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ACRRES:
# an innovative small scale biorefinery pilot

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Background

At ACRRES (Application centre of Renewable Resources) an innovative concept of small scale biorefinery is constructed and tested, aiming at maximizing locally the valorisation of biomass for food and non-food purposes. The concept is directed at transporting high value products (end products and semi-manufactured products) resulting in minimised transport of water and maximised local re-use of nutrients. As such, small scale biorefinery can be a stepping stone in the development and implementation of the biobased economy.

Biogas

Energy Production from fermentation of animal slurry is a great opportunity to improve environmental impact of animal farming. By controlled fermentation of animal slurry the natural process that causes release of methane and CO2 into the environment is harnessed. Using anaerobic digestion the biogas is captured instead, and used for the production of green electricity by combustion producing heat as a by-product. The remaining material (now called digestate) still contains the nitrogen and phosphate components that make it a valuable fertilizer.
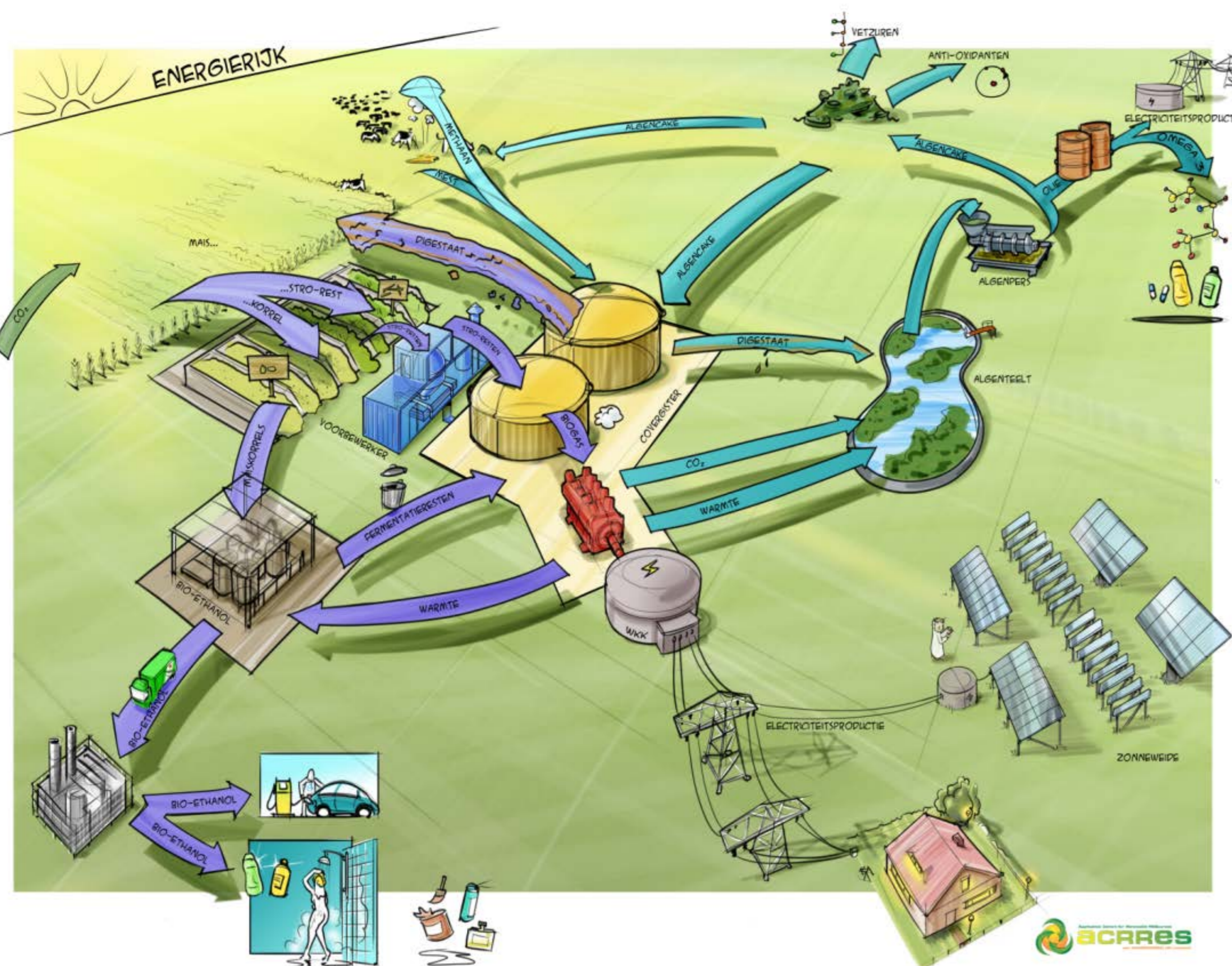
Corn refinery

The Byosense corn refinery process designed by Byosis is tested as part of the small scale biorefinery. This refinery process starts at harvest level where corn kernels and stover are collected separately. The stover is used to give a boost in biogas production when added to the anaerobic digestion, especially when pretreated. Corn kernels are further refined. First alcoholic fermentation transforms the starch into ethanol which can be used as biofuel, as raw material for chemical industry or as an ingredient of various types of liqour. The remaining solid material is rich in protein and valuable as a feed ingredient. Heat is needed for several steps in the process which is provided by integrating the corn refinery with the nearby CHP that produces both heat and electricity from biogas.

Biomass pretreatment

Biomass pretreatment is used to increase the efficiency of an anaerobic digester by hydrolyzing low-value biomass that is difficult to digest (e.g. maize stover). The technology aimed at is Thermal Pressure Hydrolysis in combination with flash explosion. This process uses a combination of heat and pressure to break cell walls and connective tissue, thus increasing the accessibility of organic material for the micro-organisms inside the anaerobic digester. As a result the production of biogas increases and the cost per unit of biogas decreases. At the same time competition with food purposes is reduced. For the pretreatment process, heat from the Combined Heat and Power (CHP) engine is used.

Algae refinery

Algae cultures are a promising new method for production of biomass, because algae have the potential of high productivity but more so because a well selected algae strain can contain high percentages of protein, starch or oil. At ACRRES the algae culturing and harvesting technology of algae food & fuel (AF&F) is put to a test. The ponds are used to grow algae fed by minerals from digestate and CO2 from the flue gasses of the nearby digester and the CHP engine. In addition the growth of algae is increased by using excess heat from the CHP engine to support algae productivity. Currently, the algae biomass produced is mostly used for high value feed applications (feed additive). We are aiming at setting up and testing algae refinery methods to allow separation of the biomass into valuable components such as proteins and PUFA's.

Future additions

The tested ACRRES concept is not a fixed concept but keeps evolving with new developments in technology and environmental research. At this moment the addition of a refinery process for manure or digestate is considered, as is a biogas upgrading installation which converts biogas into a liquid biofuel and concentrated CO2. In a broader sense ACRRES is open to new and innovative technologies that help to maximizing the utilization of available resources.