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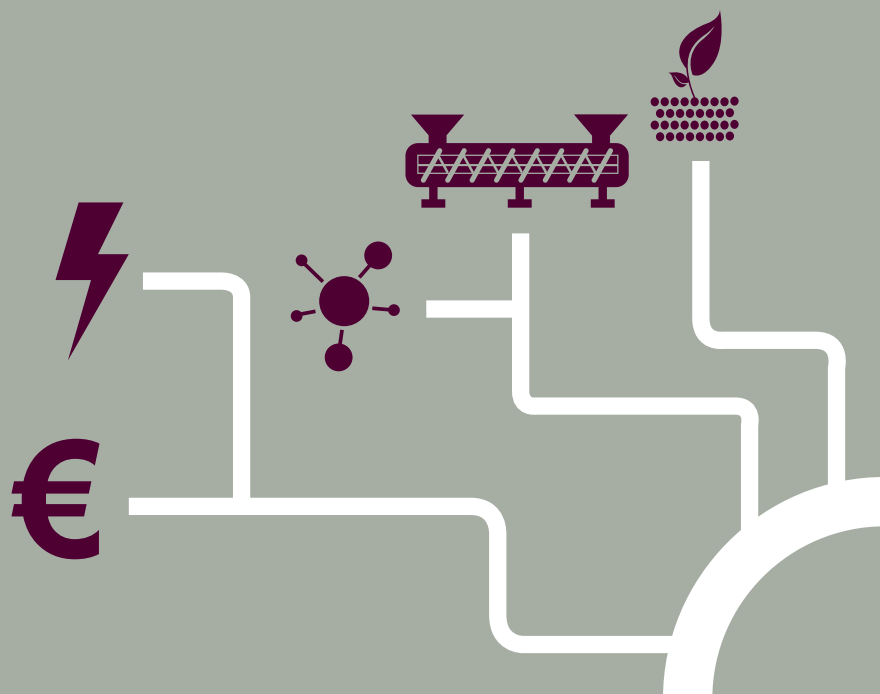
Pyrolysis of Digestate

Development plan summary (Saxler, Germany)

Overview: A biogas plant has been operational in Saxler for several years. The biogas plant is fuelled by maize, whole crop and grass silage, manure and Igniscum. The biogas produced is combusted directly in a Combined Heat and Power engine (CHP) on the site of the biogas plant. The thermal energy produced is used for the heating of the buildings, the digester, as well as the digestate to produce a fertilizer. A basic study to investigate the possibilities of use for the dried digestate within a further process such as pyrolysis should be undertaken.

Business case

The aim of this study is to develop an economical and ecological sustainable new concept for the further use of digestate of the biogas plant in Saxler. In a preliminary estimation the quality of the digestate was investigated. The main findings are: 1. The lower heating value of the dried digestate is in the range of approximately 14.4 MJ/kg or 4.0 kWh/kg, and 2. The annual tonnage is in the range of 4.40 Mg/a with a dry substance content of 80%.



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Pyrolysis as a preferred conversion technology

The pyrolysis process usually starts with the drying of the feedstock. This step needs a dryer and, depending on the water content of the raw feedstock and the required maximum water content of the used pyrolysis technology, a significant amount of energy. If a Pyroformer™ (developed by the European Bioenergy Research Institute at Aston University) was chosen as the conversion technology, pyrolysis starts with drying (50% – 90% dry matter) followed by pelletisation. If using a different pyrolysis technology – for example a PYREG 500 (a product of Pyreg GmbH located in Dörth, Germany) – neither drying or pelletisation of the digestate is necessary. One product of both technologies is a solid char fraction. It can be assumed that the char produced can be used as fertiliser because only maize, whole crop and grass silage, manure and Igniscum are used as feedstocks. The thermal energy generated can be used for drying the digestate and/or any other biomass such as wood chips. In the case of using a Pyroformer™ the generated power is fed into the public grid and can subsidised either in line with the German Renewable Energy Sources Act (EEG) or by the combined Heat-and-Power Generation Act (KWKG).

Permits and integration

The necessary official approvals and permits for operation are challenging as the site of the biogas plant in Saxler presently has no necessary approval by emissions laws (4th German Federal Emission Protection Ordinance) to operate a pyrolysis plant. The integration of a smaller pyrolysis unit on the site of the biogas plant should be possible but due to the current lack of local thermal energy consumers, it is not feasible. The operator of the biogas plant is now proving the possibility of storing and transporting the generated outputs (via a latent-heat storage system for example).

Profitability

The installation of a pyrolysis plant on this site is technically feasible but presently a statement concerning the profitability cannot be made. This is particularly dependant on the preferred chosen technology, the resulting necessary pre-treatment of the feedstock and the quality of the char produced, the possibility to get additional feedstock from other biogas plants, as well as the costs of the necessary environmental approvals and permits. Presently there is a lack of knowledge regarding the investment of operational costs for the mentioned pyrolysis technologies as well as the official acceptance for using a pyrolysis unit on site the biogas plant in Saxler. These questions will be addressed quickly.

Final conclusion

The operation of a pyrolysis unit or any other thermal conversion technology using the digestate of the biogas plant in Saxler, is suitable. The possibility for utilising the produced char as a fertilizer has not yet been clarified yet but will be investigated in the detailed business case. To decide whether an installation of a pyrolysis unit on site the biogas plant in Saxler is feasible, the legal approval issues, as well as the costs of the necessary approval procedure, must be determined.

This development plan is part of BioenNW, a €7.9m strategic initiative of the 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.

Report issued in August 2015

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