

The background image shows a large stack of cut logs on the left and a large pile of wood chips or biomass on the right, under a clear blue sky. The text is overlaid on this image.

Thermal Biomass Gasification in Denmark

IEA Bioenergy Task 33

First semi-annual task meeting

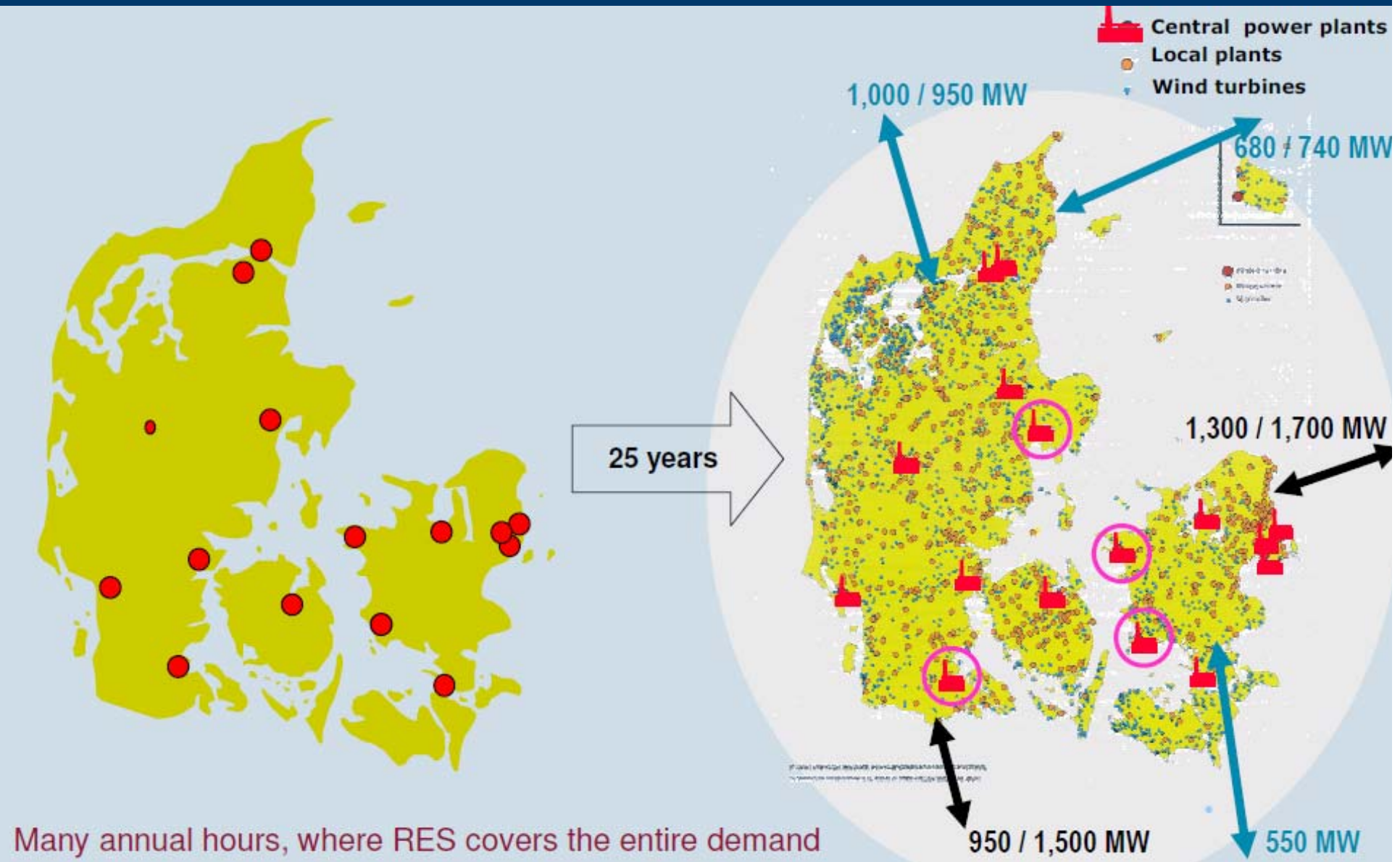
Ischia, Italy, 13 May 2013

M.Sc. Morten Tony Hansen

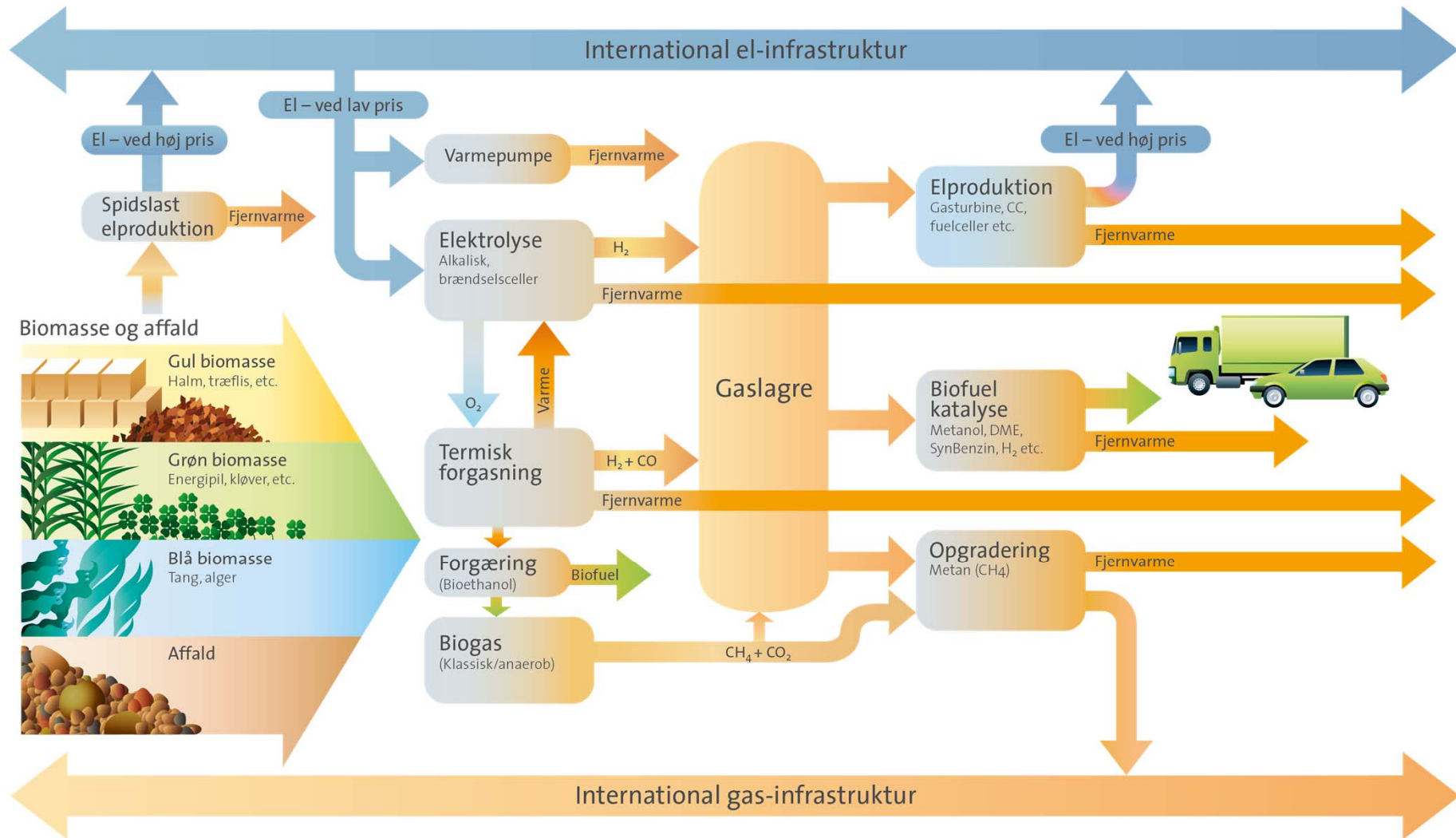
Senior Project Manager

FORCE Technology – Thermal Energy and Fluid Mechanics

Danish electricity generation system

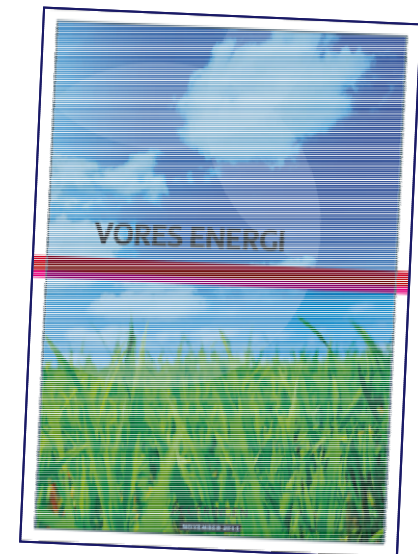


A vision for the Danish energy system 2050



Source: Energinet.dk

- 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 still ongoing
 - Real energy plan hopefully coming up
- Current feed-in tarif: ~15 €/kWh
 - New: approved by the EC
 - Related to the natural gas price



- Financing the energy agreement
 - Should have been "Security of supply tax", now simple tax increase is discussed
 - Still stalling conversion of coal CHP plants into pellets/biofuel
- Thermal power plants under pressure
 - Biomass CHP plants sold to district heating companies
 - Central plants - one block per year have ceased operation
 - Utilities outsource engineering and services
 - The future for decentralised CHP generation is questioned
 - New plants: heating focus with power generation possibility
- New R&D topics: biogas, liquid biofuels, hydrogen

Babcock & Wilcox Vølund - Harboøre Plant



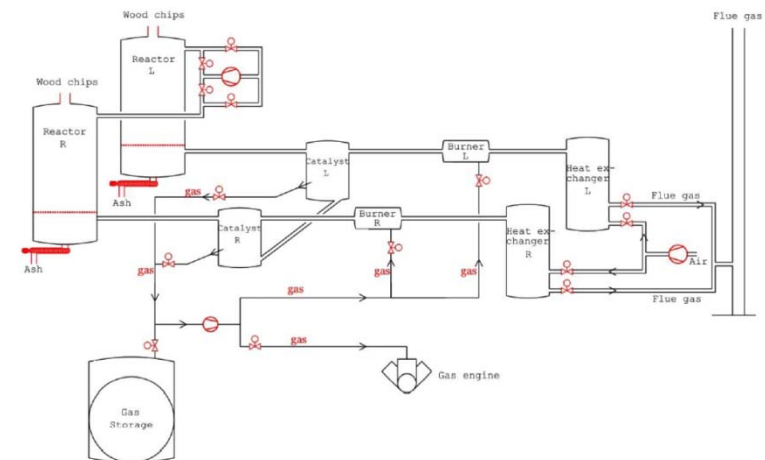
- Updraft type, wood chip fired
 - 1 MW_e (1.4 MW_e installed)
 - Tar challenge turned into flexibility advantage - bio oil
- 21 years of gasifier operation
 - CHP operation for 14 years
 - Operated 100% by heat demand
- The host is very happy
- BWV would like new demo plant
 - Feed in tariff challenging in DK
 - Preferences of plant owners in DK
 - Heat of low value in foreign markets



Babcock & Wilcox Vølund - Ammongas



- FIRgas Alternating Gasifier
 - Twin bed filter
 - Aiming at straw
- Technology being developed by B&W Vølund
- Pilot plant 400 kW_{th}
 - Wood chips
 - In intermittent operation
- Application not yet clear
 - Fuel likely, not IC engine
 - Gas composition high on H₂ and CO, no N₂, low CO₂



Biosynergi - Hillerød Plant



- Demonstration CHP plant under construction in Hillerød
 - 300 kW_e
 - Wood chips
- Open core downdraft type
- Status
 - Building in place
 - Large hardware in place
 - Assembly still ongoing
- Building and financing challenges
 - Seem overcome
 - Expected commissioning 2014



Weiss - Hillerød plant



- CHP plant in Hillerød
 - 600 kW_e
 - Wood chip fired
- Staged down draft Gasifier
 - Developed by DTU
 - Licenced by COWI
- Design for unmanned operation
- Continuous operation pending
 - Faced various challenges
 - Structural changes in company
 - 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_{th}
 - Loose wheat straw
 - Gas co-fired into coal boiler
 - Tests with various fuels
 - Ash used for fertiliser field tests
- Full scale demo plant
 - 60 MW_{th}
 - Expected operational in 2016-17
- Technology for sale



Andritz/Carbona - Skive plant



- Europe's largest for CHP
 - 6 MW_e
 - Wood pellet fuelled
 - Pressurized CFB - Carbona
- Co-financed by the US DOE
- Stable operation
 - Availability 70%
 - 2013: 26 GWh_e and 52 GWh heat
 - New catalyst in summer 2014
- Liquid fuel generation project
 - Further investments are made
 - Tigas process from Haldor Topsøe



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

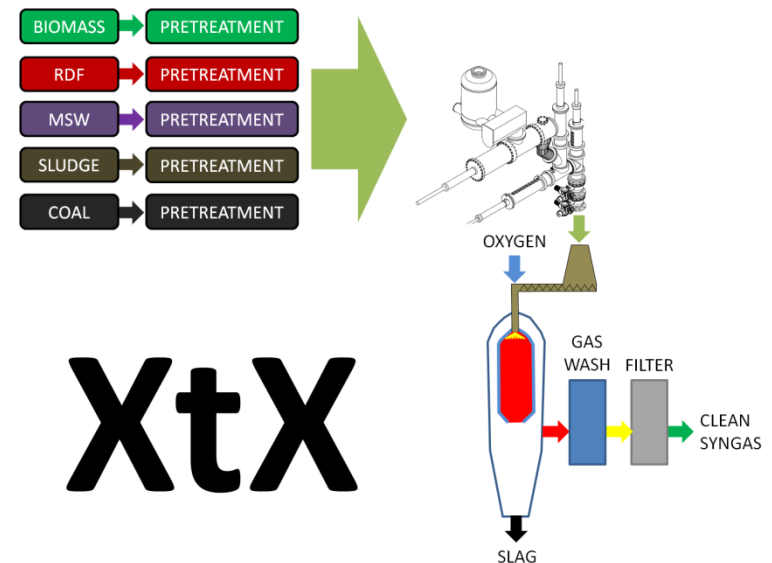
TK Energy - Køge



- 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 H₂



Steeper Energy - Aalborg + Frederikshavn



- Hydrothermal liquefaction
 - Biomasses & wastes
 - 300 bar/400°C
- Test facility at the university
 - 3 l/h biooil
- Full scale demonstration vision
 - Frederikshavn
 - 50-150 t/y S-free marine diesel
 - Test study supposed to end 2013
- 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
 - No updates on operation
- Strongly profiled plant



- Supported from DEA/EUDP



Frichs Sublimator - Havndal plant



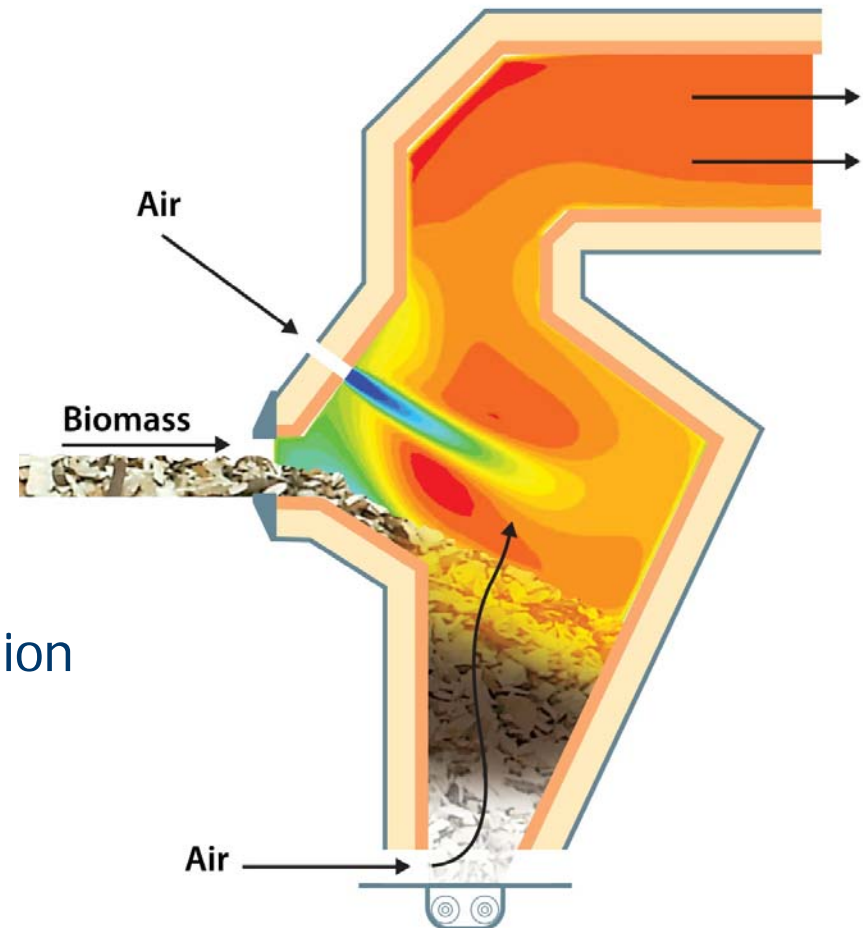
- Flash pyrolysis/BioChar 7 CHP unit
 - Straw fed (1.2 T/h)
- Proprietary "Sublimator system"
 - Integrated gas cleaning and cooling
- Frichs CHP system with
 - $1 \text{ MW}_e / 1.2 \text{ MW}_{th}$
- Plant installed at farm in Havndal
- Aim to sublimate manure fibre
 - EUDP project
- Currently under commissioning
 - Full operation in July 2014 expected
 - Partly unmanned operation expected



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



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 is a large, neat stack of cut logs. On the right, there is a large, conical pile of wood chips or sawdust. The ground is dirt and wood debris. The sky is blue with some white clouds. The text "Thank you!" is overlaid in the lower center of the image.

Thank you!

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