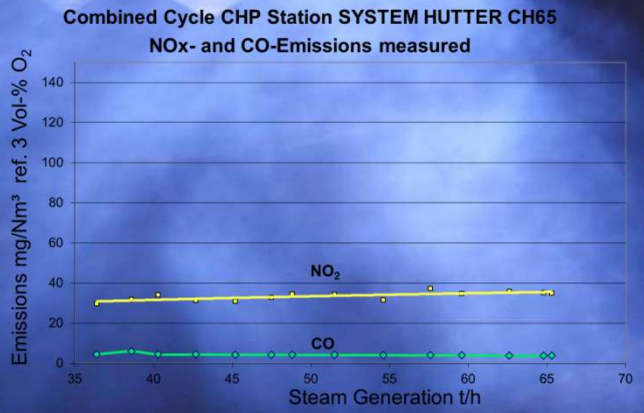
HUTTER FREI POWER GMBH

CCGT-CHP-Stations with low-emission Boiler Firing



High-grade Recycling Rotary Kiln Plants,
such as Delacquering Plants

Company Profile

Supplier, General Planner and Engineer of

CCGT-CHP-Stations, Turbine-based CHP Stations, Rotary Kiln Delacquering Plants, Thermal Power Stations, and Residue-to-Energy integrated in (CHP-)Power Stations

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General Manager: M.Sc. Patrick Frei
Homepage: www.hutter-frei.com

History

HUTTER FREI POWER GMBH was formed from

the company **FRIEDRICH HUTTER GMBH** founded 1988 in Germany,
who developed, patented and successfully introduced
in 1989 the Combined Gas Turbine and Steam Turbine CHP Station SYSTEM HUTTER
(CCGT Combined Cycle Gas Turbine; CCPP Combined Cycle Power Plant; CHP = Combined Heat and Power)
as a Pioneer of industrial and gas turbine based CHP Stations into the market.

The multiple built **Combined Cycle CHP Station SYSTEM HUTTER** was developed specially
for highest fuel utilisation factors (total efficiencies) at higher electricity generation, for extended operating flexibility,
for low-emission and highly reliable energy supply and for CO_2-emission reduction.

HUTTER FREI POWER GMBH was founded in 2006

by M.Sc. Friedrich Hutter and M.Sc. Patrick Frei.
The Swiss company HUTTER FREI POWER GMBH has taken over the business activities of FRIEDRICH HUTTER GMBH
and the hand-over to the next generation was launched.

Overview of Activities

Our Company is **acting**:

- on the one hand as **Consulting-**, **Planning- & Executing Engineer (Owner's Engineer, General Planner, EPCM)**, and
- on the other hand in **Development**, **Design**, **Engineering, Procurement** and **Supply (Component Supply, EPC/Turn-key)**

of **Combined Heat, Cold & Power Stations**, **Power Stations**, **Rotary Kiln Recycling Plants, Therm. Residue-to-Energy Plants**

Our **Customers** are:

- Industries, Energy Supply Companies, (Public) Utilities, Waste Disposal Companies, Recycling Companies, University plants, Hospitals, Banks, State-owned Institutes, Investors, etc.

Our **Products**:

- **are based on innovative**, **high-grade** and **low emissioning** technologies, and
- form together with **competent** and **experienced** Employees the basis for successful solutions

Solutions: We offer **solutions**, which are **tailor-made** and **optimised** for the **individual** Customer needs

Know-how: By means of our **combined know-how** in Consulting, technical Planning and as Supplier:

- we have the **latest state of the art** at our disposal and consider and analyse **all available technological solutions**
- Consequently we are in a position to really **optimise** the **Customer benefit**

Our Guiding Principles in Customer Projects

- HUTTER FREI POWER provides **high-grade products and services** in the sector of Turbine-based Combined Heat, Cold and Power Stations, Thermal Power Stations, Thermal Recycling Plants and Residue-to-Energy Plants.
- We act as **Plant Engineer for the entire plant scope** in the role as Supplier, General Planner or Consultant.
- **The main focus of our strategy and actions** is the **goal** to place the **customer needs in the center** and to offer him products and services of the **highest quality** and **long-term value at fair costs**.
- We act as a **Partner for our Customers**, who analyses continuously the technical and economic developments in the (CHP-)Power Plant business and thermal recycling sector.

- Our **services** start with a careful and in-depth analysis of the customer needs and all relevant boundary conditions with the focus of mid- and long-term perspective, including a sensitivity analysis.
- Our way of proceeding takes place in a **structured manner**, considering all feasible options and concepts with **all applicable plant technologies**.
  The aim is to find the **tailor-made individually optimised solution** optimal for the Customer's need.
- We **analyse** from the **Customer perspective**, defining **different scenarios** e.g. an expected, an optimistic and a pessimistic scenario, providing our Customer with the relevant decision making information.
- HUTTER FREI POWER **successfully lead complex projects** and **act in line with the overall project interest**.
- Challenges and problems are analysed and solved with a **specially developed methodology and proceeding**.
- We **act competently and experienced** and **keep at least the agreements**.

Our Customers

Our Customers are looking for a Partner for a high-grade solution,

- which provides with highest efficiency, extended operating flexibility, fast load change, highest reliability his energy need
  - for simultaneous useful heat, useful cold and electricity (**Combined Heat, Cold & Power Station**), or
  - for solely electricity (**Power Station**)
- which provides as **Recycling Rotary Kiln Plant** high conservation of energy and resources and low material loss
- which as **Thermal Residue-to-Energy integrated in Power Stations** saves fossil fuels and reduces waste disposal costs
- which turns out to be the optimal plant variant considering all applicable plant technologies
- which are individually optimised to his needs
- which uses high efficient and environmentally protecting technology
- and which offers the needed flexibilities in the type of operation and in the operating range

Our Customers are looking for a Partner,

- who analyses continuously technical and economic developments in the Power Plant & Thermal Recycling sector
- who acts competently and experienced
- who keeps at least the agreements
- who can successfully lead a complex Power Plant- and Thermal Recycling project
- and who acts in line with the overall project interest

Competent & experienced Employees for New- and Extension-Plants

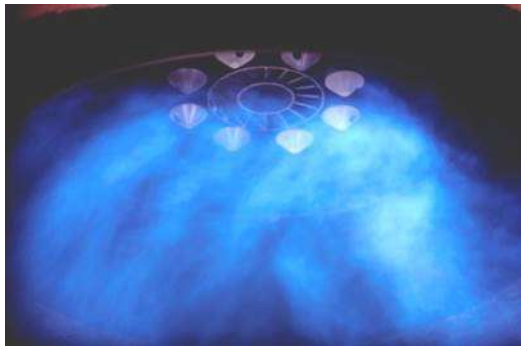
- Consulting and Studies
- Development of innovative plant technologies
- Development of projects
- Customer Support, e.g. with the preparation of permit application
- Expert Know-how of Plant Engineering and for Components of power plants, at latest state of the art
- Steam Generator detailed design with geometrical boiler construction, static and dynamic calculation
- Planning, Design, Engineering, Procurement, Supplier control, Erection control, Commissioning control
- Innovative open-loop- and closed-loop control concepts, e.g. for steam generator- and steam turbine plant
- Project management
- Site management, Overall Erection Management,
- Overall Commissioning Management
- Commissioning
- Acceptance tests measurement and/or its control

Patent Rights

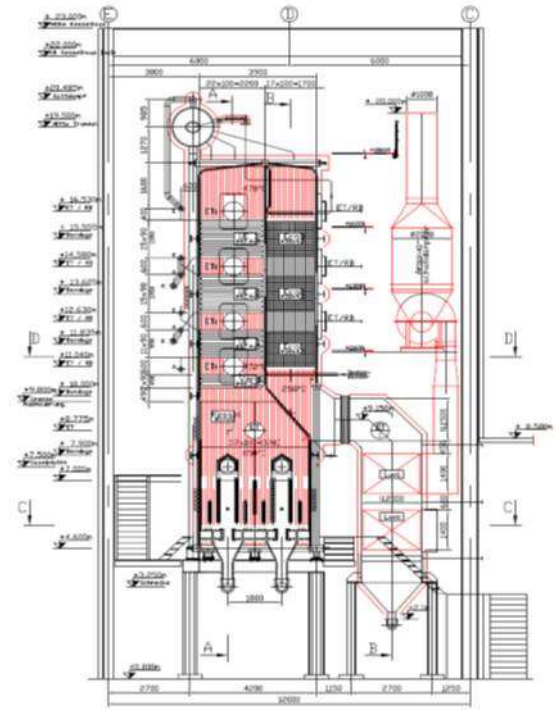
Our Company is holder of Patent Rights:

- on low emission technology of Steam Generator Firing, and on special thermal
  Steam Generator configuration of Radiation-type SYSTEM HUTTER Steam Generators downstream Gas Turbines to reach highest total efficiencies and consequently fuel savings and reductions of CO_2 emissions

- on CO reduction technologies on bubbling fluidized-bed Combustion Plants



Cut-away Gas Turbine ROLLS ROYCE KB5
in the Zellcheming Fair in Wiesbaden, Germany



Design of optimised Bubbling Fluidized-Bed Combustion for rejects from paper- and card-board- production with high-pressure Steam Generator

Product- and Services-Strategy

High-grade energy conversion plants and recycling plants
are the better answer
to the global challenge of climate change and preserving the CO_2 balance.

With our aim of
efficiency increase, **fuel savings**, **emission reductions, operating flexibilities** and **highest reliabilities**,
we **developed innovative technologies**, which are the basis of our services as Owner's Engineer and of our products.

Our services and products lead with their
primary energy savings (fuel savings), very low air pollutant emissions and conservation of resources to
environmentally-beneficial and highly economical solutions.

Our Combined Heat & Power Stations and Thermal Power Stations achieve **highest fuel utilisation factors** (SYSTEM HUTTER up to 94 %), **reliabilities** (SYSTEM HUTTER > 99,5 %) **and high operating flexibilities.**

Our Recycling Rotary Kiln Plants and Thermal Residue-to-Energy Plants result in
energy savings, conservation of resources and minimisation of material loss.

Based on the **competence** and **experience** of our Engineers
HUTTER FREI POWER offers a **wide variety of high-grade**
engineering services and products in the power plant and thermal recycling sector.

Overview of Products

Development, Planning, Design, Engineering, Supply and Commissioning
of high-grade, high-efficient, environmentally-protecting, operation-flexible and low-emissioning
Combined Heat, Cold & Power Stations, Heating Plants, Rotary Kiln Recycling Plants, Residue-to-Energy Plants

and as Consultant, General Planner or EPCM-Contractor
of **Combined Heat, Cold & Power Stations, Thermal Power Stations,** entire **Waste Incineration Plants**

- Engineering Services (Consulting, Planning, Engineering, General Planning, Owner's Engineer, EPCM-Contractor)
- Thermal Recycling Rotary Kiln Plants, such as Delacquering of UBC- or aluminium sheet material
- Thermal Rotary Kiln Residue-to-Energy integrated in (Combined Heat &) Power Stations
- Thermal Waste-to-Energy Plants and Waste CHP Stations
- Combined Cycle CHP Stations SYSTEM HUTTER with own-developed SYSTEM HUTTER Radiation-type Steam Generator
- Combined Gas- and Steam Turbine CHP Stations (CCGT or CCPP) with Heat Recovery Steam Generator
- Steam Turbine CHP Stations
- Heating Stations with Steam Generators and/or District Heating Grids
- Thermal Power Stations, such as Combined Cycle Gas Turbine Power Stations, Steam Turbine Power Stations
- Process Automation & Distributed Control Systems

Products

Engineering Services (Consulting, Engineering, General Planner, Owner's Engineer, EPCM-Contractor)

Electrification & Master Plans; Project Development, Pre-, Parameter-, Feasibility Studies, Pre-Engineering;
Design, Engineering, Project Management, Specification, Supplier Supervision, Site-, Erection- & Commissioning Mgmt.;
Requirements for Process Automation as Process Function Plans, Step Sequence- & Logic Diagrams, Control Schematics, etc.

As Consultant, Planning- / Executing Engineer, as Owner's Engineer, as General Planner or as EPCM-Contractor

- we can act at our Supply Products, if the Customer does not want a General Contractor / EPC-Supplier
- we act at Products for the Construction of Power Stations, which are not in our Hardware Supply Program, as e.g. Large Power Stations (large CCGT, large Steam Power Stations) or Overall Waste Incineration Plants

Thermal Recycling-Rotary Kiln Plants

Supply of Recycling-Rotary Kiln Plants; e.g. aluminium recycling with delacquering of used beverage cans (UBC) or aluminium sheets with high delacquering quality and with further developed process & control; for high reliability

Thermal Rotary Kiln Residue-to-Energy integrated in (Combined Heat &) Power Stations

Supply of Rotary Kiln Residue-to-Energy Plants; for the safe and environmentally friendly disposal of a wide range of residues (e.g. production residues, agriculture, agricultural waste, biomass); innovatively integrated in a (CHP-)Power Station for generation of electricity and useful heat/-cooling and substitution of fossil steam generation fuels with efficiencies up to approx. 90 %.

Thermal Waste-to-Energy Plants & Waste CHP Stations

At waste incineration plants we act as Planning and Executing Engineer and supply the water-steam cycle with the electricity and useful heat generation. For the thermal waste-to-energy and flue gas cleaning we act as ENGINEER.

Products

Combined Cycle CHP Stations SYSTEM HUTTER (Combined Cycle Gas Turbine CHP)

Supply of Combined Gas- and Steam Turbine CHP Stations with SYSTEM HUTTER Radiation-type Steam Generator for the simultaneous generation of useful steam & electricity, efficiencies up to 94%, extended operating range and flexible fuel use. As fuel in the Steam Generator Firing, bio fuels and in combination with Rotary Kiln residues as well can be used.

Gas Turbine CHP Stations with Heat Recovery Steam Generator (and Steam Turbine ⇒ CCGT)

Supply of Gas Turbines with further developed Heat Recovery Steam Generator (and Steam Turbine) for the simultaneous generation of hot water and electricity, or at price ratios electricity to natural gas greater than 3.6, for fuels natural gas & temporarily diesel.

Steam Turbine CHP Stations

Supply of Steam Turbines with Radiation-type Steam Generator with a wide range of fuels: gas, oil, biomass, bio fuels or in combination with Rotary Kiln residues. If Gas Turbine CHP Stations are not economically optimal or if Gas Turbines can not be realised.

Heating Plants with Steam Generator and/or District Heating Grids

Supply of Steam Generator Plants for SYSTEM HUTTER-, Gas Turbine- and Steam Turbine CHP Stations. The Steam Generator can be equipped with different fuel systems. Supply of district heating grids.

Thermal Power Stations (as Supplier for Power Stations up to medium industrial plant size)

Supply of Thermal Power Stations up to medium size, with all Turbine-based technologies, with fuels gas, oil, biomass or bio fuels, for the generation of electricity. Electricity subsequently can be used for cooling as well.

We supply as well the **Distributed Control System** with innovative process control based on mathematic algorithms and specially designed open- & closed loop controls; for fast load changes and stable closed-loop controls, easy operability and high automation degree.

Overview of Services

Consulting Engineer (Owner‘s Engineer)
Planning- and Executing Engineer
General Planer / EPCM-Contractor
Component-Supplier
Turn-key Supplier (EPC-Contractor)

HUTTER FREI POWER offers all Services in all project phases of our Products:

Analysis and Design (Project-Development Phase and Project-Pre-Planning-Phase)

- General Planning for Electrifications, Master Plans, Integrated Infrastructure Concepts, Site Investigations, Project Developments, Pre-Studies, Parameter Studies, Feasibility Studies, Environmental Impact Assessments, economic-technical Analysis, Plant Concept Designs, Preliminary Planning

Planning and Procurement (Project-Planning-Phase with Pre-Engineering)

- Overall Planning, Conceptual Planning, Permitting Studies, Execution Planning, Plant specification, Inquiry Specifications (ITT), Bid Evaluations, Contract Award Negotiations and -Recommendation, Contract Preparation, Pre-Engineering

Execution / Project Realisation from Order to Hand-over (Project-Execution-Phase)

- Project Management, Execution Planning, Interface Management, Supplier- & -Document Control, Factory Acceptance Test, Site Management, Overall Erection Management, Overall Civil Management, Commissioning Management, Environmental Health & Safety Coordination, Training, Acceptance Tests, Trial Run, Documentation, Warranty Support

Operation-Phase

- Operation- & Maintenance Supports, Plant Assessments, Modernisations, Environment-, Performance- and Efficiency Increases

General Consulting

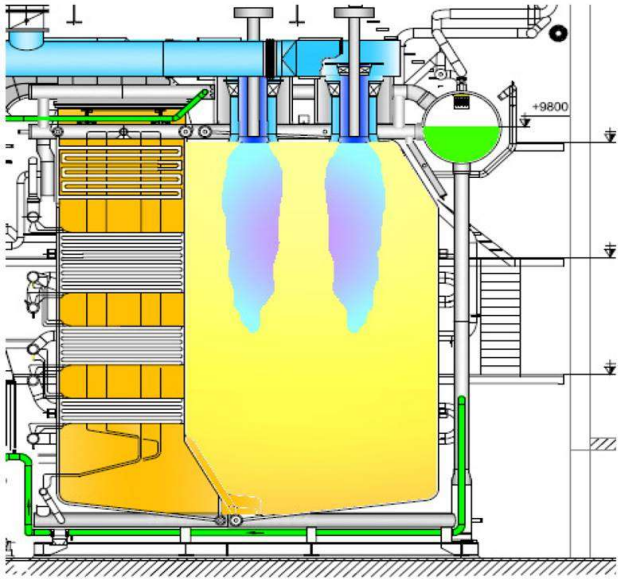
- Market Analysis, Project Developments, Project Financing, Lender's Engineer, Due Diligence, Portfolio Management for Energy Purchasing, Studies

Overview of Services

Detailed Component Design & Commissioning:

Steam Generators

- Detailed Design with preparation of Steam Generator Model
- Calculation with special Steam Generator calculation program
- Determination of heat exchanger configuration, geometry, material and heat exchanger type for all heat exchangers
  (incl. number of tubes, wall thicknesses, distances, etc.)
- Calculation of Thermal Calculations, Water Calculations
- Preparation of open-loop and closed-loop controls for Steam Generators
- Hot Commissioning of Steam Generators
- Performance Measurement of Steam Generators



Exhaust Gas System

- Detailed Design of GT Exhaust Gas Duct System with
  Special Dampers, Exhaust Gas Ducts, Exhaust Gas Impact Plate Diffusor, Expansion Joints

Rotary Kiln

- Detail design of Rotary Kiln with fittings, drive, bearings, inlet- and discharge casings

Overall Distributed Control System (DCS)

- Detailed Input for DCS application program with
  step sequence diagrams, logic diagrams, control schematics, system descriptions, failure reactions
- Commissioning of DCS application program

Each Plant is tailor-made and individually optimised for the Customer's Needs

Sequence for Design, Engineering and Purchasing

1. Step: Prepare overall cycle concept and overall heat balances

2. Step: Develop the optimal variant of the overall cycle according to the Customer needs (and with Gas Turbine CHP Stations select the most optimal suiting Gas Turbine)

3. Step: Prepare overall operation and control concept of the overall plant

4. Step: Prepare of Component-Specifications, inquire Supplier proposals and adjust them

5. Step: Supplier proposals with the technically necessary quality, competence and delivery schedule are evaluated according to economy, technology, competence, delivery schedule and opportunities / risks; The orders will be placed according to the comprehensive assessment of all criteria.

- the only in-depth standardisation is with the Gas Turbine;
  all other components are individually designed and purchased
- the competence and experience of the ENGINEER is the key for each individual project

Plant References of HUTTER FREI POWER

Summary of Plant References from HUTTER FREI POWER

Plant Type	No. of References		Smallest Plant		Largest Plant
CCGT CHP Stations	34	from	7.2 $MW_{el.}$; 26 t/h live steam; 25 t/h process steam	to	154 $MW_{el.}$; 400 t/h live steam; 388 t/h process steam
Gas Turbine CHP Stations	3	from	3 $MW_{el.}$; 10 t/h live steam; 12 t/h process steam	to	4 $MW_{el.}$; 12 t/h live steam; 12 t/h process steam
Steam Turbine CHP Stations	5	from	3 $MW_{el.}$; 10 t/h live steam; 12 t/h process steam	to	7 $MW_{el.}$; 70 t/h live steam; 68 t/h process steam
CCGT Power Stations	8	from	170 $MW_{el.}$; 190 t/h HP live steam; 42 t/h LP live steam	to	870 $MW_{el.}$; 540 t/h HP live steam; 640 t/h reheat steam; 95 t/h LP live steam
Steam Power Stations	3	from	3 $MW_{el.}$; 11 t/h live steam; 10 t/h reheat steam	to	700 $MW_{el.}$; 2000 t/h live steam; 1800 t/h reheat steam
Waste-to-Energy Plants	7	from	97'000 t/a waste; 46 t/h live steam; 10 $MW_{el.}$; 14 t/h steam extraction for external heat supply	to	360'000 t/a waste; 160 t/h live steam; 22 $MW_{el.}$; 80 t/h steam to CCGT; 60 t/h district heating steam
Waste Incineration Plants	8	from	80'000 t/a waste; 37 t/h live steam	to	360'000 t/a waste; 160 t/h live steam
Residue-to-Energy Plants	6	from	25'000 t/a Residues (Rejects); 2 Mio m^3/a Sewer Gas; 14 t/h live steam; 14 t/h process steam	to	120'000 t/a Residues; 9 $MW_{el.}$; 32 t/h live steam; 29 t/h reheat steam
District Heating Stations	11	from	20 t/h district heating steam	to	95 t/h district heating steam
Rotary Kiln Delacquering Plants	1	from	7.1 t/h UBC feedstock capacity	to	7.1 t/h UBC feedstock capacity

Plant References

- In addition to the plant references of HUTTER FREI POWER, our Employees have worked, as part of their previous Employers, in numerous further plant references in the sector of thermal power stations, turbine-based combined heat & power stations and steam generator plants, such as:
  - ABB POWER GENERATION, Switzerland
  - ALSTOM POWER, Switzerland
  - SIEMENS ENERGY, Germany
  - ABB Enertech, Switzerland
  - ABB Boiler Plants, Switzerland
  - SULZER THERMTEC, Switzerland
  - STONE & WEBSTER ENGINEERING Corp., USA
  - ESCHER WYSS, Switzerland
  - FICHTNER CONSULTING ENGINEERS, Germany
  - Pöyry AF Colenco, Switzerland

Excerpt from our Customers

- Egyptian Electricity Authority, Cairo, Egypt
- Swiss Federal Office for Energy, Bern, Switzerland
- Swiss Federal Office for the Environment, Bern, Switzerland
- Government of The Socialist Republic of the Union of Burma
- Paper- and Board Mill VAREL, Varel, Germany
- Board Mill BUCHMANN, Rinnthal, Germany
- Board Mill SMURFIT KAPPA; Obertsrot, Germany
- Paper Mill SMURFIT KAPPA EUROPA CARTON; Hoya, Germany
- Sirnac- Silopi Power Plant, Turkey
- Saline Water Conversion Corporation, Riyadh, Saudi Arabia
- Energy Supply Schwaben AG (EnBW), Stuttgart, Germany
- Isar Amper Werke AG, Munich, Germany
- Municipal Company Mainz-Wiesbaden AG, Mainz, Germany
- Bangladesh Power & Water Development Board, Dacca, Bangladesh
- Medina Electric Company, Jeddah, Saudi Arabia
- Makkah Taif Power Station, Taif, Saudi Arabia
- Korea Electric Company, Seoul, Korea
- Societé Nigerienne d'Electricité Niamey, Niger
- Electricity Corporation Riyadh, Saudi Arabia
- Municipal Company Ludwigsburg AG, Ludwigsburg, Germany
- Nederlandse Energie Ontwikkelings Maatschapij BV, Sittard, Niederlande
- Veba Oil AG, Gelsenkirchen-Buer, Germany
- Municipal Company Kassel AG, Germany
- Public Corp. for Electric Power, Aden, People's Democratic Republic of Yemen
- Government of Malaysia, Economic Planning Unit, Kuala Lumpur, Malaysia
- UPM Kymmene Oyi, Helsinki, Finland
- UPM Nordland Papier GmbH, Dörpen, Germany
- UPM Schongau GmbH, Schongau, Germany
- United Westphalian Electricity Company VEW, Dortmund, Germany
- Ministère du Plan, Cotonou, Benin, Africa
- Government of Morocco
- Elektroandina CCPP Tocopilla, Tocopilla, Chile
- Entsorgungsgesellschaft Mainz mbH, Waste-to-Energy Plant, Mainz, Germany
- EDELMAG S.A. Grupo CGE, Punta Arenas, Chile
- Meyr-Melnhof Gernsbach AG, Gernsbach, Germany
- Energy Service Westfalen Weser AG – Melitta, Minden, Germany

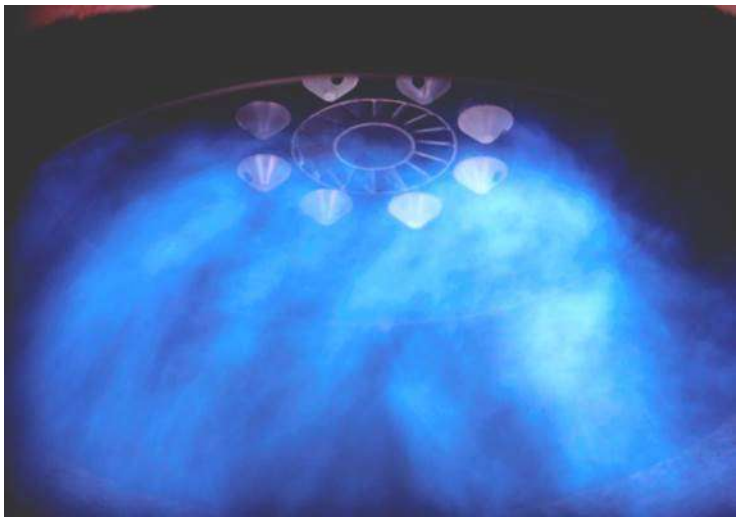
Three Combined Cycle CHP Stations SYSTEM HUTTER Varel 1, 2, 3

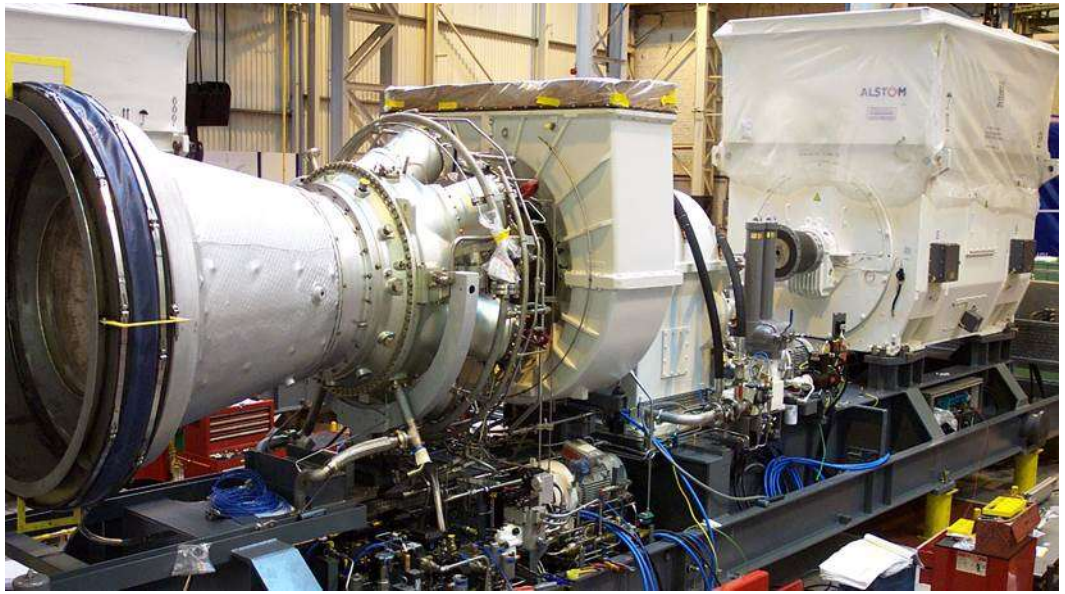
Three Combined Cycle CHP Stations SYSTEM HUTTER at the Paper and Board Mill Varel, Germany,

Varel 1; 1990; 266‘000 OH

Varel 2; 2003; 151‘000 OH

Varel 3; 2008; 115‘000 OH





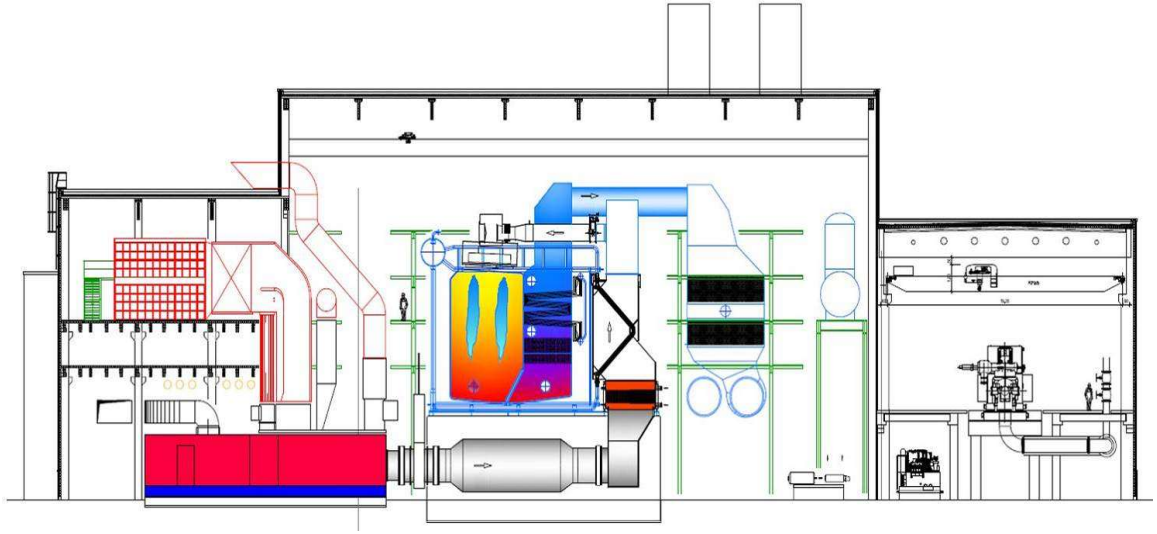
Product Descriptions and Reference Descriptions

- Further slides about the Product Descriptions and Engineering-Services of HUTTER FREI POWER, its advantages, its Customers & Operators and slides about the choice of combined heat & power station technology are included in the company presentation.
- Slides about our references are included in the presentation of references.

Examples of our Products:

Aluminium-Recycling for 8 & 11 t/h feedstock flow
with the new Generation of
Rotary Kiln Delacquering Plants:

Combined Cycle CHP Station SYSTEM HUTTER
in the example with a nominal live steam mass flow of
200 t/h with 45 MW Gas Turbine:



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