

# Country report Austria

June 2019



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**University of Natural Resources and Life Sciences Vienna  
(BOKU)**

Photo: SYNCRAFT@Werk Beta / Mierschach / South Tyrol / Italy



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# Content

- Research organizations and projects
- Austrian companies active in thermal gasification
- Implementations

**froling**   
besser heizen

**HARGASSNER**   
HEIZTECHNIK DER ZUKUNFT

  
LOCK  
ÖKOENERGIE

**URBAS**  
stahl- und anlagenbau

 **SYNCRAFT**<sup>®</sup>  
Das Holzkraftwerk.

# Research organizations and projects

# Research organizations

Vienna University of Technology



## Project: CEMphos

- Recovery of phosphorus(acid) with universal applicability e.g. for the production of fertilizers with high safety standards and market acceptance
- A phosphorus recycling rate of 85% waste-free recycling of sewage and industrial sludge with minimum energy input
- Reuse of 100% iron and slag in cement production
- Work-up or low-volume landfilling of heavy metals

# Research organizations

Vienna University of Technology



## Project: Heat-to-Fuel

- Upgrading of alternative, residual biomass feedstock and **conversion of excess heat to liquid fuels** in a combined gasification, FT and aqueous phase reforming plant.
- a Horizon 2020 EU-funded project carried out by 14 partners from across Europe

### Aims:

- biofuel prices below €1 per liter. This is achieved by a 20% cost reduction in the biofuel production processes;
- Contribute to delivering goals of EU's energy security by increasing the share of local resources used for producing energy, and thus reducing EU's dependency of energy's imports;
- Prove the technological feasibility and economic worthiness of the concept acting as a catalyst of future industrial units.

# Research organizations

Vienna University of Technology



## Project: RenewableSteelGases

- Potential steel gases are converter gas, coke oven gas and blast furnace gas which differ by their compositions, particularly in terms of CO, CO<sub>2</sub>, H<sub>2</sub> and N<sub>2</sub> content.
- By integrating Power-to-Gas (PtG) in a steel plant, renewable power is used to produce hydrogen by water electrolysis, which is utilized for a subsequent methanation of the steel gases. Furthermore, a fluidized bed biomass gasification is integrated for the production of renewable H<sub>2</sub> and CO<sub>2</sub>.
- Steel gases are especially suitable for methanation in terms of their composition, their amount as well as their temporal availability, and the need for conditioning of these gases upstream the methanation have to be investigated.

# Research organizations



University of Natural Resources  
and Life Sciences, Vienna

**Institute of Chemical and Energy Engineering  
(IVET)**

**Since 1<sup>st</sup> January 2019 representative of Austria  
in the Task 33**

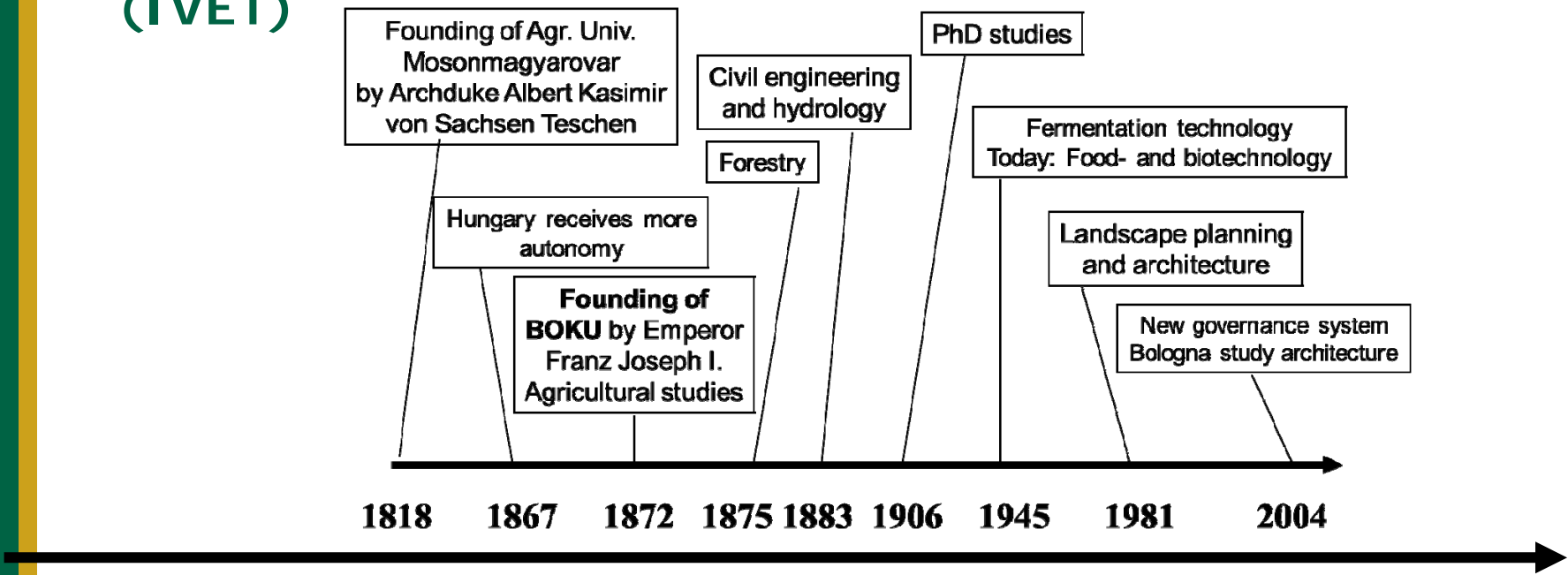


University of Natural Resources  
and Life Sciences, Vienna  
SCIENCES

# Research organizations

## University of Natural Resources and Life Sciences Vienna (BOKU Wien)

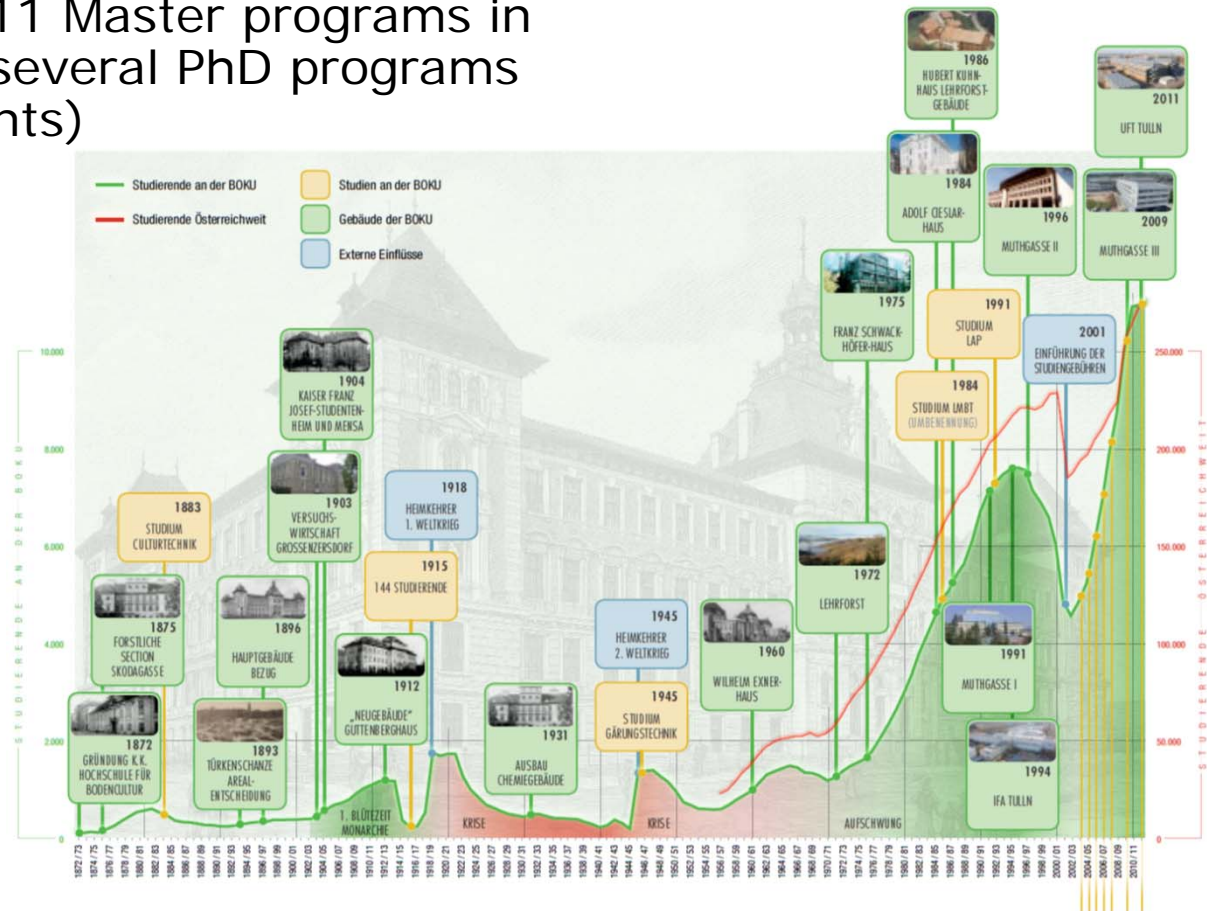
### Institute of Chemical and Energy Engineering (IVET)



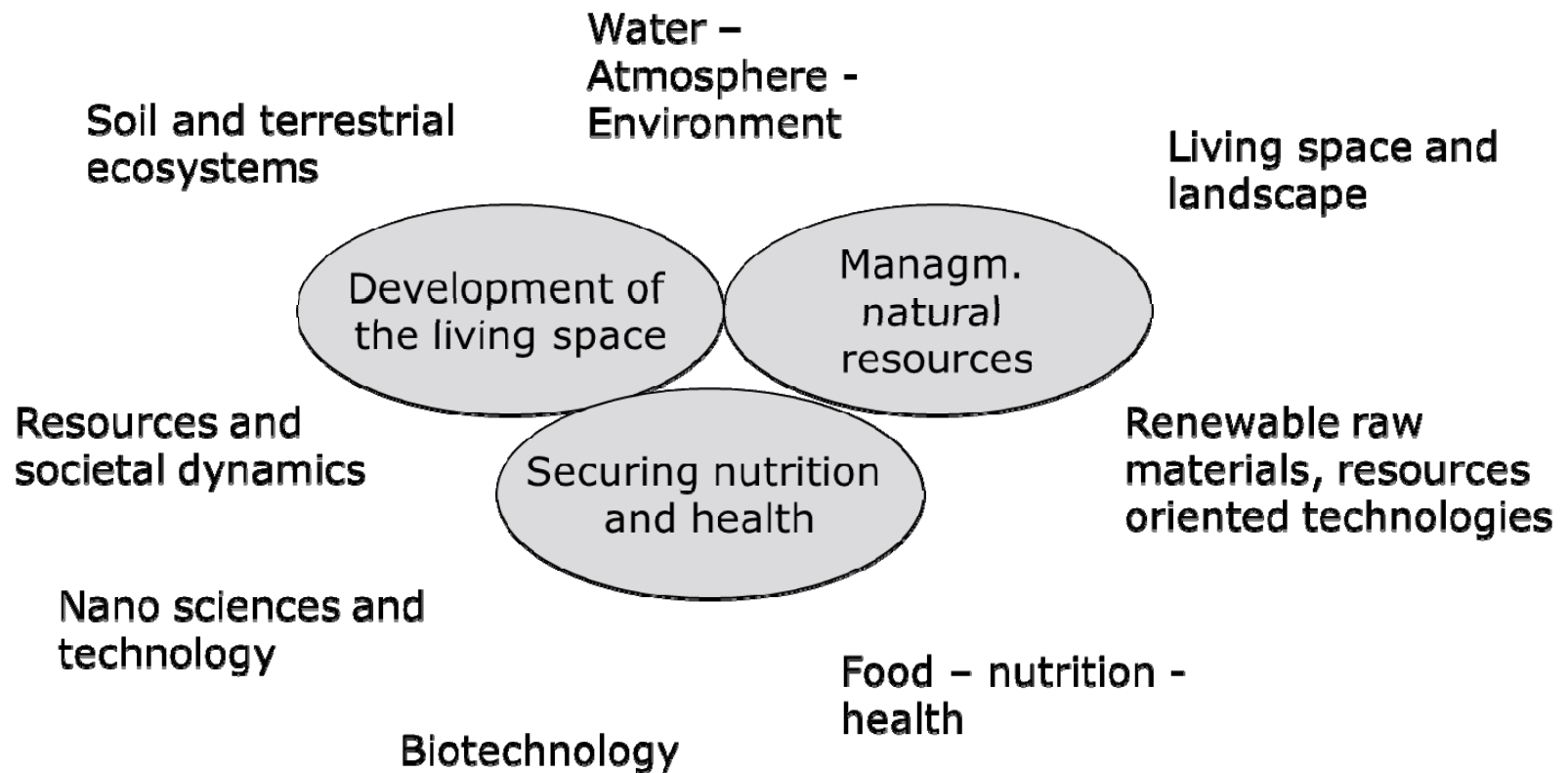


# Number of students

~ **13.000 students** in 8 Bachelor, 26 Master (+ several double degree programm; 11 Master programs in English) and several PhD programs (~ 800 students)



# BOKU themes



# BOKU departments

	Department für Materialwissenschaften und Prozesstechnik (Department of Material Sciences and Process Engineering)
	Department für Biotechnologie (Department of Biotechnology)
	Department Wasser-Atmosphäre-Umwelt (WAU) (Department of Water, Atmosphere and Environment)
	Department für Nanobiotechnologie (DNBT) (Department of Nanobiotechnology)
	Department für Chemie (Department of Chemistry)
	Department für Integrative Biologie und Biodiversitätsforschung (Department of Integrative Biology and Biodiversity Research)
	Department für Lebensmittelwissenschaften und Lebensmitteltechnologie (Department of Food Sciences and Technology)
	Department für Raum, Landschaft und Infrastruktur (Department of Landscape, Spatial and Infrastructural Sciences)
	Department für Wirtschafts- und Sozialwissenschaften (Department of Economics and Social Sciences)
	Department für Nachhaltige Agrarsysteme (Department of Sustainable Agricultural Systems)
	Department für Bautechnik und Naturgefahren (Department of Civil Engineering and Natural Hazards)
	Department für Wald- und Bodenwissenschaften (Department of Forest- and Soil Services)
	Department für Angewandte Pflanzenwissenschaften und Pflanzenbiotechnologie (Department of Applied Plant Sciences and Plant Biotechnology)
	Interuniversitäres Department für Agrarbiotechnologie, IFA-Tulln (Department of Agrobiotechnology / IFA Tulln)
	Department für Angewandte Genetik und Zellbiologie (DAGZ) (Department of Applied Genetics and Cell Biology)

# Research organizations



University of Natural Resources  
and Life Sciences, Vienna

**University of Natural Resources and Life Sciences  
Vienna (BOKU Wien)**

**Department of Material Sciences  
and Process Engineering**

- Institute of Wood Science and Technology
- Institute of Physics and Materials Science
- Institute of Chemical and Energy Engineering
- Institute of Molecular Modeling and Simulation

# Institute of Chemical and Energy Engineering

Research Group  
Process  
Engineering of  
Renewable  
Resources

Christoph Pfeifer



Research Group  
Thermal Process  
Engineering

Martin Wendland



Research Group  
Energy Technology  
and Energy  
Management

Tobias Pröll



# Research

- Process Engineering of Renewable Resources
  - Fluidized bed pyrolysis/gasification/combustion of low grade feedstocks
  - Biochar/hydrochar production
- Thermal Process Technology
  - Feedstock preparation and product purification
- Energy Technology and Energy Management
  - Energy Efficiency in Buildings and Industry
  - Innovative Heat Grids and Waste Heat Recovery
  - Fluidized Bed Systems
- Research methodology: experimental work in bench-scale units accompanied by modelling and simulation

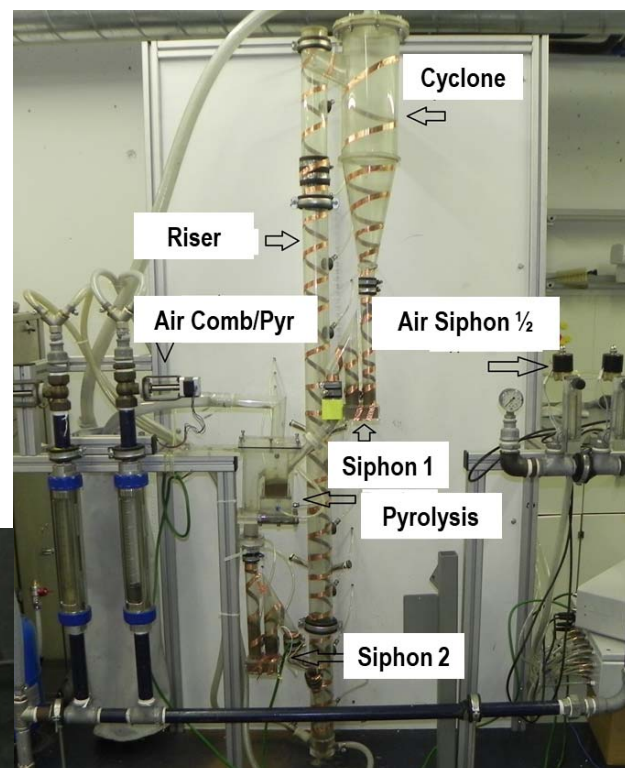
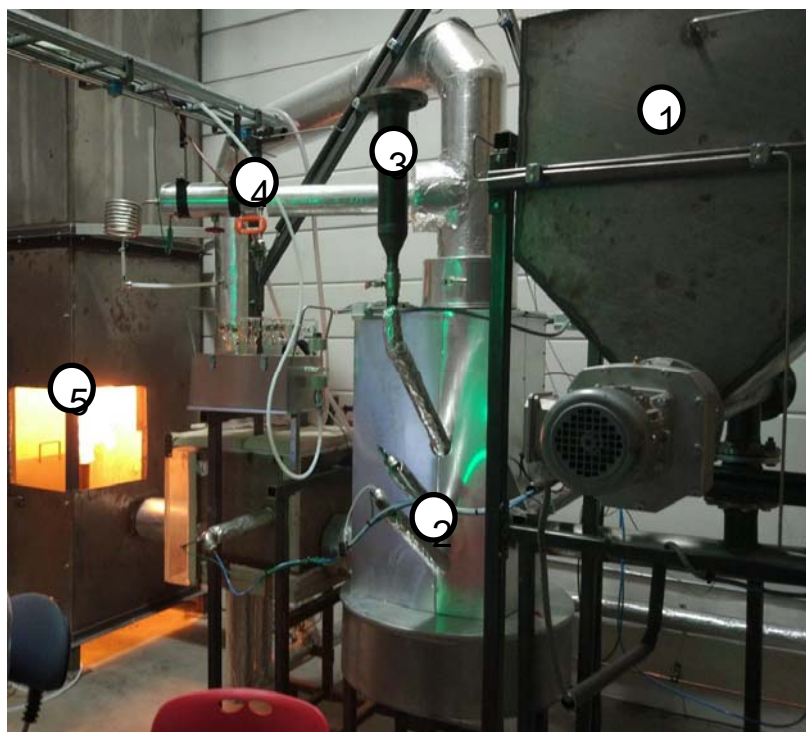


# Methodology/tools

- Cold flow models of fluidised beds
- Lab scale/pilot scale plants for new technologies
- Simulation tools
  - mass- and energy-balances/process design - simulation software IPSEpro
  - CFD - simulation software Fluent
- Thermogravimetric analysis (in cooperation with the Institute of Waste Management)
- Fuel analysis – CHN analyser, ash melting microscope, bomb calorimeter, ...
- Industry cooperation/support
  - Process optimisation
  - Mobile analytics (gas compositions, etc.)



# Impressions





# Research organizations



University of Natural Resources  
and Life Sciences, Vienna

## University of Natural Resources and Life Sciences Vienna (BOKU Wien)

### Project: BioAdd

Gasification/combustion of adddivated biomass –  
additives are used to avoid microbiological degrading

### Project: Flash

Determination of ash melting behavior (ash melting  
temperature, ash viscosity) for high temperature  
gasification

# Research organizations

**Graz University of Technology**  
**Institute of Thermal Engineering**



Projects areas:

- Combustion and gasification
- CFD-simulations
  - reactive fluid flows
  - solar thermal processes
  - extrusion and injection molding (polymers)
  - thermal Management
- Thermo-dynamical process simulation
- Fluidized bed combustion
- Second Generation Fuels and fuel cells
- CO<sub>2</sub>-free gas- and coal-burning power plant

# Research organizations



**MCI – University of Applied Sciences for Environmental-, Process- and Biotechnology, Innsbruck**

Projects areas:

- Multi-staged fixed bed gasification systems
- Valorization of biomass
- Biomass to power and heat
- Engine & emissions
- Energy distribution and storage

# Research organizations

bioenergy2020+

(Locations in Güssing and Wieselburg)

Projects areas:

- Product gas production/treatment/utilization
- Process development and optimization
- Measuring and analysis technology
- Fundamental R&D on ashes and bed materials
- 1<sup>st</sup> and 2<sup>nd</sup> generation biofuels
- Representative of Austria in IEA Bioenergy Task 39 liquid biofuels
- Secretary of IEA Advanced Motor Fuels
- ExCo member in IEA Bioenergy (Dina Bacovsky)
  
- Relocation of infrastructure from Güssing to Vienna planned

# Research organizations

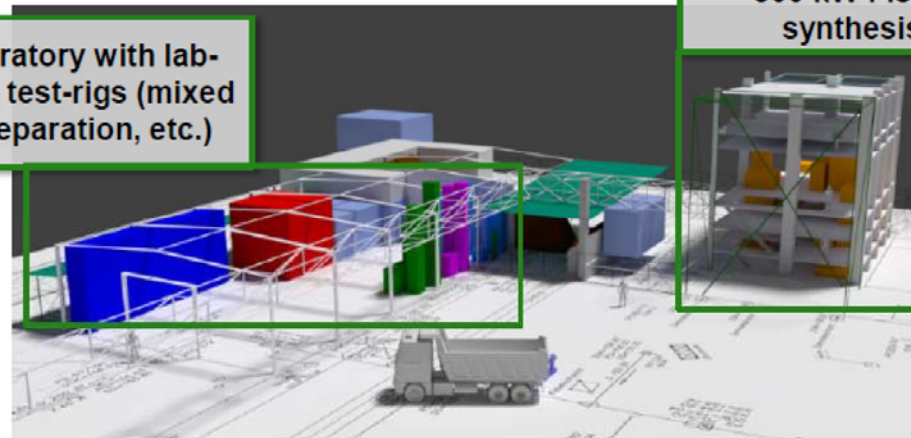
bioenergy2020+

## 1 MW DFB gasification + synthesis: Waste2Value

New research location at industrial site *Simmeringer Haide*

1 MW DFB gasification demonstration plant (improved reactor design) + 300 kW Fischer-Tropsch synthesis pilot plant

Research laboratory with lab-scale synthesis test-rigs (mixed alcohols, H<sub>2</sub> separation, etc.)



COMET

Competence Centers for  
Excellent Technologies

# Research organizations

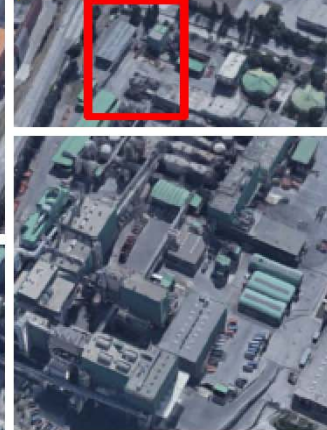
bioenergy2020+

## Waste2Value development at industrial-site

Waste sorting/  
waste recovery



Waste2Value  
demonstration



Waste water treatment

Waste incineration  
(fluidized bed reactors,  
Rotary kilns)



**Waste2Value  
demonstration:**

- DFB gasification of waste and residues
- Fischer-Tropsch
- H<sub>2</sub> production
- Methanation
- Mixed alcohols
- Burnable gas for direct substitution of fossil fuels
- etc.

# Austrian companies

# Austrian companies

**ANDRITZ ENERGY & ENVIRONMENT GmbH**  
([www.andritz.com](http://www.andritz.com))



- Energy and environmental systems, fluidised bed gasifiers, biomass-handling systems
- Steam and power generation
- Patent owner of FICFB gasification
- Involved in Skive (over Carbona)



# Austrian companies

## Aichernig Engineering GmbH (former REPOTEC)

(<http://www.repotec.at>)

- Engineering of FICFB gasifiers for CHP, BioSNG and other synthesis (Güssing, Ulm, Göteborg)

## REPOTEC – Aichernig Engineering and TOYO Energy Solution managed to cooperate as partners:

- REPOTEC – Aichernig Engineering is providing the technology and contributes it's comprehensive experience at every project step, TOYO Energy Solution is in charge of acquiring and developing each project
- erecting of the first plant in Wajima area, Japan in 2018



repotec  
renewable power technologies

# Austrian companies

## GET- Güssing Energy Technologies (get.ac.at)



- Research, consulting and engineering
- CHP
- Synthetic biofuels
- Heating & cooling
- Domestic installations
- Education Centre (since 2006 in cooperation with Vienna University of Technology)

# Austrian companies

## Güssing Renewable Energy

<http://www.gussingrenewable.com>



A cosmopolitical managed enterprise aiming at the global market, offering customized instantly usable CO<sub>2</sub>-neutral solutions all over the world

- Nongbua (Thailand) gasification facility



# Austrian companies

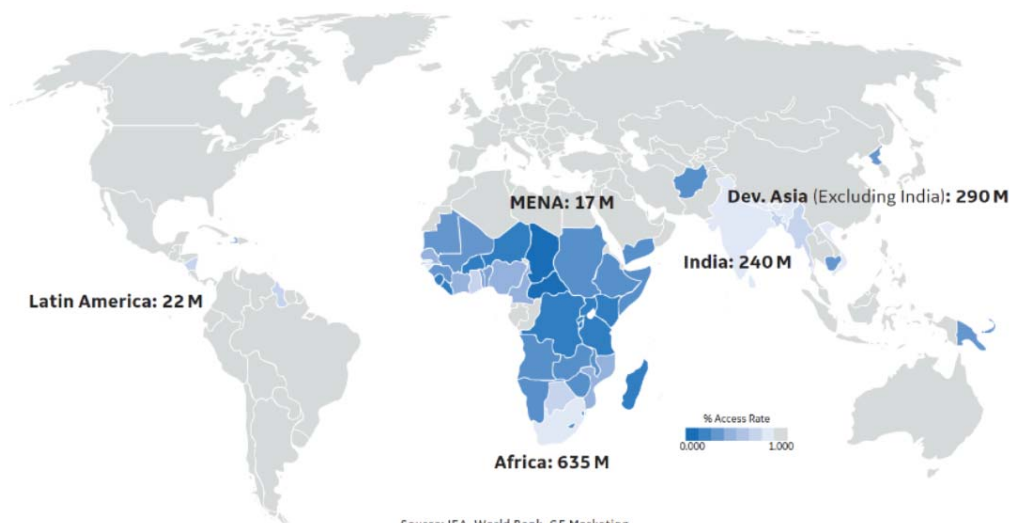
**GE Jenbacher Energiesysteme AG**



(<https://information.jenbacher.com/index.php>)

- Gas engines

**PEOPLE WITHOUT ELECTRICITY TODAY**



# Austrian companies

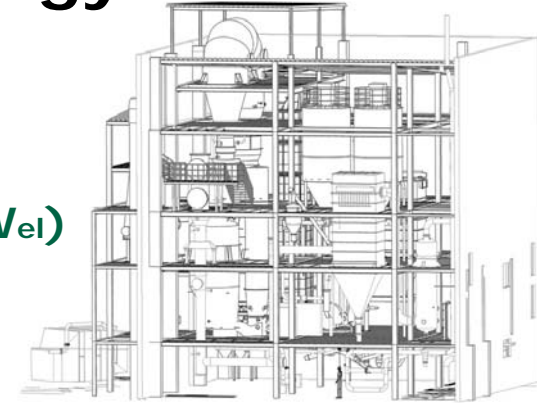
## Small scale fixed bed gasification



# Implementations

# Implementation – DFB technology

- Senden/Ulm, Germany (14 MW<sub>fuel</sub>, 5 MW<sub>el</sub>)
- ? (CR Germany)
- Gaya, France
  - 0,5 MW<sub>fuel</sub>
  - BioSNG R&D
  - commercial operation in 2023
- Nongbua, Thailand
  - (4 MW<sub>fuel</sub>, 1 MW<sub>el</sub>)
- Demoplant in Daigo, Japan
  - (4 MW<sub>fuel</sub>, 1 MW<sub>el</sub>)



Source: REPOTEC



Source: projetgaya.com



Source: Gussingrenewable.asia



# Güssing Renewable Energy



## Gasification plant in Nongbua, Thailand

**In commercial operation since 16<sup>th</sup> January 2019**



# Güssing Renewable Energy



GP Energy has completed entire supply of Double Fluidized Bed Gasifier for Edison Power at Diago, Japan. Installation work is in progress at full swing.



**Commissioning**  
Q3 2017

**Feedstock**  
Biomass



Fuel Power  
4 MW



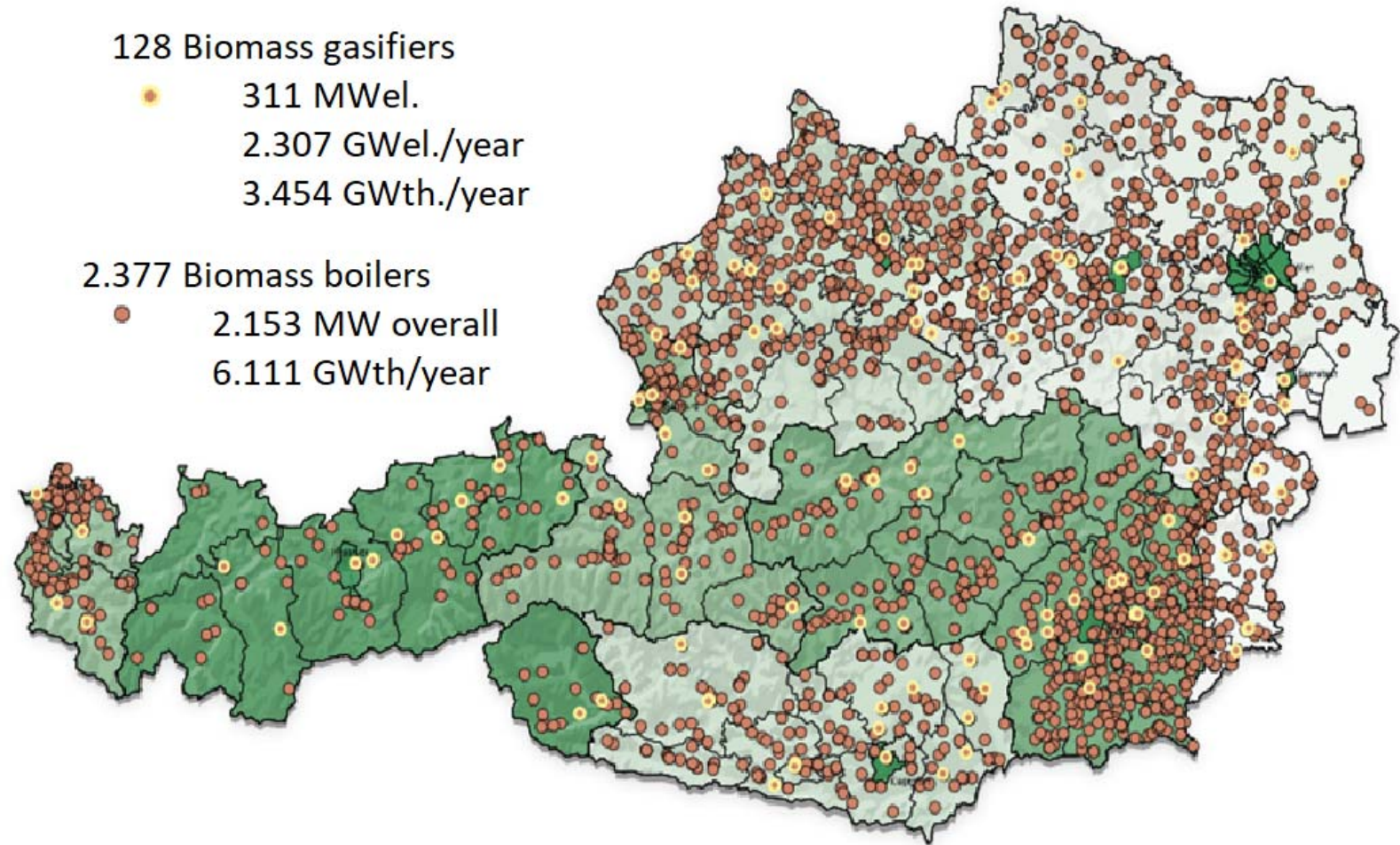
Electric Energy  
1.2 MW



Thermal Energy  
1.5 MW

**DFB facility in Japan under construction**

# Implementations – small scale gasification



Source: biomasseverband.at

# Implementation – small scale gasification



<b>Power output</b>	<b>kW</b>	<b>49/51</b>
<b>Heat output</b>	<b>kW</b>	<b>~ 107</b>
<b>Feedstock (wood chips) consumption by 6000 op.hours</b>	<b>t</b>	<b>300</b>
<b>Overall efficiency</b>	<b>%</b>	<b>~83</b>
<b>Power efficiency</b>	<b>%</b>	<b>~27</b>

<b>Biowaerme Grabner Wenigzell, AT</b>	<b>Initially 3 facilities In 2016 4th facility Over 8.400 operating hours per year</b>
<b>Fernwaerme und Brennholztrocknung Suhodolnik, SI</b>	10 facilities in operation
<b>Osserhotel Silbersbach, DE</b>	Since 2014 – 1 facility in operation
<b>Fernwaerme Jennersdorf</b>	District heating + 200 kW electricity
<b>Molzbachhof Kirchberg am Wechsel</b>	Heating for hotel and school 2 facilities – 100 kWel + 200 kWth





## Implementation – small scale gasification



Location	Type	Output gasification unit
BEVZ GmbH Kirchberg an der Raab	2 x GGV 1.7 Prototypes & 1 x GGV 1.7 Series maschine	54 kWel 132 kWth
Mayer GmbH Zeltweg, Murtal	2 x GGV 1.7	36 kWel 88 kWth
Biowärme Lassnitz Steirisch Lassnitz. Murau	1 x GGV 2.7	55 kWel 125 kWth
FM Holzstrom GmbH St. Lambrecht, Murau	2 x GGV 2.7	110 kWel 250 kWth
Heizwerk Fritzer Sirnitz, Feldkirchen	3 x GGV 2.7	165 kWel 375 kWth
Kirchheimerhof Bad Kleinkirchheim Spittal an der Drau	1 x GGV 2.7	55 kWel 125 kWth
Regionalwärme St. Margareten St. Margareten in Rosental	1 x GGV 1.7	18 kWel 44 kWth
Heim AG-Fischer Schleitheim- Schaffenhäusern, Switzerland	1 x GGV 1.7	18 kWel 44 kWth
Haffhus GmbH Hotel und Ferienanlage, Ueckermünde, Germany	1 x GGV 1.7	18 kWel 44 kWth

GGV 1.7	GGV 2.7
<b>18 kWel./44 kWth output</b>	<b>55 kWel. /120 kWth output</b>
<b>19 kg/h chips consumption</b>	<b>50/60 kg/h chips consumption</b>
<b>400 V/50 Hz el. output</b>	<b>400 V/660 Hz el. output</b>
<b>Max. 90°C thermal output</b>	<b>Max. 90°C thermal output</b>
<b>5.209 x 2.221 x 2.620 mm dimensions</b>	<b>5.000 x 2.700 x 3.400 mm dimensions</b>



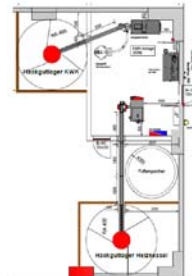
**About 15 facilities in operation, further facilities under construction**

## Implementation – small scale gasification



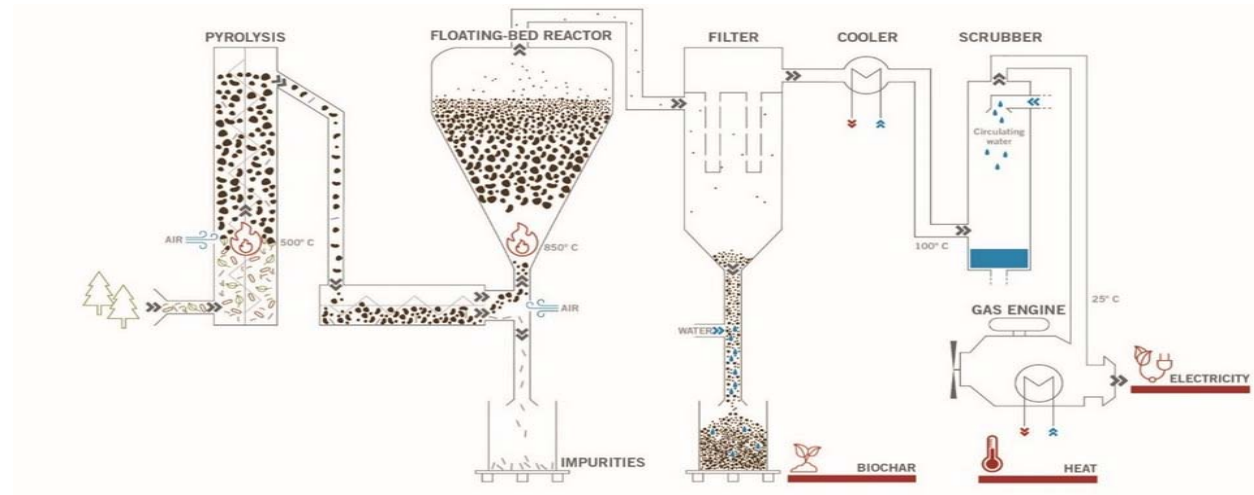
### Now 6 reference facilities in operation:

- Local heating Weng im Innkreis (since 2017)
- Farming Enterprise Schönauer (Salzburg, since 2018)
- Farming Enterprise Eblinger (NÖ, since 2018)
- Farming Enterprise Hubinger (OÖ, since 2018)
- Local heating Dellach (Kärnten, since 2019)
- Farming Enterprise Fuchsgruber (Bayern, since 2018)



**5-10 further projects in planning/construction**

# Implementation – small scale gasification



- Floating fixed bed technology
- The charcoal makes the difference – considerable additional earnings due to valuable product

**Now 7 facilities in operation and  
8 facilities under construction/commissioning**



CraftWERK 1000-300 / Innsbruck / AT  
Commissioned early 2017; produces 261kW power and 601kW heat. Delivered including low-temperature heat utilisation and dryer.



CraftWERK 2x CW 1800-400 / Laas / IT  
Commissioned end of 2018; produces 800kW power and 1.230kW heat. Powers with 2 gasifiers 1 gas engine Typ Jenbacher 420.



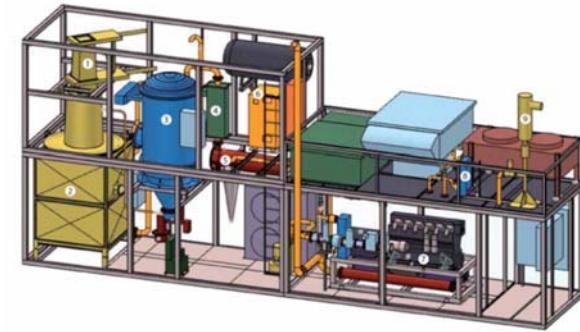
CraftWERK CW 700-200 / Dornbirn / AT  
Commissioned end 2014; produces 220kW power and 500kW heat. Delivered with 185kW power. Low-temperature heat utilisation retrofitted 2016.



CraftWERK CW 4x1800-500 / Shingu / JP  
First 4-units plant designed for the Japanese market. Commissioning 2019/2020; 1,76MW electric capacity. Scope of supply: from dryer to gas engines.

# Implementation – small scale gasification

**URBAS**  
stahl- und anlagenbau



Over 30 facilities in operation all over the Europe

**CHP PLANTS**

**Bioenergy Topolcany s.r.o.**

COUNTRY: Slovakia

OUTPUT: 2 x 18 t/h + 8.1 MW<sub>e</sub>

PRESSURE: 78 bar

TEMPERATURE: 520 °C

EXTRACTION: max. 31,000 kW



**URBAS**  
energie-technik

**Plymouth Bio-  
Eggenham Power Plant**

COUNTRY: France

OUTPUT: 20.5 t/h + 5.5 MW<sub>e</sub>

PRESSURE: 48 bar

TEMPERATURE: 520 °C

EXTRACTION: max. 14,500 kW



**Heulin Bio Energie**

COUNTRY: France

OUTPUT: 54.5 t/h + 13 MW<sub>e</sub>

PRESSURE: 48 bar

TEMPERATURE: 520 °C

EXTRACTION: max. 12,000 kW



**Bioenergiezentrum GmbH  
Lindenberg Power Plant**

COUNTRY: Austria

OUTPUT: 28 t/h + 5 MW<sub>e</sub>

PRESSURE: 78 bar

TEMPERATURE: 540 °C

EXTRACTION: max. 30,000 kW



**Soleis du Limousin**

COUNTRY: France

OUTPUT: 18.5 t/h + 5.5 MW<sub>e</sub>

PRESSURE: 48 bar

TEMPERATURE: 520 °C

EXTRACTION: max. 14,000 kW



**Cransul Invest Group  
Planques Power Plant**

COUNTRY: Latvia

OUTPUT: 20.5 t/h + 4 MW<sub>e</sub>

PRESSURE: 78 bar

TEMPERATURE: 520 °C

EXTRACTION: max. 14,000 kW



*Thank you for  
your attention*

[www.ieabioenergy.com](http://www.ieabioenergy.com)  
[www.task33.ieabioenergy.com](http://www.task33.ieabioenergy.com)

IEA Bioenergy



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