Integrated systems for farm diversification into energy production by anaerobic digestion: implications for rural development, land use & the environment

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Project aim:

To examine the potential for energy production by anaerobic digestion (AD) on farms, and the contribution this could make to rural development and diversification of agricultural practice.

Anaerobic digestion (AD) can be used to provide renewable energy from most organic material.
AD produces 2 outputs:
- energy in the form of biogas
- digestate a source of organic fertiliser.

The project will investigate changing land use to energy production using AD including:
- optimising crop selection
- effects on the environment,
- social impacts (economic and visual)
- public and farmer perception of the use of AD.

Crop based AD for energy:
- provides alternative employment
- can increase diversity through the use of a wide range of crops
- produces a fuel which clean, environmentally friendly and has multiple uses.

areas of research

technical & economic models

plant & animal diversity

crops & cropping

crops

digestate

large and small scale digesters

biogas

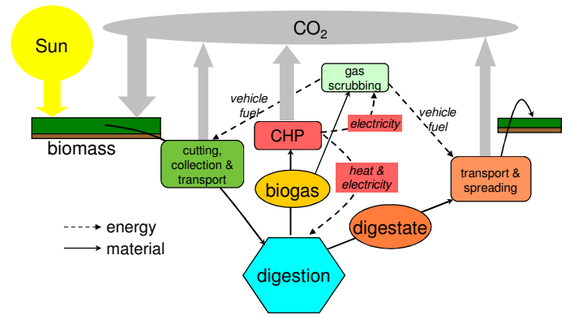
CHP

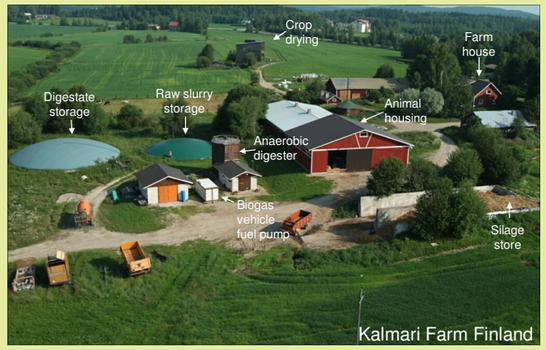
vehicle fuel

land use

social impacts (employment, community, transport, visual)

AD of crops can result in both CO_2 and energy cycles which are closed. Energy, produced in the form of biogas, can be converted to heat and electricity (CHP) used in the process, and to vehicle fuel used in crop production and digestate distribution. CO_2 released in the production and use of the fuel was initially absorbed by the crops used making the process carbon neutral.





The use and benefits of anaerobic digestion at farm scale have been demonstrated at the Kalmari farm in Finland. The farmer digests cattle slurry and crops produced on the farm, with some imported chocolate waste. The biogas is used in CHP to provide electricity and heat for use on the farm plus providing vehicle fuel used by the farmer and sold locally.

Project objectives:

Technical Issues

- Construct a technical database of processing and engineering options for farm-based biogas production
- Analyse technical factors that influence the end use of biogas as a fuel source
- Identify crop species and growth stages suited to energy production through anaerobic digestion

Modelling

- Develop an energy-based model of crop types available for energy farming within the UK
- Model the commercial profitability of AD energy production at a farm level within both large and medium-sized arable and dairy systems scenarios
- Energy and economic analysis for co-digestion of slurry, farm-produced wastes, and/or imported organic wastes

Societal Issues

- To assess whether farm energy self-sufficiency (or partial self-sufficiency) is achievable and more desirable than energy export off the farm
- Social, community and economic benefits of farm diversification to farmers and the wider rural community
- Assessment of acceptability of diversification into energy production by AD from a public and farmers' perspective and responses to new patterns of land use

Environmental

- Assessment of potential environmental benefits and impacts of nutrient management through fertiliser substitution
- Assessment of benefits to environmental protection (including GHG and ammonia emissions) on farms through introduction of AD
- Development of methods to assess potential benefits to biodiversity in a wider context as a result of diversification into farm energy production through AD

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