# Support for on-site anaerobic digestion (AD)

Smaller scale on-site digestion has a place in the range of renewables technologies because it can be deployed on farms, factories and in rural communities, producing base load and dispatchable power that is used at the point where the bio-degradable residues are produced. With a significant impact on GHG emissions by cutting fossil fuel use and capturing methane that would otherwise be released from biodegradable residues, AD has a lower carbon footprint compared to other disposal systems, will contribute to decarbonising our food production and is a critical part of the circular economy.

The last Government created a degression system for the Feed-in Tariff Scheme that discriminated against smaller scale AD (in particular plants generating under 250kWe) and was not reflected by actual deployment. The new cost FITs control mechanism introduced on 8th February will compound the situation and penalise small scale AD even further, due to extremely tight caps and high levels of degression that will occur each quarter, combined with a very narrow differential between tariffs across the different scales of AD.

The opportunity exists for multiple smaller on-site AD plants (not just on farms). Moreover AD can provide supplementary income for hard pressed dairy farmers and help to decarbonise our food supply chain, not just at a farm level but also by reducing carbon emissions from food manufacturing. However, the unintended consequence of excessive degression has been to discourage development of slurry based AD plants.

The challenge is to demonstrate that modest support (compared to the funding being given to nuclear or even shale gas development) over the next five years will deliver a viable on-site AD sector. There are three significant benefits that AD can deliver to the British economy, without placing excessive demands on taxpayers or having a long-term impact on cost of electricity to consumers. These are outlined below.

**GHG emissions Reduction**

The Committee on Climate Change (CCC)'s 5th Carbon Budget proposals accept the ability of anaerobic digestion to cut the agri-food sector's GHG emissions. As highlighted in the Government 'Indicator framework', "the use of slurries for anaerobic digestion (AD) has significant GHG reduction potential, far outweighing the reduction from improved storage of slurries and manures. Methane emissions and diffuse pollution from the storage and handling of slurries and manures are reduced and methane generated from livestock manures during AD can be used to replace fossil fuel use. In addition, there is the potential to increase nitrogen efficiency and cut fossil fuel based fertiliser use, if the digestate is subsequently spread to land. However, significant start-up and running costs are barriers to uptake. 2015 survey data indicated that just 2% of farms processed slurries for AD".

According to the CCC, improved fertiliser use will deliver cuts to $NO_2$ emissions, while measures to help reduce farm methane emissions, include the use of anaerobic digestion and improvements in fuel efficiency. The report states: "*Around 2 $MtCO_2e$ could be saved*

*in the livestock sector through changes in diet, improvements in animal health and breeding. Other options aimed at manure management, energy efficiency and on-farm anaerobic digestion could deliver an additional 1.3 MtCO₂e in 2030*." There are significant additional carbon benefits from the use of smaller-scale AD for farm and food residues.

As shown in the REA/Bangor University report on carbon reduction impact, **small scale AD is a very cost effective way to abate carbon: it would only cost between £48 and £60 per tonne of $CO_2$ saved, at Feed-in tariff rates of 16 - 20 p/kWh.** This compares very favourably to GHG reduction costs for other renewable energy technologies, of up to £180/t $CO_2$e saved (see more detail on the carbon reduction impact of small scale AD in annex 1).

**Decentralised Energy**

On-site AD is able to generate baseload and dispatchable energy at the point of use, based on use of wastes and production residues. Hence, farms and factories can make use of slurry and their bio-degradable process residues. There are a number of examples in the food sector of such plants (the Secretary of State for Energy and Climate Change Amber Rudd visited the plant at Nestle Fawdon a year ago) but these tend to be on sites of major multinationals (Nestle, Unilever, Diageo) rather than on smaller SME businesses (an example is BV Dairy's plant in Dorset, funded by WRAP, although not widely replicated).

Corporate expectations are changing. Managers at all levels are increasingly being held accountable for their site's environmental impact and that of their supply chains. Global food industry leaders are backing a more sustainable approach to food and beverage production. After the Paris Climate Change Summit, CEO's of leading companies including Unilever and Nestle stated: "*We want the facilities where we make our products to be powered by renewable energy with nothing going to waste*." Proven benefits of deployment of on-site digestion in the agri-food sector include reduced energy costs, lower disposal and effluent treatment costs, while cutting resultant carbon emissions. The challenge is transferring this approach to SME business that proliferate in our food sector.

**Economic Benefits**

On-site digestion has the potential to deliver a number of wider economic benefits for the UK. Some of the leading technology companies in the sector are British and in the last five years there has been significant investment in the technology based on indigenous engineering expertise. The British AD sector has created jobs in design and installation but also in the operation of plants which are more complex to build and operate than the weather related renewables, such as wind or solar.

Scope to deploy large numbers of smaller on-site AD plants (often in more deprived rural or urban areas) will create jobs, boost local economic activity and help stimulate growth. Also development of modular (lower cost) units will provide manufacturing jobs and help to reduce the cost of such plants. It addition, with the base of a secure market in the UK we know that there will be significant export opportunities for modular AD plants. Hence modest support from taxpayers (at little cost to consumers) for the sub 250kW sector will have significant commercial and fiscal benefits.

Hence there is a compelling case for reversing the degression that has undermined the development of on-site AD sector in recent years. We are seeking the provision of enhanced support for a limited period, with a degression mechanism that is well understood (without unfair expenditure caps making it even harder to develop the on-site market). Support is needed because such plants lack economies of scale available to larger plants, so it is harder to develop projects and secure funding.

We are seeking a strike price which is more competitive than contracts such as the Nuclear CfD. This is not to deny the need for large scale generation but we also need to match this with smaller scale decentralised renewables. It has always been understood that the FIT regime was intended to support early adopters (it was also designed to support smaller scale technologies and the 5MWe upper limit for the AD FIT, set by the last Labour government, was misconceived).

The REA is seeking a restructuring of the FIT regime, re-setting the FIT tariffs to create a more favourable environment for development of smaller scale AD (under 500kWe, but particularly under 250kWe, where deployment has not fulfilled expectations). However, the main ask is for a new sub 100kWe FIT band to promote small plants at a farm, factory and community level (the Germans have had such a band for three years). **The REA consider that a minimum tariff of 16 p/kWh should be awarded to small scale AD < 100 kWe to make it viable and initiate rapid on farm deployment.** This request is supported by the evidence provided within the REA/Bangor report (see Annex I for further details).

We have lost three years in the development of the under 250kWe and sub 100kWe sectors, where multiple plants on farm and factory sites could have contributed to the faster decarbonisation of the food chain. Hundreds of smaller plant will have a major impact on our renewables targets but also deliver a wide range of economic, energy supply and environmental benefits with modest support.

While the on-site industrial digestion market is developing slowly in the UK, converting residues into renewable energy needs Government support to stimulate investment. The existing incentives are intended to support early adopters but in the longer term on-site digestion should be viable without such support, due to the potential cost savings that these plants can deliver. Also we think that there should be a modest premium to account for the carbon reduction these plants can deliver.

If we take a net cost of 9p/kWh as the proxy for economic production (although this is lower than the strike price for nuclear power, which is 9.26 p/kWh), then **we consider that this should be achievable in five to eight years with an incentive of 16p per kWh to kick start the process.** We may need three years to really kick start the market and then a period of transparent degression based on levels of deployment would be acceptable.

There is also a case for a higher rate for sub 250kW plants. **The REA considers that a minimum tariff of 11p/kWh is required to make sub 250 kW plants viable**. Another option for consideration in the upcoming consultation on FITs for AD could be to allow these plants to receive the 16p rate for the first 100kW of output (this could also be allowed for 500kW plants, allowing a modest claw back of the excessive degression that has taken place in the last three years (over 60% under 500kW compared to under 20% over 500kW).

Hence smaller scale on-site AD is viable if looked at from a carbon mitigation perspective. It is a cheap way for Government to abate carbon, while supporting the farming sector, SMEs and local communities. **The Conservative manifesto committed to deliver low carbon energy 'at least cost' and the Government also wants to support industrial decarbonisation**. DECC has stated many times that they are comparing the carbon abatement of different technologies based on every pound spent. **The REA/Bangor report shows that small scale AD offers decarbonisation at least cost (i.e. the cost of small scale AD per tonne of $CO_2$ saved is very low compared to other renewable energy generation).**

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## Summary of Bangor University Report Annex 1

Small scale, farm AD largely based on manures/slurries is typically less cost-effective in cost per kWh generated than large scale electricity generation. However, as confirmed in a recent scientific report published by Bangor University and the REA (see full report here), it has the potential to abate substantial GHG emissions, it is much cheaper when looking at it in terms of carbon savings.

This report shows that small scale on-farm AD (<100 kWe) primarily for slurry/manure and process residues, would only cost £60 per tonne of $CO_2$ saved even at a Feed-in tariff rate of 20 p/kWh. This compares very favourably to GHG reduction costs for other renewable energy technologies, of up to £180/t $CO_2e$ saved (the cost estimated for other renewable electricity generation based on a subsidy of £0.09 per kWh, set by DECC as the maximum support for renewable energy).[1] At a FIT rate of 16p/kWh the cost of small scale AD per tonne of $CO^2$ saved would be lower (£48/tonne).

As shown in the Bangor report, AD can achieve a "carbon credit" of 3.27 kg $CO^2e$ saved per kWh net electricity generated, compared with a maximum carbon credit of 0.49 kg $CO^2e$ saved per kWh electricity generated achievable through electricity replacement alone for other renewables.

**If slurry from all UK medium and large dairy farms was treated in AD plants, 1.8 Mt $CO^2e$ could be saved each year across the UK, which is the equivalent of taking almost 900,000 cars off the road**. This represents much larger savings compared to those specified by the Climate Change Committee, which restrict the maximum potential to a range of 0.1 to 0.3 Mt $CO^2$ saved. As shown below, the main process affecting GHG abatement is the avoidance through AD of GHG emissions that would otherwise be released from traditional manure/slurry management systems ("avoided manure storage and application") – including storage, transport and spreading of manures.

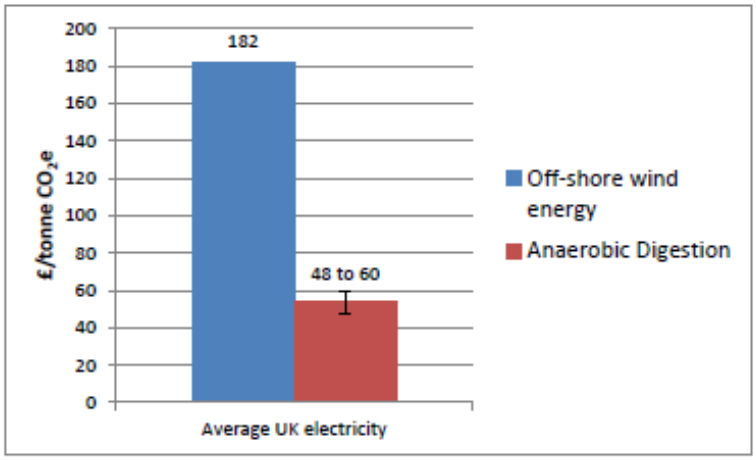


Figure 2. Comparison of abatement costs for off shore wind renewable energy and AD based on replacement of gird average electricity generation.

If UK policy was to encourage construction of a larger number of smaller scale decentralised on-farm biogas plants, it would reduce the environmental impact of farming (reducing pollution from slurries, with some energy production and reduced fossil fuel derived fertiliser use), plus the carbon impact from the digestion of locally sourced organic wastes), resulting in a measurable impact on national emissions targets. Such plants have potential for volume cost savings, as they do not have to be designed as bespoke systems, thus further lowering the unit cost. There would be a similar benefit for AD on SMS food processing sites with nutrients also being returned to the land.

[1] The last Government took the support offered to offshore wind under the RO as the maximum it should pay, treating it as the 'marginal' technology to meet the 2020 renewables target. Initially set at 2 ROCs/MWh, falling to 1.9 from 1 April 2016 and 1.8 a year later. AD in the RO received the same level - this was the starting point for AD at over 500kWe in the Feed in Tariff. Hence 9p/kWh seems like a reasonable reference point.