Policy Recommendations

to accelerate the implementation of on-farm anaerobic digestion

Report To the Government Office of the South East

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Background

I am a farmer. I have previously written a DEFRA funded study on the implementation of renewable energy on farms, worked briefly in the wind power industry, and have two decades experience of communicating climate change as co-founder and chair of an environmental information organisation.

However it is from the perspective of a commercial farmer that I make the following recommendations.

Introduction

This document contains a number of policy recommendations that have been formulated as a result of my SEEDA funded research into on-farm AD.

I have taken what I perceive to be the main barriers to implementation and made suggestions as to how these barriers can be reduced or removed. For farmers and their bankers/investors seeking to get into AD, a return on investment sufficient to compensate for the risks and opportunity cost involved is required. Why else do it?

If action is sought from farmers to undertake activity to mitigate against climate change, then farmers need to be compensated for the private provision of public goods just as they are for conservation benefits through Natural England's stewardship schemes.

Feed-in Tariffs (FITs)

FITs are having a major impact on farm renewables. I myself expect to be installing in-field solar PV over the next 12 months. I am doing so because finally I see the possibility of a commercial rate of return.

Regrettably the FIT has failed AD in two regards. Firstly the levels have been set too low to provide and adequate return on investment, and no provision has been made to give incentive to the installation of smaller on-farm AD plants.

Considerable lobbying of DECC was made to this effect during the consultation phase, particularly by the Renewable Energy Association (REA).

The DECC calculation for on-farm AD FITs contained an error. DECC assumed in their calculations that maize silage – a key feedstock of almost all on-farm AD plants – should be included at zero cost.

Whilst manure may (usually, but by no means always) be free to a farmer, maize is certainly not. Owen Yeatman who runs one of the first on-farm AD plants (375kW) in the UK relies on maize to provide 70% of his gas output, with 30% coming from manure from 400 cows. Yeatman puts a figure of £25,000 on his annual requirement for 1,000 tonnes of maize, ie £25/tonne. A 1MW plant can use up to 25,000 tonnes of maize silage per year.

Others have made the calculation using maize silage costed at £25 per tonne, that the resulting electricity cost from maize alone is 5p per unit. Hence a further 5 pence per unit is required to meet and IRR of 8%.

DECC calculated FITs on an Internal Rate of Return (IRR) of 8%. This IRR figure of 8%, whilst perfectly acceptable for a very low risk and low intervention technology like solar PV, is wholly inadequate for AD. AD is a far riskier, complex, and relatively untested option and this needs to be reflected in the IRR. Venture Capital (VC) funding requires at least a 15% return. Planned on-farm AD plants involving VC funding have been cancelled following the FIT announcement.

In addition the FITs provide no increased incentive for smaller plants, ie 350kW and below. When I asked Jeremy Eppel, Deputy Director of Future Farming at DEFRA, why smaller plants had not been given a greater incentive in the FIT scheme, in a similar fashion to other renewables, his reply to me was that there was a “lack of evidence base” for doing so.

Of course a sliding scale encouraging smaller plants would have quickly allowed early adopters to provide this much needed evidence base. Without reliable figures on smaller scale on-farm AD few farmers and their investors will enter the market. The FIT could and should have been designed to provide this evidence base.

The fact that by adopting manure-based AD systems farmers are reducing methane emissions to the environment should also be recognised and rewarded. Methane (over the short term in which action is more urgently required) is at least 70 times as powerful a greenhouse gas as carbon dioxide, and hence should be a major priority in climate change mitigation policy.

Manure has low value as an AD feedstock, but very high importance as a producer of greenhouse gas.

Recommendation 1

The FIT level for AD should be recalculated using an IRR that reflects commercial lending environment and the cost of money to invest.

Recommendation 2

The FIT level should be recalculated using the appropriate farmer cost for maize.

Recommendation 3

A graduated scale of higher FITs for smaller plants, similar to that used for wind, solar PV and hydro should be implemented to stimulate this end of the market, and to provide an evidence base for small scale, on-farm plants.

This FIT level could be degressed in a similar way to other renewable technologies, with early adopters being offered an additional incentive for a limited period, so that the financial burden would not be large. An evidence base for small scale AD and also a demonstration case study programme would emerge by default.

Recommendation 4

Avoided farm methane emissions should be valued at their true short-term Global Warming Potential of 70 times carbon dioxide equivalent. This will highlight the priority for action on methane avoidance. Consequently this significant contribution to emission reduction from on-farm AD should be given an additional incentive through a FIT supplement for use of manure as a feedstock.

Grid Connection

For an AD plant intending to generate electricity a grid connection is required. If the proposed location does not have sufficient line capacity (usually a 11kV line) the operator is responsible for upgrading the grid to his plant in order to be able to export and sell electricity.

Two existing on-farm AD plants (Kemble, Cirencester and Lowbrook, Dorset) both had to scale back their generation ambitions because of low grid capacity.

Quotes for grid connections to proposed farm plants range between £650,000 and £9,000 with an average of £90,000 per plant. Whilst connection costs will have to born by someone, many on-farm AD plants are falling at this first hurdle.

A mapping exercise to provide information on rural grid capacities would remove considerable uncertainty from farmer feasibility processes.

Recommendation 5

Improve access to information regarding local grid conditions and availability on or near farms. This information has the potential to assist other renewable energy developments, not just AD.

Farm size and the need for farm cooperatives

The minimum currently viable on-farm plant is 0.5MW, at a cost in the region of £2M. Some will dissent from this figure, but this is the recognised industry view. Many would argue that, given the FIT levels, the minimum is closer to 1MW to make a profit.

The "tank capacity" of the plant is a small percentage of the overall budget; much of the operating facility is required whatever the capacity – hence the push to larger plants.

The mapping of manure availability, ie where the livestock farms are in relation to each other, would be a considerable spur to activity. In essence, if sufficient feedstock is available within "tractor haulage distance" then AD cooperatives are possible. Clusters of viable cooperation could be identified and encouraged. Of almost equal usefulness is the information that for many farms, AD without FIT encouragement of small-scale operations, is not viable.

Clearly financial risk can also be reduced though collaboration.

The need for collaboration and unfit FITs

A 200 cow dairy herd requires roughly 250 acres to feed itself. In order to utilise the manure from 200 cows in a 250kW AD plant a further 250 acres of maize is required to feed the AD plant. In other words, in a cattle manure/maize only system of this size the area farmed has to double. Despite this, the FIT calculations put maize in at zero cost.

Food waste

Animal manures are the least productive AD plant input, as their gas yields are low. Slurry from 200 cows would provide only 3.2% of the gas required for a 250kW plant: a further 100ha of maize is required.

Manures are not a good feedstock for AD plants, except for the fact that they are usually free.

Put another way, the addition of food waste into a previously manure only AD plant in the ratio 20% food waste, 80% manure will double the gas/electrical output.

In order for farmers, particularly those with less than 500 cows (the average English herd size is 112) to be able to offer the methane management and climate change mitigation possible with an AD plants, other feedstocks are required. Maize is one such feedstock. Food waste is another.

From a strict energy perspective, using a calculation based on Energy Return on Energy Invested (EroEI), the amount of energy used in cultivations, fertiliser, etc to produce maize, most wastes are a better feedstock for AD plants than energy crops. Hence a policy promoting food waste use over maize use has unassailable environmental credentials.

Maize however is a much better energy crop for the UK than rape grown for biodiesel or wheat grown for bioethanol. You can travel three times as far in car fuelled by a hectare of maize producing gas in an AD plant than you can from the same area of rape or wheat.

Food waste is very difficult to source for a farm operator. Many organisations have an interest in this process: WRAP, NISP, Environment Agency, Waste Collection Authorities, Waste Disposal Authorities, Private Waste Contractors, Regional Development Agencies, etc. This is in addition to those actually producing the waste!

Once again the mapping of the local availability of food waste can begin to offer a means of enhancing the viability of on-farm AD.

Recommendation 6

Demonstration projects should be encouraged to look at collaboration between local authority food waste collection and farmers. Not only is a combination of food waste and manure a good feedstock for an AD

plant, but also land is required to spread the AD plant digestate output.

Recommendation 7

Three key aspects of on-farm AD viability - grid, manure availability in the locality, and food waste availability - are all location specific.

There is a need for mapping, down to the individual farm level, to offer the information required to understand local viability, particularly with respect to cooperative ventures.

Modern GIS capabilities offer an easy solution to this problem. A number of small initiatives are underway (Cheshire and Lincolnshire), though none capture the range of information required to properly promote activity.

Biogas to Grid (BtG) and Biogas to Vehicle (BtV)

Other AD models remove the need for an electrical grid connection completely. In these models the gas is utilised directly.

The cost of a generator engine to convert the gas to electricity is avoided, but a "gas scrubber" of comparable cost is required to clean the gas. The gas can then be feed into the existing gas grid or directly to power vehicles.

BtG is being promoted by the UK Anaerobic Digestion and Biogas Association (ADBA) and is widespread in Continental Europe, particularly Germany. Although a growing number of German farms are connected into the gas grid, this seems an unlikely option for most UK on-farm AD.

BtV however is used in some circumstances in Continental Europe on quite small farms. Gas vehicle use is growing, but little research is taking place in the UK to demonstrate a model whereby gas from on-farm AD can be used in vehicles.

The Department for Transport Renewable Transport Fuel Obligation is the stated financial incentive in this regard, though to date there is little awareness of the use of this in context of on-farm AD. Lincolnshire County Council are looking into this as a fuel source for public sector vehicles.

Recommendation 8

Demonstration projects should be established to examine the use of AD biogas in vehicles.

In particular there is an excellent business and environmental case for AD gas use in local authority vehicles. In the SEEDA region Eastleigh (constituency of the new Secretary of State for Energy and Climate Change), is keen to pursue this option.

Grant confusion

Since my original investigations into farming and renewable energy in 2006, the situation with respect to grant funding for farmers and climate change mitigation has been nothing but extremely confused. A Carbon Trust employee admitted to me that farmers are discriminated against. UK businesses can receive an interest free loan up to £100,000 from the Carbon Trust for implementing carbon dioxide reduction investment including renewables. Farms can only receive a maximum of £20,000, ie 1% of a typical AD plant cost. In addition, the Carbon Trust is unable to confirm if their loan is compatible with the receipt of FITs

Throughout the 12 months of my AD research it has also been impossible to confirm or deny that the receipt of a capital grant from the Rural Development Programme for England (RDPE) would not rule out the receipt of FITs. There is nothing worse in project planning than uncertainty. A land agent with a specific energy brief recently commented to me that: “unless you get both FITs and RDPE you can wave goodbye to the uptake of AD except for very favourable sites”.

As if this was not enough, SEEDA has policy of not wishing to grant aid the use of land for fuel over food. This means that if satisfactory resolution of the RDPE and FIT issue is achieved, grants will not be made for any business growing maize to feed and AD plant – effectively ruling out most on-farm AD plants. Indications are that some informal dispensation may be given up to 20%, but whether that is 20% of feedstock or 20% of land area of holding it is not known.

Much is made of the “German AD revolution”. Many aspects of the German business environment are different from the UK. For instance maize yields can be double that of the UK thus making the additional land area required to run an AD plant considerably less. As significant is that fact that some German on-farm AD plants have received up to 90% grant funding when linked in to community energy infrastructure.

Recommendation 9

There is an urgent need for clarification of the RDPE/FIT status. Until this happens most plans for on-farm AD plants will remain just that – plans.

Recommendation 10

The UK must attempt to access the same level of funding for innovative community-based energy projects that offer a win-win between rural and urban interests as in Recommendation 5.

Planning

The default response from planners to AD is “no”. This is entirely understandable given the low level of on-farm AD activity in the UK. Case studies are very rare. Concerns exist over an activity that it terms of noise, visual intrusion and odour are no different from normal farming activities. Only in the case of using imported food wastes will activity increase above the normal. There is an urgent need to address planning misconceptions over all aspects of renewable energy, and not just in the rural environment.

It is also important that distinctions are made between on-farm AD and centralised AD (CAD) in a municipal environment. There is a real danger that the planning perception taken from large industrial looking and traffic generating CAD plants, is applied to smaller, far less busy on-farm AD plants.

Recommendation 11

Planning guidance whether statutory or advisory needs to better address the climate change mitigation agenda in order to meet government targets for renewable energy.

General Permitted Development Orders need to be re-examined in the light of on-farm renewables.

Renewable Heat Incentive (RHI)

The RHI is an excellent policy initiative from an energy perspective, as it will encourage the better use of heat. It has particular relevance to AD because of the heat produced in the biological process. Whilst it is going to be more difficult for farm AD plants, because of location, to utilise the heat, the RHI may in many farm cases be the incentive that tips the financial balance positive on a project's viability.

Horticultural enterprises with organic waste feedstock and greenhouses to use the heat are best placed to exploit the technology. The new Barfoots AD plant at Chichester falls into this category.

Recommendation 11

The uncertainty over the level of the RHI and particularly whether it is compatible with RDPE funding needs early clarification. Few business decisions will be taken until these issues are resolved.

The value of digestate

The output from an AD plant has to be disposed of. In a closed farm with some grass-based activity and of sufficient area this can have a positive advantage in reducing artificial fertiliser use. In the absence of sufficient on-farm "spreading area", the inclusion of food waste or other "off farm inputs" regulatory barriers start to pose problems. Arable farmers will be reticent to take the material, as it is not allowed on malting barley land. In addition the fact that it is high in volume and low in nutrient means that financial costs associated with transport and spreading quickly exceed the fertiliser benefits.

Both WRAP and the REA are making very good progress to resolve issues surrounding the "acceptability" AD digestate.

It is clear however for transport and handling reasons that its viability as a saleable product is limited to a very small distance from the plant, and then at levels rarely exceeding £2/tonne.

To suggest that digestate is an income stream, as many in the policy community are saying, is misleading and unhelpful.

Environment Agency (EA) Permitting

Environment Agency permitting is complicated, but perhaps not unduly complex. In essence, as one moves from a "closed" farm environment to the import/export of AD plant material, onto the use of food waste, the greater the permitting required.

A three-tier system operates with an exemption level, a standard level and a bespoke level for larger plants.

Many different AD models exist – size, movements on/off holding, food waste, digestate end use, gas or electricity output, etc etc. This means that despite the EA's used of the phrase "standard permit" no standards really exist!

This is probably not a barrier to activity, merely an area that requires greater clarification.

Recommendation 12

The Environment Agency should make the process of assessing the required permits much simpler. This could be carried out by a simple question and answer website page that directs the enquirer to the relevant sections only.

Summary

On-farm AD development is struggling under the weight of a number of the issues discussed in this document.

This is regrettable not just from the point of view of farm income potential foregone, but also from a climate change mitigation perspective with regards to methane management. The technology, as a means of producing energy from waste, has strong environmental credentials.

Better use of nutrient is going to be increasingly important as oil prices, and correspondingly fertiliser prices, rise. Nitrogenous fertiliser use and the resulting nitrous oxide emissions is of course even more of a climate change problem than methane (298 times more impact per unit weight than carbon dioxide).

The energy argument for AD is good. The financial argument is lacking.

Of all the recommendations in this document, two changes will in my view make a large impact:

Firstly, the financial return to AD farmers needs to be improved. In the short term, without this, few farmers other than the very big, the brave and the bankable will get into AD.

A FIT bonus for using manure as a feedstock in AD plants would have a positive effect in reducing methane emissions (so long as manure is not stock-piled before use). Financial viability is enhanced. Better nutrient use would result in some reduction in nitrous oxide emissions from fertiliser use. These other greenhouse gas benefits might exceed the nevertheless useful contribution AD can make towards meeting the UK's renewable energy.

Secondly, taking a longer perspective, a mapping exercise is required to identify and promote suitable locations for beneficial collaboration, not just between farmers themselves, but also between farmers, local authorities and food waste producers. The selenium present in cattle manure has been shown to have a considerable benefit as an additive to food waste AD plants

To conclude, the AD industry needs farmers. All municipal AD plants have to find a means of disposing of the digestate, and recent evidence shows that manures, even in small quantities, can assist food waste plants. A dialogue is required.