



Bioliqids-CHP

Power generation from Biomass

www.bioliqids-chp.eu

A collaborative R&D project between Russia and the EU

Partners

- BTG Biomass Technology Group (NL) Co-ordinator
- Encontech (NL)
- University of Florence (Italy)
- Boreskov Institute of Catalysis (Russia)
- Federal State Unitary Enterprise 'NAMI' (Russia)
- Aston University (United Kingdom)
- The Likhachev Plant (AMO ZIL) (Russia)

Objectives

- To modify or upgrade bioliqids to enable their use in engines and turbines;
- To find a technical and economic optimum between fuel upgrading and engine/turbine modification;
- To develop methods/techniques to control exhaust emissions;
- To evaluate the complete chain for application in EU & Russia.

Bioliqids

The fuels considered are fast pyrolysis oil, biodiesel, vegetable oil, blends and emulsions.

CHP

CHP stands for Combined Heat and Power. The project addresses capacities of less than 1 MWe.



Joint Activities

Emission Catalysts

Boreskov Institute of Catalysis has developed and tested catalysts for upgrading pyrolysis oil and for NO_x reduction. Upgraded pyrolysis oils have been tested by NAMI who have also tested the newly developed NO_x reduction catalysts on their engine.

Pyrolysis Oil Blends

Aston has developed a method of blending pyrolysis oil and biodiesel with bio-alcohols. This provides improved properties and enables properties and characteristics to be better matched to the engine or turbine requirements and has been evaluated by BTG and Florence.

Round Robin

A Round Robin exercise to establish and compare the basis fuel properties of vegetable oil, biodiesel and pyrolysis oil has been completed. The results were compared to the relevant standards and found to be in good agreement.

Training Materials

A set of training materials targeted at Masters students is being developed and will be made available on the project website in 2011.

Promotion and Dissemination

Extensive publicity material has been produced and widely distributed in English and Russian.

Acknowledgment

The project is funded through the European Commission (7th Framework Programme, Grant FP7-227303) and the Ministry of Education and Science of the Russian Federation (Contract 02.527.11.0003).

Biomass Technology Group

Contributions

- Pyrolysis oil production, characterization, upgrading and supply.
- Material research and engine component development.
- Diesel engine modification & operation on several bioliqids.

Results

Pyrolysis oil has been produced from wood and straw. A fully stainless steel fuel pump and fuel injector have been constructed and installed on a 1-cylinder, 20 kWe diesel engine. The engine has been evaluated with several bioliqids including biodiesel, sunflower oil, bio-ethanol and pyrolysis oil.



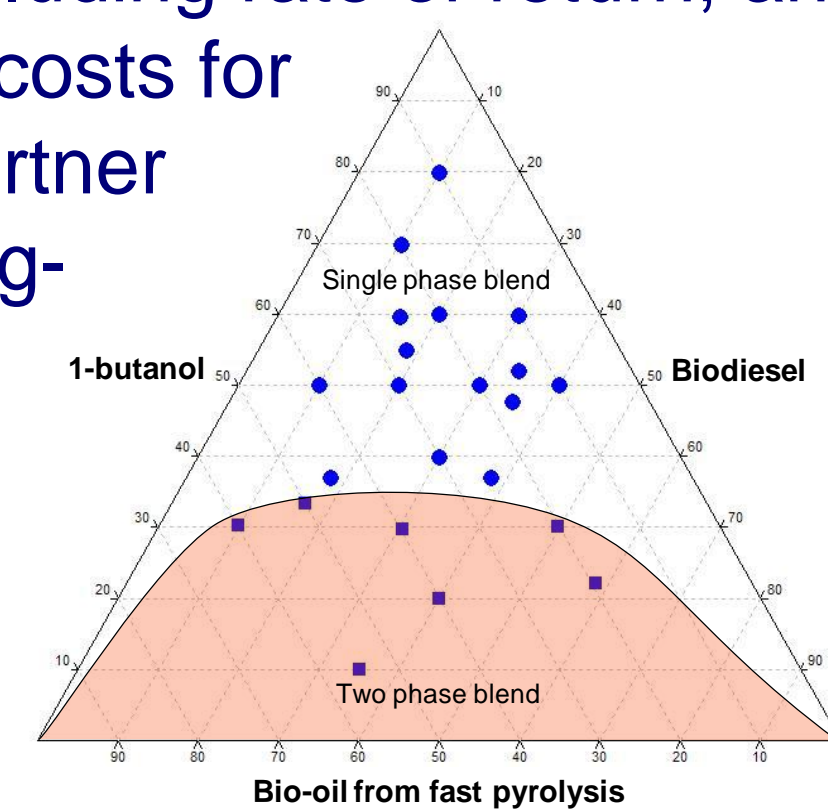
Aston University

Contributions

- Techno-economic assessment of CHP systems.
- Blending of pyrolysis oil with other bioliqids.
- Dissemination and exploitation plans.

Results

A technoeconomic assessment of various CHP systems was carried out including rate of return, and heat and power production costs for different scenarios in the partner countries. A variety of configurations are included for a variety of bioliqids. New developments in blends of pyrolysis oil with biodiesel have been achieved.



Bioliqids
Pyrolysis oil
Vegetable oil
Biodiesel

Upgrading

Emulsions & Blends

Engines

Micro-turbines

Products
Cooling
Electricity
Heat

Gas cleaning
NO_x
CO
Hydrocarbons

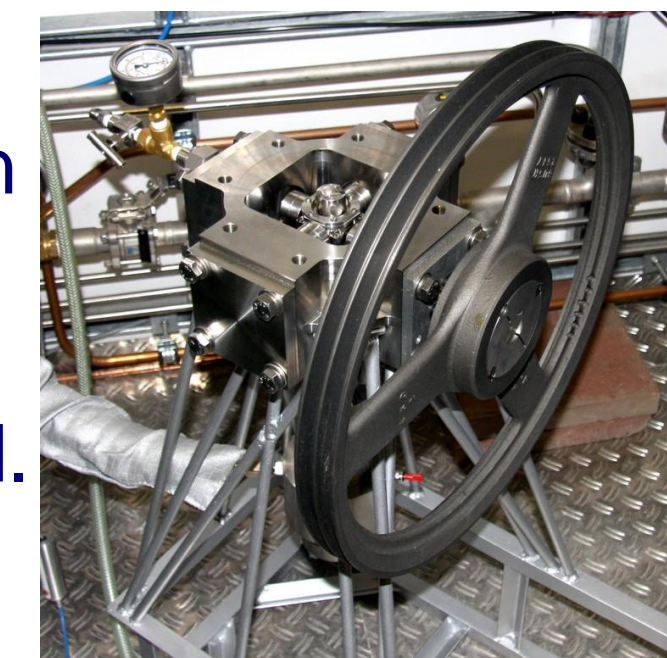
Encontech

Contributions

- Development of novel external combustion engines for combined heat and power production.
- Liaison between European and Russian partners.

Results

Two types of external combustion engines – Stirling and Rankine cycle - for CHP systems were designed, constructed and tested. Both can operate on bioliqids and are expected to be valuable alternatives to conventional prime movers. Their main advantage is simplicity.



University of Florence

Contributions

- Production of pyrolysis oil - biodiesel emulsions.
- Selection and modification of a small scale microgasturbine for bioliqids.
- Test with various bioliqids (biodiesel, straight vegetable oil, pyrolysis oil).

Results

Emulsions with biodiesel were a suitable method to upgrade the biomass pyrolysis oil. A microgasturbine equipped with a can-type combustion chamber was converted to bioliqids. Biodiesel and straight vegetable oil required minor modifications, while for pyrolysis oil the entire fuel line and the combustion chamber and liner were redesigned and rebuilt.



NAMI

Contributions

- Development of power plant CHP based on an engine unit.

Results

- Capacity at design conditions: 100 kWe and up to 150 kWth.
- Efficiency of power generation: 33.3%.
- Efficiency of heat generation: 47.1%.
- Overall efficiency: 75.6%.
- NO_x reduction in exhaust gas: 82.3%.
- All results exceeded the technical specification of the project.



Boreskov Institute of Catalysis

Contributions

- Development and testing of pyrolysis oil upgrading catalysts.
- Supply of upgraded pyrolysis oil to NAMI for testing.
- Development and testing of de NO_x catalysts.

Results

Several catalysts have been developed and evaluated. The more promising products have been used to support engine development at NAMI.

