

# case study

## The High Efficiency Recycling of Biofuel Waste Products

### Creating added value fuel products from biodiesel derived waste Glycerol

#### Project Summary

**Problem:** Biodiesel produces Glycerol as a waste product, which is of limited use since there is currently an oversupply condition in the marketplace

**Solution:** A novel processing approach will enable the Glycerol to be used as a fuel and/or fuel additive in its own right.

#### Partnership

- Liverpool John Moores University
- Longma Clean Energy, commercial biofuels manufacturer based in Herefordshire

#### Inspiration

During biodiesel production 10% of the raw materials are converted to glycerol as a waste product; this is a low value waste product (£120/tonne). The aim of this project is to use unique microwave technologies to convert this to a main stream fuel product (~ £625/tonne). This will encourage the uptake of biofuels by maximising returns from the raw materials. The potential impact of this project is to help to expand the use of crop based oil as a primarily fuel component for road transport and CHP applications. In particular the project will encourage the growth of fuel oil blending companies and increase the economic viability of biofuel CHP systems.

#### Innovation

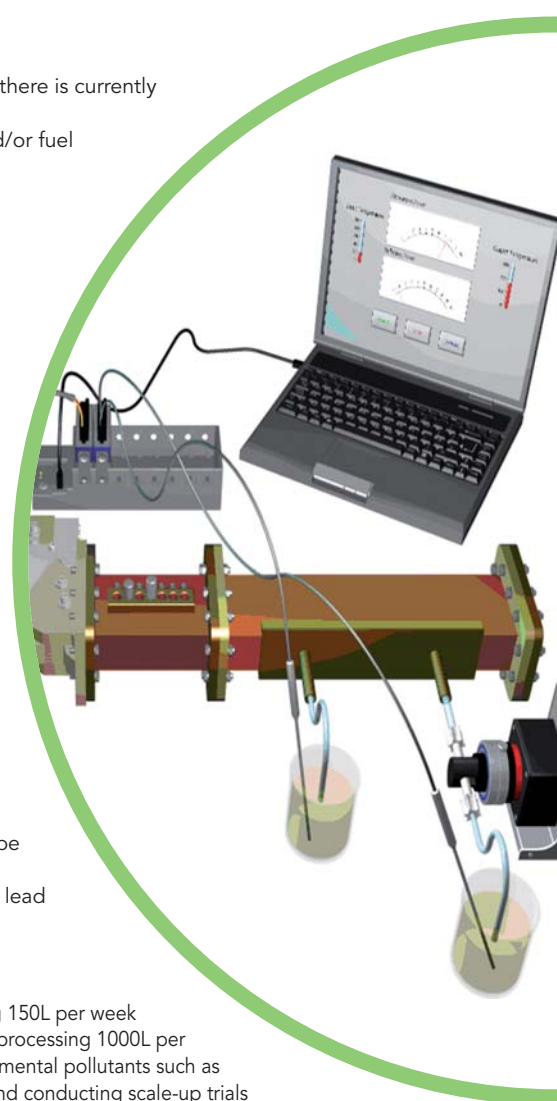
Although current technology exists for burning glycerol in space heaters, its application in engines causes problems with fuel flow and combustion. This potentially results in the production of toxic chemicals. This project aims to produce a modified glycerol additive that can be added to fuel that does not cause harm to the engine. Plasmas are a well-established technological tool used in a wide range of applications as diverse as the modification of surfaces and hydrocarbon reforming. We propose to exploit novel plasma technology to activate CO<sub>2</sub> and CH<sub>4</sub> and, by subsequent intermolecular reactions, transform them into more complex hydrocarbons such as formaldehyde and methanol which may subsequently be exploited commercially. Furthermore, plasma conversion of CO<sub>2</sub> and CH<sub>4</sub>, which are strong greenhouse gases, into such products whose global warming potential is much reduced will lead to a more benign environmental impact.

#### Development

Liverpool John Moores University have done initial trials on a system capable of processing 150L per week (40hrs) and have developed a larger scale microwave processing system that is capable of processing 1000L per week. We use a novel plasma reactor system containing MnO<sub>2</sub> catalysts to destroy environmental pollutants such as volatile organic compounds (VOCs) and to produce ozone for odour control applications and conducting scale-up trials of these devices for commercial application in VOC removal.

A novelty of this reactor is that, in contrast to other plasma based systems, it does not produce NO<sub>x</sub> by-products even when operating with air as the carrier gas. These investigations are aimed at finding the plasma system most suitable for the processing of CH<sub>4</sub>/CO<sub>2</sub> mixtures and optimising both the product yield and energy efficiency. Special care will be taken to determine the process selectivity and reaction channels. In the latter we are also fortunate in having an ongoing collaboration with Hiden Analytical, a leading mass spectrometry company in the UK who are developing a unique range of quadruple mass spectrometers capable of operating at atmospheric pressure.

**Carbon Connections** is HEIF-funded investment project utilising £3 million for carbon reduction activities. Based at the UEA, Carbon Connections supports innovative projects in carbon reduction using a partnership model. The aim is to facilitate knowledge transfer between universities and research laboratories and the business community to speed commercial development of carbon-saving projects, whether technological or behavioural in focus.



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