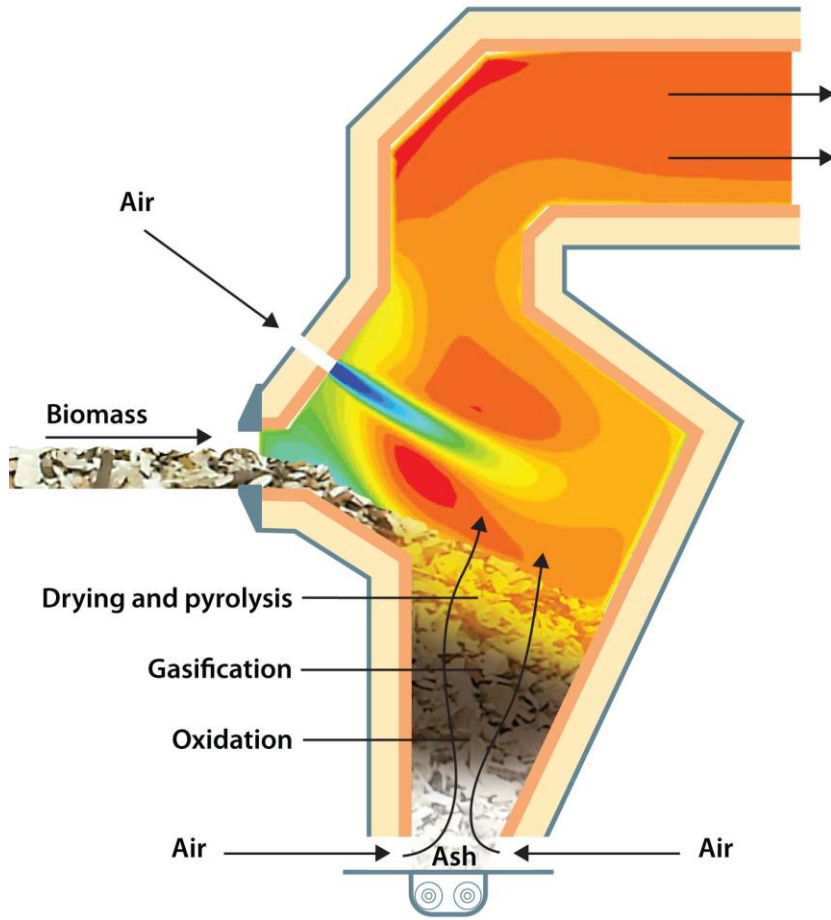


Biomass furnace with updraft gasification

Jens Dall Bentzen – Dall Energy



Dall Energy
New biomass technologies

Agenda

- **Introduction to Dall Energy**
- **Dall Energy biomass system**
- **Dall Energy Furnace**
- **Next step**

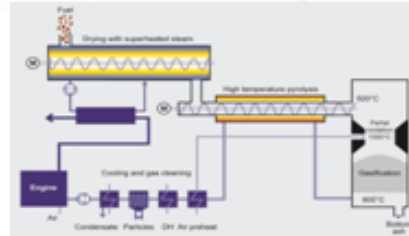


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Introduction to Dall Energy

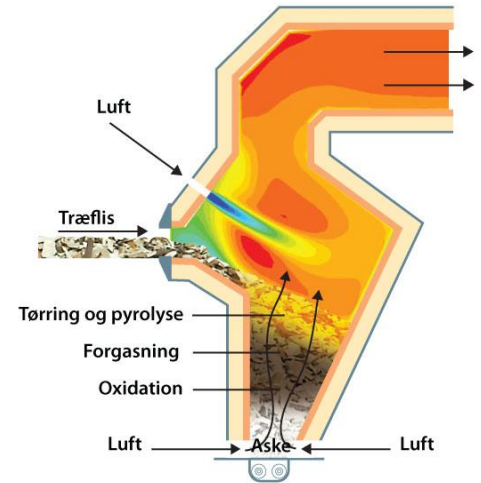
Scrubber for biomass gasifier

Bag filter



Upscale and optimizing biomass gasifier

Patent, verification and demonstration



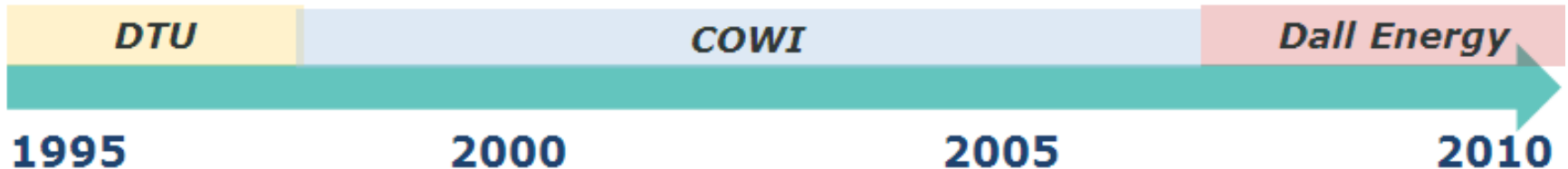
Tender of biomass plant

Calculation tool

Patent on gas cooling

Biomass

District heat



Dall Energy team - Persons

- **Process: Bjørn Teislev**
- **Practical solutions: Claus Geest**
- **Refractory lining: Jørgen Beck**
- **Design, patents, sales: Jens Dall Bentzen**
- **CFD : FORCE**



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Dall Energy team - Manufacturers

- **Furnace /steel: SEM steelindustry**
- **Glasfiber (Flue gas scrubbers): Scancomposit**
- **Condensate filter: Løkken VVS (Cometas)**

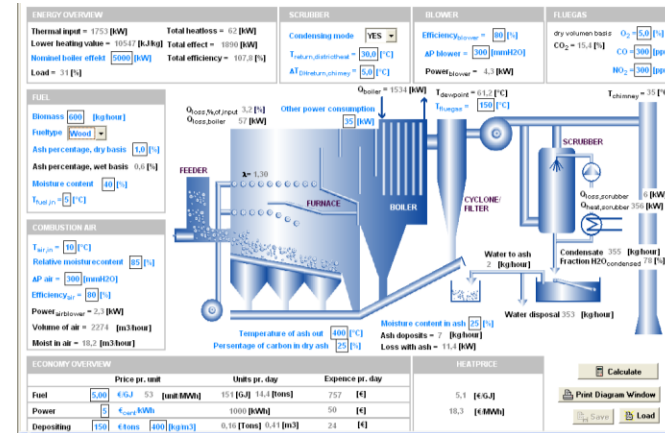


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Dall Energy biomasse system

Challenges in 2007:

- Unburned carbon in ash
- Partial load
- Maintenance
- Condensate filter
- Corrosion in boiler
- Fuel flexibility
- Efficiency
- Emissions



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 New biomass technologies

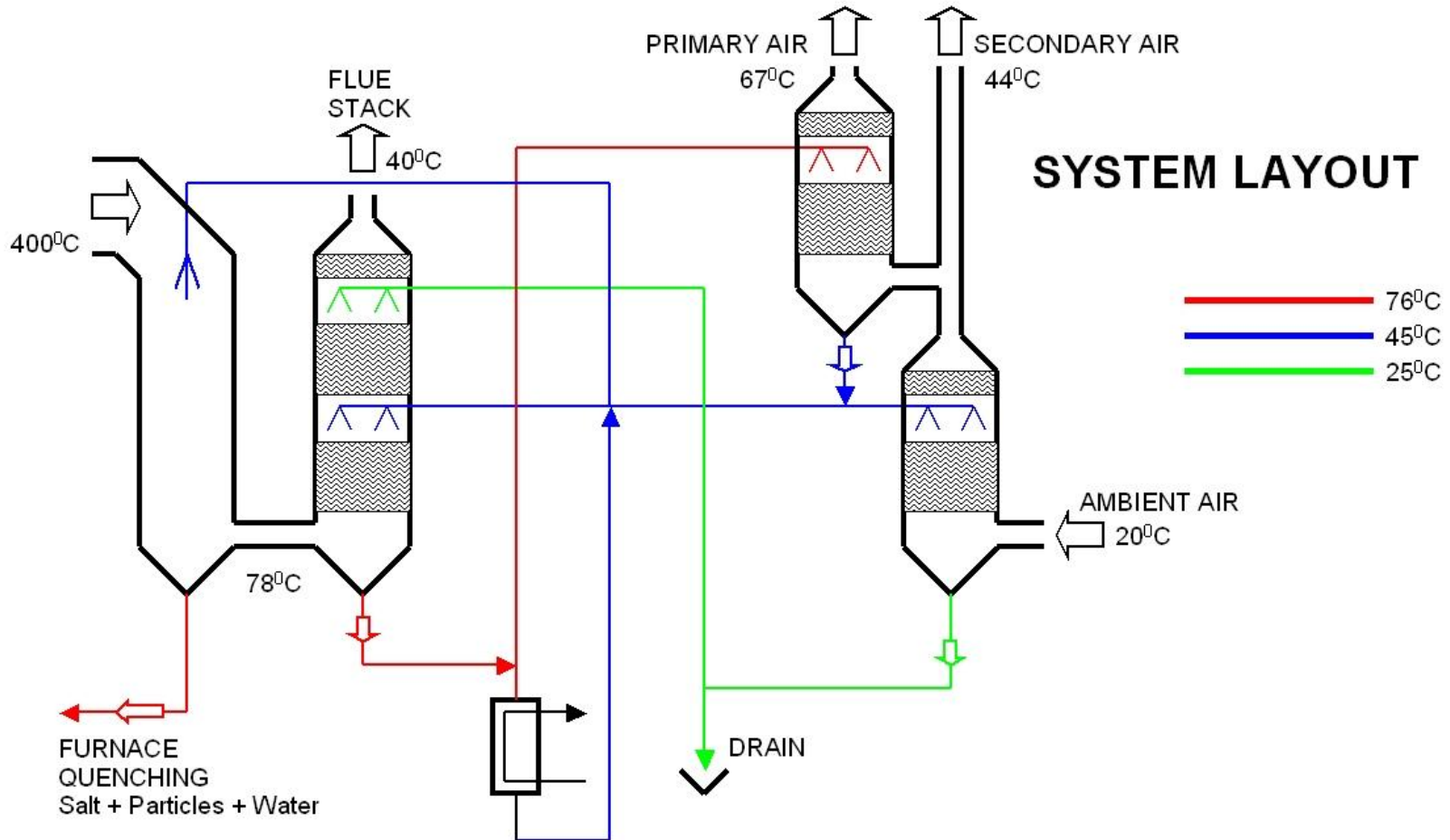
Dall Energy biomasse system to district heat

	Standard	Dall Energy
Furnace		
Fuel	Wet <u>or</u> dry	Wet <u>and</u> dry
CO 100% (mg/Nm3)	100	15
CO 20% (mg/Nm3)	500	15
CO 10% (mg/Nm3)	N.A.	15
Dust (mg/Nm3)	200-1000	20
NOx (mg/Nm3)	250-300	150-175
carbon in aske (%)	20-50%	<5%
Maintanance	High	Low
System		
Product	Heat only	Heat only / CHP with ORC
Partikel filter	Multi cyklon	No
Efficiency (LHV)	90-105%	115%
Condensate filter	Complex	Simple

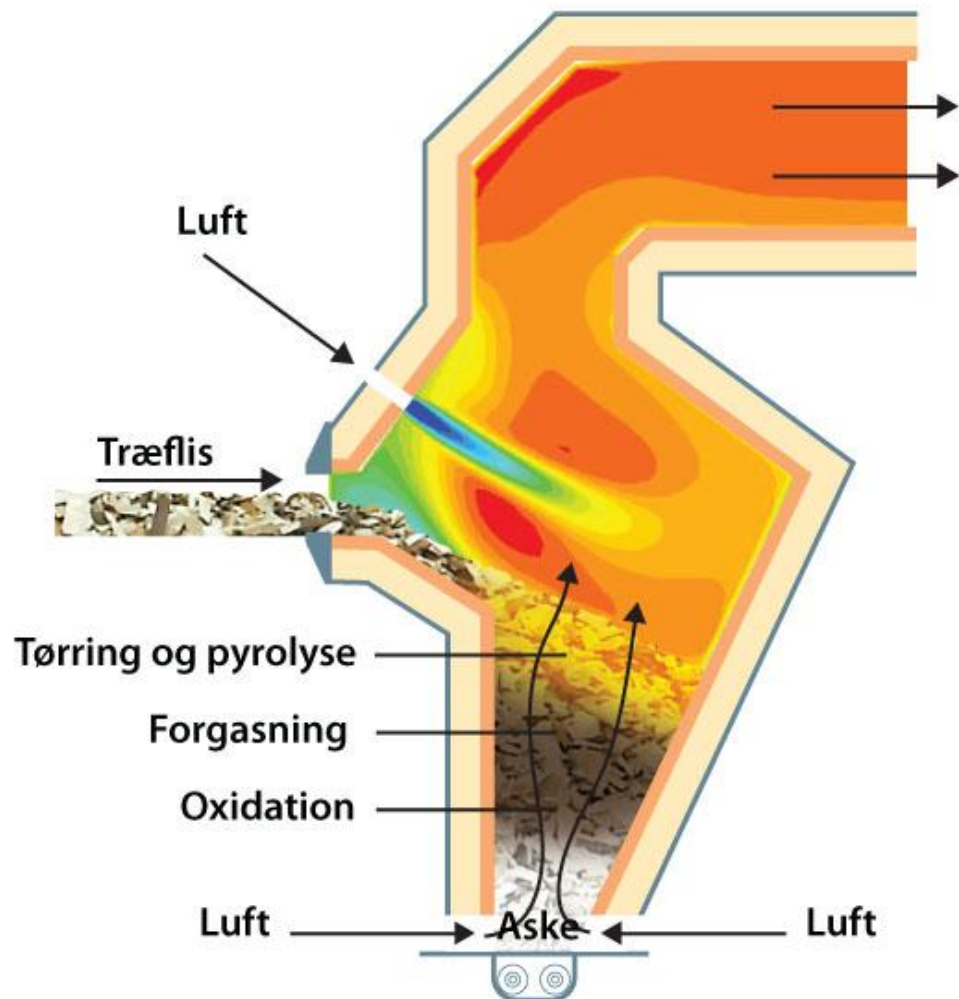


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Gascooling and cleaning



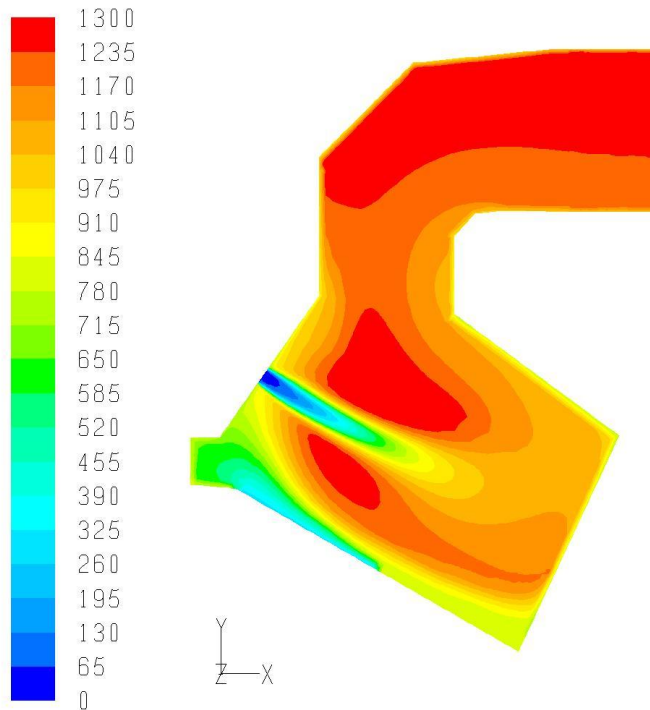
Dall Energy furnace



Dall Energy
New biomass technologies

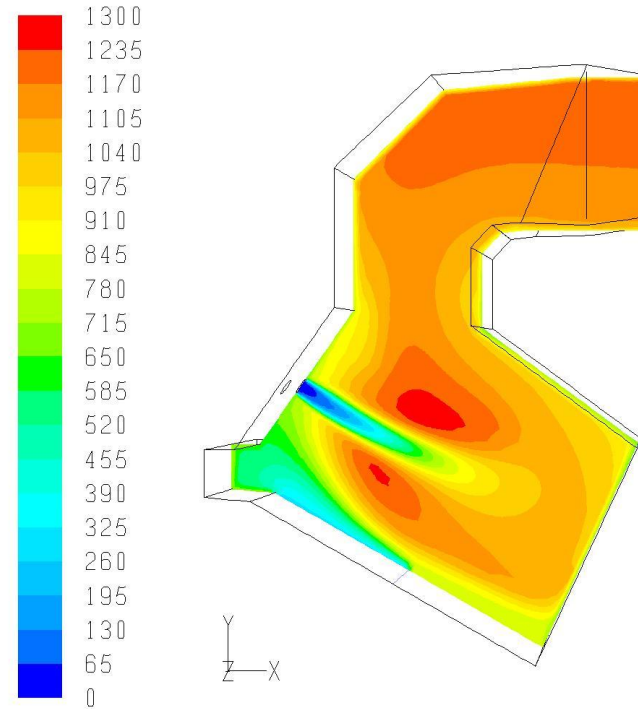
Dall Energy Furnace

100% Load Temperature



Dall Energy
Contours of Static Temperature (c)
Force Technology

10% Load Temperature

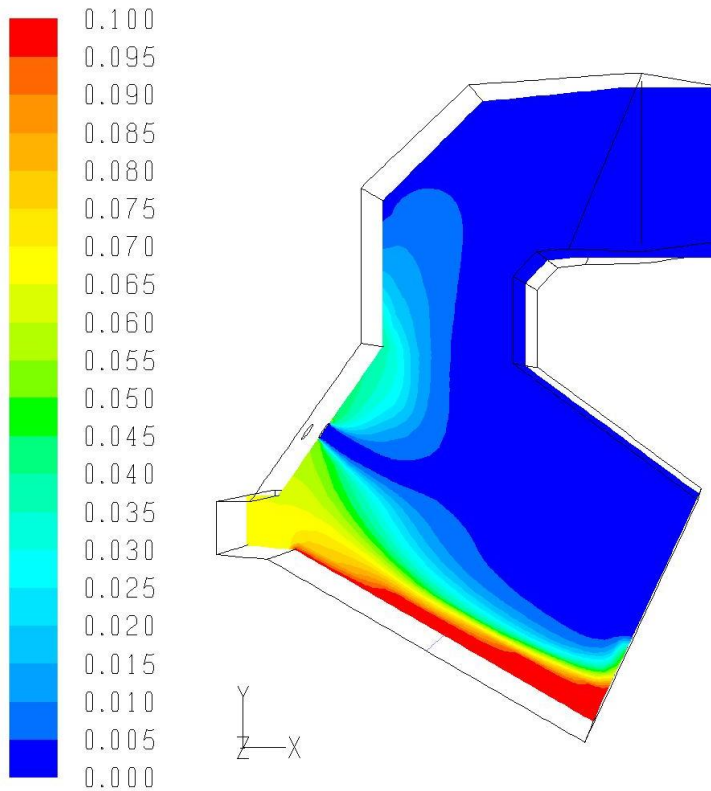


Dall Energy
Contours of Static Temperature (c)
Force Technology



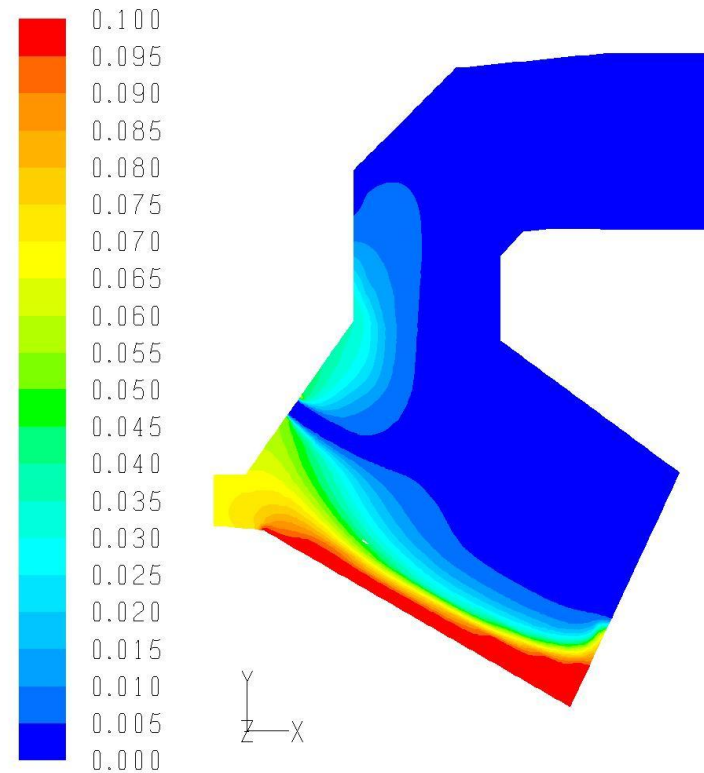
Dall Energy Furnace

100% Load - CO



Dall Energy
Contours of massfraction-co-dry
Force Technology

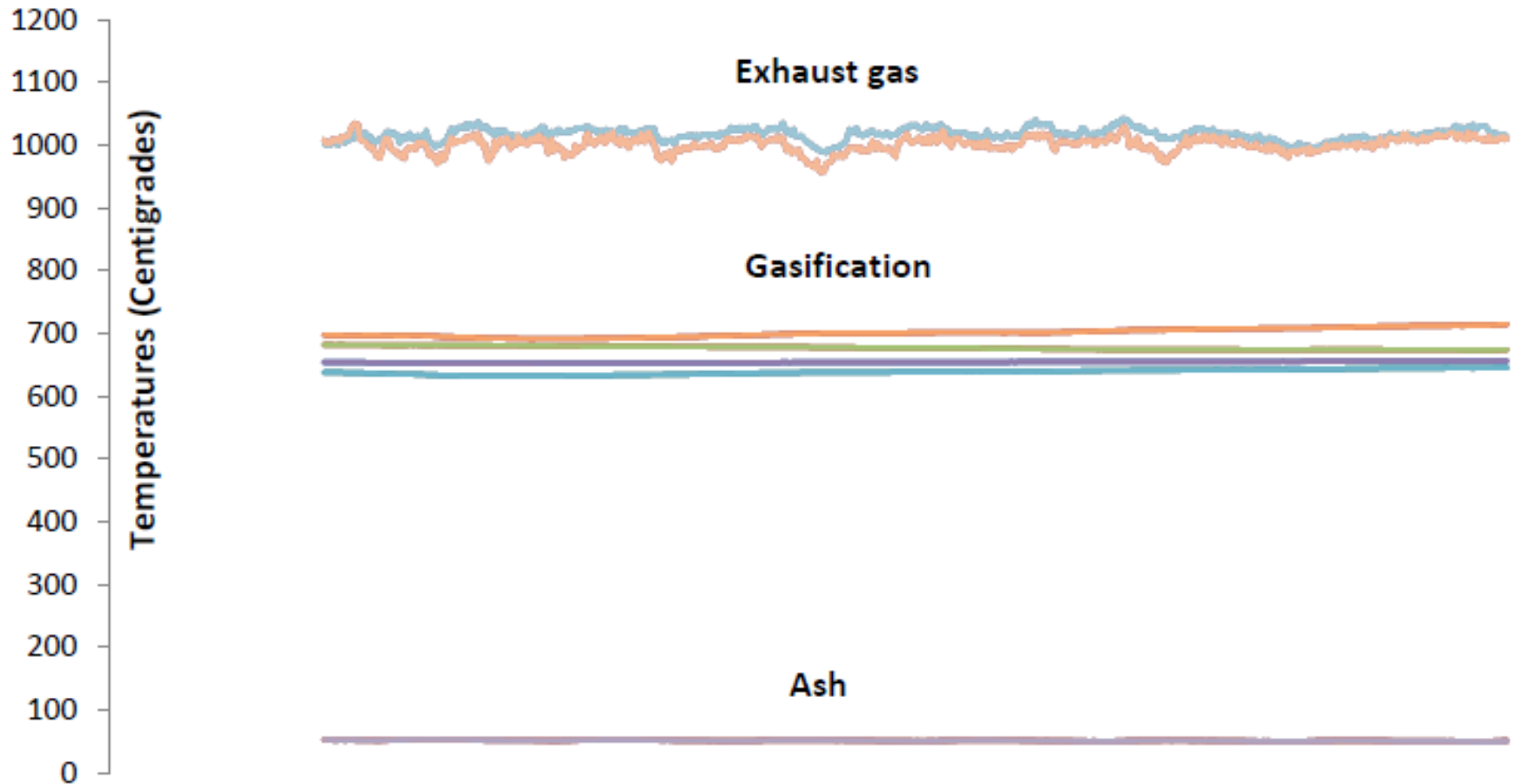
10% Load - CO



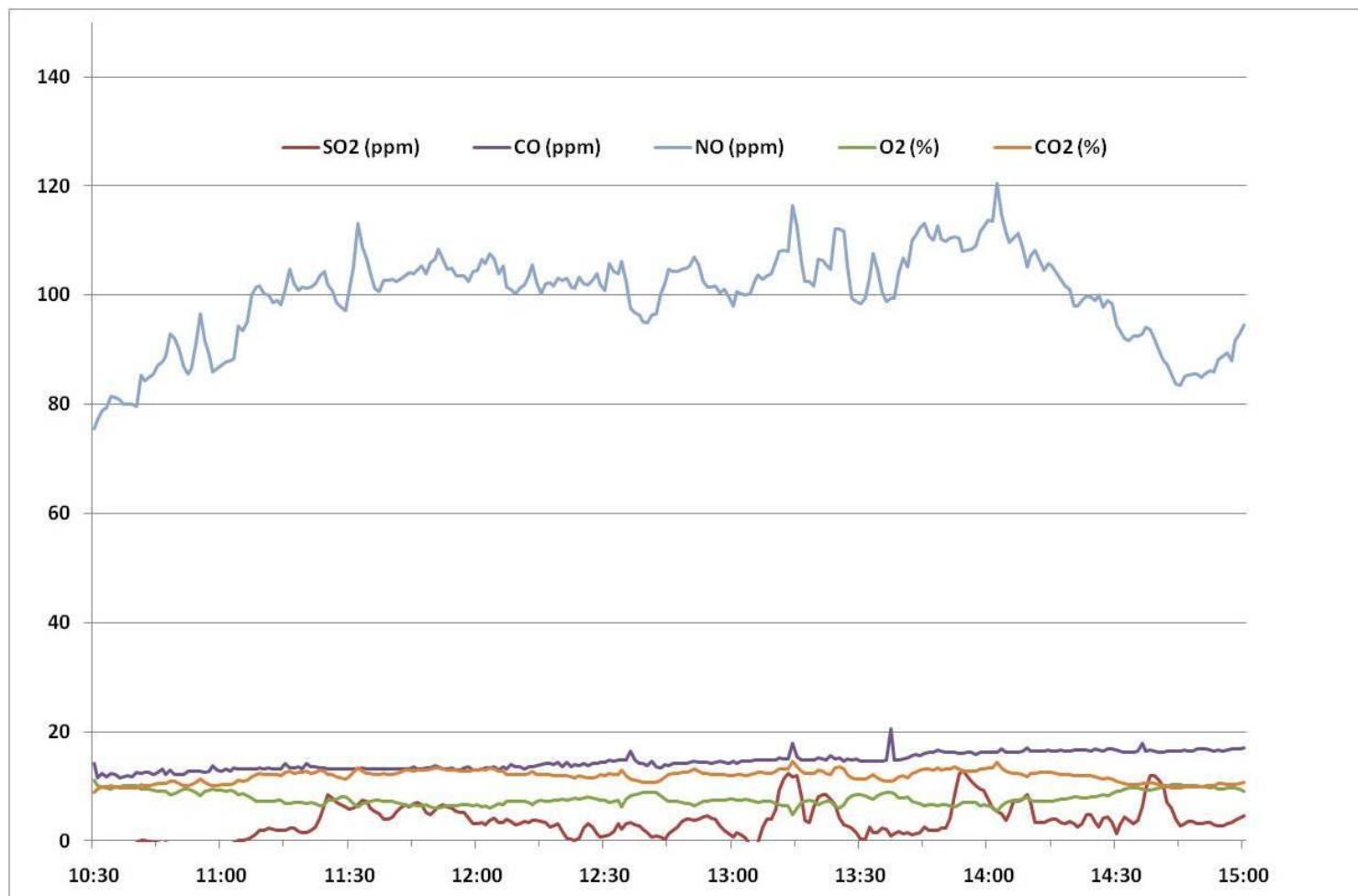
Dall Energy
Contours of massfraction-co-dry
Force Technology



Temperatures in Furnace



Emissions



Dall Energy
New biomass technologies

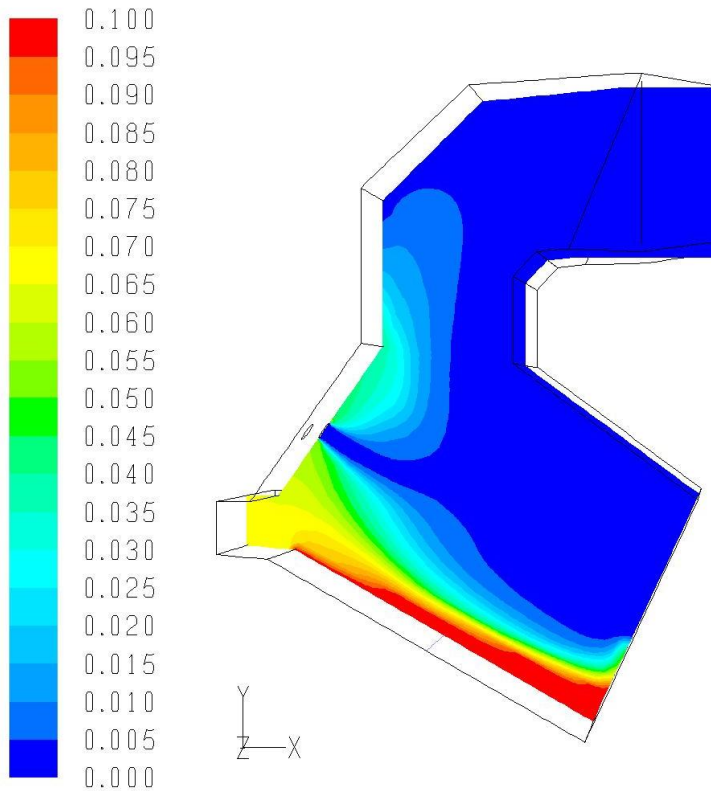
Dust out of furnace

Content in mg/Nm ³ (Dry)			
Sample no.	1	2	3
Position	Outlet combustion chamber	Outlet combustion chamber	Outlet combustion chamber
Date	09-12-2009	09-12-2009	09-12-2009
Sampling period	10:48-11:48	12:02-13:02	13:09-14:09
Particles, mg/Nm ³ (Dry)	18,5	32,6	26,8
O ₂ -concentration, % (V, D)	7,7	7,4	7,1
Particles, mg/Nm ³ (Dry) at 10 % O ₂	15,3	26,5	21,2



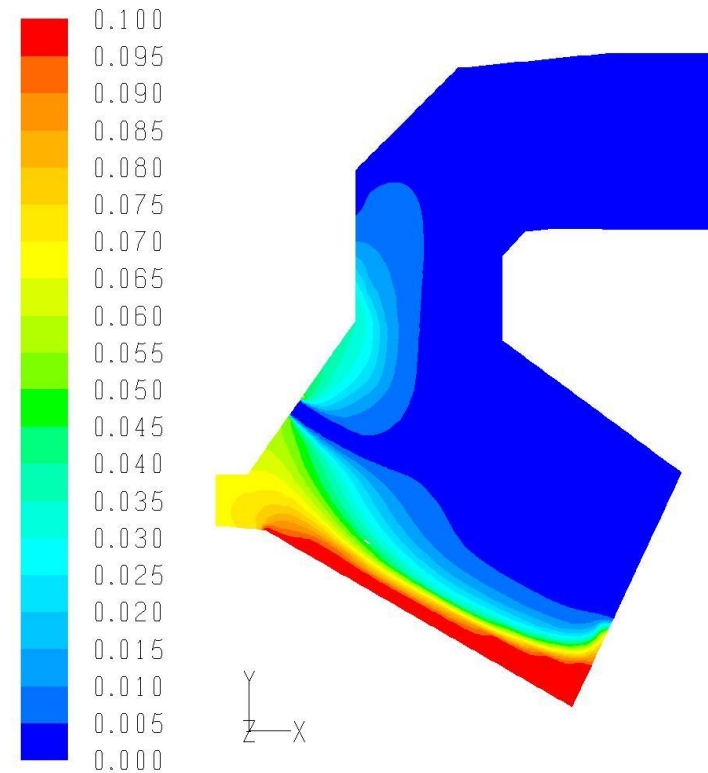
Dall Energy Furnace

100% Load - CO



Dall Energy
Contours of massfraction-co-dry
Force Technology

10% Load - CO



Dall Energy
Contours of massfraction-co-dry
Force Technology



Next steps

- 2010 8 MW heat only demonstration in DK
- 2011 13 MW/2 MW CHP in DK + heat only international

