CAPCOMs (Clean Agro Pellet Commodities) can strongly reduce greenhouse gas emissions

The reduction of greenhouse gas emissions of the production of electricity, heat, liquid fuels, chemicals and materials.

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In order to reduce greenhouse gas emissions, alternative resources are needed to fulfil our demands for energy, fuels and materials. Use of wood residues for production of electricity and heat is considered to be too expensive. Alco Energy Rotterdam (AER) is looking for alternative resources as the use of crops for biofuel production was capped by the EU. Commodities from agro-residues can reduce GHG emissions, fulfil demands for energy, fuels, chemicals and materials at reasonable costs but these residues have low density, are not biologically stable and contain nutrients.

To enable large scale application of agricultural residues, it is needed to produce an intermediate. This intermediate should be dense, stable, low in nutrients and applicable in thermal and fermentation processes. In the CAPCOM-NL project, a series of technologies were tested to produce such a commodity from agricultural residues.

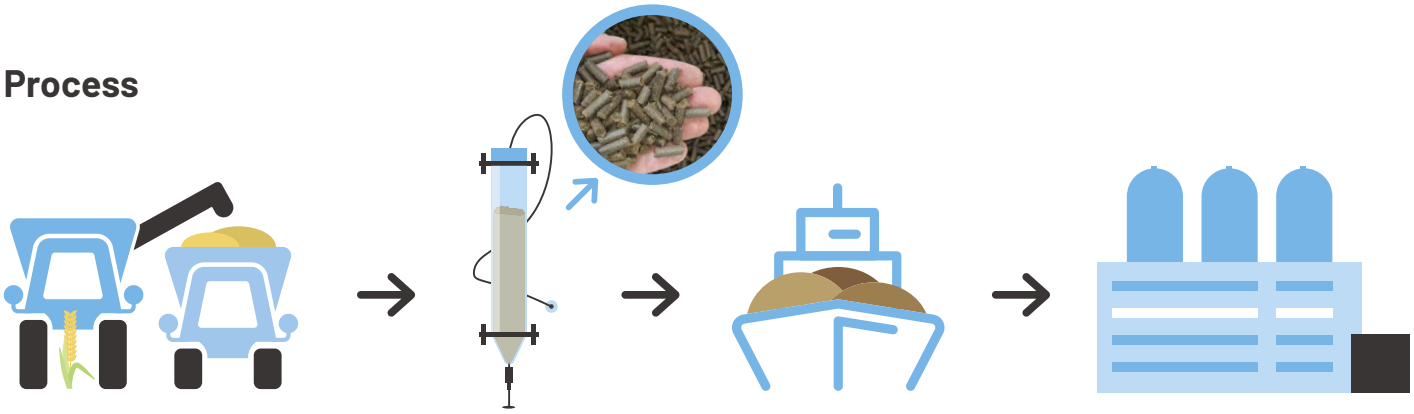
The project was funded by TKI-BBE and project partners. It is a unique cooperation where the entire supply chain is represented: farmers (Cradle Crops), agro-industry (Palmaceites in Colombia and Raizen in Brazil), technology developers (Viride, Wageningen Food and Biobased Research and TNO), harbour facilities (SmartPort) and possible end users (RWE, AER). The project started in February 2019 and ended in April 2021. WFBR, TNO and Viride have performed the main research tasks.

Research

In order to produce a commodity that is dense, stable and low in nutrients, a two-step approach was used. First the material is extracted with water to remove the nutrients. The extracted nutrients may be reused in the field. In the second step, the material is pre-treated and pelletized to improve density and stability.

Experiments showed that potassium, sodium and chloride content can be reduced by over 90%. The pelleting process was more smooth after pre-treatment. The density and durability of the pellets were good. Application tests on the resulting pellets were performed.

Process



These tests showed that the pellets could be applied in a coal fired power plant and subsequently decreases the dependency of coal. The pellets that were pre-treated under mild conditions were hydrolysed to produce sugars that were successfully fermented into ethanol.

The economic assessment showed that pellets could be produced and transported to Rotterdam harbour area at a cost of 6 Euro/GJ. The sustainability analysis showed that the GHG emissions are low and that savings of over 90% can be achieved for combustion applications and over 70% for liquid fuels application. The extraction of nutrients improves both the economy (savings on fertilizer costs) and the environmental impact (savings on new fertilizer production) of the production chain. For a price and emission comparison with other feedstocks delivered and used in Rotterdam respectively, see table 1.

Read the full report of the research here

Outlook

The Rotterdam Port area is very suitable for transhipment of agro-pellet commodities. It can be reached by large vessels to receive pellets from inland and from overseas. It already has large facilities for production of electricity/heat and ethanol that could be converted for the use of agro-pellets. In the longer term, the agro-pellets could be used to provide raw materials for the (petro)chemical and fermentation industry. Several pathways are possible: via gasification, via pyrolysis, via furans or via hydrolysis and fermentation.

Biomass is not always regarded as a sustainable energy source. The CAPCOM-NL project may serve as an input for constructive debates concerning this topic.

Table 1	Price	Emission
	Euro/GJ Lower Heating Value	gCO2eq/MJ electricity
CAPCOM	5.1-6.3	12-21
Wood pellets	9.0	19
Coal	3.0	231
Natural gas	4.7	101
Fossil comparator		183

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