Future support for low carbon heat

Consultation Response by Feedback Global

The government wishes to "increase the proportion of green gas in the grid" and to "provide targeted support to heat pumps". The summary of evidence presented here shows that "green gas" from Anaerobic Digestion (AD) is often a suboptimal use of land and resources, except for a limited sustainable niche. Feedback therefore recommends that greater subsidies are dedicated to electrifying the heat supply as quickly as possible through technologies such as heat pumps, rather than locking in expensive and suboptimal "green gas" infrastructure. Feedback recommends increased taxes on landfill and incineration of waste feedstocks so that AD becomes attractive as a last resort only, with the revenue raised used to subsidise more cost-effective and more sustainable alternatives to AD, such as food waste prevention, afforestation, a just transition to more plant-based diets, and scaling up more efficient renewables such as solar and wind.

Please note that this consultation response draws heavily on a Life Cycle Assessment on anaerobic digestion soon to be published by Feedback and the University of Bangor (Styles *et al.*, 2020). The full life cycle assessment and research report will be published in August 2020 and Feedback would be available to present the findings to BEIS.

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Q1. Do you agree that the tiering structure as outlined above is appropriate and would deliver the best value for money? Yes/No. Please provide evidence to support your response.

No. Feedback recommend that subsidies should not be provided at all for biomethane from AD – and that it would be better value for money to increase taxes and penalties on incineration, landfill and landspreading, and direct funding to more sustainable alternatives to AD (see below).

Q2. What are your views on the impact of a 15-year tariff period to support biomethane? Please provide evidence to support your response.

Feedback strongly oppose any extension of the tariff period for supporting biomethane production. A Life Cycle Assessment soon to be published by Feedback and the University of Bangor shows that **the emissions mitigation potential of AD significantly decreases in future decarbonisation scenarios, for all feedstocks including manure** and even it is assumed that CCS is fitted (Styles *et al.*, 2020). Total emissions from AD are usually compared with the current energy mix in a given country, or against fossil fuels – with which AD compares more favourably (Meyer-Aurich *et al.*, 2012; Timonen *et al.*, 2019). However, the current UK energy mix must be rapidly decarbonised and shifted to renewables to avoid climate crisis, and Feedback's study reveals that **as the energy grid progressively shifts to rely more on renewable energy such as wind and solar, the emissions mitigation of AD shrinks significantly** (Styles *et al.*, 2020). **It thus makes very little sense to lock in subsidies for the production of biomethane from AD over very extended time periods**, during which AD's emissions mitigation potential will have already significantly declined, and will only continue to decrease.

Q3. What are your views on the advantages and disadvantages of a shorter 10- or 12-year tariff period and whether they would help maximise value for money? Please provide evidence to support your response.

Feedback recommend that subsidies to biomethane from AD be completely removed (explained in more detail below) – but **if subsidies are preserved, we strongly support as short a time-scale as possible**, as explained in Feedback's response to Q2, above.

Q4. Do you have any views on the appropriate tariff level, within these ranges? Please provide evidence to support your response.

Feedback recommend that subsidies to biomethane from AD be completely removed – set at zero – and replaced with increased taxes on incineration and landfill and more stringent regulation on disposal and landspreading of manure. This will prevent AD subsidies diverting land and resources away from more environmental alternatives, but will ensure that AD is used in preference to worse alternatives such as landfill, incineration or landspreading. **Feedback recommends that the government refocuses its funding towards more sustainable alternatives to AD, such as food waste prevention and use as animal feed, afforestation, a just transition to more plant-based diets, electrification of heating infrastructure, and scaling up more efficient renewables such as solar and wind.**

In the case of manure, **at best, AD plants mitigate a fraction of the methane emissions of manure, when shifts to plant-based diets would remove the manure (and other livestock emissions) completely.** There is now scientific consensus on the vital importance of dietary shifts and meat reduction to mitigate climate change. **At worst,** Feedback has found evidence that **AD subsidies can actively incentivise the expansion of intensive livestock systems – primarily through bringing down the costs and difficulties of manure disposal, and helping livestock farms gain planning permission**, but also through locking in demand for manure into the future to recoup costs (SourceMaterial, 2018; Pig World, 2019). **AD plants also usually require large volumes of maize or grass to be co-digested** alongside manure to be economically viable (see above).

The government must ensure that AD subsidies do not incentivise the continuation and growth of the unsustainable industry it proposes to mitigate the effects of; a far better alternative is for the government to incentivise a just transition to less and better meat. A report commissioned by the Committee on Climate Change (CCC) estimates that a 50% reduction in just the UK's beef, lamb, and dairy consumption by 2050 could result in a 37% reduction in the total UK agricultural sector's domestic emissions by 2050 (CEH and Rothamsted Research, 2019, p. 29). It would also free up an estimated 4.2 to 6.9 million hectares of grassland[1]. If trees were planted on 4.2 million hectares, this would result in an estimated 54 million tonnes CO2eq annual average carbon sequestration by 2032[2], which (assuming UK agriculture's emissions fall by 37%) would be enough to offset remaining UK domestic agricultural emissions nearly two times over[3]. Dietary shifts away from chicken and pork to plant-based proteins are also very effective at reducing emissions (Poore and Nemecek, 2018 Figure 1).

[1] The estimate of 4.2 million hectares is 50% of the pastureland which Harwatt and Hayek (2019) estimate is currently used for animal agriculture. The higher figure is from the Committee on Climate Change commissioned report, which compares land use savings relative to a future "business as usual" scenario where 12.26 million hectares of grasslands are assumed to be used for agricultural production by 2050.

[2] Extrapolated from Harwatt and Hayek (2019).

[3] Based on the UK's domestic agricultural emissions in 2018: 45.4 million tonnes CO2eq (BEIS, 2020).

In contrast, **increasing penalties and regulations on the disposal of manure will both provide an incentive for farmers to invest in on-farm AD plants to reduce their costs of disposal, and more importantly disincentivise unsustainable intensive livestock facilities, facilitating a transition to less and better meat**. To ensure sustainable livelihoods, this should be complemented with government grants, subsidies and retraining programmes to create good green jobs in plant-based protein production on cropland formerly used to grow animal feed, as well as in afforestation and nature restoration on former pastureland. These schemes should be complemented with increased taxation on imported meats and animal feed, to ensure UK production is not simply replaced by imports.

If the government wants to incentivise the use of **AD as a food waste management option** where food waste prevention or re-use as animal feed are not possible, Feedback recommends that the best approach is to **increase tax penalties on lower stages in the food use hierarchy such as incineration and landfill, taxing landfill higher than incineration, rather than offering subsidies to AD**. Subsidising AD risks perverse incentives diverting food waste down the food use hierarchy from prevention and use as animal feed. Waitrose admitted to the House of Lords enquiry into food waste that "**there is a clear temptation, on economic grounds, to prioritise energy recovery over redistribution**" (House of Lords EU Committee, 2013, p. 46). The House of Lords report therefore recommended that incentives for anaerobic digestion should not distort the food waste hierarchy (House of Lords EU Committee, 2013, p. 48). Increasing taxes on landfill and incineration is also likely to increase the gate fees paid for collection of waste feedstocks for AD, making AD plants more financially viable without the need for subsidies, and it will also generate revenue which could be used to incentivise higher levels of the hierarchy – mostly food waste prevention programmes, but also use of surplus food as animal feed.

In 2011, **Defra estimated that food waste prevention saved on average 8 times more emissions than sending food waste to AD** (Defra and Department of Energy and Climate Change, 2011, p. 10). Other studies have found that prevention of food waste was found to save 5 to 25 times the emissions compared with sending food to AD (Moult *et al.*, 2018). **Feedback's upcoming LCA found that preventing food waste results in direct emissions savings approximately 9 times higher than sending it to AD – and that if the land used to grow this food is instead afforested, this results in emissions mitigation levels over 44 times higher** than sending the same volume of food waste to AD, per tonne food waste (Styles *et al.*, 2020). Therefore, **a significantly more cost-effective use of government revenue would be to increase funding for food waste prevention and afforestation**, funded through revenue raised from increased taxes on incineration and landfill.

A Life Cycle Assessment soon to be published by Feedback and the University of Bangor finds that **reducing UK food waste by 50% from farm to fork (with afforestation on the roughly 3.01 million hectares of grassland spared by this) would save approximately 51.5 million tonnes CO2eq – about 11.4% of the UK's current total GHG emissions**[4] – in addition to saving 0.8 million hectares of cropland which could produce 6.48 billion kcal per year more than a scenario in which AD use in maximised[5] – enough to feed 7.89 million people, nearly 10% of the UK population. **In contrast, the**

[4] In this scenario (Circular/AD Min), UK food waste is assumed to be reduced by 50%, against a 2015 baseline and as a percentage of edible and inedible food waste, and some food surplus currently going to animal feed is assumed to be prevented – with remaining food waste going to AD. It was also assumed that the law was reformed in this scenario to allow some food surplus from catering and containing meat to be sent to non-ruminant animal feed after being safely processed.

[5] The scenario used for comparison (AD Max) assumes that food waste is reduced in line with WRAP's current voluntary commitments for 2030 (50% reduction of just edible food waste compared with a mix of baselines

LCA concludes that even in the most optimistic scenario where 87% manures and slurries are used for AD alongside significant volumes of food waste and crops, AD mitigates up to only 14.9 Mt CO2 eq per year directly – equivalent to around 3.3% of the UK's 2018 emissions– which is significantly lower than the ADBA's estimation that AD has potential to mitigate UK emissions by up to 6% (Whitlock, 2019). It must therefore be ensured that AD is used as last resort and does not detraction from food waste prevention.

Even for food waste which cannot be prevented, Feedback strongly disputes the consultation claim that "AD represents the waste treatment route with the best environmental outcome for food waste that cannot be prevented or redistributed" (p18). This **contradicts the government's own statutory guidance on the Food and drink waste hierarchy for dealing with surplus and waste, which clearly states that making "animal feed from former food" should be prioritised over sending food waste to AD** from an environmental perspective (Defra, 2018). This is backed up by the evidence. For instance, Feedback's LCA found that in the current technology context, **sending food waste to animal feed saves nearly 3 times the emissions as sending it to AD – in addition to sparing extra cropland for food production** (Styles *et al.*, 2020). If cropland previously used to grow animal feed is instead used to plant trees, sending food waste to animal feed saves nearly 5 times the emissions as sending it to AD (Styles *et al.*, 2020) – it is worth bearing in mind the higher emissions mitigation figure as sometimes animal feed imported into the UK is in direct competition with forests. Salemdeeb *et al.* (2017) also found that using heat-treated food waste in animal feed (wet-feed) was better on 13 out of 14 environmental indicators such as global warming potential and water pollution than sending it to AD. Currently there are legal barriers to the UK feeding certain types of food waste and surplus to non-ruminant livestock – namely, food which might contain traces of meat, or from the catering industry[6]. EU-funded research has shown that such food can in principle be safely treated through the right combination of heat-treatment and acidification, so that it can be converted to safe "eco-feed" for pigs and chickens (Luyckx *et al.*, 2019). A test facility is being set up in the Netherlands led by the University of Wageningen and major animal feed companies, with funding from the Dutch government, to finetune the treatment procedures required for feed safety. For more details on the greenhouse gas emissions savings, other benefits, and safety aspects, see the REFRESH policy brief on animal feed (REFRESH, 2019). Just as the EU ban on feeding certain types of food waste to pigs and chickens originated in the UK, the UK can use Brexit as an opportunity to reform these regulations to ensure "eco-feed" is safely produced.

For an exploration of why growing crops such as maize, grass and miscanthus as AD feedstocks is a significantly suboptimal use of land, please refer to Feedback's answer to Q9 below.

Q9. What are your views on increasing the minimum percentage of waste feedstocks above 50%, now or in the future? What could be a suitable new threshold? Please provide evidence to support your response.

Feedback recommends that non-waste feedstocks like maize and grass should not be given any subsidies through the Green Gas Support Scheme or RHI, since this diverts valuable agricultural land from food production, afforestation and renewables like solar PV, which result in far greater emissions mitigation and food security.

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from 2007 onwards for different sectors, with primary production food waste excluded from concrete targets), but all remaining food waste is assumed to be sent to AD

[6] Feedback do not propose that household food waste be fed to livestock due to additional safety considerations, but here a focus can still be maintained on prevention rather than AD.

In the case of crops If the aim is carbon sequestration, far more renewable energy could be generated by using this land to install solar PV or afforesting the land instead. **In the current technology context, afforestation of land would achieve 2.6 times (maize) to 11.5 times (grass) more net GHG mitigation than cultivation of crops for AD biogas production on equivalent land area** (Styles *et al.*, 2020). By the **net zero context** modelled in the LCA, crop-based **AD feedstocks become completely ineffective at emissions mitigation, even assuming BECCS is deployed at AD plants**, with maize resulting in only -20 kg CO_2 eq. per tonne, and grass actually resulting in positive emissions of +20 kg CO_2 eq. per tonne of grass sent to AD (Styles *et al.*, 2020). **Solar PV generates 12-18 times more useful energy per hectare than maize or grass grown for AD** (Styles *et al.*, 2020 SI B5). Grassland where possible should therefore be used for afforestation or solar PV rather than to grow grass for AD feedstocks – and subsidies should be focused accordingly. Monocropped maize could either be used for solar PV or afforestation or for food production. **Where afforestation or solar PV are not possible – for instance, where maize is grown in rotation – Feedback recommend replacing maize grown for AD with plant-based proteins like legumes for human food consumption**, which can also be grown in rotation, would benefit the UK's food security, generates income for farmers and would facilitate a just transition towards less and better meat, whilst also having a significantly better impact on soils. Miscanthus is extremely economically unviable as an AD feedstock, so it is doubtful whether it could become a cost-effective alternative AD feedstock. Miscanthus, short rotation forestry and short rotation coppice are all costly crops to grow, resulting in losses between -£25,900/ha for short rotation coppice and -£31,500/ha for miscanthus (Committee on Climate Change, 2020, p. 57). Miscanthus production in England was estimated at only 71,000 – 107,000 tonnes in 2018, about 22% less than in 2009 (Defra, 2019, p. 14).

Feedback recommend that even AD plants which run on 100% waste feedstocks should not be granted subsidies. For evidence in support of this recommendation, please refer to Feedback's response to Q4 above. **However, if subsidies are granted, they should only be provided for AD plants using 100% waste feedstocks of the most sustainable type:**

- For household food waste collections – since it is not possible to send this to redistribution or animal feed for safety reasons. However, funding for food waste prevention should still be prioritised, including a focus on changing retailer policies which might lower household food waste such as removing or extending best before dates, making food available in a variety of portion sizes so consumers do not have to buy more than they need, and providing resealable packaging where appropriate.
- For smaller-scale more sustainable livestock farms which have been in operation for at least 10 years, and intend to own a stake in the AD plant. This support should be conditional on the farm not expanding their livestock production. These conditions help reduce the incentives AD might give for livestock expansion (see evidence presented to Q4).

Q23. Do you agree that support for buildings technologies should change from a tariff to a grant? Yes/No. Please provide evidence to support your response.

Yes, Feedback supports the proposal of grants to support heat pump installation, although tariffs could optionally be provided alongside grants. Feedback recommends that the **government should significantly increase investment in converting UK heating systems to run primarily on electricity** – such as through use of heat-pumps – rather than risk locking in expensive biogas infrastructure long into the future, since renewable electricity is a lower carbon alternative, and there is evidence that the emissions mitigation of AD will decline significantly, even with CCS.

Priority should instead be given to renewable electricity sources with higher emissions mitigation potential such as onshore and offshore wind, solar PV and tidal energy – which produce lower emissions and lower cost electricity. A comprehensive study comparing electricity generated from biogas produced by AD with other renewable energy sources, found that when any other feedstock than manure was used, "**biogas systems generate higher greenhouse emissions than any of the renewable options**" including wind, solar PV and hydro (Fusi *et al.*, 2016). Moreover, a Life Cycle Assessment soon to be published by Feedback and the University of Bangor shows that the emissions mitigation potential of **AD significantly decreases in future decarbonisation scenarios, for all feedstocks including manure** (Styles *et al.*, 2020). Total emissions from AD are usually compared with the current energy mix in a given country, or against fossil fuels – with which AD compares more favourably (Meyer-Aurich *et al.*, 2012; Timonen *et al.*, 2019). However, the current UK energy mix must be rapidly decarbonised and shifted to renewables to avoid climate crisis, and Feedback's study reveals that **as the energy grid progressively shifts to rely more on renewable energy such as wind and solar, the emissions mitigation of AD shrinks significantly** (Styles *et al.*, 2020). It thus makes very little sense to subsidise production of electricity through biogas, since more sustainable and cheaper alternatives readily exist, and by the time additional AD infrastructure is built, AD's emissions mitigation potential will have already significantly declined, and will only continue to decrease. For instance, whereas -190 kg CO_2e is mitigated per tonne of food waste used for biogas production in the current technology context, this was found to dramatically decline to -66 kg CO_2e Mg^{-1} in a net zero context, with most of the remaining mitigation in the net zero context relying on the assumption of BECCS being applied to AD plants (Styles *et al.*, 2020). Similarly, -154 kg CO_2e is mitigated per tonne of poultry manure used for biogas production in the current technology context, but this was found to dramatically decline to -57 kg CO_2e Mg^{-1} in a net zero context (Styles *et al.*, 2020). The emissions mitigation per tonne of cattle and pig manure used for AD is even lower.

Q39. Do you agree with not supporting biogas combustion under the new policies? Yes/No. Please provide evidence to support your response, including any wider detail on decarbonisation opportunities for biogas combustion in rural areas.

Yes. Feedback strongly agrees that biogas combustion should not be covered under the new policies, because of the inefficiencies of biogas production from AD referenced in previous questions. Feedback agree that biogas from AD presents a "limited decarbonisation opportunity".

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