



Waste2Value - From Waste to Value: Gasification and Upgrading of Syngas

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Project description

Waste2Value represents a research and demonstration initiative driving the use of waste residues to produce hydrogen-rich syngas. In this frame waste fuels such as sewage sludge, industrial residues, waste wood and biogenic residues are converted into a valuable syngas. In a second process step, the syngas is upgraded into valuable products such as liquid fuels (high quality diesel and kerosene) or chemicals. The Waste2Value concept is currently being demonstrated at the Syngas Platform Vienna of BEST Bioenergy and Sustainable Technologies GmbH.

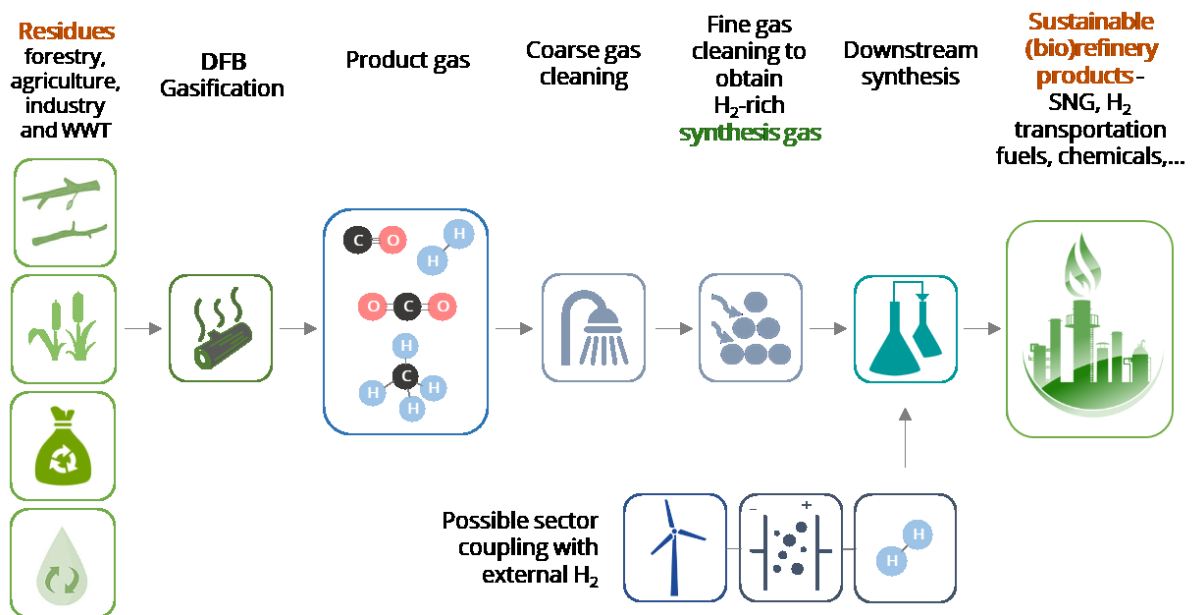


Figure 1: Overview of process; DFB- dual fluidized bed

Base information	
Link for more information	https://www.best-research.eu/content/en/infrastructure/Syngas_Vienna
Contact person, email	Matthias Kuba, matthias.kuba@best-research.eu Gerald Weber, gerald.weber@best-research.eu
Location	Vienna, Austria
Owner/Operator	BEST - Bioenergy and Sustainable Technologies GmbH
Technology supplier	The demonstration facilities have been erected within a consortium under the lead of BEST at the Syngas Platform Vienna located at the industrial site of Wien Energie with the core process, being a DFB gasification process, jointly developed by BEST and TU Wien and erected by the SMS group.
Facility planned since/Start of the project	2019
Construction year	2021
Status	Demonstration (advanced DFB gasification for syngas production from waste)
Feedstock	Waste fuels such as sewage sludge, industrial residues, waste wood and other biogenic residues
Products	Syngas (H ₂ :CO ratio of approx. 2:1) Liquid fuels (high-quality diesel and kerosene) and chemicals
Size	1 MW thermal feedstock input
Type of flexibility provided	Feedstock flexibility; Product flexibility: Syngas is basis for a variety of different end products including H ₂ , SNG, liquid fuels or chemicals; Possible sector coupling with external hydrogen
Flexibility characteristics	
Minimum load	Operation at partial capacity possible
Other	Flexibility in fuel and product
Investment cost of the plant (€)	8,8 Mio. EUR (2021)

Technical and Commercial Details

The core of the demonstration facility at the Syngas Platform Vienna is a second-generation DFB gasification process - namely the advanced DFB gasification - jointly developed by BEST and TU Wien. The second generation differs significantly from the first generation, as instead of woody biomass, now the main focus is the use of waste as input material. Thus, the demonstration plant is a first-of-its-kind when it comes to waste gasification.

In addition to the flexibility in fuel and product the process can be coupled with external hydrogen to further increase the product yield. This was demonstrated for the first generation and is possible for the second generation too.

The research results enable the economic and technical assessment of the overall process and provide the basis for industrial-scale implementation by our company partners, such as Wien Energie, BASF, Dieffenbacher Energy, Repotec, and many more.

On an industrial scale (30 MW fuel heating capacity), this technology can produce around 10 million litres of green diesel or green kerosene per year, saving up to 30,000 metric tons of CO₂ equivalents.

In the medium term, the Waste2Value facility at the Syngas Platform Vienna can be used to investigate other research priorities such as green gas (hydrogen and/or SNG) production and CO₂ capture and utilization.

The Waste2Value facilities, and the technologies it is based on, represent an important component in future sustainable biorefinery processes. The versatility of the process allows for quick adaptation towards changing market situations, as the H₂-rich syngas can be upgraded into different end products including H₂, SNG, liquid fuels or chemicals.

The use of the energy potential of waste - in addition to the already existing generation of electricity, heat and cooling, referred to as Waste to Energy, - will be expanded to include the generation of green fuels and chemicals, referred to as Waste to Value.

Market opportunities

The facility is flexible in terms of feedstock that can be used as well as in terms of product that can be produced. The H₂-rich syngas from the gasification can serve as intermediate for producing H₂, SNG, liquid fuels or chemicals. Depending on the market needs, the technology can be adapted. This will allow adaptation of the facility to changing market conditions and thus adds resilience to the system.

The gasifier offers the opportunity to create value-added products from wastes and residues. It is versatile not only for the feedstock but also for the product. The hydrogen-rich syngas from the gasifier can be processed into hydrogen, methane, other renewable gas mixtures ready for use in e.g. the iron and steel industry, and liquid fuels. The facility allows to demonstrate the feasibility of different products and product qualities and offers technological flexibility.

The Waste2Value concept was a perfect match for the cooperation between BEST and Wien Energie on the industrial site Simmeringer Haide. The site has a permission to handle waste, so sewage sludge and other wastes can be used as a feedstock. Wien Energie produces heat and electricity, so can always make use of the raw syngas from the gasifier. And the company was looking for a technology that would enable them to create added value, which is the case because of the possibility to produce various fuels and chemicals. The demonstration plant is well integrated into the industrial site of Wien Energie, with e.g. post-processing the flue gas in accordance with the legal regulations. Moreover, personnel of Wien Energie is currently being trained to run the demonstration plant, as to lift the workload of the scientists during operational campaigns. This will make the concept feasible.

Lessons to Industry

One challenge is the stable operation with different feedstock and products. Here the automation and control system needs to be able to adapt preferably automatically enabling the required flexibility. This challenge is addressed in current projects, where the automation and control system is improved by combining deep process knowledge with profound control theoretical methods.

The operation of the Waste2Value facilities is a challenge as we do not aim for standard operation. We test different feedstock, different process parameters, media recirculation's, etc. to explore the range of possibilities these facilities offers. Thus, new challenges arise with every test campaign, which we solve with our excellent team on site, gaining knowledge for industrial market introduction.

Daniel Hochstöger, Syngas Platform Technologies, BEST

The scale necessary for large-scale industrial application, e.g. iron making based on renewable syngas, is still challenging. The two biggest challenges are (1) the scale of the required gasification facilities, which is a magnitude of order larger than what modern day, steam based gasification plants for biogenic sources are designed for, and (2) the logistics involved in the steady and secure supply of the required (comparatively large) amounts of suitable feedstock. The first challenge is addressed by the research campaigns gaining knowledge for scale-up. The second challenge is addressed by the flexibility in feedstock the DFB gasification process can provide, which is demonstrated and evaluated within the research campaigns.

Waste2Value facilities in Vienna, Austria



Figure 2: Photo of the dual fluidized bed (DFB) steam gasification process. The downstream synthesis is located in the green halls in the background. © BEST, 2021

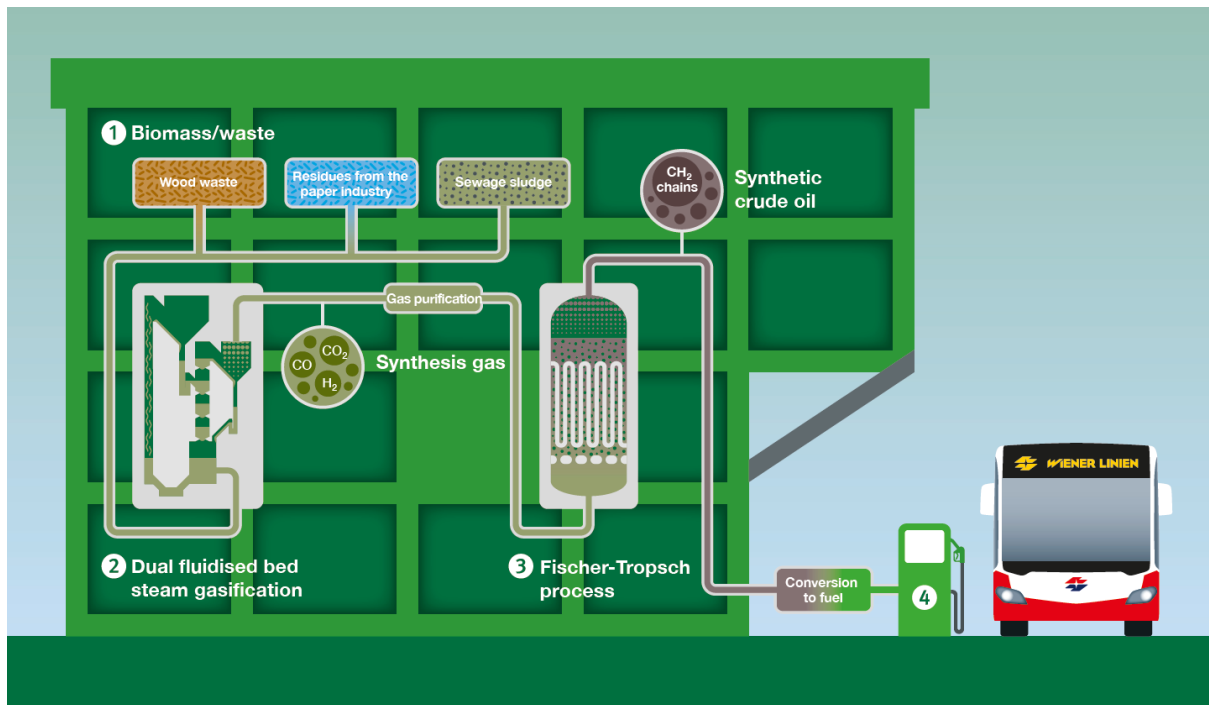


Figure 3: Process flow chart for the production of high-quality diesel from different feedstocks highlighting the flexibility in feedstock. © BEST