



Gasification in a CFB-Reactor

A simple and economic way of
co-firing renewable fuels
in existing Power Plants

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Structure of lecture

- **Introduction**
- **Biomass: Characteristics and Technical Aspects**
- **The BioCoComb-Gasification Process**
- **Operation Experiences and Problems**
- **Scaling up to higher capacities**
- **Economics**
- **Conclusion and Outlook**

Characteristics of Biomass

- Low heating value
- Particle size and structure
- Low ash melting point
- Composition of biomass
- Ash quality
- High specific gas production



Co-firing Concepts

- **Combustion of biomass in a separate unit and injection of the created flue gas into the boiler**
- **Grinding of biomass in special mills**
- **Integrated co-combustion grate for biomass**
- **Partial gasification of biomass and combustion of the product gas as additional fuel in existing power plants**

Advantages of Biomass utilisation in large power plants

- **Existing infrastructure: building, boiler, steam process, turbine, generator, flue gas cleaning etc.**
- **High efficiency of large power plant**
- **Adaptation to local biomass availability**
- **Compared with small (stand-alone) units:**
 - **Low specific investment costs**
 - **Low operation expenses**

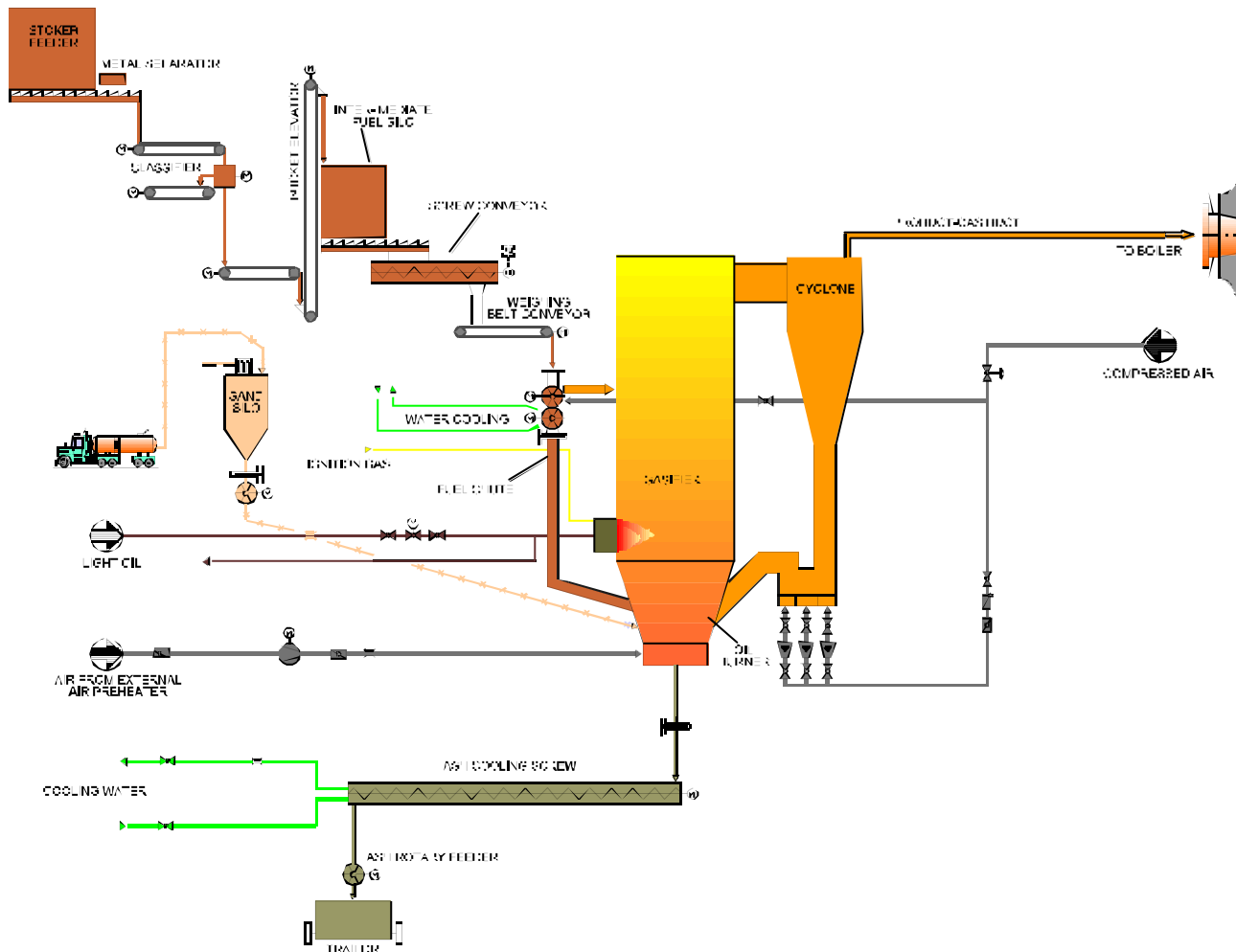


EC - THERMIE Demonstration Project

- BioCoComb - Preparation of Biofuel for Co-Combustion
- Location: Zeltweg, Austria
- Realisation time: 1996 - 1999
- 10 MW_{th} CFB reactor
- Fuels: Bark, Wood Chips, Sawdust,...
- Autothermal Gasification
- Product gas directly into the coal boiler
 - No gas cleaning
 - No gas cooling
- Energy of fuel transported by
 - Low calorific-value-gas
 - Sensible heat
 - Fine combustible char particles



The Gasification Process



Operation Behaviour

- Easy temperature control
- Plant is flexible in the temperature range from 780°C to 850°C
- Smooth at changes of load between 50 % and 100 % of nominal load. This value depends strongly on the humidity of the fuel and from the temperature of the reactor.
- No negative effects on the behaviour of coal boiler operation
- Reduction of NO_x formation by "*reburning*", thus reduction of demand of ammonia water

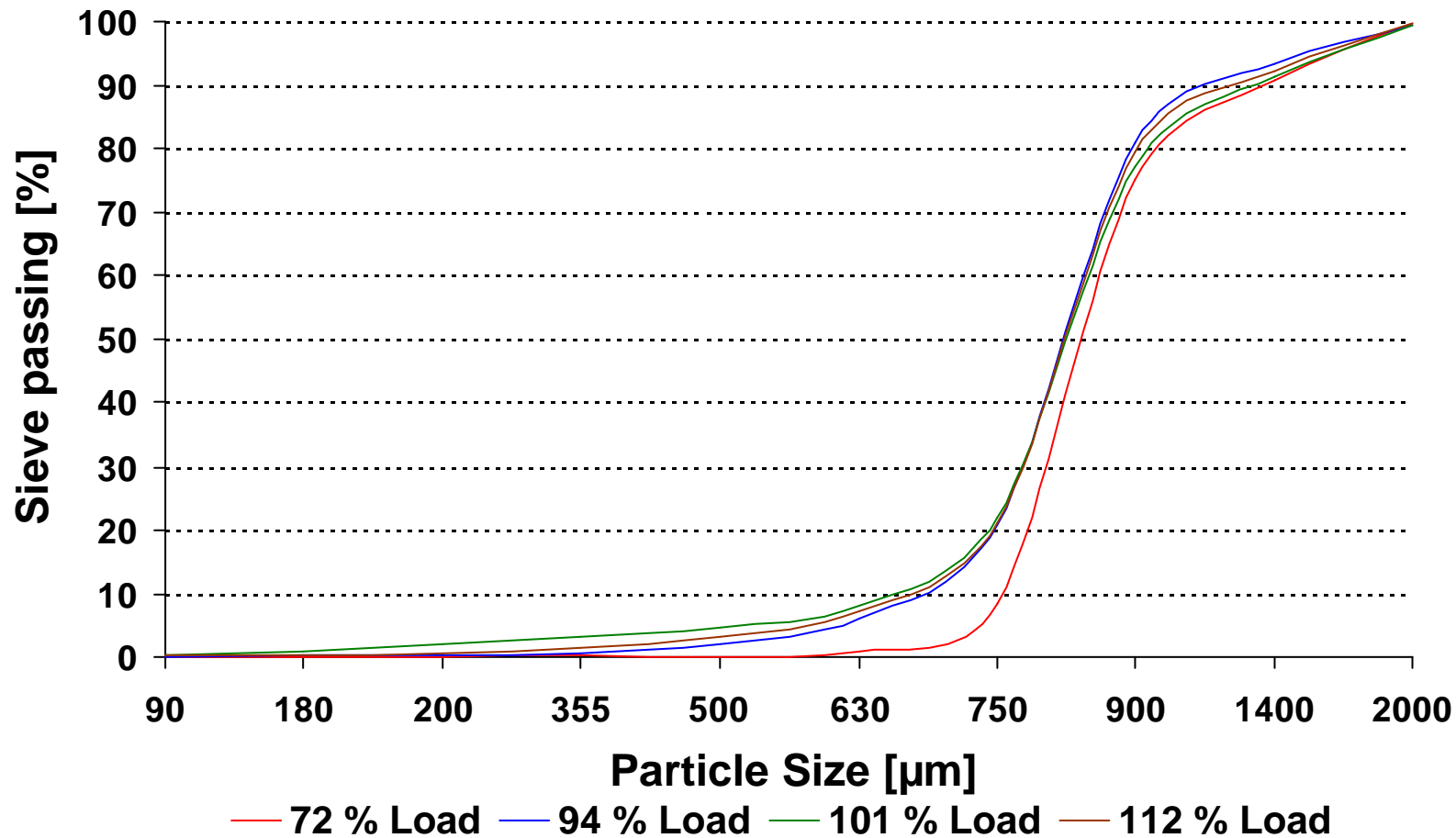


Operation Problems

- Gasifier itself operates without any problems
- Fuel system: bridges in silos, blockages in the separator or in the duplex rotary feeder (mainly while firing wood chips)
- Metal separator: problems with big parts
- Rotary feeders: dust escape

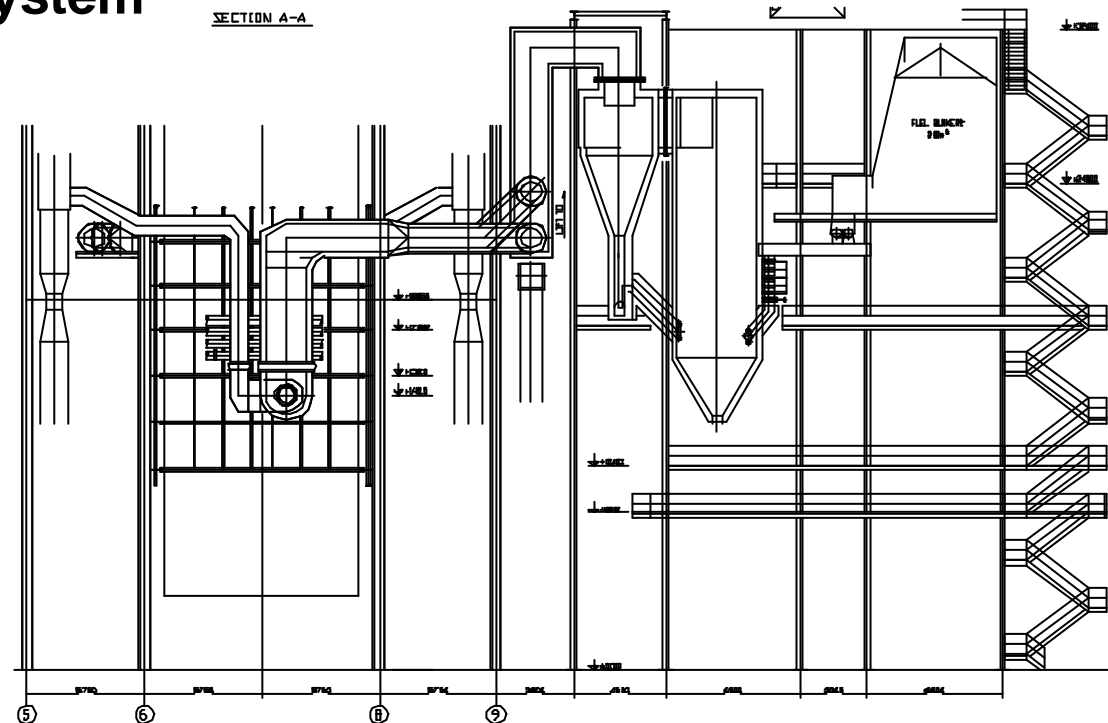


Particle Size Distribution of the Bed Material

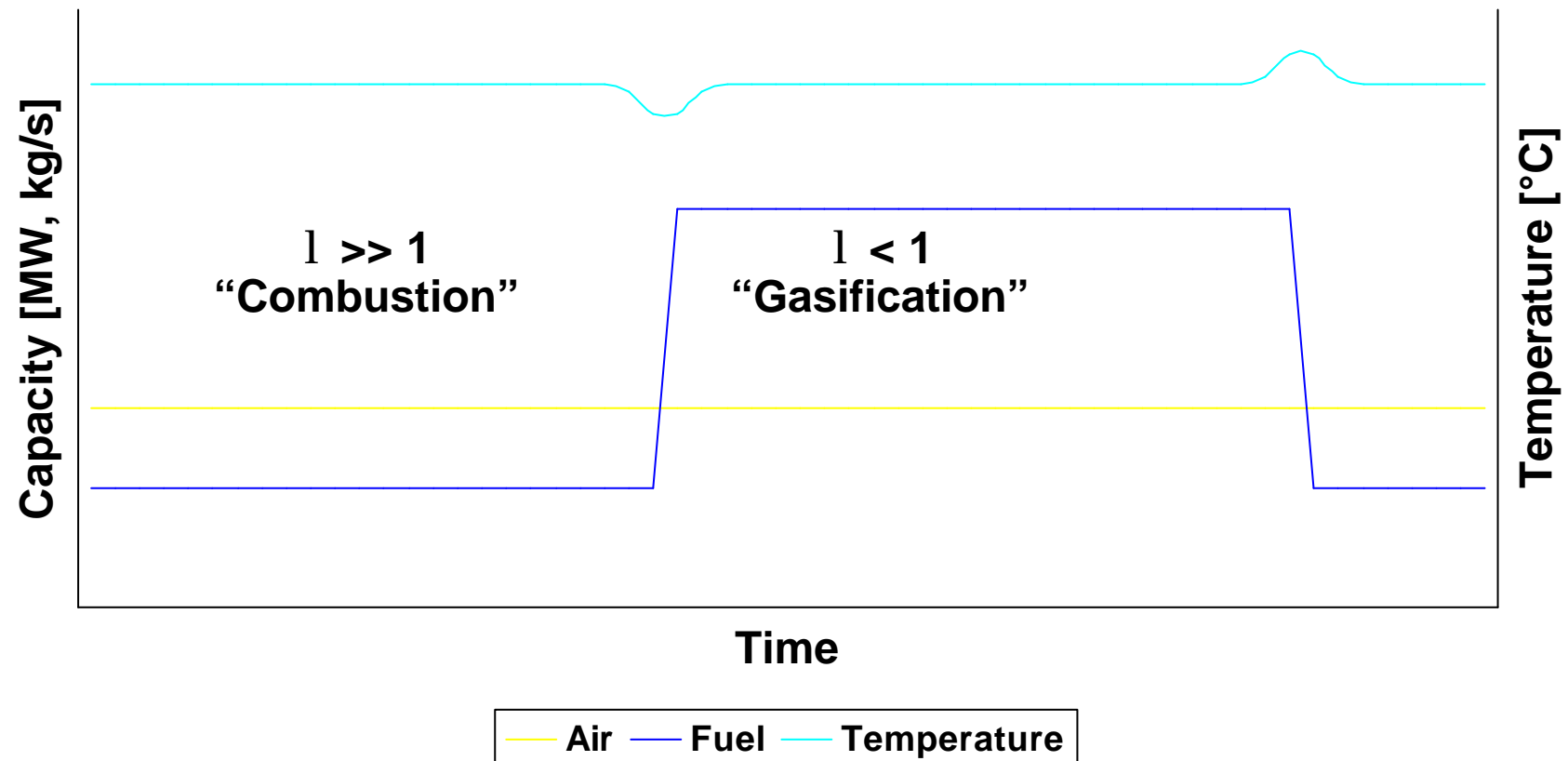


Main Tasks for Scaling up

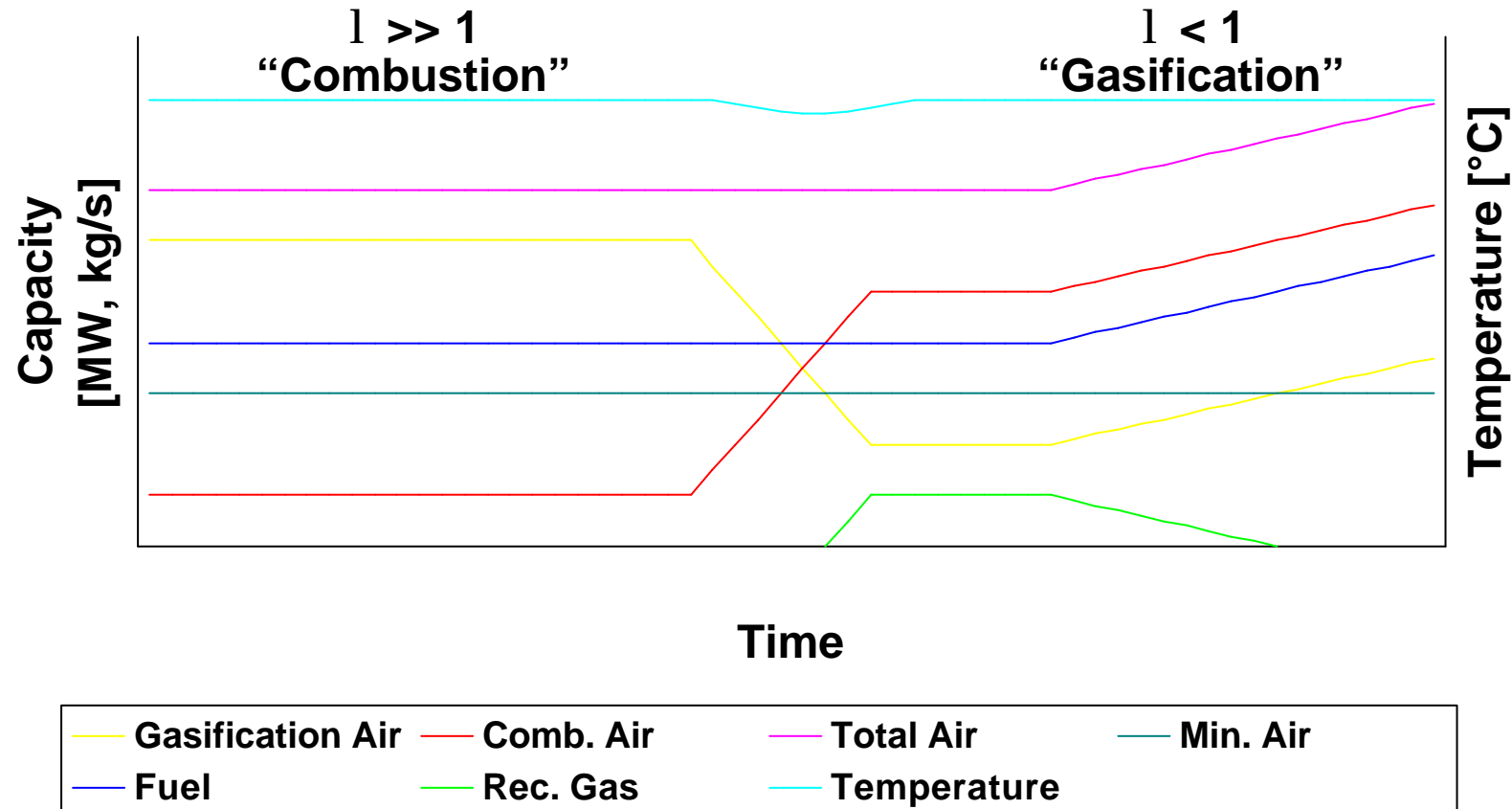
- Start up burners in the wind box
- Separate combustion air supply at boiler inlet
- Flue gas recirculation system



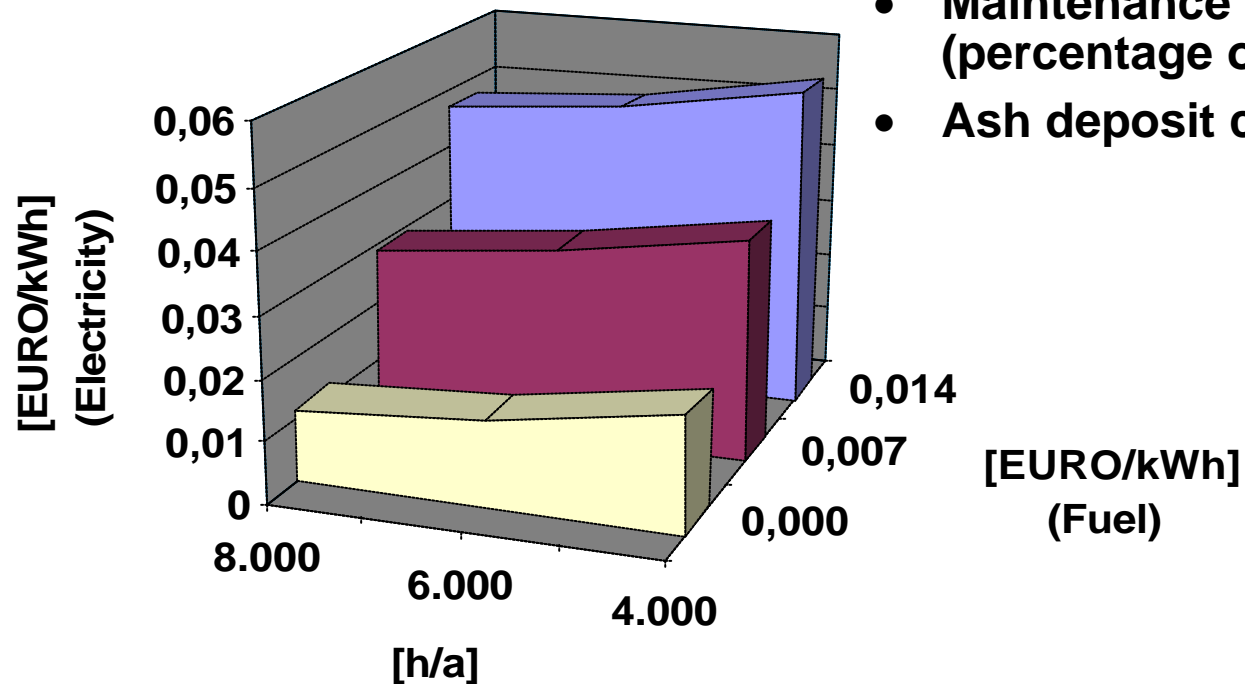
“Switch-Over” to Gasification (Demonstration Plant)



“Switch-Over” to Gasification (Large Scale Plant)



Economics



- Thermal Capacity: 50 MW
- Plant lifetime: 20 years
- Interest rate: 6 % p.a.
- Overall plant efficiency: 40 % net
- Maintenance cost: 1,5 %/a
(percentage of investment)
- Ash deposit cost: 150 €/t

Possible Applications

- Installation into existing Power Plants
- No influence to the Power Plant operation
- Wide range of fuels due to the CFB-technology
- Co-firing of wastes also possible



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