Organics Recycling & Biogas

Spring 2024 Issue 53

The magazine from REA Organics and Green Gas

Dead wood redemption

REA ORGANICS REA GREEN GAS

Welcome

Jenny Grant, Head of Organics and Natural Capital
Sara Bartle, Green Gas and Hydrogen Policy Lead

Welcome to this edition of our magazine. Since our last issue there's finally been a raft of publications from the Government.

We now have further details on Simpler Recycling and dates for when the mandatory food and garden waste collections must be in place, with collections from businesses starting in March 2025 and households in March 2026. It's good news that the Green Gas Support Scheme has been extended to March 2028 and the response to the mid-scheme review consultation has been published. We also have consultations in Scotland to both reform Environmental Authorisations and on the Circular Economy and Waste Route Map to 2030. You can find member briefings on these (and many other topics) on the resources section of our website.

It was lovely to see some members at our recent Resolution Reception and Green Gas Forum meeting. We are looking forward to the forthcoming Organics Conference on 21 March, which is shaping up to be a great day with lots of interesting topics and engaging speakers. We hope to see many of you there.

Work continues on many other topics, including the revision of the Compost and Anaerobic Digestate Quality Protocols. Thank you to members for providing feedback on the proposed tightening of plastics limits. We are hopeful that interim revised protocols will be published in the first half of this year with a further revision taking place after the risk assessment work has been completed.

Thank you for your support and we hope you enjoy this issue. Please get in touch if you have any feedback or if we can help with any issues you are facing.

Jenny and Sara.

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Household food waste up by 13.5%

A new report from WRAP has revealed that food waste from UK homes increased 13.5 per cent between 2018 and 2021, rising to 76 kg per person per year.

WRAP highlighted that although the overall trend from 2007-21 shows a 17 per cent reduction in household food waste, the recent rise is concerning, with implications for emissions targets and local authority spending.

The analysis measured only food waste collected by local authorities, which constitutes around 80 per cent of UK household food waste, to enable robust comparisons.

WRAP suggested that two key factors contributed to the 2018-21 increase. First, Covid-19 restrictions resulted in fewer opportunities for people to eat out. Second, food prices were lower, relative to average wages, at the time. Consequently, the charity commented, "despite action taken to reduce food waste over the same period, there was still an increase overall".

Catherine David, Director of Behaviour Change and Business Programmes at WRAP, called for "significant action, at scale" to tackle rising household food waste.

David urged for greater collaboration across the food sector, to share the responsibility of reducing food waste between producers and consumers: "Our food system is making it hard for people to buy only what they need, and to use more of what they buy... We need retailers, brands, manufacturers, hospitality businesses, local authorities and national governments to work together... We need to reshape the food system and treat food like the precious resource it is."

WRAP's Courtauld Commitment 2030, a voluntary agreement across the UK food chain, aims to halve food waste by 2030 (compared with 2007 levels), in line with the UN Sustainable Development Goals.

Greater Manchester considers England's first dry AD plants

A new report by the Greater Manchester Combined Authority (GMCA) Waste and Recycling Committee proposes launching two procurement exercises to increase organic waste processing in the area.

The 'Biowaste Management Strategy' report, which awaits full approval from the GMCA, suggests running a market testing exercise for expressions of interest in the design, build, financing and operation of two 100,000 tonne biowaste treatment facilities.

Expected to open in 2029, the facilities must employ in-vessel composting (IVC) or dry anaerobic digestion (AD) technologies. Dry AD is already being used in Europe and other parts of the world. If commissioned, the new dry AD plants in Greater Manchester would be the first in England.

Jenny Grant, Head of Organics at the REA (the Association for Renewable Energy and Clean Technology), commented: "Organic waste can play a vital role in meeting our net zero and climate change mitigation ambitions and it is great to see this acknowledged in the GMCA strategy and their consideration of technologies that can process food and garden waste and maximise their value."

The GMCA manages 1.1 million tonnes of municipal waste per year from over one million households across nine districts.

In October 2023, Defra confirmed the requirement for weekly separate garden and food waste collections from April 2026. "It is now necessary to ensure that GMCA has treatment capacity in place for the long term for mixed garden and food waste collected by the districts," said the GMCA.

The Authority's new report also recommended running a biowaste framework from 2026 to 2029, for the IVC treatment of mixed organic waste.

Scotland's Circular Economy Route Map

Scotland has introduced its Circular Economy Route Map, with the aim of transforming the nation's approach to waste management and recycling by 2030. A critical component of the strategy is the focus on reducing food waste.

Specific plans include a review of the rural exemption for food waste recycling as part of the recycling co-design process in 2024/25 and 2025/26. Also, the allocation of £1.7 million to improve access and infrastructure for food waste recycling in various local authorities.

The review continues on from the Scottish Government's 2019 Food Waste Reduction Action Plan, which includes various initiatives to encourage the reduction and recycling of food waste, from awareness campaigns to funding schemes, and which is supported by the £70 million Recycling Improvement Fund (RIF).

Simpler Recycling

Jenny Grant,
Head of Organics and Natural Capital, REA

Towards the end of 2023, the Government published their long-awaited post-consultation response on Simpler Recycling (previously known as Consistency in Household and Business Recycling in England). This included the planned implementation dates for when food and garden wastes must be collected from households and for business food waste collections:

- Businesses (and relevant non-domestic premises) will have to implement the collection reforms by 31 March 2025, with a two-year extension for micro firms (fewer than 10 FTEs) until 31 March 2027.
- Household collections (for all recyclables, food and garden) will need to be in place by 31 March 2026 (unless a transitional arrangement is in place regarding food waste collections).

Alongside the Government response were two consultations. One on additional policies (to expand the list of non-domestic premises and additional information to be recorded for digital waste tracking) and another on exemptions and statutory guidance. The Government proposed an exemption to allow local authorities and other waste collectors to always co-collect recyclable waste in a recyclable waste stream with at least one other recyclable waste stream, as long as dry recycling is collected separately from residual and organic waste streams, without the need for a written assessment.

The statutory guidance proposed direction on materials in and out of scope, food waste collections from communal premises, frequency of garden waste collections and frequency of residual waste collections. Following feedback from members, REA submitted responses to both consultations. We await further details and the legislation to implement the requirements, which is expected in the first half of 2024.

GGSS update

Sara Bartle,
Green Gas and Hydrogen Policy Lead, REA

At the time of writing, we are still awaiting the response to the Green Gas Support Scheme (GGSS) mid-scheme review. However, an announcement made in October confirmed the Government has decided to extend the scheme by two years, to March 2028.

In the REA mid-scheme review response, we suggested that an extension to March 2028 would provide a meaningful buffer for project planning and allow time to act on the rollout of mandatory food waste collections. The REA is aware that members will be able to green-light projects and submit applications to the scheme following the announcement so this is particularly welcome news and should help with the low numbers of applications moving through the registration process, with only one participant having been fully registered since the scheme opened.

Industry conversations continue on grid connection issues with problems reported on lengthy connection times and costs. The current seasonal variability on access to the distribution grid has yet to be resolved with suggestions such as reverse compression being investigated. This, along with the required calorific value constraints and variability across the country, puts pressure on producers to be able to operate effectively. The issues need to be resolved for the increasing ambition for biomethane production set in the Biomass Strategy (increase from 7TWh in 2022 to 30-40TWh by 2035) to be realised and to ensure the success of the GGSS or whatever support mechanism follows.

Preventing and managing contaminants

Emily Nichols

The International Solid Waste Association's (ISWA) Biological Waste Treatment group has published a Practitioner's Guide to Preventing and Managing Contaminants in Organic Waste Recycling. It provides background information and case studies about the different types of contaminants (physical, chemical and biological) that can enter organic waste streams intended for recycling, their potential impacts and the ways in which they can be prevented or removed.

The section on managing contaminants provides a contaminant management hierarchy, contaminant removal costs, health and safety considerations, and a subsection about Hazard Analysis and Critical Control Point (HACCP) and its relevance.

Preventing contamination is prioritised and the report covers collection schemes, public awareness initiatives, product bans and restrictions, and differential gate fees. Removing or eliminating physical contaminants covers: physical contaminants, separation techniques and associated factors; chemical (organic and inorganic) contaminants, and biological contaminants. An appendix provides practical examples of contaminant removal at four organics recycling facilities, outlining specific steps that eliminate or divert contaminants from the main process flow. "As contaminants threaten to impair recycling processes and reduce product quality, it is essential that they be prevented and removed effectively", says ISWA.

Packaging and packaging waste reforms

Emily Nichols,
Technical Manager, Organics and Natural Capital, REA

The UK Government and Devolved Administrations are continuing their stakeholder engagement. They consulted on the draft Producer Responsibility Obligations (Packaging and Packaging Waste) Regulations 2024 and asked how clear the draft regulations were on the responsibilities of the seven types of affected or role-playing organisations and on ease of implementation.

REA's response largely focussed on compostable packaging; that it should be a specific material category in the Extended Producer Responsibility (EPR) reporting system; seeking clarity on whether collecting it with food waste or food plus garden waste exempts it from EPR; seeking clarity on what factors must be included in recyclability assessment; calling for fee revenue from large producers of compostable packaging to go to facilities that organically recycle this packaging; and, given the seemingly dry-recyclables focussed 'Recycle' or 'Do not recycle' labelling requirements, saying REA would like to discuss with the Government a labelling approach that could work for third-party certified compostable packaging under the EPR system.

The Government also invited responses to their draft list of packaging materials to be disincentivised under the EPR system. REA's response agreed that 'degradable' plastics should be disincentivised but disagreed that independently certified compostable packaging products, which cover a range of material types, should also be disincentivised.

In the EU, the Council of the European Union has agreed a 'general approach' (negotiating position) to the European Commission's proposal for a regulation on packaging and packaging waste. Amongst their proposed requirements, the Council agreed that tea bags and sticky labels on fruit and vegetables must be compostable and introduced the option for EU Member States 'to require other packaging (e.g. coffee pods and lightweight plastic carrier bags) to be compostable under specific conditions'. Agreed amendments also included clarifications on labelling – to ensure consumers are well informed about the material composition of packaging and its proper disposal when it becomes waste – and the introduction of some flexibility to take into account existing labelling systems in some member states.

Scottish Government: Changes to Environmental Authorisations

Jenny Grant

The Scottish Government and SEPA's joint Better Environmental Regulation Programme have launched a consultation which sets out proposals for incorporating SEPA's four main regulatory regimes into an integrated authorisation framework.

The consultation proposes extending the Environmental Authorisation Regulations 2018 to regulate water, waste and industrial activities. The regulations are currently in draft form and the consultation seeks views on the draft text, proposed new activities and technical provisions. New activities covered include a change to the regulation of sewage sludge activities and the extension of environmental regulation to the activities of carbon capture, non-waste anaerobic digestion and certain generators by bringing them within the scope of the 2018 Regulations.

SEPA will also be consulting on proposals for the type of authorisation that will be required for waste, water and industrial activities once they are brought into the 2018 Regulations.

Update on Quality Protocol revision

Jenny Grant

Work on revising the Quality Protocols (QPs) for composts and digestates is progressing.

REAL has provided its Plastic Analysis report and proposed that limits applicable to plastics ⩾ 2 mm are tightened to match the SEPA limits, with a two-year transition from when the revised QPs are published as Resources Frameworks. Under the proposal, the plastics limit would become 0.06 per cent m/m for compost and 8 per cent of PAS110 physical contaminant limits for digestate. REA have provided members' feedback to the Environment Agency (EA) and will provide further feedback when possible.

To inform the risk assessment, a hazard analysis has been carried out. REAL's Research hub intend to deliver the project to update the Risk Assessment for compost and digestate to inform the QP revisions. Discussions are also underway regarding the position statement on manure and slurry-derived digestates and we are awaiting feedback from the EA. For more information on QP work, please contact Jenny.

Events Round Up

Jenny Grant, Head of Organics and Natural Capital at REA, talks through some of the in-person events that have happened and that are coming up in the calendar.

REsolution

18 Jan, House of Commons, London

It was great to see so many of our members at our annual event where we gathered together to discuss our resolutions for renewable energy and clean technology. It brought together senior representatives of REA members and other sector stakeholders for an evening of networking and discussion on the UK's pathway to achieving Net Zero.

The evening was hosted by Dr Alan Whitehead MP who stressed the importance of more investment and a faster transition to a low carbon future. Additionally, Amanda Solloway MP, Minister of Affordability and Skills, highlighted the need to inspire the next generation to come into the renewable energy and clean technology industry. Thanks to Dr Whitehead MP, our sponsors Eaton and Hitachi Energy and the team for making the night possible.

Nominations open: British Renewable Energy Awards

13 June, Sheraton Grand, London

The REA is delighted to announce that nominations are now open for the British Renewable Energy Awards (BREAs) 2024.

The BREAs are the highlight of the renewable energy calendar and the awards honour the organisations and individuals that have enabled the industry to do the amazing work that we see today as we push for Net Zero by 2050.

The 2024 Award Ceremony and Gala Dinner will take place in London in The Ballroom at the Sheraton Grand London Park Lane, in the heart of Mayfair on Thursday, 13 June.

For a hard-working, highly committed industry that's faced more than its fair share of challenges, this will be our night of celebration and glamour so we encourage you to enter yourselves, your clients or your colleagues and ensure they get the recognition they deserve.

Nominations are now open. There are 16 varied award categories, all of which are FREE to enter and applications will only take a few minutes of your time to complete. Details can be found on the REA website events page.

Organics Conference - 21 March, Chesford Grange, Kenilworth

The REA's Organics Conference is the largest gathering in the UK focused on composting, anaerobic digestion and recycling organic materials to land. The 2024 conference will delve deep into recent policy announcements, research and innovation to understand their impact on the sector.

The day will highlight the benefits of circular bioresources from collections to applications with useful case studies, best practice guidance, regulatory updates and examples of forward-looking innovation. Book now to come together with fellow advocates, experts and enthusiasts and help shape a world where organics recycling plays a key role in meeting the UK's net zero targets. Topics planned include:

Session 1: Navigating policy and regulations

- Government's view on the role of organics recycling in the circular economy.
- Update on the latest regulatory issues, including updates on Quality Protocols.
- A panel discussion on Simpler Recycling reforms.

Session 2: Organics waste recycling from bins to site

- Behaviour change and waste collections.
- Collections Guidance and charging for garden waste collections.
- Digital waste tracking reforms.

Session 3: Capturing the benefits of circular bioresources

- Recognising organic materials in regenerative agriculture.
- Managing recycled nutrients correctly in line with nutrient neutrality requirements.
- Accounting for compost and digestate under the GHG protocol.

Session 4: Innovation in the sector

- Biodegradable packaging as a potent source of biogas following thermal hydrolysis pre-treatment
- Enriching the earth – replacing peat.
- Biochar's role in mitigating climate change.

Following the conference we will have our Gala Dinner, always a great night of networking and entertainment. We look forward to catching up with members at what is shaping up to be a great day.

Navigating nutrient neutrality

Anna Becvar, Director of Earthcare Technical, takes us on a tour of the complexities involved in proving nutrient neutrality for new housing developments as well as new AD and compost sites.

Nutrient neutrality was first introduced in 2019, following an EU case known colloquially as "The Dutch Case". Affected Local Planning Authorities (LPAs) were simultaneously advised by Natural England that they should not approve certain new developments within affected areas unless nutrient neutrality for either nitrogen or phosphorus – and in some cases both – was achieved.

Nutrient inputs are considered to come mainly from either wastewater from existing housing or agricultural sources. Simply put, wastewater contribution comes largely from final effluent from wastewater treatment works being discharged to a water body, whereas that contributed from agriculture is likely to be more diffuse from surface water runoff or indeed leached to groundwater. The presence of excessive nutrients can cause eutrophication, which causes a dense growth of plant life in water bodies, which then impacts protected habitats and species.

Uncertainty as to whether new development will cause further deterioration in designated sites, and/or will make them appreciably more difficult to restore, led to the introduction of the concept of nutrient neutrality within the planning process. Areas that are affected by nutrient neutrality are defined as habitat sites protected by the Conservation of Habitats and Species Regulations 2017 (as amended). These include Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and component Sites of Special Scientific Interest (SSSIs). Ramsar sites – wetlands of international importance – are also included as these are protected as a matter of government policy.

Examples of the types of development that may create additional nutrient 'load' include:

- Overnight accommodation from new housing or tourist accommodation
- Festivals and campsites
- New farm livestock accommodation and stabling for horses
- Anaerobic digestion (AD) and composting facilities

Surplus nutrient load must be mitigated through measures such as upgrading wastewater treatment plants, constructing wetlands to remove nutrients from surface waters, or putting land into fallow, i.e. taking land out of agricultural production, removing livestock, and ceasing the use of fertilisers or manures for perpetuity. Mitigation should benefit the affected catchment where development is to take place. The cessation of existing nutrient loadings must correspond with or precede the time when the development nutrient contribution is to take place – e.g. the day a house becomes occupied.

Local variation

LPAs in affected areas require nutrient neutrality to be proven to validate a planning application before determination. It is the LPA which should determine whether a planning proposal is likely to have a significant effect on any European site. Natural England must be consulted on any appropriate assessment the authority decides to make.

> Local Planning Authorities in affected areas require nutrient neutrality to be proven to validate a planning application before determination

The situation has attracted headlines such as: "There is nothing neutral about nutrient neutrality" as only certain areas of the country are affected and there has been great variability in LPA approach within affected areas. The resulting uncertainty has slowed development and, in some areas, brought it to a grinding halt.

Some LPAs have invested funds in supplying their own mitigation measures, whereas others have not, and this has meant that developers have been left to find their own local mitigation. Hence significant pressure has been placed on the Government to come up with a more workable solution.

With regards to all the housing developments currently on hold due to nutrient neutrality, the King's Speech was eagerly awaited in anticipation of extensive quick-fix measures to 'unlock' all affected new homes. Instead, Jeremy Hunt announced in the Autumn Statement that there would be a £110 million fund to "deliver high-quality nutrient mitigation schemes, unlocking 40,000 homes". Perhaps we will see another change in approach in 2024.

Nutrient neutrality and AD

The AD and composting industries recognise the potential impact their activities may have on the environment, and aim to mitigate this by applying controls. Together with agriculture, they are also regulated by the Environment Agency.

Earthcare Technical has actively

engaged in nutrient neutrality work from the start, due to our in-depth knowledge of nutrient interactions and in part because I live within one of the first affected catchments (the Solent). This has led to proactive discussions with Natural England and at times we have highlighted the potential 'crossovers' with the Environment Agency's work.

There is a generic methodology in place for assessing new developments, but it does not apply to agricultural and industrial development. Demonstrating nutrient neutrality for an organic waste treatment facility is relatively straightforward. New planning applications for AD plants and compost sites within affected areas must be supported by a Nutrient Neutrality Assessment and Mitigation Strategy report or a 'NNAMS' for short.

Elements of the design and operation of a facility which could affect surface and groundwater quality need to be assessed. These include:

- Site location and infrastructure design
- Drainage system design including clean and dirty water management;
- Site operations
- Origin and production methods, and use of feedstock materials
- Digestate or compost management and use – to effectively replace manufactured fertilisers

Soil management and nutrient use are regulated by the Environment Agency through the Farming Rules for Water. However, operators should expect to address Natural England with questions about the growing of maize for AD, and biofertiliser management. A well-designed, well-built and well-managed facility should not add to existing nutrient burdens, and the whole scheme should be deliverable in line with the requirements of the Habitats Regulations. Earthcare successfully supported two AD site planning applications with NNAMS reports in 2023.

Delivering biodiversity net gains

In 2024, new developments must contend with a further cultural shift in that they must not only avoid harming biodiversity but must make a positive contribution to it. Major developments will be subject to Biodiversity Net Gain (BNG) requirements when these become mandatory in early 2024, smaller ones from April 2024. Nationally significant infrastructure projects are expected to meet BNG requirements from November 2025. To date, only draft BNG guidance has been released. The date on which BNG comes into force had not been confirmed at the time of writing.

In 2024, new developments must contend with a further cultural shift in that they must not only avoid harming biodiversity but must make a positive contribution to it

Biodiversity can be lost through development or generated through enhancing or creating habitats. A habitat will have a number of biodiversity units depending on its size, quality and location. A tool has been produced for calculating BNG units and Earthcare is already working with several suitably qualified ecologists in assessing potential off-site mitigation land on behalf of landowners.

Waste treatment developments are not exempt from BNG requirements, although commercial developments where floor space is less than 1,000 square metres or total site area is less than one hectare are exempt.

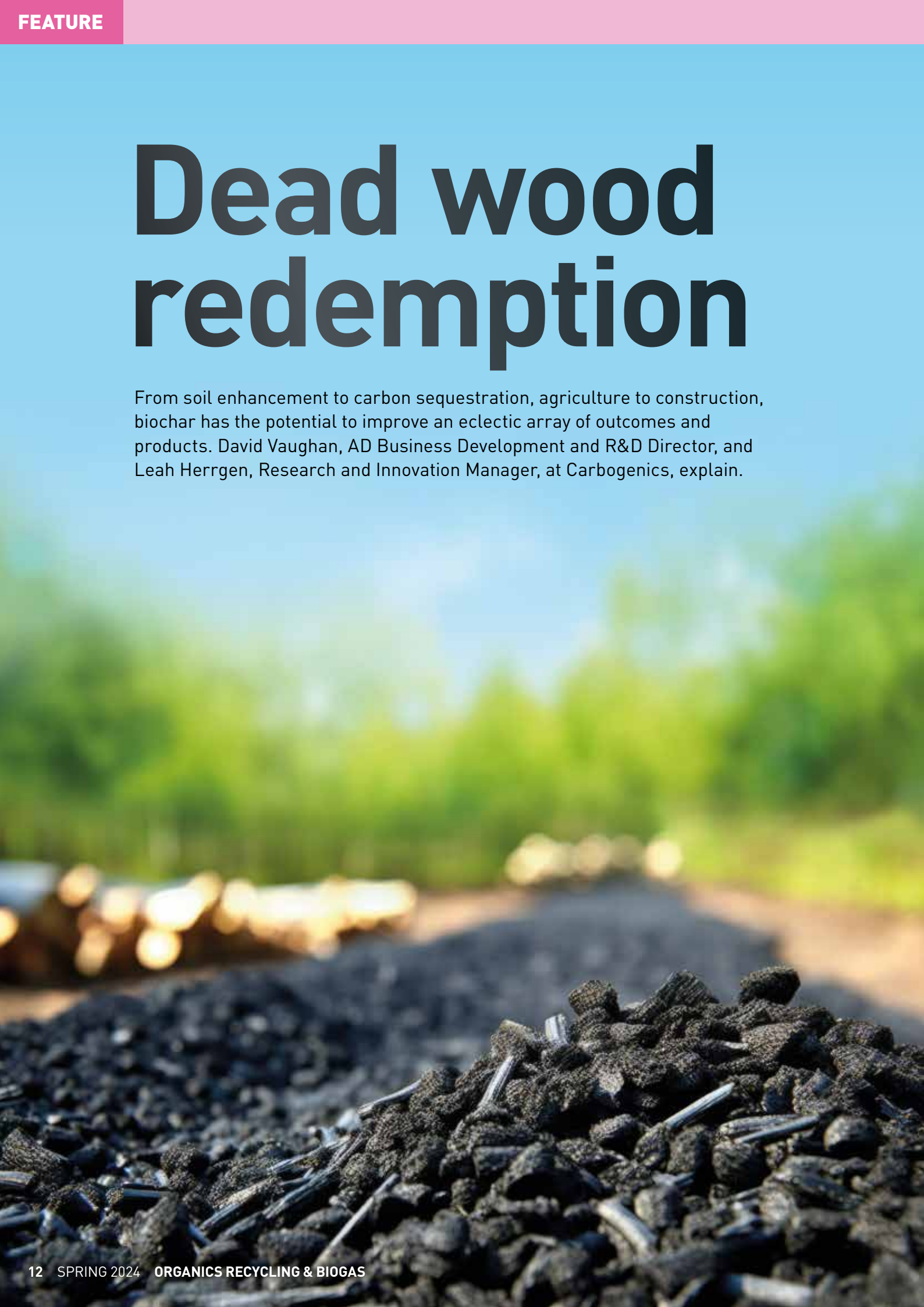
There are three ways to achieve BNG, but they must be explored in the following order: on-site units, off-site units and statutory biodiversity units. The purchase of statutory biodiversity units from the Government is a last resort. The Government will use the revenue from the sale of such units to invest in habitat creation in England.

BNG certainly presents opportunities for landowners to sell credits and improve biodiversity on their land. The land manager is legally responsible for creating or enhancing one or more habitats and managing that/these habitat(s) for at least 30 years to achieve the target condition. This period is misaligned with that required for nutrient neutrality and meeting both scheme requirements on the same land to 'credit stack' is somewhat complex.

Shaping government policies to accommodate the need for renewable energy, secure food production, recycling and BNG is undoubtedly a challenge. Communication and agreement across sectors and within government are key.

Dead wood redemption

From soil enhancement to carbon sequestration, agriculture to construction, biochar has the potential to improve an eclectic array of outcomes and products. David Vaughan, AD Business Development and R&D Director, and Leah Herrgen, Research and Innovation Manager, at Carbogenics, explain.



The International Biochar Initiative (IBI) defines biochar as "a solid material obtained from the thermochemical conversion of biomass in an oxygen-limited environment". In other words, an organic feedstock such as wood, manure or leaves is heated to a temperature between 300 and 800 degrees celsius, with very little oxygen present. This process, referred to as pyrolysis, produces biochar, a charcoal-like by-product rich in stable carbon. Yet, biochar differs from charcoal, which is mainly used as a fuel, in that its primary applications are in agriculture, horticulture and related fields.

Among the key physicochemical properties of biochar are its porous structure and high surface area. Typically, biochar boasts a surface area of 100-500 m2/g. As such, a single gramme of char has roughly the same surface area as a doubles tennis court. Furthermore, depending on the production parameters, biochar has a high number of functional groups on its surface. Due to these characteristics, it can retain water and nutrients as well as adsorb environmental pollutants. It also offers a suitable growing environment for many beneficial microorganisms.

An additional key attribute of biochar is its permanence. The carbon in biochar is highly stable and can endure in soil for thousands of years without being degraded by microorganisms. Thus, biochar represents a long-term CO_2 sink that can sequester carbon in the soil virtually indefinitely. This makes biochar a promising Carbon Dioxide Removal (CDR) technology that can contribute to the mitigation of climate change and help work towards net zero goals.

> Biochar has the potential to increase crop yields, plant health and soil quality

Producing biochar from compost oversize

Whereas virgin wood is regularly used for biochar production, the use of waste materials would be the best option and compost oversize would be an ideal feedstock. Compost oversize (the large or coarse materials that remain in the compost pile or bin after the composting process has taken place) represents a significant issue for the industry due to contamination from plastics and metals and can often end up in landfill. However, there is an increasing drive to clean it up and provide alternative uses, one of which could be the production of biochar.

The benefit of compost oversize is that it is predominately woody material, which is ideal for biochar production. It is a relatively simple lignocellulosic material which results in a clean biochar with a high carbon content. The challenges would be around contamination within the oversize. While the organic fraction would be fine, any metals would be detrimental to the process. Plastics, to a certain extent, would burn off during the pyrolysis process. However, heavy plastics may persist, which would make the biochar unsuitable for many applications.

Additionally, there is some concern about the chlorine content within compost oversize that has been co-mingled with food waste containing chlorine-containing materials such as PVC (polyvinyl chloride) plastics or chlorine-bleached paper products, which may be harmful to pyrolysis equipment.

Less of an issue but still to be considered is the requirement for pre-processing prior to pyrolysis. To maintain consistency in biochar production, the woody material needs to

be reduced to a uniform size to ensure each piece is treated evenly in the process and the quality of the product is maintained.

Exploring biochar's potential

The multifaceted benefits of biochar include its diverse applications, many of which are outlined below. However, the list is not exhaustive:

Soil enhancement: The best-known application for biochar is its use in soil improvement. When applied directly to agricultural and horticultural soils or used in urban landscaping, biochar has the potential to increase crop yields, plant health and soil quality due to its ability to retain water and plant nutrients, loosen soil structure, and initiate humus formation. In addition, biochar can also bind nitrogen compounds such as ammonia and nitrate and prevent their leaching into the groundwater, making them available for plants instead. Biochar thus reduces the need for mineral fertilisers in agriculture. However, there are some caveats to this application. Recent research has shown that a biochar's feedstock, and the soil type and crop to which the biochar is applied, can impact its effectiveness. Applications such as land remediation, urban landscaping and use on soils that are nutrient-poor gain the greatest benefit. There is also increasing evidence that mixing biochar with compost can have beneficial effects on plant growth.

There is an increasing body of research showing that adding biochar to the soil can have an impact on plant pests and diseases. A review of trials on the use of biochar and the effect on above-ground and below-ground plant pathogens concluded that the most common biochars in successful studies were from woody waste with success rates of 86 per cent for fungi and 96 per cent for bacteria.

> The carbon in biochar is highly stable and can endure in soil for thousands of years without being degraded by microorganisms

However, the species of pathogen tested were far from exhaustive and many studies showed no effect at all. This further highlights the variability of the effects of biochar and that one size does not fit all.

Feed additive: Biochar is already in use as a feed additive for a range of farm animals including cows, pigs and poultry, where it can prevent or treat digestive problems. This leads to improved feed conversion and hence faster weight gain and better meat quality. The resulting biochar-enriched manure can be spread on arable land for enhanced crop production. Biochar acts as a carrier for plant nutrients and thus improves the effectiveness of manure from biochar-fed livestock. The requirements for a biochar to be used as a feed additive are quite stringent so only the best quality chars can be used.

Biogas plants: Anaerobic digestion (AD) is a biological process through which microorganisms digest organic materials such as food waste, farm manure, or sewage sludge, and turn it into biogas and biological fertiliser. The biogas is either turned into electricity which is fed to the grid or upgraded to biomethane which is fed to the gas grid. AD plants face multiple challenges, including process instability and low biogas yields. Also, high ammonia concentration can be toxic to the microbiology and excessive hydrogen sulphide in the biogas can damage the engines involved in electricity production. With its large surface area, biochar not only provides a substrate for the growth of beneficial microorganisms but also adsorbs inhibitory substances, thereby stabilising the digestion process and

increasing biogas yields. There are a limited number of companies that produce biochar specifically tailored to the biogas industry, but they have shown that these biochars can also improve methane concentration in the biogas, reduce ammonia concentration in the tank and reduce hydrogen sulphide in the gas. These factors can represent significant benefits for the biogas industry. Lastly, as the biochar is not consumed in the process it will come out in the digestate and can enhance the effectiveness of the AD digestate as a fertiliser.

The European Biochar Certification specifications look at various aspects of the biochar, with heavy metal concentration being a large part of the analysis. However, biochar that doesn't fall into the categories that are suitable for land application can find an outlet. These are called basic materials, and the applications can be far from basic within industries such as construction (within lightweight concrete or insulation) and electronics (within the manufacture of supercapacitors or carbon-based nanomaterials). This means that biochars from wastes like sewage sludge, although not currently suitable for land application, can still find a market.

One tonne of biochar can sequester 2.5-3.0 tonnes of CO_2 equivalents

Carbon sequestration strategies: the biochar connection

Anthropogenic climate change is driven by increasing amounts of CO_2 in the atmosphere. Since the carbon in biochar is stable, biochar production can be used to sequester carbon in the soil for vast periods, contributing to climate change mitigation. The amount of CO_2 sequestered depends on the amount of carbon in the biochar which in turn depends upon the feedstock and process parameters used, but typically one tonne of biochar can sequester 2.5-3.0 tonnes of CO_2 equivalents. The carbon sequestered in biochar can be represented and traded in the form of carbon credits. These credits can be purchased by environmentally conscious companies to offset their carbon

emissions. At the time of writing, one tonne of biochar-based carbon fetched between €100 and €500 on the voluntary carbon trading platform Puro.Earth. The additional income from carbon credits can enable biochar makers to offer their products at a lower price, thereby contributing to the economic viability of the biochar industry.

What does the regulatory landscape look like?

Biochar is a relatively new but rapidly growing industry that is expected to play an important role in the decarbonisation of the economy. The European Biochar Market Report showed a production capacity of 53,000 tonnes per year at the end of 2022, which is expected to exceed 90,000 tonnes per year by the end of 2023. Similar increases in production capacity are expected to continue over the coming years.

Due to the novelty and current small size of the sector, in most European countries there is as yet no legislation dealing specifically with biochar. However, biochar has recently been approved as a fertiliser in the EU, which is one of several developments that are expected to boost the biochar industry. In terms of biochar production, at present the most relevant certification system for biochar in Europe is the European Biochar Certificate (EBC), which includes specifications on permitted feedstocks, material characteristics, limits for problematic substances and production and use requirements. This provides certainty to biochar buyers that the product they are purchasing has been produced sustainably and satisfies the rigorous EBC quality standards. Consequently, many biochar manufacturers pursue efforts to obtain EBC accreditation for their product, but participation in the scheme is voluntary and does not form part of biochar legislation.

Biochar is an old material but a relatively young market, with extensive research being conducted into its possible uses. Due to its many attributes, biochar is finding itself being connected to a lot of potential markets. As with any new product, some of biochar's applications will need to overcome legislative hurdles. Biochar is a growth industry and is set to play a large role in tackling climate change, the race to net zero and carbon sequestration. The industry, which will need good, abundant feedstocks, represents a viable alternative use for waste materials such as compost oversize.

Hot Topic: What should replace the Green Gas Support Scheme (GGSS)?

Josh Henthorne,
Biomethane Originator,
Centrica Energy

Direct subsidies reduce investment risk and provide the price guarantee that many investors require, always acting as a minimum `floor price` for the producer. However, subsidy prices – even with the additional gas and green certificates revenue – are not always the highest achievable market price.

There is significant demand for volumes unsupported by the GGSS, driven primarily by the transport sector but interest also comes from corporates. The GGSS allows flexibility when claiming the subsidy, allowing unsupported volumes to be sold when prices are more attractive and the subsidy to be claimed when not. The concept of the subsidy as a floor price with this flexibility would be attractive to traders like us, who want the opportunity to optimise sales, and the producer, who wants price certainty but with 'upside' potential. Future support should therefore be careful not to lock in producers, allowing them to waive the support and sell some unsubsidised volumes.

Another key consideration is the recognition of biomethane under the UK Emissions Trading Scheme (ETS). Removing or reducing the obligation for carbon allowances for large industrial gas consumers if they buy biomethane from the grid could be a key driver for the sector. These arrangements could provide producers with a hedging opportunity and some degree of price security, stimulating demand-side incentives rather than supply-side production tariffs. We have found there is corporate interest in buying biomethane but current uncertainty around ETS eligibility is proving a barrier to further progress and is inconsistent with EU ETS positions. Market-based reporting tools such as green gas certificates must also continue to report GHG emission reduction under the GHG Protocol, Science Based Target initiative and other similar instruments, as these are essential to drive corporates' demand and to create a premium for biomethane certificates.

In summary, the sector needs longer-term certainty around the future support for new build sites and Combined Heat and Power (CHP) conversions. We think future support should provide the price security that investors need while also allowing some volumes to be sold as unsupported. There must also be a joined-up approach with eligibility under the UK ETS and more broadly the use of Energy Attribute Certificates (EACs).

> Future support should be careful not to lock in producers, allowing them to waive the support and sell some unsubsidised volumes

Richard Gueterbock,
Director,
Foodchains

The UK biogas sector is being undermined by this Government's failure to back bio-energy production from smaller (on-site) off-grid systems. The EU responded to the impact of the Ukraine war on global energy and food security with increased bio-energy support.

While the EU expands biogas output, the UK is failing to unleash its potential by excluding off-grid production. The flawed GGSS is inhibiting the expansion of biogas supply and hence rural fossil fuel replacement. Despite stalled growth, the GGSS has been extended to 2028. For years, BEIS has failed to support smaller AD plants. Neglect of off-grid biogas continues.

Agri-food decarbonisation needs a more diverse approach, including:

- Support for modular, on-site biogas (including covered lagoons) on livestock farms
- More ambitious plans for off-grid gas fuels (BioCNG, bio-propane and – in time – hydrogen) to replace fossil fuels in heavy vehicles
- Re-thinking the internal combustion (IC) engine ban for heavy vehicles and support for companies like New Holland and JCB developing clean IC engines

Grant funding is needed for on-farm AD to help manage nutrients and emissions. Innovative approaches, such as modular systems or small-scale CO_2 capture, also require support.

Increased biogas output from agri-food residues requires smaller plants for sites with no gas-grid connection. Replacing the flawed GGSS needs a more flexible approach, including:

- Continued support for grid-connected AD (perhaps a Contract for Differences approach, where a base price could be guaranteed, to make projects bankable)
- Urgent support for off-grid AD to help manage agri-food bio-residues
- Plans to keep existing CHP AD sites in production, post-loss of Feed-in Tarrifs and Renewable Heat Incentives
- Facilitated conversion to BioCNG fuel production, where appropriate, to avoid stranded assets
- Updating the Renewable Transport Fuel Obligation to boost local bio-fuel supply, rather than imports

For a brighter vision of the role of biogas in agri-food decarbonisation, do we have to wait for a new government with greater ambition for decentralised bio-energy?

Simon Farris,
Bioresources Strategy and Commercial Lead, Severn Trent Water

There is currently a unique opportunity in the UK wastewater industry to develop biomethane. Sewage sludge needs treatment – it is unavoidable waste and it continues to grow in volume. Incentive-supported electricity starts to disappear from 2027 as the Renewable Obligation legacy comes to a close, and many companies in the sector, including Severn Trent, have committed to Net Zero by 2030. All wastewater companies are looking at how we can drive the best value from our sewage-derived biogas and satisfy these three challenges at a significant scale in the next five years.

Biomethane can maximise our opportunity by being more efficient than power generation, offsetting more carbon and fuelling vehicles, so why are we not choosing it?

Capital costs for biomethane plants remain high, and the commodity price is generally lower than the cost of avoided electrical imports. Therefore we are not yet in a position to progress biomethane subsidy-free.

Selling our carbon savings to third parties is challenging (we need them for our own ambition) and so we need a well-developed price for carbon that encourages us to develop our energy offering in different ways – e.g. benefits for self-supply.

I believe that any future gas subsidy needs to offer financial support to companies, to balance the relative risk/reward of technologies and to encourage an efficient carbon choice for themselves and the wider energy markets. There is the opportunity for plant expansions and new technologies to produce more biogas and lower our carbon footprint but at the moment these are not seen as valid for incentivisation. I believe we need a scheme that can facilitate the expansion of existing AD sites, provide options for CHP conversion and allow companies to decarbonise their own footprint.

David Kinnersley,
Head of Agribusiness, Fisher German

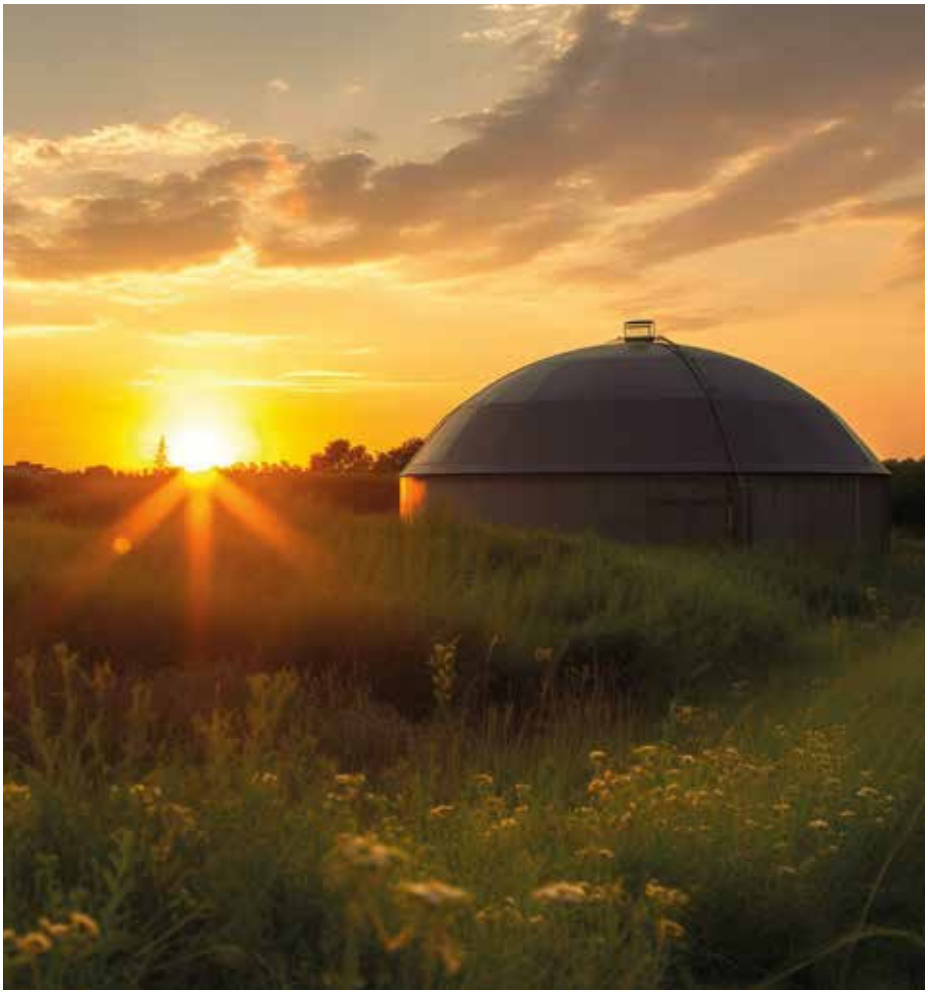
Biomethane is a useful component in the portfolio of renewable energy fuels. As an energy source, it is flexible in terms of where it can be used – in existing heating boilers, gas CHPs, as a greener fuel for road haulage and farm tractors – as well as how it can be stored for future use.

Biomethane can be derived from many different sources – food waste, cattle manures and energy crops; capturing methane that otherwise may have entered into the atmosphere. However, the cost of the infrastructure required to produce biomethane and inject it into the grid hasn't reduced, unlike that of solar and wind turbines. It therefore needs continued support of some type to ensure it continues to develop in the UK and reduce fossil fuel consumption.

A replacement for the GGSS should be able to provide consistent support for new AD developments and, in my view, ideally, present an option for existing plants which are CHP-only to convert to biomethane production when their FiT support comes to an end.

The lessons learnt from the previous schemes are that if the level of support comes from a fossil fuel levy rather than the Treasury then it is more likely to be acceptable. The length of the scheme support is critical to ensure that developers have time to get planning consent (an increasingly risky element), raise funding and build and commission plants.

The replacement scheme will therefore ideally be funded from a levy derived from fossil fuel suppliers or consumers, encouraging a lower carbon biomethane. A route to encourage its production at a smaller scale for on-farm use and as a replacement for rural heating fuels could also encourage reductions in oil-based fuels while capturing agricultural emissions from livestock manures.



Dependability a cornerstone for Ed Hall Services

Managing Director Nikki Dixon describes how Komptech equipment plays a vital role in annually processing over 250,000 tonnes of green wastes

For some operators with municipal contracts processing green waste is outside their core activity, which is where a composting specialist bridges the gap.

In doing this, Lincolnshire-based Ed Hall Services has adopted a niche business model, running composting facilities across the country.

Founded in 1998 by Nikki Dixon's father, Ed Hall, this family business has blossomed into a significant force in the industry. Today, it manages over 250,000 tonnes a year at various locations around the UK.

"The first green waste we shredded was back in 1998," recalls Nikki, reflecting on the company's origin. "At that time, there was no PAS100 specification; we worked to a protocol, but there wasn't an official accreditation."

Some local authorities had begun to offer a garden waste collection, yet treating this organic waste was not as sophisticated as it is today, often simply shredding it to then use for landfill cover.

As the company evolved, the first machine it purchased from Komptech was a Magnum screen in 2000, enabling them to improve separation of finished compost from oversize and contaminants, improving consistency in the output material.

"Our next machine was in 2001, Komptech had developed their Hurrikan Windsifter which teamed up very well with the Magnum," she recounts. "It was a very long setup, with one machine behind the other."

The addition of a second Magnum, in 2002, reflected further expansion in Ed Hall Services' capacity. As the company grew, so did its range of Komptech machines, each addition reflecting business growth.

The introduction of the Crambo slow-speed shredder in 2008 marked a turning point. "We've never not used a Crambo since 2008," Nikki asserts. This shift to a more sophisticated shredding technology allowed for more effective processing of the compacted waste, with the Crambo's ability to handle varying profiles of green waste significantly improving operational efficiency.

This was followed by the acquisition of a Mustang, which in 2014 was then in turn replaced by the Nemus, Komptech's newer, more fuel-efficient trommel screen. In doing so, Ed Hall was the first UK customer to acquire a Nemus for refining additional grades of composted material.

Teamwork and efficiency

Ed Hall Services has evolved to become a major force in the industry, managing a substantial amount of garden waste. Led by herself, along with her husband Andrew and Ben Ashton, the Head of Operations, Nikki emphasises how it's the whole

The Crambo slow-speed shredders are deployed on numerous sites managed by Ed Hall Services

A Komptech Top Turner, similar to the one deployed by Ed Hall Services

team, comprising around 34 dedicated staff, that is the driving force behind the company's impressive scale of operations.

As well as investing in its people, Ed Hall Services has continually upgraded its equipment as the operation has grown, currently running six Crambo shredders across the country, along the way trading some older models in for the newer Crambo 5200D Direct, which offers more versatility.

"For me, the Crambo has always been the best shredder out there. The steel is always a couple of mm thicker than their competitors. Over the years shredders wear away, so these things do matter."

In addition, the company has invested in other machines in the Komptech portfolio, including the recent acquisition of an L3 Star Screen, which is able to handle a greater throughput of material and has replaced two trommel screens the company was running. For Nikki, the economics of this are clear cut: "We are running one machine instead of two. So there's one lot of servicing, instead of two... There are cost savings all the way through, from insurance, to oil for servicing, disposal, et cetera. It's more environmentally friendly. And it's lower fuel costs for us just running the one machine.

"It probably gets looked after better; if you've got one person servicing two trommel screens, it can be tight for time. But just servicing the one machine, it is much easier for them and it's less work for the loading shovel as well. It's not rushing about as much, it's better for the operator."

There are also occupational health benefits from switching to the L3. "It's incredibly quiet compared to the trommels. You can walk on site and have to ask if it's on," she notes.

"The other thing for the L3 over a trommel is that the activity takes place inside it, so you don't get as many bioaerosols exposed into the air as you do with the trommel.

"It depends on the time of year but if it's August and we've had a particularly dry summer, there's more dust, and as the trommel goes round, there's quite a lot of dust, but less so with an L3 screen. So for us it's just a win-win."

Although Ed Hall Services operates across multiple sites, this is the only one to also have a Komptech TopTurn, for turning over material in the windrow: "It's a phenomenal machine. It's just regrettable that all sites don't have space to accommodate one."

Although their top turner is only used a couple of hours a week, it more than makes up for the time it's not in use. "The work it can achieve would take a loading shovel all week to do, probably two loading shovels.

"It turns [the windrow] better than anything. It is like putting it through a shredder again. You are incorporating oxygen very evenly to the material. So it just maximises every stage of the process. You get less oversize, which makes a difference to quality and overall costs and that's because of the rotor spinning across - I always think it's like a busy mole!"

Partnership

The relationship with Komptech, facilitated through the John Hanlon dealership, has been a significant factor in the growth trajectory of Ed Hall Services. "Komptech really knows how to build a machine," remarks Nikki. "Everything's just a little bit better than their competitors, as is their research and development. They're absolutely on it."

Although maintenance is managed in-house by her team, the advent of telematics means that John Hanlon and Komptech are able to anticipate when manufacturer servicing is required.

However, for her business, the back-up service provided has been as important. When accounting for what makes an effective partnership, Nikki cites some key metrics: "What happens when something goes wrong? What do they do? How quickly does it get fixed and if it can't be fixed, how will they help you? Do they always pick up the phone? With Hanlon's you just get tick, tick, tick."

Beyond biomethane: Biogenic CO_2

Biogenic CO_2 – previously considered a by-product of anaerobic digestion and secondary to more lucrative biomethane – has traditionally been released back into the atmosphere rather than cossetted away for trade. **Dr Nick Primmer**, Policy Lead at Future Biogas, however, believes that capturing and utilising the derivative could hold the key to unlocking the potential of the AD sector.

Not all carbon dioxide (CO_2) emissions are equal. It all depends on where the molecules' carbon originates.

When derived from fossil fuels, carbon that had been stored within the Earth's crust for millions of years is released into the atmosphere, increasing its concentration of greenhouse gases (GHGs) and driving anthropogenic climate change.

When derived from the atmosphere, CO_2 emissions are carbon neutral – they do not result in a net increase in GHG concentrations over time. For carbon to originate from the atmosphere, it must first be captured via a technological or biological pathway. For the latter, all plants absorb CO_2 from the atmosphere and assimilate the carbon into their cells via photosynthesis. This biogenic carbon may be eaten, digested, and/or processed, each converting the carbon into new molecules. The release of any biogenically-sourced carbon dioxide (or bio-CO_2) simply completes its cycle back to the atmosphere.

As the UK transitions to Net Zero, we must rethink how we source and use carbon. Today, much of the economy relies heavily on fossil carbon. It is physically found within gas networks, transport fuels, building materials, food and drink products, and countless other commodities – notwithstanding the use of fossil-derived energy to create these products.

Here lies the potential of anaerobic digestion (AD) and its production of biogas – a gaseous mix of biomethane (CH_4) and carbon dioxide (CO_2), each composed of biogenic carbon. Over the last decade, government subsidies have focused on AD's production of biomethane, driving the development of new capacity. Bio-CO_2 has been treated as a by-product of biomethane production and largely vented back to the atmosphere.

Today, however, bio-CO_2 is being increasingly recognised as a highly valued co-product, alongside biomethane. Both the government and the private sector are increasingly recognising the importance of bio-CO_2 in the delivery of their Net Zero strategies – specifically via its utilisation or storage.

Utilisation

Utilisation of bio-CO_2 relates to the direct replacement of fossil-CO_2 within existing processes and products, or to its use as a biogenic carbon feedstock in the creation of new products e.g., sustainable aviation fuel (SAF).

Today, the UK uses around 600,000 tonnes of CO_2 per year, principally in the manufacturing of food and drinks. Historically, the majority of this gas has been supplied by factories which convert immense quantities

of fossil natural gas into artificial fertiliser, generating an abundant stream of fossil-CO_2 as a by-product. This process has flooded the market with high volumes of cheap CO_2. And since the market fails to differentiate between the carbon's origin, consumers were not incentivised to purchase more expensive bio-CO_2.

However, a series of extremely high natural gas prices between 2021 and 2023, owing to cold winters and the Ukraine war, severely disrupted fertiliser production and with it CO_2 supply. While government payouts temporarily maintained operations to minimise disruption across the CO_2 supply chain, the UK's largest fertiliser plants are now closing permanently. Consequently, the price of CO_2 for utilisation has increased as customers seek new suppliers.

The UK's existing biomethane plants produce over one million tonnes of bio-CO_2 annually, yet only a small proportion is currently captured. It could therefore fulfil today's entire utilisation demand. However, today's utilisation market reflects relatively low-value CO_2 pathways – those which may be fulfilled by either biogenic or fossil CO_2 sources.

The future value of utilisation lies within the development of next-generation fuels, which specifically require CO_2 derived from the atmosphere. Scaling up these new utilisation pathways will significantly increase the total demand for bio-CO_2 worldwide. For shipping and aviation sectors to decarbonise, they will need vast quantities for sustainable fuel; it is unlikely electrification can fulfil its process requirements. Consequently, they will need to source vast quantities of biogenic carbon, to re-shape into carbon-neutral alternatives to fossil fuels. For example, an estimated 117 Mt of bio-CO_2 will be required to produce enough SAF to meet the UK's and EU's sustainable aviation targets.

Storage

Bio-CO_2 can be permanently stored within geological reservoirs to deliver GHG removals, actively lowering the concentration of GHGs within the atmosphere. Here, carbon is locked away from the atmosphere for over 10,000 years, ensuring it no longer contributes to global warming. This is a carbon-negative solution.

GHG Removal (GGR) – also known as Carbon Dioxide Removal (CDR) – is an essential component of the UK's Net Zero Strategy, offsetting the unavoidable emissions of the hardest-to-decarbonise sectors. The Government's Net Zero Strategy forecasts that 80 million tonnes of removals will be required each year by 2050. Today, negligible levels of removals are being delivered, due to the lack of storage infrastructure and reporting standards.

To help scale up this nascent sector, the Government is currently developing policy support. This will likely follow a Contracts for Difference (CfD) style mechanism, offering a guaranteed price for removals delivered. The Government will bolster demand

> The Government and the private sector are increasingly recognising the importance of bio-CO_2 in the delivery of their Net Zero strategies

Bio-CO_2 holds the ability to break AD's current dependence on government subsidies.

for removals by incorporating them into the UK Emissions Trading Scheme (UK ETS), which sets emissions caps on some of the country's largest GHG emitters. Obligated companies will be able to purchase removal credits to comply with ever-stricter emissions caps. In combination, a growing market for removals and price certainty will greatly support the deployment of carbon capture technology across the UK's biomethane plants and even drive the growth of new capacity.

Geological storage facilities are also being developed all around the UK; for example, Hynet (Merseyside), Endurance (Teesside and the Humber), and Acorn (Peterhead). Each will exploit depleted gas fields or saline aquifers naturally present in the waters surrounding the British Isles and each will be capable of storing bio-CO_2 securely for over 10,000 years.

Accelerated by government support, the development of these facilities is on track to come online from 2027/8. At this point, AD will be able to send its bio-CO_2 for storage. The resultant GGR credits may be sold to corporates seeking to offset their unavoidable emissions, and thus achieve Net Zero.

For many companies, GGRs will be unavoidable if they wish to become Net Zero. Such a high demand will invariably drive AD plants to capture their bio-CO_2 – supporting a business model which goes beyond biomethane generation.

Standards

Bio-CO_2 holds the ability to break AD's current dependence on government subsidies. But to ensure a long-term, sustainable industry, it is critical that the industry upholds the highest standards.

Membrane separation, one of the most commonly deployed upgrading technologies, is able to generate a stream of 'food-grade' CO_2 – short-hand for gas that meets the purity requirements for food manufacturing. There are two leading standards, European Industrial Gas Association (EIGA) and International Society of Beverage Technologists (ISBA), which are currently used to verify CO_2 quality. While any stream of CO_2 that meets these standards could be sent for utilisation (or storage), some food companies may still be wary of perception issues if the gas is derived from waste.

For storage, the standards and regulations are being developed in the UK and EU. The quality of GGRs will be determined by the permanence, additionality, and sustainability of the removal pathway. Measuring and reporting quality ensures market transparency, enabling customers to understand pricing when comparing removals derived from different projects. Complementary accreditations, such as International Sustainability and Carbon Certification (ISCC), can provide proof of sustainability, while also quantifying life-cycle emissions.

For example, at Future Biogas, our new plants will generate ISCC-accredited, unsubsidised biomethane, and capture bio-CO_2 for storage, delivering 100 per cent additional, 100 per cent permanent, and 100 per cent sustainable removals.

Only by unlocking the value of bio-CO_2 can AD reach its full potential – maximising its ability to support the UK's net zero transition.

Biowaste management in Bavaria

Jenny Grant, Head of Organics and Natural Capital at the REA, takes us with her on the 2023 study tour to some anaerobic digestion (AD) plants in Germany.

In October 2023, Cre and the REA held a study tour of dry AD plants in Germany. We, along with delegates from the UK and Ireland, assembled at Munich airport where we were picked up by our tour guide, Josef Barth. An international expert in the field of organic waste treatment, quality management, compost quality and marketing, Josef was Executive Director of the European Compost Network for over ten years and now works as a consultant.

Day one

After a late dinner and overnight stop in Landsberg, we made our way to the first plant of the tour – the Oko Power AD plant in Altenstadt. The plant operates a wet AD system, processing 50,000 tonnes per annum (tpa) of biowaste and organic residues from food production and they upgrade the biomethane to inject to the gas grid. The main difference from UK plants was obvious as we arrived as the main digestion tanks were underground - it did not look like a typical AD plant! This is also unusual in Germany but when the plant was built over 20 years ago, it was state-of-the-art. According to the site manager, the main advantage is that the tanks are reasonably easy to clean out with an excavator.

Food waste is received into a bunker and they have a separate line with a hammer mill to remove any packaging. The feedstock is pasteurised and then goes into one of three digesters for the initial phase. The plant operates a two-phase digestion process with six tanks in total with a residence time of approximately 30 days. Digestate is screened with a 0.7mm screen to remove any remaining contamination and is regularly tested to ensure it meets the German quality label. The final digestate is collected by local farmers to be spread on farmland. All contaminants removed from the process are sent to energy from waste facilities.

Biogas – enough to power a town with 13,000 inhabitants – is captured and used for the combined heat and power (CHP) engine and is cleaned up for injection into the gas grid. The plant also has a filling station for biomethane vehicles. The CHP powers the plant and surplus energy is used for an adjacent facility treating waste water.

En-route to the next site we stopped for lunch in Bad Tölz. A nice walk along the river bank took us into a pretty town centre where we enjoyed lunch outside. The next site was the VIVO Municipal Enterprise's dry AD site in Warngau. It operates a dry AD process followed by in-vessel composting. The site treats 15,000tpa of biowaste (co-mingled food and garden waste). Alongside the AD and composting plant there is a household recycling centre and a well-stocked 'fleamarket' (a.k.a reuse shop) with a wide range of items for sale.

Incoming waste is received into the site and screened before the larger fraction goes over a sorting line for contamination removal. It is then processed through a hammermill. Material is loaded into one of four fermenter tunnels, which are filled three-quarters full and undergo a short aerobic phase to heat up before water is added at the top to

start the AD process. The percolate is collected at the bottom of the tunnels in underfloor storage tanks and is recirculated. The gas that is generated is captured. After 21-28 days in the AD tunnels, material is transferred to one of six composting tunnels alongside some fresh garden waste. In the aerated composting tunnels the material undergoes a hygienisation phase for a minimum of six days at 60 degrees Celsius before being transferred to another tunnel for a further period of three weeks. Following composting, the material is screened to 12mm and the resultant compost is tested and used in soil production. It is used by local landscapers and gardeners. Biogas is used in a CHP, supplying on-site demand, and also fed into the grid.

> The main difference from UK plants was obvious as we arrived as the main digestion tanks were underground

The day concluded with dinner in the hotel in Straubing. We had a presentation from Horst Müller about the 3A Biogas process and their two reference plants in Austria. They have a dry fermentation process with three phases. Firstly, a short aerobic phase to heat material up, then an anaerobic phase for 21-35 days before returning to a final aerobic phase for hygienisation and stabilisation to produce compost.

The evening concluded with a lovely dinner where plenty of schnitzel, sausages and schnapps were consumed!

Day two

The first plant of the day was the dry AD plant Aiterhofen, of the ZAW-SR Straubing district. The site is owned by the municipality and services approximately 150,000 households over an area of 1270km^2. The site was built in 1992 and has capacity for around 18,000tpa of garden waste, biowaste (food and garden waste) and some organic commercial waste. After reception, material is loaded into one of seven digestion tunnels. There is a short aerobic phase to heat the material to 38-41 degrees celsius

and then aeration is stopped and the biowaste is sprinkled with the percolate water to move to the anaerobic phase. The biogas is used through a CHP to provide heat to the process and power is also exported to the grid.

After about two weeks, the gas production decreases, the fermenters are aerated and the digestate goes for composting. It is mixed 1:1 with shredded garden waste and composted in windrows for six to eight weeks. The site has a good market for its outputs and, following screening, it sells bagged and loose compost. 80 per cent goes to agriculture for €6 per tonne, 10 per cent as woody biomass, four per cent to landscapers at €38/t and six per cent to soil production at €3.5/t. Contamination is around two per cent and the site works hard to remove contamination throughout the process. Staff go out on collections to lift lids on bins with a yellow and red card warning system and carry out widespread education programmes for householders.

We made the most of the good weather and had another lovely lunch outside in the sunshine before visiting the final plant.

AWG Donau-Wald operates a dry thermophilic plug flow system in Passau. With the capacity for 47,000tpa, the site mostly takes food and garden waste from households. It also operates a second 22,00tpa composting plant for garden waste only.

Contamination in household biowaste received is between seven and 12 per cent and the site removes approximately three per cent at the front end with the remainder being removed at the end of the process. It has recently expanded collections in a new area and has put a lot of effort into communications and is seeing contamination levels of around 0.5 per cent. It strongly advocates the benefits of education and communication. The company is also considering a new system with optical scanning of bins where they are tipped to detect and record contamination.

Incoming material is screened to 80mm, with contamination removed via a picking line, and the material then undergoes size reduction. The site has three parallel digesters and material is fed in at one end before moving slowly through the digester to be discharged at the other end. It is a thermophilic process and operates at 58 degrees Celsius with a residence time of approximately two weeks. The biogas is used for on-site heating with excess heat going to a district heating system and the electricity exported to the grid.

Digestate is removed and dewatered. Some of the liquid fraction is recirculated in the process and the rest is used as liquid fertiliser. The solid fraction goes for aerated composting for four weeks prior to screening. The site focuses on marketing and produces 30 different compost types for growing media and a range of special blends. Alongside the AD and compost plant, the company operates a household waste recycling centre collecting 38 different types of materials – an impressive array of different and well-labelled skips.

> The evening concluded with a lovely dinner where plenty of schnitzel, sausages and schnapps were consumed!

The tour concluded with a farewell meal at the airport. It was a great trip to be a part of and to see how biowaste is managed in Bavaria.

Thanks to Percy Forster of Cré and to Josef Barth for organising the study tour and for looking after us all. Massive thanks also to all the hosts who were very welcoming and open in sharing information about their process and in answering our many questions.

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CCS & BCS

Georgia Phetmanh, Schemes Manager at REAL, provides the latest on the Compost and Biofertiliser Schemes and the REAL Research Hub

COMPOST AND BIOFERTILISER CERTIFICATION SCHEMES

Annual Report 2022

In September 2023, REAL published the 2022 Annual Report for the CCS and BCS. The report provides an overview of data collected during 2022 and also gives an update on Research Hub developments.

The report shows that by the end of 2022 there were 177 certified composting processes: 138 in England, six in Northern Ireland, 21 in Scotland, 11 in Wales, and one in the Republic of Ireland, which is the first producer certified outside of the UK.

By the end of 2022, there were 103 plants certified under BCS, with a total registered annual throughput of approximately five million tonnes.

Of the 103 plants, 75 were located in England, seven in Northern Ireland, 13 in Scotland, and eight in Wales.

Paper on Plastic Contamination in End-of-Waste Compost and Digestate

REAL has recently published a paper presenting an analysis of CCS and BCS data on plastic contamination in samples submitted by certified operators for routine testing or re-tests after a failure.

This analysis was conducted to contribute to the revision of the Compost and Anaerobic Digestate Quality Protocols and examines the failure rate of samples in England, Wales, and Northern Ireland against the current limits for plastics or physical contaminants in PAS 100 and PAS 110, as well as how many failed against SEPA's tighter plastic limits.

The analysis shows that 98.3 per cent of compost samples taken between 1 January 2022 and 31 July 2023 passed against the PAS 100 limit.

The level of plastic contamination in the majority of compost samples fell below 0.02 per cent mass/mass. Over the same period, 98.7 per cent of digestate samples passed the PAS 110 limit.

The full paper can be read on the CCS and BCS websites.

PC&S Analyst Webinars

REAL held its first CCS and BCS Physical Contaminants & Stones (PC&S) Analyst Webinars for the Approved Laboratories.

The PC&S methods are labour-intensive and require a high level of decision-making in the identification and classification of fragments.

As such, following a suggestion from a previous WRAP report, REAL developed webinars for analysts to further give producers confidence in their results.

THE RESEARCH HUB

Residual Biogas Potential Test Improvements and Alternatives: This project aims to undertake a technical evaluation of the Residual Biogas Potential test, the digestate stability test recognised under PAS110.

The final report (under review) includes analysis to identify causes of test failures/nonresponses, exploration of predictive modelling, experimental analysis on the effect of varying inocula, and assessment of alternative procedures.

Carbon Accounting for Compost and Digestate: This project aims to demonstrate to compost producers and AD operators the benefits of engaging with the GHG Protocol (GHGP) and provide carbon accounting guidance.

A final report is expected to be published in early 2024, which will include relevant information on the GHGP and a methodology for calculating the carbon associated with the production and application of compost and digestate.

Plastic contamination method assessment: This project aims to evaluate current plastic assessment methods for CCS and BCS and any potential improvements or alternatives to these methods.

A final report is to be published in 2024 and is expected to include an assessment of the current mass-based method, consideration of an area-based method, and research into microplastic assessment methods.

Plant Response Test Interpretation and Comparison: This project aims to assess the performance of the spring barley test on CCS composts alongside the tomato plant test.

After attempting twice to recruit a contractor for the work via the standard Research Hub procedure, REAL has elected to take the project forward another way.

Risk assessment updates for compost and digestate to inform Compost Quality Protocol and AD Quality Protocol revision: This project (containing two 'phases') was selected in 2023 to support the revision of the Compost and AD Quality Protocols. REAL are awaiting the delivery of a scoping paper to initiate this work.

Optimising digester biology to boost biogas yields

Tim Elsome, General Manager of FM BioEnergy, outlines how novel product development and a holistic approach to digester care are helping AD operators maximise their biogas output.

Since 2013, we have been supporting biogas operators to optimise their plant biology, gain greater process control and ultimately increase their gas yields. Working across both waste and agricultural facilities, FM BioEnergy's client base generates over 30 per cent of the UK's AD output.

As competition for feedstock has increased and the industry has matured, demand for our services has risen. The financial implications of an underperforming plant can be severe – a 1MWe site running at 70 per cent efficiency is losing a potential income of £1,000 per day, even before you factor in feedstock costs. If the cause of inefficiency is due to biological reasons, the situation will not improve without intervention.

Industry-wide solutions

The best approach to digester optimisation is to look at the whole plant holistically, using data, laboratory results and analysis. This will ensure that the AD operator is only using products or services that they need.

For this reason, our portfolio is wide-ranging, including biological consultancy, bespoke trace elements and digester additives, as well as plant health checks, gas leakage detection surveys and silage additives.

It's also important that any plant optimisation service provider moves with the times, evolving as new trends and problems are uncovered. As we're on the frontline of issues facing AD operators, we're often the first to spot trends that span right across the sector. We work closely with our German product partner Schaumann BioEnergy to shape the development of their new product ranges to ensure they're solving real-world problems faced by the industry.

Trace element safety

A recent example of this is our daily trace element additive tab, BC.MICROcon5, which was developed in response to customer feedback for a product that is safe to handle, easy to administer and can maintain biological stability in the digester.

It contains the exact daily dose for a 1MW plant of the five most essential trace elements for biological stability – nickel, selenium, cobalt, tungsten and molybdenum. A nine-week trial at BioWatt's Katharos Organic AD plant in Thaxted, Essex revealed an increase of 3.05m^3 of methane (CH_4) and 12.2 kWhe per tonne of feedstock – a 400 per cent return on investment.

We hope this innovation will spark a change in the way that trace elements are administered across the industry, removing the need for safetywear and improving dosing accuracy while keeping plant biology stable.

Increasing the potential of British grass

Also developed in response to feedback from our customers is Silasil SG, a silage additive specifically for British grass. Previous grass silage additives were aimed at European grasses, which are inherently different to those grown in the UK. Our climate is cooler and wetter, meaning our grass silage has a lower dry matter content. Understanding the importance of this to on-farm AD operators has led to this latest product development, which is helping to preserve the biogas potential of British grass in the clamp, ultimately generating more methane and therefore more profit for the plant owner.

Safety first

Over the next 12 months, we plan to continue to help optimise plant performance, as well as improve site safety by reducing methane leakage. We've carried out gas leakage detection surveys at over 1,200 sites across the UK and Europe in recent years and found leaks at 85 per cent of plants. We regularly share our results with the industry in a bid to educate operators about the most common leakage hotspots – pressure relief valves, mixers, carbon filters, service boxes and compressors – and reduce the number and severity of leaks.

As the industry continues to consolidate and mature, we hope to see standards of both plant performance and safety continuing to rise. At the same time, we'll keep on innovating to provide solutions to ever-evolving issues faced by AD operators across the UK.

Green Gas Steering Group

John Baldwin takes a look at the future of the gas grid, asserting that there will always be a role for gas – even when hydrogen and electricity dominate the energy mix.

John Baldwin,
Managing Director,
CNG Services

Since 2011, I have spent a fair amount of time trying to help the UK shale gas market move forward. My theory has been to 'produce it, tax it and fund good stuff'. I had a plan for heat pumps and their refurbishment in Blackpool. We didn't do that and the UK industry is now heading to Texas; fertiliser has already gone.

The energy culture wars stopped any sensible debate. It's a bit like that now with electricity versus hydrogen gas: "it's time to decommission the gas grid".

Energy is complicated and the decarbonisation of an economy burning over 800 TWh/annum of gas is difficult, especially when there are occasionally very cold days. It seems to have been presented as a binary choice that we will decide in 2026: 'Do we electrify everything or have a hydrogen gas grid?'

There is a hybrid option that breaks free of culture wars. In 2012, I spoke at a (shale gas) conference and said that the UK strategy for electricity was gas, but with as much nuclear, biomass, wind and solar as possible – in order to burn less gas. This has been successful. In the first nine months of 2023, we had 201 TWh of electricity generated with 154 TWh of gas burnt, so the system had 137 per cent gas conversion efficiency. Next year it will be 160 per cent and in 10 years around 500 per cent.

However, gas will still be burnt. It is there for the Hydrogen Business Model factories going from 100 per cent gas to 95 per cent hydrogen with gas backup. And for gas engine backup generation plants that may only operate during the Dunkelflaute every 10 years, but without which consumers would have no heat. And for industrial, commercial and domestic customers who cannot get to 100 per cent electricity. My house was built in 1874 and lends itself to keeping the gas boiler, and not using gas for most of the year.

A total gas demand of 200-300 TWh/annum in 2050 is likely for all the above. So, where do we get it from? The family of Green Gases of course. By 2035, we can aim for 100 TWh/annum if we apply ourselves.

> Energy is complicated and the decarbonisation of an economy burning over 800 TWh/annum of gas is difficult

REA Green Gas Steering Group members

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Marches Biogas

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Technical Director,
WRM Ltd

Organics Steering Group

Graeme Kennett outlines the novel opportunities for the biowaste sector to contribute to the wider circular economy, beyond the production of compost and digestate.

Graeme Kennett
(Chair), Principal Environmental Consultant, Mabbett & Associates Ltd

The biowaste sector has established itself as being extremely proficient in producing quality organic matter and organic fertiliser for use in domestic agriculture and horticulture over many years. However, as we progress through the 21st Century is it now time to look to add value to these processes? As a sector, rather than focusing on conserving and replenishing the country's organic resources, improving soil health and vitality, is it time to start looking at 'one planet' living and the circular economy?

As the circular economy becomes increasingly embedded into our industrial strategy, we should be harnessing the desire for more circularity and looking at establishing more symbiotic relationships with industry that require products that we, as a part of the bio-economy, are in a prime position to deliver.

Even now, we see other options for organic materials including the production of eco-friendly matter such as bioplastic polyhydroxyalkanoates (PHA), which belongs to a polyester family and consequently has the potential to replace hydrocarbon-based conventional polymers. Bacteria for PHA production can be grown on several renewable waste feedstocks. So, to boost the use of available biomass feedstock, biorefining development must come together on high carbon efficiencies and assisting the conversion of all biomass fractions, including lignin and fermentation-derived CO_2. Additionally, novel technological platforms should allow the incorporation of unconventional, currently-underused carbon feedstocks, such as livestock manure, into biorefining processes.

As a leading industrial sector group with extensive reach across the renewables industry the Organics forum can establish and extend its aims to include involvement in the industrial circular economy and a sustainable carbon cycle. Doing this elevates the sector from being seen solely as a producer of compost or digestate to one that can fully integrate into the supply chain. This aim then gives us direction, to inspire, recruit and enthuse members, and to give purpose to the work we do and how we fit within the wider REA and the whole circular economy.

At times there will be conflict between 'food and fuel' and, as there are so many pressures on the environment, these choices won't be easy, but nothing worthwhile ever is.

REA Organics Steering Group members

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