

# KACELLE Project

## Cutting edge EU biorefinery research brings second-generation bioethanol closer to the market

*The €9.1 million EU demonstration project "Kacelle" aims at improving the commercial competitiveness of second generation bioethanol produced from agricultural residues. The project aims at upscaling one of the world's largest demonstration biorefinery plants to lower the production cost of bioethanol and to avoid thousands of tons of CO<sub>2</sub> emissions each year. This will contribute to achieving the EU's climate change target for biofuels by 2020 (10% renewables, mainly biofuels used for transports).*

Supported under the Seventh Framework Programme (FP7) of the European Commission, the Kacelle project aims at doubling the current processing capacity of one of the world's largest biorefinery demonstration plants located in Kalundborg, Denmark, the so-called Inbicon plant. To date the plant processes 4 tons of agricultural residues per hour.

The plant uses the patented Inbicon Core technology. This is an enzymatic pre-treatment that significantly improves the conversion of agricultural residues (e.g. wheat straw) into second generation bioethanol, making them more competitive with first generation bioethanol and in the longer term also with fossil fuels.

In addition, it applies the IBUS concept (Integrated Biomass Utilisation System) which is characterised by the symbiotic relation between the Inbicon plant and surrounding industries. The demonstration plant uses waste heat from a neighbouring power plant for its processing. In return, different co-products from the Inbicon plant's bioethanol production can be used as a substitute for coal by the power plant (e.g. lignin) and in the production of feed by livestock feed suppliers (e.g. molasses). Additional uses for the co-products of the biorefinery demonstration plant are being developed, such as biochemicals and biopharmaceuticals. This allows the demonstration plant to keep costs at a minimum and to limit its CO<sub>2</sub> emissions.

The Kacelle project is the last step of a research process developed and supported by the European Commission since 2002. At that time, the development of the IBUS concept was funded by the EU with €6.5 million.

In 2008, after several successful years using the IBUS concept, researchers were able to set up the Inbicon plant, one of the world's largest biorefinery demonstration plants. Since October 2009, the Inbicon plant has been processing 4 tons of biomass per hour and producing 5 million litres of second generation bioethanol per year. Following the good results of the demonstration plant, the European Commission further invested in this technology and guaranteed support for the upscaling of the plant processing and production systems in order for it to reach a commercial stage. The Inbicon technology is ready to be put on the market today, however, due to its high production costs, its bioethanol is not yet competitive with first generation bioethanol.

The European Union is committed to reducing its green house gas emissions by at least 20% and using at least 10% of renewables, mainly biofuels in transport, by 2020. The sustainability of many so-called "first-generation biofuels", which are produced primarily from food crops, such as grains, sugar cane and vegetable oils, have been questioned. Attention has thus been raised to the potential of "second-generation biofuels" produced from non-food biomass products using a pre-treatment process based on enzymes.

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