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Project

Sustainability of bio fuels

From Cultivation to Disposal: How to Optimise Biorefineries

A novel concept for biorefineries, developed by the Bern University of Applied Sciences (BFH), shows that it is possible to produce aircraft fuel from climate-neutral, plant material. Various unresolved issues can be solved in practice by means of pilot projects.

Biorefineries can produce renewable aviation fuel from maize. A research project was initiated to investigate how this process can be optimised. *Source:* Pixabay/fietzfotos

At a glance

- Fuel from biomass instead of non-renewable, fossil fuels represents an opportunity, but also carries risks.
- The availability of biomass from Swiss agriculture and forestry is higher than previously assumed.
- For the operation of new biorefineries, the facilities must be energy-optimised.

Maize as far as the eye can see: approximately ten years ago, Germany experienced a biogas boom that left vast stretches of land covered with little more than maize. This was due to the fact that the Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG) promoted biogas plants in which the feedstock is often maize. The aim was to convert the biomass growing in the fields into electricity so as to reduce dependence on fossil carbon sources such as lignite.

However, the maize and rapeseed fields planted for biodiesel production had undesirable ecological consequences; they became a paradise for rats and wild boars, and the hog population literally exploded. According to the Wirtschaftswoche 2011, damage caused by wild boars quickly amounts to 1000 to 2000 euros per hectare. In addition, the cultivation of biogas maize competes with feed production and pushes up the price of farm tenancy.

Optimisation thanks to evaluation methods

A research project of the School of Agricultural, Forest and Food Sciences (HAFL) at the Bern University of Applied Sciences (BFH) has developed a new method for improved, in advance assessment of these and other risks; threats to human beings, the environment and plant populations, risks that can occur during the production, use and disposal of biomass-based fuels and plastics.

In addition to a risk assessment, this research project also provides suggestions on how to organise and improve the efficiency of process chains. Thus, the results of this work serve as an important basis for political and corporate decisions regarding the use of green energy.

This project specifically focused on the conversion of so-called lignocellulosic biomass into aircraft fuel or, alternatively, into commodity chemicals. Lignocellulose is found in the cell wall of wood and straw. This type of biomass is the most commonly available raw material on earth for the production of biofuels such as bioethanol.

500 000 tonnes of dry matter are available

In order firstly to identify and secondly to avoid sustainability risks, the researchers working on this project performed a technical, economic and environmental assessment of the biorefinery processes, from plant cultivation to disposal. In an initial step, they determined the currently available amount of biomass: in Swiss agriculture and forestry, approximately 500 000 tonnes of dry matter are sustainably available each year for biorefinery purposes. They consist of residual wood, harvest residues (mainly cereal, maize and rapeseed straw) and herbaceous biomass from unfertilised meadows with low livestock density. Many of these grassland areas are ecological compensation areas that may not be fertilised, but must be mown. The cut grass offers low feed value for livestock.

In a second step, the researchers determined, among other things, how to harvest and process this mass, while avoiding damage to meadows and forests. This can for instance be achieved by adopting sustainable countermeasures, such as the use of manure or direct seeding (a method by which sowing is performed in non-tilled soil, so as to slow down the decomposition of humus, a process harmful to the climate and soil). The scientists believe that by taking these factors into account, damage to nature is unlikely.

Profitability calls for higher kerosene prices

Economically, they see the sale of sustainably produced and processed biomass to biorefineries as a new opportunity for Swiss agriculture. However, this implies that biorefineries can sell the produced kerosene at approximately twice the price of the fossil kerosene currently available. Biorefineries can also contribute to decentralisation, a feature that is being aspired to not only in the energy transition, but also in Swiss agricultural and economic policy. In the medium term, the emergence of a new market for agriculturally produced biomass and wood resources from remote areas, such as the Jura, is conceivable.

Sustainably produced kerosene can increase acceptance of the energy transition

However, this project reveals that the impact on the overall energy market would be small, as aircraft fuel is a niche market. And even within this niche market, the prevailing political conditions would determine the success of biofuel. It would for instance depend on whether or not taxes are levied on the fuel on the basis of sustainability criteria.

This is one of the reasons why both economic and technical questions remain open, and these can only be answered by pilot applications in practice. Despite these unresolved issues, the researchers assume that sustainably produced fuel from Swiss biomass would be welcomed by a large part of the population, thus increasing the fundamental acceptance of the energy transition.

This joint project, which also includes two other sub-projects, focuses on the development of new processes for the conversion of plant biomass, including by-products such as maize straw, freshly cut plant residues and beechwood, into special fuels for aircraft and freight trains, and into primary products for the production of plastic materials.

Produkte aus diesem Projekt

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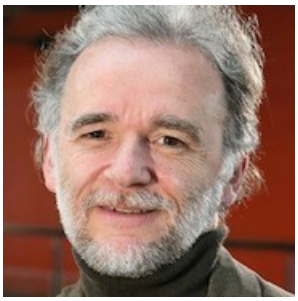

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All information provided on these pages corresponds to the status of knowledge as of 17.12.2018.