

ES+S

P r e s e n t a t i o n

ES+S

Energy Systems und Solutions GmbH

Industriestrasse 8
D-18069 Rostock
Germany

Presentation ES+S Oktober 2009

The company



The company **ES+S** developed its scientific and technical foundations in the years since 1975.

Its special competences in the fields of

- Fluidized bed technology
- Boiler fuel burning systems
- Plant design and optimization
- Project management

are based on many years of work in research institutions in Magdeburg, Berlin and Rostock.

The company

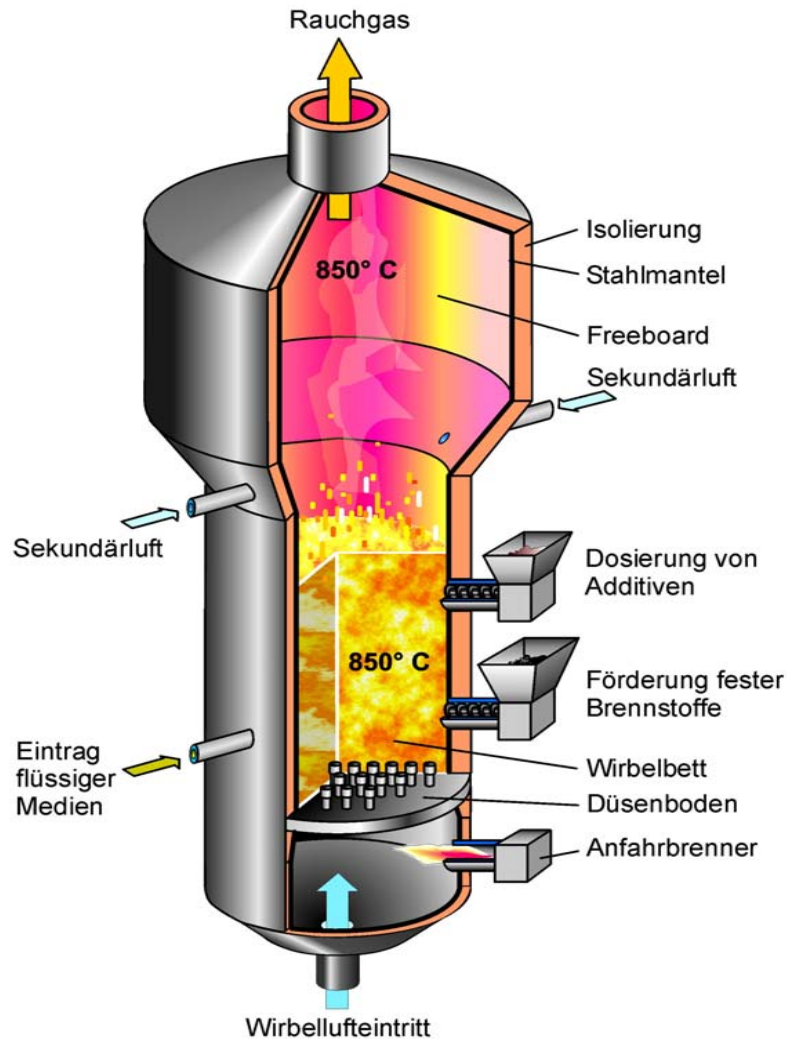


The main focus of the development of ESS has been on

**fixed fluidized bed combustors
with small outputs**

which were developed at the Institute for Energy and Environmental Technology at the University of Rostock under the directorship of Prof. Dr.-Ing. habil. Dieter Steinbrecht and developed further in collaboration with ESS. In addition, ESS has its own industrial property rights in this regard.

Stationäre Wirbelschicht



Fluidized bed combustor

Upward-blowing jets of turbulent air flow through the bed. When the flow rate exceeds the rate of fluidization, the original sand bedding turns into a fluid-like (fluidized) state offering excellent conditions for chemical reactions.

Fuels (solid, pasty, liquid and gaseous) can be added to the fluidized bed, which is at a high temperature, and burned under controlled conditions.

Theoretical principles



The principles behind the process of fixed fluidized bed combustion (FFBC) have been known for about 80 years.

The further development of the process specifically for systems with small outputs has been carried out at the University of Rostock since the mid-1990s in the Faculty of “Environmental Technology” .

For small outputs the specific characteristics of a FFBC such as the fluidization factor, loosening point, discharge point, dwell time and combustion chamber were supplemented by temperature consistency, freeboard design, fuel identification systems and much simplified design.

Characteristics of “our” FFBC system (1)

+ Custom-tailored system configuration

i.e. design for actual application requirements with site-specific options for fuels

+ Integration of the FFBC in a power system

for the optimum use of flue/exhaust gas energy with site-specific optimization and for the stabilization of the combustion process

Key characteristics of “our” fixed fluidized bed combustor system (FFBC) (2)

+ Suitability for a wider range of fuels

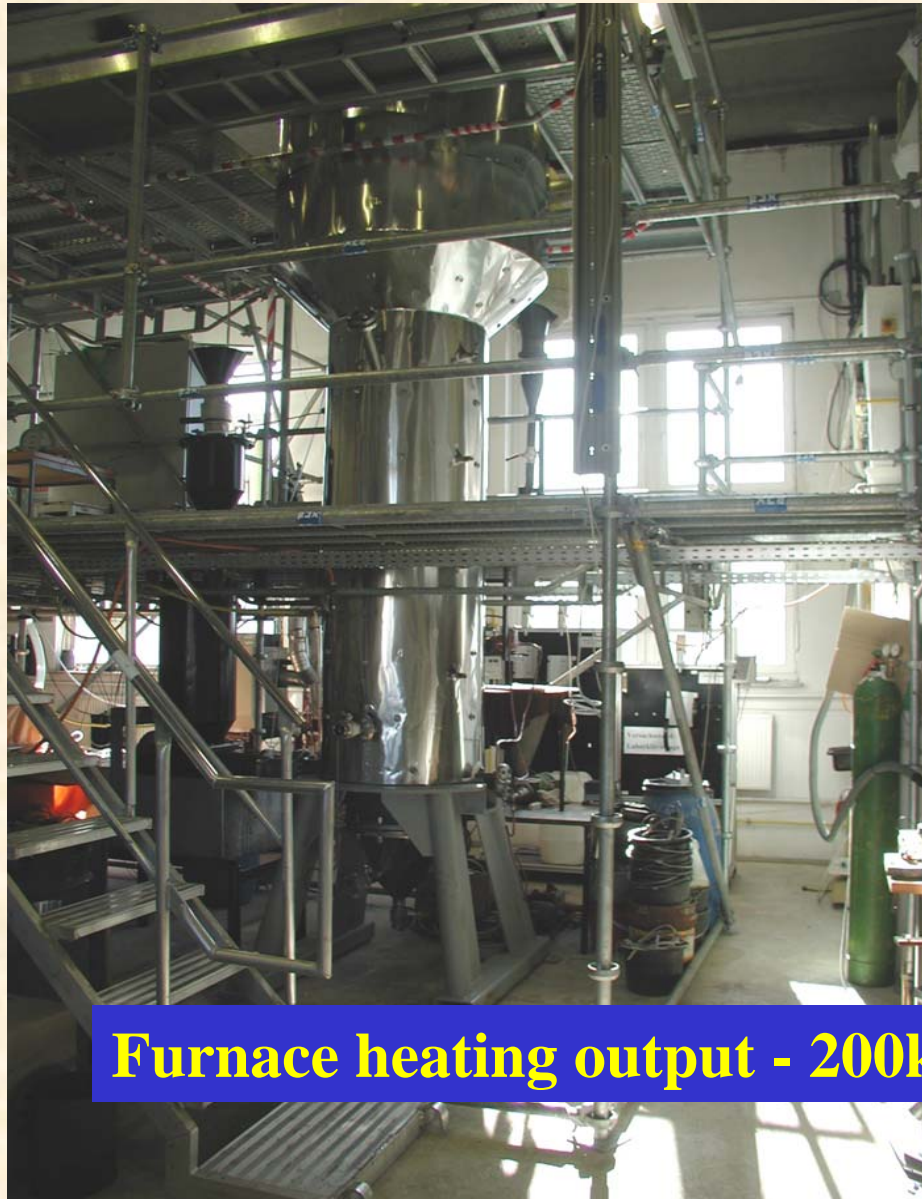
to include gaseous and liquid fuels, in particular low thermal value gases (lean gas from landfill sites) and pasty sludge (sewage sludge)

+ Use of the process for desulphurization

with desulphurization efficiency of > 99% without input of additives and without after-treatment of the flue gas

Theoretical principles

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Fixed fluidized bed combustor
SWSF DN 400 at the Institute for
Energy and Environmental
Technology

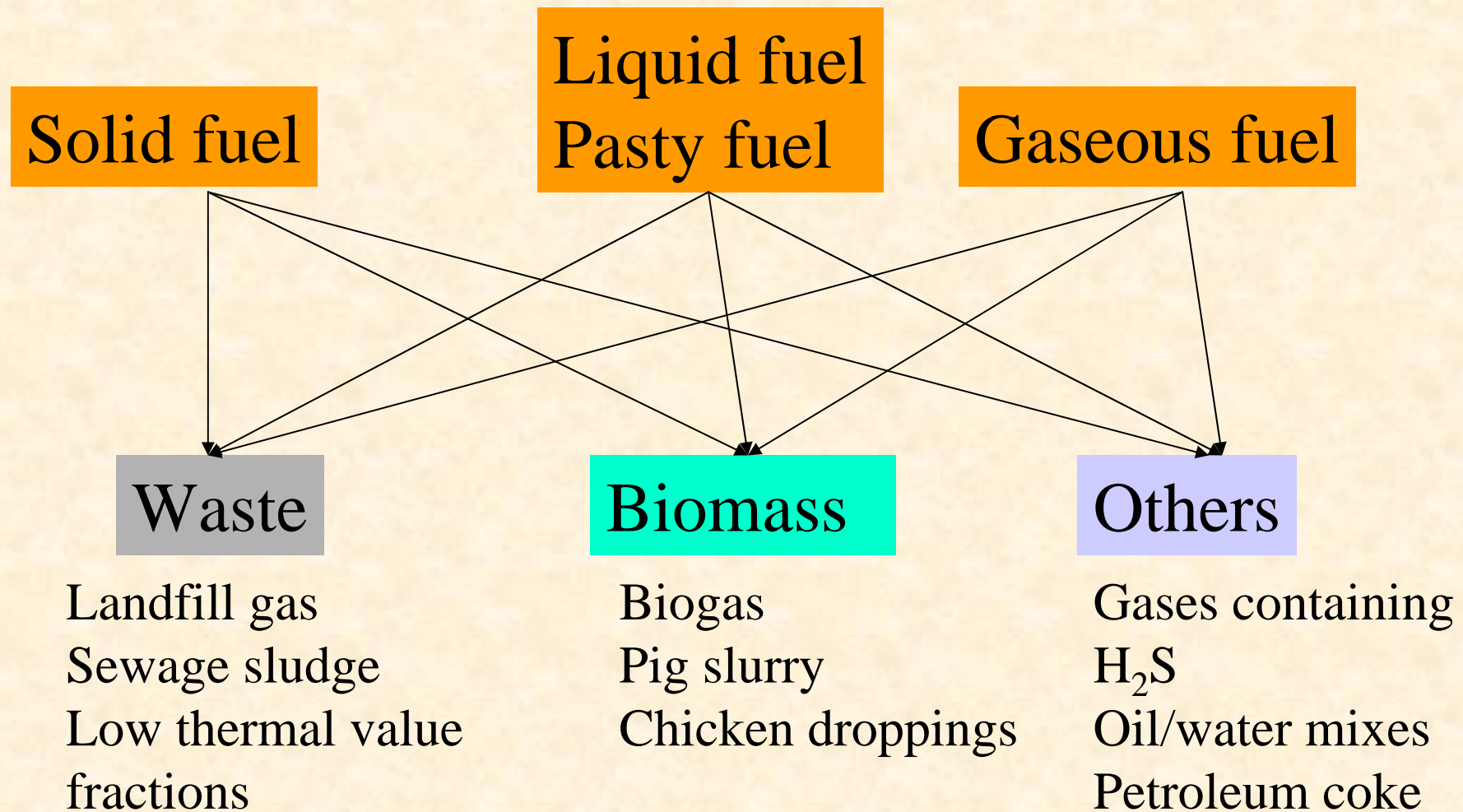
IEUT

at the University of Rostock,
2003

All theoretical knowledge was
verified on this test facility which
meets industrial requirements

Furnace heating output - 200kW

Range of fuels



Range of fuels



Range of thermal values

Gases: Lean landfill gas 35% CH₄ - 12550 kJ/kg

Lean landfill gas 12% CH₄ - 4300 kJ/kg

Lean natural gas 9% CH₄ - 5500 kJ/kg

Sludge: 50 % H₂O sewage sludge - 4200 kJ/kg

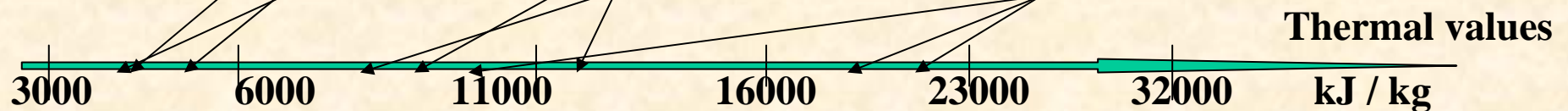
70 % H₂O expectorates - 8445 kJ/kg

Solid fuels: 43% H₂O chicken droppings - 7600 kJ/kg

10% H₂O energy crops - 22000 kJ/kg

5% H₂O lightweight shredder fractions - 19000 kJ/kg

9% S petroleum coke - 8400 kcal/kg



Range of fuels

Waste: Tests performed

- **Secondary fuels (fuels from waste)**
- **Coarse fractions from mechanical-biological treatment plants (MBP)**
- **Sewage sludge, dewatered / dried**
- **Landfill gas, landfill seepage water**
- **Paper sludge (e.g. expectorates)**
- **Tar sludge, acid resin tar**
- **Oil/water emulsions (e.g. sludges)**
- **Accumulator scrap, cable casting compounds**

*Range of fuels***Biomass: Tests performed**

- **Straw, straw pellets**
- **Energy crops (rye)**
- **Chicken droppings with a base of wood chips and straw**
- **Horse manure, pig slurry**
- **Ground offal**
- **Rapeseed extraction meal**
- **Sea grass**
- **Extracted plant oils**
- **Cocoa bean shells and jute bags**
- **Sea mud – combustion - drying**

Range of fuels

Other materials: Tests performed

- **Sulphurous gases**
- **Petroleum coke with high concentrations of sulphur**
- **Contaminated crude oil products**
- **Low thermal value fuel gases**

Emissions



All the systems that we construct are designed to meet the criteria in Germany relating to emissions of every kind.

The process-specific lengthy period of time that the fuel particles have to spend in the combustion stage and the “countless” number of ignition sources and the precisely controllable amount of excess oxygen ensures that all of the particles are completely burnt.

A very important factor in this regard is the fact that it allows additives to be added in the combustion stage which make possible the chemical bonding of substances like sulphur.

Emissions



CO - very long residence time = minimum CO

NO_x - No prompt NO_x

- No thermal NO_x

- Fuel – NO_x reducible in combustion chamber

e.g. using urea

SO₂ - Drastically reducible in the combustion chamber (using limestone)

HCL - Reducible in the combustion chamber

Dioxins – No new formation after combustion

References



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A total of four of these systems have been developed, constructed and put into operation on the basis of our concept.

- + **Since 1996** the **university test facility** with approx. 3,000 operating hours to date (front picture)
- + **Since 2004** a **system used for lean landfill gas disposal** with over 31,000 hours of continuous operation to date
- + **Since 2003** a **transportable system** for trial runs with difficult fuels
- + **Since 2008** the construction of a fluidized bed for **lean gas disposal**

References

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Landfillgas – Landfill Rönkendorf



References

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mobile plant: Desulphurisation of Gases



Thermal power - 100kW

A photograph of an industrial plant, likely a landfill gas-to-electricity conversion facility. The plant consists of several large metal structures, including a tall white chimney, a red and white boiler, and a yellow and blue turbine and generator housing. A blue container is visible in the foreground. The plant is situated in a grassy area with trees in the background. Three red arrows point from text labels to specific parts of the plant: one to a large cylindrical tank on the left, one to the red and white boiler structure, and one to the yellow and blue turbine and generator housing. A blue banner at the bottom of the image contains text in yellow. The sky is blue with some clouds.

Fluidised bed

Staemboiler

Turbine und Generator

Thermal power – 800kW

poor landfill gas to electricity Camitz since 04/ 2008

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