ANDRITZ

Environment & Process

Torrefaction

The “ACB Process” – a brief introduction

The ACB© Process – a brief introduction

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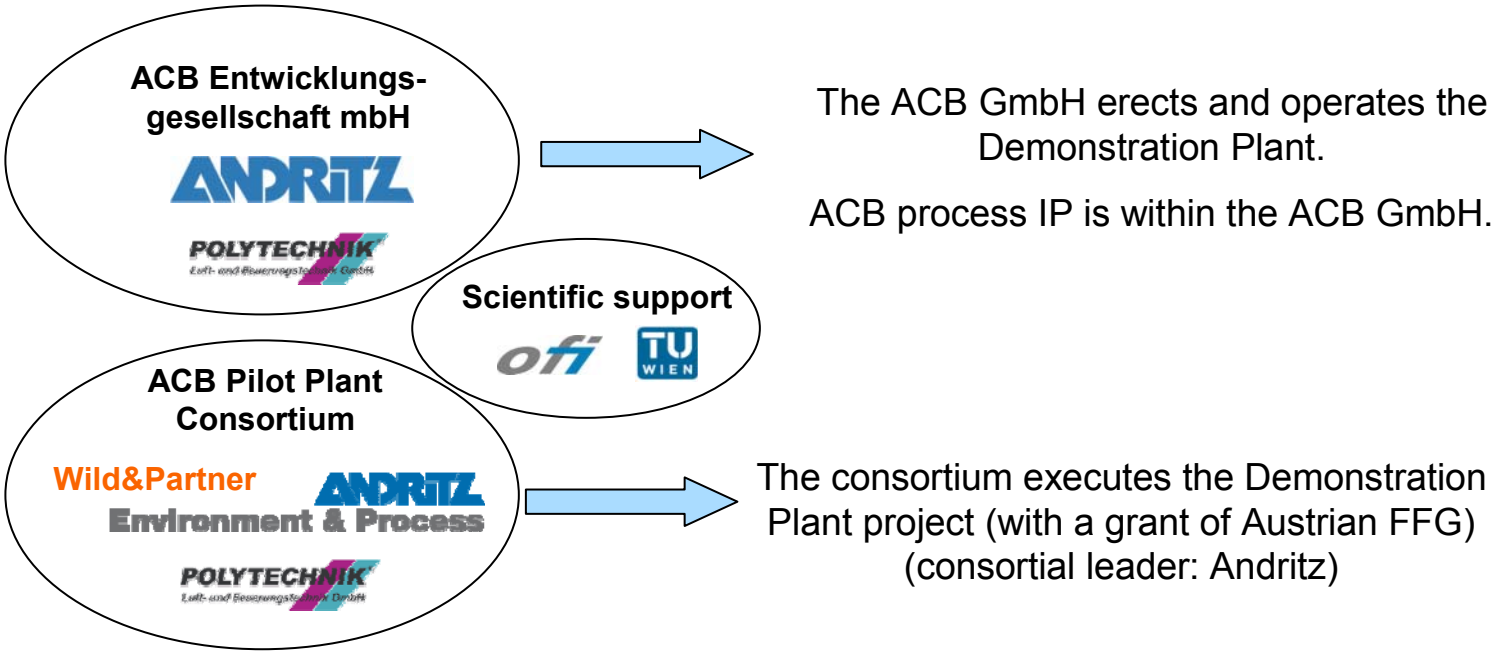
- ACB target and history of development
- The ACB process: main process steps
- Process Equipments
- ACB Demonstration plant in Frohnleiten

The ACB© Process – a brief introduction

ACB? Who is behind?

- **ACB .. Accelerated Carbonized Biomass =** Brandname © EBES GmbH

- **Development:**



- **Commercialization: Andritz has the exclusive rights for commercialization**

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ACB? Who is behind?

ANDRITZ Hydro

ANDRITZ Pulp & Paper

ANDRITZ Metals

ANDRITZ Environment & Process

ANDRITZ Feed & Biofuel

ACB Project Lead within Andritz: ANDRITZ Environment & Process

ANDRITZ ENVIRONMENT & PROCESS is one of the leading global suppliers of plants, equipment, and services for mechanical and thermal solid/liquid separation of sludges, suspensions and thermal drying of biomass.

The business area's field of activity covers design and manufacture of key components (centrifuges, filter presses, rotating filters, and plants for dewatering sludge, drying of biomass and sludge, sludge incineration), as well as erection and start-up of turnkey plants, including automation, safety engineering, and services.

Supplier of Pelletizing Equipment: ANDRITZ Feed & Biofuel

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ACB? Who is behind?




POLYTECHNIK®
Biomass Energy



POLYTECHNIK LUFT- UND FEUERUNGSTECHNIK GMBH is one of the most important suppliers of firing systems for biogenic fuels in the timber industry, and is famous for planning and providing turnkey systems and installations. The current export rate is about 95 %. worldwide.

The company offers these firing systems in a performance range from 300 kW – 20.000 kW (individual boiler output). Depending on the type and water content of the fuel, a variety of firing systems are used (underfeed system, underfeed-burn-out grate, and hydraulic grate system), with media carriers being warm water, hot water, steam, or thermal oil.

More than 2,300 Polytechnik systems are already in use worldwide.

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ACB target and history of development

Targets of ACB Process Development:

- Product Quality and Process Efficiency
- Process Robustness and Flexibility
- Process Safety
- Integration of industrially proven equipment from Andritz and Polytechnik

Targets of ACB Plant Development:

- Establish complete production-unit (ACB-Plant):

  IN: Fresh Biomass → OUT: densified, torrefied Biomassfuel

- ACB Plant includes also Energy Supply + waste gas utilizsation
- Design throughput / line: 50.000 t/a of torrefied pellets
- Feedmaterial: solid biomasses in widest range

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ACB target and history of development

Research Phase:

Successful proof of concept for torrefaction of biomass and pelletization of torrefied material

Demonstration phase:

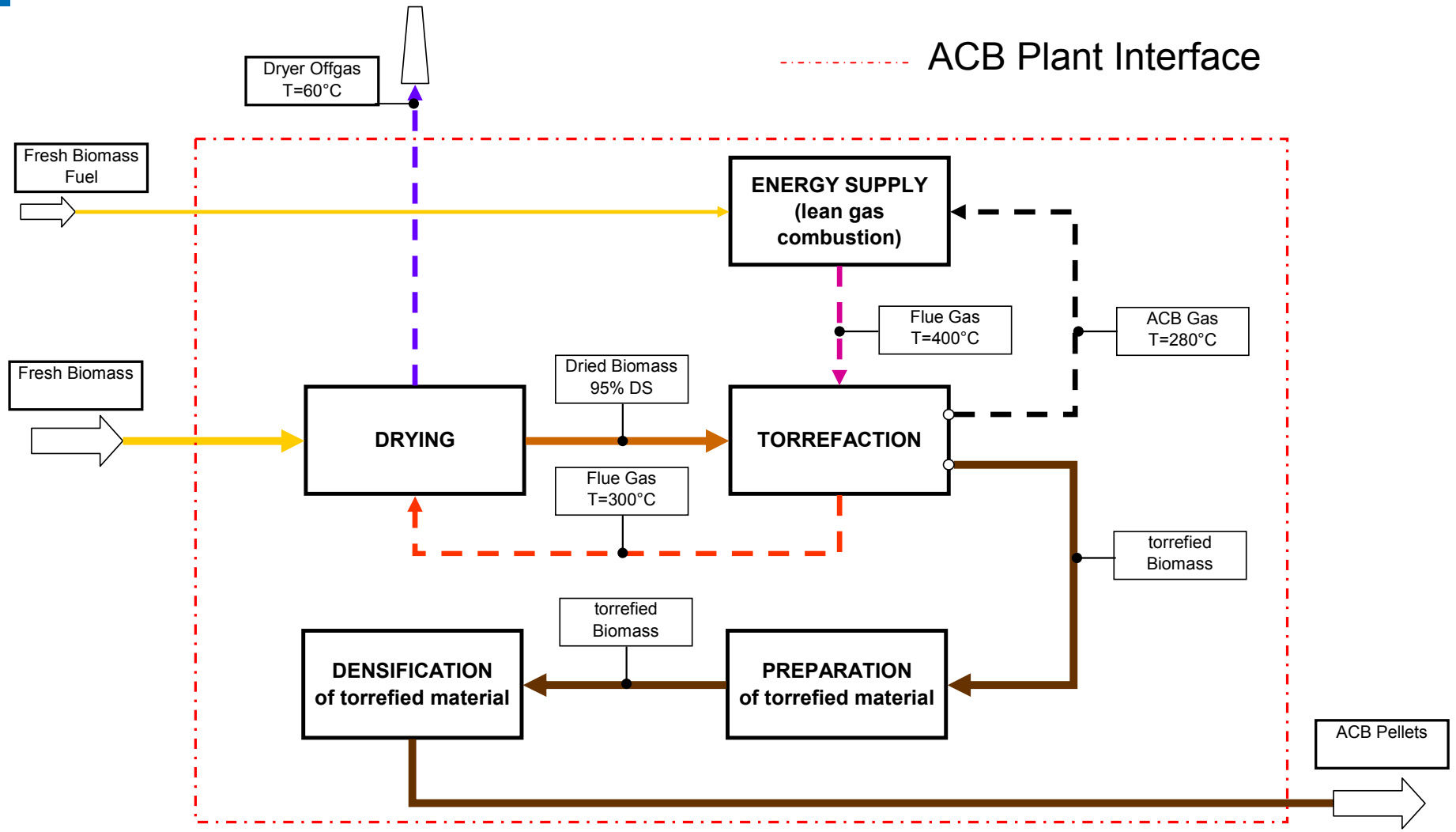
Upscaling of procedures and operations to industrial scale (50.000 mt/a); roll-out of first full-scale units

Maturity Phase:

Optimization of procedures and operations

The ACB© Process – a brief introduction

Main Process Steps



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Main Process Steps

Realization of main process steps:

1. Drying	Standard application for Andritz biomass drying solution. Use of Andritz belt dryer (BDS RD). Heat input is realized using precooled flue gas after torrefaction reactor.
2. Torrefaction	Torrefaction reactor necessities have been defined after extensive research work and trials with lab- and pilot scale equipment. Mechanical reactor design is based on existing drum drying system (DDS).
3. Energy Supply	Polytechnik grate firing systems used with modifications for incorporation of lean gas incineration. CFD modelling used to define necessary adaptions.
4. Preparation	Traditional size reduction, pre-conditioning and die/roller configuration as used for non-treated wood has shown positive results. Andritz Feed & Biofuel is working intensively on further developing process necessities.
5. Densification (=Pelletizing)	The torrefaction process has shown significant effect on pelletizing properties with e.g. a much higher energy input required compared to non-treated wood. Research, tests and pelletizing equipment configuration changes are pending in support of developing feasible industrial pelletizing solution for torrefied wood.

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Process Equipment

Step 1: Drying:

BDS Drying-Technology

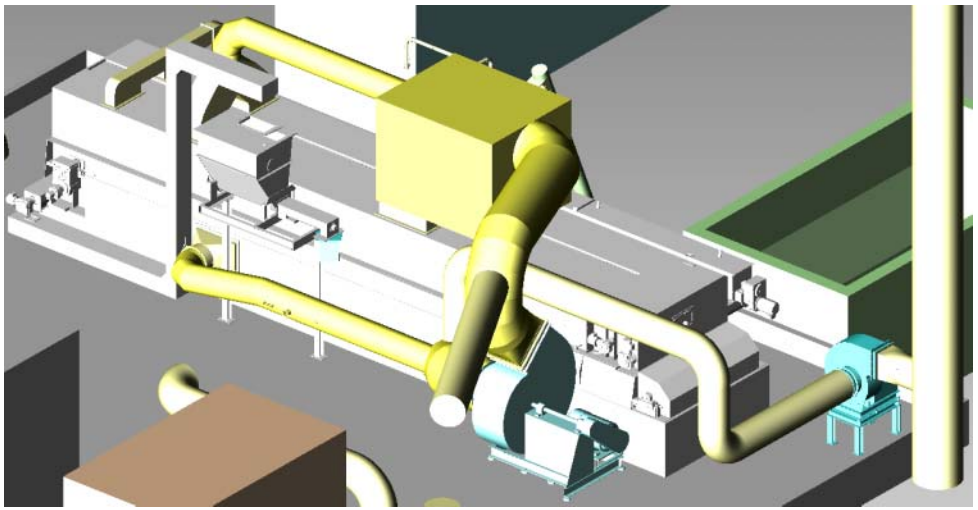
Closed loop belt dryer, directly heated with fluegas

-Utilization of waste heat after reactor

-Optimum efficiency (fluegastemperature approx. 60-70°C)

-Industrial approved technology

-worldwide 22 reference dryer for biomass and sewage sludge



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Process Equipment

Step 2: Torrefaction

Andritz Reactor Technology

-Rotating, indirectly heated drum-reactor.

-Retention time control via special drum internals

-Fluegas flow-pattern prevents condensation problems

-High flexibility in terms of allowable particle size (no clogging, channeling or increase in pressure-drop)

-Andritz sealing technology to prevent oxygen entrance

-Construction based on Andritz DDS

(Drum Drying systems **> 100 lines in operation worldwide)**

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Process Equipment

-Step 3: Energy Supply (lean gas combustion)

Polytechnik Firing Technology:

-Hydraulic reciprocating grate firing (1.500 kW)

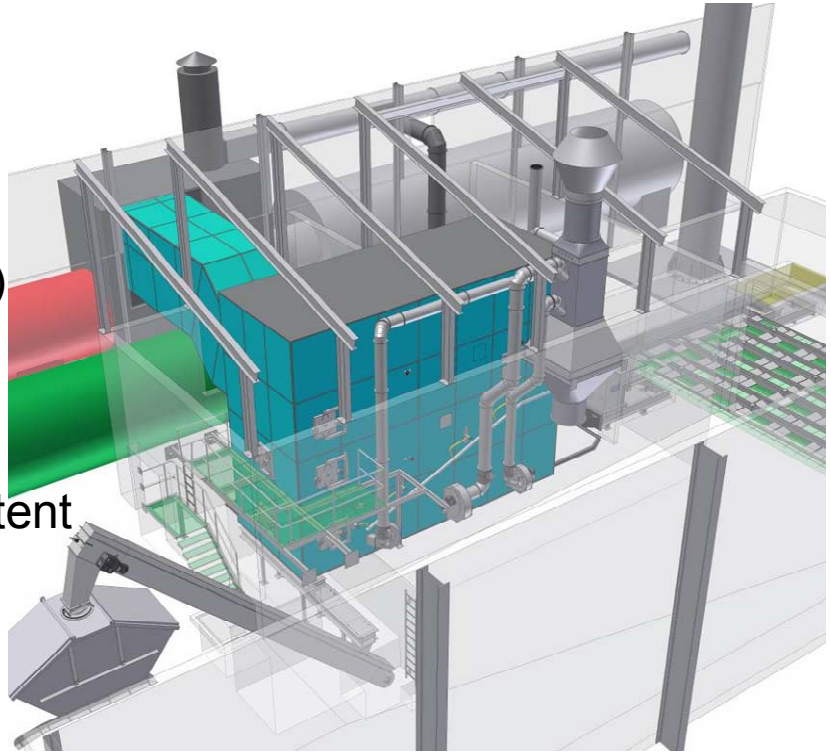
-New developed burner for hot lean gas (280 °C)

-maximum heat coverage from lean gas

-Additional fuel: wood chips 20 – 55% water content

-Long residual time for low emissions

-Mixing chamber for hot gas generation (400 °C)



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Process Equipment

Step 4: Preparation for densification

Andritz Cooling, Milling and Conditioning Technology

Cooling: Andritz cooling screw technology to efficiently cool torrefied material down to temperatures where torrefaction reactions are stopped and material is safe to handle

Size Reduction:
Andritz Hammermill (Multimill or Optimill) for appropriate size reduction

Conditioning: to activate remaining natural or additional binders by applying: Moisture / Retention Time / Heat

Andritz available conditioning equipment:

- Optimum mixing efficiency in CM conditioners
- Retention-time controlled operation in CRT conditioners

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Process Equipment

Step 5: Densification by Pelletizing

Andritz Pelletizing Technology:
Andritz pelletizing equipment offers state of the art machinery-basis to further develop feasible industrial pelletizing solution for torrefied biomass.

Andritz Pellet-Coolers:
Highly efficient air-cooler design for bulk material cooling.

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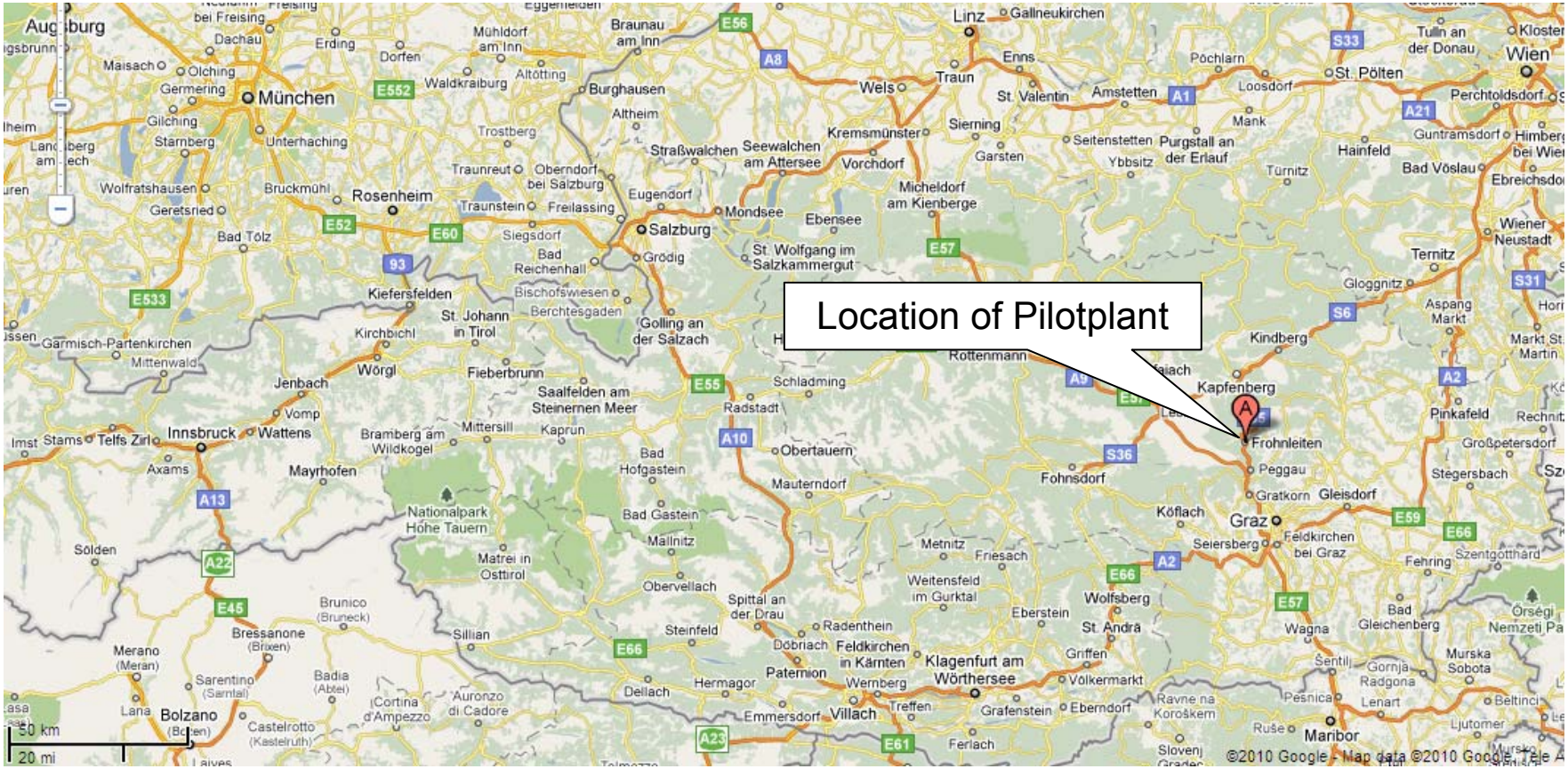
Demonstration Plant in Frohnleiten

ACB-Demonstrationplant project: Capacity: 1t ACB Pellets/h

- Location: ABEZ Frohnleiten: dump site close to Graz, Austria



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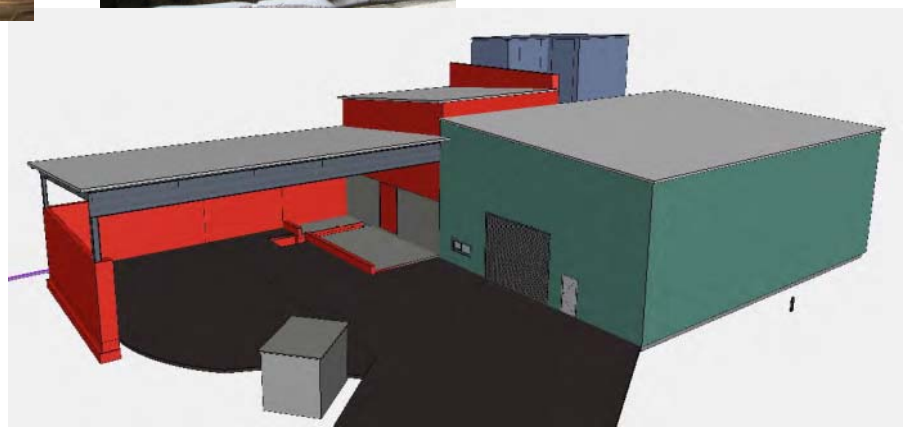
Demonstration Plant in Frohnleiten

ACB-Demonstrationplant project: Capacity = 1t ACB Pellets/h

- Existing Andritz sludge belt-dryer – will be modified for ACB requirements
- Existing building
- Existing logistics (feed bunker, product bunker, etc…)
- Existing permit



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Summary

Development Targets	Solutions
Product Quality	Product quality can be assured by use of a simple process concept but still application of sophisticated plant automation and control system.
Efficiency	Thermal utilization of waste gas streams, Low offgas temperature minimizes thermal losses!
Robustness, Flexibility and Availability	Flexibility in terms of particle size, approved mechanical design, no additional heat transfer medium, no gas/gas heat-exchange (fouling). Adequate Plant size for decentralized torrefaction projects.
Process-Safety	Risk Analysis for entire plant accomplished acc. to EN 14121 and machinery directive 2006/42/EC. Process design in accordance with ATEX regulations.
Use of proven equipment	All main equipments are of approved design or at least are based on existing equipment (Andritz or Polytechnik).

Andritz can offer a promising „turn key solution“ for production of torrefied biomass-fuel.

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END

Thanks for your attention!

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