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Institut für ZukunftsEnergieSysteme

Evontec GmbH&Co.KG: Pyrolysis of wood fibres

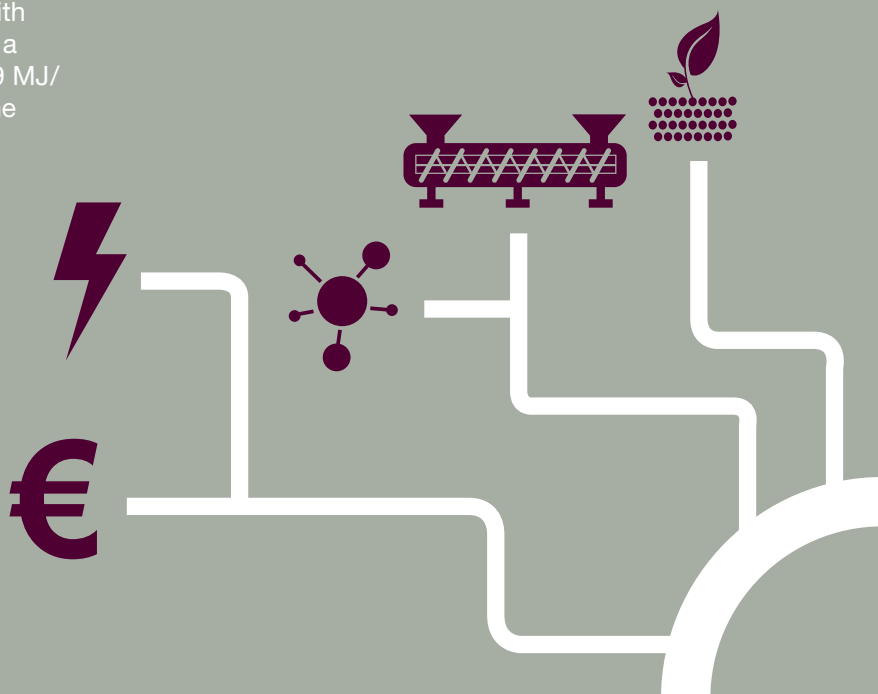
Development Plan Summary (Ottweiler-Fürth, Germany)

Overview: In the village of Ottweiler-Fürth it is planned to develop a local district heating network (DHN) powered by wood chip boilers and a combined heat & power engine (CHP) fed by a biogas pipeline to heat over 200 private houses. The electricity produced would be injected into the grid. To complement this scheme the addition of introducing a pyrolysis or gasification plant to transform wood waste into higher value products is also being investigated.

Project detail:

The objective of this study was to develop an economical, as well as an ecological, sustainable new concept for the further use of wood fibres in the bioenergy village of Ottweiler-Fürth. In a preliminary investigation, the quality of the pre-dried wood fibres was determined. The results of the investigation showed an ash content and incombustible part of pre-dried wood fibres of approximately 1.1%, with a water content of almost 60%. This equates to a lower heating value of the original material of 5.9 MJ/kg (=1.7 kWh/kg) and a lower heating value of the organic substance of 17.7 MJ/kg (=4.9 kWh/kg).

In addition to the above, it is also proposed to establish an organic rankin cycle (ORC) plant on the site. The overall installed capacity of the plant would be 4.5 MWTh. The boiler house, as well as the biogas plant, would be located just outside the village. The addition of a pyrolysis plant would enable wood fibres to be converted into combustible gases and liquids which can be used in the CHP to partly cover its base energy load of the DHN. The pyrolysis process also generates charcoal (or biochar) which could in turn be sold as a fertilizer as it is only made from wood fibres. Gasification could also be used to generate sustainable fuels from wood fibres, although it would not produce biochar.



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Pyrolysis as preferred conversion technology

The pyrolysis process typically starts with the drying of the feedstock. This pre-treatment requires a dryer to reduce the feedstock water content to the required level for the chosen pyrolysis technology. The larger the water content needs to be reduced, the more expensive the process.

Two pyrolysis processes were identified for potential application on the Ottweiler-Fürth site: the Pyroformer™ (developed by the European Bioenergy Research Institute and patented by Aston University, Birmingham, UK) would require drying (up to 90% dry matter) and pelletization; the PYREG 500 (a product of the Pyreg GmbH located in Dörth, Germany) would require drying up to 60% dry matter and does not require pelletization.

Both pyrolysis technologies produce a solid char fraction (biochar). It can be assumed that this biochar can be used as fertilizer – as it is only made from wood fibres – subject to appropriate certification.

If a Pyroformer™ were to be used, the produced gaseous and liquid outputs could be used in the CHP unit of the biogas plant or in a separate CHP unit. The generated power could be injected into the grid and would benefit from subsidies through the German Combined Heat-and-Power Act (KWKG) or the German Renewable Energy Sources Act (EEG 2014). In the case of a PYREG 500 being used, the gaseous and liquid fractions would be combusted directly in the PYREG process via a FLOX™ burner. In both cases the generated thermal energy can be either used on site or fed into the DHN.

Permits and integration

Official approvals and permits to operate a pyrolysis plant would be required as the site of the biogas plant nearby Ottweiler-Fürth has not been granted the necessary emission approval (in accordance with the 4th German Federal Emission Protection Ordinance).

The physical integration of a smaller pyrolysis unit on the site of the existing biogas plant and the wood chip boilers would be possible via the DHN. The operator of the plant is now investigating the value of the biochar.

Profitability

The installation of a pyrolysis plant on the site of the biogas plant and wood chip boiler near the village of Ottweiler-Fürth is technically feasible. The profitability of such a scheme would depend on the chosen pyrolysis technology, as well as the feedstock pre-treatment requirements, the quality of biochar produced, as well as costs associated with necessary approvals and permits.

Presently there is a lack of knowledge regarding the capital investment and operational costs for these pyrolysis technologies, as well as the official acceptance for using a pyrolysis unit in Ottweiler-Fürth.

Final conclusion

The study showed that it is technically feasible to operate a pyrolysis unit or another thermal conversion technology to further process the dried wood fibres.

The use of the biochar – resulting from the pyrolysis process – for use as fertilizer still remains to be clarified.

Other factors including the necessary approvals and economic models would need to be investigated in order to ascertain the viability of this project.

This development plan has been produced through BioenNW – a €7.9m strategic initiative of the European Union INTERREG IVB North West Europe Programme (2011-2015). BioenNW is led by the European Bioenergy Research Institute at Aston University, UK and sees 11 partners working together to deliver small-scale bioenergy schemes throughout North West Europe.

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