Biomass combustion

TBU Stubenvoll GmbH

TBU Services

Engineering, consulting, supervision and start-up for

waste and biomass incineration plants

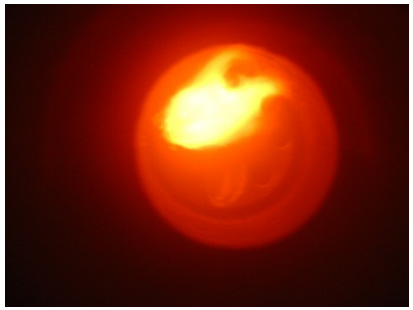
Basic engineering, detail engineering, delivery of special parts and supervision of production, assembly and start-up for

fluidised bed incinerators for fuels such as

waste fuels, biomass and sewage sludge

and

dry, semi-dry and wet flue gas cleaning plants

Energy Recovery of Biomass

Fuels: **wood, straw, dry energy plants**

Combined heat and power generation ->

- **Grate and fluidised bed fired steam boiler with turbine**

Efficiency: - in case of combined heat and power generation:

overall efficiency up to 90%, circa 10-15% electrical energy

- in case of power generation: circa 25-30% electrical efficiency

For additional firing in the power station->

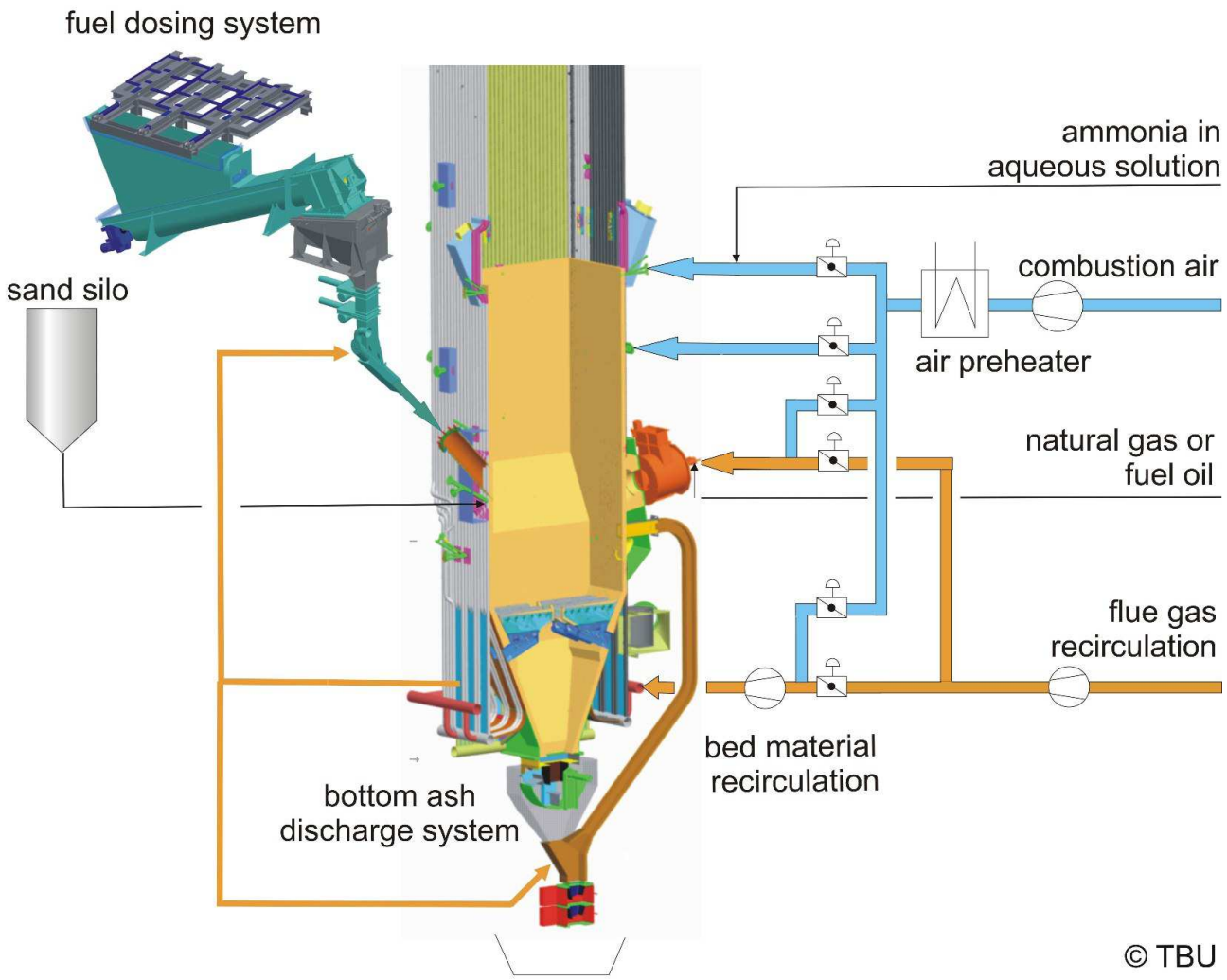
- **Upstream facilities as pyrolysis**
- **Combustion of pyrolysis coke in a fluidised bed**

Efficiency: - in case of combined heat and power generation:

overall efficiency circa 90%, circa 20-25% electrical energy

- in case of power generation: more than 35%

Stationary Fluidised Bed (bubbling bed) with Staged Combustion



Optimised fuel- and bed material system for biomass and waste fuels

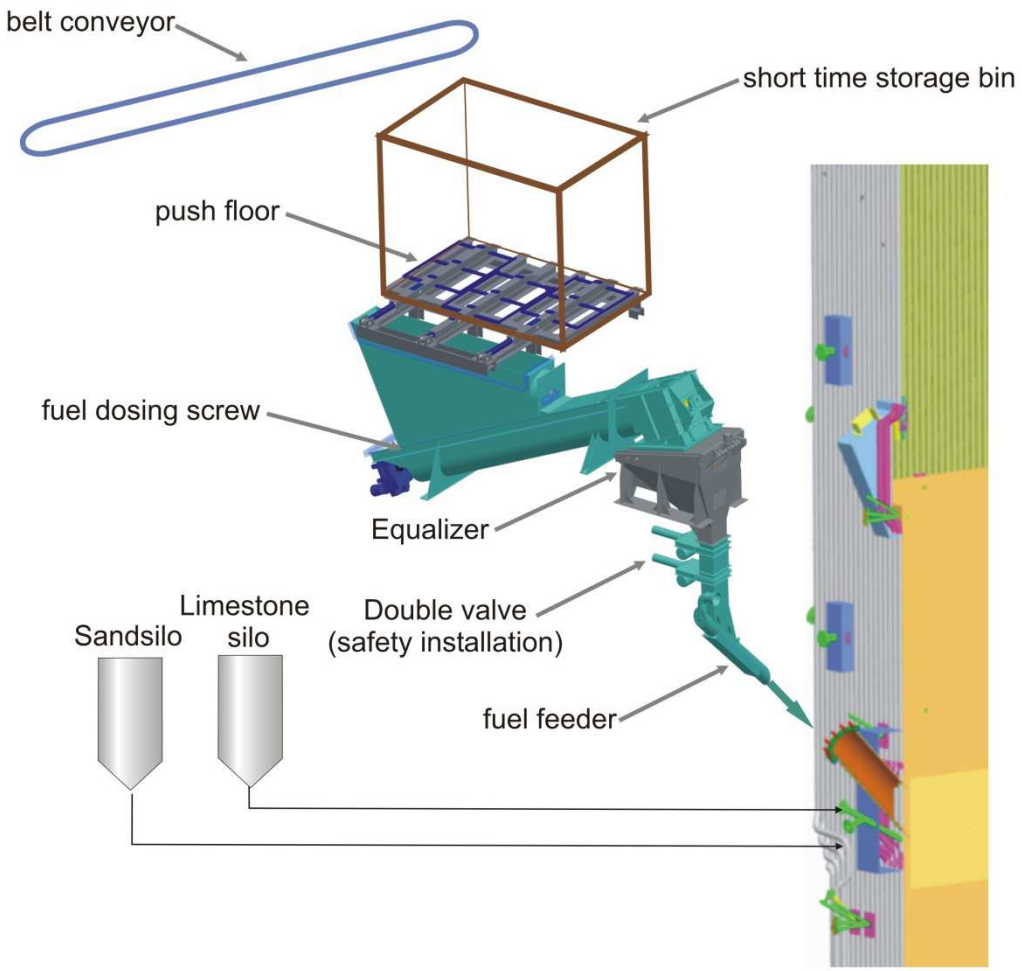
- ✓ Dosing screw for fuels with equalisation
- ✓ Pneumatical fuel feeding
- ✓ Open nozzle floor
- ✓ Screening and precipitation of big ash parts by the bed ash system

Optimised air and flue gas system

- ✓ Controlled composition for fluidising gas consisting of air and recirculation gas
- ✓ Two different levels for secondary air
- ✓ Controlled profile of combustion chamber temperature

Fuel Dosing System with Equalizer and Injector

- ✓ Dosing system for fuels up to 300 mm feed size
- ✓ Precise and constant dosage
- ✓ Pneumatic fuel feeding onto the bed surface
- ✓ Burn-back protection: temperature monitoring, sub-pressure, burn-back double valve (open under normal operation)
- ✓ Additional burn-back protection by water sprinkling system



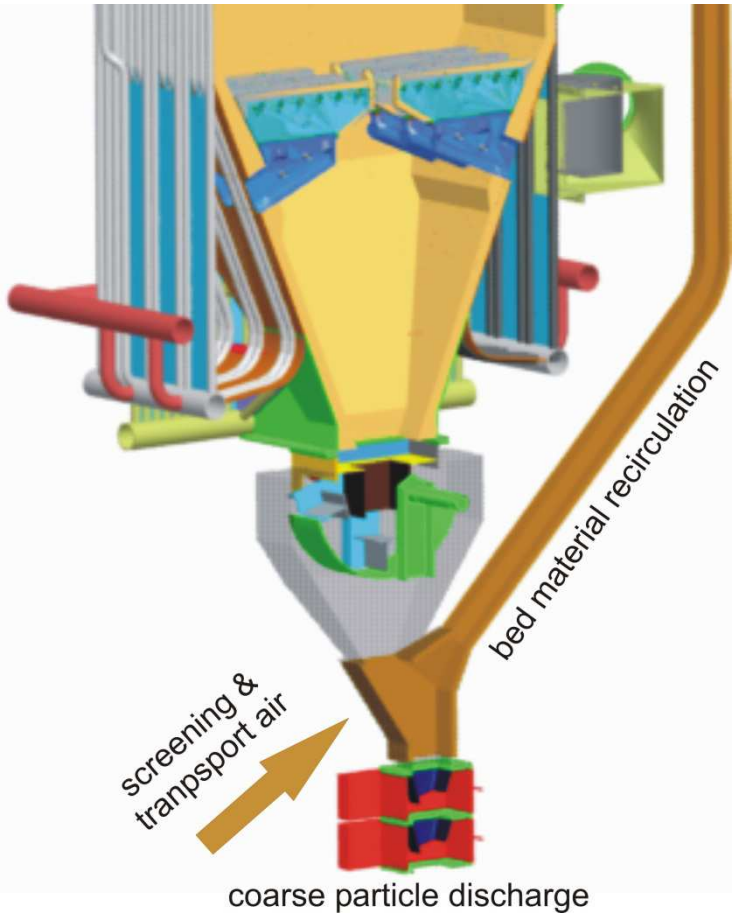
Open Nozzle Floor and Pendular Discharge

Open nozzle grid

- ✓ Open nozzle grid suitable for discharge of coarse particles up to 300 mm
- ✓ Low pressure drop for fluidisation gas
- ✓ Optimised distribution of primary air

Mechanical bed material (bottom ash) discharge

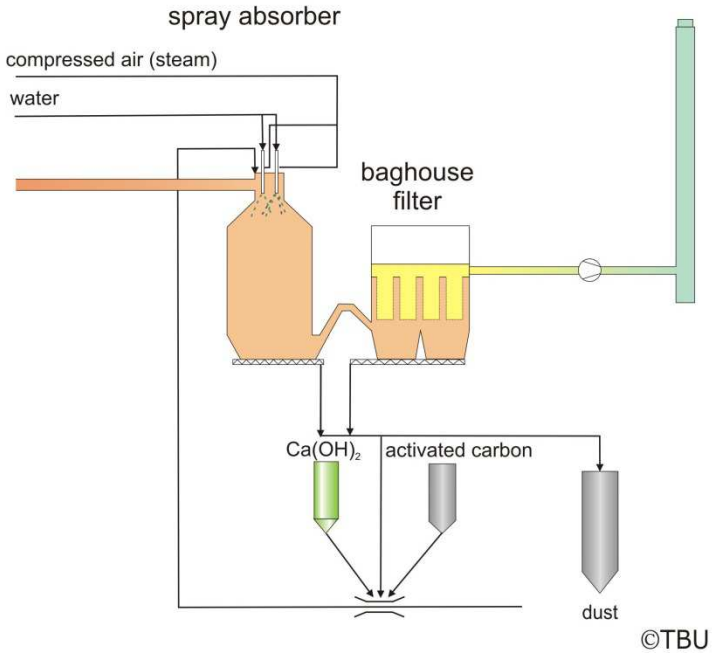
- ✓ Pneumatic screening
- ✓ Continuous recirculation of fine bed material to combustion chamber
- ✓ Discharge of coarse particles
- ✓ Transport of fresh sand together with re-circulated fines

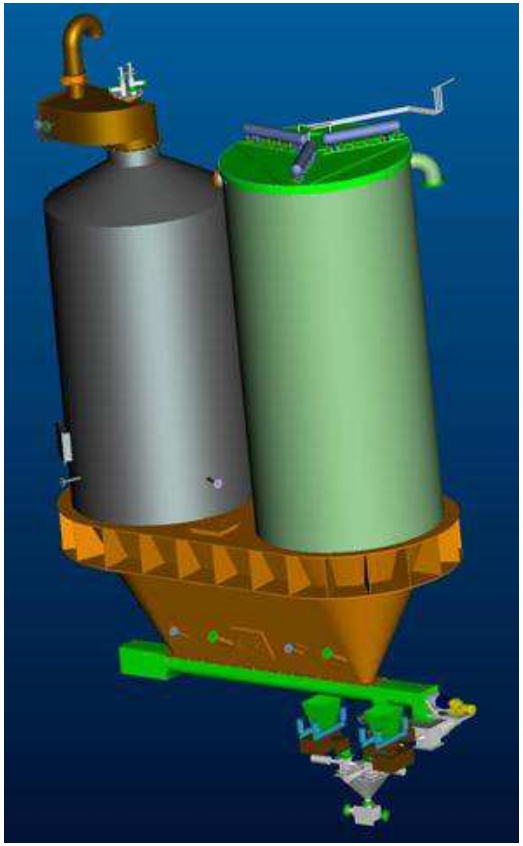


Dry and Semy-dry System

This system is used for waste and hazardous waste incinerators to remove following flue gas components:

- ✓ Dust
- ✓ HCl, HF, SO2
- ✓ Mercury
- ✓ Dioxins und Furans





Optimised gas adsorption and dedusting system for low concentrations of gaseous pollutants

- ✓ Low pressure drop
- ✓ High availability of nozzles
- ✓ Simple combined system

Wet Flue Gas Cleaning System

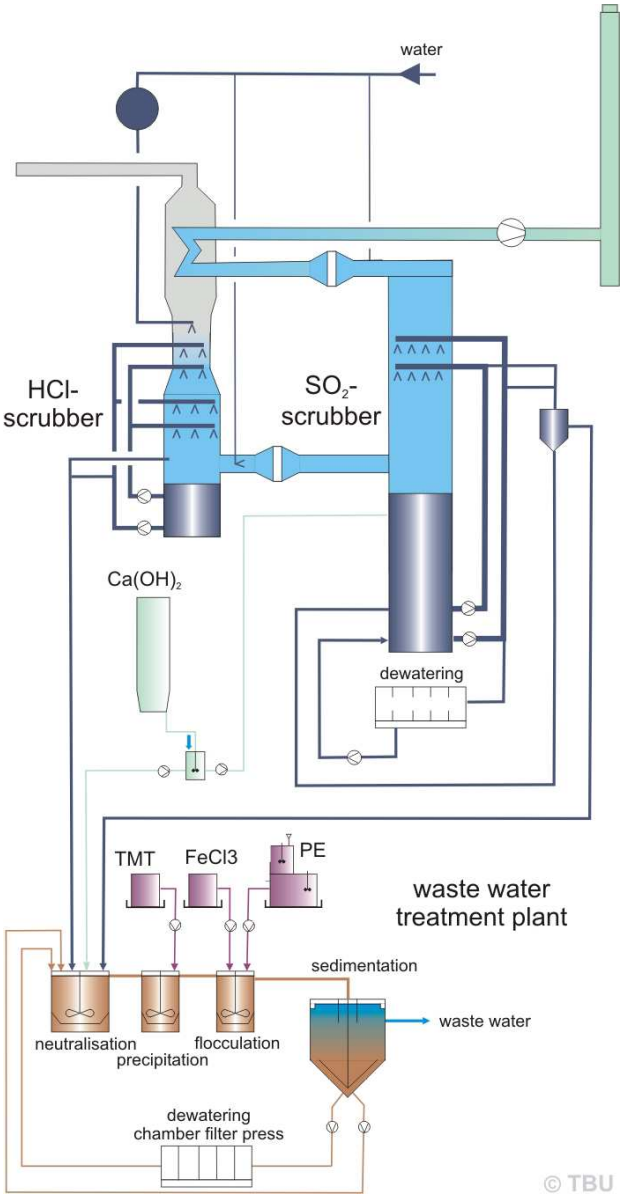
This system is used for waste and hazardous waste incinerators to remove following flue gas components:

- ✓ HCl, HF, SO2
- ✓ Mercury
- ✓ Heavy metals

Advantages:

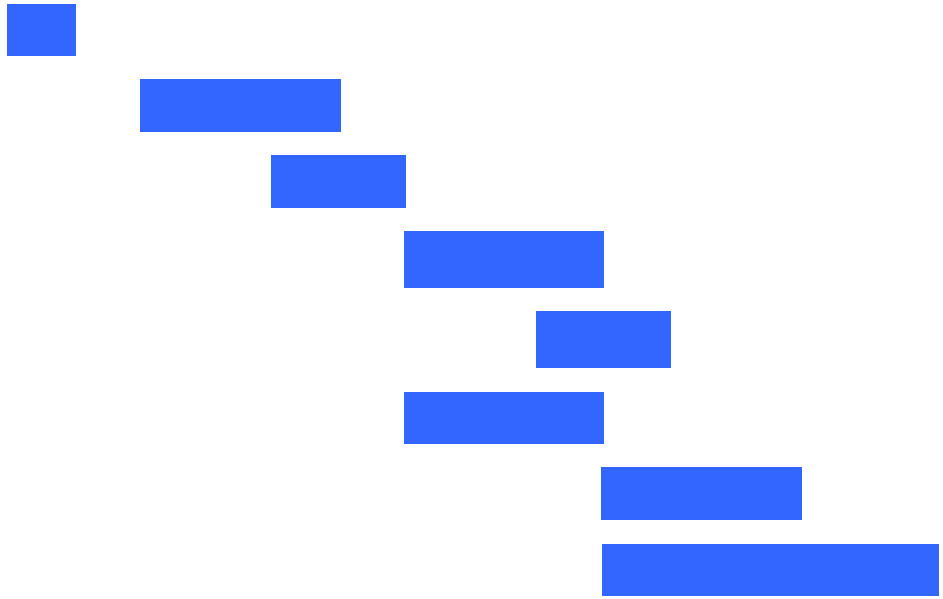
- ✓ Low pressure drop
- ✓ Low water pressure
- ✓ Low energy consumption
- ✓ Low emissions of HCl, HF, SO2
- ✓ Optimised residues→ gypsum from the SO_2 scrubber
- ✓ Neutralisation medium

  CaCO3 and Ca(OH)2



References – Biomass Power Plants

Projects	Capacity (MW)
LAG 7 (AT)	110
Neubrücke (DE)	30
Altenstadt (DE)	40
EVN (AT)	5
Heiligenkreuz (AT)	48
Basel (AT)	30
Zürich / Aubrugg (CH)	44
Bern (CH)	27



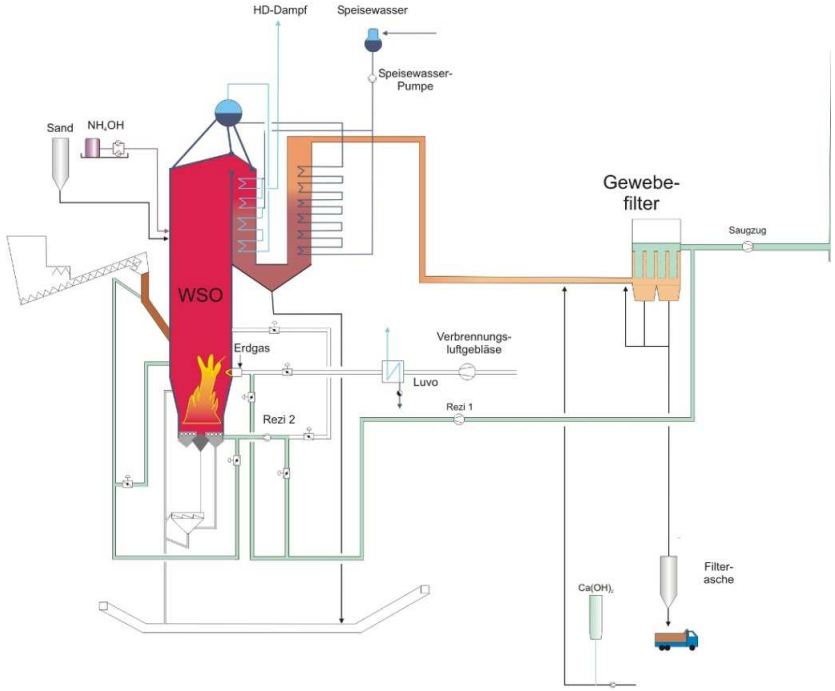
Biomass Power Plant Bern (Switzerland 2009 - 2013)

Project Description:

- ✓ Fluidised bed incinerator for biomass
- ✓ Production of electrical energy and steam for district heating

Capacity:

- ✓ 27 MW fuel heat capacity



Plant Concept:

- ✓ Storage of biomass
- ✓ Boiler with integrated fluidised bed incineration
- ✓ Dry flue gas cleaning plant

TBU: basic engineering, know-how provider of combustion and start-up assistance

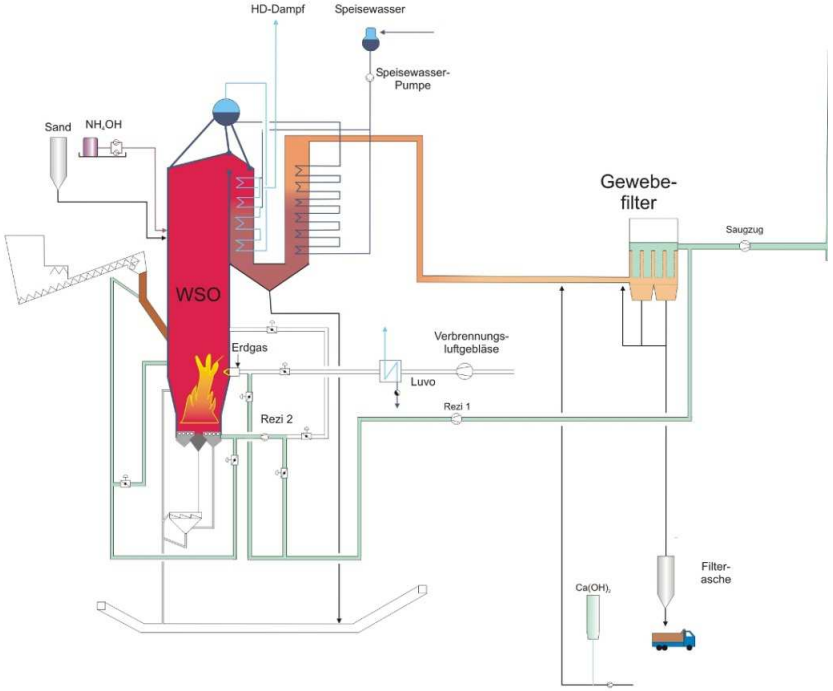
Biomass Power Plant Zurich / Aubrugg (Switzerland 2009 - 2010)

Project Description:

- ✓ Fluidised bed incinerator for biomass
- ✓ Production of electrical energy and steam for district heating

Capacity:

- ✓ 44 MW fuel heat capacity
- ✓ Emissions according to Swiss law



Plant Concept:

- ✓ Storage of biomass
- ✓ Boiler with integrated fluidised bed incineration
- ✓ Dry flue gas cleaning plant

TBU: basic engineering, know-how provider of combustion and start-up assistance

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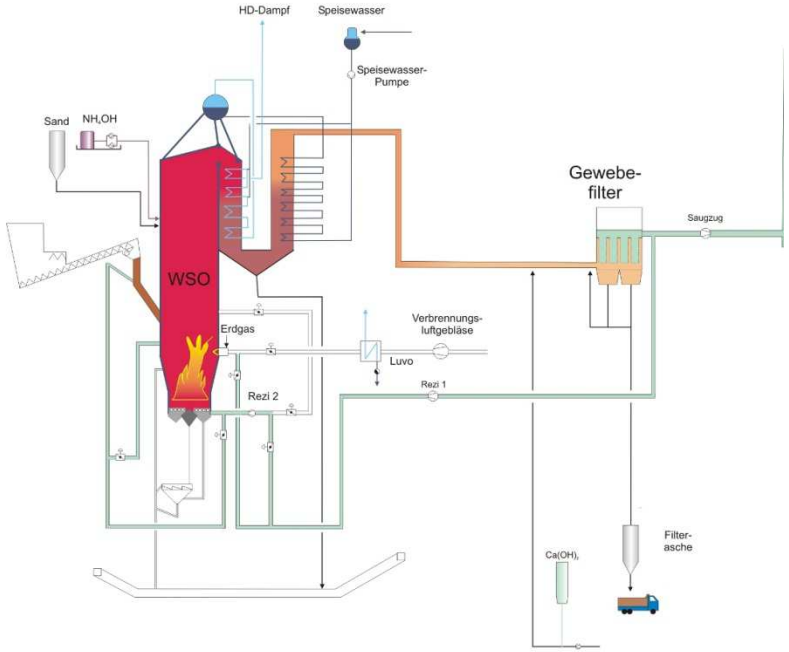
IWB Biomass Power Plant Basel (Switzerland 2006 - 2008)

Project Description:

- ✓ Fluidised bed incinerator for biomass
- ✓ Production of electrical energy and steam for district heating

Capacity:

- ✓ 30 MW fuel heat capacity
- ✓ Emissions according to Swiss law



Plant Concept:

- ✓ Storage of biomass
- ✓ Boiler with integrated fluidised bed incineration
- ✓ Dry flue gas cleaning plant
- ✓ Existing water steam cycle with turbine

TBU: basic engineering, detail engineering, supervision of production and assembly of combustion as well as start-up of the whole plant

Biomass Power Plant Heiligenkreuz (Austria2008-2009)

Project Description:

- ✓ Fluidised bed incinerator for biomass
- ✓ Production of electrical energy and process steam

Capacity:

- ✓ 48 MW fuel heat capacity
- ✓ Emissions according to 17 BImSchV

Operating company: Bewag und Begas

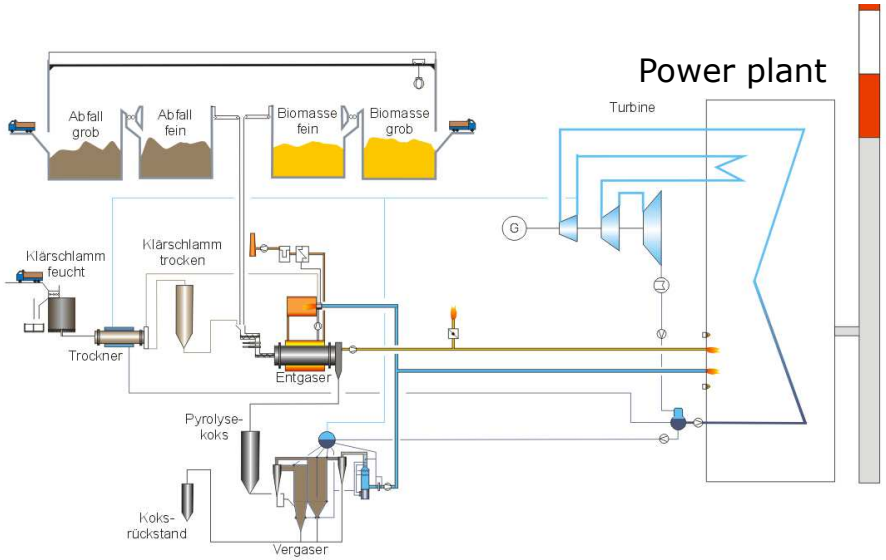
Combustion: Babcock Wilcox

Boiler: Marcegaglia

TBU: simulation of combustion, improvement actions for combustion for prevention of depositions at the same time with capacity increase of 10 %

Project: Use of Alternative Fuels in a Large-scale Power Plant

Degasing and gasification of alternative fuels

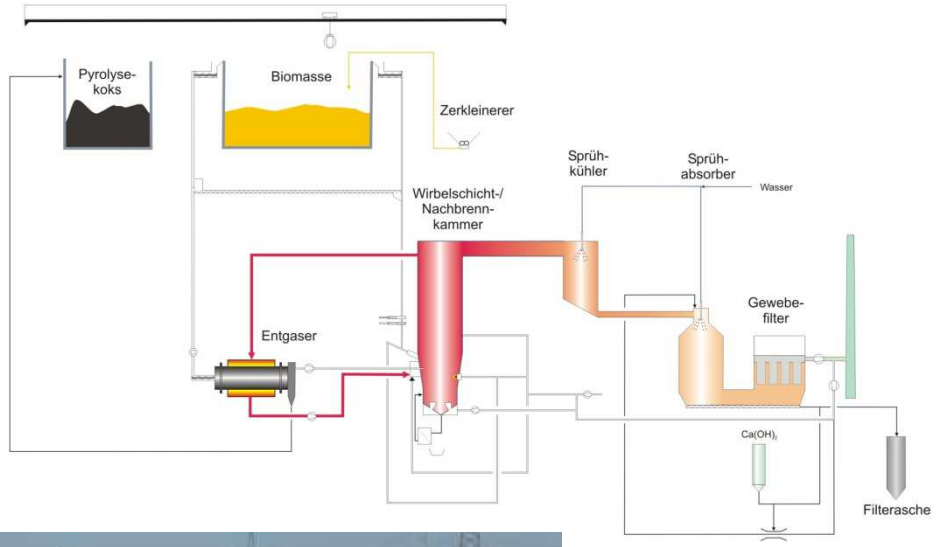


pre-treatment plant

Pilot Plant for Straw Pyrolysis Dürnrohr (Austria 2006 - 2008)

Project Description:

- ✓ Pyrolysis of straw
- ✓ Combustion of pyrolysis gas
- ✓ Combustion of straw and pyrolysis coke in a fluidised bed combustion
- ✓ Project objective: Confirmation of design data and technology demonstration for use of straw in a large power plant



Capacity:

- ✓ 5 MW fuel heat capacity,
- ✓ Emission limits to Austrian law

Plant Concept:

- ✓ Indirect heated rotary kiln
- ✓ Fluidised bed incinerator
- ✓ Spray cooler
- ✓ Spray absorber
- ✓ Baghouse filter

TBU: approval procedure, basic engineering, detail engineering, supervision of production and commissioning , start-up

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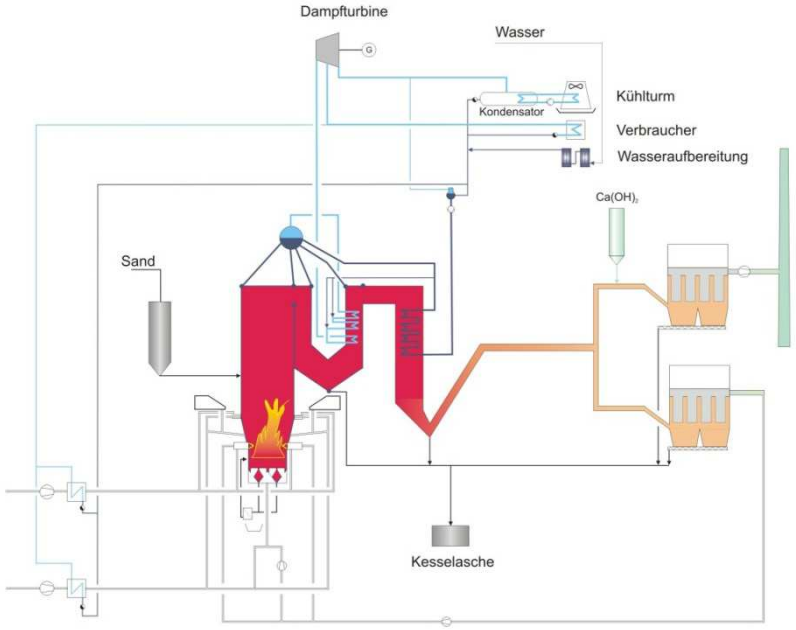
Waste Wood Fluidised Bed Incineration Plant ALTENSTADT-SCHONGAU (Germany 2004-2005)

Project Description:

- ✓ Upgrade of the existing fluidised bed incinerator
- ✓ Production of electrical energy and steam for district heating from biomass

Capacity:

- ✓ 40,4 MW fuel heat capacity
- ✓ Emissions according to 17 BimschV



Plant Concept:

- ✓ Storage of waste wood
- ✓ Boiler with integrated fluidised bed combustion
- ✓ Dry flue gas cleaning plant
- ✓ Water steam cycle with turbine

TBU: basic and detail engineering, supervision of production and assembly of combustion as well as the start-up of the whole plant

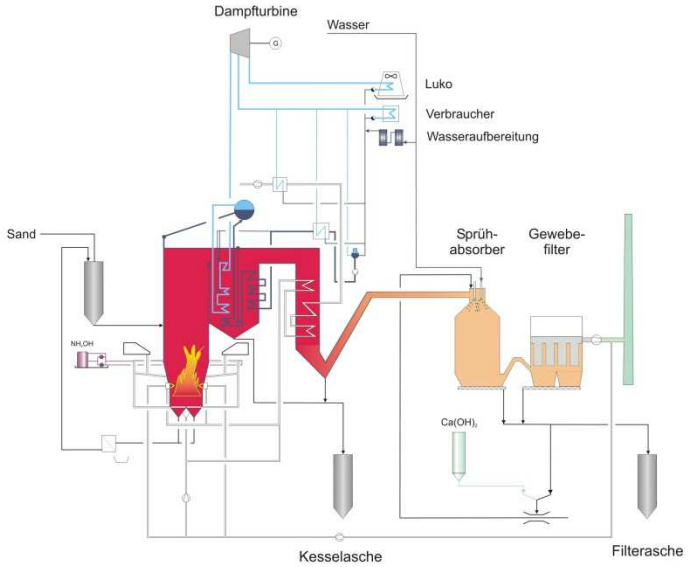
Waste Wood Fluidised Bed Incineration Plant OIE Neubrücke (Germany 2002/03)

Project Description:

- ✓ Fluidised bed incinerator for biomass and waste wood
- ✓ Production of electrical energy and steam for district heating

Capacity:

- ✓ 30 MW fuel heat capacity
- ✓ Total capacity 60.000 tons per year



Plant Concept:

- ✓ Storage of waste wood
- ✓ Boiler with integrated fluidised bed combustion
- ✓ Selective non-catalytic NOx-reduction
- ✓ Semi-dry flue gas cleaning plant
- ✓ Water steam cycle with turbine

TBU: basic engineering, detail engineering, supervision of production and assembly of combustion and flue gas cleaning and start-up of the whole plant

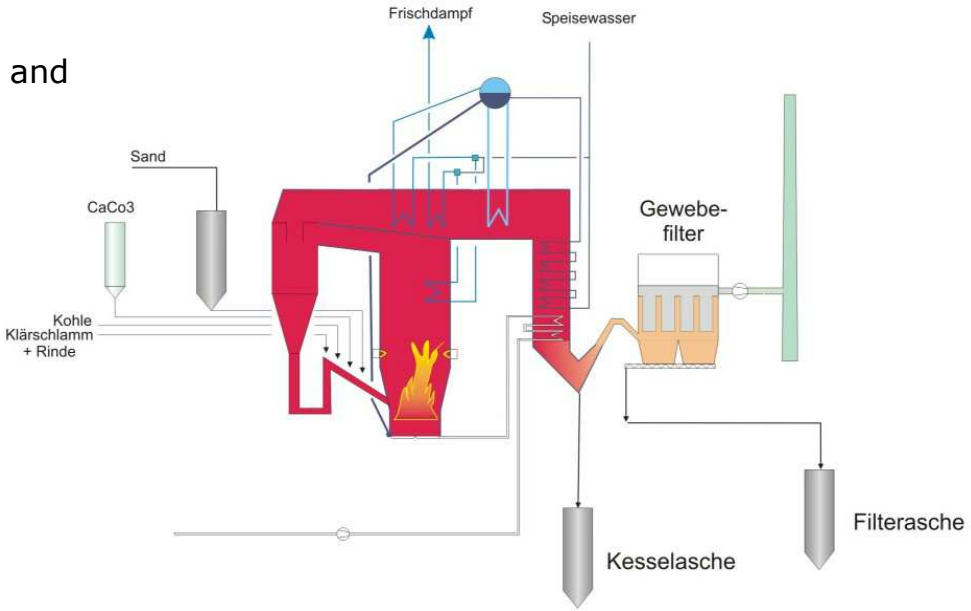
Waste Fluidised Bed Boiler 1K7 Lenzing AG (Austria 2000)

Project Description:

- ✓ Upgrade of existent fluidised bed boiler for combustion of bark, coal, internal waste fuels and sewage sludge
- ✓ New concept for combustion control system

Capacity:

- ✓ 110 MW fuel heat capacity



Plant Concept:

- ✓ Fuel transport
- ✓ Boiler with integrated combustion
- ✓ Baghouse filter

TBU: Process engineering and start-up

Experiences with Different Technologies in Different Countries

Our engineering for your success is based on many years of experience in the field of advanced environmental plants all over the world. We have successfully engineered projects in:

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Marsa (Malta)

Frankfurt (Germany)

Zürich / Aubrugg (Switzerland)

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- Australia
- China
- Croatia
- Czech Republic
- France
- Germany
- Great Britain
- Greece
- Hungary

- Italy
- Korea
- Malta
- Netherlands
- Russia
- Switzerland
- Slovakia
- South Africa
- Taiwan

Kaucuk Kralupy (Czech Republic)

Neubrücke (Germany)

Moscow (Russia)

Lenzing (Austria)

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