

## Policy Position Statement

# Co-digestion of sewage sludge and waste

### Purpose

This Policy Position Statement outlines the main issues concerning increasing the levels of co-digestion of waste together with sewage sludge. It considers the technical, demographic, economic, legal and policy barriers to wider co-digestion of waste. It highlights areas where achievable opportunities exist and where there is a requirement for greater facilitation, and considers the overall contribution co-digestion can make to Anaerobic Digestion (AD) targets. It is set within the wider context of the UK Government's planned increased levels of AD and should be read in conjunction with CIWEM's PPSs on Wastewater Biosolids Treatment and Use.

### CIWEM calls for:

1. A consistent and proportionate approach to policy for the production and use of biogas irrespective of feedstock. This should include appropriate financial incentives for the renewable energy produced and rules for the land application of digestate.
2. A review and update of the regulations governing the outputs of co-digestion, focused on the protection of soils, crops, animals, people and the environment in general, from the perspective of the receptors (not the origins of the feedstocks) and including clarity on the end point for waste controls relating to co-digestate.
3. An update to the Quality Protocol for Anaerobic Digestate (PAS 110) to include provision for the use of biosolids (sewage sludge) as feedstock in order to define a clear approved method for meeting the requirements of Article 6 of the Waste Framework Directive on End of Waste Criteria.
4. An appropriate and clear economic regulatory framework for co-digestion, putting in place measures which permit water and sewage companies to increase their biogas outputs via co-digestion particularly where digester headroom capacity exists, reduce their carbon impact and appropriately invest proceeds back into the regulated business, potentially in cooperation with waste companies.
5. Revision of the Sludge Use in Agriculture Regulations to reflect the benefits of co-digestion and to put in place a clear legislative framework for the use of all treated organic residuals
6. The UK Government to provide and publish clarity on the Animal By Product Regulations requirements for co-digestion.

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## Context

Anaerobic digestion is a long-established technology for the treatment of sewage sludge by the water industry. The technology is of increasing interest to the waste management industry and to farmers. DECC is promoting AD as a technology for renewable energy and Defra for more sustainable waste management. AD produces multiple benefits including a source of renewable energy in the form of biogas (which can either be burnt to generate heat and electricity in combined heat and power units or upgraded to biomethane and injected into the gas distribution grid or used for vehicle fuel). Digestate from the process can be used as a useful fertiliser and soil conditioner for agriculture and other land use applications. In addition, the recycling of digestate in this way diverts biodegradable waste from landfill.

Defraii highlights significant potential for future AD capacity on the basis of over 100 million tonnes of organic waste currently being produced in the UK annually, comprising:

- 12-20 million tonnes of food waste (approximately half of which is municipal waste collected by local authorities, the rest being hotel or food manufacturing waste);
- 90 million tonnes of agricultural material such as manure and slurry;
- 1.73 million dry tonnes of sewage sludge.

The UK Government has set a target of expanding AD capacity significantly and hopes to see the UK as a world leader in anaerobic digestion by 2020. Given the level of expertise on AD within water companies, Defra regards this industry as being central to the expansion of AD, thus the question of the ability to feasibly co-digest sewage sludge with biodegradable waste is being increasingly considered.

There are a number of targets for 2020 which help to drive the high priority now attached to AD by the UK Government. Under the Climate Change Act 2008<sup>iii</sup> greenhouse gas emissions should be at least 34% below the 1990 baseline. In addition, the EU Renewable Energy Directive<sup>iv</sup> requires 15% of UK's energy to be generated from renewable sources. The 2009 Low Carbon Transition Plan<sup>v</sup> and UK Renewable Energy Strategy<sup>vi</sup> as well as the UK Biomass Strategy<sup>vii</sup> and Waste Strategy for England<sup>viii</sup> (both 2007) also encourage wider use of AD, including co-digestion. Production of biogas by AD is also eligible for Renewables Obligation Certificates (ROCs), although there are different rates for biogas produced from anaerobically digested sewage sludge (which is regarded as an established technology that receives 0.5 ROCs/ MWh) and biodegradable solid waste (which receives 2.0 ROCs per MWh [and 3 or 4 ROCs depending on output in Northern Ireland]). The banding of ROCs is due to be reviewed in 2011. The water industry does not receive support for electricity generated under the Feed-in Tariff scheme, though it will qualify for the Renewable Heat Incentive when this is introduced in 2011.

In addition, there is an ongoing driver, in the form of the EU Landfill Directive, to reduce the amount of biodegradable municipal waste sent to landfill. By 2020 only 35% of the amount produced in 1990 will be able to be disposed of this way. Between 12 and 20 million wet tonnes of food waste produced are produced in the UK per year, much of which would be suitable for AD and at typical generation efficiencies, could potentially be used to generate upwards of 6TWh of electricity (roughly 1.7% of UK annual consumption).

Water and sewerage companies are presently responsible for by far the largest inventory of AD infrastructure. Where any spare (headroom) capacity exists, CIWEM considers that it would be in the country's and the environment's interests to use this for co-digestion. If the existing capacity is fully utilised it could be 'turbo-charged' by retrofitting advanced digestion, alternatively additional digesters could be built. All of these options use the existing expertise, grid connections, vehicle handling and onsite capacity to treat associated effluent. A logical means of increasing such output may be to co-digest sewage sludge with biodegradable material (e.g. energy crop, manure or liquid waste) of an appropriate quality.

Co-digestion describes the process during which a number of different waste types are mixed together and anaerobically digested. This process can have clear benefits, firstly in improving the ability to digest certain difficult to digest waste types, and also, in the case of sewage sludge, adding to the existing calorific value thus increasing the biogas output of the digestion process. Importantly, in some locations it can result in the critical mass of biogas substrate to be realised within a haulage distance that makes AD financially viable.

Many biodegradable wastes are co-digested (e.g. farmyard manure plus municipal waste, food waste plus energy crops, etc.) but as they all fall under a common regulatory framework, the main obstacles relate to issues including demographics, investment potential and feedstock suitability if AD is to be expanded significantly as a waste treatment technique.

In the case of co-digesting sewage sludge (biosolids) with other wastes (which is practiced in other countries including Denmark and Germany) the UK has created additional complications by utilising different regulatory regimes, which presently appear quite difficult to reconcile, or which in order to satisfy, impose economic burdens of such significance that they make such co-digestion financially unattractive.

## Discussion of Key Issues

### Government targets

The UK Government sees AD as a viable source of renewable fuel in the form of biogas, both for upgrading to biomethane for injection into the grid or vehicle fuel and to generate electricity. In addition, AD represents a means to divert significant amounts of biodegradable waste away from landfill provided an appropriate digestate recycling route is available. Thus, it can contribute to meeting targets set under the Landfill Directive (it must be emphasised that an appropriate recycling route is essential for this diversion to be achieved – otherwise AD outputs can result in a greater volume of waste produced than existed initially because the waste has to be diluted before digestion). Digestate also constitutes a useful source of nutrients for recycling back to land. This context is likely to see increased AD capacity in the UK in coming years, and the Government has stated that it wishes the UK to become a world leader in the technology.

A major attraction of co-digestion for the water industry is its potential to make more use of existing AD assets and headroom digester capacity, to optimise biogas output and help water companies meet their own targets for renewable energy and energy efficiency compliance. It may be argued that co-digestion will not make any difference to the country's targets for greenhouse gas reduction, landfill diversion or renewable energy, because the feedstock

employed in co-digestion would be exploited by one of the many new digesters under construction or planned. In addition, the tonnage of sewage sludge which could be treated by AD (and thus co-digestion) is very limited compared to the theoretical feedstock volumes available from other sources. However this neglects some very significant issues: sewage works' AD has on-site treatment for reject water, they have grid connections and good road access, they have expertise to operate AD and combined heat and power and they have 24-hour surveillance monitoring. Defra envisages "The water industry will be at the hub of a national anaerobic digestion infrastructure. Where appropriate, water companies will generate additional renewable energy by using their spare capacity to process other feedstocks such as food waste."<sup>ix</sup>

## Regulatory issues

The contribution to Government targets that can be made from co-digestion of waste is limited under current circumstances. The majority of existing AD capacity is operated by water and sewerage companies and whilst a number are now examining the potential to utilise their spare digester capacity by co-digesting sewage sludge with other biodegradable wastes, there are a number of regulatory barriers that prevent this potential from being realised.

The digestate produced from sewage sludge is currently controlled under the Sludge (Use in Agriculture) Regulations<sup>x</sup> which govern how it can be applied to agricultural land. If appropriately produced and managed (in accordance with the regulations), such digestate represents a safe and inexpensive alternative to inorganic fertiliser for farmers and a viable route for water companies as well as a sustainable way of recycling nutrients to land. These regulations only apply to agricultural use of digestate; non-agricultural use is still governed by the Environmental Permitting Regulations 2010<sup>xi</sup>. But there is nothing in the Sludge Directive that would prevent it from being relevant to all land application, provided there was separate accounting for use in agriculture<sup>xii</sup>.

Digestate from source-segregated biodegradable waste is controlled under the Environmental Permitting Regulations and its production may also be subject to requirements under the Animal By-Products Regulations (ABPR)<sup>xiii</sup>. Spreading to agricultural land requires an environmental permit or appropriate exemption for certain waste types. However, this too could be appropriately managed under the tried and tested sludge Regulations. Alternatively, an output produced adhering to the requirements of approved quality protocols for compost or anaerobic digestate (e.g. PAS 100 and PAS 110) may be classified as a non-waste for re-use and not be subject to waste regulation control.

If sewage sludge is co-digested with biodegradable waste, it might no longer fall under the scope of the Sludge (Use in Agriculture) Regulations and thus outside of the scope of the Environmental Permitting Regulations. Consequently a potentially expensive environmental permit may also be required of the farmer in order for him to apply the resultant digestate to land. Co-digestate is also presently not covered by any of the approved quality protocols which also remove the output from the regulatory regime for waste and in order for it to be covered there will need to be clarity on how it could meet the requirements of Article 6 of the EU Waste Framework Directive on End of Waste Criteria. Also, additional pre-treatment of the feedstock may be required to meet the requirements of the ABPR. Currently, this has the effect of making co-digestion unattractively complex and expensive, even in locations where there

may be a locally available, secure supply of feedstock of sufficiently high quality. Under its Anaerobic Digestion Implementation Plan, Defra has committed to identify the regulatory requirements for co-digestion of sewage sludge with other feedstocksxiv.

### Investment issues

If water companies are to be encouraged to invest in AD of waste, and co-digestion, there will need to be consideration as to how companies can receive solid waste from producers, which are outside their regulated customer base (with waste collection being paid for via council taxes), utilise this to optimise biogas production and reinvest the proceeds back into the regulated business (which is funded through water bills). Waste operators will also demand a level playing field so that they are not at a competitive disadvantage to water companies, who may be (or perceived to be) in a monopolistic position. Water companies could theoretically make use of secure sources of funding (from water bills) to develop digester capacity to treat waste. Spare capacity being sold for commercial feed stocks could seriously distort local market conditions, with below market prices being used to secure feed stocks. An option might be that the construction and/or operation of digesters at wastewater treatment works is opened up to the commercial market; waste companies may or may not be in a better position to deliver value for money through this approach, which could result in lower operating cost and perhaps ultimately a lower charge to the water company customer.

Arriving at an appropriate financial framework will require collaboration between OFWAT and other industry regulators and OFWAT has sought guidance from the Office of Fair Trading for its view on how to fairly regulate this issue. Water companies will require a good financial model in order to determine a gate fee for waste, which recognises: the income from the energy (and possibly digestate disposal to land); the additional costs for handling the waste and a contribution to the asset value that has been paid for by the customer and thus should be recompensed). OFWAT have made it clear that if the financial model is robust, they will not stand in the way of co-digestion.

An important attraction of utilising existing water company capacity is that they also have the assets and supply chains to recycle the digestate. Without economic digestate recycling routes, new digesters will struggle. Digestate is produced at 4% dry solids and is thus expensive to transport. It must therefore be dewatered to at least 20% dry solids. Dewatering liquor must then be treated as it contains soluble N and P and some organic matter. Water Companies have dewatering facilities and a sewage treatment plant to put the liquor back through (nutrient recovery as struvite and ammonia is emerging technology, which is an added environmental advantage).

Prices for both energy and fertiliser are likely to increase in the medium to long-term. Both biogas and fertiliser outputs from AD represent more sustainable sources of these valuable resources than fossil fuels and inorganic fertilisers, the prices for which will become increasingly expensive by comparison.

The allocation of Renewables Obligation Certificates (ROCs) vary considerably for sewage and biowaste (energy generated from digested sewage sludge qualifies for 0.5 ROCs per MWh of electricity generated) whereas that generated from biowaste qualifies for 2 ROCs per MWh, making the allocation of ROCs for mixed feedstock problematic. The Renewable Heat

Incentive provides 6.5p/kWh, guaranteed until 2035 for eligible schemes where electricity is generated using CHP units.

### Demographic issues

The benefits of existing AD capacity near to urban centres and potential recycling routes for digestate are significant if the regulatory hurdles can be overcome. It should be possible to remove these hurdles, and importantly with no diminution in environmental protection. Co-digestion of waste with sewage sludge at existing wastewater treatment works (which are located close to the major conurbations they serve and hence a ready supply of biodegradable waste feedstock) offers an opportunity to achieve financial viability for AD whilst reducing waste transportation requirements (lowering the carbon intensity of the collection/transportation process). For example, for sewage sludge AD to be financially viable requires about 100,000 population, as does food waste AD. Co-digestion would be viable for a town of 50,000 people but mono-digestion would not and wastes would have to travel to a centralised site with the associated transport carbon emissions. The water industry has a significant experience base on AD, and to a lesser extent in relation to co-digestion.

### Feedstock issues

There are a number of waste streams that can be anaerobically digested, particularly domestic and commercial food wastes, and commercial and industrial tankered wastes. The main issues concern the quality of the feedstock and the ability to separate contaminants, which can negatively affect digester efficiency, even if present in relatively small amounts. Quality control of feedstock is thus important, and becomes particularly relevant in the case of source-segregated municipal solid waste where contaminants are commonly found. The revised Waste Framework Directive (WFD) may deliver improvements in the segregation of waste which may improve feedstock quality issues. A sister Biowaste Directive could also be forthcoming, which may help to ease the regulation of co-digestion.

The Animal By Products Regulations (ABPR)<sup>xv</sup> also have important implications for co-digestion because of the proportion of other materials introduced into sewage works AD plant, which may contain meat or other waste animal material. Generally the presence of such material in the feedstock requires heat treatment prior to the digestion process. Defra has been working with Water UK to provide guidance to water industry operators on the requirements of these Regulations including at what point and in what proportions pasteurized ABPR waste can be blended with sewage sludge. Advanced digestion would meet ABPR requirements and would have the benefit of trebling the capacity of many existing digesters. If this treatment were applied to all co-digestion feed then the output would be classified as enhanced treated digestate under the Safe Sludge Matrix<sup>xvi</sup>, but depending on the detail of any agreement, this may not be required.

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*Note: CIWEM Policy Position Statements (PPS) represents the Institution's views on issues at a particular point in time. It is accepted that situations change as research provides new evidence. It should be understood, therefore, that CIWEM PPS's are under constant review and that previously held views may*

*alter and lead to revised PPS's. PPSs are produced as a consensus report and do not represent the view of individual members of CIWEM.*

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- i CIWEM. Wastewater Biosolids Treatment / Use Policy Position Statement. April 2010
  - ii Defra. Accelerating the Uptake of Anaerobic Digestion in England: an Implementation Plan. March 2010
  - iii UK Statutory instrument: The Climate Change Act 2008
  - iv Directive 2009/28/EC on the promotion of the use of energy from renewable sources. 23rd April 2009
  - v HM Government. The UK Low carbon Transition Plan. July 2009
  - vi HM Government. The UK Renewable Energy Strategy. July 2009
  - vii DTi: UK Biomass Strategy. May 2007
  - viii Defra. Waste strategy for England. May 2007
  - ix Defra. Anaerobic Digestion – Shared Goals. February 2009
  - x UK Statutory Instrument: The Sludge (Use in Agriculture) Regulations 1989
  - xi UK Statutory Instrument: The Environmental Permitting (England and Wales) Regulations 2010
  - xii UK Statutory Instrument: The Environmental Permitting (England and Wales) Regulations 2010
  - xiii UK Statutory Instrument: The Animal By-Products (Enforcement) (England) Regulations 2011
  - xiv Defra. Accelerating the Uptake of Anaerobic Digestion in England: an Implementation Plan. March 2010
  - xiv ADAS. Safe Sludge Matrix – Guidelines for the application of sewage sludge to agricultural land