A POLYTECHNIKAL SHOWCASE

For Austrian biomass combustion technology specialists POLYTECHNIK Luft- und Feuerungstechnik GmbH, 2022 was the year the family-held company hit a major speed bump in its 56-year history but managed to stay on track. With the backing of a long-term strategic investor, a strengthened organizational structure, and well-stocked order books, the company is "back in black" to meet global demand for state-of-the-art biomass combustion and carbonization solutions.

POLYTECHNIK IS A WELL-RENOWNED BIOENERGY technology player with an enviable portfolio of proprietary technology and over 3 300 references. These plants, from 300 kW to 30 MW, are found on all five continents across a variety of sectors, using all manner of biomass fuels.

The completion of a major modernization and expansion investment of its Weissenbach facilities in Austria in early 2021, along with Covid-19 associated disruptions resulted in Polytechnik finding itself financially overstretched at the beginning of 2022.

Having plenty to do but not the means to do, the company filed for reconstruction during which Sustainable Future Investments GmbH (SFI), an investment arm of the privately-held HKL family foundation, stepped in as a long-term strategic investor.

Lukas Schirnhofer, Owner, and Managing Director, Polytechnik presented the Green Carbon concept during a session at CEBC 2023.

– This was a key milestone enabling the company to keep operations running and continue working on the around 40 ongoing projects that were in various stages of development. These had a combined order value of around EUR 50 million, and with the exception of one project that was canceled, all orders could be continued during this difficult period, said Heinz Grossmann, Managing Director, and Director of Finance and Strategic Investments, adding the that canceled project has since been brought back onto the table.

Growth in demand

All employees in the group were retained, and with the modernized main production and headquarters in Weissenbach, a production site in Ungaro, Romania, a joint venture production site in China, and well-stocked order books, the company is in good shape.

– While DACH and the rest of the EU we consider to be our home market, North America, South East Asia, and ANZ, are all regions where we are also seeing strong demand and growth, said Lukas Schirnhofer, Managing Director, and Director of Sales, Technology, and Production.

Polytechnikal showcase

Leaving biomass combustion aside, within its IP portfolio, Polytechnik has developed a novel carbonization technology fully integrated with energy production. Green Carbon GmbH, in Uelitz, Germany, is a proverbial "Polytechnikal" showcase. Commissioned in 2016 as a pilot plant, it operates 24/7, producing around 3 000 tonnes per annum of certified charcoal and biochar products. Qualities include biochar for animal feed, and pharmaceuticals, "Terra Preta" biochar for soil improvement, high-quality barbecue charcoal, and biocoal for steelmaking and battery production.

Automated retort plant

Developed by Polytechnik, a distinguishing feature is the proprietary continuous batch process, the world's first automated retort plant, enabling the production of various carbonized products and qualities from different biomass sources, and particle sizes.

The incoming sized material is first loaded into one of the dryer containers where the material is dried using heated air from the plant to bring the moisture content down to around 10 percent. This can take up to four days depending on the material – green waste or sawmill offcuts. Once dried, the feedstock is tipped into a reception hopper and transported to the retort filling station where an empty retort (4 m³) waits. The filled retort is automatically transported to an enclosed preheating station.

Here the feedstock is heated with hot air up to 150°C for 4 to 5 hours to prepare the feedstock raw material for carbonization.

– This step reduces the time needed in the pyrolysis station and increases the output of the plant, explained Lukas Schirnhofer.

An indoor crane, equipped with two independently operated lifting devices, transports retorts from station to station.

– The movements of material are optimized to ensure the energy plant and pyrolysis station can continue operating safely, quickly efficiently. This highly technical automation ensures flexibility in operation, Lukas Schirnhofer said.

After preheating, the preheated retort is closed via an airtight cover and transported to the pyrolysis station where the retort is loaded into a reactor chamber and heated up to 650°C for two to four hours. As soon as a reactor completes carbonization, that is, no low-temperature pyrolytic gases remain, the reactor opens, and the crane moves the retort to the cooling station.

Here the retort is cooled to ambient temperature using cool air >>

>> that takes up to 27 hours to complete. The cooled retort is then transported to an enclosed unloading station where a conveyor transports the discharged charcoal to a screening and/or crushing station, allowing the production of different product sizes before being passed on to a packaging station for sacking, big bags, etc. The empty retort is transported back to the retort filling station.

Low NOx lean gas burner

The energy for the carbonization plant is supplied from a purpose-built biomass-fired combustion system, with a water-cooled reciprocating grate for combustion. The system includes fully automated fuel storage and handling systems which feed the biomass into the combustion system of the plant. The pyrolytic gases from the reactor station are combusted in a specially designed combustion chamber using a novel multi-stage weak gas low NOx burner.

– Advanced highly intelligent controls, primary and secondary air systems, and an adiabatic combustion chamber ensure the complete oxidation of both biomass fuel and pyrolytic gases - hence high efficiency and low emissions, said Lukas Schirnhofer.

Standardized, modular, and scalable

While the Uelitz facility uses hot air for its processes, current Green Carbon designs are combined heat and power (CHP) based using a high-temperature organic rankine cycle (ORC) unit. The electricity can be or self-consumption or exported to the grid and the post-ORC energy used for heating.

– The Green Carbon design is standardized with modular and scalable plants and outputs from 4 500 tonnes to 12 000 tonnes per annum of reproducible, high quality, and certified carbon product. Bespoke designs for up to 20 000 tonnes per annum are also available ended Lukas Schirnhofer.

Text & photo: Alan Sherrard
Photos: Polytechnik
BI127/7065/AS

(Above) A retort being moved from the reactor station to the cooling station. (Top left) A view of the Green Carbon facility with the external dryer containers, and big bag storage. The highly automated plant produces 3 000 tonnes per annum of biochar and charcoal products.

Thailand set for "FlashTor" rollout

Back in September 2020, TTCL Public Company Ltd (TTCL) an integrated Thai Engineering, Procurement, and Construction (EPC) and investment company, and Blackwood Technology B.V., a Dutch torrefaction technology provider, closed on a strategic partnership to roll out torrefaction plants in South East Asia (SEA) based on Blackwood's proprietary "FlashTor" torrefaction technology. As part of the deal, TTCL also acquired a controlling equity stake in Blackwood.

In March 2021, Blackwood and TTCL opened a testing and R&D facility in Ratchaburi, Thailand to which the Blackwood FlashTor pilot plant in Prodock, Amsterdam, the Netherlands was relocated to. In July last year, the companies inaugurated a torrefaction demonstration plant in Lampang province.

– We built the demo plant with maximum flexibility in mind to demonstrate that our FlashTor technology can process different biomass sources - woody biomass and agricultural residues - at scale, not just in the lab. The project was also the first result of our partnership with TTCL, combining our best-in-class torrefaction technology with TTCL's capabilities as an integrated EPC company, said Thomas Chopin, CFO of Blackwood Technology.

Plans for six plants

TTCL also revealed that it plans to develop 450 000 tonnes per annum (tpa) of torrefied biomass capacity in Thailand – six 75 000 tpa plants with Blackwood's technology. An application has been submitted for support from Japan's Ministry of Economy, Trade and Industry (METI) under the Asian Green Growth Partnership (AGGP) to build the first 75 000 tpa plant in northern Thailand.

– Independently of TTCL's plan to deploy additional black pellet plants in ASEAN countries, we are in active discussions with prospective customers in other regions that are interested in our FlashTor technology for their torrefaction projects, ended Maarten Herrebrugh, CEO of Blackwood Technology without disclosing further details.

Given that the company was present at Bio360 Expo, Europe would seem to be a region on the map for Blackwood and torrefaction.

Thomas Chopin (left), CFO and Maarten Herrebrugh, CEO, Blackwood Technology at Bio360 Expo 2023 in Nantes, France.

Text & photo: Alan Sherrard
BI127/7074/AS