

20 years of RD&D experience with the dual fluidized bed steam gasification concept

Walter Haslinger

Bolzano, December 2 2016







Our vision

Our overall vision is to become

- a world leader in biomass to energy research
- a leading member of the biobased economy community









3 locations + 2 research sites >15 years of experience



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Company structure and shareholders

- BIOENERGY 2020+ GmbH
- Mostly public shareholders
- Biggest individual shareholder: Association of industry partners



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Concept and development of the dual fluidized bed (DFB) steam gasifier

Looking back ...







Concept of the dual fluidized steam gasification









Development of the DFB concept and R&D facilities







Development of the DFB concept and R&D facilities





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Layout of the Güssing DFB biomass gasification plant







Availabiltiy of the Güssing DFB biomass gasification plant: ~100.000 h of demo operation







Commercial dual fluidized bed steam gasifiers

Location	Usage / Product	Fuel / Product MW, MW	Start up	Supplier	Status
Güssing, AT	Gas engine	8.0 _{fuel} / 2.0 _{el}	2002	AE&E, Repotec	End of demonstration life time reached
Oberwart, AT	Gas engine / ORC / H ₂	8.5 _{fuel} / 2.8 _{el}	2008	Ortner Anlagenbau	On hold
Villach, AT	Gas engine	15 _{fuel} / 3.7 _{el}	2010	Ortner Anlagenbau	On hold
Senden/Ulm, DE	Gas engine / ORC	14 _{fuel} / 5 _{el}	2011	Repotec	Operational
Burgeis, IT	Gas engine	2 _{fuel} / 0.5 _{el}	2012	Repotec, RevoGas	On hold
Göteborg, Sweden	BioSNG	32 _{fuel} /20 _{BioSNG}	2013	Repotec/ Valmet	Operational
California	R&D	1 MW _{fuel}	2013	GREG	Operational
Gaya, France	BioSNG R&D	0,5 MW _{fuel}	2016	Repotec	Under construction
Thailand	Gas engine	4 _{fuel} / 1 _{el}	2016	GREG	Under construction



Selected highlights and status of ongoing research activities

That's where we are ...





Research along the process chain



Performance and long term tests / maintenance

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Cold flow modelling to overcome operational problems and support scale up



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The new design concept: G-Volution

- ZONE **Basification** Combustion zone Bolzano, December 2 2016
- lesser limitations in scale up, as there is no stationary fluidized bed anymore
- excellent gas-solids contact between catalytic bed material and product gas → lower tar content
- increases of residence times for fuel particles as well as gases with regard to gas-solids interaction
- solids residence time distribution resembles a cascade of stirred vessels (dispersed downward movement of solids)
- 100 kW pilot plant at Vienna University of Technology in operation
 - 250 kW pilot plant with improved feedstock flexibility planned for Güssing site of BIOENERGY 2020+ foreseen for late 2017





Alternative bed materials – investigating the catalytic activity of relevant materials

- Fresh olivine
- Fresh quartz
- Used olivine (from long-term operation in industrial biomass gasification plant)
- Used quartz (from long-term operation in industrial biomass combustion plant)
- Calcium oxide (benchmark)
- Simplified results
 - Correlation between WGS and steam reforming reactions
 - Catalytic activity assigned to layer formed independently of original particle



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H₂ production within a polygeneration concept based on the DFB biomass gasification

Concept



- Main findings
 - Simple process based on state of the art unit operations yielding
 - H₂ with a purity of 99.9 % at a specific production rate of 30 g kg⁻¹ biomass
 - Valuable off-gas with a LHV of 7.9 MJ m⁻³











Scheme and status of biomass to FT-products









Mixed alcohol synthesis lab-scale process chain







Summary and conclusions

- The dual fluidized bed steam gasifier (the "Güssing" gasifier) has been the most successful biomass gasification demonstration project worldwide
- This success was only possible due to
 - Fundamental research performed at Vienna University of Technology
 - The willingness of industry to invest into the new technology
 - The availability of investment support from public funds and long-term oriented structural research funding (Knet, Kplus and COMET)
- Today's research mostly aims at
 - Technology development towards an extension of the feasible feedstock quality and feedstock sources
 - Improving the economics of the operation of the gasifier
 - Exploring and scale up of downstream syngas processes towards higher value products







Key partner



Other scientific partners





- GUSSING repotec Industry partners RENEWABLE ENERGY SWU Unipetrol **IR LIQUIDE** mondi Stadtwerke Ulm/ Neu-Ulm GmbH **SWU** Creative Oxygen CLARIAN. ALBEMARLE[®]
- Funding partners and programs com≦t

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Thank you

Further information and contacts

DI Dr Walter Haslinger

walter.haslinger@bioenergy2020.eu, Tel +43 7416 52238-20

DI Dr Reinhard Rauch, Area Manager Biomass Gasification Systems

<u>reinhard.rauch@bioenergy2020.eu</u>, Tel +43 3322 42606-152

DI Matthias Kuba, Head of Unit Gasification

matthias.kuba@bioenergy2020.eu, Tel. +43 3322 42606-156

DI Gerald Weber, Head of Unit Syngas Processes

gerald.weber@bioenergy2020.eu, Tel. +43 3322 42606-154