BSAP Fund

Closing nutrient cycles of material flows from agriculture, industry and communities by combining biogas and pyrolysis processes

Gasum (former Biovakka)

BSAP-2012-205
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Executive summary of the project

The project aimed at developing a concept for management of organic waste material flows and reducing the nutrient emissions to Baltic Sea. The concept integrates biogas and pyrolysis processes and produces biochar, as well as liquid and gaseous products.

One important raw material for biogas production is sewage sludge, which contains valuable nutrients, phosphorus and nitrogen. Municipal wastewater contains also harmful compounds, such as organic compounds from households and e.g. pharmaceutical residues. These are not all converted in the anaerobic digestion process, so further treatment of the reject would add value and enhance the possibilities to effectively use the reject as e.g. organic fertilizer or soil conditioner. Pyrolysis offers a means to treat the solid fraction of digestate so that its nutrient value is preserved while potentially destroying the harmful compounds present.

The BSAP fund was used to purchase the first full-scale unit of the full-scale pyrolysis plant, development of predrying technology for the solid fraction of digestate, pyrolysis test runs with the solid fraction of digestate, evaluating the characteristics and end-use possibilities of produced biochar, and process development. The purchased unit is able to treat a small fraction of the solid fraction of digestate produced by Gasum Topinoja biogas plant (~5%). As such, the pyrolysis plant is valuable as a demonstration unit, first of its kind, where the challenging drying and pyrolysis processes have been successfully integrated. The system has been able to produce biochar, bioliquids and energy gases with significant capacities.

By combining the biogas and pyrolysis processes nutrient cycles from communities, agriculture and industry are closed. The project has shown the potential of the concept in minimizing environmental impacts of organic material treatment and disposal. During the project, also new products and raw materials were produced and their utilization in different applications was assessed. The technical evaluation of the integrated concept is given in this report.

Main activities during the project:

- 2014 -2015: Start of the project. Data collection, negotiations with professionals in the field and potential equipment suppliers, detailed negotiations and signing of purchase contract with selected supplier (Ecomation Oy) on 21st November 2014.

- 2015-2016: Main pieces of equipment installed. The acquisition of Biovakka and Biovakka Suomi Oy took place by Gasum Oy, reorganization of the project personnel caused delay. However, activities were continued as planned and the project was carried on by Gasum Oy.

- 2016-2017: Fire safety protection installations. Permission assessments as demanded by different authorities (building, environmental permits, safety clearances for emergency services department). Development work regarding plant safety and operability.

- 2017-2018: Automation system configurations, plant optimization and final test runs at the pilot. Gasum is a Nordic energy company and the number one expert in the gas sector in Finland. It has seven biogas plants in Finland and five in Sweden and is the leading supplier of biogas in the Nordics.

Gasum promotes the circular economy by processing waste and producing biogas and recycled nutrients in Finland and in Sweden.

Biokymppi is a private limited company whose main business is treatment of organic waste material, bioenergy production and fertilizer production. It has its biogas plant in eastern Finland in Kitee with capacity of ~20 000 t/year. It is the first biogas company which is producing digestate of organic farming quality.