Nordic Graduate School in Biofuel Science and Technology-2

Maria Zevenhoven

Coordinator

Visby, Sept 2008/MZ

norden
Nordic Energy Research

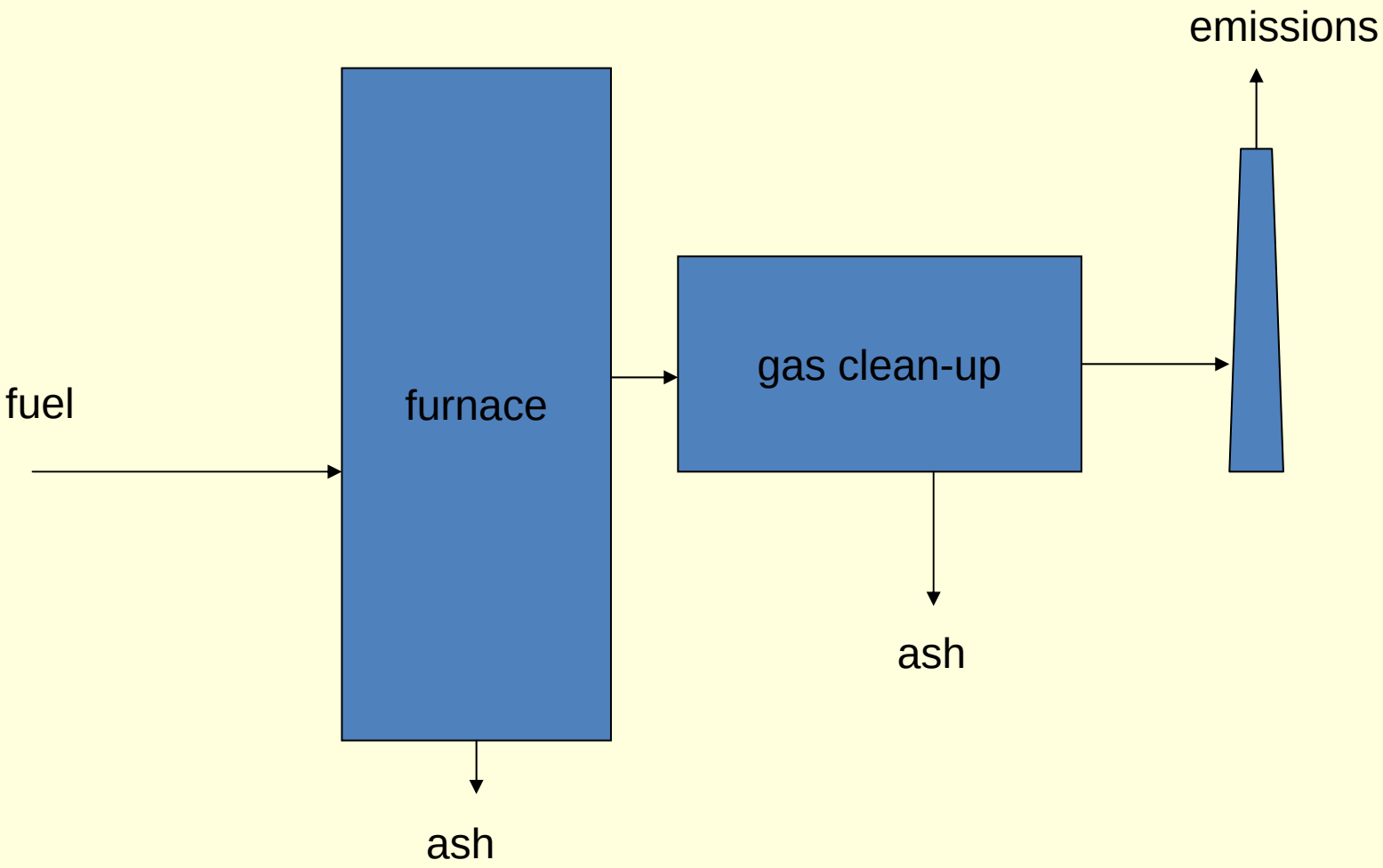
“Analytical techniques in combustion”

CTU, DTU, AAU, NTNU

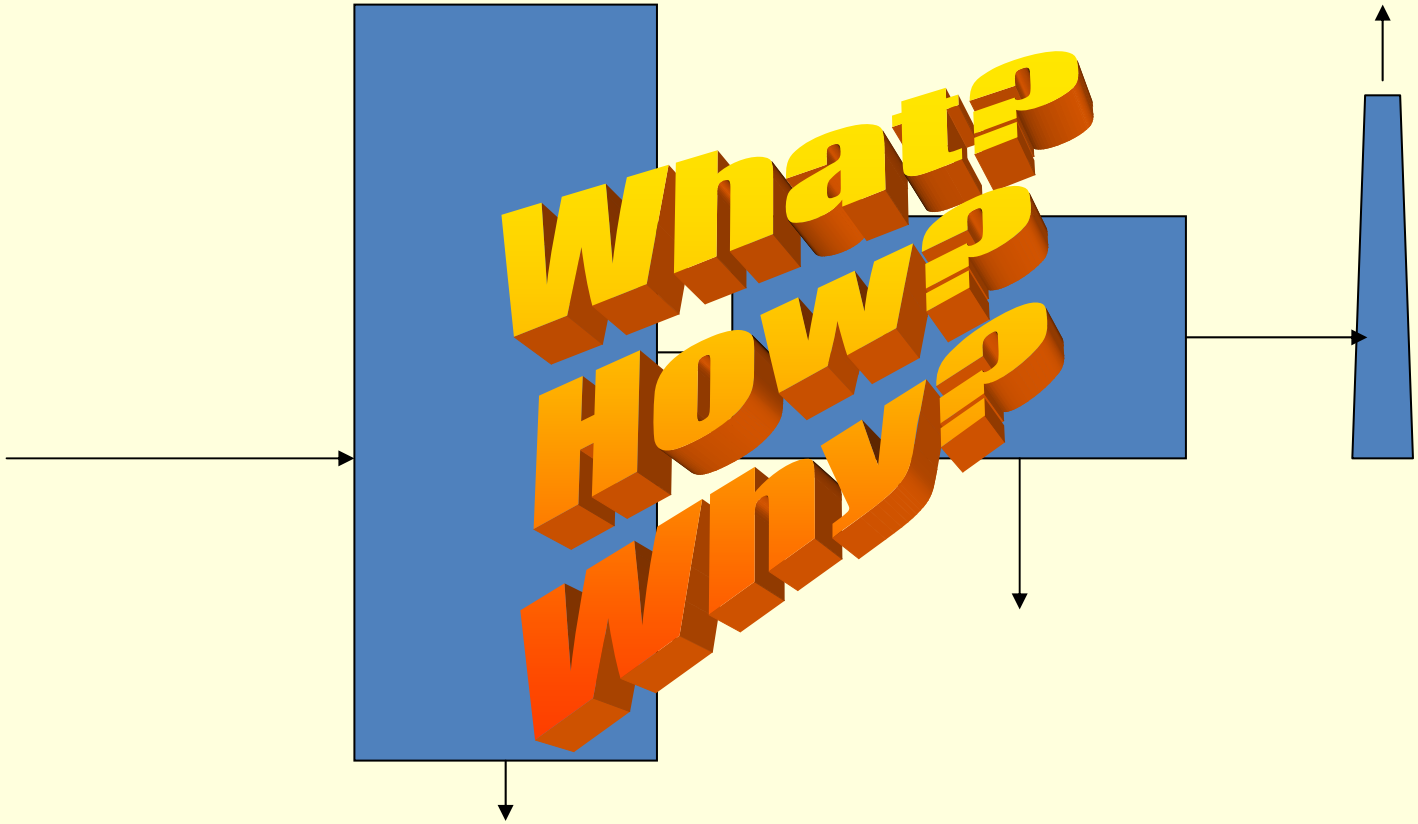
A educational and scientific effort of:

Visby, Sept 2008/MZ

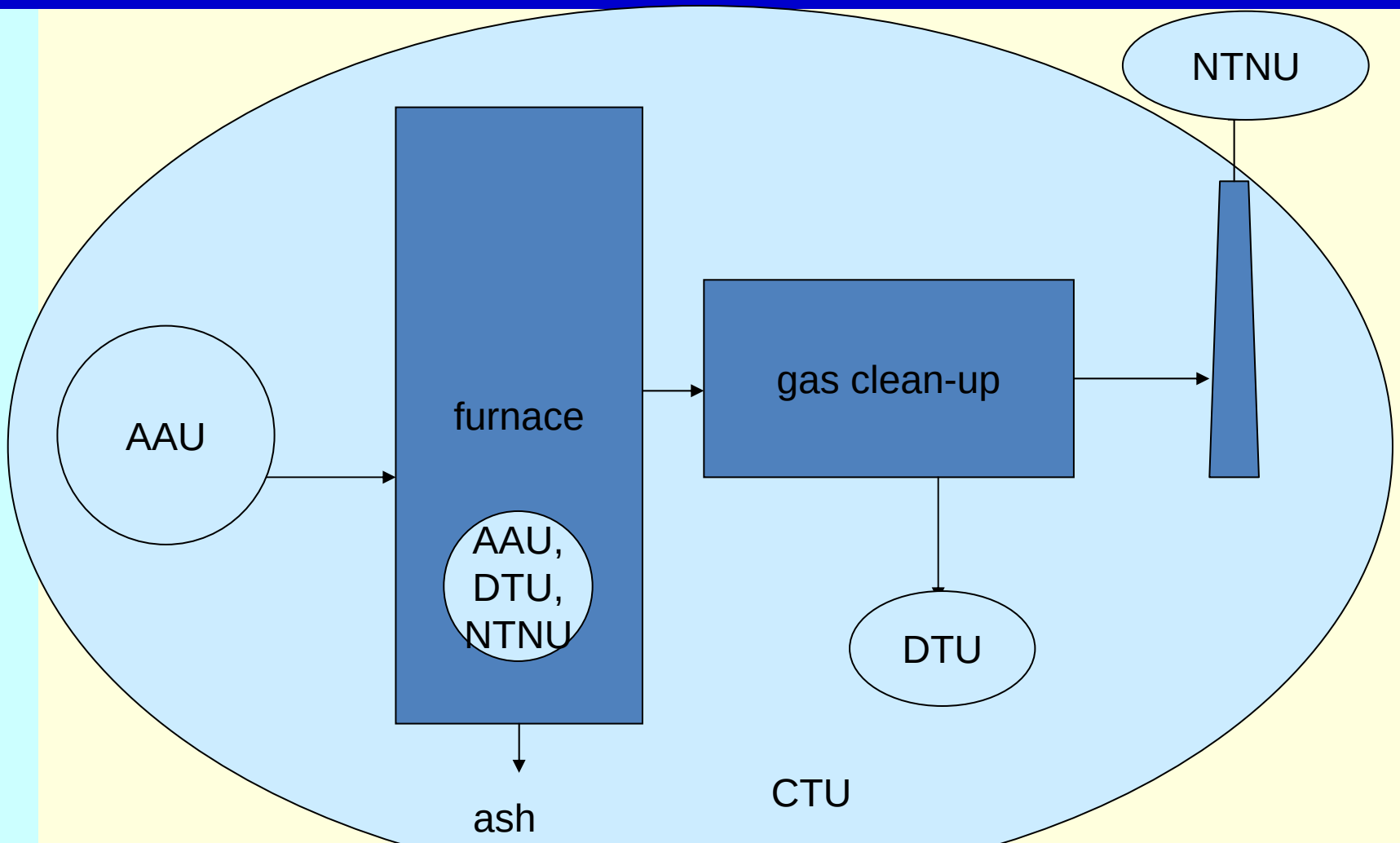
The big picture



The big picture



The big picture



The big picture

- Questions:
  - What kind of fuel did we burn?
  - How do these fuels burn?
  - What compounds are formed and where do we find them in a boiler?
  - How do these compounds form?
  - How do additives influence ash forming matter?
  - Why did all this happen?
  - What kind of equipment is used?

Goal 1/2

- In this course we are looking for the answers:
  - In an educational and scientific way
  - by going to a boiler and studying the measurement technique and perform real research tests,
  - by taking samples with us through the whole course,
  - by studying our samples with help of expertise present at our universities.

Goal 2/2

- Introduction in **analytical techniques in combustion** used by DTU, ÅAU, NTNU
  - Fuel analysis
    - Ultimate
    - Proximate
    - Ash composition
    - Chemical fractionation
  - Ash analysis
    - Fly ash
    - Bottom ash
    - Deposits
    - Bed material
    - Ash chemistry
  - Combustion behaviour
    - Pyrolysis vs char burning
    - Formation of gaseous compounds
    - Etc.

Organisation

- 16 participants (4 per University)
- Nordic students get first chance

- You should attend all 4 parts
- Total 10 ETCS or more?

Organisation

- Dates:
  - Part 1 CTU: Oct. 2008: 20-24.10.2008
  - Part 2 DTU: Feb. 2009 2-7.2.2009
  - Part 3 NTNU: May 2009 4-8.5.2009
  - Part 4 ÅAU: Sept 2009 21-25.9.2009

Last examination

- Write a report for the annual report

  2009-2010

  Send your contribution to MZ (should be scientific readable) before Dec 22.2009

  You'll get your credits/certificate before Jan 1.2010
- Present our findings at the annual seminar of the school
- Tasks will be divided into groups

Examination

- Group 1
  "Mass- and specie balances"
  What is this? Ash in with fuel, ash out with bottom ash, and flyash. Species of interest: K, Na, Ca, Cl, and S. In this task calculation of appropriate molar ratios such as Ca/S, S/Cl, Cl(K+Na) should be calculated.

- Hao Wu, Shamira, Linda

Examination

- Group 2
  "Fuel nitrogen conversion in the CFB"
  What is this? Evaluation of emissions of NO, NO2, N2O and NH3. Measurement of HCN, HNCO and NH3 in the furnace of the boiler. Corresponding evaluation of tests with the TGA at NTNU/SINTEF (using the same fuels). In the task the influence of addition of ammoniumsulphate on fuel-n conversion to NO, N2O should be included as well as the potential ammonia slip.

- Frida, Johanna, Fredrik, ()

Examination

- Group 3
  Fuel nitrogen conversion in the oxyfuel test rigg"
  What is this? Evaluation of emissions of NO, NO2, N2O and NH3 from one test run on the oxyfuel test rigg. Evaluation of one measurement of HCN, NH3 and HNCO in the furnace of the oxyfuel test rigg.

  TGA measurements NTNU

- Daniel F, Daniel K, Stefan H

Examination

- Group 4
  Analysis of deposit rings by weighting, SEM-EDX, XRD?, determination of sulphation degree on deposit rings and influence of addition of ammonium sulphate. In the task evaluation of data from the insitu alkali monitor should be included

- Muhammad, Norazana, Kavitha

Examination

- Group 5
  Analysis of bed samples and samples from the cyclone leg with SEM-EDX, influence of the addition of straw and ammonium sulphate

- Patrycja, Johan, Oskar,