



Renovia: Surplus manure to create valuable products

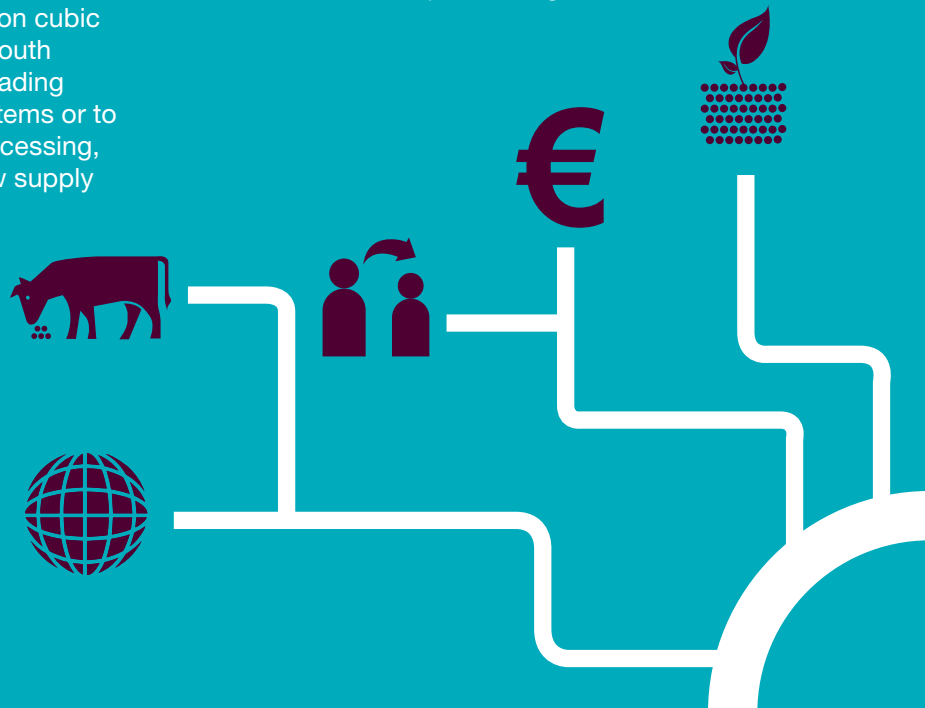
Development Plan Summary (Eindhoven, Netherlands)

Overview: In the Netherlands, 70 million tonnes of cow, pig and chicken manure are produced every year. Much of this manure is utilised as a fertiliser for grass, corn and other crops. Current regulations and legislation means that a surplus of around 5 million cubic metres (predominantly of pig manure) is left. Renovia has been working with a number of partners to develop an economical and ecologically responsible approach to converting this residual manure into high value products, including liquid fuels which can be used as aviation fuel.

Transforming manure into aviation fuel has many stages. The first step in the process to convert pig manure into liquid fuels involves separating the manure into three components: clean water; a thick, semi-solid manure; and a thin liquid which contains the nutrients, nitrogen and potassium. Houbraken's Hobe BV Mestverwerking plant has many years of experience in this type of component separation and can process 60-80,000 cubic metres of manure every year. However, in order to meet demand, 14 units would be required just to process the 1 million cubic metres of surplus manure produced in the south east of the Netherlands. Difficulties in persuading companies to invest in such processing systems or to transport manure to regional centres for processing, led Renovia to investigate and identify a new supply chain approach.

Renovia's partnership with VP systems, (a company specialising in filtration techniques, particularly manure), suppliers and processing plants led to Renovia forming the joint venture, VP Minovia. VP Minovia's plan is to build 14 manure processing plants located on the sites of specialist

companies in the south east of the Netherlands. These sites would ensure the supply of manure and the disposal of the concentrate residue. The solid fraction would then be sold for a fixed price to Renovia for further processing. This supply chain approach enables farmers to dispose of their manure for a fixed, low price. At the same time, contractors are able to generate sales and ultimately profits, and VP Minovia is assured of an adequate supply of raw materials for further processing.

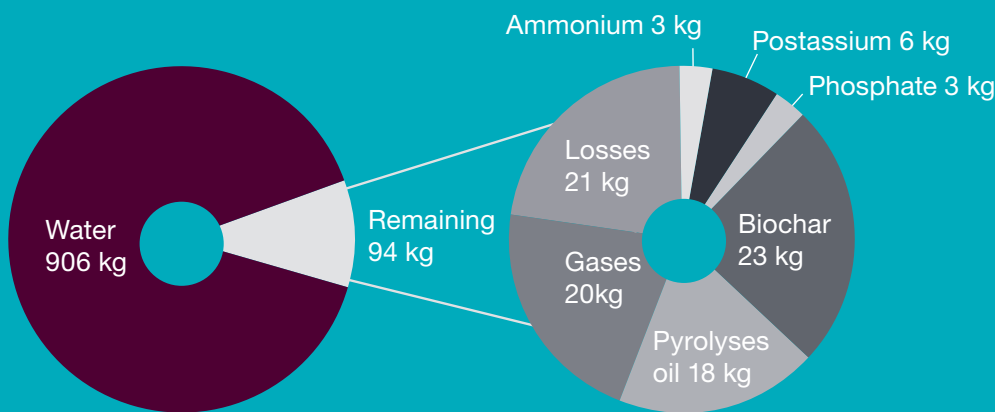


Further processing would be carried out in centralised plants using a Pulverised Air Dryer (PAD). The PAD system requires far less energy than a traditional tunnel dryer. It is odourless (due to presence of ammonia) and also allows nitrogen to remain in the manure. The thick manure is still classified as a manure rather than a fertilizer as the nitrogen, phosphorous and potassium is below the 16% legal limit. If it was more than 16% it would need to be sold abroad due to EU legislation.

The concentrate of the processing can also be further processed to create a solid ammonium sulphate and a liquid with potassium content of almost 30%, both of which can be sold as fertilizers. This process can take place in a large scale unit in the south east of the Netherlands.

Instead of burning the thick manure (70% dry matter), Renovia is investigating the opportunity to create a higher value product in the form of biochar. Biochar can be created using a pyrolysis process (heating without oxygen). Biochar can be used to improve the structure of soil and enhance its carbon content. Due to its phosphate content, it is also able to improve soil fertility. This could be very valuable for agricultural land and also increase crop yields.

As well as biochar, pyrolysis also generates gas and oil. Research is currently taking place to investigate whether the pyrolysis oil can be upgraded to kerosene, which can in turn be used as aviation fuel. Pyrolysis oil could also be used as fuel for lower quality applications, for example, for use in ground power units at airports or fuel to power mobile generators.



Collaboration

The pyrolysis of manure is the basis of a joint initiative between Renovia and BioenNW partner, SRE. The initiative enabled Renovia to conduct research into the transformation of manure into aviation fuel and SRE provided help with legal and licensing requirements. This ranged from listing the licenses required for the various steps and the requirements for these licences, to finding partners and helping to establish contacts with other partners.

This development plan has been produced through BioenNW – a €7.9m strategic initiative of the European Union INTERREG IVB North West Europe Programme (2011-2015). BioenNW is led by the European Bioenergy Research Institute at Aston University, UK and sees 11 partners working together to deliver small-scale bioenergy schemes throughout North West Europe.

“People often think of manure as a problem. In fact manure could be a solution for many other problems, such as soil degradation, nutrient deficiency and the growing demand for renewable energy.”

Henri Elen, Director of Renovia

“The trick is to bring the various partners, such as business, government and research institutes, together like musicians in an orchestra.”

Henri Elen, Director of Renovia

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