



Country Update: Netherlands



Fast pyrolysis demonstration

The EMPYRO project is meant to demonstrate a 25 MWth polygeneration pyrolysis plant to produce electricity, process steam and fuel oil from woody biomass. The installation will be owned and operated by the company EMPYRO BV. The plant is built in Hengelo (NL) on the premises of AkzoNobel, and construction will be completed by the end of 2014. The core conversion process is a fast pyrolysis process based on BTG-BTL technology. The feedstock can be either clean wood ("A-wood") or slightly contaminated wood ("B-wood"). Excess heat will be converted into process steam to drive a steam turbine for electricity generation. Part of the low-pressure steam will be used to dry the biomass, while excess steam will be sent to AkzoNobel.

Incentive programme SDE+

In the Netherlands the production of renewable heat and electricity is promoted through the SDE+-programme. The programme was launched in 2012, and continued in 2013 and 2014. A special category has been introduced for heat and/or power from liquid biomass including pyrolysis oil. Upon approval financial support is obtained for a period of 12 years. To qualify for this SDE+ subsidy, the liquid fuels need to fulfil certain sustainability criteria, which should not be a problem for pyrolysis oil produced from biomass and residues. In SDE+-2013 proposals to co-fire pyrolysis oil with natural gas have been submitted and approved.

Oil application

The oil produced by EMPYRO will be co-fired in a newly built steam boiler at FrieslandCampina in Borculo (the Netherlands). The boiler is currently under construction, and up to 70% of the natural gas is replaced by pyrolysis liquid. The oil produced at EMPYRO will be transported by tank trucks to the site in Borculo.

Research & development

RTD activities in the field of fast pyrolysis are on-going at several companies, institutes and universities.

At BTG Biomass Technology

Group bv RTD work is carried out on the fast pyrolysis process as well as pyrolysis oil uses. Application research includes (modified) diesel engines, (catalytic) oil gasification, upgrading to refinery feedstock or transportation fuels, and pyrolysis oil fractionation (pyrolytic lignin, sugars). Together with ETC (Piteå, Sweden) the gasification of pyrolysis oil in an entrained flow gasifier has been further explored using pyrolysis oil derived from wood as well as straw. BTG is partner in a large European project called FastCard which started in January 2014. One of the major subjects is the hydrotreating and co-refining of pyrolysis oil.

The **University of Twente** is active in the field of catalytic pyrolysis, upgrading to transportation fuels, esterification, application in turbines, catalytic

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reforming to syngas, and fractional condensation. Recently, a project was approved by NWO on the production of chemicals and fuels via fast pyrolysis using demineralized biomass.

The **University of Groningen** is working on catalytic upgrading and esterification of pyrolysis oil, extraction of chemicals as well as on different analysis techniques for pyrolysis oil or its fractions. In cooperation with the company **BioBTX bv** the catalytic pyrolysis of biomass is under development with the aim to produce renewable BTX.

ECN will continue its lignin pyrolysis activities aimed at the development of a robust pyrolysis system to convert pure lignins into phenolic bio-oil and bio-char for various added-value applications. ECN is also working on the design and construction of a new type of CFB system for fast pyrolysis.

Wageningen University did exploratory research on the fermentation of the sugar fraction from pyrolysis oil, and developed a process for using pyrolysis oil as wood preservative.

Nettenergy BV launched its mobile flash pyrolysis unit in 2014, and demonstrated the unit on a few occasions. This unit will simultaneously produce biochar, two qualities of pyrolysis oil of which one contains only 4% water, wood vinegar and enough wood gas to generate 50 kWh electricity. Ongoing research in bio refining and gasification to both chemical products as well as

transportation fuels will continue. Together with **Nimaro Ageno Consult bv** the production of green chemicals from pyrolysis oil or fractions will be further explored.

In 2013 and 2014 **OPRA turbines bv** continued their work on the combustion of pyrolysis oil. They successfully modified and tested the new combustion chamber of their turbine to enable fuelling pyrolysis oil.

In the national programme '**CatchBio**' several PhD students are working on different aspects of catalytic pyrolysis of biomass or related subjects. Besides the University of Twente, the University of Groningen and ECN, projects were also initiated at Utrecht University and Delft University.

The University of Utrecht is also involved in the European funded project CASCATBEL on catalytic pyrolysis. Recently, the new Dutch programme called **TKI-BBE** has been launched and fast pyrolysis and oil applications is one of the topics. The province of Overijssel is funding a RTD programme BE2.0 –coordinated by the University of Twente- with the aim to promote biomass energy with activities on pyrolysis oil upgrading and turbine application.