

BIO-OIL, HEAT AND ELECTRICITY

with Valmet's pyrolysis technology

With integrated pyrolysis technology, the fluidized bed boiler at Fortum's power plant in Joensuu, Finland, was turned into a biorefinery. In addition to heat and electricity, the plant now produces bio-oil.

TEXT Marjaana Lehtinen

In 2013, Fortum commissioned the world's first industrial-scale, bio-oil plant integrated with a combined heat and power (CHP) plant. The targets of the investment were to increase total efficiency and the value of the existing CHP plant, as well as to open the possibility to explore interesting new business opportunities.

The new plant has an annual capacity of 50,000 tonnes of bio-oil from wood-based fuels. The use of bio-oil has a significant positive environmental impact because energy

produced with it can reduce greenhouse emissions by up to 90% compared with fossil fuels.

The bio-oil plant was supplied by Valmet as a turnkey delivery, including the foundations and buildings, feedstock reception and pre-treatment, pyrolysis system, bio-oil storage tanks, loading equipment, automation and electrification. The delivery also included installation, testing and training.

Quality according to specifications

In Joensuu, bio-oil is produced mainly from wood chips using fast pyrolysis technology. Constructed in connection with a fluidized bed, the solution features a reactor where the wood is vaporized. In fast pyrolysis, wood is decomposed in an oxygen-free atmosphere at high temperatures. The resulting vapors are condensed and the end product, bio-oil, looks and smells like tar.

"The process performs well: we have reached the planned production capacity, and the bio-oil quality fulfills specifications," says **Timo Partanen**, Power Plant Manager,

Fortum Joensuu. "The introduction of a totally new technology always calls for further development, but it already looks like we will reach the targets set for the investment."

Bio-oil proven suitable also for large power plants

Bio-oil can be used as a replacement for heavy and light fuel oil at heat plants or in the production of industrial steam. Fortum's bio-oil has been successfully used at Savon Voima's heat plant in Iisalmi and at the company's own heat plants in Joensuu and Espoo, Finland.

In 2015, Fortum exported its first batch of 160 tonnes of bio-oil for test combustion at E.ON's Karlshamn power plant in Sweden. As one of the biggest peak-load and reserve power plants in the Nordic countries, this plant wanted to decrease its environmental load and get further assurance that biofuel can replace some of the heavy fuel oil in the future. In the successful test combustion, bio-oil was incinerated at a record output of 175 megawatts.

"Both small and large plants have now

been run with bio-oil, and experience has shown that it works well in energy production. Our bio-oil has aroused a lot of interest, and we have ongoing negotiations with other customers," Partanen continues.

Process and product development continues

Currently Fortum and Valmet are further developing and optimizing the process as well as testing other feedstocks, such as forest residues and sawdust. The target is to maximize fuel flexibility, while maintaining the required quality parameters, such as heating value.

"In optimizing the process, Valmet's in-line analyzers continuously monitor both feedstock and oil moisture, and our specially developed laboratory equipment is used for other bio-oil specific measurements. The control applications in the Valmet DNA automation system play a key role in the optimization work," says **Joakim Autio**,

Product Manager, Pyrolysis, Valmet.

In the future, bio-oil may become a valuable raw material for various biochemicals or traffic fuels. To promote this development, Fortum and Valmet have joined forces in the LignoCat project, which develops catalytic pyrolysis technology to produce high-value biofuels that replace fossil transportation fuels and to create new business for the consortium companies.

Important milestone

The world's first integrated commercial-scale bio-oil plant in Joensuu is an important milestone and an excellent reference for Valmet. "We are in the process of commercializing the new technology and are ready for the next deliveries. The market has shown interest both in the pyrolysis process and in bio-oil," Autio adds. ■



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Up to 90% less greenhouse emissions.

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