RESPONSE TO COMMITTEE ON CLIMATE CHANGE CALL FOR EVIDENCE ON BIOENERGY

The Anaerobic Digestion and Bioresources Association (ADBA) is the trade association that represents the range of interests and matters related to the anaerobic digestion of organic materials (AD) across the UK, including the collection of waste for use as feedstock. ADBA understands the complex range of skills required by developers of new AD plants, from feedstock management through technology to energy production, markets and resource to land.

The organisation has over 400 members from across the AD industry, including plant operators and developers, farmers, local authorities, waste management companies, supermarkets, food processors, energy and water companies, equipment manufacturers and suppliers, consultants, financiers and supporting service companies. Anaerobic digestion can make a significant contribution to renewable energy, climate change, and critical resource preservation targets, subject to the right policies being in place.

General comments

We welcome the Committee on Climate Change (CCC)'s call for evidence and are pleased to be able to contribute and help shape the updated 2018 Bioenergy Review. Following strong growth in recent years the UK's AD sector now produces approximately 11.4TWh of biogas 24 hours a day, enough to power over 1 million homes. It is vital that Government updates its bioenergy strategy to recognise the important role AD can play in meeting UK carbon budgets through decarbonisation of the power, heat, agriculture and transport sectors, as well as by ensuring energy security.

AD and biomethane address several of the policy gaps the CCC has recently identified in its assessment of the Government's Clean Growth Strategy[1]:

Low-carbon heat in homes, businesses and industry

AD already reduces the UK's carbon emissions by over 1% and could reduce them by as much as 4%. The CCC regards biomethane as a "low regret option" and has noted how the Government's Clean Growth Strategy provides "little or no commitment to a low-carbon supply mix in heat networks and no commitment to biomethane post-2021".

Power generation

Contrary to the risks of nuclear power (both cost and delay are highlighted by the CCC) AD offers a route to market for low-carbon electricity generation that is good for UK energy security. Biogas is generated in the UK and supplies are constant and reliable. AD is already delivering significant amounts of home grown green electricity and gas now and has the potential to deliver around 30% of domestic electricity or gas demand, while also reducing imports, curbing carbon emissions and improving UK Balance of Payments.

Agriculture and land use

Support for AD through a strengthened bioenergy strategy would help achieve the CCC call for "strong policies to deliver emissions reductions in agriculture" taking effect by 2022. Returning digestate to Britain's soils would help reverse its poor quality, which is costing the UK £1.4bn a year according to a recent Parliamentary Office of Science and Technology estimate. Integrated into farming, AD also supports the rural economy by stabilising farming businesses, improving their ability to withstand fluctuations in global commodity markets.

[1] https://www.theccc.org.uk/wp-content/uploads/2018/01/CCC-Independent-Assessment-of-UKs-Clean-Growth-Strategy-2018.pdf

Waste

Government will not be able to meet its recycling targets without separate food waste collections, which will require more food waste AD capacity to treat and recycle the resulting separated food waste. We agree with the CCC assessment that the forthcoming Resources and Waste Strategy, due later this year, must "set out firm policies to end food waste going to landfill and this should be implemented by 2025, five years earlier than currently planned." We call for the Strategy to go further and introduce an end to the incineration of food waste.

Surface transport

While the CCC notes how there has to date been "little concrete action on emissions from HGVs" AD is delivering large quantities of home grown green gas now and has the potential to deliver around 80TWh by 2030 – almost enough to power every HGV in the UK.

GHG emissions and sustainability of bioenergy imports

Question 1. What is the latest evidence on lifecycle GHG emissions of biomass and other biofuels imported into the UK? How could this change over time as a function of scaling up supply? We are particularly interested in evidence that considers the full range of relevant issues including changes to forest and land carbon stocks, direct and indirect land-use change and wider market effects.

Anaerobic digestion (AD) is the natural breakdown of organic material such as food waste, farm wastes, purpose grown crops and sewage sludge in the absence of oxygen. Biogas from AD plants is approximately 60% methane and 40% carbon dioxide. It can be used in a Combined Heat and Power (CHP) engine to generate electricity and heat, or it can be upgraded to biomethane – almost pure methane – by removing the impurities and the renewable CO_2, which itself can be used commercially. Biomethane can then be used locally to fuel vehicles or injected into the gas grid for use as a transport or heating fuel elsewhere.

The standards of the Renewable Heat Incentive confirm the low GHG lifecycle emissions of AD plants where sustainability of the fuel produced is determined by both compliance with the land criteria and the emission limit of 34.8gCO_2 per MJ of biomethane injected, which is designed to achieve a 60% greenhouse gas emissions saving relative to the EU fossil fuel heat average.[2] This is in accordance with the EU's Renewable Energy Directive.

With just seven hundred thousand tonnes of household food waste being collected for recycling (for composting and AD) compared to the seven million tonnes of household food waste being produced each year, the Government should be focussing on tackling that inedible food waste before it considers the expansion of imported woody material. The revised Bioenergy Strategy should recommend the UK Government introduce mandatory food waste collections for every household as soon as possible, funded by central government.

AD holds the key for changing public attitudes on food waste around the world. All inedible food waste should be sent to AD as it extracts far more renewable energy per tonne than incineration alternatives. Treating all the UK's inedible food waste through AD would produce 8TWh of green gas per year, which is enough energy to power around 800,000 homes, 24 hours a day, 7 days a week. Compared to incineration AD has a much more efficient energy conversion of organic matter whilst also achieving a greater abatement of greenhouse gases.

A co-product of the anaerobic digestion process is a fertiliser called 'digestate', containing water, crop nutrients and organic carbon for soils. Digestate currently has a low or even negative commercial value and one of the goals of the 2018 bioenergy strategy should be to continue to improve its quality, availability and its value. Digestate can also increase soil organic matter and prevent run-off, which can help slow soil erosion. This is important as soil damage, risk of run-off, drainflow, run-through to groundwater and erosion all effect conditions. Poor management

[2] https://www.ofgem.gov.uk/ofgem-publications/89240/guidancevolume2v7finalmarch2016-pdf 20.

practice and an over-reliance on chemical inputs has rendered 30% of the world's arable land unprotected and less productive.[3]

Question 2. Under what circumstances can imported biomass and other biofuels deliver real GHG emissions savings (considering full life-cycle emissions and indirect/wider market effects)? Conversely, what evidence is there for ruling out certain sources on the grounds of lifecycle GHG emissions or sustainability risks?

AD makes use of UK-sourced, locally-produced material that would otherwise often go to waste. Unlike incineration AD returns the nutrients and some organic matter back to the land, providing nutritional and organic matter content to the soil used for growing food. AD has a substantial role to play in improving the UK's soil health. The biofertiliser produced from recycling organic material such as food and farm wastes, manures and slurries, and sewage through AD can be used instead of the expensive, carbon-intensive alternatives. Digestate helps maintain pH and soil fertility; improving soil quality, crop yields and the availability of nutrients (principally including nitrogen, potassium and phosphorus) whilst, significantly, also replacing the organic matter component.

According to EU research undertaken by Valorgas AD produces 60% more energy than the net calorific value of food waste.[4] AD extracts more energy than incineration: the calorific value of food waste (based on its lower heat value) is typically around 2200 MJ tonne^{-1} of wet weight when incinerated, whereas the raw energy yield as methane (when first digestated) is 3600 MJ tonne^{-1}, a difference of more than 60% that strongly supports digestion as the preferred option over incineration. ADBA has undertaken its own simple cost-benefit analysis of sending food waste to AD as compared to incineration, which we have attached to our submission.

Due to long term contracts, many local authorities continue to use incineration plants – for subsequent contracts support should be provided to ensure authorities can send food waste to AD, where it is no longer regarded as 'waste' and is instead recognised as a valuable contributor to the UK's production of green gas, electricity, heat and biofertiliser.

As well as wasting this important resource and the bioenergy it can generate, there is also a significant cost to local authorities with households ultimately paying for the costs of disposal through council tax.[5] With a cost per tonne of £86.10 for any local authority to dispose of waste to landfill, collectively authorities in England are spending around £500 million to dispose of their household waste.[6] Encouraging waste controllers to recycle food ensures that this weighty resource is extracted from general refuse collections, reducing the long-term cost burden to local authorities and, in turn, rate payers.

Question 3. Currently the UK imports a significant proportion of wood pellets for biomass electricity production from North America, particularly the south-east USA.

No comment.

Question 4. Aside from GHG emissions, what evidence is there of other sustainability impacts associated with imported biomass or other biofuels? What evidence is there for how these might change as a function of scaling up supply (from the US, and internationally)?

No comment.

Question 5. Are there any benefits resulting from importing biomass or other biofuels into the UK (e.g. development benefits)? How might these vary internationally? What are the conditions required for any benefits to be realised?

No comment.

[3] Tony Juniper, What Has Nature Ever Done for Us?: How Money Really Does Grow On Trees (Profile Books: 2013) 34.
[4] https://cordis.europa.eu/result/rcn/146204_en.html
[5] http://www.wrap.org.uk/sites/files/wrap/hhfdw-2012-main.pdf.pdf 5. This is based on 2012 food prices.
[6] https://www.gov.uk/government/publications/landfill-tax-increase-in-rates/landfill-tax-increase-in-rates

Sustainability policy and certification

Question 6. What are the strengths, weaknesses and gaps of the current sustainability framework for bioenergy in the UK? How could the current sustainability framework for bioenergy in the UK be improved to address these issues?

Strengths – AD's inherent sustainability is recognised

Sustainability is at the heart of the UK AD industry, but the current framework needs to be revised with AD at its centre to ensure the numerous benefits it delivers can be realised. Rather than arbitrary limitations on the use of crops in new AD plants the UK sustainability framework would be improved if it adhered to an objective sustainability criterion of life-cycle carbon emissions.

The sustainability imperatives AD helps achieve include:

- Helping protect UK biodiversity;
- Recycling essential nutrients and organic matter to soils;
- Restoring degraded landscapes;
- Reducing food waste;
- Achieving reductions in biodegradable municipal waste and related emissions; and,
- Reducing emissions from manure, farm wastes and slurries.

Abatement from digestate use also translates into significant CO_2 savings replacing carbon-intensive, imported artificial fertilisers. High in Nitrogen, Potassium and Phosphorus, waste-derived digestate returns organic matter to soil, delivers nutritional benefits to land which can increase food crop yields, and can help restore contaminated or degraded land.

In this respect AD, supported by a new bioenergy strategy, would help deliver Government aims, as set out in the Clean Growth Strategy, Industrial Strategy White Paper and the 25 Year Environment Plan.

Such strengths need to be nurtured not abandoned. With recognition of the numerous benefits that AD delivers and supportive policy, the AD industry could have continued to deploy at the rate seen in 2014, when around three times as many plants were commissioned than the year before. At this time, the industry received supportive tariffs and policy was relatively stable. Since then, tariffs on both the Renewable Heat Incentive (RHI) and the Feed-in Tariff (FIT) have been slashed, leading to a decline in applications for new plants. Delays to the introduction of December 2016 reforms to the RHI have further dampened projected deployment.

AD contributes to nine of the 17 Sustainable Development Goals agreed by the countries of the United Nations to be achieved by 2030. With investment in new areas of research, estimates show biogas could produce up to 60%[7] of current coal power generation, thereby reducing global greenhouse gas emissions by 18-20%.[8] This is based on the use of wastes, agricultural residues and novel crops which can be integrated into food and fodder crop cultivation to supply energy and also increase food production.[9] UK sustainability strategy must recognise this contribution and champion the industry responsible.

We believe any sustainability framework should champion the AD industry and ensure it is sufficiently supported. This includes maintaining renewable financial incentives at a level adequate to make private sector led projects

[7] The potential for biogas generation, including from CAM crops, is 5.5 PWhe, and coal generation is 9.1 PWhe (i.e. 60% of coal) http://pubs.rsc.org/EN/content/articlelanding/2015/ee/c5ee00242g#!divAbstract

[8] Fossil fuel combustion for energy accounts for 68% of total greenhouse gas emissions. Coal is 45% of the fossil fuel combustion for energy. So coal is over 30% of emissions given that coal has higher emissions per unit of energy produced than fuels such as natural gas. https://www.iea.org/publications/freepublications/publication/CO2EmissionsFromFuelCombustionHighlights2015.pdf If biogas displaced 60% of coal emissions, it would reduce global emissions by 18%. Biogas also reduces methane emissions from waste and manure management.

[9] http://pubs.rsc.org/EN/content/articlelanding/2015/ee/c5ee00242g#!divAbstract

economically viable – until there is a strong enough carbon price, or plant capital and operational expenditure fall in response to a developed supply chain. Reductions should be consistent with the speed with which individual technologies can reduce costs.

We are already tasking industry to prepare for reduced incentive levels even further over the next five years. We will do this by improving performance, reducing costs, investing in R&D, and continuing to work with government. As we discuss in further detail in our response to question 10, below, funding to develop a (virtual) Centre for Anaerobic Biotechnology and Bioresources Research (CABB) hub as a centre of global excellence would enhance these efforts and support the industry's glide path to being zero-subsidy. The objective of this will be to transform AD, which is currently often perceived solely as a waste treatment technology, into a low cost multi-functional biotechnology The AD industry accepts the need for environmental regulation and stringent sustainability standards. The AD Certification Scheme (ADCS) is the only certification scheme in the UK that assesses the all-round safety, environmental and operational performance of anaerobic digestion (AD) plants. It is a key element of our Best Practice Programme, which encompasses all our work on improving standards in the industry. The Scheme provides an independent audit process and report, which is a useful tool for operators to ensure they are meeting required standards and identify how they can improve. Developed by ADBA with extensive engagement with industry stakeholders, it aims to support the industry to be a mature and thriving sector that delivers consistently excellent projects. Further information can be found at: https://www.adcertificationscheme.co.uk/

Weaknesses – local authority discretion for separate food waste collections

Lack of support for local authorities and discretion when it comes to implementation of separate food waste collections for some households is a significant weakness in the sustainability framework. Let down by the lack of mandatory collections in England, the UK falls short of international standards and we are likely to miss targets on biodegradable waste unless policy is changed – we urge the CCC to recommend progress on this issue within months not years.

As we have already noted, food waste is a valuable resource that a sustainable, circular economy country should prevent wherever possible, but extract the most from in instances where it is unavoidable. Yet the UK wastes 10.2 million tonnes of this valuable resource, with 7.3 million tonnes of this coming from households.[10]

Accordingly, ADBA continues to recommend that England urgently follow the example of the devolved nations and introduce as soon as possible a target to prohibit all biodegradable municipal waste sent to landfill. Currently, of all biodegradable waste sent to landfill in the UK, 83% is from England.[11] As the CCC has recognised, sending a tonne of food waste to AD instead of landfill saves 500kgCO_2, if the entirety of this resource was sent to AD each year around 1.2 million tonnes of CO_2e would be saved per year[12] - which is equivalent to taking 600,000 cars off the road for an entire year.[13] And, it is right that AD continues to be identified as vital if the country is to meet its carbon targets.[14] To this end, we welcomed the CCC's recent assessment of the Clean Growth Strategy, which recommended: "The Government's new Resources and Waste Strategy, due in 2018, should set out firm policies to end food waste going to landfill and this should be implemented by 2025, five years earlier than currently planned."[15]

[10] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/577752/UK_Statistics_on_Waste_statistical_notice_Dec_2016_FINAL.pdf 1.

[11] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/577752/UK_Statistics_on_Waste_statistical_notice_Dec_2016_FINAL.pdf 5

[12] https://documents.theccc.org.uk/wp-content/uploads/2015/11/Committee-on-Climate-Change-Fifth-Carbon-Budget-Report.pdf

[13] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/602389/rtfo-annual-report-2015-2016-web-version.pdf 4.

[14] https://documents.theccc.org.uk/wp-content/uploads/2015/11/Committee-on-Climate-Change-Fifth-Carbon-Budget-Report.pdf 67.

[15] https://www.theccc.org.uk/wp-content/uploads/2018/01/CCC-Independent-Assessment-of-UKs-Clean-Growth-Strategy-2018.pdf 20.

We recommend the CCC advises Government through their Bioenergy Review to introduce statutory instruments to oblige local authorities to separately collect food waste and send it for recycling, in line with the waste hierarchy. Separate food waste collections lead to an overall reduction in food waste volume and will divert a valuable resource from incineration or landfill – AD can turn wastes into riches for the UK. We regard such measures to be proportionate to the scale of food waste in England and its economic, environmental and social costs.

As many local authorities have long term waste disposal contracts where food waste is sent with residual waste to landfill or incineration, any regulations should acknowledge that costs may be incurred when altering contracts and transitional support may be required. Despite existing contracts many local authorities have successfully added a separate food waste collection during an existing contract. Where this is not possible and where there is a clear business case, financial support should be provided to local authorities to ensure food waste can be collected and its resource value extracted.

While the devolved administrations have been successful in reducing food waste and maximising their recyclate resource, England has fallen behind because of this weak, discretionary approach. Across England individual 'household waste' recycling rates range from 14% to 65%.[16] This data confirms that while voluntary initiatives can help to reduce food waste by raising awareness of the problem, they do not go far enough. Mandatory separate food waste collections are urgently needed in England.

Gaps – policy gaps for heat and agriculture from the 2020s

We recommend a new Bioenergy Strategy calls on Government to extend the RHI at least to the end of the current Parliament and work with industry to develop new policies that will encourage further growth of the AD and other low-carbon technologies. The Renewable Heat Incentive is the centrepiece of UK Government efforts to decarbonise the heat sector. However, the scheme effectively closes to new biomethane projects injecting into the grid at the end of 2019 (since Tariff Guarantees – due to be introduced by Government in early 2018 – are currently not on offer to plants commissioning beyond 31 December 2019).

The biomethane-to-grid industry will have made significant progress by the end of the decade, but without further support from government (which was lacking in the Clean Growth Strategy), this growth will end. The wholesale price of gas (currently approximately 2 p/kWh) is not sufficient to incentivise further deployment and there is no robust carbon pricing policies proposed to increase this – something which we believe the CCC should urge Government to introduce.

We welcome the recent CCC assessment of policy in the Government's Clean Growth Strategy regarding heat. The CCC state, "the Strategy provides little commitment to a low-carbon supply mix in heat networks and no commitment to biomethane post-2021, both of which the Committee has identified as 'low-regrets' options at this stage. There is also little commitment to support an increase in the use of bioenergy for industrial process heat."[17]

On farm emissions abatement is another area where AD can offer a significant contribution to reducing emissions and where there is a significant gap in the sustainability strategy. As the CCC note, "no progress has been made in reducing agricultural emissions over the past last six years."[18] While the successor to the Common Agricultural Policy may only come into effect in the mid-2020s, leaving these emissions unaddressed until then is not acceptable, especially when AD has the potential to provide waste management for farms, supply green energy, and reduce some of agriculture's current 14% contribution to the UK's total GHG emissions. There are currently

[16] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/664594/LACW_mgt_annual_Stats_Notice_Dec_2017.pdf 13.
[17] https://www.theccc.org.uk/wp-content/uploads/2018/01/CCC-Independent-Assessment-of-UKs-Clean-Growth-Strategy-2018.pdf 16.
[18] https://www.theccc.org.uk/wp-content/uploads/2018/01/CCC-Independent-Assessment-of-UKs-Clean-Growth-Strategy-2018.pdf 73.

90 million tonnes of manure spread to land each year, which if sent to AD would abate 6.65MtCO_2 annually, a huge contribution for any one industry.[19]

To deliver these benefits to the UK we propose three policies to compliment sustainability framework, set out below. The policies we put forward could be integrated into various farm support structures, be it a direct payment system like the CAP or a contract as has been proposed by the Country Land and Business Association.[20] We believe these policies would not require additional funding, but would redirect farm support to environmental objectives currently paid to British farmers through the CAP. The proposed policies are:

1. **Renewable biofertiliser credits.** The Credit would align with UK farmers' calls for a post-Brexit settlement to lead to the establishment of a points-based 'Farmed Environment' system aimed at protecting landscape features, biodiversity, climate change mitigation, soil and water care.[21] A Renewable Biofertiliser would provide all of benefits digestate brings to farming set out above. Support for a Renewable Biofertiliser Credit through domestic agricultural policy would also encourage greater uptake of AD.
2. **Agricultural greenhouse gas (GHG) abatement fund**. A second proposal is to establish an annual competitive funding initiative, to which applicants would propose potential CO_2e agricultural abatement and their associated costs of achieving this. Successful applicants would be those providing the greatest carbon cost effectiveness or other sustainability drivers. Use of grants provide a quick means of distributing capital funding, ensuring that measures to reduce agricultural GHG emissions can be implemented promptly. However, payment-by-results could be another approach if the certainty could be provided to farmers to invest.
   The CCC recognises that agriculture emissions can be reduced by changing farming practices, reduced food waste and through an adjusted human diet of less carbon-intensive foods. However, they concede that "there is a limit to what is likely to be achievable, so residual emissions in 2050 may be around 30 MtCO2e."[22]
   Such an awards scheme would ensure the eligibility of a diverse mix of GHG abatement initiatives including but not limited to AD. Breadth of the scheme is necessary to deliver cost effective carbon abatement as government acknowledged in the implementation of the Fifth Carbon Budget and its decarbonisation target.[23]
3. **Favourable tax systems to support AD**. Tax relief provides a means of indirectly supporting AD and would be justified for its environmental deliverables, which constitute a public good. Sufficient tax relief would remove the need for subsidy, such as that which has existed to date in the FIT and RHI; such support remains necessary for AD plants to commission given the continuing low carbon price.

As well as providing sustainable bioenergy, helping to decarbonise the UK energy supply, the full potential of AD would deliver:

- 35,000 mainly rural jobs[24];
- £1 bn in CO_2 savings per year;
- £0.9 bn reduced gas imports per year;
- £0.11 bn avoided fertiliser imports and emissions per year; and,

[19] This figure assumes the current 90 million tonnes of manure is sent to AD and envisage growth of 15 million tonnes over over 15 years. See our attached Market Potential dataset for further details.
[20] https://www.cla.org.uk/influence/all-news/time-change-farm-support-say-rural-landowners
[21] British Farmer & Grower (December 2016) 'Brexit: What Next for British Farming' 11.
[22] https://www.theccc.org.uk/wp-content/uploads/2015/11/Fifth-Carbon-Budget_Ch3_The-Cost-effective-path.pdf 57.
[23] We envisage the grants award process and the sum being based on the volume of carbon savings in both the short-term and long-term, as well as being based on other sustainability deliverables. GLOBALG.A.P advocates SDG-based market incentives to encourages farmers, retailers and food brands to development certification standards for good, sustainable agricultural practices that can measurably be seen to contribute towards the SDGs. 175,000 farmers in 120 countries have already applied.
[24] Jobs per year over a 10-year period, by which time the full potential of AD will be realised.

- And public goods of soil quality, biodiversity and rural economy support.[25]

Question 7. Ofgem has identified a number of certification schemes that it considers appropriate for demonstrating compliance with the 'Land Criteria' under the Renewable Obligation sustainability standards. Are these certification schemes adequate? Why/why not? How could they be improved?
We understand the Land Criteria to be sufficiently robust. As detailed in the Ofgem RO guidance on the Land Criteria, where applicable AD operators provide evidence to demonstrate that their feedstocks have not been grown on peatland or forest. Where feedstocks are grown on cropland this complies with the criteria. Manures and slurries are exempt.[26]

This question is not applicable to AD plants processing food waste, these are exempt.[27]

Question 8. What certification schemes currently represent 'best practice'? Why?
There are two different certification schemes we would like to draw the CCC's attention to. Firstly, the AD Certification Scheme (ADCS) is an industry-led initiative which aims to support the AD industry in the UK to improve operational, environmental and health & safety performance. It has been developed by the Anaerobic Digestion and Bioresources Association (ADBA) with extensive input from industry stakeholders. Through discussions with the industry, it became clear that there is a large amount of existing regulation, guidance and standards that can help operators deliver a high-performing plant. The scheme was developed to raise awareness of these, to better define operational excellence in our sector and provide a mechanism whereby operators can undergo an independent audit and certification process. The scheme was launched in December 2017 and has been well-received by the industry. Whilst ADBA owns the scheme, the audit and certification process is delivered independently by a third-party Certification Body. ADBA will be monitoring the scheme's impact alongside stakeholders who have been involved, including the Environment Agency, Health and Safety Executive, insurers and operators, and a report will be released each year detailing participation levels and other findings.

Secondly, the UK AD and bioresources industry has also pioneered the Biomethane Certification Scheme (BMCS), an independent certification scheme ("ICS") run by Green Gas Trading Limited. Green Gas Trading was set up to provide both a credible process for certifying biomethane and a trading platform to facilitate the trading of certificates. The biomethane certificates issued under the scheme can be traded separately from the physical commodity gas. This allows the certificate owner to transact the physical commodity at the market price for that product whilst seeking the highest economic value for the Biomethane Certificate ("BMC"). Trading the gas and the certificates separately makes it possible to maximise the value of this exceedingly low carbon, green gas at a market determined price. The UK has another certification scheme operated by the Renewable Energy Association which does not feature a carbon number. We think it would be advantageous and facilitative of the certification market and sustainability imperatives if a criterion of recommended and minimum levels of information was developed to ensure parity and incentivise operators to increase carbon savings and policy makers to make

[25] AD delivers a significant proportion of the cross-compliance measures and Pillar 2 requirements of the Common Agricultural Policy (CAP), helping ensure the sustainability of UK farming post Brexit. Current UK interpretation of Pillar 1 cross-compliance for CAP include minimising soil erosion and maintaining the level of organic matter in soil, see https://www.gov.uk/guidance/guide-to-cross-compliance-in-england-2016. The UK approach to Pillar 2 influences, and allocates financial support to: knowledge transfer and innovation; competitiveness of agri-sector and sustainable forestry; food chain organisation, including processing and marketing of agricultural products, animal welfare and risk management in agriculture; restoring, preserving and enhancing ecosystems related to agriculture and forestry; resource efficiency and climate; and, social inclusion and local development in rural areas. See http://ec.europa.eu/agriculture/sites/agriculture/files/rural-development-2014-2020/country-files/uk/factsheet-england_en.pdf Evidence for the above claims is further discussed in our Industrial Strategy green paper submission.
[26] https://www.ofgem.gov.uk/system/files/docs/2016/03/ofgem_ro_sustainability_criteria_guidance_march_16.pdf 24.
[27] ibid 10.

decisions based on actual sustainability credentials. On 30 June 2017 UKAS announced of GGT's scheme the first accreditation against ISO 14065 for verification of claims.[28]

Question 9. Ofgem has set out approaches to calculating bioenergy GHG emissions for demonstrating compliance with the 'GHG Criteria' under the Renewable Obligation sustainability standards. Are these approaches adequate? Why/why not? How could they be improved?

In accordance with the GHG Criteria we believe full life-cycle GHG emission calculations are appropriate for bioenergy. However, to ensure fairness across the UK energy mix the same reporting should be required of all fuels.

To meet UK carbon budgets and our commitments in respect of the Paris Agreement, we believe it is imperative a robust carbon price is introduced, to reflect the externalities of climate change. We believe an appropriate value would be at least £100 per tonne of avoided CO_2e[29], and at least £70 per tonne emitted.[30]

Question 10. Please highlight any further measures you feel are required to ensure bioenergy feedstocks used in the UK are sustainable and deliver significant life-cycle GHG emissions savings. Why are these measures needed?

There are three measures the new Bioenergy Strategy should address to help ensure suitable feedstocks continue to be used in the generation of low-carbon energy. These are:

- Reversing diminishing financial incentives;
- Ensuring funding for research and development; and,
- Increasing support for on-farm AD and recognising the non-energy benefits AD delivers.

We set out our concerns and accompanying evidence points below.

Diminishing financial incentives

We recommend that a forward-looking bioenergy strategy look at sustainability of the route to market of different technologies as well as, of course, the sustainability of the feedstocks themselves. Diminishing financial incentives mean that sustainable bioenergy feedstocks – including many wastes – may go unused.

Where renewables are concerned Government response has been to reduce tariffs once technologies and their supply chain are at a sufficiently mature point and no longer require support. At a principled level this is the correct approach, incentives should reduce over time, but this should be consistent with the speed with which individual technologies can reduce costs. Although AD is now an established technology, it cannot reduce costs at the same rate as e.g. solar and wind without significant growth as well as investment in R&D. It therefore still requires support to reach the industry's significant potential.

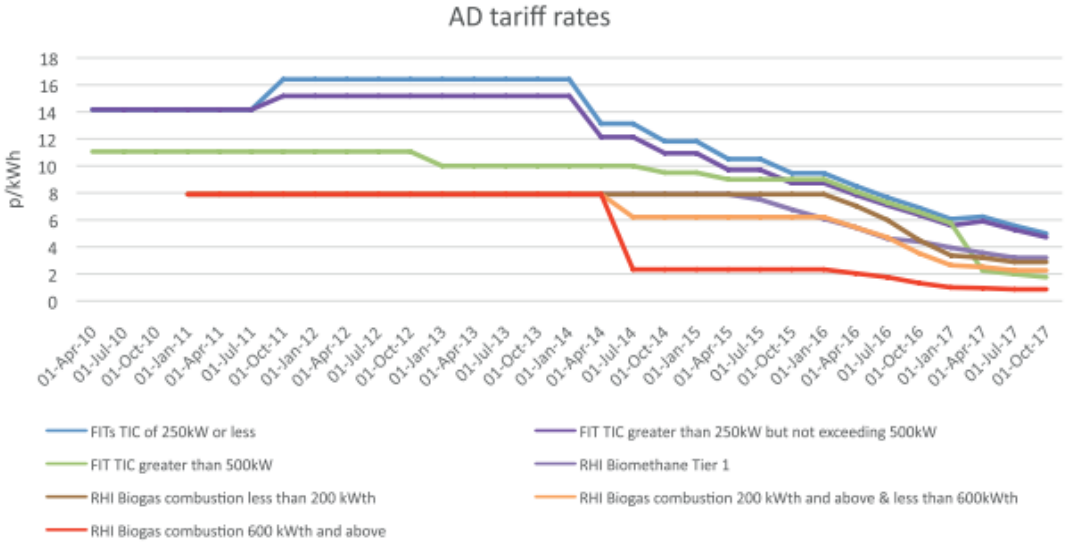
The below chart demonstrates illustrates the tariff degressions the industry continues to experience – this is the case despite the numerous benefits the technology delivers and the fact that much of the capital cost of AD plants have not fallen, related as they are to world commodity prices, notably for steel and concrete.

[28] https://www.ukas.com/news/ukas-announces-first-accreditation-for-verification-of-claims-under-the-green-gas-trading-limited-biomethane-certification-scheme-bmcs/

[29] We understand £100 a tonne of CO_2 to be an average price for climate change mitigation and adaptation. As a point of comparison Sweden currently prices carbon at $150 per tonne of CO_2. https://www.carbontax.org/where-carbon-is-taxed/

[30] A 2011 consultation inquiry into the carbon price by HMT suggested a target price for a tonne of carbon dioxide in 2030 of £70, see www.researchbriefings.files.parliament.uk/documents/SN05927/SN05927.pdf 9.

Chart 6



[31]

Recent legislative proposals are eroding what support there is and at too quick a pace: there will soon be no electrical generation support for small scale and sub 5MW anaerobic digestion:

- The Renewables Obligation closed to new applicants on 31 March 2017;
- The Feed-in Tariff is capped to just 5MW per quarter and the tariff is too low to attract new applicants; and,
- The first two rounds of Contracts for Difference excluded all sub-5MW AD plants. Additionally, the ongoing Contracts for Difference for Renewable Electricity Generation: Consultation on proposed amendments to the scheme contains no proposals to reform the scheme to enable AD projects to enter.[32]

AD is delivering home grown green gas now and can continue to do so with government support. AD is on the path to becoming the most cost-effective form of low-carbon baseload power. With government support, the industry could be on a trajectory to a cost of generating power of £100 per MWhe in 2020 and could have greater electrical capacity than Hinkley Point C, sooner and at less risk (without the creation of toxic waste).[33] When taking AD's carbon abatement contribution into account alongside the value derived from baseload energy generation, AD offers exceptional value for money compared to renewable and non-renewable alternatives – and that's before assessing the technology's contribution to rural communities, food security and waste resource management.

AD also provides a quantifiable economic benefit in balancing the intermittency of other renewables and reducing the need to reinforce the grid, which we have estimated at £30/MWh. Indeed, in Italy research has shown that the "cost structure of biomethane may be competitive with solar and wind renewables when considering the cost of intermittency".[34]

[31] ADBA November 2017 Policy and Market Report.

[32] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/668382/Contracts_for_Difference_for_Renewable_Energy_Consultation_on_proposed_Amendments.pdf

[33] ADBA July 2016 Market Report.

[34] SNAM has conducted analysis into the cost of intermittent technologies in Italy, http://www.snam.it/export/sites/snam-rp/repository/file/gas_naturale/global-gas-report/global_gas_report_2017.pdf 46.

Research and development

AD is currently only delivering a fraction of its potential. Further investment via targeted, collaborative research would enable a step change in the rate of development, allowing anaerobic biotechnology to deliver far greater potential much faster.

To deliver the potential of AD and further contribute to the economy we need the funding sought to develop the (virtual) Centre for Anaerobic Biotechnology and Bioresources Research (CABB) hub as a centre of global excellence. The objective of this will be to transform AD, which is currently often perceived solely as a waste treatment technology, into a low cost multi-functional biotechnology. It would make AD a key ingredient in developing integrated processes to deliver future energy and resource provision. It will achieve this by bringing together and coordinating the research input of often disparate groups, to ensure the interdisciplinarity needed to achieve rapidly the full potential of anaerobic biotechnology.

CABB will facilitate a coordinated and cost-effective approach to taking new ideas and concepts and moving them through the technology readiness levels (TRLs) to demonstration and final implementation. It will work closely with government agencies such as Innovate UK and with trade associations to engage industrial participation at an early stage and will identify collaborative research opportunities to remove barriers to societal acceptance in both UK and overseas market places. Importantly the (virtual) Centre would aim to bring together the research teams that can rapidly progress core ideas through parallel rather than sequential research, thus 'fast tracking' innovation to commercial reality. The Centre will thus play a key role in mapping pathways to successful translation of research to industry, dissemination of research findings, protecting intellectual property, and networking.

The Centre would be a 'virtual' centre, with the core administrative function of distributing funds to the UK's existing world-leading research bases. Membership of the Centre will not be exclusive, but initial support comes from the Universities of Oxford, Southampton, Reading, Newcastle and Cranfield, Imperial College and the Royal Botanic Gardens at Kew. ADBA will play an integral role in facilitating industry participation and successful research translation. A total budget of £50m over 5-7 years is sought, and it is believed this will provide better value and outcomes compared to the piecemeal, competitive grant environment that is currently in place which does not lend itself well to the interdisciplinary research.[35]

The growth of the AD industry demonstrates the potential successes of the circular economy. With renewed support for bioenergy changing labour and use of natural resources will deliver stability through increased resource security as well as creating new businesses and raising employment levels: WRAP estimate that by 2030 the circular economy could create 210,000 jobs, worth up to £100 billion to the UK as a whole.[36] Continued growth will support the bioresources market, products formed from AD processing of food waste and other feedstocks.

Support for On-Farm AD and greater recognition of its non-energy benefits

In the next few years the UK will become responsible for funding all agricultural policy measures following the referendum decision on EU membership. This will require substantial fiscal rebalancing – in 2014 payments to UK farmers funded through the Common Agriculture Policy (CAP) amounted to £3.5 billion.

Government priorities and decisions over trade and the future relationship between the UK and the EU will greatly impact UK farming and energy – a different circumstance may arise depending on whether the UK is a member of the Customs Union, re-joins EFTA and the EEA, whether a bespoke or general free trade agreement is signed, or if no agreement is signed and WTO default rules and tariffs apply.

In the mid to long term, however, there is significant opportunity for the non-energy benefits of AD to be further recognised and rewarded in agricultural policy. The non-energy benefits of AD are numerous but as of yet they have not been linked to financial support mechanisms, support has only been provided for energy generated. We

[35] We have attached the CABB proposal with our response to the call of evidence.
[36] http://www.wrap.org.uk/content/employment-and-circular-economy

believe it is time for all the benefits of AD to be recognised, in particular for their role in achieving the following policy objectives:

- Reducing emissions from rotting manure, farm wastes and slurries, and replacing petrochemical derived artificial fertilisers, abating significant amounts of carbon;
- Supporting farmers by diversifying their income, providing a steady income that is not dependent on fluctuating global commodity prices, and reducing input costs;
- Improving food security through profitable crop rotation and the recycling of essential crop requirements of Nitrogen (N), Phosphorous (P), Potassium (K) and trace elements through the spreading of digestate back to farmland, replacing the need for petrochemical-derived artificial fertilisers from overseas;
- Increasing organic matter, improving soil structure, reducing water demand, reducing soil degradation and run-off;
- Strengthening the rural economy by creating jobs: the AD industry currently employs 3,500 people and has the potential to employ 35,000; and,
- Developing low carbon technology and expertise to export to global markets.

AD also provides a waste management solution to sewage, as well as food waste as has been discussed above, and is used at the majority of waste treatment facilities across the UK.[37]

Question 11. Some large UK users of imported biomass use a risk-based approach to assess the sustainability risks associated with importing biomass from specific jurisdictions. What is the role for these approaches?

No comment.

Supply of bioenergy feedstocks

Question 12. What are the most credible and up-to-date estimates for global bioenergy resource potential through to 2050, broken down by feedstock type? What key assumptions underpin these estimates?

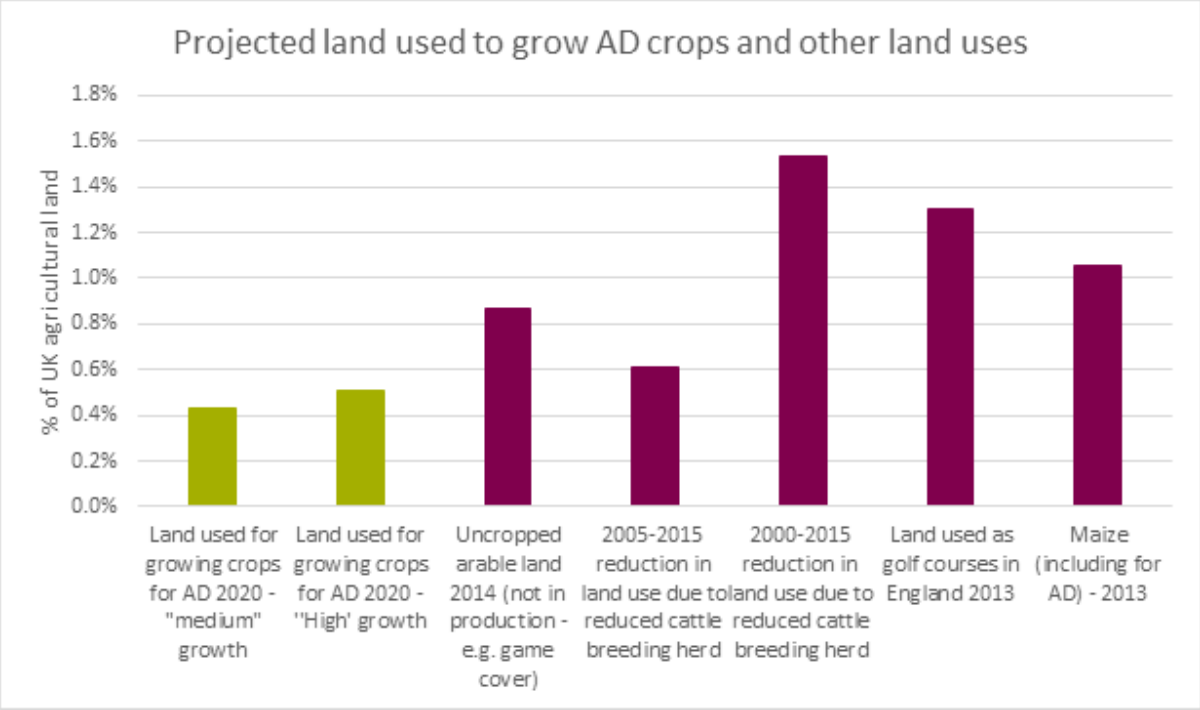
No comment, the AD industry does not import biomass.

Question 13. What is the latest evidence relating to the availability of 'marginal' and abandoned agricultural land for growing bioenergy crops (where possible, reflecting broader sustainability requirements e.g. water stress, biodiversity, social issues)? Is this evidence adequately reflected in global resource estimates?

The UK currently has 284 agricultural AD plants. Along with the 29 plants that have mixed farm and commercial waste feedstocks these plants process ~4.7million tonnes of waste and crop each year. Each year the plants generate 0.85TWh electricity, 2.33TWh biomethane and abate 0.1Mt CO_2e from manure.[38]

Although the UK has lost 888k ha of agricultural land since 1984 (through development, golf courses etc.) there has been little further impact since 2011 – when the AD industry began to develop in earnest. Accordingly, as the below numbers demonstrate, AD does not place a significant demand on land and has not significantly impacted UK food production.

[37] Ofwat reports AD treatment for 75% of UK sewage sludge. https://www.ofwat.gov.uk/wp-content/uploads/2015/12/pap_tec20151210water2020app1.pdf 4.
[38] ADBA data. We are happy to provide this to the CCC on request.



	2011-13 average	2014-16 average	Unit	Comment	Data source
AD crops	371,109	1,808,268	Tonnes	Increase in AD crops	ADBA
Arable production (cereals, potatoes, oilseed rape, sugar beet)	26,717,240	29,948,043	Tonnes	Producing more arable crops	DEFRA statistics
Number of cattle and pigs	14,530,333	14,736,333	Number	Similar livestock numbers	DEFRA statistics
Number of poultry	161,740,333	169,956,667	Number	Similar poultry numbers	DEFRA statistics
	2010/11-2012/13 average	2013/14-2014/15 average	Unit	Comment	
Net Import Feed (AHDB)	1,463,357	1,240,733	Tonnes	Importing less animal feed	AHDB, based on HMRC data[39]

The ambition for the AD industry is to build 1,000 agricultural AD plants, which would use approximately 200,000-250,000 of grassland and arable land (~1.3% of UK land). Currently under 100,000 hectares are used. Using this land would help deliver a 4% reduction in UK greenhouse gas emissions, which is the emissions reduction the UK AD industry could deliver collectively, which rests on the use of crops being used. There is no evidence that this scale of ambition would significantly impact on UK food production, and a DEFRA study has shown that "Spatial modelling of land rental values found no significant influence of proximity to AD plants".[40] With limited impact on food production it is unlikely that land use change be a significant factor in greenhouse gas modelling scenarios.

[39] ADBA analysis, AHDB and DEFRA data.
[40] http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=2&ProjectID=19655

SUSTAINABLE USE OF CROPS IN AD

We believe there is a strong case to support well managed feedstocks sent to AD of all varieties. The RHI's existing sustainability criteria provides assurances as to the carbon abated and the GHG emissions of the energy produced by the plant. Accordingly, there is no need to add blanket restrictions on use of crops so should be removed

Building crop-based plants can lead to more waste being treated

AD plants can use a variety of different feedstocks at the same time. While it can be easier to secure funding for a crop-based plant with guaranteed feedstocks, there are clear economic drivers for operational plants to use lower cost feedstocks wherever possible – which are generally likely to be wastes and residues. This is already being demonstrated at several operational AD sites, limiting any land used.

Wider carbon and environmental benefits delivered by AD

Agricultural feedstocks can be integrated into a farm's crop rotation to support food production and the wider farming business. This helps deal with problems caused by mono-cropping – such as blackgrass – in areas where food crop rotations have not proved commercially viable.

Artificial fertilisers are extremely carbon and resource intensive: one tonne of artificial fertiliser requires 108 tonnes of water and one tonne of oil, whilst also producing eight tonnes of carbon dioxide in the process.[41] In addition to the carbon value, digestate has an important strategic role to play in our food security: phosphorous is a finite resource but a macromineral essential for all plant growth, with world production expected to peak in the 2030s.

Feedstock diversity supports innovation

The AD industry continues to develop innovative feedstocks that could, in the near future, present genuinely advanced use of failed agricultural and horticultural crops and other low input, high diversity biomass. As the below examples show such new feedstocks would turn unavoidable sources of wastes and residues into bioenergy:

- The Royal Society for the Protection of Birds (RSPB) study on use of wetland biomass for AD. According to the RSPB unmanaged reed bed, wet grassland, fen, lowland heathland, upland heath and grassland provide a sustainable supply of bioenergy feedstock, and can have a positive impact on biodiversity;
- The Centre for Process Innovation (CPI) is conducting research into the financial viability and practicalities of using seaweed as a feedstock for biomethane generation from AD; and,
- Peakhill Associates is undertaking a study into the sustainability of Low-Impact High-Diversity road verge biomass as feedstock for use in AD plants. The study focuses on the Lincolnshire Local Highways Authority, which contracts for the mowing of 13,135km (1,445ha) of road verge, with all grass residue currently being left on site. In trials of verge harvesting undertaken by Montgomeryshire Wildlife Trust average dry matter content was 29%, giving a total harvest fresh weight of 1,303kg/km – valuable feedstock that could be used to generate biomethane for use in transport.

The benefits crop rotation brings to farming

The potential benefits of effective crop rotation are myriad; increasing soil organic matter, improving soil structure, reducing soil degradation and run-off, and ultimately resulting in greater long-term farm profitability. Increased levels of soil organic matter enhances water and nutrient retention, and decreases synthetic fertiliser requirements. Improved soil structure in turn improves drainage, reduces risk of water-logging and boosts supply of soil water during droughts.

AD is an ideal component for profitable crop rotation. AD helps make break crops (those used between repeated cereal sowings) economic for farmers, while maintaining and enhancing biodiversity; farmers can incorporate crops for AD into their rotations, which can increase subsequent yields of food crops, or grow them on unproductive

[41] http://www.publications.parliament.uk/pa/cm200809/cmselect/cmenvfru/memo/secfoods/ucm4702.htm

marginal land. Use of cover crops (those grown for the protection or enhancement of soil) can prevent persistent problems such as nematodes and black grass from arising.

BASELINE ROTATION (BEFORE)

	1st quarter			2nd quarter			3rd quarter			4th quarter		
	jan	feb	mar	april	may	june	july	aug	sept	oct	nov	dec
1st year	fallow					o'w veg						
2nd year					fallow					w/wheat		
3rd year										sugar beet		
4th year										fallow		
5th year					fallow							
6th year										w/rape		
7th year(1st)										fallow		

AD ENERGY ROTATION (AFTER, OPTIMISED)

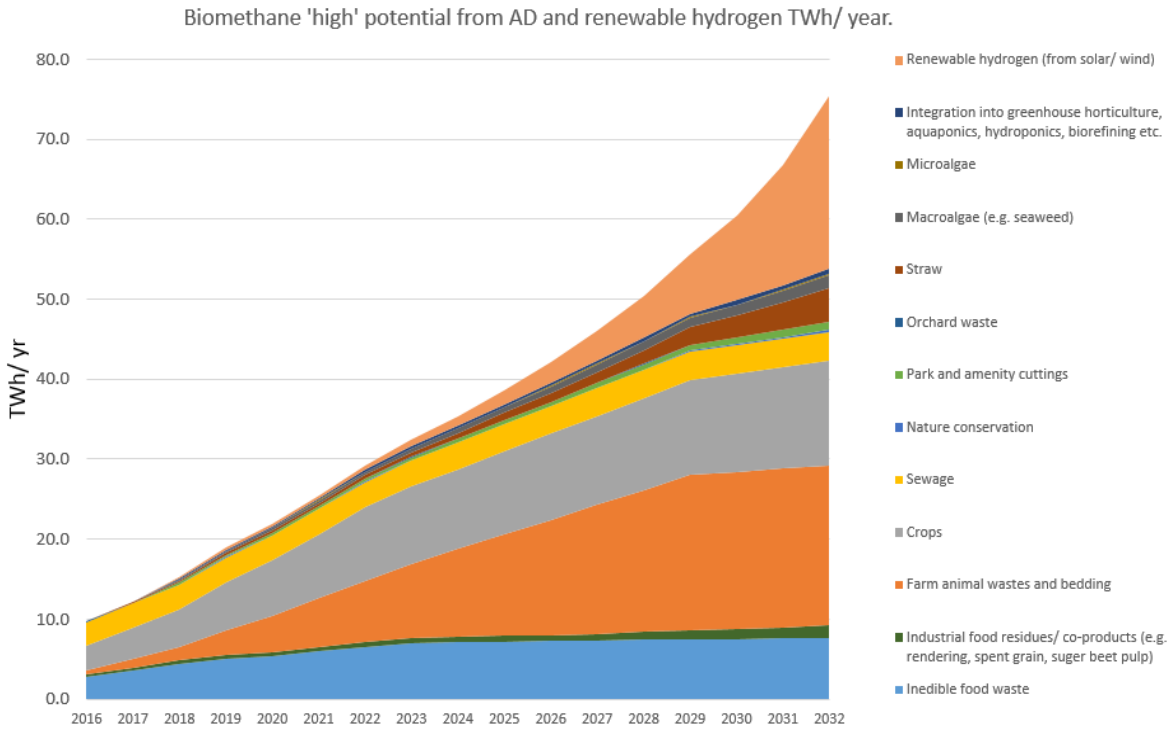
	1st quarter			2nd quarter			3rd quarter			4th quarter		
	jan	feb	mar	april	may	june	july	aug	sept	oct	nov	dec
1st year						o'w veg						
2nd year					maize					w/wheat		
3rd year										sugar beet		
4th year										fallow		
5th year					maize					rye		
6th year										w/rape		
7th year(1st)										fallow		

Rotation comparison showing six-year baseline rotation where land is left fallow for three cropping seasons and an AD scenario where maize and winter rye are planted during the fallow periods. No food crop is displaced.[42]

Question 14. What are the most credible and up-to-date estimates for the amount of bioenergy resource that could be produced from UK waste sources through to 2050? Where possible please state any assumptions relating the reduction, reuse and recycling of different future waste streams.

As the below chart shows, with the right government support the AD industry's potential is great, around 80TWh by 2030. We encourage the CCC to urge the Government to creative this supportive framework.

[42] This table is taken from Jalil Yesufu and David Styles, 'Consequential Life Cycle Assessment of Modified Crop Rotations Producing Biogas Feedstock' (2016). The work identifies the extent to which rotation optimisation can mitigate food crop displacement, and thus reduce worst-case Intended Land Use Change (ILUC) penalties sometimes applied to bioenergy feedstocks.



Question 15. What factors (opportunities, constraints, assumptions) should the CCC reflect in its bioenergy resource scenarios through to 2050?
We have included our assumptions with our submission to the Call for Evidence, see attached.

Question 16. What should be the assumptions on the share of international resource which can be accessed by the UK (e.g. per capita, current or future energy demand)?
No comment.

Question 17. What are the prospects for the development and commercial production of 3rd generation bioenergy feedstocks (e.g. algae)? What are the timescales, costs, risks, opportunities and abatement potential of using algae to make biofuels?
Algae links with AD in several possible ways as pre- or post-treatment, with heat or electricity from the AD plant running these additional processes. Algae is a recognised feedstock for producing biomethane. In addition, algae consume CO_2 very efficiently and projects to use the CO_2 that results from the AD process (separated from the biogas to leave methane) to grow algae are in the pipeline. These algae can be used as feedstock for AD.

As an example of its potential, the Royal Netherlands Institute for Sea Research finds that if all the acreage in between the North Sea's 25,000 wind turbines was used for seaweed cultivation, the 250 million tonnes of biomass (producing 400m^3 of biogas per tonne) would abate 65 million cubic tonnes of methane – 14.4% of the EU28's total energy consumption.[43]

[43] https://www.nioz.nl/en/research/north-sea and

Scaling up UK sustainable supply

Question 18. What are the main opportunities to scale-up the supply of sustainably-produced domestic bioenergy supply in the UK? Where possible please provide details on the scale of opportunity.

The UK is a world leader in biogas with UK companies already exporting over £100m-worth of biogas-related expertise and equipment per year. The UK has close to a fifth of all biomethane plants in Europe.

The AD industry has already transformed the UK energy sector, with commissioned plants currently delivering 708MWe-equivalent of renewable, indigenous power to UK homes and business – an increase of over 350% from where the industry was just ten years ago. There is significant potential for the AD industry to continue this economic growth with a pipeline of around 400 projects with planning permission.

In addition to supporting the (virtual) Centre for Anaerobic Biotechnology and Bioresources Research (CABB) (see our response, above, to question 10) further economic growth could be achieved by embracing the following opportunities:

- Support for on farm and agricultural AD – the referendum decision to leave the European Union has implications for the Common Agricultural Policy and AD provides a key means of supporting farmers whilst achieving strategic objectives of energy generation and GHG emissions reduction. With sufficient support the UK could see 1,000 AD plants by 2020, dispersed throughout the country, delivering economic growth through the creation of thousands of rural jobs and new export opportunities.
- Exporting waste management technologies – while most waste treatment facilities in the UK use AD to stabilise sewage sludge before it is recycled as biofertiliser back to agricultural land 2.4 billion people around the world still lack basic sanitation. The anaerobic digestion of biosolids promotes a sanitary and hygienic environment by providing decentralised and local treatment of these wastes, as well as extracting the energy and producing biofertiliser. Exporting UK good practice in this area can deliver growth to British businesses whilst also supporting the UN's Sustainable Development Goals.
- Developing anaerobic biorefineries – support for new products and technologies through industry could bring ways of sustaining the sector with reduced reliance on financial mechanisms, allowing AD to remain the most cost-effective method of producing home-grown green gas and electricity, and contributing to the UK's 2020 renewable energy, recycling, decarbonisation, and climate change targets. This support – again through the proposed Centre for Anaerobic Biotechnology and Bioresources Research referred to above – would further develop the relationship between research and industry to promote UK research and innovation, and encourage manufacturing – all of which can be exported to the growing global biogas market.

Question 19. What risks are associated with scaling-up domestic supply and how can these risks be managed?

As we have set out in our response to question 13, above, there are no risks as growth of AD does not have large land impacts. We discuss intended land use change below, in our response to question 30.

Question 20. What 'low-regrets' measures should be taken now (e.g. planting strategies) to increase sustainably-produced domestic bioenergy supply?

As discussed throughout our response to the call for evidence there are four key tasks we urge the CCC to recommend to Government in its Bioenergy Review:

1. England should urgently follow the example of the devolved nations and introduce as soon as possible a target to prohibit all biodegradable municipal waste sent to landfill and incineration within five years.

Currently, of all biodegradable waste sent to landfill in the UK, 83% is from England.[44] The UK as a whole wastes 7.7 million tonnes of this valuable resource.[45]

2. To support the growth of on farm AD to ensure that as much of the 90 million tonnes of manure spread to land each year is instead sent to AD to provide waste management for farms, supply green energy, and reduce UK GHG emissions – agriculture contributes around 14% to the UK's total GHG emissions.
3. Restoring sufficient tariff support and delivering tariff stability across electricity, heat and transport sectors help drive investment and enable the UK to take a significant share of the global market, which we estimate to be worth £1 trillion.
4. Support for the proposed virtual Centre for Anaerobic Biotechnology and Bioresources Research (CABB) hub as a centre of global excellence. See our response to question 10, above, for further details.

Question 21. What international examples of best-practice should the UK should look to when considering approaches to scaling-up domestic supply?

There are numerous lessons to be learned to help scale up UK bioenergy supply. We set out some examples below, and have attached ADBA's 2016 International Market Report, attached, which presents in depth studies.

- The AD industry in **South Korea** is established, currently small but rapidly growing. It has the infrastructure and institutional drivers in place to support this growth. South Korea has already implemented a nationwide ban on disposal of food residues into landfills and waterways, which resulted in close to 100% food waste collection from households and businesses – of huge bioenergy potential when treated through AD. It has recently gone a step further by introducing a volume-based food waste fee system whereby residents pay for the disposal of food waste generated.
- In **Germany** AD plants may be operated so as to enter into a pulse mode to dispatch electricity when demand is high. This dynamic application arose following the amendment of their Renewable Energy regulations to introduce a 'flexibility tariff' for dispatchable electricity generation. The flexibility rate has a total cap of 1,350MW to help ensure that the sector is predominantly providing baseload electricity. Individual AD plant operators receive financial support once they have increased the installed capacity of the plants. Generation of this sort is further supported by priority connection rights to feed into the grid. The ensures bioenergy supply increase but also aligns this to demand.
- In the **United States of America** co-digestion of food waste with wastewater sludge at wastewater treatment plants is driving up both methane yield and profitability for the early adopters. According to the American Biogas Council, some systems are reporting double the biogas yield from adding just 10% food waste, thus turning food waste from municipalities, restaurants, cafes, food processing facilities and agriculture from a liability into an asset.

Question 22. What policy measures should be considered by Government to help scale-up domestic supply?

Support for the generation of bioenergy through Combined Heat and Power requires an overhaul.

In relation to renewable electricity generation and the support generators currently receive financial consultants have informed ADBA:

> *"We've seen a number of plants pull their projects over the last twelve months, having spent some considerable amounts, just because they, or the funders, couldn't see how they would make it work."*[46]

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[44] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/577752/UK_Statistics_on_Waste_statistical_notice_Dec_2016_FINAL.pdf 5

[45] ibid 1.

[46] ADBA member response to 2016 FIT Review.

The long-awaited FIT consultation presents an opportunity to not only tackle ongoing operational matters but provide the industry with some reassurances that following the closure of the FIT to new applicants in March 2019 AD will be supported on its way to becoming subsidy free.

The situation with biomethane projects is somewhat more positive following the tariff reset under the Renewable Heat Incentive (RHI). However, due to the delay in implementing the December 2016 reform package many projects that are on hold are now at risk. As well as encouraging their swift implementation, we call on the CCC to urge Government to engage with industry stakeholders on the future of heat and of the gas grid to 2050.

Additionally, as we have noted in our response to question 6, above, policy is required to support the future of on-farm AD. Such policy might include:

1. Renewable biofertiliser credits;
2. Agricultural greenhouse gas (GHG) abatement fund; and,
3. Favourable tax systems to support AD.

Investment in transport

To date, investment in use of biomethane as a transport fuel has been far less than biogas heat or biomethane projects due to the volatility of the Renewable Transport Fuel Certificate traded value when compared to the RHI tariff. The RHI also guarantees a fixed tariff for twenty years which the RTFO does not. While we support many of the recently confirmed reforms to the RTFO we believe that biomethane should be categorised as a development fuel.

As we recommended in our submission to DfT's 2017 consultation on the RTFO, to increase the supply of advanced biofuels generally and stimulate the supply of biomethane in particular we recommend DfT introduce a floor price to the RTFC to provide stability and open up advanced biofuels for investment. We also note that additional certainty for investors, beyond 2032, needs to be provided if the scheme is to stimulate the use of biomethane in vehicles.

Biomethane should be specified as one of the sub-target development fuels. As a transport fuel it offers high GHG emissions savings, making it an essential component of government plans to meet Carbon Budget targets.

As the below well to tank emissions values from the Joint Research Centre-EUCAR-CONCAWE project show biomethane as a transport fuel offers significant carbon savings. This is the case whether feedstocks of waste, residue or crop are used.

GHG factors (gCO_2e/mj) from JRC-EUCAR-CONCAWE project[47]				
Municipal organic waste	Wet manure	Maize	Double cropping maize / barley	Diesel counterfactual
14.8	-69.9	40.8	26.8	88.6

The JRC-EUCAR-CONCAWE project assumes wastes are 'GHG free' and accounts for emissions that are avoided by using organic wastes and residues in the biogas process and not letting those GHG emissions reach the open air, which accounts for the negative emissions value presented above for wet manure.[48] We believe this approach presents a more complete account of lifecycle emissions when compared to the default GHG emission values presented in the RED Annex V. This uses a different methodology and avoided emissions are not accounted for.

[47] http://iet.jrc.ec.europa.eu/sites/about-jec/files/documents/report_2013/wtt_v4_pathways_2-cbg_july_2013.xlsx Note: diesel fuel emissions values are taken from the oil and gas pathway, see http://iet.jrc.ec.europa.eu/sites/about-jec/files/documents/report_2013/wtt_v4_pathways_1-oil_gas_july_2013.xlsx

[48] http://iet.jrc.ec.europa.eu/about-jec/sites/iet.jrc.ec.europa.eu.about-jec/files/documents/wtw_report_v4a_march_2014_final.pdf 33.

To achieve consensus on well to wheel energy use and GHG emissions values we encourage DfT to undertake a full lifecycle assessment that will provide for reconciliation between the RED and JRC-EUCAR-CONCAWE data. To this end DfT should refer to BEIS' sustainability criteria submissions, reported by AD operators under the RHI, and the biomethane certification data provided by Green Gas Trading's Biomethane Certification Scheme (BMCS).

Investment in heat networks

AD is a baseload generator and can deliver a constant supply of heat, making it the perfect energy source for heat networks. The generation of heat from biogas CHP engines and boilers is currently supported by the Renewable Heat Incentive (RHI) for the fossil fuel natural gas that is displaced and there are significant opportunities to build on this by integrating heat networks with both existing and new sites.

The RHI does not provide support for network infrastructure to deliver heat to the end user and the cost of infrastructure to deliver low carbon heat has proved prohibitively high for the vast amount of AD plants. We estimate that 3.8TWhth is co-generated from existing AD plants and that the majority of this heat is vented. We encourage the CCC to urge Government to produce its long-awaited heat strategy and recognise the important contribution that biomethane can make, not only in terms of decarbonisation but also on cost:

- KPMG have estimated that using green gas and existing infrastructure is 2-3 times cheaper than other scenarios for delivering heat.[49]
- Policy Exchange also encourage expansion in biomethane for grid injection, noting that biomethane "goes with the grain of consumer preferences and minimises costs to the consumer."[50]

The impact of feedstock on investment

Securing plant feedstock is vital to investment and government intervention and regulation is strongly felt in the sector. As discussed throughout our response, Government inaction on inedible food waste in England is inhibiting industry growth.

Additionally, the restrictions to payments for crop feedstocks for new plants under the RHI risks stifling innovation in the generation of renewable heat. One example of a sector at risk is technology for capturing and using carbon dioxide from biomethane plants. Carbon capture denotes technologies developed to capture carbon dioxide (CO_2) emitted during the generation of power, the infrastructure for handling and transporting CO_2, and the technologies for injecting and storing the CO_2. Recovered CO_2 can be used in various industries or refined to displace petrochemicals through liquefaction, with research underway into producing chemicals, plastics and fuels such as methanol.[51] The International Energy Agency refers to carbon capture as a "critical component in a portfolio of low-carbon energy technologies if governments undertake ambitious measures to combat climate change."[52] Use of renewable CO_2 generated in the AD process displaces fossil fuels and would contribute to the UK Carbon Budgets and emissions reduction targets – it constitutes yet another contribution that AD can make to the UK bioeconomy and export to the world.

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49 http://www.energynetworks.org/assets/files/gas/futures/KPMG%20Future%20of%20Gas%20Main%20report%20plus%20appendices%20FINAL.pdf

50 http://www.policyexchange.org.uk/images/publications/too%20hot%20to%20handle%20-%20sept%2016.pdf 10-11.

51 https://workspace.imperial.ac.uk/climatechange/Public/pdfs/Briefing%20Papers/Grantham%20Briefing%20paper_Carbon%20Capture%20Technology_November%202010.pdf p3.

52 http://www.iea.org/publications/freepublications/publication/technologyroadmapcarboncaptureandstorage.pdf p5.

Best-use of bioenergy resources

Question 23. Gasification has been identified as a potentially important technology for unlocking the full potential of bioenergy to support economy-wide decarbonisation.
No comment.

Question 24. Bioenergy with Carbon Capture and Storage (BECCS) has been identified as a key potential mechanism for achieving the UK's 2050 carbon target due to the 'negative emissions' it could offer.
No comment.

Question 25. Once developed BECCS is a technology that could be deployed in many different countries around the world. What principles and mechanisms should be used to determine where BECCS is deployed and how any associated negative emissions are accounted for? Should any UK participation in any international BECCS scheme be counted as additional to efforts to meet domestic carbon budgets?
No comment.

Question 26. There is currently substantial interest in the development of 'advanced' biofuels for use in sectors such as aviation, shipping and/or heavy duty transport.
a) What are the most promising technologies/processes for advanced biofuel production up to 2050? Please provide details on each technology/process including advantages/disadvantages, timescales for commercial deployment, feedstock type, fuel type and end-user.
b) What efficiencies and costs are likely to be achieved? What scope is there for improvement and/or cost reductions over time? Please differentiate between technologies/processes.
c) What are likely to be the optimal feedstock types for advanced biofuel technologies?
d) What are likely to be the optimal end-uses of advanced biofuel technologies?
e) What are the main barriers and uncertainties associated with the development, deployment and use of advanced biofuel technologies?
f) What risks are associated with the pursuit of advanced biofuel technologies and how can these be managed?
We believe the recent reforms to Renewable Transport Fuel Obligation should have specified biomethane as a development fuels and introduced a floor price for both RTFCs and development fuel RTFCs to provide stability. As a transport fuel biomethane offers high GHG emissions savings, making it an essential component of government plans to decarbonise the transport sector and meet UK carbon budget targets.

Over the short to mid-term time frame biomethane presents the only practical means of decarbonising heavy goods vehicles, buses and non-road mobile machinery. Over the last five years GHG emissions from HGVs have been rising – HGVs represent 21% of overall transport emissions, so large gains can be made with relatively small effort: biomethane as a transport fuel will be crucial to decarbonise this most polluting of sectors.[53] Though electrification may offer a low carbon alternative to petrol and diesel passenger cars it is not a panacea across all vehicle sizes – something which the CCC itself recognised, "large, long-distance HGVs are not suitable for conventional electrification as they would require an excessively large battery for long-distance movement of goods."[54]

Questions 27-28.
No comment.

Question 29. There are also a number of other potential non-energy uses of bio-feedstocks including bio-based plastics and bio-based chemicals.

[53] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/567900/env0201.ods
[54] https://documents.theccc.org.uk/wp-content/uploads/2015/11/Sectoral-scenarios-for-the-fifth-carbon-budget-Committee-on-Climate-Change.pdf 142.

a. **What other non-energy uses of bio-feedstocks have the most potential through to 2050 in terms of GHG abatement, cost, timescales and market size?**
b. **What are the barriers to increasing these non-energy uses and how can these barriers be overcome?**
c. **What risks are associated with the pursuit of other non-energy uses of bio-feedstocks and how can these be managed?**

Bioplastics can be made from volatile fatty acids produced during the AD process and we encourage the CCC Bioenergy Review to support innovations in this areas as well as their commercialisation. If encouraged, waste going to landfill could be dramatically reduced, meeting EU Waste Framework Directive targets for recovery and disposal of waste. UK government recognises AD as the treatment option for food waste which achieves the "greatest environmental benefit" but only 12% of food and drink waste is currently recycled through AD.

Bioplastics also present a unique way for the UK to meet the EU's Circular Economy Package, installing competitiveness, fostering sustainable economic growth and generating new jobs.

GHG emissions reporting and accounting

Question 30. What are the strengths and weaknesses of the current approach to GHG emissions accounting for bioenergy in the UK and internationally? Specifically, what are the main gaps in the current land use emissions accounting rules?

We believe the existing approach followed by the EU currently should be maintained. It presents a clear and established methodology for Indirect Land Use Changes (ILUC) though this is not appropriate for AD as there isn't any indirect land use change due to AD.

It is a weakness of the current approach of sustainability accounting to limit use of crops in new AD plants in an arbitrary manner, and the framework could be improved if an objective sustainability criterion of life-cycle carbon emissions was instead used.

As we have provided evidence for, above, in our response to question 13 growing the AD industry through stronger enforcement of sending appropriate wastes and residues to AD would not alter UK food production.

Question 31. What are the risks, in terms of GHG emissions, associated with importing biomass or other biofuels from countries that have not committed to limiting or reducing emissions under the Kyoto Protocol or Paris Agreement? How can these risks be managed?

No comment.

Question 32. What alternative method(s) for bioenergy emissions accounting should be considered? What would the implications of these alternative method(s) be?

No comment.

Indicators

Question 33. What key areas should be reflected in these indicators?

We support the use of indicators to track progress towards key bioenergy outcomes including increased supply. We are happy to continue to engage with the CCC in the development of what would be appropriate for AD. As we have noted above, we do not believe that crops for AD has had a significant impact on UK food production and ILUC – rather than arbitrary crop caps perhaps the agricultural market should be monitored to measure this.

Such indicators should form the basis of RHI payments as distinct from arbitrary crop caps as has been introduced for new applicants to the FIT and (forthcoming) the RHI.

Question 34. Please provide details of any examples of international best-practice in the area of bioenergy indicators.
No comment.

Other

Question 35. Please submit any further evidence that you would like us to consider.
No comment.