



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

Energy production on farms through Anaerobic Digestion

The potential for bioenergy production through on-farm anaerobic digestion (AD), and the contribution this could make to rural development and diversification of agricultural practice.



The Broad Challenge

- To find reliable, diverse, affordable, safe, environmentally sustainable and publicly acceptable mechanisms for the productive use of agricultural land for energy supply, incorporating agricultural waste treatment, nutrient management and promoting environmental protection and improvement, within integrated conventional farming systems.

Aims

- Carry out a detailed analysis of regulatory measures in the European Community and those specific to the UK that influence the development of bioenergy and biofuel production
- Identify drivers and obstacles to the development of on-farm digestion as part of a wider strategy for rural development and for meeting cross compliance criteria
- Assess the technology options and their compatibility with farming practices
- Develop rigorous models for the economics, energetics and land use implications of diversification into on-farm energy production using energy crops, agricultural residues and wastes
- Assess the benefits and potential drawbacks for environmental protection and sustainable agricultural practice, using novel environmental risk-based analysis methodologies
- Seek farmers' opinions on diversification and renewable energy production using AD, and explore the potential benefits to the wider rural community from uptake of this technology in an integrated farming system



Specific objectives

- To review policy and regulatory drivers currently in use across Europe to promote farm-based energy production, their compatibility with international obligations, and to view these in a UK context for the promotion of AD as a contributor to rural development making use of the results to inform policy makers involved in strategic planning.
- To document the state of the art of anaerobic digestion as applied on farms for the purposes of nutrient management and energy production and to use the results as a base line for the development of farm based digestion models
- To construct a technical data base of the processing and engineering options for farm-based biogas production which will give information on capital and running costs for different digester layouts and sizes
- To analyse the technical factors which influence the end use of biogas as a fuel source providing a cost basis for the externalities of on farm energy production and the economic implications and stability of markets for exporting renewable energy off farm as either electricity or transport fuel
- To identify crop species and growth stages suited to energy production through anaerobic digestion to establish the potential for crop energy productivity on a UK regional basis
- To construct an energy-based cost benefit analysis model for energy farming within the UK using AD technology that will provide the net energy yields per hectare based on a whole systems analytical approach
- To estimate, for both arable and dairy scenarios, the commercial profitability of AD energy production within the system boundaries of the farm by producing a sophisticated model capable of running different land usage scenarios at different scales of operation and to verification of this model using a case study scenario approach involving a elected number of farmers.

- To make an energy and economic cost benefit analysis for the co-digestion of slurry, farm-produced crop wastes, and importation onto farms of commercial food waste and/or other organic wastes in order to assess the feasibility of on farm digestion without supplementary land use implications
- To assess the environmental benefits and impacts of nutrient management through fertiliser substitution to provide data which will add an environmental dimension to the economic and energy models as well building a knowledge base on which an environmentally sustainable nutrient management strategy can be built for the UK
- To assess of the benefits to environmental protection (including GHG and ammonia emissions) and disease management on farms through the introduction of anaerobic digestion as a diversification activity by developing a cost benefit analysis to provide data for an overall ERA and data input into the central suite of models.
- To assess the potential benefits to biodiversity in a wider context as a result diversification of farming into energy production through anaerobic digestion by developing an ERA based approach and conceptual models which can be used to identify the response to a wide range of agricultural changes as a result of diversification of the farming system.
- To assess whether farm energy self sufficiency (or partial self sufficiency) is achievable, and a more desirable option than the export of energy off the farm.
- To assess whether there are social, community and economic benefits to the rural community including some of the less tangible community benefits which may be regionally variable, the potential for job creation and the development of new skills
- To assess the acceptability of diversification into energy production by AD from a public and farmers prospective and to judge the response to any new pattern of land use
- To provide an overall economic and environmental impact assessment of AD in a UK farming context on which policymakers can make decisions as to its role in a rural development strategy and from which stakeholders in the rural and agricultural communities can evaluate the suitability of the technology to local circumstances.

Inter-relationships



