



An economical method of biofuel production

Fuels made from plant materials could play a role in the move to more sustainable energy production. A new costing study suggests that large-scale biomass-to-liquid (BTL) plants, could manufacture such synthetic fuels ('biosynfuel') at a cost of about 1 Euro per kg in central Europe.

Under the EU Climate Action and Renewable Energy package¹, Member States need to source a minimum of 10 per cent of their road transport energy needs from renewable energy by 2020. Biosynfuels are a type of biofuel that are produced via synthetic gas, or 'syngas', a blend of carbon monoxide and hydrogen. Syngas can be produced from any organic carbon material, including coal, but the BTL process uses a variety of bulk plant material (biomass) as feedstock, including plant residues, such as dry forest products (waste timber, tree bark) and agricultural materials (straw); it can also use waste paper and cardboard. This helps to reduce the competition between crops grown for food and those grown for biofuels.

BTL technology is complex and requires high levels of investment in large-scale plants. In order to calculate how much a BTL plant would cost to develop, the researchers modelled the costs of producing syngas using the 'bioliq' process, developed in Germany and partly funded by the EU RENEW² project. These costs were based on existing production plants using two similar conversion processes - coal to liquid (CTL) and gas to liquid (GTL) technology, as found in production plants in South Africa. Extra costs associated with BTL, compared to CTL and GTL, are accounted for. These include the cost of the extra oxygen required during production and the cost of removing impurities from raw biosyngas.

The plant and waste feedstock material is bulky and large quantities are required to make biosynfuel. The researchers suggest it is more economical to collect the material in a number of local centres first, where it undergoes pyrolysis (heated in the absence of air) to produce a concentrate. This can be then more easily transported to a large-scale plant via rail. This also minimises traffic congestion from delivery vehicles around any single plant. At the central, large-scale plant the concentrated material is converted to syngas. Finally, the syngas is purified and can be turned into synthetic motor fuel, such as methanol, hydrogen and synthetic diesel (biodiesel) or other useful chemicals.

The study suggests that for a BTL plant with a raw output capacity greater than 1 million tonnes per year, 1 litre of biosynfuel would cost about 0.8 Euros (about 1.04 Euros per kg). Around half of the costs relate to the feedstock, including transportation, which helps generate income for farmers. The other half relates to production costs. Allowing a 30 per cent margin for uncertainty, biosynfuel could cost between 0.56 and 1.04 Euros per litre. Biomass production and delivery costs are high in central Europe and contribute to about half of the total costs of producing synthetic fuels. The other half comes from the technical costs for the pyrolysis and biosynfuel production plants. For comparison, researchers estimated the cost of a litre of conventional motor fuel, without tax, as 0.56 Euros, achieved when the price of crude oil is 75 Euros (\$100) per barrel. In developing countries, where the cost of biomass inputs are lower, biosynfuel could be produced more cheaply and would be able to compete with the cost of fossil fuels earlier than in industrialised countries.

With increasing use of vehicle transport, it is likely that natural gas and coal reserves will continue to be used as energy sources. The researchers suggest future supplies of biosynfuels will not be sufficient to meet this growing demand for liquid fuels. However, it is possible to combine BTL technology with existing CTL and GTL technologies in mixed plants. If waste CO₂ can be captured and stored from these combined plants, this development will help to mitigate against climate change. However, it should be remembered that carbon capture and storage represents an additional cost and is itself an energy intensive process. It is also unlikely to be realised before 2020.

1. See: http://ec.europa.eu/environment/climat/climate_action.htm

2. RENEW (Sustainable energy systems for transport) was supported by the European Commission under the Sixth Framework Programme. See: <http://www.renew-fuel.com/home.php>

Source: Henrich, E., Dahmen, N. and Dinjus, E. (2009) Cost estimate for biosynfuel production via biosyncrude gasification. *Biofuels, Bioproducts & Biorefining*. 3:28-41.

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