Nordic Biogas Conference

The methane platform: A-, B-, C-, E-, F- and L-methane

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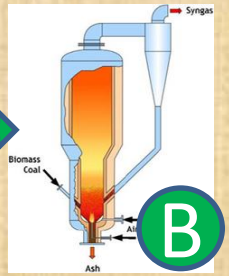
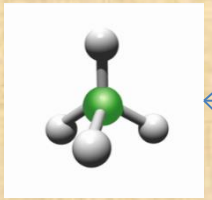
www.renewtec.se
Renewable Energy Technology International AB

The methane platform



Chemicals
Plastics
Paint, etc



A-methane (anaerobic digestion)

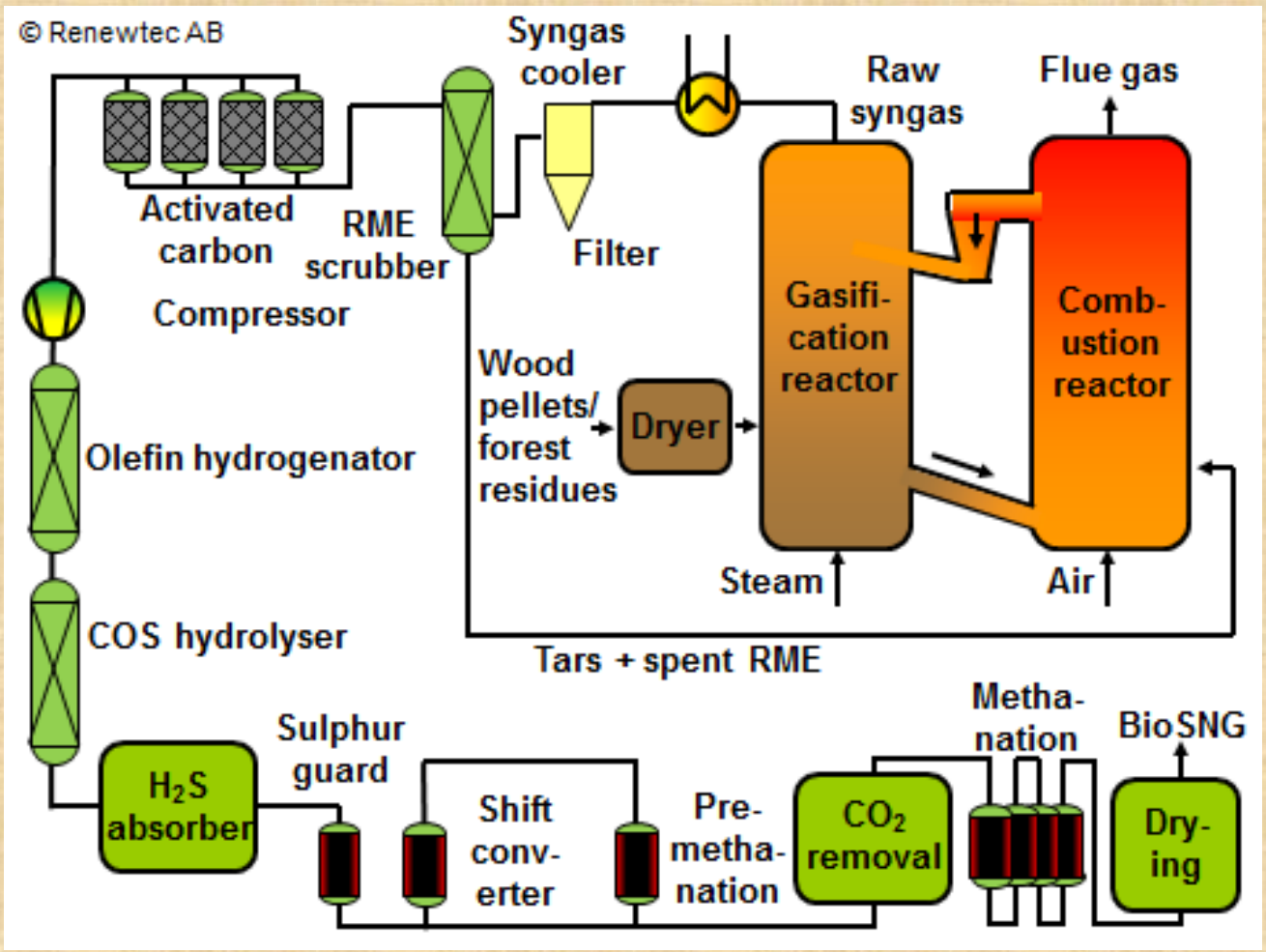
NAWARO Bioenergy Park Güstrow

- Güstrow ~40 km south of Rostock, Germany
- 400,000 ton substrate (corn and grass silage, cereales etc)
- Upgrading (water scrubber)
- 46 million Nm^3 biomethane (~460 GWh)
- 100 Meuro investment

www.nawaro.ag

B-methane (bioSNG)

Gothenburg Biomass Gasification, GoBiGas



32 MW_{th}

>20 MW_{bioSNG}

η_{SNG} ~65%

$\eta_{overall}$ ~90%

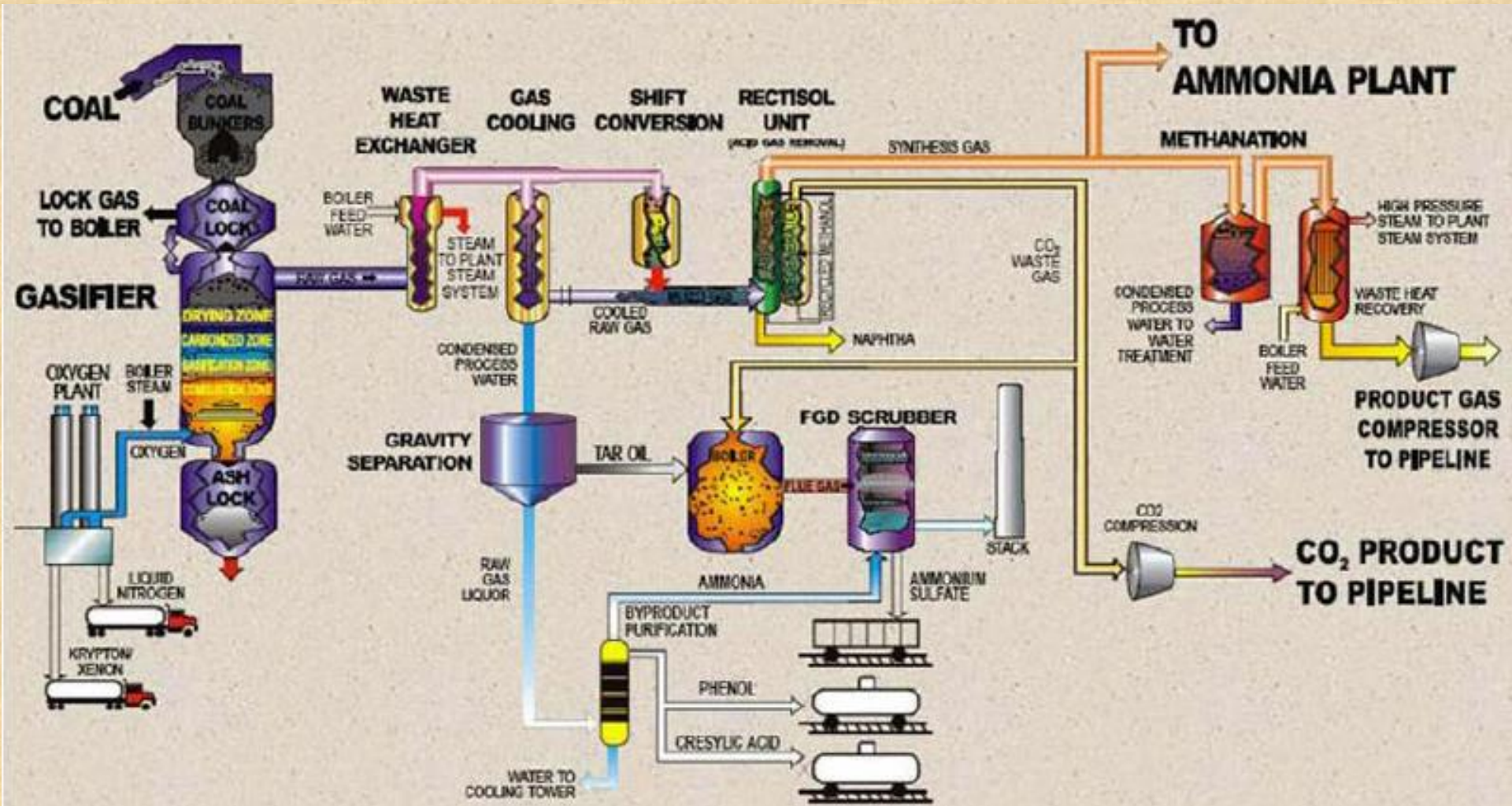
Status: Under commissioning

Injection into the transmission grid

www.gobigas.se

C-methane (SNG from lignite coal)

Great Plains, USA



C-methane (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. The only commercial-scale coal gasification facility in the United States that manufactures ”natural gas”

www.dakotagas.com

E-methane (methane from electricity)

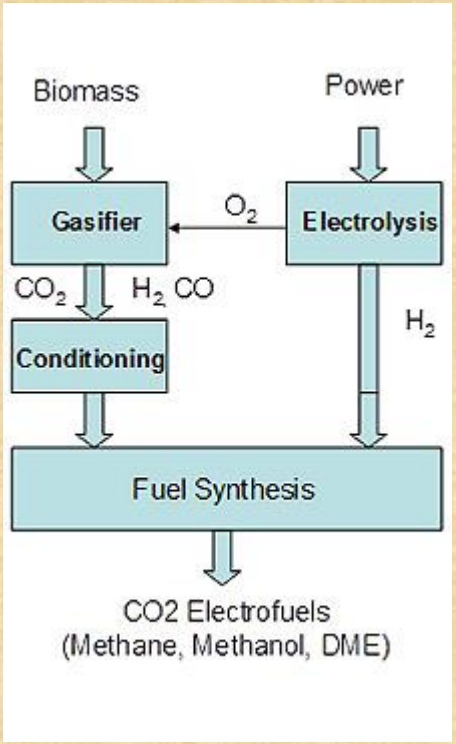
CO_2 Electrofuels project

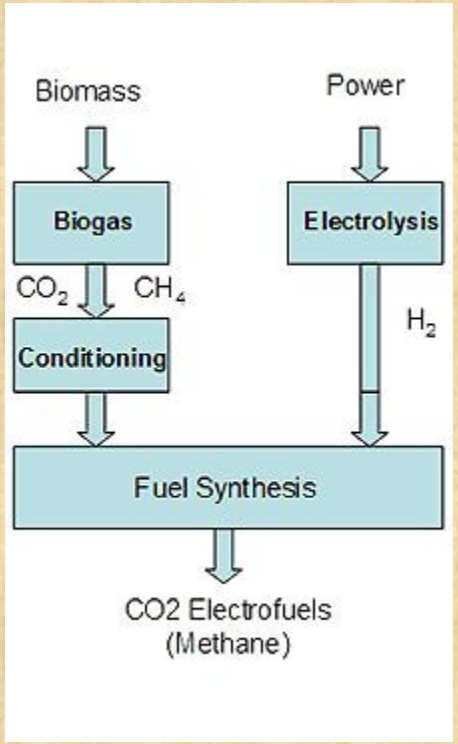
Project partners: E.ON, SORPA, Chemrec, Innovation Centre Iceland, Haldor Topsoe, DTU, Oliudreifing, Wärtsilä, Volvo and EA Energy Analysis

Fuels: Methane, methanol, DME

Target: Quantify the capacity and cost potential of the CO_2 Electrofuels concept and propose a roadmap for the introduction of CO_2 Electrofuels in the Nordic region

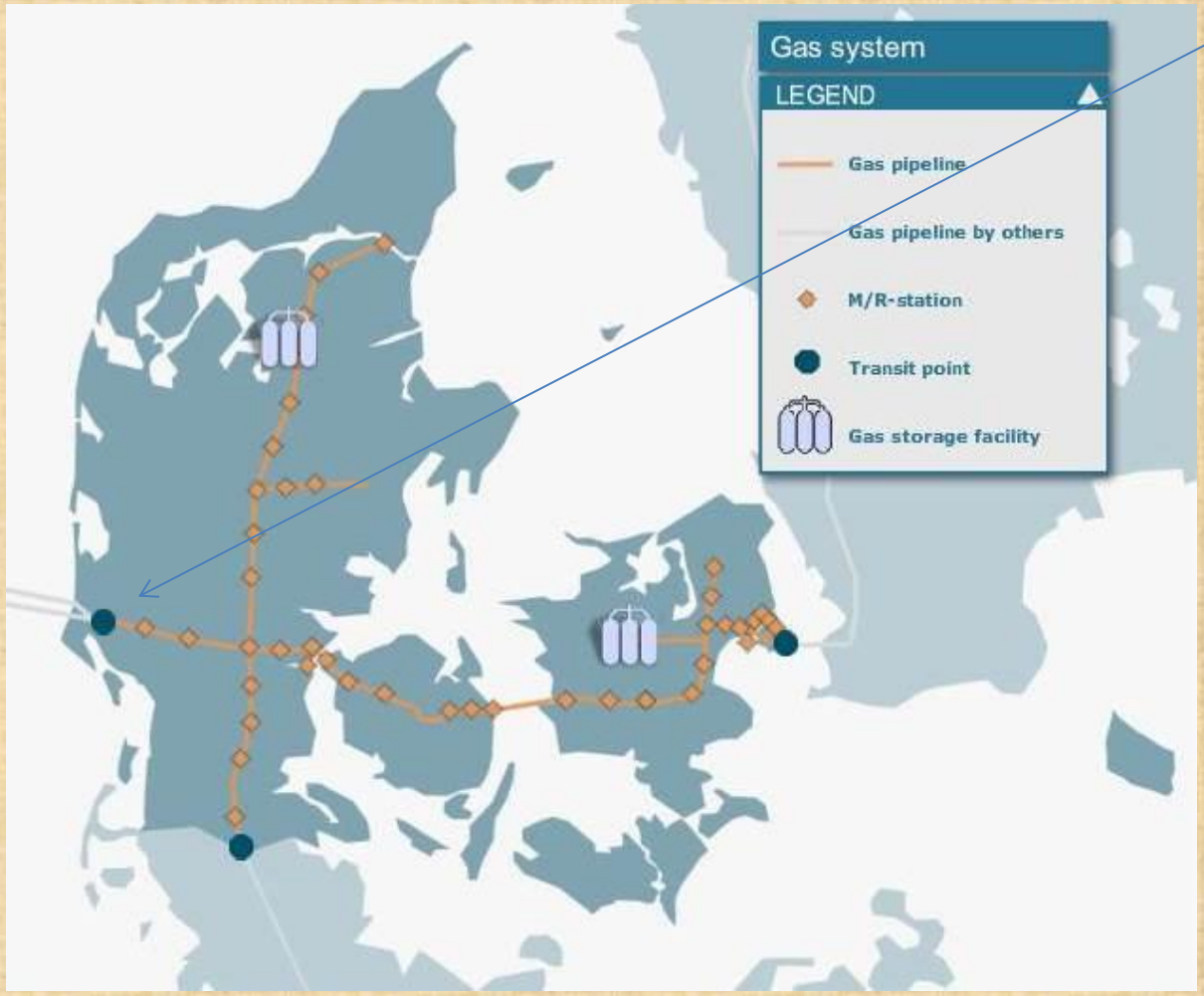
www.co2-electrofuels.org





F-methane (fossil methane)

Danish North Sea natural gas



Gas quality (Nybro):
Average values 2012

Methane 88.8 mol-%
Ethane 6.2 mol-%
Propane 2.5 mol-%
$>C_3$ 1.1 mol-%
Carbon dioxide 1 mol-%

LHV 11.0 kWh/Nm^3
HHV 12.2 kWh/Nm^3

$Wobbe_{High}$ 15.2 kWh/Nm^3

www.energinet.dk

L-methane (landfill gas)

Reykjavik landfill

- Landfill gas collection started in 1996 – initially the gas was flared
- Upgraded to vehicle fuel quality in 2000 (water scrubber)
- Study tour on the 29th of August

http://www.sorpa.is/en/operating-centers/the-landfill-site

Production

Renewable methane

High quality fuel from waste! Many of the wet substrates used in anaerobic digestion has a negative heating value. You can put out a fire with it. Put it into a digester and obtain a fuel that can be used as vehicle fuel!

Methane release to the atmosphere is avoided.

All the nutrients are in the digestate. A possibility to replace artficial fertilizers.

BioSNG has the highest conversion efficiency! The efficiency from biomass to biomethane is 60-70%. The highest of all second generation fuels!

Distribution

Gaseous state an advantage!

Pipeline distribution: Energy efficient, safe and environmentally friendly

No need for road bound transportation -> less traffic, less pollution, less environmental risks

Methane vs. hydrogen

Methane has 3 times as high heating value as hydrogen

No hydrogen embrittlement with methane

Distribution systems and applications are already in place

Global development

More safe (higher ignition energy needed, burn with visible flame, less risk for explosion etc)

Utilization

Gaseous state an advantage!

Mixing: Easy to obtain a well controlled air/fuel mixture and hence a good combustion quality – no soot, no particles, low NOx

No ash: There are no ash forming substances and hence no problem with ash removal, fouling, clogging, high temperature corrosion etc

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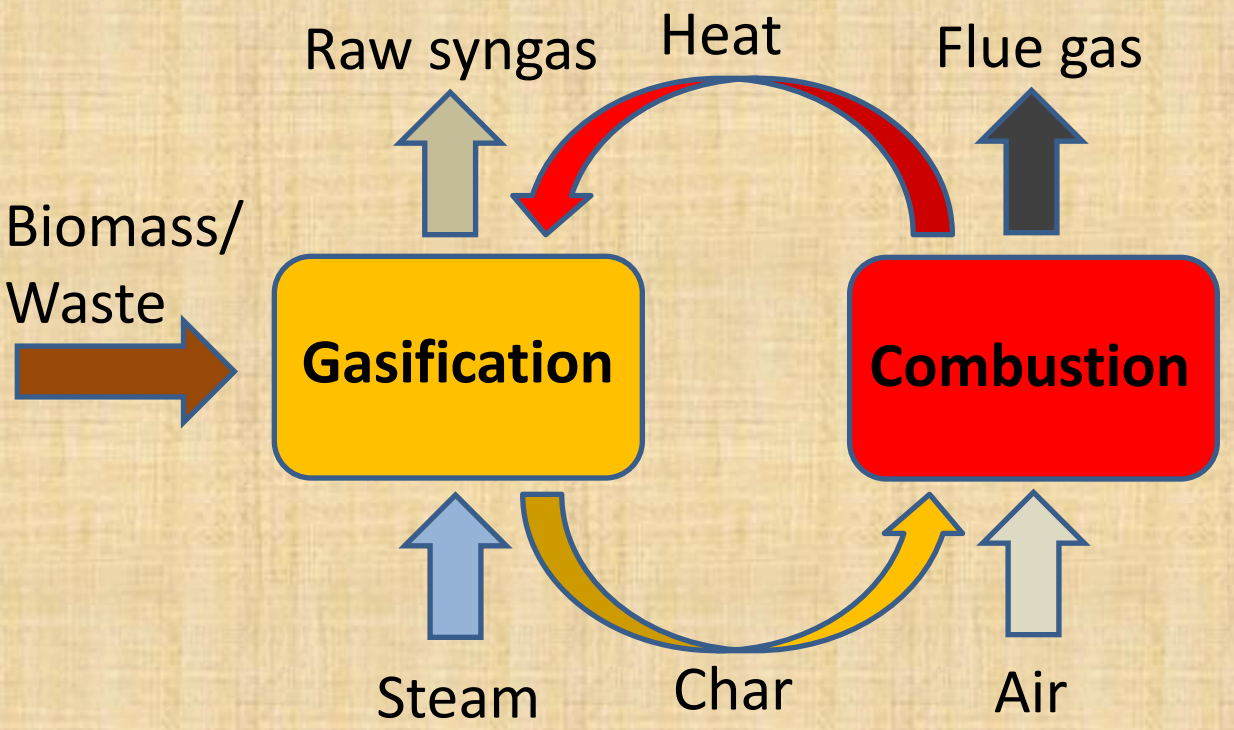
High H/C ratio: Condensing gas boilers with efficiency above 100% based on the lower heating value, less carbon dioxide formed per unit released energy

The simplest hydrocarbon: Simple combustion chemistry -> no cancerogenic compunds formed

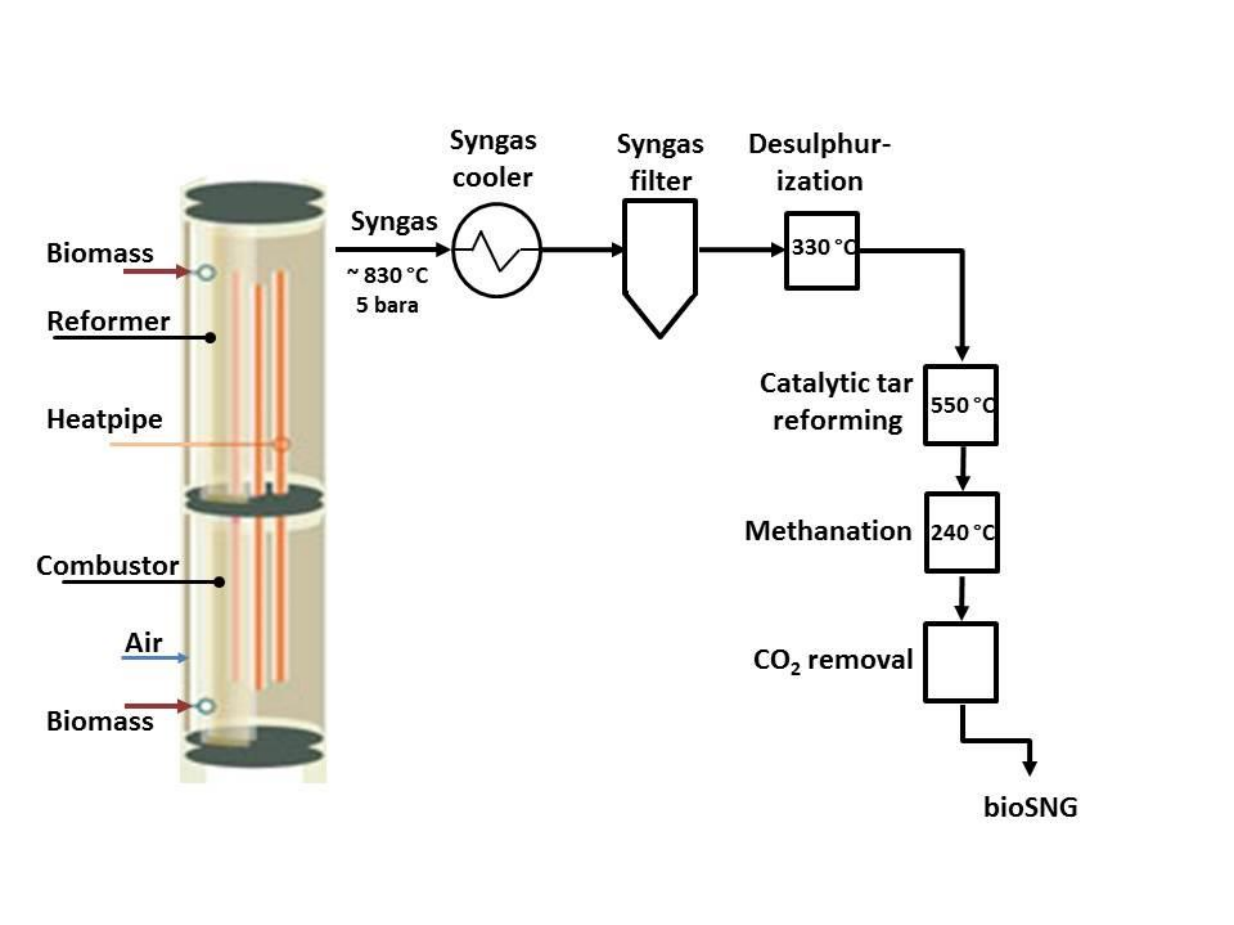
Small scale gasification and methanation

Indirect gasification opens up the possibility to produce nitrogen free syngas in small and medium scale (<<100 MW_{th})



Technology adopted for small scale gasification and methanation

Heat pipe reformer, 1.4 MW_{th}



Small scale gasification and methanation -economy

The production cost was investigated in a project financed by Region Skåne, Region Halland, AB Gas & Värmeteknik, AGA Gas AB, BioMil AB, Danish Gas Technology Center, E.ON Gasification Deveplopment AB, Highterm Research GmbH, Lund University, NSR AB, O2 Bio AB, Purac Puregas AB and Renewtec AB.

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Region Halland

LUNDS UNIVERSITET
Lunds Tekniska Högskola

NSR

PURAC PUREGAS

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DGC
Danish Gas Technology Centre

Region Skåne

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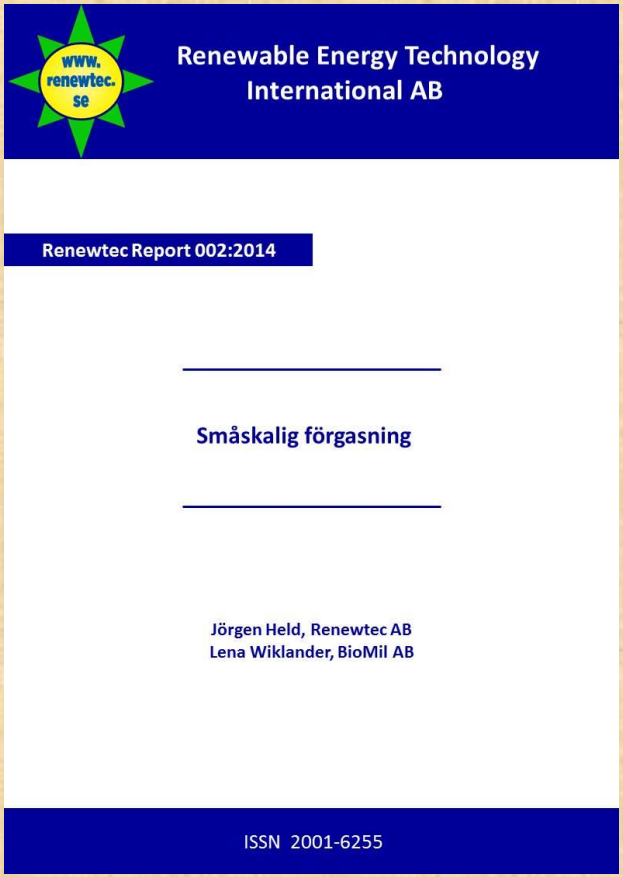
Small scale gasification and methanation -production cost



The bioSNG production cost for a 5.6 MW_{th} system based on 4 heat pipe reformers, catalytic tar reforming and CO_2 removal with amine scrubber was ~67 – 132 €cent/Nm^3

- Internal interest rate
- Existing investment support
- Excess heat utilization
- Fuel cost

www.renewtec.se/Report_002.2014.pdf

The report is only available in Swedish

Conclusions

-production

There is a multitude of technologies available for producing renewable methane from indigenous, non-edible low quality feedstock (waste, by-products, ligno-cellulose etc).

Indirect gasification opens up the possibility to produce a nitrogen free syngas suitable for methanation in the relative small scale (<<100 MW) with a high conversion efficiency (60-70%).

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

Conclusions

distribution and utilization

Renewable methane benefits from the global development of NG and the infrastructure and market for NG. Hence, there is a need for gas quality standards/harmonization and the possibility to trade renewable methane across the borders.

Methane is one of the (if not the most) versatile fuel. Methane can be used with high efficiency and ultralow emissions.

One doesn't have to be a fortune teller to see that the methane platform is waiting around the corner!

REGATEC 2015

7-8 May 2015

Alimara hotel
Barcelona

www.regatec.org

REGATEC 2015 has a technical and industrial focus and is directed towards microbial and thermochemical conversion of biomass and waste to biomethane, Power-to-gas and biomass gasification for CHP production.

REGATEC includes presentations by invited experts (in plenary and parallel sessions), a poster session and an extensive exhibition

REGATEC 2014 attracted 160 participants from 25 countries and 30 exhibitors. We expect REGATEC 2015 to be bigger.

THANK YOU FOR YOUR ATTENTION!

Dr. Jörgen Held

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