



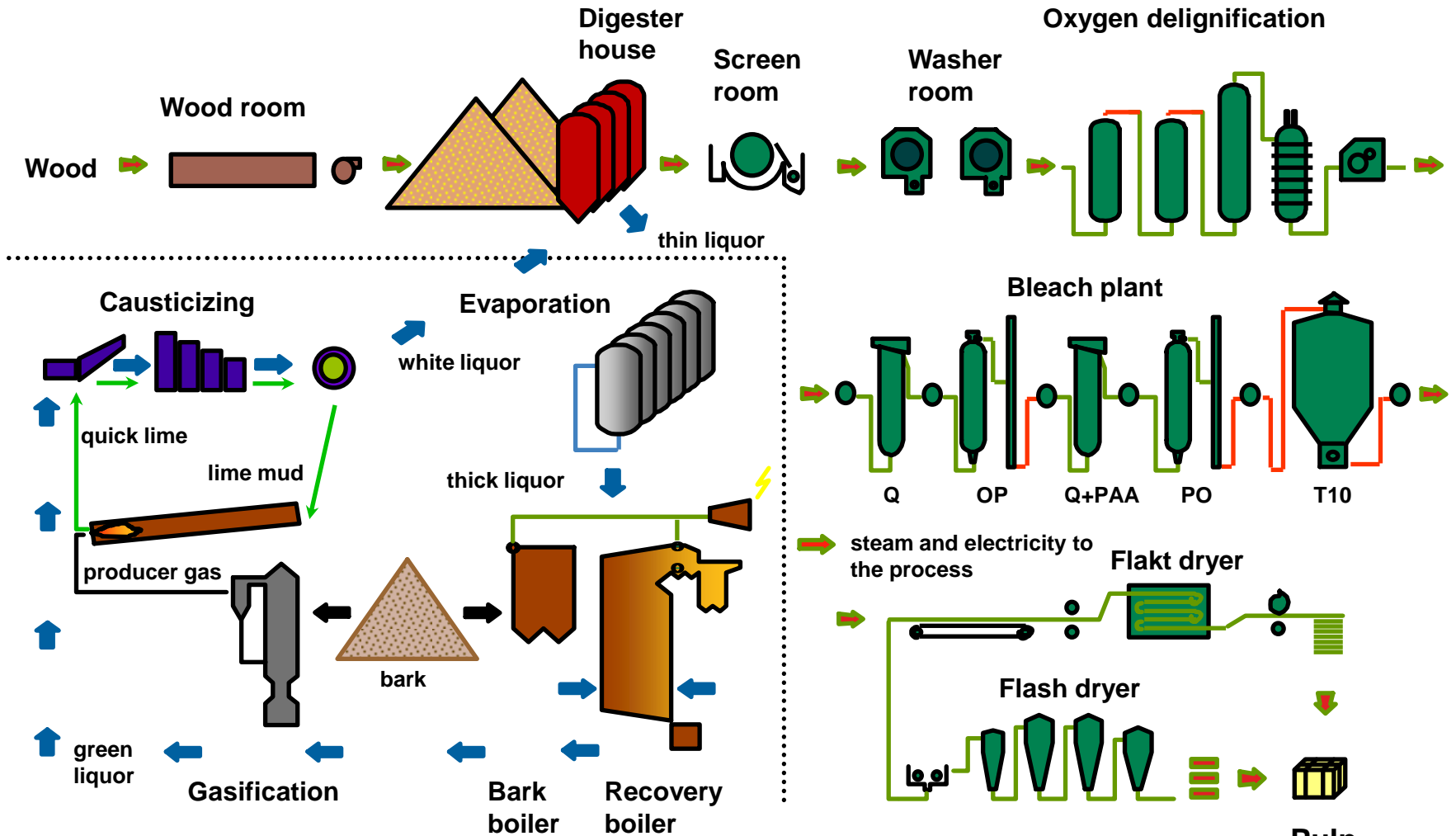
The Gasifier at Värö

IEA Technical Meeting

3-5 May 2009 Gothenburg Sweden

Claes Breitholtz

Värö Pulp Mill



History



- Limekiln is easy to switch for gasification gas – size is usually feasible and fuel is typically available.
- At 1980's, during second oil crisis, several gasifiers were built, in order to replace oil with biomass.
- At Värö, Södra Cell Sweden, a 35 MW Metso (Götaverken) Gasifier has been in use since 1987.

Main components



1. Airfan
2. Air preheater
3. Air to gasifier
4. Gasifier
5. Cyclone
6. Product gas pipe
7. Fuel silo

Some data

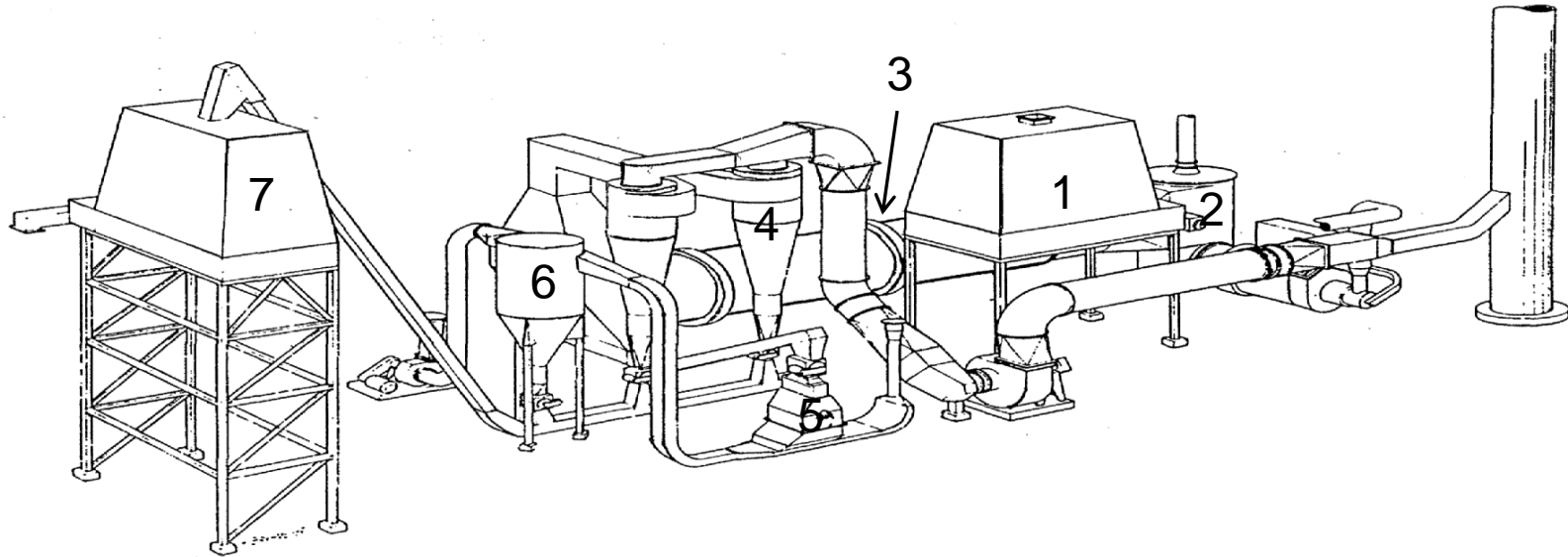


- Power: 35 MW
- Total height: 30 m
- Outer diameter: 3.5 m
- Bed temperature: 800°C
- Pressure: 10 kPag
- Fuel: Dried bark
- Bed material:
Dolomite/Limestone

Fuel preparation



Fuel preparation – Main components



- 1. Wet fuel silo
- 2. Gas preheater
- 3. Rotary dryer
- 4. Cyclone
- 5. Crusher
- 6. Filter
- 7. Dry fuel silo

Fuel properties

- Fuel as received:
 - Dry content: 45-55%
 - LHV: 8-10 MJ/kg
- Dried bark
 - Dry content: 90%
 - LHV: 18 MJ/kg
- Gas
 - LHV: 6-7 MJ/kg
 - CO₂, CO, H₂ ≈ 15%
 - CH₄ ≈ 5%



Experience - Operation

- The capacity of the lime kiln is in the same level with product gas as with heavy oil. Up to 100% of lime kiln load has been operated with product gas.
- The gasifier and lime kiln are operating at constant load. Changes in humidity in the bark changes the heat demand in the dryer. This variation is compensated by heavy oil in the lime kiln.
- The gasifier and dryer are connected as product gas is used in the dryer. This connection affect the availability.

Experience - Availability

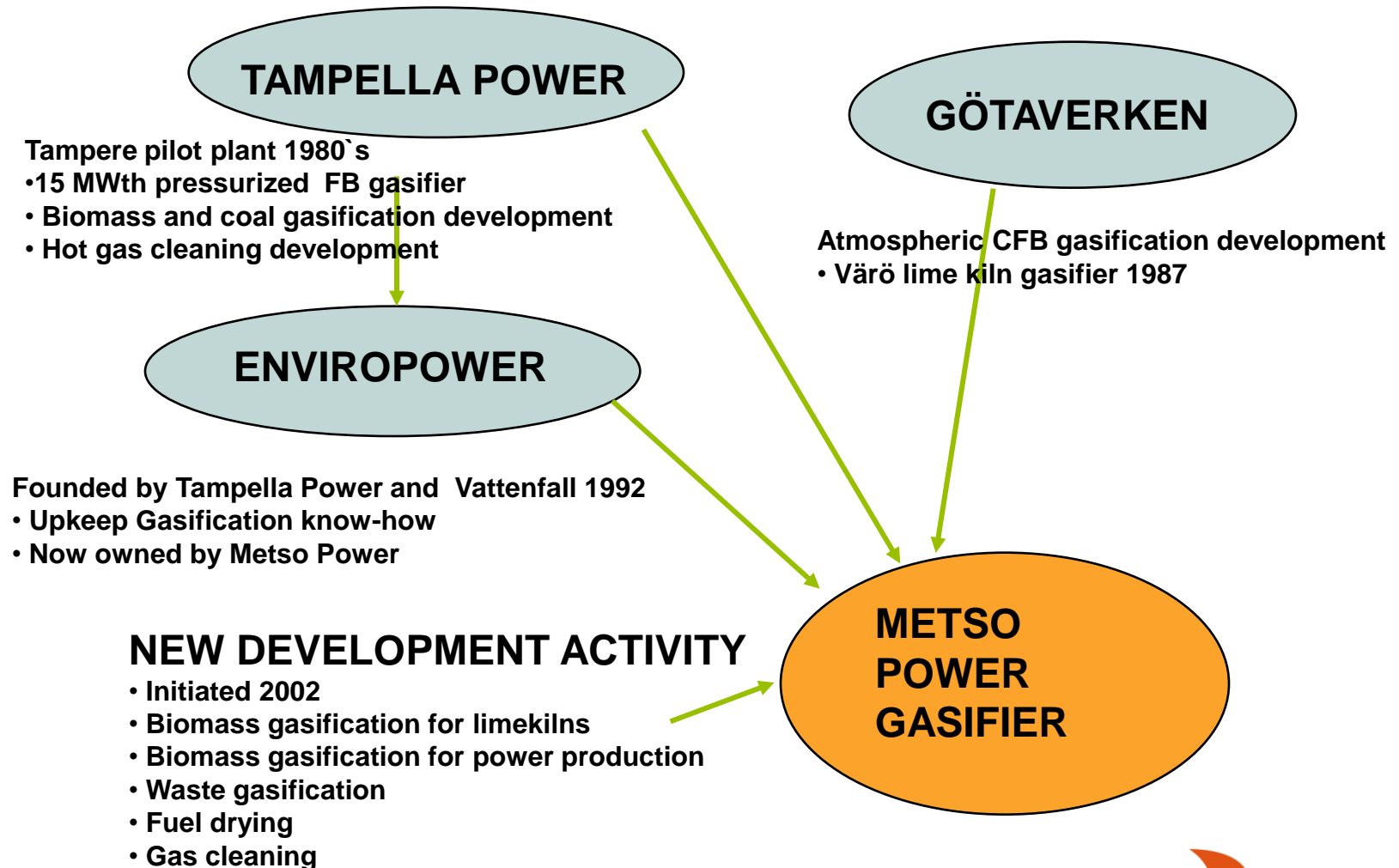
- During periods of “low” oil price, the maintenance budget was low. The availability was as a consequence reduced. Now, the yearly budget for maintenance is about 200' €.
- An study of operation 2004-2005 shows a total availability of 86% during the second half of 2005. The tendency is that the availability is improving. Down time was caused by
 - Fuel preparation 6% (Spark in grinder, Flue gas rec. fan, Transport of dried fuel, Later: Dryer)
 - Gasifier 5% (Ash transport, Sintering of bed material)
 - Tar removal from air preheater 1% (Regular cleaning)
 - Other 2%



Biomass gasification to replace oil and natural gas

Metso's experience, today's offer and
development of future technologies

History of Gasification in Metso Power



METSO Power's experience on gasification



Biomass gasification in Götaverken

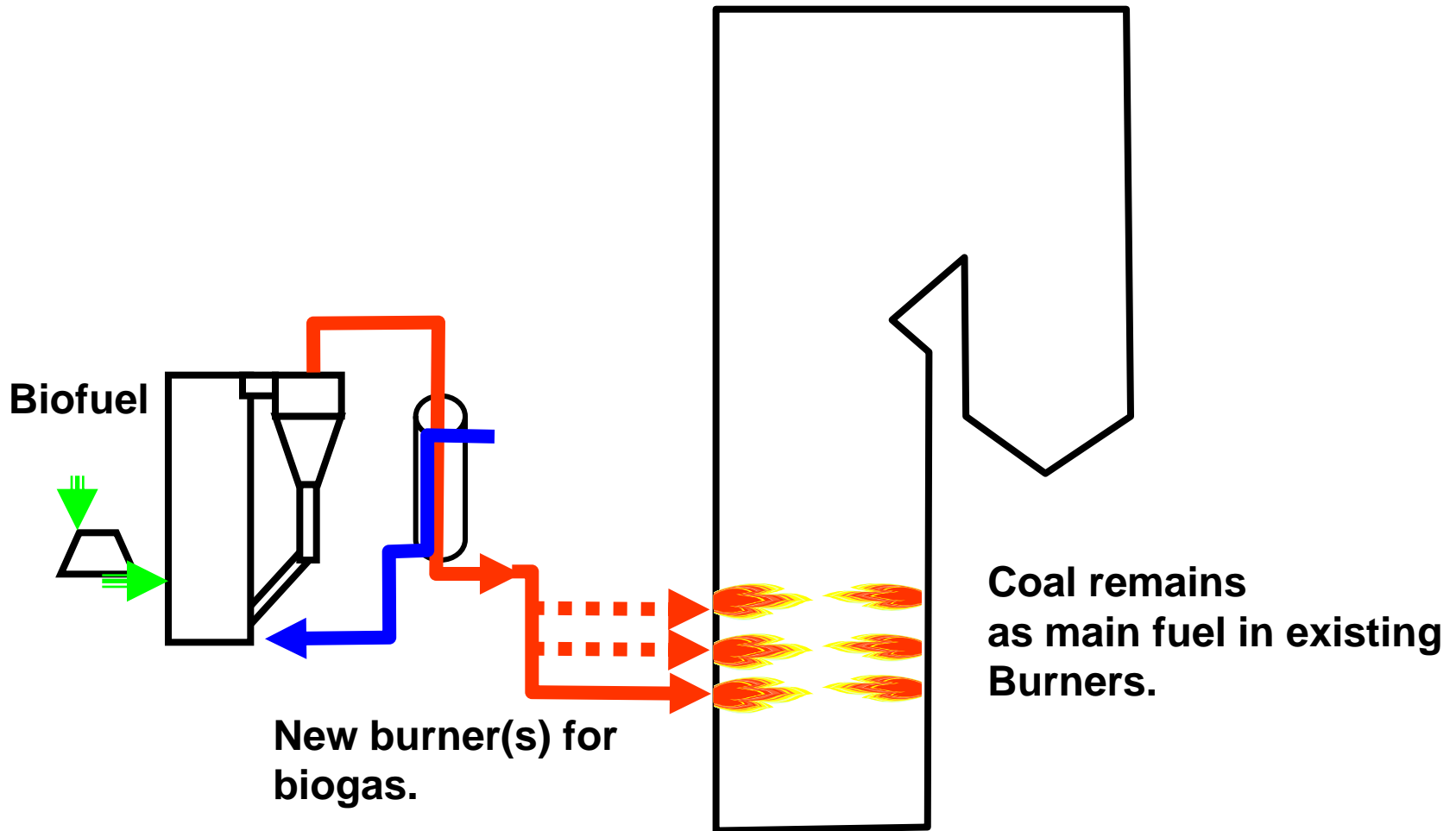
- Atmospheric fluid bed gasification
- For limekiln applications
- Mainly in Sweden
- Late 1980's
- One commercial unit in operation for 20 years

Coal and biomass gasification in Tampella

- Pressurized fluid bed gasification
- 15 MW test unit in operation 1990 - 1995
- Gas cleaning test

Now both companies are part of Metso Power

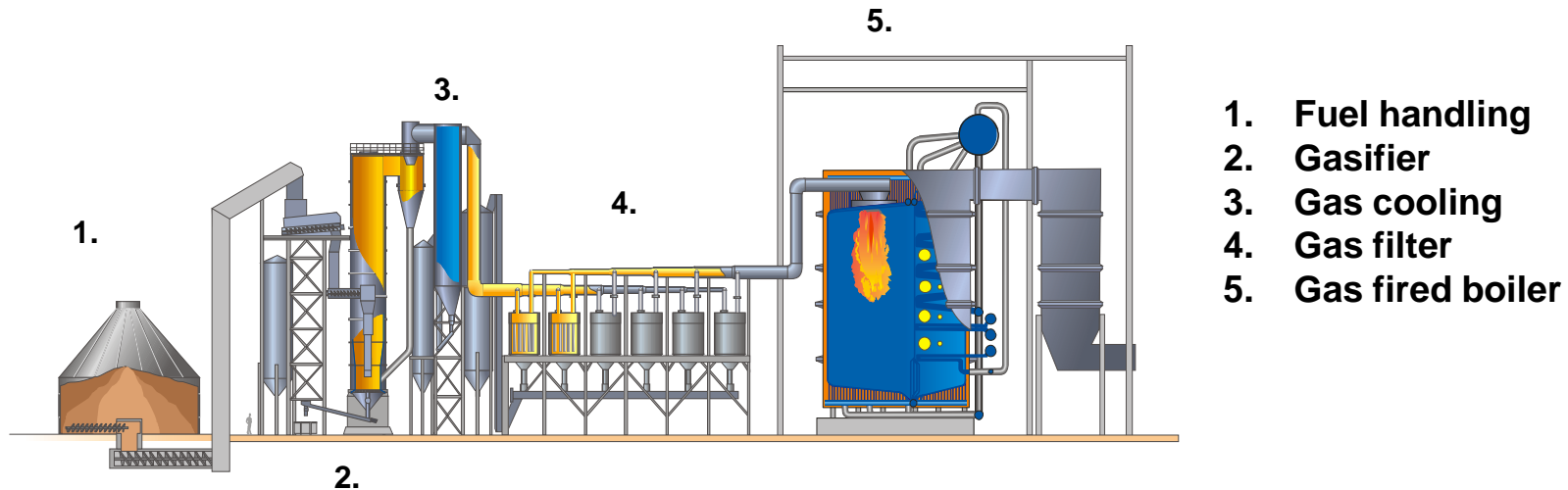
Cofiring biofuel in PC boilers through gasification



WASTE GASIFICATION FOR POWER TECHNICAL CONCEPT- CASE LAHTI

Process concept:

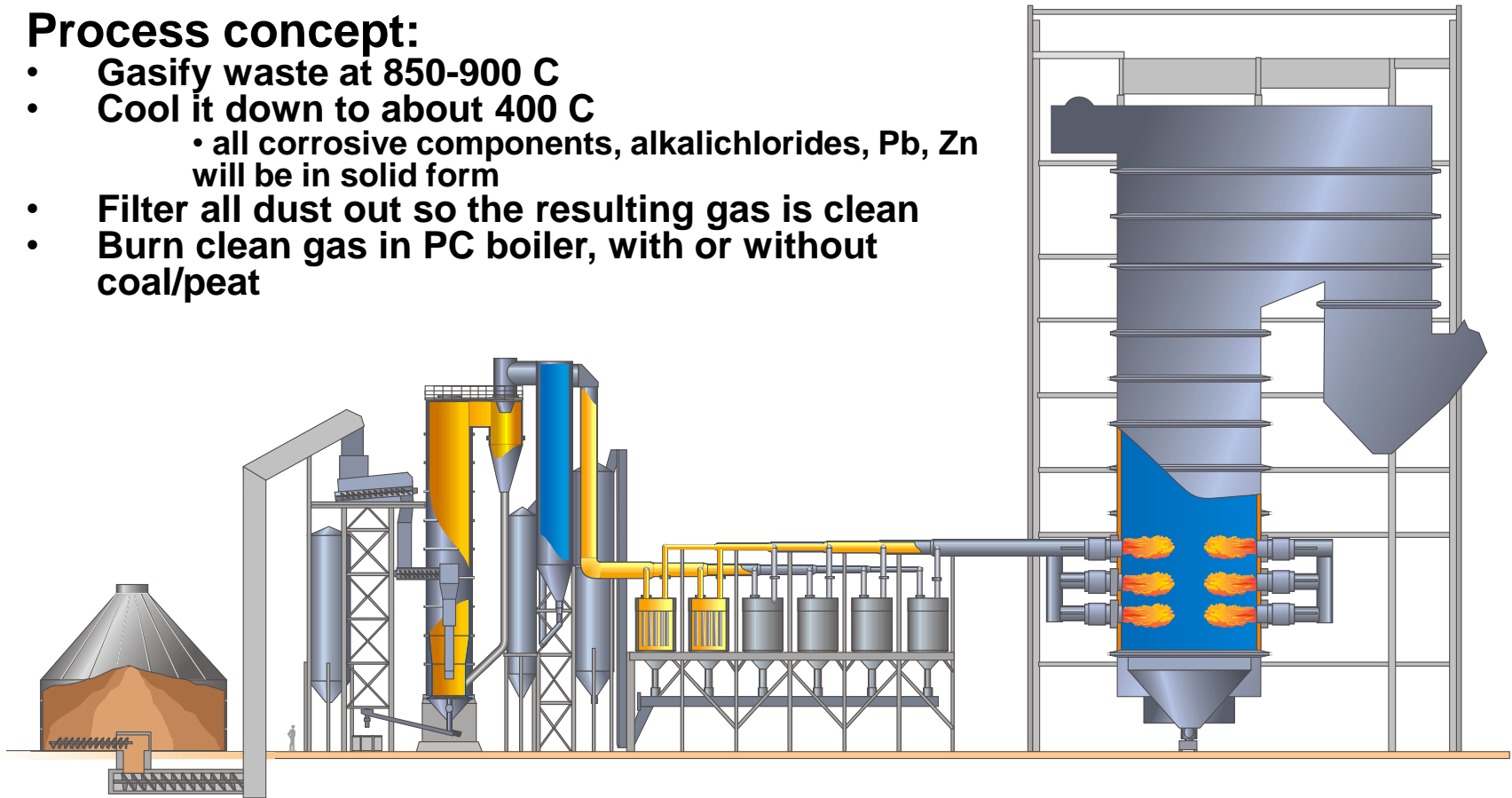
- Gasify waste at 850-900 C
- Cool it down to about 400 C
 - all corrosive components, alkalichlorides, Pb, Zn will be in solid form
- Filter all dust out so the resulting gas is clean
- Burn clean gas in gas fired boiler



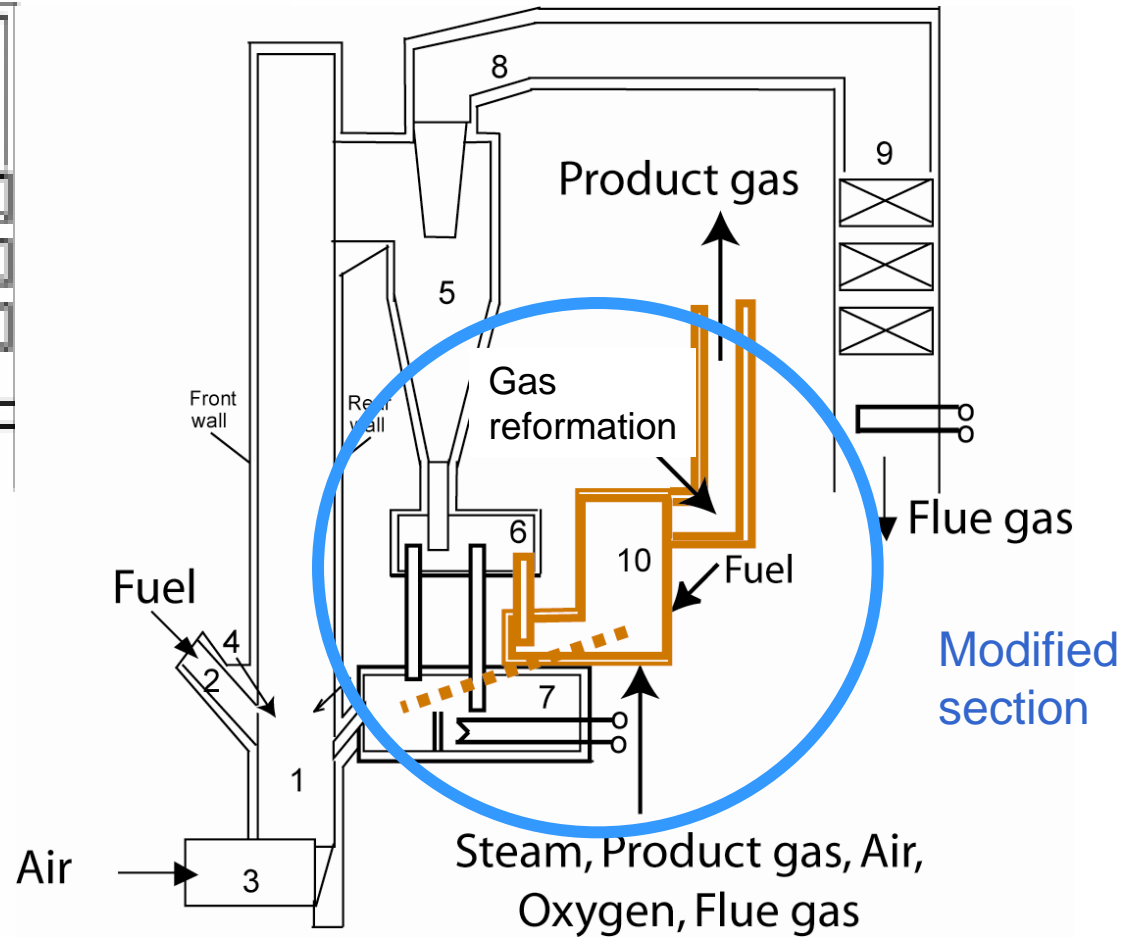
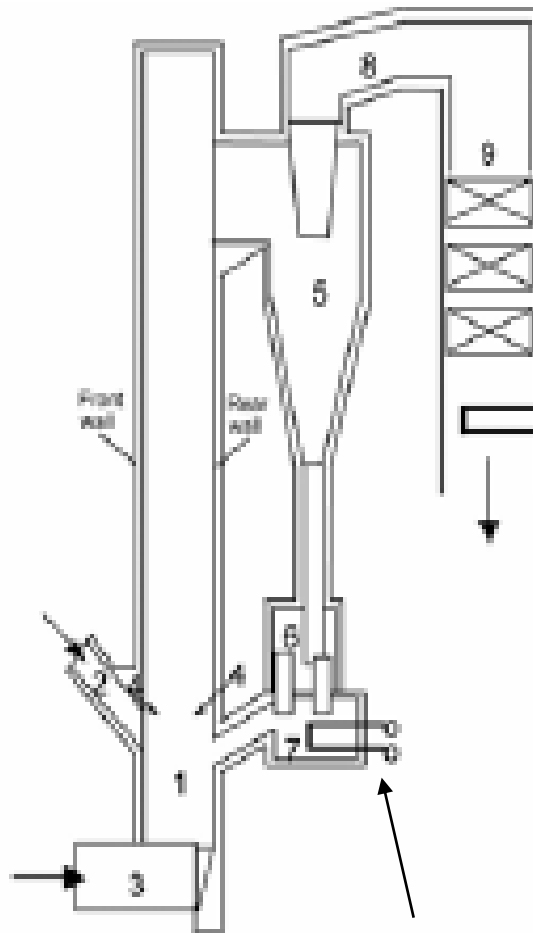
WASTE GASIFICATION FOR POWER STUDY FOR MÄLARENENERGI

Process concept:

- Gasify waste at 850-900 C
- Cool it down to about 400 C
 - all corrosive components, alkalichlorides, Pb, Zn will be in solid form
- Filter all dust out so the resulting gas is clean
- Burn clean gas in PC boiler, with or without coal/peat



Chalmers University gasifier concept: Pilot gasifier docked to existing CFB-boiler



GoBiGas

Gothenburg Biomass Gasification Project

- Project for biomass gasification by Göteborg Energi and E.ON aiming to substitute natural gas
- Step 1: 20 MW gas, ready to start 2011/2012
- Step 2: 100 MW gas ready to start 2015
- Allothermal/indirect gasification based on the Repotec technology demonstrated in Güssing

- Metso is discussing with Göteborg Energi about being a supplier of the gasifier station, i.e. the gasifier and gas cleaning with including equipment.