Intervention Strategy for Wales:

A Vision for Small Scale On-farm Anaerobic Digestion

November 2016

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691755.

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Introduction to the Biogas Action Project

Biogas Action is an EU funded Horizon 2020 project[1] which aims to promote rapid development of the European biogas/ biomethane sector by focusing on the non-technical barriers to widespread production of biogas from manure and other organic wastes.

Introduction to the Intervention Strategy

This document has come about following discussions with key stakeholders from agricultural and anaerobic digestion industries and regulators in Wales, and represents the views of members of the group. Severn Wye Energy Agency, under the Biogas Action project, have facilitated these discussions and compiled this report as a recommendation to Welsh Government to introduce an Anaerobic Digestion Strategy for Wales.

Introduction to the Biogas Sector in Wales

In Wales, there are 15 Anaerobic Digestion (AD) plants[2], of which 10 were completed in the past 3 years. 5 food waste plants currently exist; although a further 10 plants are in the developmental process. 2 of the existing plants process "other waste" (abattoir waste, and the organic fraction of municipal solid and commercial and industrial wastes).The remaining 8 AD plants are farm fed (Table 1).

With the exception of food waste processing plants, the AD industry in Wales is centred upon small to medium scale facilities, and it has been identified that this lower capacity, i.e. farm scale AD, is the area that requires the most support.

Dairy farming, in particular, would be a primary candidate for farm scale AD, as it produces large volumes of manure and slurry and also has relatively high energy use. The dairy farming industry in Wales is centred primarily in South West Wales, in the counties of Pembrokeshire, Carmarthenshire and Ceredigion, and to a lesser degree in some areas of North East Wales. A recent study in 2014[3] reported there to be 1,853 milk producers in Wales, which showed a 32% decline from 2004 figures. The total number of dairy cows in Wales, however, has only fallen 4% in the past 10 years, with a total number of 234,000 in 2014. The average herd size, therefore, has increased (by 7.4%) to 127 dairy cows. If these were good-sized dairy cows, the slurry from these would equate to an AD plant of approximately 13kWe or equivalent.

UK funding for electricity generation from AD plants (FITs; Feed in Tariffs) and, more recently, for the use of renewable heat and biomethane injection (RHI; Renewable Heat Incentive), has unintentionally tended to favour comparatively large scale systems, due to the way the tariffs are set and structured. Small scale, on farm AD below 500kWe capacity has proven to be more difficult to fund due to the relatively high cost of project delivery in

[1] The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither the INEA nor the European Commission are responsible for any use that may be made of the information contained therein.
[2] Data from AD Portal Biogas Map , updated May 2016
[3] Dairy statistics: An insider's guide 2015. Agriculture and Horticulture Development Board (2015).

comparison to the energy generated. While larger scales of AD offer benefits in terms of cost per kWh of energy, they require secure supplies and larger volumes of feedstock. This has tended to mean that they rely heavily on crop feedstocks in order to be able to manage the financial risk posed by feedstock insecurity; or that they are waste fed. The growing of maize is seen as being particularly disadvantageous in environmental terms and grass would be seen as a better supplement to waste products (if considered essential), and produces a similar gas yield. While small scale AD is higher cost per kW of energy delivered, it can deliver a range of wider benefits to the agri-environment sector which are not currently recognised financially.

Advantages of on-farm Anaerobic Digestion of Animal Wastes

There are many advantages to promoting farm scale AD in Wales. From an environmental perspective, processing slurry through AD enables sustainable nutrient management on farm, and also enables the export of unwanted nutrients from enriched sites to sites lacking in nutrients. AD also enables sustainable soil management, by increasing soil organic matter and water holding capacity. Greenhouse Gas (GHG) emissions are reduced with less storage, handling and spreading of manure, and decreased demand for chemical fertilisers.

There are also several economic advantages of farm scale AD. Dairy farms have high heating and cooling demands and heat generation can be utilised to heat buildings, water for washing down and sterilisation, drinking water for the cattle (which improves health), or to dry timber, and there are currently government incentives (RHI) to do this. Therefore on-farm energy costs are decreased, in addition to reduced slurry management costs and fertiliser costs. Grass growth achieved from digestate application has been shown to parallel that of a compound chemical fertiliser, thus negating the need to purchase fertiliser in many cases. In comparison to direct slurry application, the use of digestate as fertiliser has been shown to increase the growth rate and quality of grass, thus resulting in healthier cattle. Digested slurry is less odorous than the raw material and therefore improves the amenity of the surrounding area. The biological oxygen demand of digestate is far lower than raw slurry and the nutrients are in a form that renders uptake by the plants much easier – the pollution of water courses and groundwater is therefore much less likely with digestate than with raw slurry.

AD can be used as a means of reducing pathogens, parasites and viable weed seeds from slurries and manures, with careful consideration of feedstock retention times and digester temperature. It can subsequently be used as a means of processing infected manure, and of decreasing weed proliferation on farmland, thus reducing the associated costs of infection / weed control. A pasteurisation step could be added for processing problematic feedstocks, as is already mandatory for digestate arising from food waste.

Barriers to Implementation of Small Scale Anaerobic Digestion

The general perception amongst the group was that legislation surrounding AD is overly complicated, including waste legislation, movement of slurry regulations, and planning regulations, although these regulations are reduced for a small scale plant using on farm wastes only. The costs and associated risks, as well as high capital costs with inadequate funding, make AD an unattractive proposal for a small scale farmer. Legislative restrictions can also complicate farming cooperatives that might look to pool feedstock into one plant.

Although the dairy farming industry may be the most suitable candidate for AD plant promotion, it is currently unstable due to low prices for milk. Many small dairy farms are being sold, or at least are not currently planning long term developments. The extra workload associated with supplementing a slurry based AD plant with additional feedstock can be difficult to maintain within a small dairy farm.

As there are few on-farm AD plants in Wales, awareness and interest among farming communities is low. Therefore there is a clear need for awareness raising, demonstration events and training events. Sound, independent advice would also be very valuable and this appears to be in short supply at present.

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Enable a funding stream for anaerobic digestion which does not conflict with energy generation subsidies
It has been identified that the current (revenue) funding for AD plants should be re-assessed in order to provide support (e.g. capital grants) for the environmental benefits of AD; e.g. pollution mitigation, GHG mitigation, decreased mineral fertiliser use; and that this funding should be separated from the current funding for renewable energy production. The dual funding issue could be addressed by separating the digester (environmental benefits) from the CHP or boiler (energy generation). In this way small scale AD plants, with little energy production but significant environmental benefits, could be funded.

An alternative means of support would be to develop a low interest loan scheme that would secure debts against the infrastructure as opposed to the farm business itself, with professional support for loan applications.

Introduce professional support for small scale AD
Independent support for small scale AD is required, for example assistance with the perceived complications of funding, planning and legislation, and / or simplification of required procedures.

Support awareness raising and demonstration events
Awareness raising and demonstration events are needed to inform the farming industry of the benefits of on farm AD. With this in mind, we suggest a number of farms of average size, e.g. 100-150 dairy cows, are identified to receive Welsh Government funding to develop demonstration slurry-based AD plants. Manufacturers of small scale AD plants, CHP units, and biogas boilers need to be involved with awareness raising events and could be offered support to develop new appropriate products.

Enable farming cooperatives
Larger scale AD plants could be developed on farm if farming cooperatives were developed in Wales, which would lead to increased payments from renewable energy subsidies and thus greater income. We suggest the legislation surrounding movement of cattle slurry is reviewed and potentially suitable locations are identified to investigate if farming cooperatives could be enabled through reduced restrictions.

Support Local Energy Supply
Support can be given to develop biogas storage combined with extra CHP capacity; to enable pilot plants to generate electricity at times of high demand, attracting higher export tariffs and

easing pressure on the grid. This could be coupled with the Energy Local model to supply energy to the local community who in turn match their demand to local supply. This model could support solar generation, i.e. generation of electricity from AD when the solar farm is not generating, and could therefore be designed to share a grid connection with PV.

Monitor the Situation in Respect of Chicken Litter/Nitrogen Stripping

There are many large poultry units in Wales with high energy demand, and the litter from such units is high in nitrogen. Spreading to land often leads to odour issues and there is growing concern about the impact upon watercourses. Other than as a minority constituent, chicken litter is seen to be a difficult feedstock for AD, but there are prototype plants being built on the near continent (particularly Netherlands) that are using nitrogen-stripping technology to pre-treat the litter. If this technology becomes proven then AD in association with poultry units may well become an extremely environmentally valuable tool. We suggest that a demonstration chicken litter-fed AD plant is developed to investigate this feedstock further.

Enable the use of alternative biomasses to energy crops

Current practices often incorporate some degree of energy crop input to supplement the AD feedstock, but this practice can be controversial if arable land is used for energy crop production. We suggest the consideration of alternative biomasses for this purpose, e.g. on-farm organic waste and grass, arisings from management of nature conservation areas or from the transport network's verges. The waste classification of this resource (arisings from the soft estate) should be reconsidered if it is proven to be a valuable feedstock for energy generation. Awareness raising events can highlight alternatives to energy crops.

Explore the Potential of Payment for Ecosystem Services (PECS)

The digestion of animal slurries has many facets that render it a suitable candidate for PECS. If such monies do become available, then the digestion of animal wastes should be considered as a highly appropriate intervention to improve soils and watercourses, for example, particularly in nitrate vulnerable zones or other sensitive ecosystems.

Site	County	Completion date	Technology provider	Capacity (kWe)	Output	Feedstock
Food waste						
Llwyn Isaf	Gwynedd	2013	Biogen	500	CHP	Food waste
Waen Biogas	Denbighshire	2014	Biogen	1000	CHP	Food waste
Tomorrow's Valley	Rhondda Cynon Taff	2015	Biogen	1000	CHP	Food waste
Bryn Quarry	Caerphilly	2016		1400	CHP	Food waste, slurry, energy crops
Rogerstone Park	Newport	2011	EnviTech Biogas	500	CHP	Food waste, potato processing waste
Other waste						
Great Porthamel	Powys	2014		500	CHP	Abattoir waste, manure, maize
Burdens Environmental	Carmarthenshire	2011	Burdens	16	CHP	MSW, C&I waste (organic fraction)
Farm fed						
Lodge Farm	Wrexham	2010	Fre-Energy	160	CHP	cattle slurry, poultry litter
Bank Farm	Powys	1991	WRI (Murcott)	125	CHP	cattle slurry, poultry manure, apple pomace
Tain Y Foel Farm	Conwy	2014	Marches	n/a	Heat only	slurry
Warren Farm	Powys	2016	Marches	250	CHP	FYM, crop silage, sugar beet
Pancross Farm	Vale of Glamorgan	2013		500	CHP	cattle slurry, silage
Caerfai Farm	Pembrokeshire	1997	Self built		cooking gas	cattle slurry, cheese production waste
Glanmeheli Farm	Powys	2015	Marches	500	CHP	poultry / cattle manure, beet, maize
Gelligarneddau*	Ceredigion	2016	Lutra	125	CHP	cattle manure, cattle slurry, grass silage

Table 1: Existing AD plants in Wales (data from AD Portal Biogas Map[4], updated May 2016, and *pers. comm.).

[4] http://www.biogas-info.co.uk/resources/biogas-map/ Accessed May 2016