

EMPYRO Project Summary



Gerhard Muggen of BTG-BTL in the Netherlands outlines the EMPYRO project



Figure 1: Polygeneration pyrolysis plant EMPYRO, Hengelo (Ov), the Netherlands.

Project objectives

The aim of the project is to build and demonstrate a 25 MW_{th} poly-generation pyrolysis plant to produce electricity, process steam, organic acids and fuel oil from woody biomass (see also figure 2 on the following page).

The EMPYRO project will be supported by the 7th framework program from the EU in the Polygeneration call.

Polygeneration through pyrolysis: simultaneous production of oil, process steam, electricity and organic acids.

Project partners:

- BTG Bioliquids BV (Netherlands)
- BTG Biomass Technology Group BV (Netherlands)
- Akzo Nobel Industrial Chemicals BV (Netherlands)
- Amandus Kahl GmbH & Co.KG (Germany)
- Bruins & Kwast Recycling BV (Netherlands)
- Jan Rusaas (Denmark)
- Stork Thermeq BV (Netherlands)
- HoSt BV, (Netherlands)

Project justification

The European chemical

industry consumes large amounts of energy, which can account for up to 60% of production costs of chemicals. In addition, this industry accounts for 12% of EU energy demand and consequently contributes to the total CO₂ emission of the EU.

Thus, it is important for the chemical industry to move away from fossil fuels in order to reduce the impact of volatile prices of fossil fuels and to continue its efforts in terms of GHG reduction.

The use of biomass for energy can contribute to reducing the impact of volatile prices of fossil fuels and to reducing the GHG emissions. Following this approach, the project will build and demonstrate a polygeneration pyrolysis plant that will use woody biomass to produce electricity, process steam and pyrolysis oil.

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Project background

The core conversion process is a flash pyrolysis plant based on the BTG technology. In Europe, no large scale pyrolysis oil production plant based on biomass is in operation. The plant will be based on the design and experience gained by BTG through the construction of a 50 t/d pyrolysis plant in Malaysia. The plant design will be further scaled up to a commercially attractive scale of 120 t/d (~ 25MW_{th}). The feedstock will be local woody biomass and/or residues.

The plant will produce electricity, process steam, pyrolysis oil and aqueous organic acids in an industrial environment to make optimal use of the biomass feedstock.

Objectives

- To construct and operate on a continuous basis a 25 MW_{th} polygeneration pyrolysis unit.
- To provide warranty conditions for the process outcomes.
- To demonstrate the use of

Specific objectives

1. To demonstrate this European technology on a full scale of 120 t/day.
2. To establish warranty conditions for commercial systems with respect to:
 - Environmental impact and health and safety aspects;
 - Technical performance specifications;
 - Accurate manpower requirements and skills for operation and maintenance;
 - Accurate capital and operating costs;
 - Plant availability;
 - Plant variability in relation to demand (steam, electricity and pyrolysis oil).
3. To set-up a training and education center around the demonstration plant, and create a Pyrolysis Platform (Pyrolysis academy) for further expansion.
4. To set-up and initiate the business roll out of the pyrolysis.

the pyrolysis oil in natural gas or HFO fuelled energy systems.

- To demonstrate the recovery of acetic acid from the pyrolysis oil.
- To have the ability to test new feedstocks in the future on a large scale.
- To develop a reference plant that can be used for education and knowledge sharing purposes, as well as for commercial

purposes.

Demonstration activities

The project consortium will construct and operate a 25 MW_{th} polygeneration pyrolysis plant at the site of AkzoNobel in Hengelo, the Netherlands. At least electricity, steam and pyrolysis oil will be produced on site. A "first of a kind" extraction of organic acids from pyrolysis oil unit will be constructed as well, based on research which is partly conducted within the EU EMPYRO project.

The biomass collection and pretreatment area is located in Goor (approx. 20km from Hengelo). From Goor it will be transported by trucks to the site in Hengelo.

Applications

Combustion of pyrolysis oil will be demonstrated for several applications:

- Application in boilers in industries and district heating in several cities in the province of Overijssel and customers in Belgium;

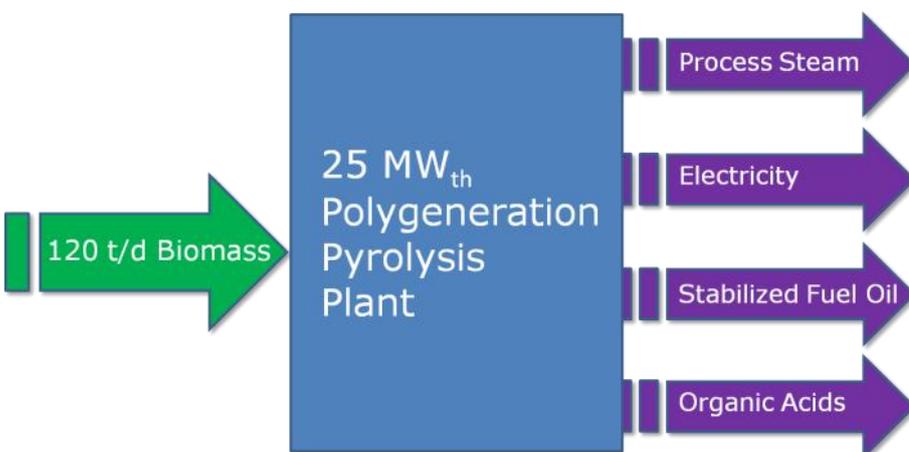


Figure 1: Empyro BV, polygeneration means in this case the production of four end products from biomass.

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- Application in 1.7 MWe gas turbine for combined heat and electricity in the district heating plant in Hengelo.

In all cases natural gas will be substituted.

Research activities: acetic acid recovery

Research activities of the project focus on the recovery of acetic acid from the aqueous fraction of pyrolysis oil.

Since no substantial quantities of pyrolysis oil have ever been available in Europe for large-scale application and research, such recovery is by default innovative. The work therefore starts with RTD work at laboratory scale to design and construct an acetic acid recovery demo system.

Expected results of the project

- Demonstration plant and commercial production of pyrolysis oil.
- The production of large quantities of pyrolysis oil for the commercial market

Expected impacts of the project

- Implementation and operation of the first (partial) commercial large scale biomass pyrolysis unit.
- Best practices for innovative polygeneration using renewable energy sources for industrial applications.
- Improved energy and environmental performance and efficient use of natural resources. Improved potential for investments of enterprises in such energy technology.
- Replacement of natural gas and acetic acids by pyrolysis oil and organic acids respectively.
- More straightforward ways of using biomass resources, with limited modification to existing equipment.
- Reduction of investments costs to build new plants based on the EMPYRO concept.
- Increased availability of pyrolysis oil for the European research community.

(between 20,000 and 25,000 t/y of pyrolysis oil).

- CFD model for pyrolysis oil combustion.
- Pyrolysis oil combustion operational experience within the European regulation.
- Hands on experience pyrolysis oil transport and logistics within Europe.
- Design of organic acid recovery unit.
- Demonstration of organic acid recovery unit.

- Financial, environmental and sustainability assessment of the EMPYRO concept.
- Training facility and visiting centre.
- Establishment of the Pyrolysis platform.

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