

The background of the slide is a photograph of biomass. On the left, there is a large stack of cut logs. On the right, there is a large pile of wood chips or sawdust. The sky is clear and blue.

# Thermal Biomass Gasification in Denmark

## IEA Bioenergy Task 33

Second semi-annual task meeting  
Göteborg, Sweden, 21 November 2013

M.Sc. Morten Tony Hansen  
Senior Project Manager  
FORCE Technology – Industrial Processes

- Government green targets
  - 2020: Half of electricity demand covered by wind
  - 2030: No coal at power plants, no oil heating
  - 2035: Electricity and heating fully covered by RE
  - 2050: Complete energy supply is fossil free
- Energy agreement points in this direction
  - Comprehensive biomass analysis ongoing
  - Real energy plan coming up
- Current feed-in tarif: 15 €/kWh
  - Currently for approval by EC
  - Related to natural gas price



- Financing the agreement: "Security of supply tax"
  - Stalling conversion of coal CHP plants
  - Discussions on log fuel and fuel for small plants
  - Expectations on price increase for district heating consumers
- Thermal power plants under pressure
  - Biomass plants sold to district heating companies
  - Central plants - one block per year cease operation
  - Utilities outsource engineering and services
  - The future for CHP generation is questioned
  - New plants heating focus with power possibility
- New R&D topics: biogas, liquid biofuels, hydrogen

# Babcock & Wilcox Vølund - Harboøre Plant



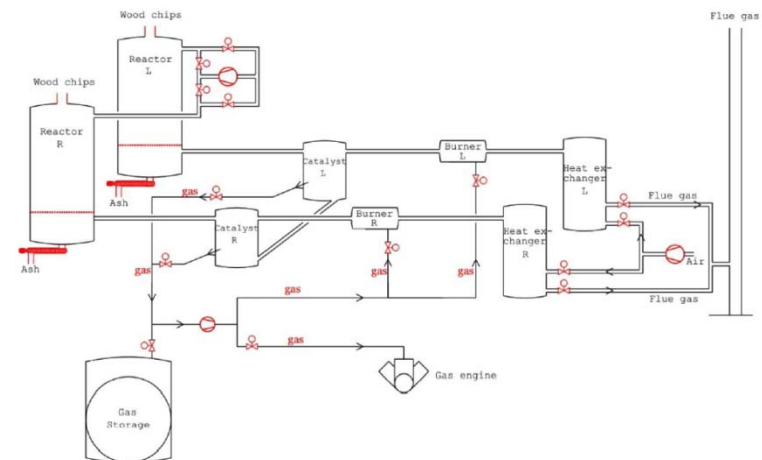
- Updraft type, wood chip fired
  - Tar challenge turned into flexibility advantage - bio oil
- 20 years of gasifier operation
  - CHP operation for 12 years
  - 650 kW<sub>e</sub>
- The operator is very happy
- BWV would like new demo plant
  - Home market challenges:
    - Feed in tariff
    - Preferences of plant owners
  - Foreign markets:
    - Heat has low value



# Babcock & Wilcox Vølund - Ammongas



- FIRgas Alternating Gasifier
  - Twin bed filter
  - Aiming at straw
- Technology now under further development by B&W Vølund
- Pilot plant 400 kW<sub>th</sub>
  - Wood chips
  - In intermittent operation
- Application not yet clear
  - Fuel likely, not IC engine
  - Gas composition high on H<sub>2</sub> and CO, no N<sub>2</sub>, low CO<sub>2</sub>



# Biosynergi - Hillerød Plant



- Demonstration CHP plant under construction in Hillerød
  - 300 kW<sub>e</sub>
  - wood chips
- Open core downdraft type
- Status
  - Building in place
  - Large hardware in place
  - Assembly ongoing
- Still expect operation in 2013



# Weiss - Hillerød plant



- CHP plant in Hillerød
  - 600 kW<sub>e</sub>
  - wood chips fired
- Staged down draft Gasifier
  - Developed by DTU
  - Licenced by COWI
- Design for unmanned operation
- Continuous operation pending
  - Encountered various start up problems in 2012
  - Continuous operation interrupted by mechanical problems in auxiliary equipment



# Pyroneer - Kalundborg plant



- Low temperature CFB
  - Developed by Peder Stoholm/DTU
- Pilot plant in Kalundborg
  - 6 MW<sub>th</sub>
  - Loose wheat straw
  - Gas co-fired into coal boiler
  - Tests with various fuels
  - Ash used for fertiliser field tests
  - Operated for design of full scale
- 50 MW full scale demo plant
  - Expected operational in 2015
- Presentation at workshop





# Andritz/Carbona - Skive plant



- Europe's largest for CHP
  - 6 MW<sub>e</sub>
  - wood pellet fuelled
  - pressurized CFB
- Co-financed by the US DOE
- Stable operation from 2012:
- Availability now 70% due to:
  - New filters
  - New catalyst
  - Improved fuel quality + additive
- Liquid fuel generation project
  - Tigas process from Haldor Topsøe



Photo courtesy of C.F. Møller, photo by Ole Hein Petersen

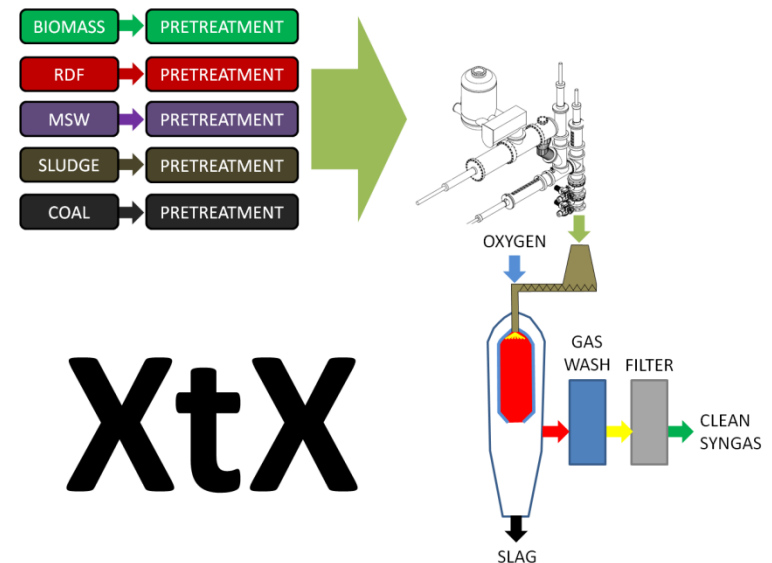
# TK Energy - Køge



- 10 MW entrained flow plant
  - Slagging
  - Dried sewage sludge
- Current challenges
  - fuel feeding
  - burner zone design



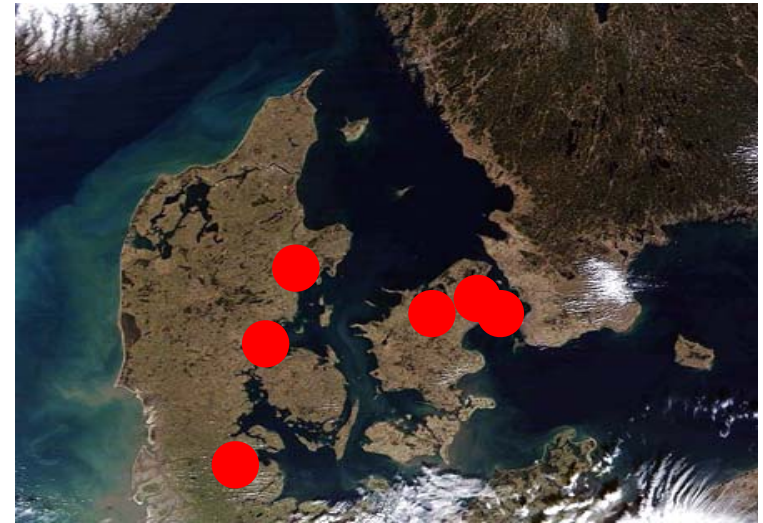
- Also project in France
  - Pressurized gasification
  - Wood waste
  - French aim: liquid fuels from H<sub>2</sub>



# Stirling DK - bankrupt - now sold



- Biomass fired Stirling engine developed for 20 years
- Updraft wood chip gasifier
- >10 plants in operation
  
- Bankrupt in spring 2013
- Employees released
- Assets now sold to REKA
  - Wood boiler solutions
  - Gasifier solutions not promoted
  - No news on new engine design



- Hydrothermal liquefaction
- Biomasses & wastes
- Test facility at the university
  - 3 l/h biooil
- Full scale demonstration :
  - 48.000 l/d
  - Studies on-going
- Strongly profiled plant
- Supported from DEA/EUDP etc.



# Organic Fuel Technology - Ødum plant



- Catalytic LT Pyrolysis
- Straw for oil and gas (-> CHP)
- 29% oil - 20% gas
- New plant in Ødum
  - Expected operational in Q2 2013
- Strongly profiled plant



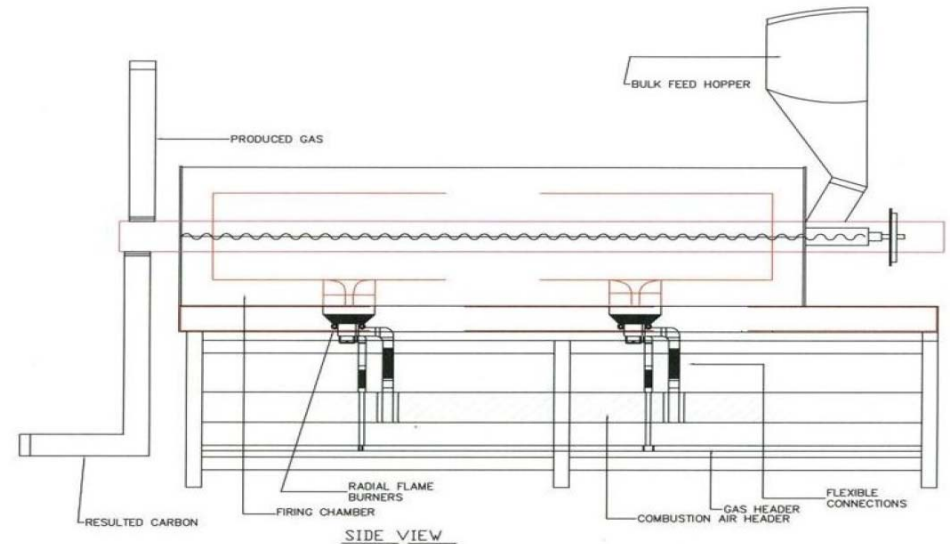
- Supported from DEA/EUDP



# Frichs Sublimator - Havndal plant



- Pyrolysis/biochar CHP unit
  - Straw fed
- Gasifier purchased abroad
- Aim to gasify manure fibre
- Plant installed at farm in Havndal
- No gas filtering/cleaning
- 
- 
- 
- 
- Currently not in operation



## Other projects/technology tracks



- Frichs - 1RGI - Gasification.dk
  - Project on optimised updraft gasifier/IC engine system
- GGC-TECH
  - Developing micro scale gasifier/gasturbine system
- DALL Energy
  - Idea to proceed with gasification from succesful furnace
- FLSmidth
  - Pilot plant soon in operation at test site

# The Danish RD&D environment



- Universities
  - Biomass Gasification Group at DTU/Risø has merged with DTU Chemical Engineering (CHEC)
  - Aalborg University with HTL
- Advanced Technology Group companies
  - Danish Technological Institute (DTI)
  - FORCE Technology
- Consultants
  - Danish Gas Technology Centre (DGC)
  - Aaen Consulting Engineers
  - COWI



A photograph of a wood processing site. On the left, there are large stacks of cut logs. On the right, there are large mounds of wood chips. A dirt path leads through the site towards the background under a blue sky with some clouds.

Thank you!

M.Sc. Morten Tony Hansen - FORCE Technology - T: +45 7215 7700 - E: [mth@force.dk](mailto:mth@force.dk)  
[www.forcetechnology.com](http://www.forcetechnology.com)