IEA Bioenergy
Technology Collaboration Programme

Country report Austria 2021

Research activities on thermochemical gasification

IEA Bioenergy: Task 33

January 2022

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Research activities on thermochemical gasification

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Image 1. page – source Biomasseverband Österreich

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Abstract

This country report Austria focuses on research activities on thermal gasification of biomass and waste. The most important Austrian research institutions, Vienna University of Technology, University of Natural Resources and Life Sciences Vienna, University of Technology Graz, MCI, BEST and their activities are described here. For more information, the contact to each research group is mentioned there.

Anyway, the report includes also information regarding implementation of bioenergy in Austria and a list of companies active in area of thermochemical gasification processes, as well as producers of gasification facilities.

1. Bioenergy in Austria

With the end of 2021 the IEA Bioenergy published Country reports on bioenergy[1] one of these reports is also "Implementation of bioenergy in Austria – 2021 update"[2].

Highlights

- Renewables make up 30% of Austria's total energy supply in 2019. The renewable energy share in final energy consumption is 35%2. Around 55% of renewable energy is from biomass.
- The main application of bioenergy is in renewable heat, both in direct heating (residential, services and industry) and in district heating. 50% of district heating is produced from biomass, and additions in district heating in the past decade were mostly through biomass-based heat and CHP plants.
- Electricity production in Austria is dominated by hydropower, with a modest role for bioenergy (mostly through CHP plants). The role of wind and solar power is growing.
- The use of fossil fuels (particularly diesel) is still growing. The role of biofuels in transport was relatively stable around 5% (by energy) in the past decade, with a general use of B7 as diesel fuel (containing up to 7% biodiesel by volume) and E5 as gasoline fuel (containing up to 5% bioethanol by volume).

Research focus related to bioenergy

The research focus for bioenergy in the upcoming years is defined in the calls for projects of the Austrian Climate and Energy Fund.

ENERGY RESEARCH (ENERGIEFORSCHUNG)

The energy research program aims at developing technological competencies to strengthen Austria as an innovation location for clean energy technologies and to improve export opportunities. A budget of € 13.5 million in funding has been available for the 2020 call. The call focusses on research and development of innovative materials, technologies, systems and concepts. The main research topics are:

• Energy systems and networks
• Energy efficiency in industry

[1] https://www.ieabioenergy.com/blog/publications/2021-country-reports/
[2] https://www.ieabioenergy.com/wp-content/uploads/2021/11/CountryReport2021_Austria_final.pdf

• Storage and conversion technologies
• Digitization as a cross-sectional technology

The "*Sub-topic 2.3 -Cross-sectional technologies for CO_2 reduction in industry*" includes the following guidelines for projects with focus on bioenergy:

- CO_2 capture directly from the atmosphere by means of technical systems or by permanently binding the carbon contained in biomass.
- Optimization of the decentralized generation of electricity, heat and cold: new systems, generators and thermoelectrics concepts, innovative adsorption and absorption processes and media, load and fuel flexibility (e.g., use of special gases, biomass combustion).
- New approaches to the use of secondary raw materials and fuels from industry (e.g., slag, process gas, old plastics) as well as trade and commerce (e.g., dismantling waste, fats, shredder light fraction), biowaste (green cuttings, crop waste, liquid manure) and biogenic residues;

The "*Sub-topic 3.1 - Storage and conversion technologies*" includes funding opportunities for optimized production, storage and cost-efficient conversion (power-to-hydrogen, gas, fuel / liquids and chemicals) of CO_2-neutral chemical energy carriers.

Further information regarding policy, energy strategy and programs:

Long-Term Strategy 2050 – Austria: https://unfccc.int/sites/default/files/resource/LTS1_Austria.pdf

• Integrated National Energy and Climate Plan for Austria 2021-2030:
https://ec.europa.eu/energy/sites/ener/files/documents/at_final_necp_main_en.pdf

• Federal law on the expansion of energy from renewable sources (in German):
https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20011619

• Upper Austria - Funding of individual biomass plants within the framework of state funding (in German):
https://www.land-oberoesterreich.gv.at/97453.htm

• Biomass local heating promotion in Lower Austria (in German):
https://www.noe.gv.at/noe/Energie/Foerd_Biomasse.html

• Guidelines Energy research - Annual program 2020 (in German):
https://www.ffg.at/sites/default/files/allgemeine_downloads/thematische%20programme/Energie/201221_Leitfaden_Energieforschung_2020.pdf

• Climate and Energy Fund – tenders (in German): https://www.klimafonds.gv.at/ausschreibungen/

2. Austrian research institutions and their activities

Since last three or even four decades a research on gasification of biomass takes place at Austrian research institutions. At the beginning only clean woody biomass was in focus as a feedstock for the conversion process, anyway, during the last twenty years a shift to waste materials can be observed. Regarding the application of the producer gas from gasification, also here a change can be seen. Heat or combined heat and power production were the applications at the beginning, now the production of biofuels and biochemicals is in the focus with increasing concern to by-products such as biochar.

In Austria, several research institutions are active in the area of thermochemical gasification:

VIENNA UNIVERSITY OF TECHNOLOGY

Institute of Chemical, Environmental and Bioscience Engineering

Research groups:

- Research Unit of Fuel and Energy System Engineering
- Research Group for Industrial Plant Engineering and Application of Digital Methods
- Accredited and Notified Testing Laboratory for Combustion Systems

The Research Area "**Fuel and Energy Systems Engineering"** provides the ideal professional framework for research-led education and for the development of innovative technologies and processes for the energy system of the future. This includes testing, analysis, modelling, experimental investigation and validation, and transformation to commercial scale using modern digital methods. This research area supports the profiling of the institute, the faculty and the Vienna University of Technology by exploring a sustainable fuel-based ecologically sound "energy supply".

The research group "**Industrial Plant Design and Application of Digital Methods**" acts as an international research partner for a sustainable utilization of biogenic raw materials and residual resources for the reduction of fossil carbon utilization. The group provides competence for technology development by the use of experimental infrastructure as well as advanced digital methods. They transfer know-how via academic teaching as well as via cooperative research projects together with the industrial partners. They offer deep know-how in the field of thermo-chemical utilization of solid fuels and accompany the design and optimization of industrial plants, as well as offer the research team an international competitive development environment for the personal and academic career.

The history of **Accredited and Notified Testing Laboratory for Combustion Systems,** which is a part of the institute, can be traced back in the days of imperial Austria in the 19th century. Since then the focus on cooperation partners needs based on the fulfilment of high quality standards and principles of scientific work have been the guidelines for the development of the laboratory to its current standard.

The long tradition is the platform for a tremendous experience and know how helping to face the daily challenges in modern analytical work. Nowadays the **Test Laboratory for Combustion Systems** is one of the leading laboratories for fuel characterization, testing of small as well as large scale combusting systems and measurements of gaseous emissions in Austria.

The high standard is represented by the accreditation for its main activities and the established quality management system according to EN ISO 17025. Currently the main focus is renewable energy especially biomass and biofuels. Beside fuel analysis and measurements for classical biomass conversion technologies,

such as combustion also gasification and pyrolysis are of main interests. The Development of new measurement techniques resp. improvements for these technologies are a permanent research task of the laboratory.
The core competences of the laboratory include:

- Fuel analysis
- Testing of combustion systems
- Emissions measurements
- Sampling and analysis of solid, liquid and gaseous products from thermochemical conversion processes

An overview on research infrastructure and analytics is given on the Institute website.[3]

Research topics from the last years and ongoing:

- Testing of the advanced dual fluidized bed (DFB) gasification (G-volution) technology in 100 kW pilot plant scale[4]
  - fuel flexibility and impact on product gas quality (agricultural, municipal and industrial waste)[5]
  - influence of different bed materials on the product gas quality[6] and change of product gas along the reactor height[7]
  - investigation of selective carbon dioxide removal with the sorption enhanced reforming/gasification process (SER/SEG)[8]
  - (partial) replacement of steam by CO_2 as gasification agent[9]
  - assessment of correlations between product gas composition and tar concentration[10]
- Gas cleaning and gas upgrading for production of hydrogen and SNG in 10 kW scale:
  - scrubber with biodiesel/water
  - fixed bed activated carbon and ZnO
  - pressure swing adsorption (PSA)
  - water gas shift (WGS) unit
- Fluidized bed methane synthesis
  - thermodynamic calculations of different gas sources[11]
  - experimental investigations in 10 kW scale from gas cylinders or live-gas from 100 kW DFB gasification pilot plant
- Support of industrial gasification processes during commissioning and operation by
  - calculation of mass and energy balance
  - measurement of gas composition and impurities.

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[3] https://www.vt.tuwien.ac.at/fuel_and_energy_system_engineering/industrial_plant_engineering_and_application_of_digital_methods/infrastructure/EN/
[4] https://doi.org/10.1007/s13399-019-00486-2
[5] https://doi.org/10.1016/j.energy.2018.08.146
[6] https://doi.org/10.1016/j.energy.2018.05.158
[7] https://doi.org/10.1016/j.energy.2019.02.025
[8] https://doi.org/10.1016/j.rser.2019.03.013
[9] https://doi.org/10.1016/j.fuel.2019.04.168
[10] https://doi.org/10.1016/j.apenergy.2019.01.181
[11] https://doi.org/10.1007/s13399-020-00910-y

UNIVERSITY OF NATURAL RESOURCES AND LIFE SCIENCES VIENNA (BOKU)

Institute of Chemical and Energy Engineering

Research groups:

- Research Group Process Engineering of Renewable Resources (Head: Univ.Prof. Christoph Pfeifer)
- Research Group Energy Technology and Energy Management (Head: Univ.Prof. Tobias Pröll)

The Research Group **"Process Engineering of Renewable Resources"** deals with the development of thermo-chemical conversion technologies (pyrolysis, hydrothermal carbonization and gasification). The main focus lies on the implementation of these technologies into biorefineries and therefore mainly handling residues and waste streams.

Different cold flow models (bubbling fluidized bed, dual fluidized bed) as well as hot units (20kW bubbling fluidized bed, 10kW screw reactor, batch reactors) are available. The group has a long experience in planning, designing, erection and commissioning of fluidized bed cold flow models as well as of laboratory and pilot scale hot units.

Moreover, the group operates a fuel analysis laboratory (full set of proximate and ultimate analyses) and has competence in calculation of mass- and energy balances using the simulation software IPSEpro with support from the research group **"Energy Technology and Energy Management (ETEM)**". ETEM has a strong focus on process development and optimization, especially for chemical looping reforming or combustion with a strong focus on mathematical modelling and simulation. Moreover, negative CO_2 emissions through biochar utilization for soil amendment is focused on. Finally, the group deals with heat integration into industrial processes, bidirectional heat grids and heat pump systems.

Moreover, team members are involved in several scientific committees of the main international scientific conferences dealing with gasification, representing Austria (industry as well as academia). Finally, editorial board memberships are important: Carbon Resources Conversion Journal, Energies Journal, Biomass Conversion and Biorefinery Journal.

Research topics and infrastructure

- Fuel analysis (proximate and ultimate analysis, bomb calorimeter, ash fusion microscope, CHN analysis, …)
- Sampling and analysis of gaseous, liquid and solid products from gasification and pyrolysis
- Thermo-gravimetric analysis (TGA-MS)
- Mass- and energy balances for processes development as well as verification of experiments
- Development of gasification processes with a special focus on fluidized bed applications
- Cold flow modelling and CFD simulation of fluidized bed processes with a main focus on gasification and pyrolysis
- Biochar production and utilization with a special focus on negative CO2 emissions
- Evaluation and optimization of industrial gasification applications

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GRAZ UNIVERSITY OF TECHNOLOGY

Institute of Thermal Engineering, Division Thermal Energy Systems and Biomass

The working group Thermal Energy Systems and Biomass develops and evaluates innovative technologies for energy conversion and efficient methods for heat generation.
Another research focus includes the experimental development of technologies based on combined heat and power generation of gasification processes with fuel cells. Furthermore, experimental research and development in the field of solid oxide fuel cells (SOFC) as well as solid oxide electrolysis cells (SOEC) is increasingly being conducted. One research focus in this field includes the development of degradation mitigation.

A selection of current research projects of the working group Thermal Energy Systems and Biomass are listed below:

- Numerical Simulation of Gas/Solid Interaction in High Temperature Processes using coupled CFD/FEM Simulation
- Development of the reliability- and durability diagnosis tools for solid oxide fuel and electrolysis cells
- Reversible solid oxide cells for electrochemical energy conversion and energy storage
- Experimental characterization and evaluation of special fuels (such as: ammonia, wood synthesis gas, biogas, diesel, ethanol, ...) for application in solid oxide fuel cells
- Electrochemical characterization and performance assessment of SOC stacks in reversible operation

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BEST RESEARCH

Bio**e**nergy and **S**ustainable **T**echnologies GmbH is a K1 Competence Centre in the Austrian COMET programme and closes the gap between academic research and industrial technology development by undertaking industry-driven applied research and development in the fields of bioenergy, the sustainable bio-based economy, and future-proof energy systems.

BEST is working on the scientific and technological basis for processes which use biomass and waste to produce heat, electricity, gaseous and liquid energy carriers and sources, and basic materials for the chemical industry. The company also carries out research on the joint use of bioenergy and other renewable energy supply technologies as a means of providing efficient, sustainable and economic solutions for the energy system of the future.

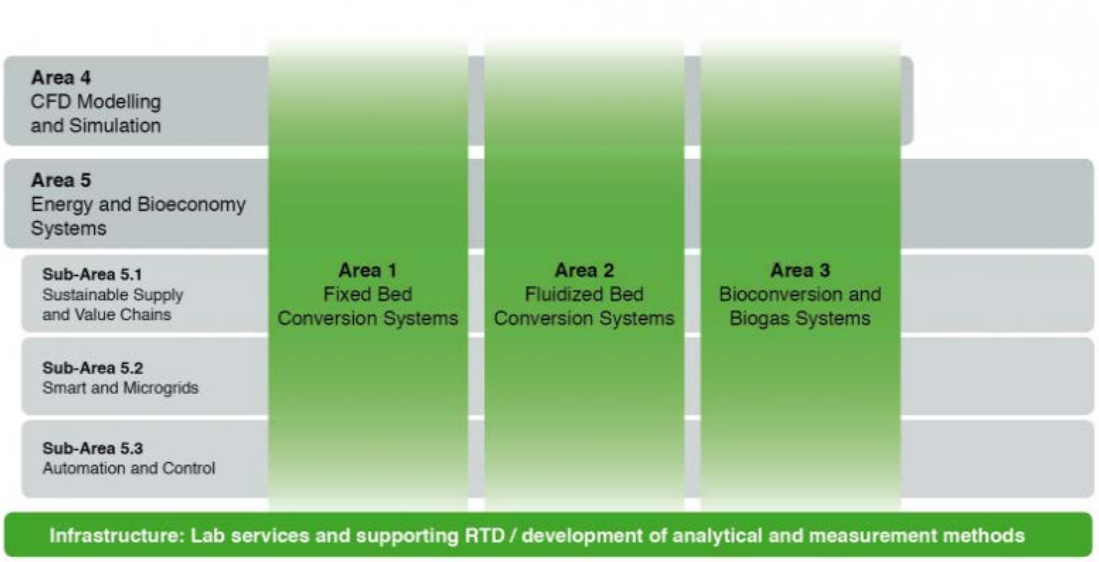

Figure 1: Organisational structure of BEST[12]

The competence area "Fluidized Bed Conversion Systems" focuses on thermal gasification and subsequent synthesis. Biomass and residuals are used as input material for gasification. The gasification process converts the feedstock into product gas, which BEST uses to produce synthetic fuels (FT diesel, FT kerosene, methanol), gaseous energy sources (hydrogen and synthetic natural gas) or chemicals. The production and use of these is largely CO_2 neutral if the process is based on renewable resources (biomass, sewage sludge, …).

The product gas is also used directly for heat and power production; for example, ash-rich residuals can be converted into a clean, ash-free and above all high calorific fuel gas for various industrial applications. Processing the product gas into storable energy sources, however, is becoming ever more important, not least because it allows use of existing infrastructure for liquid fuels and natural gas (drop-in fuels in the automotive sector and the existing natural gas network). The results of the research can be found in their publications[13].

The individual methods are developed and optimized in three fields along the process chain: gas production (thermal gasification), gas treatment and gas application and use (synthesis). The research involves developing and advancing individual process steps, overall processes and the infrastructure required. BEST has

[12] https://best-research.eu/en/company/overview
[13] https://best-research.eu/content/en/publications?area_id=9

the expertise and infrastructure needed to investigate complete process chains.

Actually, the project **Waste2Value**[14] should be mentioned here.

The Waste2Value project is driving the use of waste residues to produce hydrogen-rich syngas. The project focuses on waste fuels such as sewage sludge, residues from the pulp and paper industry, and mixtures with waste wood. In a second process step, the syngas is synthesized into liquid fuel (high quality diesel and kerosene). The current stage of the project runs to 2023 and covers construction and start-up of the pilot facility to gain the relevant operational experience. The Waste2Value research programme examines the entire process chain, starting with the waste fuel, and including syngas production, purification, treatment and synthesis through to the final refining and use of the FT fuel in fleet trials for public transport. The plant is the first of its kind in the world designed to demonstrate the use of this technology in a single, end-to-end process in an industrial environment. The project results will allow the process to be evaluated in economic and technical terms, providing the basis for the planned industrial-scale implementation of the process.

The COMET project is funded by the Austrian Research Promotion Agency (FFG) and managed by the K1 Competence Centre BEST. In addition to Wien Energie and SMS Group, the company partners also include Heinzel Paper, Wiener Linien GmbH, Wiener Netze GmbH and the Österreichische Bundesforste (Austrian Forest Authority), while Vienna University of Technology and the Luleå University of Technology are the scientific partners.

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Contact:

Markus Luisser: markus.luisser@best-research.eu

[14] https://www.best-research.eu/en/competence_areas/all_projects/view/611

MCI INNSBRUCK – TECHNOLOGY AND LIFE SCIENCES

Research area **Energy & Process Technologies**

The research focus lies in the intersection of energy and process engineering and deals with the multifaceted issues of these fields. Focal points are, for example, in the areas of energy supply from biogenic and renewable raw materials, the topic of water with its characteristics of waste water, process water and drinking water as well as an energy-efficient and resource-efficient use of snow-making systems.

The aim of the research projects in this field is to develop innovative solutions and concepts for current and future challenges, which are often developed together with partners from industry and research.

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MCI INNSBRUCK – JOSEF RESSEL CENTRE

The Josef Ressel Centre for production of activated charcoal out of municipal residues was established in 2020 for the duration of five years at the Management Centre Innsbruck, Department for Environmental-, Process and Energy Engineering.

Coal from wood gas power plants can play an important role in wastewater treatment. How to equip the powdered coal with the desired properties in the gasification process is the subject of research at this JR Centre.

Wood gas power plants are primarily used to provide renewable energy. When gasifying wood, including residual wood from the communal environment, powdered coal is also a by-product. This coal is currently used as an additive for liquid manure treatment (odour reduction), as a soil improver, but also for the stabilization of biological processes (biogas and digester gas processes) without the underlying mechanisms being known in detail.

In addition to these unspecific areas of application, it would be desirable to process the powder coal in such a way that it can also be used for previously unsolved problems in wastewater treatment. This so-called activated or even functionalized powdered activated carbon could be used, for example, for the pre-treatment of highly polluted wastewater, to stabilize digester gas processes, to improve the properties of digested sludge (drain ability) and as an adsorbent for drug residues and other micro pollutants in wastewater.

Within the scope of this JR Centre, the role of powder carbon in these processes is to be examined in more detail. Furthermore, it should be defined which additional properties it must have in order to fulfil the functions sought. A worthwhile approach in practice would be to change the properties of the powder carbon by adjusting the process parameters during the gasification in order to obtain activated carbon with a larger surface. For additional physical properties such as polarity or wetting properties, post-treatment can be carried out in an external reactor using various methods such as chemical impregnation and / or steam treatment. The JR Centre is researching how the gasification process can be changed and which type of post-treatment of the powdered activated carbon has to take place in order to achieve this necessary functionalization.

PROJECT PARTNERS

SYNCRAFT Engineering plans and installs turnkey wood power plants in the range between 200 and 500 kW electrical power. But also the adaptation or reconstruction of existing systems for efficient heat and basic load supply is one of the core competences of the privately owned and Austrian company based in Tyrol.

In addition, three innovative municipal service companies are cooperating in the "Josef Ressel Centre for the production of powdered activated carbon from municipal residues": Stadtwerke Schwaz, Innsbrucker Kommunalbetriebe and Gemeindewerke Telfs. Their core business areas include energy supply, water supply and disposal, the provision of information technology and numerous other services within its supply areas. As innovators in the municipalities, they show great interest in the ongoing development of a safe and sustainable municipal infrastructure.

PROJEKT FUNDING

The financial support by the Austrian Federal Ministry for Digital and Economic Affairs and the National Foundation for Research, Technology and Development, the Christian Doppler Research Association is gratefully acknowledged.

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3. Implementation

About 48% from district heat demand is covered by biomass, from this 48% about 20% is covered by CHP facilities. In power mix, the electric power production from CHP facilities was about 3% of the overall power production.

At the moment, there are about 150 small scale CHP facilities in operation in Austria, the location distribution can be seen in the figure below. CHP facilities, which are visible in the map come not only from Austrian producers, but also from German and Italian ones.

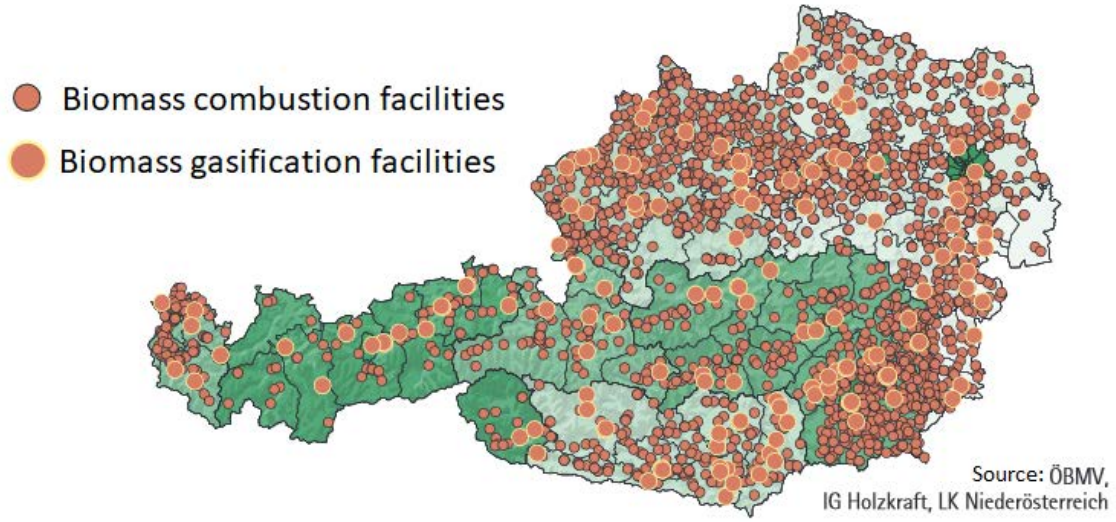

Figure 2: Distribution of biomass combustion and gasification facilities in Austria

AUSTRIAN COMPANIES

In Austria, there are several companies active in the field of thermochemical gasification. The most important ones are listed below.

Aichernig Engineering GmbH (former REPOTEC)
Engineering of FICFB gasifiers for CHP, BioSNG and other synthesis (Güssing, Ulm, Göteborg)
http://www.repotec.at

GE Jenbacher Energiesysteme AG
Gas engines for power production
https://information.jenbacher.com/index.php

GET- Güssing Energy Technologies
Research, consulting and engineering, education centre
get.ac.at

Güssing Renewable Energy
FICFB gasification systems
http://www.gussingrenewable.com

Small scale gasification facilities - producers

Froeling https://www.froeling.com/en/
Fixed bed gasification systems, CHP production

Glock Ecoenergy https://www.glock-ecoenergy.com/en
Fixed bed gasification systems, CHP production
Status 01/2022:
58 operational facilities (45 in Austria, 13 abroad)
10 planed

GRESCO Power https://gresco-power.com/
Fixed bed gasification systems, CHP production

Hargassner https://www.hargassner.at/en/
Fixed bed gasification systems, CHP production
Status 01/2022:
30 operational facilities
30 planned

SynCraft https://www.syncraft.at/
Floating fixed bed gasification, CHP production, biochar as a valuable by-product
Status 01/2022:
29 operational facilities
19 planned

Urbas https://www.urbas.at/en/energietechnik/
Fixed bed gasification systems, CHP production
Status 01/2022:
28 operational facilities

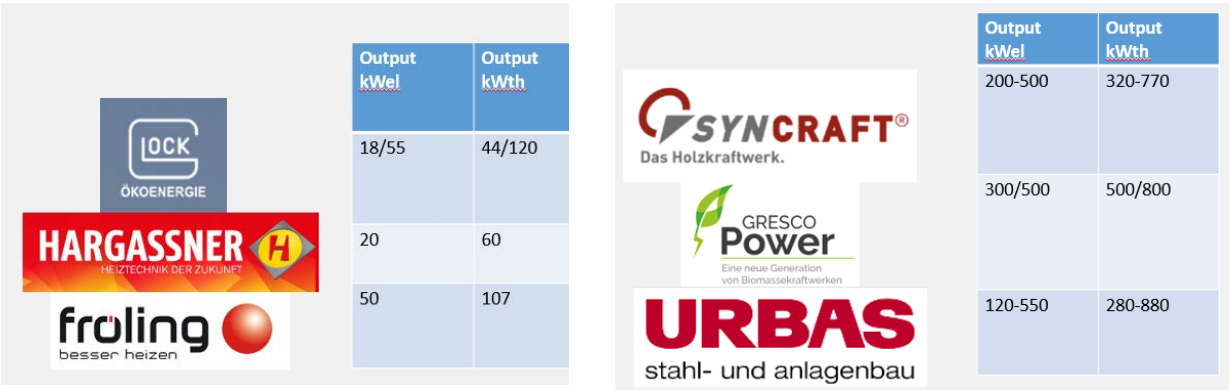

Figure 3: Overview on Austrian gasification facilities producers

Facilities under commissioning

COMET-Project Waste2Value[15]

From Waste to Value

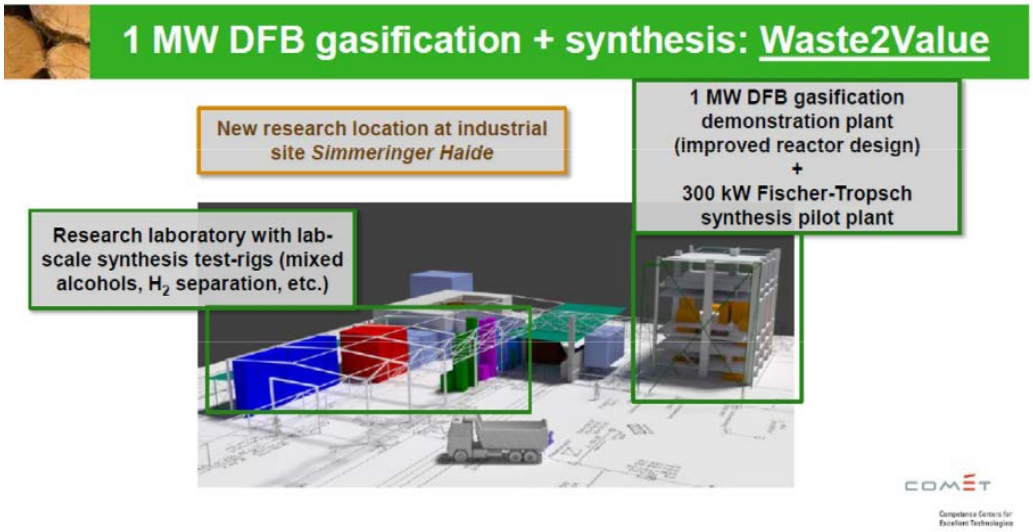

Figure 4: Visualisation Waste-2-Value (source: BEST)

As already mentioned earlier in this report, a 1 MW dual fluidized bed gasification facility coupled with 300 kW Fischer-Tropsch synthesis pilot plant is under commissioning in Vienna.

The technological key ingredient of the process chain is a thermal conversion process turning waste materials into syngas which can be converted into a variety of energy carriers such as green fuels, green gas, and green hydrogen. If the feedstock is renewably sourced (wood, wood waste, sewage sludge, biogenic waste, etc.), the final products are equally 100% renewable. Non-renewable residues such as non-recyclable plastics can also be processed. While less sustainable than the carbon from renewable feedstock, the carbon from non-renewable feedstock would be upcycled for multiple usage-cycles, similar to the system of paper recycling.

It is also possible to mix fuels, resulting in a mixture of renewable and non-renewable recycled carbon in the resulting products (green fuel, green gas). It is worth mentioning that legislators could use 14C radiocarbon dating to determine the exact fraction of renewable and non-renewable carbon in the product (green diesel, green gas) to give them a very robust, tamperproof and scientifically accurate way to establish a carbon taxing scheme.

A by-product of FT fuel production (which incidentally also generates far fewer particle emissions than fossil diesel during combustion) is a series of valuable chemicals needed in the chemical industry. Another option is to synthesise the generated gases into sustainably produced alcohols which are also required in the chemical industry. Where sewage sludge is the starting material, there are first promising research results that the contained can be recovered as fertilizer directly from the process. Phosphorus is essential in the manufacture of agricultural fertilisers. There are only two phosphorus mining areas in the world, and it is estimated that these will only continue to be productive for a few more decades.

All in all, thermochemical syngas production is an extremely promising technology, with significant potential to become a key element in tomorrow's "Green Economy"– especially in densely-wooded areas, like for example Austria, California and

[15] https://www.best-research.eu/content/en/competence_areas/all_projects/view/611

Canada but also in waste treatment in general, swapping landfills for renewable, upcycled energy carriers.

The project volume is about EUR 9 Mio. The operation should start in Q1/2022.

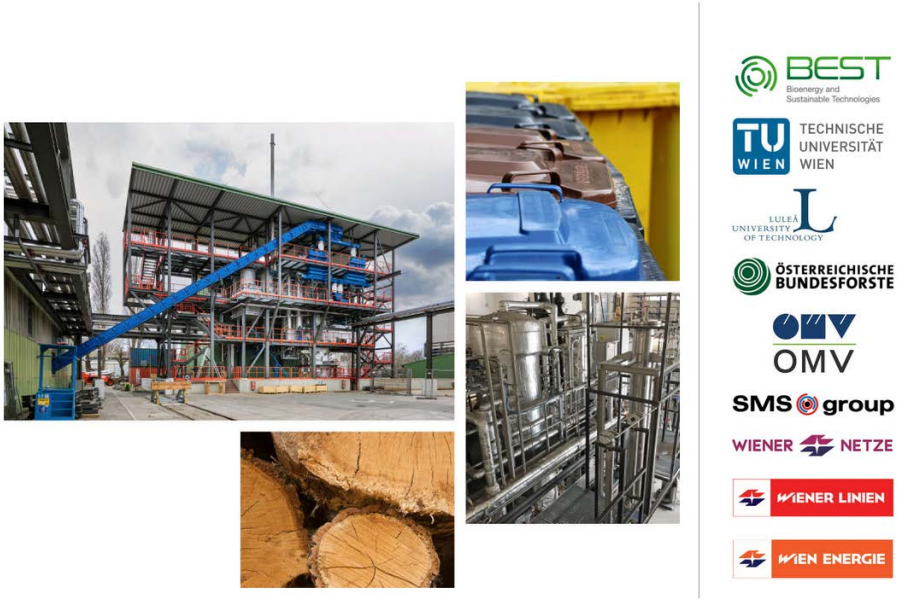

Figure 5: Waste-2-Value facility and project partners (source: BEST)

Conclusions

The thermal gasification is still an actual topic in Austria, even if there are nowadays no large scale operational units in operation.

According to research topics, it is obvious, that gasification is not only a technology for production of renewable heat and power. It can offer much more benefits for our environment. It is a flexible technology concerning the feedstock; not only clean woody biomass can be employed, but also practically every other carbonaceous residue and waste streams which could not be utilized efficiently with other technologies. Hereby, the gasification reduces the landfilling and can play a considerable role in a circular economy.

Furthermore, it is a technology suitable for production of renewable biofuels and biochemicals. The synthesis gas from gasification can be used for e.g. production of Fischer-Tropsch fuels, such as bio- diesel, kerosene, etc., as it is shown in project Waste-2-Value.

The whole spectrum utilization of syngas is shown in the figure below. The valuable by-product of gasification is (bio)char, which can be used in many ways. One of them is carbon storage, e.g. as soil enrichment, an additive to building materials, as activated char coal etc. One main topic is the utilization of biochar since it is one technology to obtain negative emissions. Biochar from gasification is compared to biochar from other processes (pyrolysis, hydrothermal carbonisation) practically free of tars, high in quality with regard to pore size distribution or specific surface area, long stability for soil applications (decades to centuries), … Especially two-stage gasification processes (eg Syncraft technology) are ideal for the production of biochar since limited gas cleaning is necessary coupled with a high quality biochar.

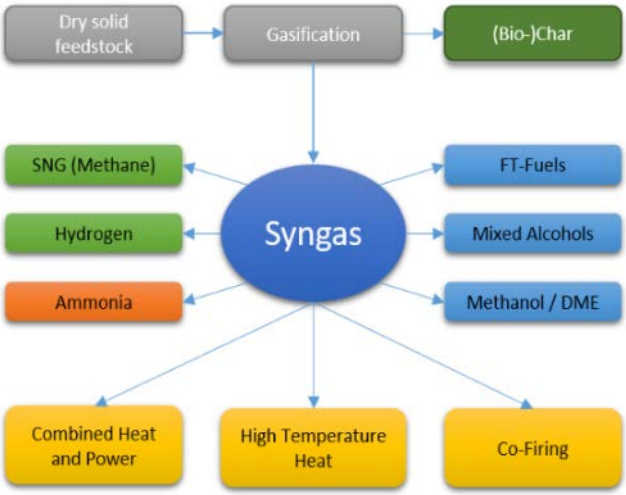

Figure 6: Utilization of synthesis gas from gasification

Austrian research institutions are internationally recognised among the leading ones on bioenergy research, thermochemical conversion of biomass and waste respectively. The Austrian know-how is employed not only within IEA Bioenergy Task 33, but also within many European and global research programs and calls.

Finally, Austrian researchers are among the most recognised persons in the biomass related scientific community.

Their activities within the scientific community (editorships in scientific journals, committees of international scientific conferences, etc.) are recognized and appreciated. Furthermore, in Austria a close communication as well as cooperation between academia and industry is given.

IEA Bioenergy

Technology Collaboration Programme