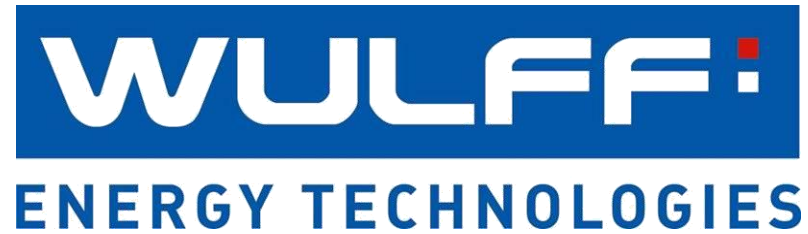




Design & operation experience of a biomass plant

C. Kühne; Dr. F. Pfab; C. Vento



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WULFF: Engineering & Service Hamburg

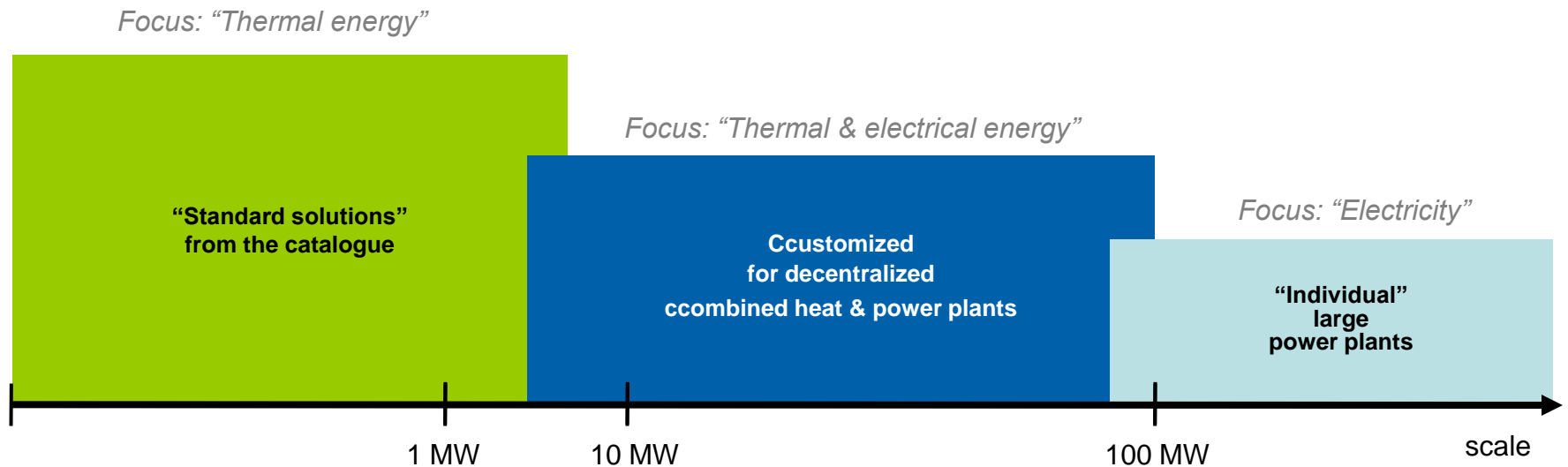
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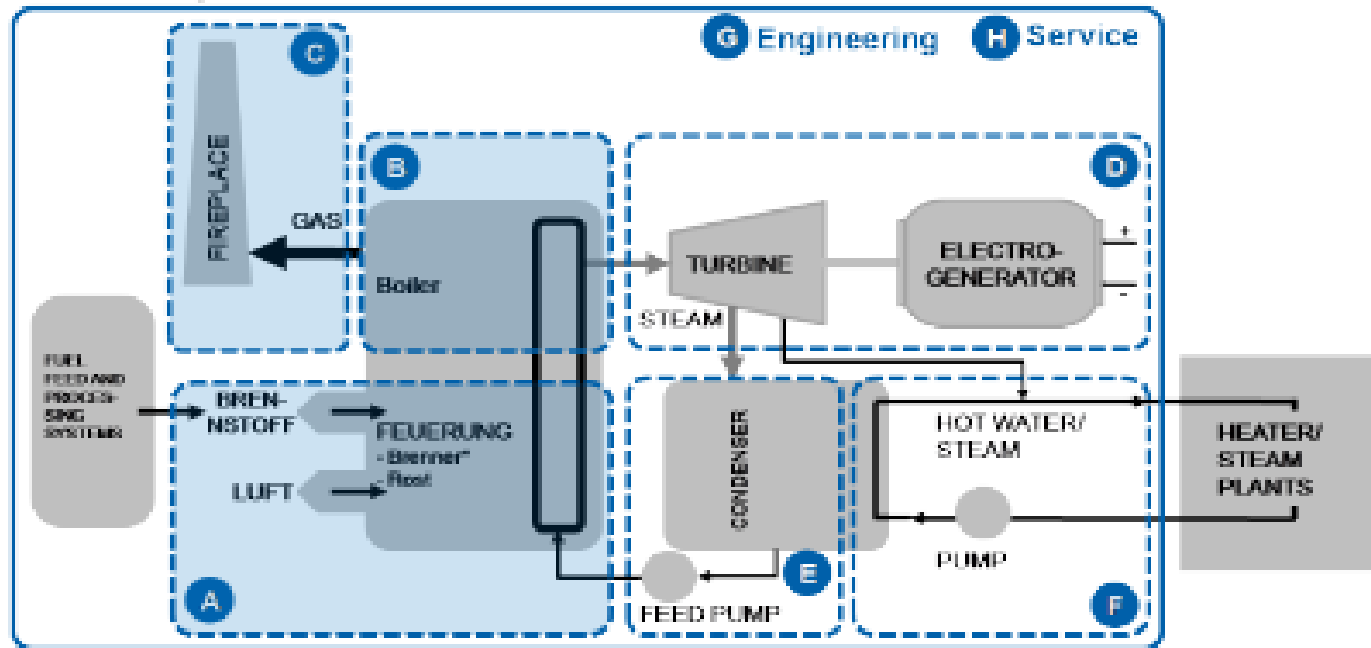


Process & supply chain



- **Supply of customized plants for energy generation** (steam, heat and electricity) on the basis of most diverse primary energies (fossil fuels, biomass and refuse-derived fuels).
- **Group competence covers the entire process chain:** engineering, design, fabrication, assembly, commissioning and after-sales service.





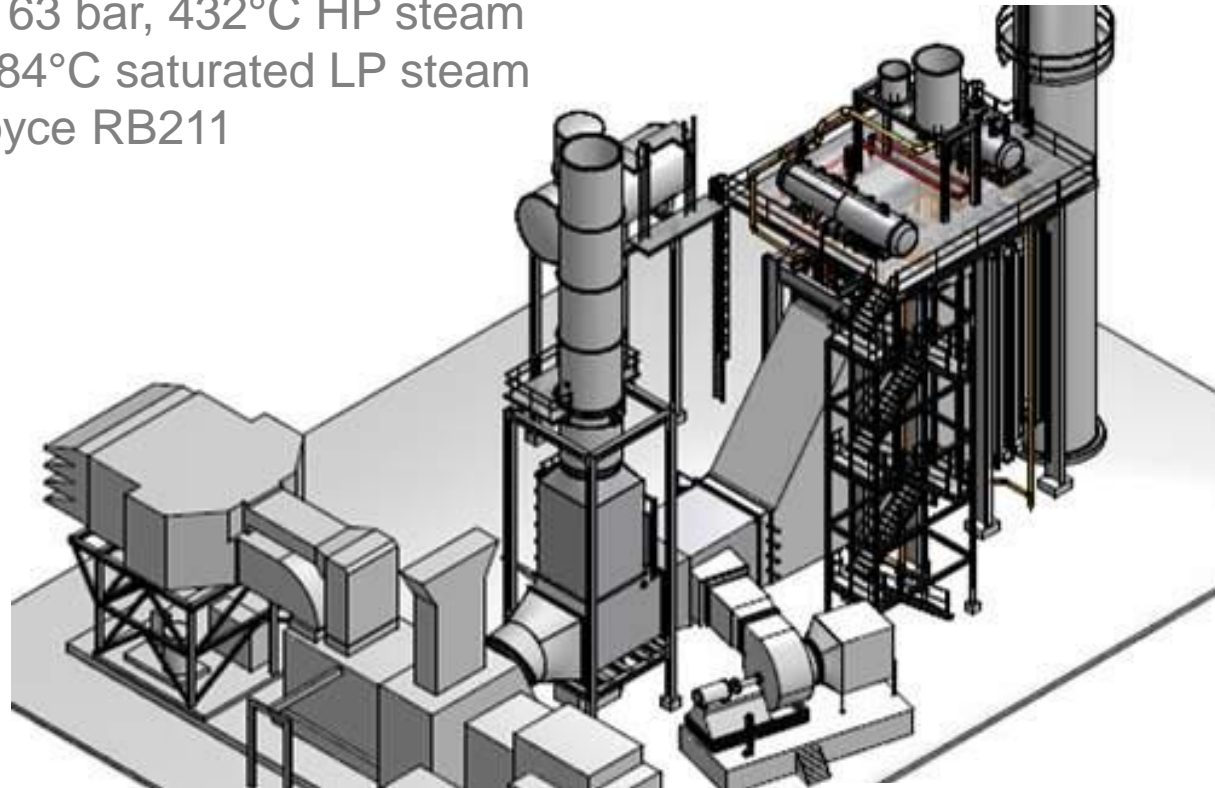
WULFF has its core competencies in the following technology areas:

- Fuel technology (A)
- Boiler technology (B) and
- Exhaust gas technology (flue gas cleaning, C)
- Engineering (G)
- Service (H)
- Fabrication of
 - Grate and furnace systems
 - Boilers (Waste heat; HRSGs; fresh air fired)
 - Drying systems (disc dryer, rendering equipment)



UMAG HRSG system behind 30 MW gas turbine

Customer: EUROPAC
Site: Dueñas / Spain
Steam capacity: 40 t/h at 63 bar, 432°C HP steam
8,5 t/h 184°C saturated LP steam
Gas turbine: Rolls Royce RB211

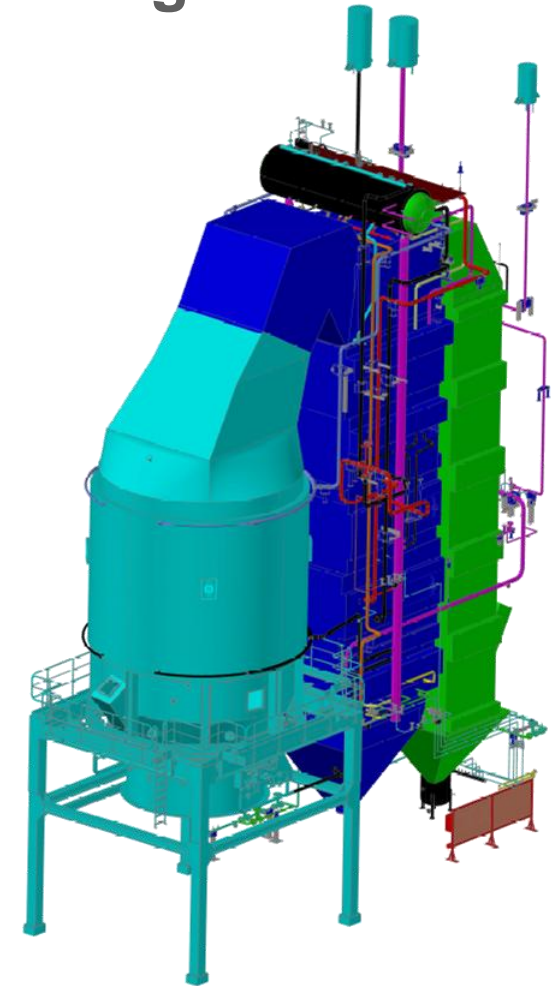
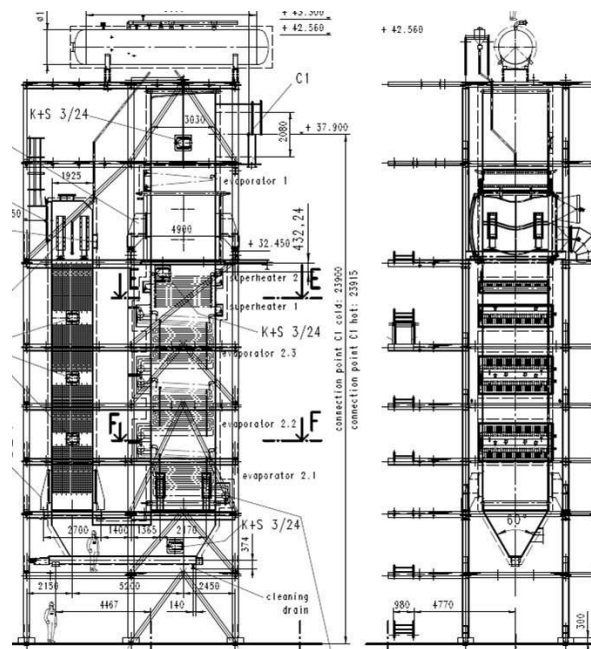


Waste heat recovery boilers



UMAG waste heat boiler behind sewage sludge combustion in a fluidized bed furnace

Customer: BAMAG
Site: Shell Green / UK
Steam capacity: 18 t/h, 42 bar/405°C





Biomass Fuels

Most marketable fuels for WULFF Biomass Plants are:

- Sustainable fuels such as natural wood, foresting residues, greens
- Rape and rapeseed residues from biodiesel refineries
- Natural wood, such as bark, sawdust, pellets



Wood and waste wood

- A I** Natural wood or only mechanically machined wood, which is only unsubstantially polluted, as well as fresh wood from forestry.
- A II** Waste wood being painted, coated, glued, varnished or otherwise treated, free of halogen-organic compounds or preservatives.
- A III** Waste wood being coated with halogen-organic compounds, but free of preservatives.
- A IV** Waste wood being treated with preservatives, such as wooden sleepers, telephone poles and waste wood that can not be assigned to other categories, except PCB-treated wood.



Refuse-derived fuels (RDF) for decentralized energy supply

Wulff development of waste-to-energy plants



As dumping or landfill of waste with significant organic content is prohibited by law, a high potential of refuse derived fuel is available. RDF is made of commercial and industrial waste in mechanical and biological waste treatment plants.

The energy recovery from RDF is clearly delimited from thermal waste treatment by law. Combustion systems for highly contaminated waste wood have been the basis for the new developed RDF-to-energy plants.

The combustion chamber has been extended for low flue gas velocities and the grate has been modified for 6 air sections.

Partial cladding of membrane walls protects against chlorine corrosion.

Due to the higher calorific value of these fuels the application of the WULFF water-cooled grate is usually favorable.

Biomass plant Flohr / Neuwied



Fuel	Waste wood A1 – A4 acc. German waste wood legislation AltholzVO
Heating value	12 – 18 MJ/kg, raw base
Water content	max. 31 weight %, raw base
Ash content	< 5 weight %, wf
Nitrogene content	< 4,3 weight %, wf
Firing capacity	30,2 MW
Fuel flow	6200 kg/h, wf
Steam quantity	32,3 t/h
Steam parameters	46 bar a / 455 °C superheated HP steam
Control range	80 – 100 %
Electric capacity	6,2 MW by 7 MW heat displacement, max. 7,5 MW
Technology	Moving grate for coarse fuel / Single-drum water tube boiler
Flue gas scrubbing system	Dry flue gas scrubbing according to 17. BImSchV and SNCR
Particularities	Flue gas recirculation for combustion optimization and for grate cooling
Commissioning	End of 2004





Economic / operational objectives

- 100 % reliability and guaranteed supply with process steam
- Power generation using contaminated wood A1-A3 and simultaneous generation of process steam via a regulated turbine bleed opening
- Coverage of the process steam supply using natural gas-fired auxiliary boilers

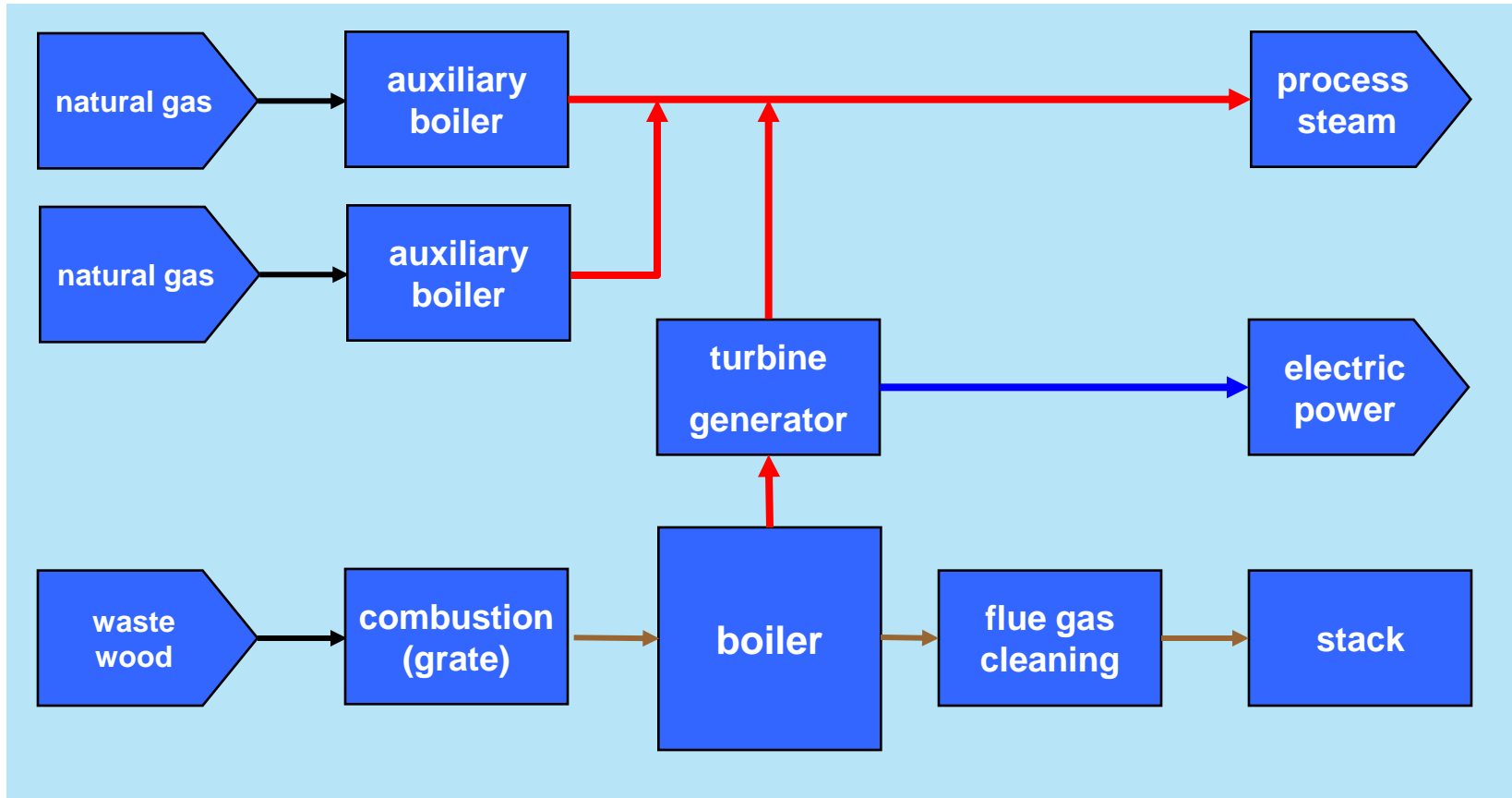


Environmental objectives

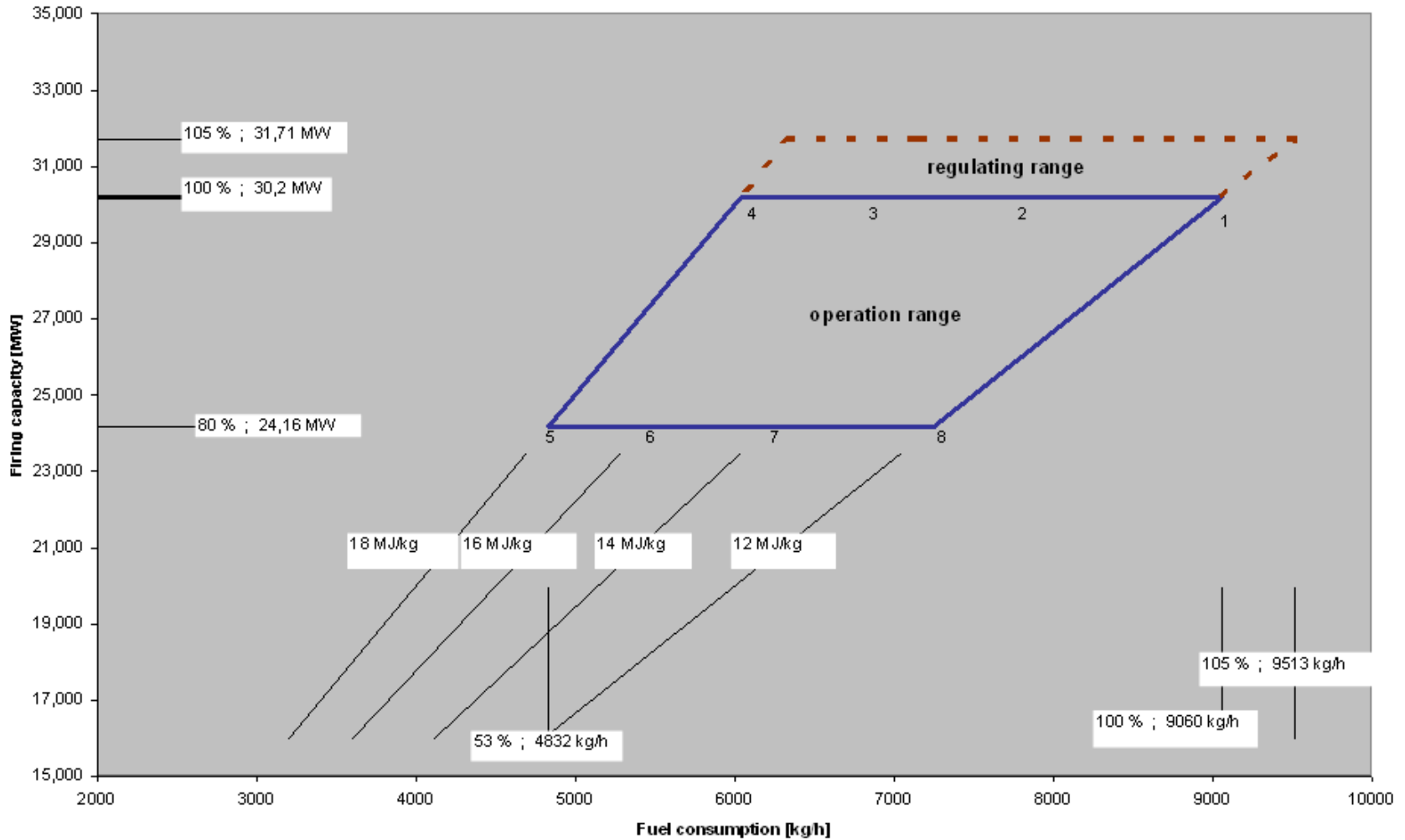
- Improvement of the emission situation at site by lower emissions and shut-off of the outdated heavy-fuel fired boilers
- Voluntary restriction of the operator only to generate 25% of the firing capacity by using highly contaminated waste wood (A3)
- Compliance with 17. BImSchV



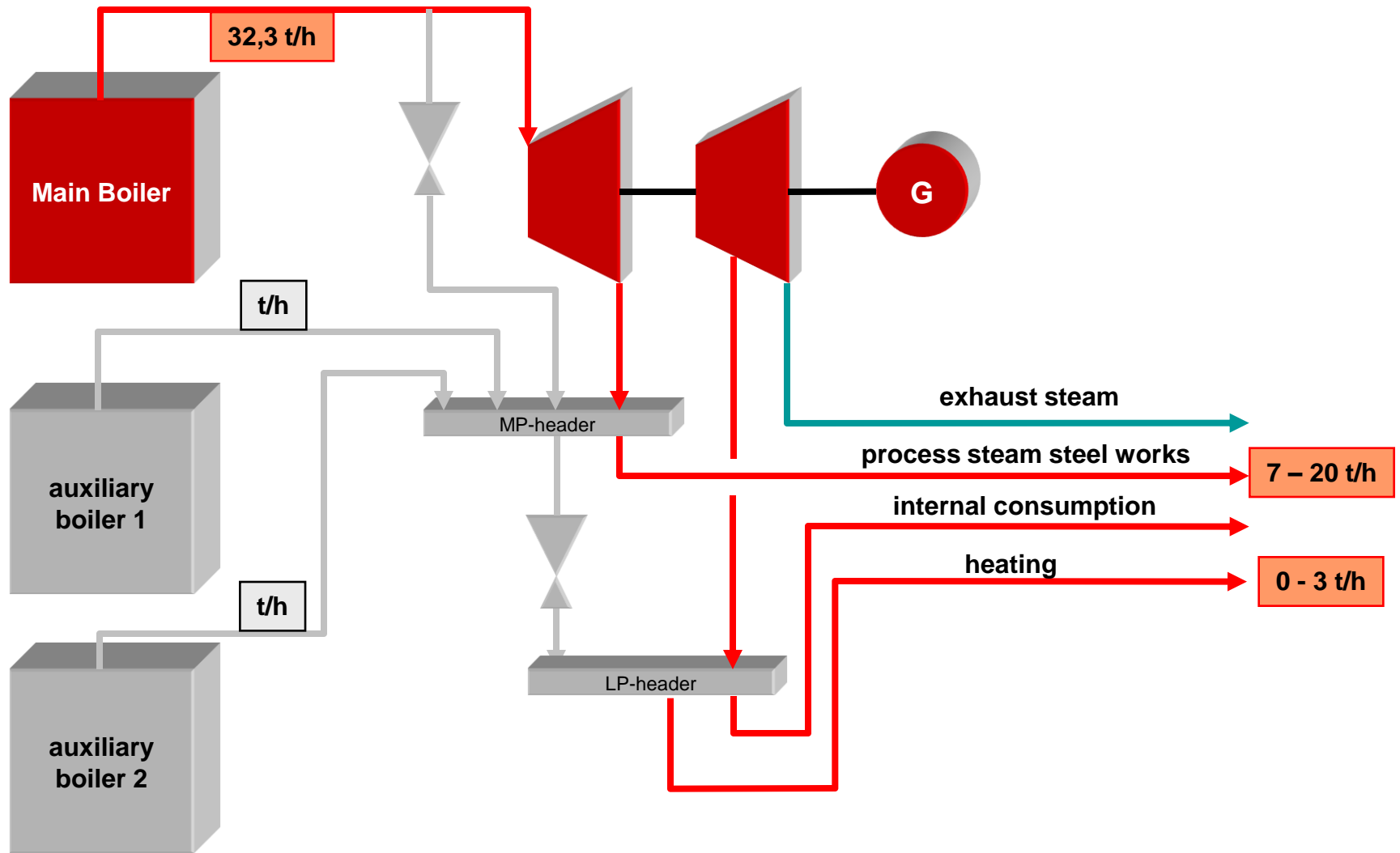
Plant Concept



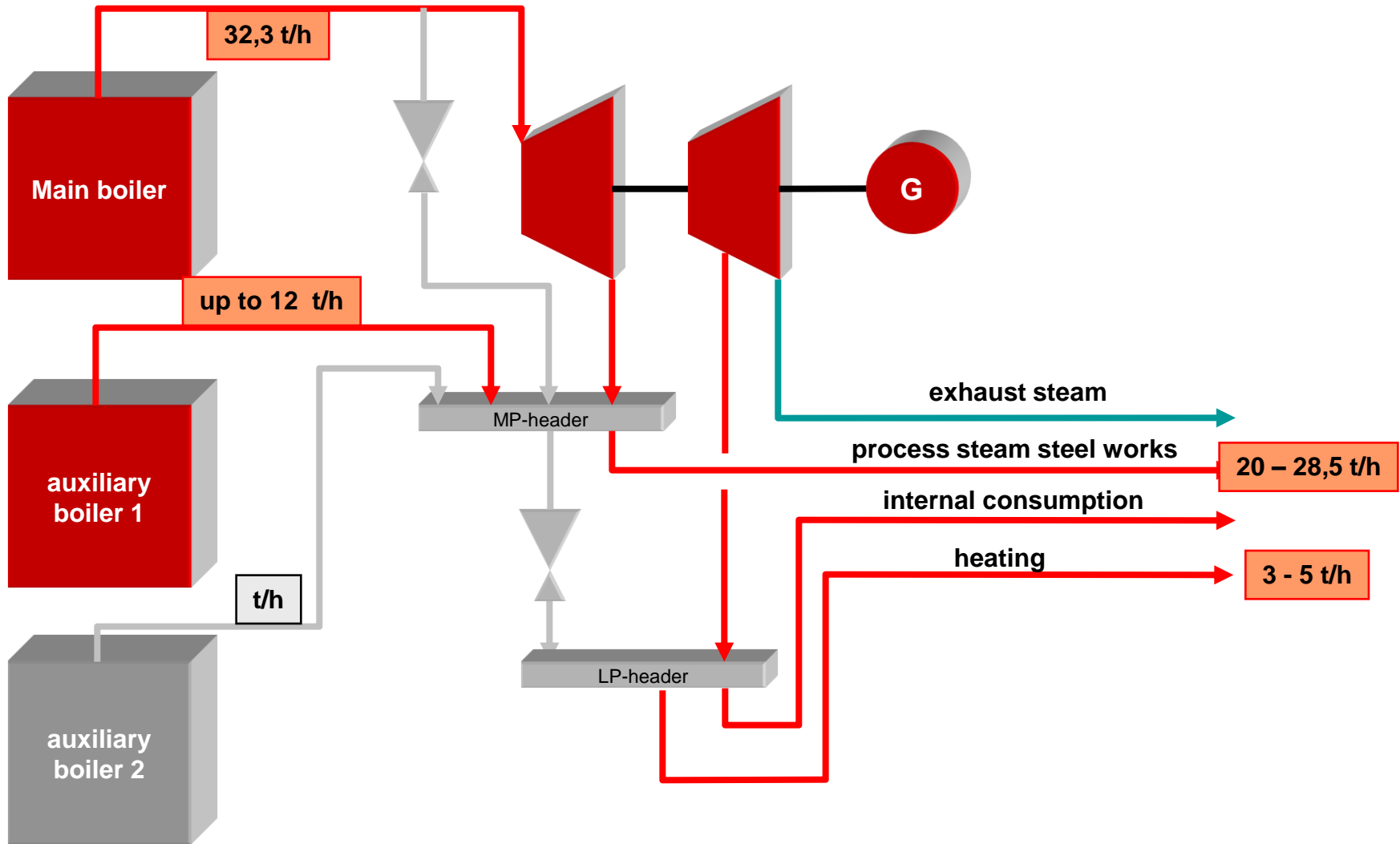
Firing – Capacity - Diagram



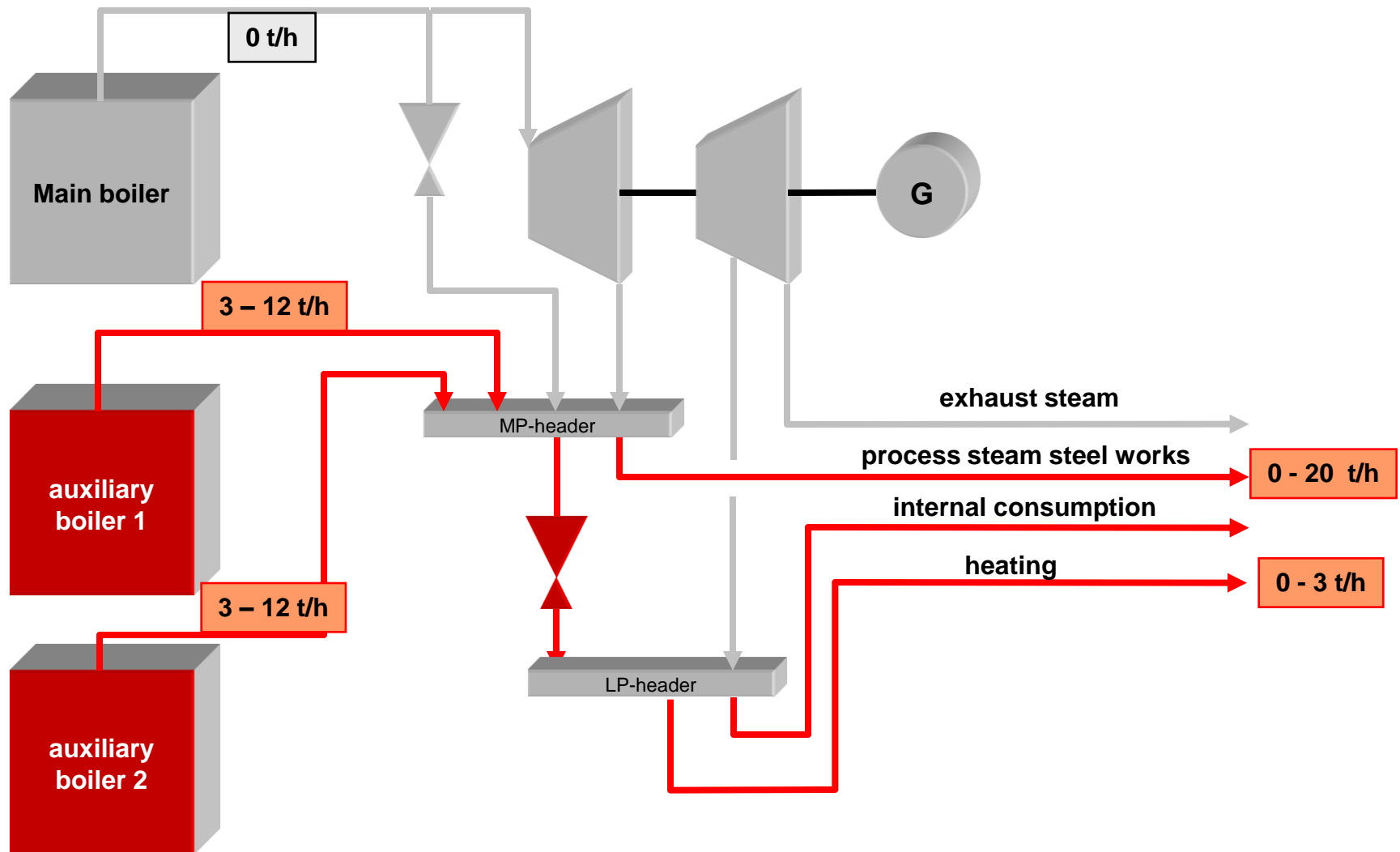
Biomass Boiler Operation



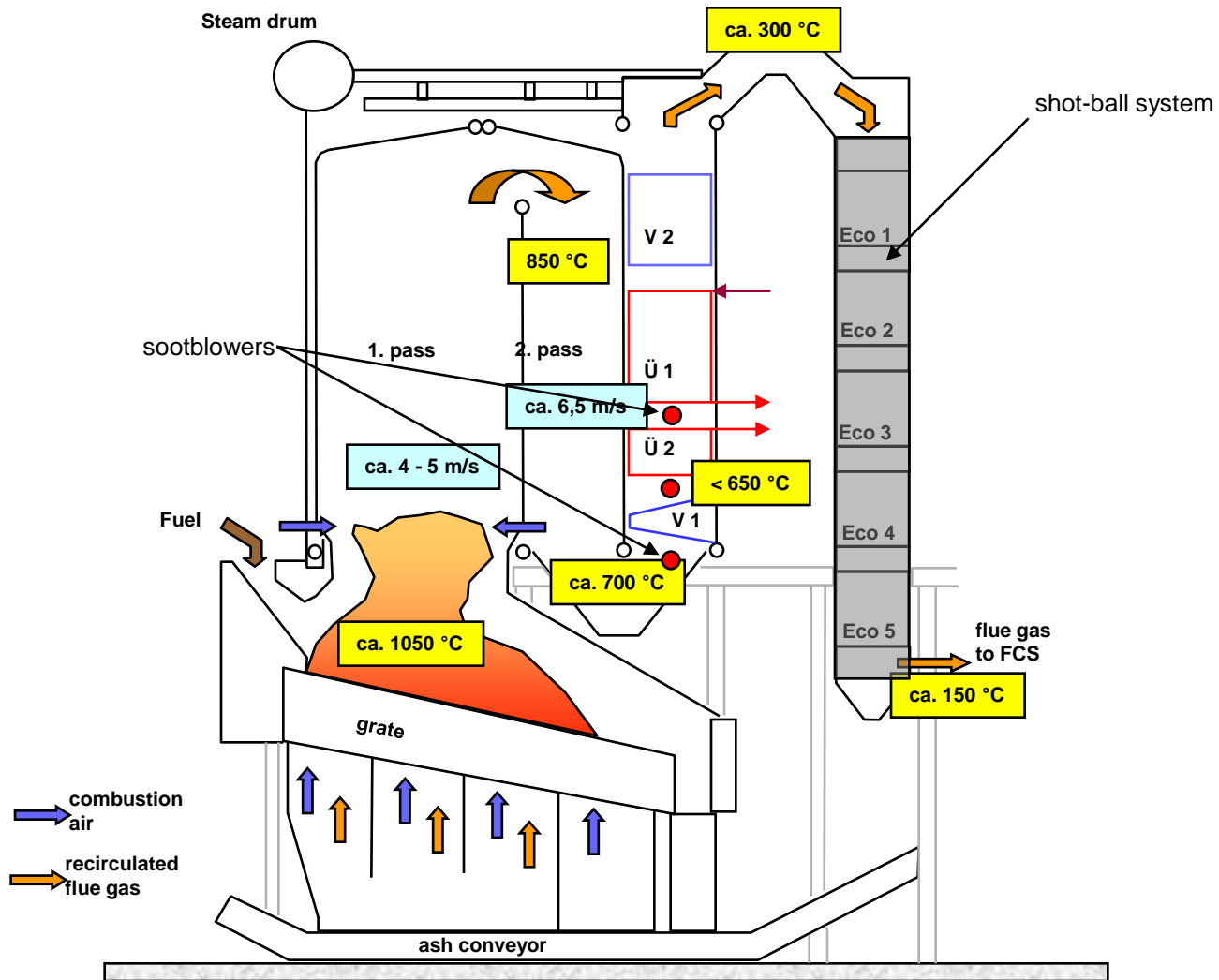
Peak Load Operation



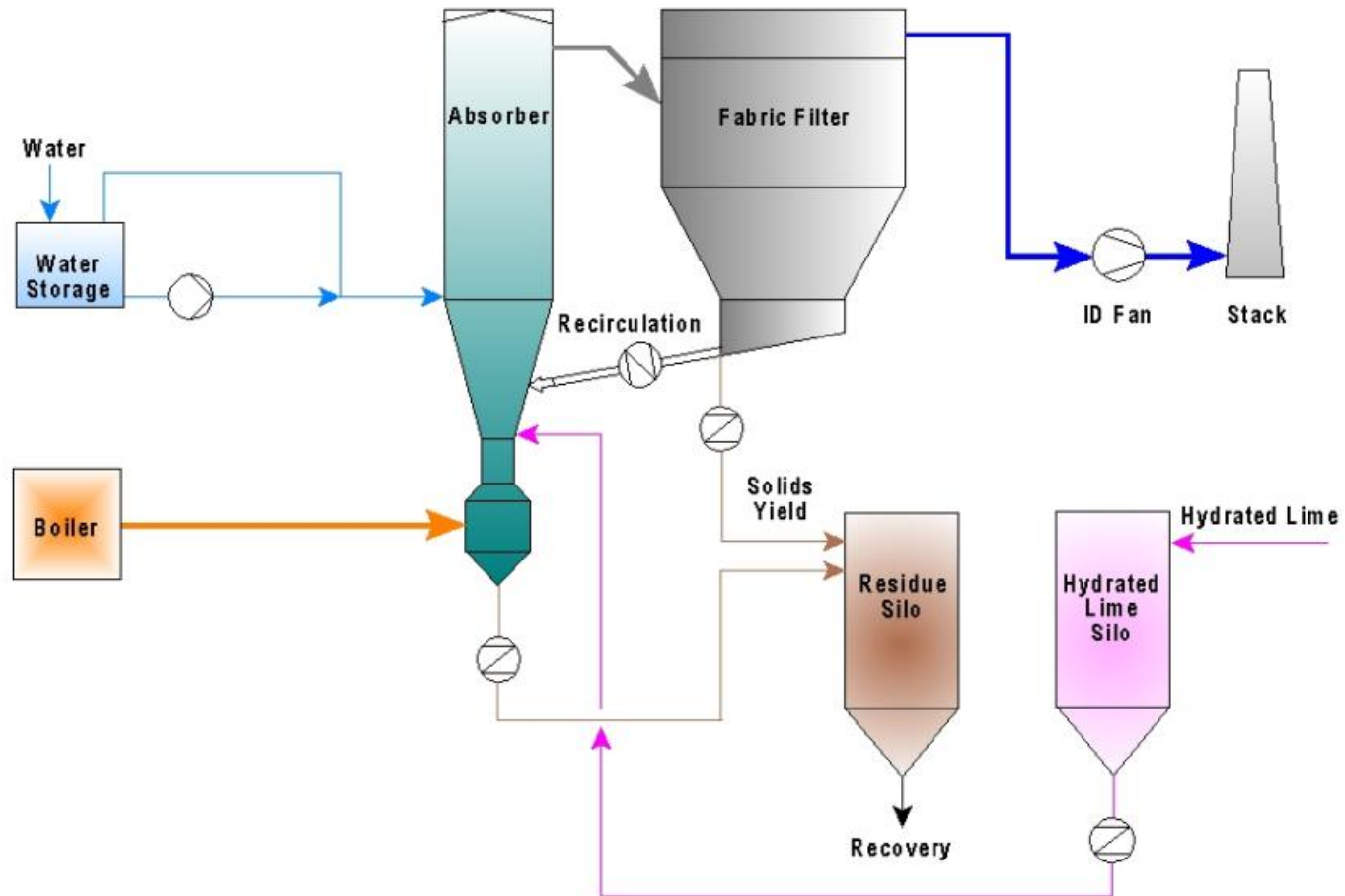
Security Operation



Boiler Concept & Design Criteria



Flue Gas Cleaning

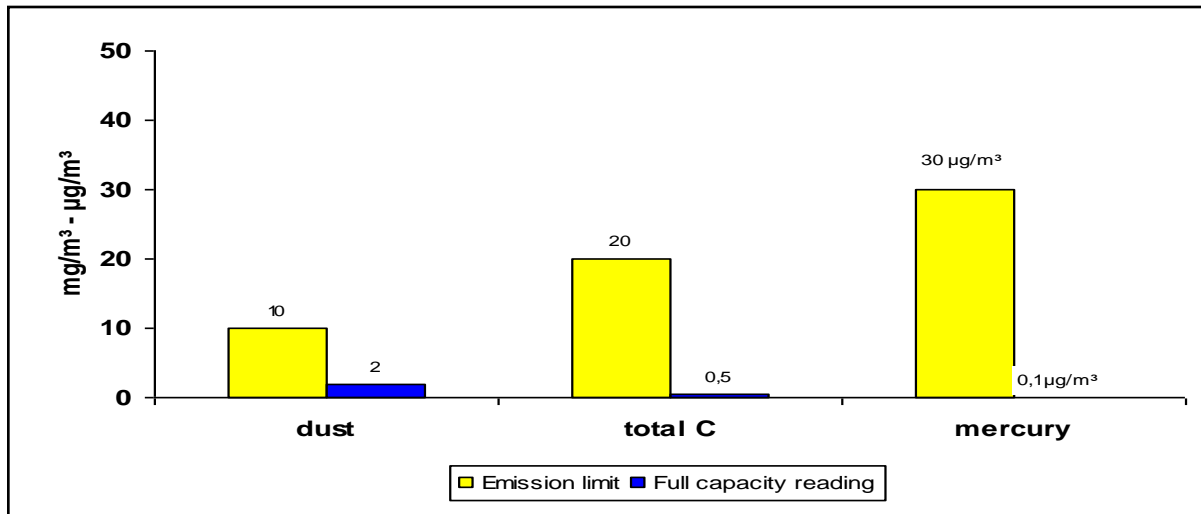
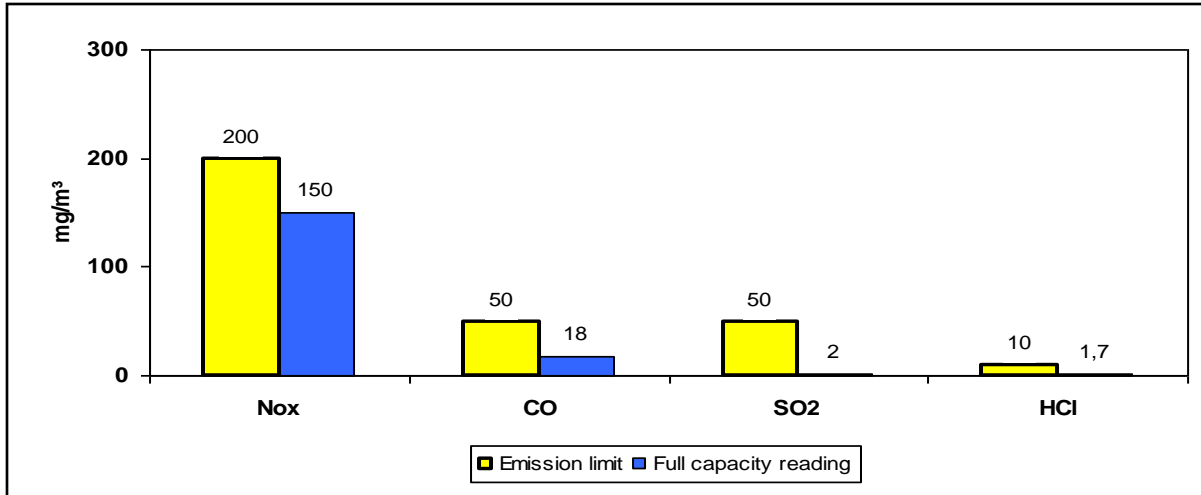


Project Milestones

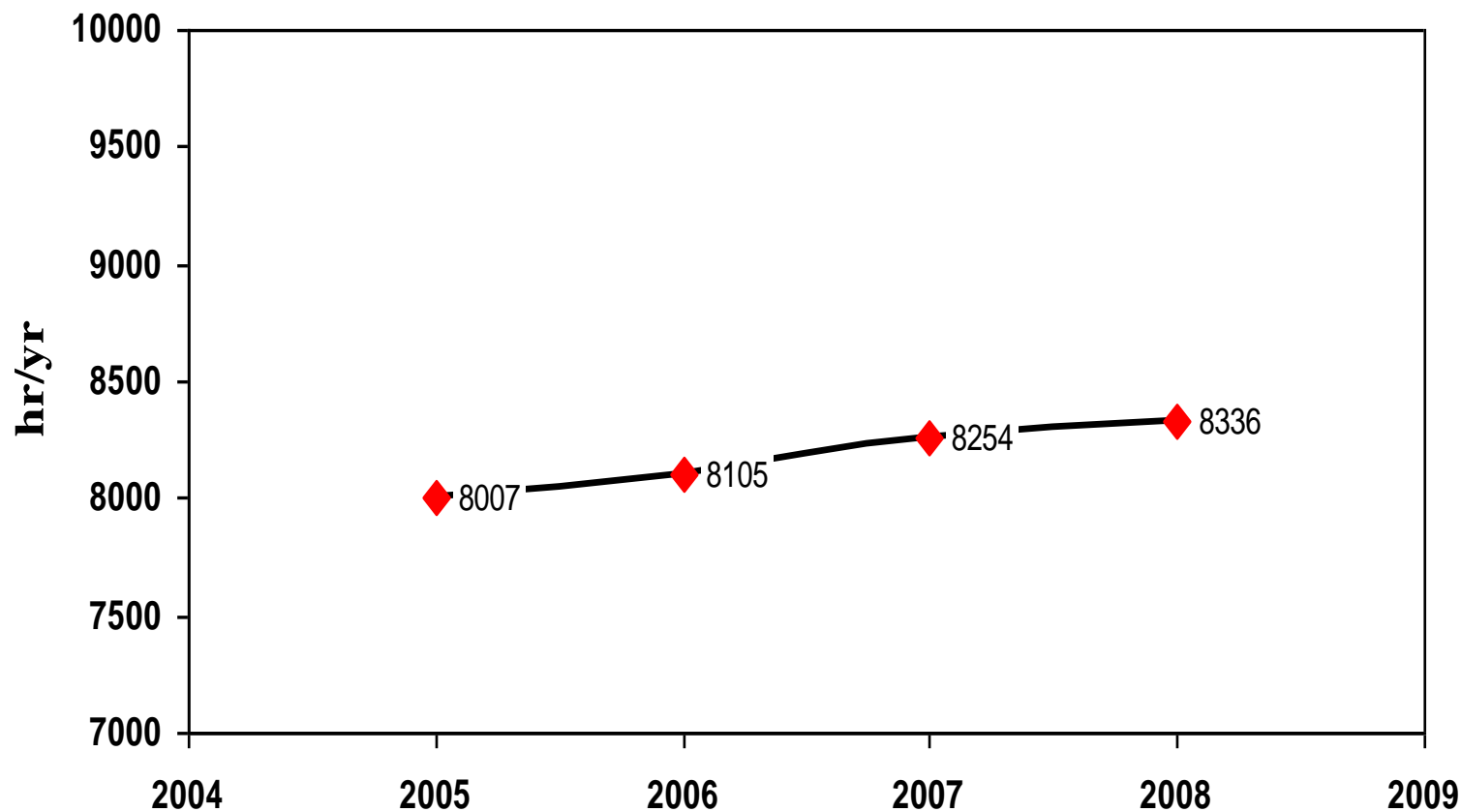


April 1999	Basic Engineering for approval
June 2000	Approval received
April 2003	Start of main order
March 2004	Start erection
June 2004	Boiler pressure test
October 2004	Operational readiness of the auxiliary boilers
December 2004	Operational readiness of the main boiler
Jan./ Febr. 2005	Test-runs
11.02.2005	Plant take-over and start of commercial operation

Emission Data



Plant Availability



Grate after 4.000 Operation Hours



Superheater 2 after 4.000 operation hours



Thank you for your attention

