IEA Task 33 Meeting

Wien, Austria

2012-11-12-16

Country Update Sweden

Lars Waldheim

Alsätravägen 130
12736 SKÄRHOLMEN

lars.waldheim @waldheim-consulting.se
070 592 81 69

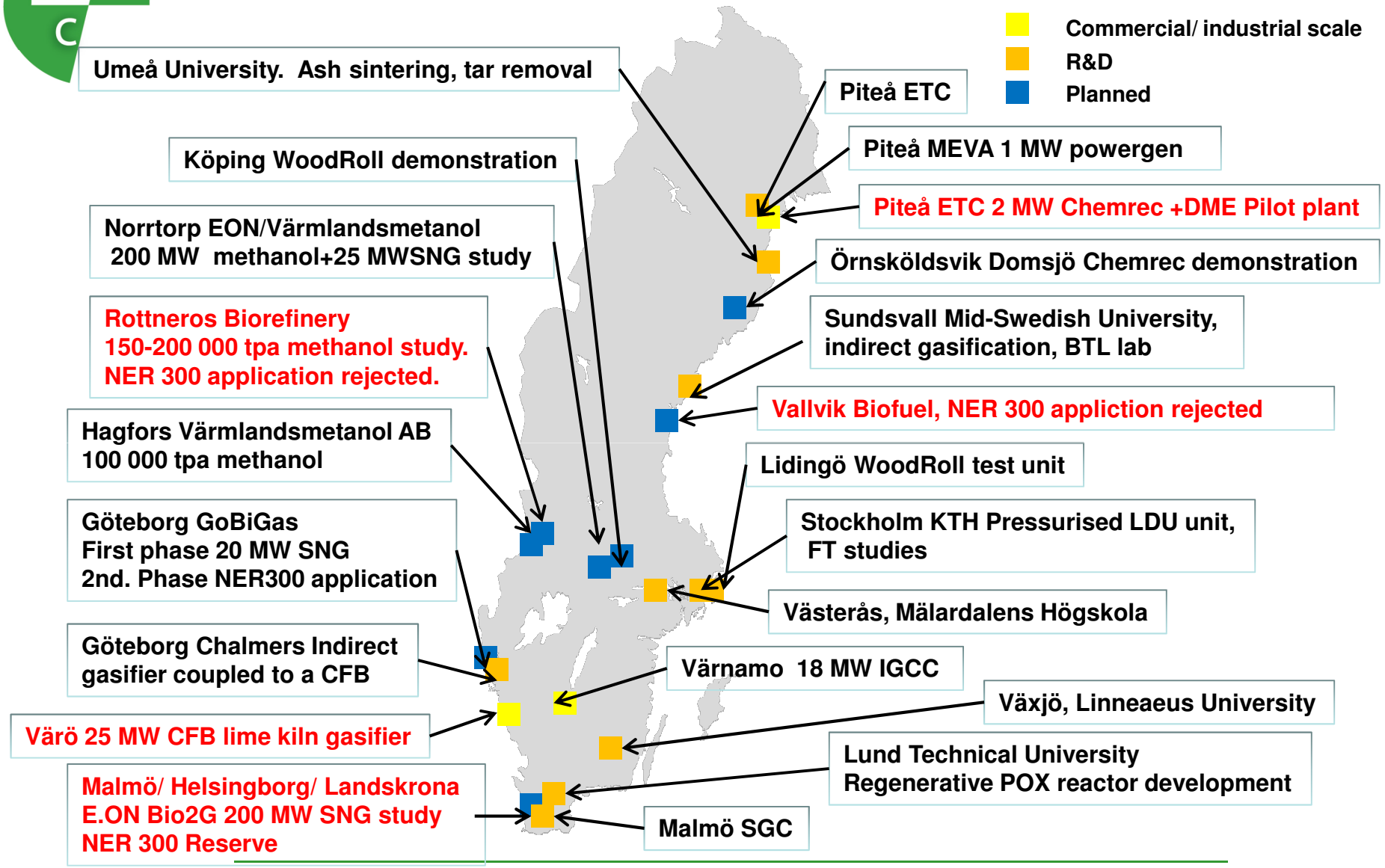
Fall 2012 Update

- Policy issues remains as in the Spring 2012 presentation

  (available on www.ieatask33.org)

- This presentation only focuses on the updates

Biomass Gasification Sweden 2011



NER 300

- EU NER300: bioenergy 5 out of 9 proposals, 3 retained
  - Pyrogrot Billerud -Category: 40 kton/a pyrolysis oil or slurry
  - ~~Vallvik Biofuel~~ -Categories: 40 000 m^3/a methanol via entrained flow gasification of i) black liquor, ii) pyrolysis oil or iii) torrefied wood
  - ~~Rottneros Biofuel~~ -Category:150 000 m^3/a methanol from lignocellulloisc biomass
  - E.ON Bio2G -Category: 40 million Nm^3/a SNG, reserve
  - GoBiGas 2 -Category: 40 million Nm^3/a SNG

- National agencies update/acceptance of projects by mid-November. New EC list by end of November

Swedish Gasification Centre (SFC)

CDGB - Centre for Direct Gasification of Biomass

CIGB – Centre for Indirect Gasification of Biomass

B4G – Biomass for Gasification, Entrained Flow Centre

Academies Chalmers, Gothenburg Univ., KTH, Linneaeus Univ., Luleå Technical Univ., Mid-Swedish Univ., Mälardalen Univ., Umeå Univ.

Companies E.ON, Metso, Göteborg Energi, Fortum, Mälarenergi, Cortus, Nynas, Eskilstuna Energi och Miljö, Nordkalk

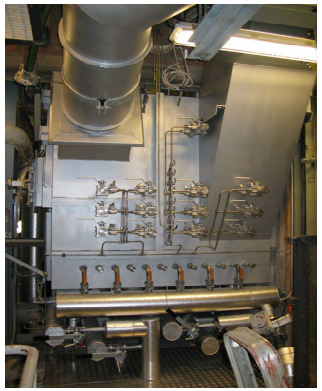
New application for 4 year activity in March 2013

Chalmers

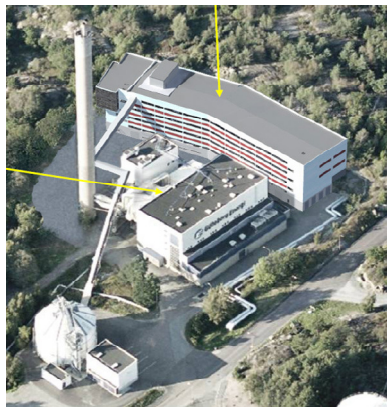
Biogas Production via Thermal Conversion
- From Research to Commercial Production

Chalmers Lab. Scale

Chalmers 2-4 MW
Pilot Scale



GoBiGas phase 1 Gothenburg
20 MW SNG Demonstration Scale
Göteborg Energi och E.ON



GoBiGas Phase 2
Gothenburg
80 MW SNG
Commercial Scale
Gbg Energi ev. E.On

CHALMERS
UNIVERSITY OF TECHNOLOGY

2008 2012 2016

Chalmers Technology development

- Goal of activity
  - Demonstrate how an indirect gasifier could be built +100 MW_{fuel}
  - Demonstrate a robust method for catalytic reformation of the gas to a syngas containing only CH4, H2, CO, CO2 H2O
  - Demonstrate a energy efficiency for dry biomass to clean syngas >85%

2012-2013 season activity focus on bed materials and chemical looping reforming.

CHALMERS
UNIVERSITY OF TECHNOLOGY

Swedish Gas Centre

On-going gasification related activities

- ***Gasification- Status and Technology and gasifier database***
  report SGC 240 2012, database on SGC homepage in 2011
- ***Co-production of SNG and FT diesel***
  PhD work at KTH, results to be published in 2012
- ***International Gasification Seminar***
  Stockholm, October 18-19, 2012
- ***Particulate contaminants from indirect gasifers***
  On-going, Chalmers gasifier to be used as test berth
- ***Autothermal regenerative POX tar reactor***
  On-going, Lund technical university
- ***On-line detection of water vapor***
  On-going, Chalmers technical university
- ***CO2 removal in indirect gasification***
  On-going, Lund university, ECN (NL)
- ***Fuel tests in 500 kW Wood Roll prototype***
  On-going, KTH, Cortus

SGC Svenskt Gastekniskt Center AB

Thermo-chemical Conversion of Biomass

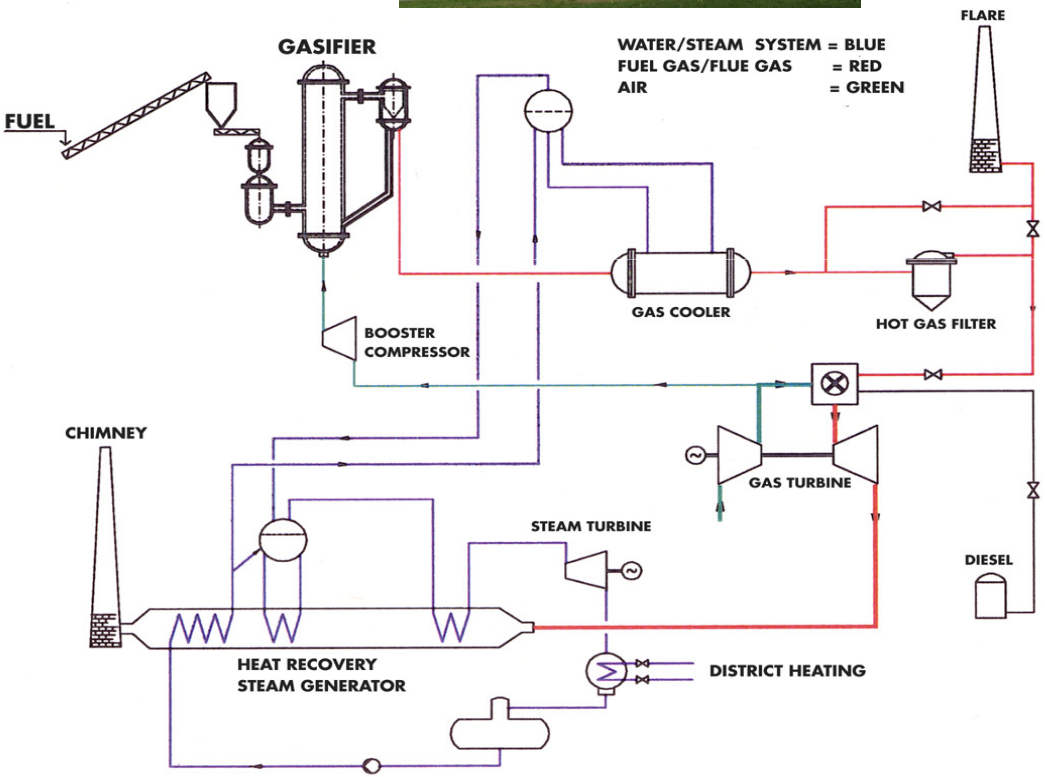
- Long experience of R&D within gasification. Activities started in the 1970s.

Technologies at KTH

- 75 kW pressurised (30 bar) & air & steam/oxygen FB gasifier with secondary reactor
- 50 kW air & steam/oxygen FB gasifier
- 5 kW air & steam/oxygen FB gasifier
- Test rigs for catalytic deactivation and particle separation concepts
- Tar analysis equipment, On-line alkali analyses

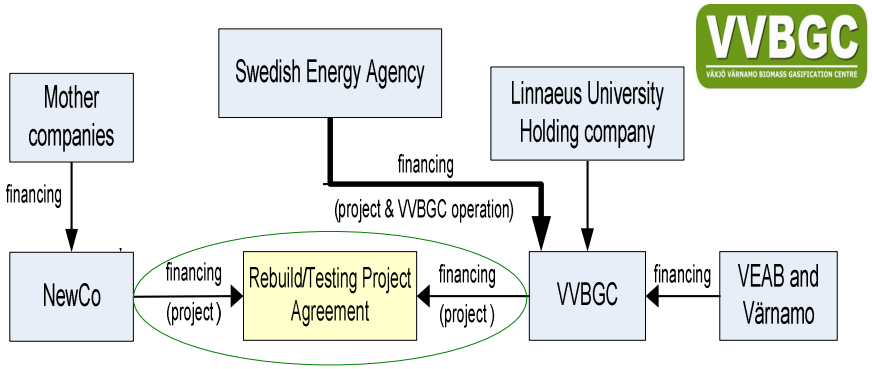
- New major grant (500 000 €) for upgrading research infrastructure

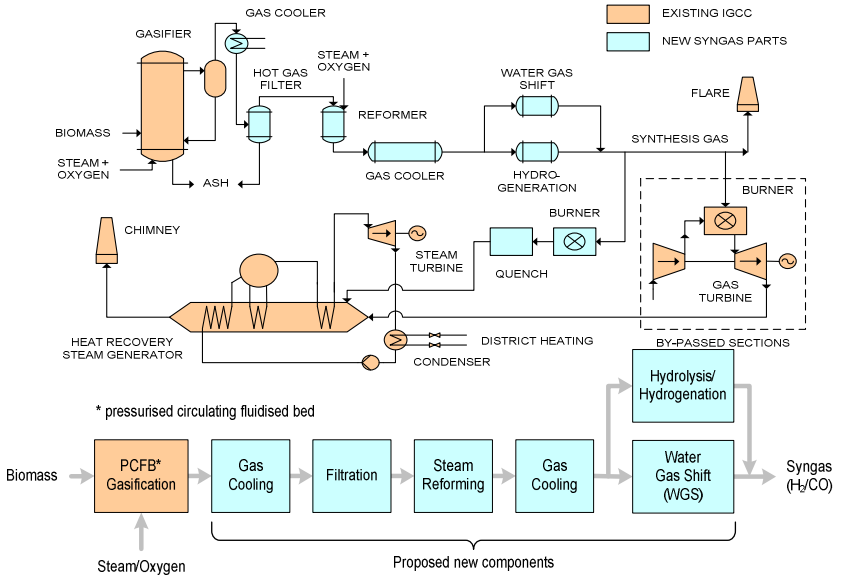
Värnamo -Pressurised combined cycle



- Supplier: Bioflow (Foster-Wheeler, Sydkraft)
- Fuel 18 MW
- Power 6 MW
- Heat 9 MW
- 18 bar pressure
- Typhoon GT
- **Mothballed in 2000. > 8000 gasifier and 3 600 hours of GT op.**

VVBGC Project Status





Activities: **Engineering initiated in January 2010.**

Status: **Project terminated in Feb. 2011 due to difficulties to close industrial funding targets.**

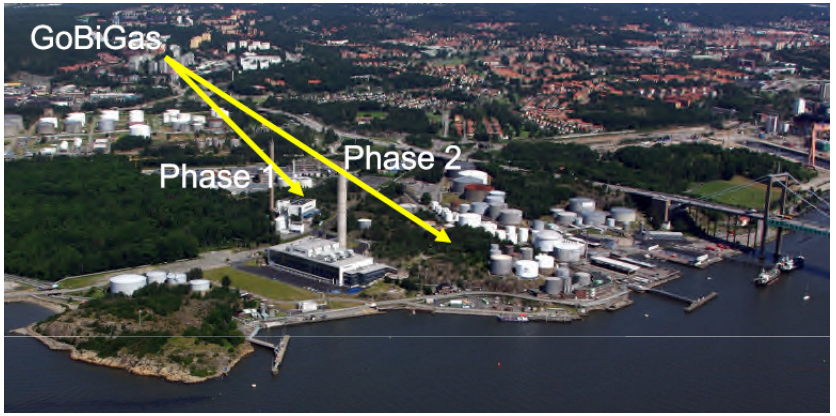
VVBGC has taken over Bioflow Oy. and associated IPR

Future: **Mothballing again.**

Biomass to SNG: GOBIGAS

GoBiGas – step by step

- **Performance goals:**
  - Biomass to biomethane 65 - 70%
  - Energy efficiency > 90%
- **Phase 1:**
  - Demonstration plant
  - Evaluation, R&D programme
  - 20 MW generating 160 GWh/year
  - In operation early 2013
  - Allothermal (in-direct) gasification
- **Phase 2:**
  - 80-100 MW generating 640-800 GWh/year
  - In operation after evaluation of Phase 1
  - Technology not yet chosen



Göteborg Energi

GOBIGAS Status

Picture , GoBiGas website November 2012, showing building.

The roof is still open for lifting vessels in

Start-up 2013

Agreement with Swedegas for pipeline transition of product gas

Black Liquor Gasification Activities

Pictures from site March 2011

BIODME

(In commissioning! First BioDME expected first part of May)

Project ends 2012. Staff have been given redundancy notice

The Lulå Technical University is investigating a take-over of operaating it for R&D contrtacting purpose

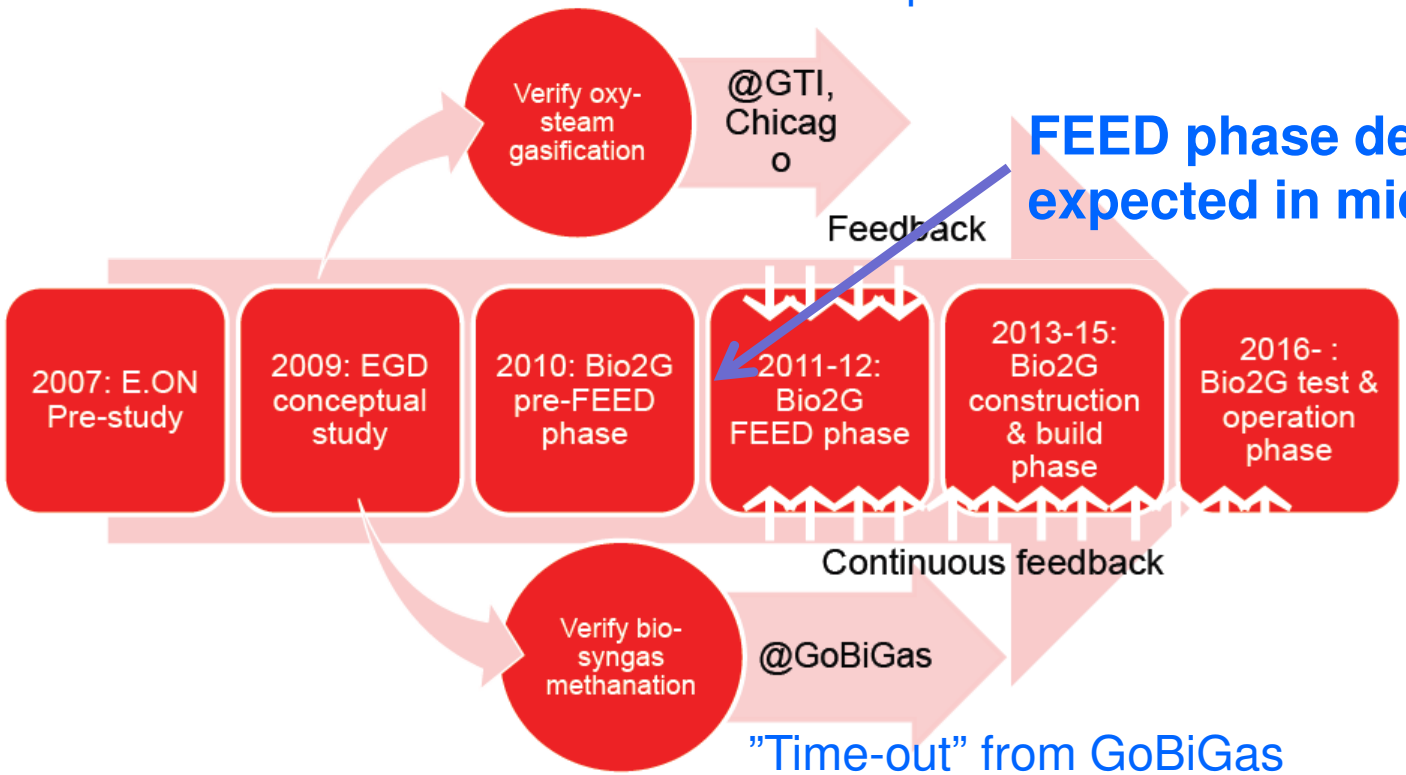
12

CHEMREC
Energy to Succeed

E.ON Bio2G

Roadmap Bio2G

Studies with Carbona and
Haldor Topsöe and others are on-going



”Time-out” from GoBiGas