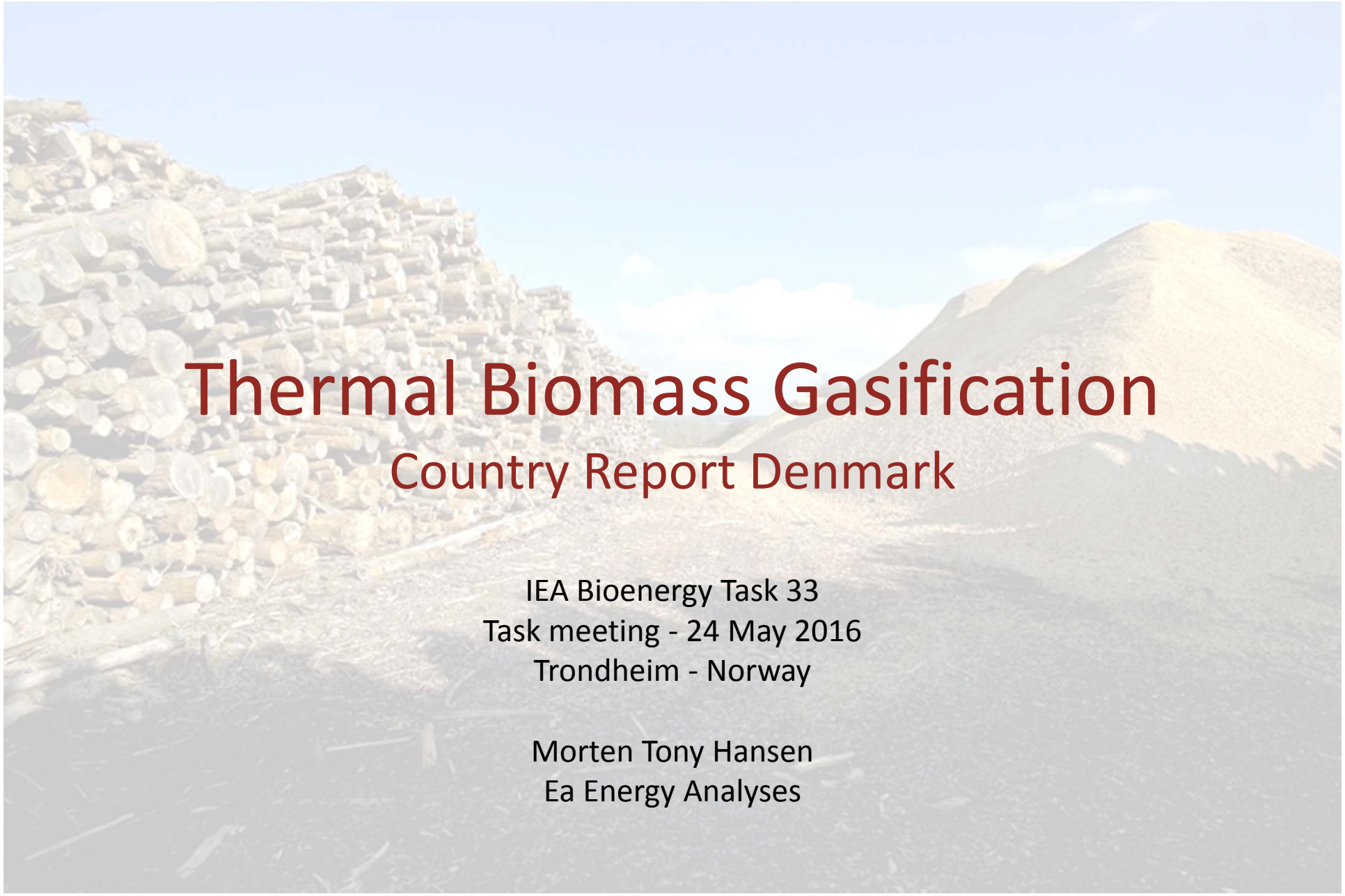

Thermal Biomass Gasification

Country Report Denmark

IEA Bioenergy Task 33
Task meeting - 24 May 2016
Trondheim - Norway

Morten Tony Hansen
Ea Energy Analyses

Ea Energy Analyses

Mixed Danish energy news

- Gasification plant news
  - New and good old gasification plants in operation
  - Promising projects mothballed/dismantled
- Energy planning news
  - Energy planners find gasification important to balance large wind share in the energy system
  - Ea Energy Analyses works on projects to
    - Develop technology data on gasifiers
    - Scenarios to fit gasifiers in the Danish energy system
- News on energy politics
  - Denmark signed COP21 agreement
  - Participation in Mission Innovation
  - Nationally, energy is on the agenda

Ea Energy Analyses

Existing framework conditions

- Energy agreement 2012
  - 2020: Half of electricity demand covered by wind
  - 2020: 35% of energy demand covered by RES
  - Bioenergy analysis in the DEA
  - Part of 2012 Parliament energy agreement
  - Four scenarios for fossil free 2050 outlined
  - Sustainable solid biomass plays a major role
  - Tax analyses are on-going
  - Decision on scenario to be taken in 2020

- Current feed-in tarif: ~15 €c/kWh$_e$
  - No incentives for bioSNG
  - Strong incentives for biogas

Ea Energy Analyses

Babcock & Wilcox Vølund - Harboøre

- Updraft type, wood chip fired
  - 1 MW_e (1.4 MW_e installed)
  - Tar challenge turned into flexibility advantage - bio oil
- 22 years of gasifier operation
  - CHP operation for 15 years
  - Operated fully to meet heat demand
- The host is very happy
- Supplier needs a new demo plant
  - Feed in tariff challenging in DK
  - Preferences of plant owners in DK
  - Heat of low value in foreign markets
- Candidate for Top 10?

Ea Energy Analyses

Andritz/Carbona - Skive

- Europe's largest for CFBG CHP
  - 28 MW_{fuel} - 6 MW_{el}
  - Wood pellets
  - Pressurized CFBG, Carbona
- Co-financed by the DoE/EU/DK
- Stable operation
  - Fuel quality improved
  - High availability
- Liquid fuel generation project
  - Further investments are made
  - TIGAS process from Haldor Topsøe is being tested

Ea Energy Analyses

Biosynergi Proces - Hillerød

- Demonstration CHP plant
- Upscale of Castor plant
  - Open core downdraft type
  - 300 kW_e / 750 kJ/s heat
  - Wet forest wood chips
- Status
  - CHP operational on natural gas
  - Gasifier has been operated for 500 hours
  - Various electrical and mechanical issues has delayed start up
- News: Has just recently started CHP operation on producer gas

Ea Energy Analyses

Weiss - Hillerød

- CHP plant in Hillerød
  - 500 kW_e / 1000 kW_{heat}
  - Fuel: Wood chips
- Staged down draft Gasifier
  - Developed by DTU
  - License by COWI
  - Scale-up by Weiss and DTU
- Design for unmanned operation
- Has been operating but faced technical problems
- Has been dismantled

Ea Energy Analyses

DONG Energy Pyroneer - Kalundborg

- Low temperature CFB
  - Developed by DTU & DONG Energy
- Pilot plant in Kalundborg
  - 6 MW_{th} (product gas: ~650°C)
  - Loose wheat straw
  - Tested with various fuels
  - Gas co-fired into coal boiler
  - Stable and safe operation demo
  - Ash used for fertiliser field tests
- Pyroneer project mothballed
  - Sale of technology not successful
  - Plans for 60 MW_{th} terminated
  - Staff moved/fired/quit

Ea Energy Analyses

Other technologies

- Hydrothermal liquefaction
  - Research projects & pilot plants
  - Universities & suppliers
- Pyrolysis plants
  - Bio oil and biochar in focus
  - Residues & difficult fuels
- Biogas boom
  - Upgrade to natural gas quality
  - Booming in plants promoted by NG suppliers

Ea Energy Analyses