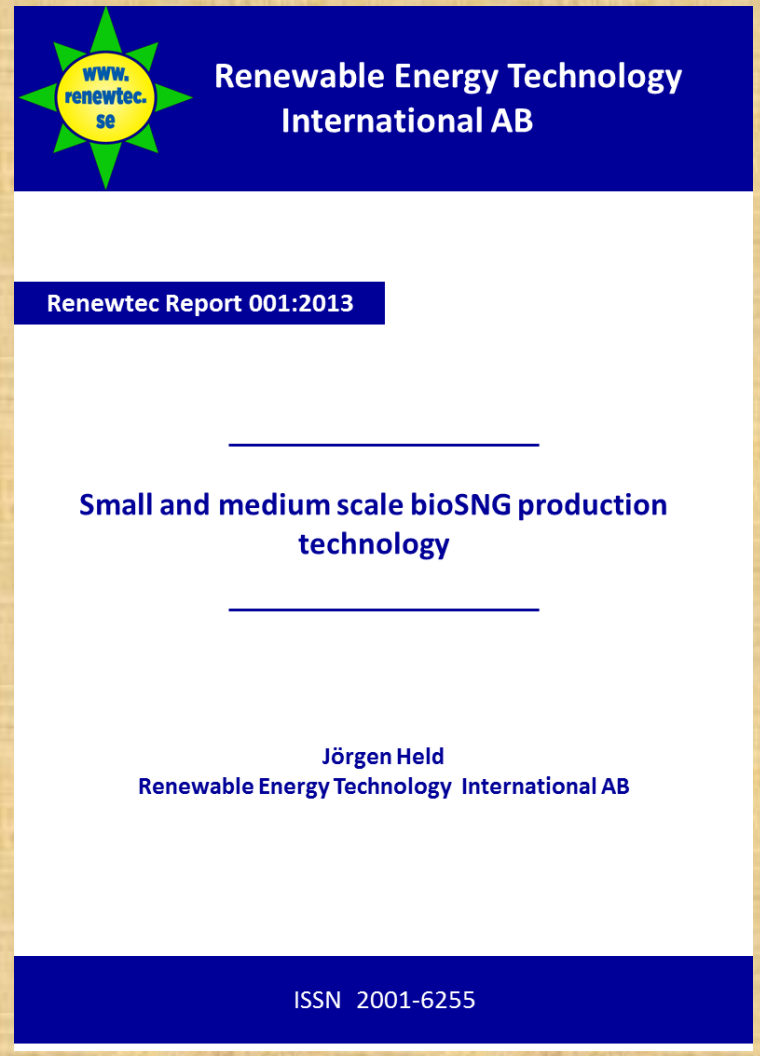
Small scale bioSNG production

Here small scale refers to plants ~10 MW or less

- Lower financial risk due to a lower investment cost
- Easier to secure the feestock supply
- Easier logistic since less feedstock is needed
- Easier to match excess heat with local heat or steam demand
- Possible synergies with existing biogas plants

Are there any available technologies and what about the costs?

Technology study



Study on small and medium scale bioSNG production.

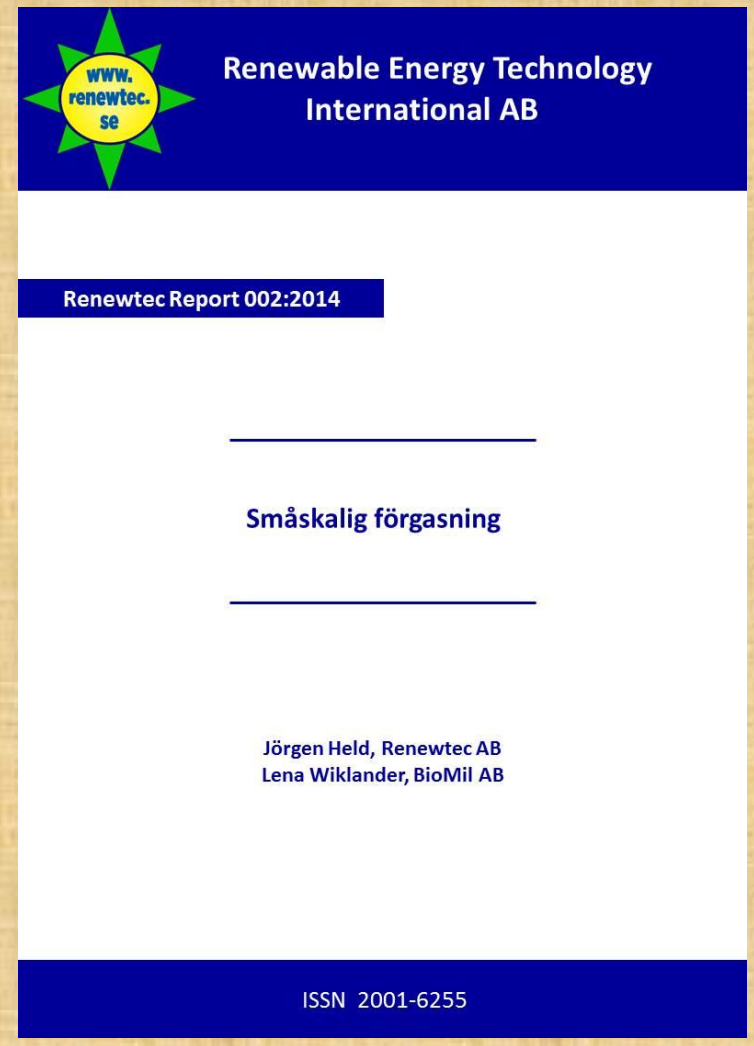
Exist technologies adopted for small and medium scale (5-30 MW_{th})

Specific investment cost for a small scale plant (5.6 MW_{th}) lower than for GoBiGas I!

e·on
DGC
Danish Gas Technology Centre
Göteborg Energi
Energimyndigheten
VATTENFALL
STOCKHOLM GAS
kraftringen
ÖRESUNDS KRAFT

http://www.renewtec.se/Report_001.2013.pdf

Market study – production cost



The bioSNG production cost based on gasification of wood chips in the 5.6 MW_{th} scale is in an interval of commercial interest!

~80 €cent/Nm^3 is of commercial interest in Sweden

http://www.renewtec.se/Report_002.2014.pdf

The SmaRTGas initiative

SmaRTGas - Small Scale Renewable Methane Technologies based on Gasification, coordinated by Renewtec AB, www.smartgas.se

Ongoing project: Investigate the conditions to start an innovation cluster within small scale bioSNG production

REGION SKANE

SYSAV

OX2

DGC
Danish Gas Technology Centre

BioMil AB
biogas, miljö och kretslopp

LUNDS UNIVERSITET
Lunds Tekniska Högskola

www.renewtec.se
Renewable Energy Technology International AB

The SmaRTGas initiative

The idea is to connect international and national spearhead R&D with stakeholders interested in biomethane market opportunities including the Swedish biomethane market, regional actors and locally available feedstock (woody biomass and different types of waste).

So far 15 leading universities and research institutes and 10 companies and organisations within the field of bioSNG have signed LOIs or expressed an interest to participate and co-finance the initiative.

Conclusions

Indirect gasification opens up the possibility to produce a nitrogen free syngas suitable for methanation in the plants <100 MW with a high conversion efficiency.

By adapting the technology to the chosen scale the high specific investment cost associated with traditional down-scaling can be cirumvented.

Due to the the high financial risk associated with large scale plants small scale bioSNG is likely to be introduced first and at a higher rate which implies that the NOAK plant can be reached quicker.

Conclusions

General steps to lower the production cost

Tar reforming instead of tar removal

Up-scaling

Going from FOAK to NOAK

Low quality biomass/waste as feedstock

Technology development and optimization

Taking advantage of local conditions

Existing CFB boiler -> add on gasifier, gas cleaning and methanation

Synergies with anaerobic digestion – heat integration, shared upgrading facility and downstream infrastructure etcetera

Thank you for your attention!

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