Organics Recycling & Biogas

Autumn 2024 Issue 54

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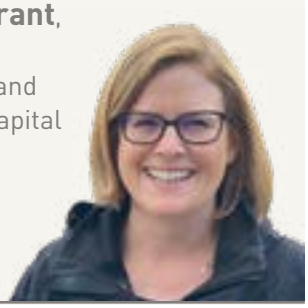
The magazine from REA Organics and Green Gas

Getting ready for digital waste tracking

REA ORGANICS REA GREEN GAS

Welcome



Jenny Grant,
Head of
Organics and
Natural Capital

Welcome to the Autumn 2024 edition of our magazine. By the time you are reading this, the General Election will have taken place and is probably a distant memory. At the time of writing, we've been busy comparing manifestos, debunking net zero myths and sharing our vision for the first 100 days of the next Government. We look forward to engaging with that Government and continuing to champion organics recycling and green gas on behalf of members.

Just before Parliament dissolved, we had some further regulations published, implementing the Simpler Recycling requirements and setting out which Local Authorities have extensions for implementing food waste collections. The statutory guidance is still to come and we have been engaging with Defra regarding the content.

The long-awaited consultation on a Future Biomethane Framework has also taken place with some hopeful inclusions for the wider industry and possible production volume target. The REA has also been working on various projects related to biomethane such as an Imperial College report looking into feedstock and production volumes, which will feed into studies on the future of the gas network; combining biomethane with hydrogen, and also socialised costs for gas grid connections.

We look forward to seeing members at various events in September: Green Gas Day; the Organics Member Meeting and Site Visit, and we will have a stand at RWM (EN-F62) so please pop by and say hello if you are visiting. We are also holding a networking session on 11th at 10:15 in the Environment Networking Hub – all welcome.

Thank you for your support, and we hope you enjoy the magazine. Please get in touch if we can help with any issues you are facing.

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Organics Recycling & Biogas is the magazine of REA Organics and REA Green Gas member forums

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Behavioural insights unlock food waste prevention potential

The Waste and Resources Action Programme (WRAP) has released a new study exploring opportunities to reduce food waste when residents have separate food waste collection. The research, conducted with behavioural consultants SKIM, focused on Wales and England with additional data from Austria for international perspective.

The study found that food waste caddies serve as visual reminders, increasing mindfulness about waste. However, this awareness may diminish over time as usage becomes habitual. Participants reported feeling satisfaction from diverting waste from disposal, which reduced guilt without encouraging wasteful behaviour. The enhanced visibility of food waste prompted reconsideration of consumption habits, including meal planning and storage techniques.

To maintain awareness, WRAP recommends regular communication campaigns or visual cues on caddies. Periodic 'challenges' or community events could encourage active thinking about food waste, disrupting automatic behaviours. The study also advocates providing localised feedback on the collective impact of food waste recycling to communicate tangible benefits.

Addressing the disconnect between edible food waste and caddy usage, WRAP says targeted education campaigns emphasising that all food waste should be included in caddies. Given the current cost-of-living crisis, framing waste reduction in terms of financial savings could be particularly effective, potentially using examples or calculators to demonstrate impact on household budgets.

WRAP emphasises that these interventions should not be implemented in isolation. A multi-faceted approach combining individual actions, education, retail sector changes, community initiatives, and targeted incentives is likely to be most effective in reducing household food waste.

WRAP plans to use these findings to inform future campaigns and policy recommendations.

First industrially compostable product certified under new UK scheme

Renewable Energy Assurance Ltd's Compostable Materials Certification Scheme (CMCS) has announced its first certified product, marking a step forward in the UK's efforts to promote compostable materials.

KOBAYASHI Healthcare Europe Ltd (Kobayashi) has become the first participant in the scheme, receiving certification for its plastic-free lens cleaning wipes. The product has been certified as industrially compostable, suitable for industrial/commercial composting in line with BS EN 13432.

The certification process involved critical tests conducted at an approved laboratory, with the final assessment carried out by DIN CERTCO, one of CMCS's certification bodies.

Georgia Phetmanh, Head of the Organics Materials Certification Scheme (OMCS), commented: "This label will enable them to clearly show UK consumers, composters, businesses, retailers, etc., that their products are industrially compostable and can therefore be recycled by commercial composting facilities. We continue to work with other producers currently going through the rigorous testing process and look forward to welcoming more to our scheme."

The CMCS website now lists the certificate information for Kobayashi's lens cleaning wipes.

End of waste for compost and digestate

The End of Waste positions, the Compost and Anaerobic Digestate Quality Protocols have been undergoing revision for some time. The revised documents are now called 'Resource Frameworks' and will replace the existing Quality Protocols. Draft versions were shared with industry for comments in July. They have the same purpose as the existing documents, to clarify the point at which waste management controls are no longer required and to provide users with the confidence that the quality of compost and digestate from source-segregated biodegradable waste conforms to an approved standard.

The Resource Framework documents are laid out differently from the existing Quality Protocols with less detail and background information. The key changes from the QPs are: amendments to the list of approved inputs; tightening of plastics limits for both compost and digestate; and removal of designated market sectors. The plastics limits proposed are:

- Compost – 0.06%m/m limit for >2mm plastic in air-dry compost (50% of current limit)
- Digestate – sub-limit for plastic contamination >2mm of 8% of the PAS110 physical contaminant limit.

The EA intend to review feedback and publish the new Resource Frameworks in September.

Simpler Recycling

Jenny Grant,
Head of Organics and Natural Capital, REA

Before Parliament dissolved for the General Election, we saw some progress with the Simpler Recycling reforms. The Government published regulations that bring into force the implementation dates for Simpler Recycling in England.

The Environment Act 2021 Commencement Regulations confirm that separate food, garden, and other recyclable waste collections must be in place by 31 March 2026 for households and 31 March 2025 for relevant non-domestic premises and relevant industrial or commercial waste from premises. These regulations also confirm which local authorities have been given transitional arrangements for introducing food waste collections, and the agreed implementation date for these authorities. There are 31 local authorities with transitional arrangements, with dates ranging from June 2026 to February 2043.

The Separation of Waste (England) Regulations 2024 have also been laid. These regulations set out descriptions of the wastes that must be separately collected, including food and garden wastes. On 9 May, the Government published its consultation response to Simpler Recycling reforms for England. This included the proposal to introduce exemptions for co-collection, expanding the list of non-domestic premises in scope and details on the statutory guidance. We await publication of the statutory guidance and Defra is developing public facing communications. Briefings on the regulations and consultation responses are available on the REA website and further updates will be circulated when published.

Future regulations covering carbon

Sara Bartle

The UK is moving towards increased industrial decarbonisation on the road to net zero. One of the ways we can achieve this is by applying carbon pricing through the UK Emissions Trading Scheme (ETS). However, there is always a danger that some industries may look to move to other countries where policy on carbon and the climate is less progressive or non-existent. This is known as carbon leakage and can be counterproductive to decarbonisation efforts and disadvantageous to UK business.

Therefore, the UK has decided to introduce a Carbon Border Adjustment Mechanism (CBAM), by 2027, on imported products. This places a liability on the importer of goods. The level will depend on the emissions intensity of the goods and the gap between the carbon pricing in the country of origin and similar UK produced products. This will impact the most emission intensive products such as aluminium, steel, cement, fertiliser, glass and hydrogen. The Government has held a recent consultation on the design and delivery of the UK CBAM and the REA has responded on behalf of members.

Other carbon policies being considered in current consultations include the non-pipeline and cross border transport of CO2 and changes to the UK ETS. Despite AD being able to claim a level of carbon neutrality, there are increasing moves to bioenergy carbon capture and storage for future deployment. Currently there are financial and geographical restrictions in access to carbon storage, encouraging the status quo of venting where capture and utilisation is not possible. The non-pipeline transport consultation seeks to investigate a route to improve this, outside of industrial clusters. Further updates are available on the REA website.

Biowaste Quality Assessment methodology

Claire Shipp,
Circular Bioresources Analyst

The REA is a partner in the Compostable Coalition UK's 'Closing the Loop' project, funded by Innovate UK. This project unites various stakeholders to promote compostable packaging by expanding business opportunities, demonstrating effective recycling practices, and validating the economic and environmental benefits of compostable packaging.

As part of this project, the REA has updated its protocol for measuring physical contaminants in biowaste feedstocks. Initially published in June 2012, the revised version – now called the REA Biowaste Quality Assessment Methodology – was published in May 2024.

The methodology provides a process for sampling, visually assessing, categorising, and reporting the amount of target materials, non-target materials, and physical contaminants in wastes delivered to facilities treating biodegradable wastes. This helps facilities to monitor waste quality, support contract negotiations, and ensure compliance with waste acceptance criteria.

The methodology is customisable to individual site processes, making it useful for composting, AD, and integrated facilities. Annex B provides Microsoft Excel worksheets for reporting assessment results, and Annex C auto-generates a chart for monitoring physical contaminant levels over time.

Having validated, reliable data on biowaste contamination is critical as high contamination rates continue to cause problems within the UK biowaste recycling industry. The methodology and annexes are available for download on the REA website – search for 'biowaste quality assessment'.

Future Biomethane Framework

Sara Barlte,
Green Gas and Hydrogen Policy Lead

In the last edition we discussed what will follow the Green Gas Support Scheme (GGSS) as the mechanism for the UK to support biomethane production. In February 2024, the call for evidence on the Future Biomethane Mechanism was published, where the government sought to explore the many possible production routes available for biomethane such as landfill gas, sewage gas and gasification, whilst also considering the options for small scale/on farm AD and repurposing old AD assets through supporting expansions and conversions.

It also asked if a production target should be introduced, something industry would welcome to strengthen ambitions and investment opportunities. The barriers of planning and gas grid connections were also explored, providing industry with an opportunity to provide evidence of the issues they have experienced in deployment to date. However, the need to improve sustainability in the sector, including feedstock and digestate management, along with carbon capture and methane leakage, was also covered.

The type of support mechanism suggested options of Supplier Obligation (Renewable Obligations, RTFO) or Contract for Difference as the Government's preferred choice for driving down costs along with revenue streams. The consultation was ambitious, covering different issues, many of which the REA raised as limitations within the GGSS. Expectations that everything will be included in the end may be overly optimistic but it's important for the sector that they have engaged. With the current Northern Ireland consultation on the future biomethane production, it's possible that we can have a UK-wide consistency of ambitions.

Nutrient Management

Jenny Grant

The Nutrient Management Expert Group was launched in November 2020, to advise Defra on how to minimise pollution from the use, manufacture, storage, and distribution of nutrients arising from agriculture and intended for crops. The group published a report in May 2024 setting out recommendations for Defra on the optimal policy approach to reduce pollution from nutrients in agriculture.

The report states that nutrient management is a significant concern for the UK government and demands a co-ordinated, long-term and strategic approach that is adaptable and monitored effectively. The significant challenge of meeting current and proposed future environmental targets requires wider change across the agri-food sector, and more radical shifts in practices of food production, supply and consumption. New policy measures will be required to match these high-level ambitions.

It sets out 15 recommendations to Defra, including:

- Development of a National Nutrient Management Strategy and an action plan to deliver it.
- Need for joined-up and long-term consistent policy.
- Ambitious government targets supported by substantially increased public and private investment.
- Policy development through meaningful co-design.
- Setting targets for soil.
- Promote nutrient management planning.

Government has welcomed the report and says that the recommendations will be of help as it looks to update current policies and develop new policies on nutrient management.

Northern Ireland policy developments

Jenny Grant

There are some policy developments underway in Northern Ireland. Firstly, the Department for Agriculture, Environment and Rural Affairs (DAERA) has consulted on 'Rethinking Our Resources: Measures for Climate Action and a Circular Economy in NI.' This consultation aligns with requirements to achieve 70 per cent of waste recycled by 2030 (Climate Change Act), 65 per cent recycling for municipal waste by 2035, 10 per cent cap on waste to landfill by 2035 (WCLO).

The consultation aims to gather information to inform policies that will improve the quality and quantity of household and non-household municipal recycling, reduce food waste, cut landfill rates, and get businesses on board to increase recycling rates.

Secondly, the Department for the Economy (DfE) has launched a call for evidence on 'Developing Biomethane Production in Northern Ireland'. This follows the recent DESNZ Future Biomethane Framework call for evidence, which asked whether there should be a framework that covered all parts of the UK. Key considerations include: considering the role of biomethane in the path to net zero energy by 2050; how to optimise management of the feedstocks needed for biomethane production; and establishing the costs for producing biomethane and potential options for developing the sector, including identification of additional revenue streams. REA responded to both consultations.

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.

Organics Conference

21 Mar, Chesford Grange, Kenilworth

The Organics Conference 2024 was another successful event. We would like to thank all the speakers who shared their valuable knowledge, the members who came to Warwickshire, and our sponsors (JCB, Komptech, John Hanlon, REAL CCS, Melcourt, and Thoni) who made it all possible!

There were many interesting presentations on topics ranging from digital waste tracking to changing behaviours and managing nutrient neutrality requirements.

We are grateful to have such wonderful members that make the Organics Conference useful and fun.

We are starting to plan next year's event and hope to see you there.

Resource and Waste Management Expo

11-12 Sept, NEC, Birmingham

At RWM, part of the Environmental Services & Solutions Expo (ESS), over 12,000 professionals from diverse sectors like waste management, recycling, energy, water, construction, manufacturing, policy-making, and environmental consultancy unite to explore innovative, sustainable solutions and drive global change.

There are five events under the ESS banner, covering circular economy, net-zero emissions, sustainability, and biodiversity conservation. ESS integrates vital discussions on natural resources and development policy.

REA will have a stand and looks forward to catching up with members and industry colleagues over the two days.

British Renewable Energy Awards

13 June, Sheraton Grand, London

The British Renewable Energy Awards (BREAs) are the highlight of the renewable energy calendar, honouring the organisations and individuals that have enabled the industry to do the amazing work as we push for Net Zero by 2050. The Awards, which took place on Thursday 13 June, in the Ballroom Suite of the Sheraton Grand Hotel, celebrated a range of individuals and companies on the forefront of the Net Zero transition.

Among the highlights was the winner of The Judges' Awards. This is awarded at the discretion of the judging panel in recognition of the exceptional contribution to the sector or for lifetime achievement. This year, the winner was Caroline Lucas, outgoing Green Party MP. Judge Dr Alan Whitehead, outgoing Labour MP, paid tribute to Caroline for her cross-party work to advance climate action in Parliament over many years. Additionally, the Sustainability Award went to Future Biogas for partnering with AstraZeneca to build a new unsubsidised biomethane BECCS plant - the first of its kind in the UK.

The REA congratulates all those nominated, shortlisted, 'highly commended', and the winners of this year's Awards. The REA thanks all guests to the event and will continue to champion the brightest and the best in the industry. Finally, the REA thanks Drax, Citation, Bio Capital, Hitachi Energy, Eaton, NGED, RECC and EY for sponsoring this year's Awards.

UK Green Gas Day

5 Sept, National Motorcycle Museum, Solihull

The REA and CNG Services have been running the UK Green Gas Day since 2012. It is the largest industry gathering in the UK focused on green gases, including hydrogen, and has seen over 300 people attending all previous years.

Along with actions to accelerate the roll-out of energy efficiency measures and the deployment of renewables, green gases such as biomethane and low-carbon hydrogen are key to reducing dependence on fossil fuels and reliance on gas from Russia; to deliver an energy future which is independent, secure, and stable.

With the announcement of an extension of the GGSS to March 2028 and the ambitions in last year's Biomass Strategy publication for increases in Biomethane production to 30-40 TWh by 2050, the Government is investigating a future biomethane framework. New financial models that are not reliant on subsidies are also emerging for biomethane plants and, along with certificates (GGCS), include carbon capture and storage, making biomethane carbon negative and particularly valuable for companies that need to offset their residual GHG emissions. Green gases supplied for transport under the Renewable Transport Fuel Obligation (RTFO) have also been growing rapidly in recent years, particularly biomethane. Mobility is also likely to be one of the key sectors to kick-start the development of the clean hydrogen sector in the UK.

Waste watchers:

Getting ready for Digital Waste Tracking

Mandatory Digital Waste Tracking is scheduled to come to the UK in 2025, but is the industry ready to execute what's required? **David Gudgeon**, Head of External Affairs at Reconomy, explains planned data collection requirements, and flags some challenges.

Back in 2018, I read through the Government's Resource & Waste Strategy, and felt a mix of optimism and pessimism about the road ahead. Fast forward six years, and the reality is that very few policies have been implemented. But the fundamental principles are still just as valid today and, this year, there has been a notable surge in policy implementation by Defra. While Extended Producer Responsibility, Deposit Return Schemes, and Simpler Recycling have taken up headlines and column inches, mandatory Digital Waste Tracking has, for many, crept under the radar.

The fact is that mandatory Digital Waste Tracking will affect every waste producer, carrier, broker, and processor in our industry, and the primary goal of implementing this legislation is straightforward and multifaceted.

In early 2022, a joint consultation was launched to consider mandatory Digital Waste Tracking. Unlike many of the proposed legislative changes that impact the waste and recycling sector, the devolved nations of the UK were unanimous in agreement that it should be 'easy to track waste and resources in real time throughout the economy'.

And so, the consultation was launched. There were 713 responses in total, with just 123 coming from waste carriers, and 91 from site operators. That's incredibly concerning when you consider the thousands of licensed businesses working across our industry. The low response rate or awareness around the subject of mandatory Digital Waste Tracking is also a sign of how prepared our industry is to the requirements of the regulation.

Subject to any changes in Government policy, mandatory Digital Waste Tracking is due to go live by April 2025.

Challenges and opportunities

So, what are the main principles and some of the key challenges with mandatory Digital Waste Tracking?

Our industry has evolved. Thirty years ago, we were in a linear 'take, make, use' economy where our resources were disregarded, and landfill was the bedrock for the disposal of waste in the UK. Today's sophisticated circular economy, on the other hand, sees the value in our finite resources and aims to put them to good use. But, on that journey, we see an industry still reliant on slips of paper to function on a daily basis. Whether that be collection notes, annual waste transfer notes, or hazardous waste consignment notes, many businesses are drowning in a sea of paperwork that ultimately gets filed away in archive boxes, never to see the light of day again.

> Mandatory Digital Waste Tracking will affect every waste producer, carrier, broker and processor in our industry

Now consider the customer experience that is on offer in the transport and service sector. Order just about anything online and you are

sent text messages, emails, and even WhatsApp or Facebook notifications to tell you what is happening.

Mandatory Digital Waste Tracking does away with much of the paperwork we have been using for decades. It introduces a streamlined approach that will enhance transparency and accountability across the waste and recycling industry.

How it will work

Key components of Digital Waste Tracking legislation include:

- A digital record must be created via the Defra portal prior to moving any waste.
- Anybody creating a digital waste record will be required to pay a fee believed to be £20 per annum.
- The Defra portal will be utilised across England, Wales, Scotland, and Northern Ireland, meaning users won't need to manage data across multiple platforms.
- Every movement of waste requires a unique identifying code which the Defra portal will generate. The code can be created any time prior to the movement of waste.
- The carrier of the waste must confirm completion of the movement to a processing facility within two working days of completing the task.

> A streamlined approach will enhance transparency and accountability across the waste and recycling industry

- The processor has two working days from receipt of the material to confirm receipt via the Defra portal. The timeline is not dependent upon the carrier completing their details first.
- If a processor moves waste to a secondary destination e.g. from a transfer station to an EfW facility, they will need to create a new unique code via the Defra portal as they are now acting as a carrier.

In principle, this process continues until the material reaches its final destination. However, we are yet to see what this means for a receiver outside of the UK and where the obligation to enter data will end.

Mandatory Digital Waste Tracking will enhance the visibility of waste pathways from 'cradle to grave'. This increased transparency helps ensure compliance with the regulations and will play a key role in reducing illegal activities associated with waste management; which is reported to cost the UK economy circa £1b per annum. This system also supports the promotion of a circular economy by providing a definitive understanding of material flows, which are essential for understanding resource use and recycling capability.

Factoring practicalities

Having read this far into the article, you've probably already had the thought that two working days is a very short timeframe to manage the data in the portal. But the challenge could get even worse.

Defra is currently saying that the unique code can be created any time prior to the movement taking place. However, Lorraine May, Senior Policy Advisor for Digital Waste Tracking, Defra, has confirmed that they may limit the creation of unique codes to a maximum of three working days before the movement. This is "to discourage records being created a long time in advance of planned waste movements, which could frustrate regulatory activities or lead to lots of incomplete records in the service. We haven't made any firm decisions about this yet until the UK waste movements part of the service is better developed and tested."

Now, place yourself in the shoes of a small 'man and van' operator or a processor with an unmanned site. How do these businesses engage with the service to create a unique code? Yes, you could access the service via your mobile phone, but that would be clunky, time consuming, and assumes you're in an area with a decent signal.

Now place yourself in the shoes of someone with dyslexia, someone with low digital literacy skills, or someone whose first language isn't English. How do we ensure that this segment of our workforce can overcome the barriers Digital Waste Tracking presents?

Where we are at

Coming back to the timeline, yes, it really is April 2025 when this is due to go live. That's only a few short months away, and there is a lot of work for everyone to do to prepare for it. The challenge of cost, IT infrastructure, time, resources, training etc. are all things we should be considering now.

Defra has been running a series of workshops to look at data input via a beta-testing platform. Sensibly, they have started with examples of green list waste movements and skips being moved from a construction site. One truck, one waste type and a straightforward disposal route meant they could test the basic principles and functionality of the portal using small volumes of data. I am yet to see how the system holds up if you attempt to create millions of unique codes for every waste stream being collected from businesses across the UK on a daily basis. For that we will all have to wait for further updates from Defra and a wider release of the beta platform, currently pencilled for "late 2023".

> I am yet to see how the system holds up if you attempt to create millions of unique codes for every waste stream being collected from businesses across the UK

I believe that bulk CSV file uploads will be the likely tool of choice for many businesses, but you need to be mindful of capturing and presenting the necessary information in the required format. Messaging on the potential for API integration and the associated timeline for that is far from clear and not something I would bet my mortgage on being sorted and usable for April 2025.

...

I suspect that for everyone reading this article, the reality is that your business needs to prepare for the significant changes set for 2025. Could delayed implementation be possible? Yes, with a shifting political landscape, a delay is possible. However, I believe mandatory Digital Waste Tracking is a 'when' rather than an 'if'. So, I would encourage everyone in our industry to prepare for the next stage of evolution for our industry.

Making dry AD add up

Should dry anaerobic digestion form part of your future business strategy? **Mark Richmond**, Technical Director at WRM, looks at the opportunities dry AD presents, in response to the recent 'Simpler Recycling' allowance for co-mingled food and garden waste collections.

The 'Simpler Recycling' announcement in November 2023 confirmed the Environment Act 2021 requirement for a separate weekly collection of food waste to be provided to all households in England. The announcement also confirmed that exemptions from the requirement would be available for authorities who co-mingle food waste with garden waste ('biowaste') on the condition that collections are provided at a weekly frequency.

The policy position on food waste collection was originally established in the 2018 Resources and Waste Strategy for England. That strategy also set out a strong policy preference of anaerobic digestion treatment for food waste largely due to the bioenergy benefits compared to composting.

The conventional low solids (e.g. 8-12 per cent dry matter) anaerobic digestion processes that have been widely deployed across the UK are typically unable to accommodate co-mingled biowaste which may have a seasonal dry matter range of 25-40 per cent. This creates an ostensible barrier for treating biowaste through anaerobic digestion and could be argued to add further weight to a source separated collection approach.

Despite this policy direction, the option to retain a current co-mingled food and garden waste service may have several merits for local authorities. Such benefits can include resident recognition and participation, which are essential to achieve good levels of set-out and thus food waste capture. This can present a difficult choice for local authorities with a co-mingled biowaste collection who look to comply with the Environment Act requirement and achieve the targeted bioenergy benefits whilst retaining the current service.

Dry anaerobic digestion treatment processes offer a solution that balances these challenges. A recent report to the Councillors at Greater Manchester Combined Authority, who have an existing weekly and year-round co-mingled collection service, shows that dry anaerobic digestion may be about to be deployed to realise the full range of waste collection and treatment benefits.

What is dry anaerobic digestion?

Dry anaerobic digestion is a waste treatment technology which is capable of producing biomethane gas and biofertiliser (digestate) from high solids content materials such as co-mingled garden and food wastes. The technology, which has been widely deployed in other European nations and is offered by large waste engineering companies with an established reputation, has only been deployed in four UK projects. These have predominantly processed residual waste fines rather than source separated household organics.

> Dry anaerobic digestion could realise the full range of waste collection and treatment benefits

The technology manifests in two principal forms: tunnel systems, which are engineered in a similar way to in-vessel composting tunnels and operate on a batch approach, and horizontal plug-flow systems, which can process continuously. Rather than macerating and diluting the waste feedstocks into a pumpable substrate which is then fed into the digester, both variants of the dry anaerobic digestion technology work with the raw feedstock, which may undergo contamination removal and an initial shredding stage before being loaded directly into the digester.

Once in the digester, the digestion process is controlled through recirculation of a microbe rich percolate onto the biowaste matrix, initiating the anaerobic breakdown and generation of biogas. Other aspects of the plant, such as the gas utilisation lines are common with the conventional anaerobic digestion plants deployed extensively to date.

The resulting outputs from the dry anaerobic digestion process are biomethane for injection into the gas grid, and a stackable solid digestate fraction which shares characteristics with compost produced at IVC facilities. Importantly, the biomethane produced by dry anaerobic digestion plants is within the scope of the Green Gas Support Scheme, providing an important financial incentive for developers and operators.

Image © Thoeni Industriebetriebe GmbH

Why haven't we seen dry AD already?

Identifying the benefits of dry anaerobic digestion relative to other waste treatment technologies leads to the question of why the technology has not been deployed to a greater degree in the UK. Aside from the absence of a clear policy driver and general uncertainty on the future of co-mingled biowaste, reasons for the limited level of deployment may include the absence of sufficient volumes in a single long-term contract, the absence of a developed merchant market, and the availability of comparatively cheap in-vessel composting capacity. Other project proposals have faced specific issues such as unrealistic commissioning periods that were historically associated with the Renewable Heat Incentive.

> The prospect of councils being able to offer Environment Act compliant co-mingled collections provides a platform for investment in dry anaerobic digestion

The clear policy driver combined with a focus on bioenergy benefits, and the need to re-invest in biowaste infrastructure changes the outlook for the technology. The prospect of councils, such as the Greater Manchester authorities, being able to offer Environment Act compliant co-mingled collections to residents also creates the prospect of high-volume long-term contracts that provide a platform for investment in dry anaerobic digestion.

The whole system business case for AD

Comparatively, the capital costs of a dry anaerobic digestion plant may be double those of a conventional low solids digestion plant. Furthermore, the absence of a readily available merchant dry anaerobic digestion market creates a situation where any local authority looking to develop a dry anaerobic digestion solution either needs to directly develop the project or let an anchor contract that enables investment in merchant capacity. So, how can the business case stack up in light of these costs? The answer is to be found in evaluating the costs and benefits of the whole waste collection and treatment service.

Key to the whole service costs is recognising that a move from a co-mingled food and garden waste service to source segregation requires a significant expansion of the frontline collection service. Alongside the purchase of new containers, this will include a new fleet of food waste collection vehicles as well as additional drivers and loaders to operate those vehicles. With typical daily property pass rates, this equates to nine new collection vehicles and twenty-seven additional staff for every 100,000 properties served. The associated operational cost for each additional collection vehicle is in the region of £155,000 per annum which would give an additional collection cost of £1.4m per annum for every 100,000 properties served. It's worth remembering that such collection costs are additional to the garden waste collection costs which the majority of waste collection authorities already incur.

When the costs of the two collection approaches are directly compared, the weighted cost of source segregated collection (which acknowledges the apportionment of food and garden waste between those services and potential winter suspension of garden waste collections) is about 30 per cent more

than a co-mingled service operating on a weekly frequency. This cost difference plays out on an annual basis, and, over a nominal twenty-year project duration, the magnitude of collection cost savings outweighs the additional treatment capital cost by a margin of around 13 per cent. Such savings are however, only apparent when collection and treatment costs are considered together which emphasises the need to look at the business case for co-mingled collections and dry anaerobic digestion on a whole system basis.

> Around 80,000-100,000 tonnes per annum of co-mingled biowaste would support investment in dry anaerobic digestion capacity

Differences in collection costs are not the only area of benefit in the business case for dry anaerobic digestion. The treatment of garden waste through anaerobic digestion provides an opportunity for additional biomethane generation from the putrescible fraction. This is particularly applicable to collections made during the summer and autumn, when garden waste streams contain higher quantities of grass cuttings and leaf litter. While the gate fee of treating garden waste through anaerobic digestion is likely to be higher than open windrow composting, the generation of back-end bioenergy revenues off-sets, and most likely exceeds that gate fee differential.

How can this opportunity play out for local authorities?

Greater Manchester is perhaps unique in offering its current co-mingled food and garden waste collection service on a weekly basis. It also has the quantity of biowaste to justify the development of dedicated dry AD treatment capacity.

But the co-mingled and dry anaerobic digestion solution may also work for other authorities whose circumstances differ from the Greater Manchester authorities. For authorities who currently collect co-mingled food and garden waste, the increase to a weekly collection frequency will be a smaller financial step than the expansion associated with a move to source segregated collections.

On project scale, around 80,000-100,000 tonnes per annum of co-mingled biowaste would be required to support investment in dry anaerobic digestion capacity. This scale could readily be attained by several of the UK's larger waste disposal authorities. It creates the very real prospect of additional dry anaerobic digestion projects being brought forward over the next five years, and this point is not lost on the established dry anaerobic digestion technology providers who are increasing their presence within the UK market.

The need for an integrated assessment

Reviewing the history of why the UK has not seen more dry anaerobic digestion to date, and the business case for the approach to be deployed in response to the requirements of the Environment Act, emphasises the need for an integrated assessment of the waste collection and treatment balance. This is perhaps easier for unitary authorities which combine these functions but should not be seen as a barrier for areas where the functions are separate. Greater Manchester, which comprises nine collection authorities and one disposal authority, provides a good example of an integrated whole system approach between a number of partners.

Waste treatment operators, who often have little involvement with household waste collection operations also have an opportunity to better understand the whole system cost as opposed to the waste treatment costs which they are familiar with. Failure to do so may see future opportunities overlooked.

Ultimately, a detailed level of collection and treatment modelling is required to assemble a whole system business case that identifies and quantifies genuine opportunities for dry anaerobic digestion.

What additional measures should the Government take to improve soil health?

Jane Gilbert,
Director,
Carbon Clarity

I'm calling on the new government at Westminster, irrespective of its colour, to introduce new policies to restore circularity to the Soil-Food-Biowaste value chain. Let me explain.

Currently, the way the UK manages its soil, food production and recycling of biowaste is linear, with little – if any – incentives to spread food waste derived compost or digestate to arable land. This is partly because of post-World War II agricultural policies placing a heavy reliance on synthetic, inorganic fertilisers; and partly due to silo-based government departments addressing soil, food and biowaste policies in isolation rather than as elements of a larger whole.

The triple planetary crisis – climate change, pollution and loss of biodiversity – is now being felt across the UK, presenting a very real threat to our nation's food security. Anyone watching Clarkson's Farm Series 3 will have seen this played out.

So, what to do? Well, I'm calling on the Government to:

1. **Establish coherent policy links between biowaste recycling and soil improvement using natural capital accounting methods.** In the short term, it should be implemented through the Sustainable Farming Incentive; and in the longer term, it should be included in the 2028 update to the 25-Year Environment Plan.
2. **Create demand for compost** by making specific reference to BSI PAS 100 certified products in the Sustainable Farming Incentive agreements and fund this at an appropriate rate (equivalent to between £30-60/tonne of biowaste).
3. **Adopt a systems-based approach** to future soil, food and biowaste policy-making.

These policy asks aren't rocket science; rather they build on existing subsidy frameworks and accounting methods. Moreover, they can be implemented simply and quickly.

Currently, the way the UK manages its soil, food production and recycling of biowaste is linear, with little – if any – incentives to spread food waste-derived compost or digestate to arable land.

Although environmental matters are devolved across the four nations of the UK, leadership from the new government has the potential to demonstrate the ease with which soil health can be improved and the circularity of the Soil-Food-Biowaste value chain restored.

Anne Bhogal,
Principal Soil Scientist, ADAS

Agricultural practices can damage soils by increasing soil compaction, erosion, and loss of organic matter. Improving soil management is a key action under Goal 6 (Using Resources from Nature Sustainably) of the revised Environmental Improvement Plan for England and Defra has committed to support farmers to bring 40 per cent of agricultural soils in England under sustainable management by 2028 and increase this to 60 per cent by 2030. However, there is no single agreed definition in the UK of sustainable soil management and no nationally recognized set of principles. Given this lack of clear definition and the lack of consensus over the metrics to quantify changes in soil quality, it is difficult to understand how an objective to increase the percentage of agricultural soils managed sustainably can be achieved.

Soil management practices vary depending on the function that the soil provides, e.g. food or energy crops production, flood control, a habitat for biodiversity, or (most likely) a combination of functions. Even when focusing on a single function, such as food production, defining appropriate sustainable soil management is not straightforward as it will depend on the farming system, soil type, topography, weather conditions and other factors outside a land manager's immediate control (e.g. supply chain demands).

> Guidelines to inform sustainable soil management should account for the different soil types, agro-climatic zones and land use that the soil is supporting

Management practices that improve soil quality over the long term typically involve ways to maintain or increase soil organic matter (SOM). Implementing such measures will usually require changes to farm practice, which may lead to changes to rotation and increased costs. The Sustainable Farming Incentive (SFI) provides support for farmers to adopt practices that increase SOM levels in arable soils. These include legume fallow, herbal leys and establishing winter cover crop after maize. The SFI also provides support for farmers to produce soil management plans that identify areas at risk of soil damage and allow targeting of measures to reduce erosion, plus nutrient management plans to support optimum nutrient supply for crop growth.

Healthy soils require a balance of biological, chemical and physical properties to ensure good function. It is important to provide simple, easy-to-interpret indicators of soil quality to enable farmers and land managers to understand the state of their soils and monitor changes over time in response to management interventions. Guidelines to inform sustainable soil management should account for the different soil types, agro-climatic zones and land use that the soil is supporting. In addition, soil analysis and testing to determine soil quality should be appropriate for combinations of soil types, land use and climatic conditions.

Dr Jonathan Scurlock,
Chief Adviser, National Farmers' Union

The NFU strongly believes that the incoming government must support farming businesses by continuing to accelerate the roll-out of the Sustainable Farming Incentive (SFI) scheme, ensuring it is properly financed from the majority of the total agricultural budget. Our 2022 Foundation of Food report highlighted why good soil health is crucial to the nation's farming systems and essential for British food production, reducing flood risk, supporting biodiversity and storing carbon. We understand that Defra intends to establish a national soil health baseline by 2028, and potentially to incentivise collection and sharing of soil data through SFI agreements. Their Environmental Improvement Plan aims to manage 40 per cent of England's agricultural soil sustainably by 2028, increasing to 60 per cent by 2030 – but there is a pressing need for policy support to encourage changed farm practices, from cultivation and rotations to managing nutrients and organic matter amendments (manures, compost, digestate).

Looking further ahead, there are exciting new opportunities for farmers to manage their soils for environmental benefit with new kinds of amendments – biochar and enhanced weathering minerals – both of which are thought to deliver soil fertility co-benefits alongside their primary purpose of capturing and storing carbon in the soil. Until recently, these novel land-based greenhouse gas removal technologies weren't even on the radar for Defra, DESNZ and independent advisors like the Climate Change Committee. However, growing commercial interest, together with field trials supported by UK Research and Innovation as well as DESNZ, are rapidly advancing the required scientific knowledge, risk assessment, and practice guidance.

> The critical need now is for our environmental regulators to have the resources to establish a framework for permitting

The critical need now is for our environmental regulators to have the resources to establish a framework for permitting, both in the formulation of novel soil amendments and their application to farmland. In the future, we may well see organic matter and nutrients routinely returned to the soil in combination with biochar and rock dust, to maximise the benefits for local soil health as well as tackling climate change.

Bin there, done that

There is much confusion around the disposal of compostable packaging but behavioural science offers clear evidence of how this can be improved. **Dr Nicola Buckland**, Senior Lecturer in Psychology at the University of Sheffield, explains.

"*It looks like normal plastic*" – this is what members of the public tell us when we provide them with compostable packaging and ask them how easy it is to identify. So, if compostable packaging looks like conventional plastics, how do consumers dispose of it? Research shows consumers often put compostable packaging in the wrong bin, such as the recycling bin. Outside of research, and in 'real world' contexts, such as in workplaces, incorrect disposal of packaging is a common problem reported by some organisations responsible for managing and collecting waste.

Currently, in the UK, compostable packaging is collected only by some local authorities and private organisations and there is no uniform communication or guidance to inform consumers where to dispose of it. This can lead to consumer confusion and result in certified compostable packaging not ending up at an industrial composting facility to break down into water, carbon dioxide and compost. As such, supporting consumers to appropriately dispose of compostable packaging is essential for effective composting schemes and environmental benefits.

As a behavioural scientist, my colleagues and I from the University of Sheffield and Hubbub – a creative environmental charity – along with partners from the Compostable Coalition UK, have been applying the science of human behaviour to understand consumers' behaviours around compostable packaging, and develop interventions that aim to increase the amount of compostable packaging collected for industrial composting.

The Behaviour Change Wheel

Our research applied the 'Behaviour Change Wheel' – a framework widely used in behavioural science to understand and change behaviours. The Behaviour Change Wheel proposes that three conditions or factors need to be met for people to enact a desired behaviour, such as composting packaging. First, people need to be capable – they need to have knowledge and awareness that packaging is compostable and/or know which bin to use. Second, people need to have the opportunity to compost packaging – both the physical opportunity, such as there being available compost bins near to where packaging is being disposed of, and the social opportunity, whereby the act of composting packaging is considered socially acceptable by others, such as colleagues, neighbours, friends and family. Finally, people need to be motivated – they need to believe that composting packaging will be beneficial to them and/or what they value. It might also be a behaviour that people automatically do without thinking about it – for example, if the workplace or home environment is set up in a way whereby composting packaging is the easiest, most convenient and automatic disposal option.

> Research shows consumers often put compostable packaging in the wrong bin, such as the recycling bin

We can assess the extent to which people are capable and motivated, and have the opportunity to compost packaging and identify any gaps in these factors. Once gaps are identified we can develop solutions or 'interventions' to target these gaps to increase the likelihood that people are capable, motivated and have the opportunity to appropriately dispose of compostable packaging. To assess people's capability, opportunity and motivation, behavioural scientists conduct research such as speaking with people in small group discussions (focus groups) or interviews. They also carry out surveys and assess previous reports and research findings. Once gaps are identified, the Behaviour Change Wheel offers guidance on the types of interventions that will be effective.

We applied the Behaviour Change Wheel in our research with 120 households from four streets in Medway, Kent, to encourage residents to put compostable packaging in their co-mingled food and garden waste bins for industrial composting. This was a new behaviour for residents as, before

the research, Medway Council did not provide any instructions about which bin to use for compostable packaging.

The intervention

In the first step of the research, we conducted focus group discussions with residents. Residents reported that they try their best to sort waste correctly. However, through the discussions, we identified gaps in capability, opportunity and motivation for residents to put compostable packaging in their food and garden waste bins. For example, in terms of capability, residents found it hard to identify compostable packaging as it looked like conventional plastic and had no clear distinctive marking on it. Residents also did not know which bin to use. For opportunity, residents did not have storage space for compostable packaging and said the food and garden waste bin was inconvenient to access every time they needed to put packaging in the bin. Some residents also reported noticing what their neighbours do in relation to sorting waste. Finally, residents were not sure about what the outputs or benefits of composting are (i.e., motivation).

Having identified these gaps, in the next step of our research, we designed an intervention to target these gaps and tested its effects on the amount of compostable packaging collected from the 120 households taking part in a six-week study. During the study, residents received regular food boxes, which contained food and beverage items in certified compostable packaging and non-compostable packaging, which they could help themselves to throughout the study (items included sweet and savoury confectionary items, fruit and vegetables, tea bags, coffee pods and carrier bags).

> The back-of-pack label was brown to match the food and garden waste bins, to encourage residents' automatic association

Residents received a food box before the intervention, one at the start of the intervention and another two weeks later. As such, these food boxes allowed us to measure the amount of compostable packaging disposed of in the food and garden waste bin after the intervention compared to before. Our partners, RECOUP weighed the amount of compostable packaging collected in food and garden waste bins for two weeks before the intervention, and four weeks after the intervention. We also surveyed residents before and after the intervention to see if the intervention increased their self-rated capability, opportunity and motivation to put compostable packaging in the food and garden waste bin.

Before the intervention, we provided only basic information to residents to inform them they could now put compostable packaging in the food and garden waste bins (delivered with the first food box). The intervention was then delivered with the second food box and it was designed to target the gaps in capability, opportunity and motivation previously found. Specifically, to address confusion identifying compostable packaging, Hubbub designed both a front- and back-of-pack label for all compostable packaging in the second and third food boxes. The front-of-pack label stated the packaging was compostable and encouraged residents to check the back of the pack for disposal instructions. The back-of-pack label showed a logo of a 'C' going into a bin with the clear action to 'Put in food waste bin'. This back-of-pack label was brown to match the brown colour of the food and garden waste bins, to encourage residents to

automatically associate the label with their food and garden waste bin.

For concerns around storage space for compostable packaging and accessing the food and garden waste bin (opportunity), we developed a leaflet which encouraged residents to use their kitchen food caddy as an intermediary bin to collect compostable packaging before taking the collection to the food and garden bin. Kitchen caddies were provided to all households who requested one. We also provided tips on where to position the food caddy so that it could be easily reached at the point at which residents were disposing of packaging. We gave residents a distinctive eye mask wrap to put on their food caddy to remind and prompt them to use the food caddy for compostable packaging. Similarly, we gave residents a tag to put on their food and garden bin to act as a reminder to put compostable packaging in the food and garden waste bin and to act as a social signal to neighbours that they were composting their packaging (fostering a social norm to compost packaging).

Finally, to address gaps in motivation, residents were given an infographic that showed the composting process. The infographic arrived with a bag of compost to show more nutritious soil as a relatable beneficial output of composting. The amount of compostable packaging in food and garden waste bins after the intervention was compared to before, when we provided only basic information about putting compostable packaging in the food and garden waste bin.

> Our intervention was effective in increasing the amount of compostable packaging disposed of in food and garden waste bins

Results

The results of the study showed that, after the intervention, participants' self-rated capability, opportunity, and motivation had increased. Moreover, there was a 75 per cent increase in the amount of compostable packaging collected in food and garden waste bins. These findings show that our behaviour change intervention was effective in increasing the amount of compostable packaging that residents disposed of in their food and garden waste bins.

We have developed and rolled out similar interventions, informed by the Behaviour Change Wheel, in workplaces within a closed-loop context, and customers of a food delivery service offering a packaging take-back scheme to collect compostable packaging. Similar to the households project, we found the interventions increased the amount of compostable packaging collected in compost bins (closed loop) and and increased customer' intentions to return compostable packaging to the take-back scheme company for industrial composting. Promisingly, across all of our studies, we found that the interventions were well received by the recipients, indicating that these types of interventions are considered acceptable, holding promise for wider-scale rollout.

A key message from our research is that compostable packaging needs to be clearly labelled with a standardised label so that it is easily recognisable and distinctive from conventional plastics. Clear instructions that state which bin to use are needed. Using a consistent colour scheme for labels and communications will also be beneficial. Finally, it's important to explore barriers to appropriate waste sorting in the context at hand and, where needed, develop and apply interventions that specifically target the identified gaps in capability, opportunity and/or motivation.

For more info see Hubbub's webpage 'Compostable packaging unearthed' and the link at the bottom to the report Unearthed - Digging into compostable packaging and consumer behaviour.

Rethinking biowaste:

The benefits of compostables in anaerobic digestion

Compostable materials can be a beneficial feedstock when included in anaerobic digestion. **Vegware** describes the potential gains for differing AD processes.

Much has been written about the suitability of compostable materials for recovery at industrial composting plants versus home composting. The upcoming mandatory food waste collections have the potential to shift the management of biodegradable waste to anaerobic digestion (AD).

As part of their UKRI funded project, the Compostable Coalition UK ran trials to explore the biomethane potential (BMP) of compostable foodservice products within standard wet and dry anaerobic digestion and thermo-pressure hydrolysis (TPH)

The findings from these trials provide critical insights into the future of compostable materials—read on to find out the methodology and results.

Wet AD

This is the most common form of AD where biomass and biowaste is converted into a slurry (typically <10 per cent dry solids (DS)) ahead of being pumped to mixed digesters to to generate biogas and digestate which can be spread to land as a biofertiliser. The issue is that compostable packaging is designed to mimic their petroleum counterparts.

As a result, first generation de-packaging equipment at AD plants cannot readily tell them apart and large amounts of compostable packaging are rejected before they have a chance to enter the digesters. The issue is that compostable plastic packaging items often look like their petroleum plastic counterparts. Estimates vary, with losses likely to be between 60 and 90 percent.

For example, corn starch bags often begin to degrade in the collection part of the food waste supply chain so will have a better chance of passing through the depackager. However, rigid cardboard and moulded biomass containers such as cups and plates will have a much higher reject rate. Also, rigid bioplastics that are generally indistinguishable from petroleum plastics will again have a very high reject rate.

This is a lost opportunity as compostable packaging has a high biomethane potential in wet digesters. Tests of a mixture of typical packaging including biobags, bagasse plates, CPLA drink lids and napkins etc, when pulped, generated a biomethane potential of 142 m³ CH_4 / tonne fresh weight (the "BMP").

This compares favourably with the benchmark BMP for anaerobic digestion of approx. 100-110 m³ for maize silage. The higher yield is mostly attributable to the higher DS of the compostable packaging, but nevertheless demonstrates the potential of this material as a source of biofuel. However, when you apply a capture efficiency of just 10-40 per cent due to de-packaging losses as modelled in Figure 1, the BMP yield drops to just 14-57 m³.

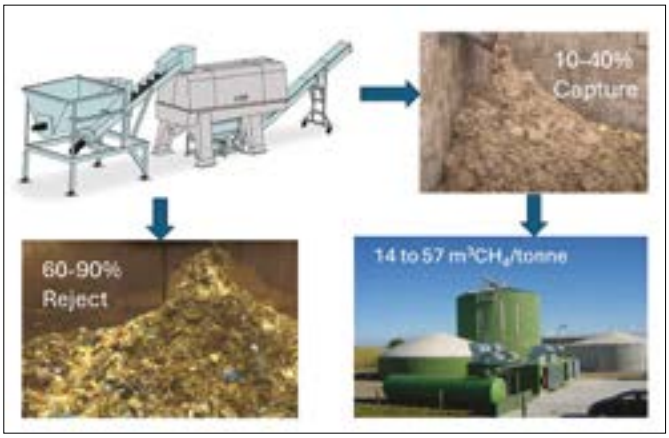

Figure 1. Wet AD

Dry Digestion

Dry digestion as the name suggests handles biowaste at higher DS levels (typically 15 – 25 per cent).

In the context of compostable packaging, the process of de-packaging does not typically occur and for the purposes of this comparison, it is assumed that all the biowaste is loaded to the dry digesters operating in either batch or semi-continuous mode.

Initial trials at laboratory level to mimic dry digestion conditions using the same mix of compostable packaging as tested for the wet digestion test yielded very poor results with the BMP yield being <10 m³. This was considered to be potentially unrepresentative, and from discussions with dry AD technology providers, the expected yield for dry AD is typically 70-80 per cent of wet digestion depending on retention times. Therefore, using the latter, yields of biomethane from compostable packaging could potentially achieve BMPs of approx. 100 m³.

In any event, as dry AD is typically followed by a composting phase the likelihood that the compostable packaging is recycled back to the soil is greatly increased while also yielding some bioenergy potential. This is modelled in Fig. 2.

Figure 2. Dry AD

Thermal hydrolysis AD

Thermal hydrolysis is an advanced form of digestion that focuses on optimising the limiting step in AD, i.e., hydrolysis. The best example of thermal hydrolysis is in sludge management where biosolids are sterilized in a steam environment at temperatures > 160°C at many larger wastewater treatment plants (WWTPs). This process disrupts cellular membranes and chemically breaks apart organic polymers which enhances biomethane output. There are relatively few examples of this process being applied to more complex biowaste and compostable packaging.

However, a process called "thermo-pressure hydrolysis" (TPH) was demonstrated at the Derby food waste AD facility between 2019 and 2021 where compostable packaging was seen to be effectively hydrolysed and transferred to the digesters. To confirm the efficiency of this process, samples of biodegradable packaging were sent to the TPH pilot plant in Dorset operated by Aerothermal. Four test campaigns occurred in addition to some additional in-house testing. The results for three comingled compostable packaging trials yielded extraordinary BMP results of between 246 and 317 m^3. Importantly, the hydrolysis process left behind very little residue when screened at 12mm that was estimated to be <2 per cent of the total mass of material entering the TPH vessel.

In parallel with these TPH trials the performance of a range of specific compostable packaging materials were tested to assess if there were differences between compostable packaging types. The results of these trials are summarised below:

Compostable packaging type	TPH / liquefaction efficiency	BMP (m3 CH4/t fresh weight)
"Biomass based packaging, Cardboard, bagasse etc"	90%	314
PLA coffee pods	86%	337
Corn starch carrier bags	96%	100
PLA based tea bags	100%	Not measured
Food waste (approx. 25% DM)	95%	110

These data demonstrate that general biomass-based packaging responds very well to thermal hydrolysis. Two exceptions were high temperature resistant bioplastics and wood, which demonstrated more resistance to thermal hydrolysis, as judged by the mixed compostable packaging trials and the individual component tests. The <2 per cent reject yield from the mixed compostable packaging trial was mostly wood. When compared with the full-scale experience at the Derby demonstration, where approx. four per cent reject including plastics was recovered during an extended test, this suggests that the bulk of compostable packaging in the food waste stream is amenable to thermal hydrolysis with a very high rate of biomethane recovery.

Figure 3. Thermal Hydolysis

Furthermore, it is evident that the digestate will also be suitable for recycling to the soil with a high recovery rate. It is also of particular note that the compostable packaging itself is a far more potent source of biomethane than the food it contains when thermally hydrolysed.

In conclusion, the potential of compostable materials as a valuable resource for anaerobic digestion is clear. Wet anaerobic digestion offers a promising pathway with high biomethane yields, but losses due to de-packaging are a major hurdle. Dry anaerobic digestion, although less efficient in terms of biogas production, provides a route for treating compostable packaging. However, the standout performer is thermo-pressure hydrolysis, which demonstrates exceptional efficiency in breaking down compostable packaging and maximising biomethane recovery, while also producing a high-quality digestate suitable for land application. These findings highlight the importance of advanced treatment technologies in unlocking the full potential of compostable materials as a sustainable and renewable resource.

For more information about the compostable materials used in the trials please contact environmental@vegware.com

For wider consideration about compostables and their place within the UK waste system please visit compostableuk.info

vegware

Measuring methane slip

Following the release of the EA's Methane Action Plan, **David Maxwell** – Policy Advisor at Future Biogas – reviews the role of new technologies in tackling methane emissions from anaerobic digestion.

Tackling methane emissions is the single most effective strategy in the short term to slow the rate of global warming and support the UK in its net zero ambitions.

Decarbonisation strategies have been increasingly focusing on methane emissions due to methane's increased Global Warming Potential (GWP). Fugitive methane emissions (accidental emissions from leaks) and methane slip (systemic emissions from key processes) are one of the main anthropogenic sources of these emissions and are considered a priority.

The Global Methane Pledge was launched at COP26 and sets the target of reducing global methane emissions collectively by 30 per cent from 2020 levels by 2030. The objective of the pledge is to catalyse actions to tackle the sources of methane emissions and stimulate their regulation.

The UK has responded to the pledge through the publication of its Methane Action Plan by the Environment Agency (EA). The action plan leverages the EA's position as an environmental regulator to work with industry, supporting knowledge sharing, and encouraging best practices.

Between 1990 and 2020 UK methane emissions reduced by 62 per cent. This is still considerably higher than pre-industrial levels and there is substantial scope for further reductions through the implementation of low-cost measures. Agriculture is currently the highest source of fugitive methane emissions in the UK, representing approximately 50 per cent of total emissions.

Given that the agriculture and waste sectors represent over 80 per cent of UK methane slip, the methane action plan has a clear focus on regulating the emissions in these sectors. This will be pertinent to operators that are permitted by the EA, but it is imperative that the entire industry work collaboratively to mitigate methane emissions.

Given the service that the anaerobic digestion (AD) sector provides to agriculture and waste to reduce their carbon intensity, the implementation of the methane action plan presents a turning point in the operation of AD plants.

Methane slip from AD undermines the sustainability of operations. With high enough levels of slip, a plant could become a net emitter of GHGs, and its biogas would fail to comply with the sustainability criteria set within the industries support schemes (e.g. RHI and GGSS).

While AD plants should also be measuring methane emissions for national emissions reporting, the financial support mechanisms have always assumed a fixed level of methane slip for all plants – one that has long underestimated the true level.

> Agriculture and waste sectors represent over 80 per cent of UK methane slip

Regulation to monitor and mitigate methane slip currently only applies to permitted sites. These sites are permitted because of the utilisation of waste feedstocks. However, all sites are at risk of emitting methane and should be following best practices to mitigate and manage the problem. Site surveying is essential to monitor and report methane emissions accurately.

At Future Biogas, we have invested in mitigating and monitoring our methane emissions, working with research institutes and technology developers to define the best practices and technologies to implement within our operations.

Paul Balcombe, Senior Lecturer at Queen Mary University of London, said: "Using advanced quantitative optical gas imaging cameras together with other detection and quantification tools, we can now detect and accurately quantify methane emissions at biogas plants. Thanks to agreements with biogas producers like Future Biogas, we have undertaken a large measurement campaign of biogas sites across the UK, Germany, and Poland to better understand the impact of methane emissions on the environmental credentials of biogas and how to drive them down to ensure we are meeting our global climate goals with this important fuel."

Technology

Using the right technology to survey sites and quantify emissions is fundamental to a successful mitigation strategy. Currently, there is a broad range of methane emissions reported for different AD sites, and surveying technology is usually the most influential factor.

Over the past year Future Biogas has been working with a research group at Queen Mary University in London, surveying our sites as part of a wider study using a cryogenically cooled optical gas imaging camera (OGI). This camera is more sensitive and can detect smaller leaks that would remain undetected using a conventional OGI camera. The approach allows us to address such potential leaks earlier, before they propagate and require more expensive repairs. This OGI camera can survey a site within half a day and is capable of quantifying leaks at a distance.

Maria Olczak, PhD candidate at Queen Mary University of London, said: "With the new EU biomethane targets outlined in REPowerEU, there is increasing focus on methane emissions related to biogas production and transport. Our research addresses a critical knowledge gap by identifying major sources of methane emissions in biogas and biomethane production and exploring cost-effective mitigation measures. We hope that our work will contribute not only towards

better understanding of the scope of the challenge, but also available solutions, enlightening further policy developments in Europe."

Surveying a site using an OGI camera is an intensive activity. Alternative techniques that have a top-down approach can be more efficient. Working with researchers at Cranfield University and the National Physics Laboratory, Future Biogas has also surveyed sites using remote sensing techniques such as Differential Light Absorption (DIAL). The main advantage of this technique is its simplicity and speed, a site can be surveyed in under an hour. It is useful for determining the total methane emissions from a site, which is valuable in regulatory and voluntary reporting. The weakness of this technique is that it can't be used to diagnose specific leaks at a component level.

Approaches

To support the use of technology, a comprehensive strategy for site surveying, diagnostics and repairs is necessary. All AD sites should implement a Leak Detection and Repair (LDAR) strategy. It is an important mechanism to ensure sites operate safely, efficiently and that they are environmentally compliant. A good LDAR strategy should include specific details on site surveying timelines and strategies for managing detected leaks. It is important that an LDAR strategy is bespoke to a specific site, to ensure it has an impact and increases confidence that the site is being operated in line with best practices.

All AD sites have systematic methane emissions such as from combined Heat and Power (CHP) systems, biomethane upgrading units, and feedstock and digestate storage. Responsible AD operators should be assessing how these sources can be mitigated or reduced. Abatement technologies such as storage covers, and emission treatment technologies should be considered in the early stages of plant design.

> Our research addresses a critical knowledge gap by identifying major sources of methane emissions in biogas and biomethane production and exploring cost-effective mitigation measures

At Future Biogas, we are implementing a range of technologies and strategies to mitigate these emissions. Our new Project Carbon Harvest sites will remove CHP systems and include carbon capture technology which will significantly reduce methane slip as more of the off gas will be recycled into the process and increase the recovery efficiency of the methane.

We have also installed modern pressure release valves (PRV) with proximity sensors to monitor and feedback when PRVs open and the quantity of methane released. The speed of response and accuracy of these valves means it is possible to diagnose repeating faults within the system. An example of this is within the gas collection domes where the inner dome lining may be caught or folded causing a rapid increase in pressure and premature opening of the PRV.

We have also invested in the more sensitive OGI cameras and are using them regularly to survey our sites for leaks. Repair work can be targeted to specific leaks, whilst common sources can be addressed with improved design or new equipment.

One of the main barriers to uptake of these technologies is the cost. Whilst the cost-benefits of these technologies can be very good, the capital costs can be substantial. Therefore, a government framework or financial support mechanism to encourage the use of these technologies by operators and third-party site surveyors would be beneficial.

If AD is to play a key role in decarbonisation, it is imperative that we use these strategies to mitigate methane emissions. This both improves the decarbonisation potential of AD and sets a high standard for the industry. This combination will demonstrate the relevance and importance of the biomethane industry in the future.

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

New Independent Laboratory Auditor

A new independent laboratory auditor was appointed earlier this year, following an open tender process in 2023.

Simon Blackhurst of SJB Quality Consulting Ltd (SJQBC) has been selected to audit CCS and BCS approved laboratories to ensure conformity with their terms and conditions. This selection was made following a careful evaluation and interview process. SJBQC has started the 2024 audit round and will share audit findings in the autumn.

CCS and BCS look forward to working with Simon, who has extensive experience in auditing and scheme test method application.

BCS Sampling Guidance Webinar

BCS held its first sampling guidance webinar for operators earlier this year. The focus of the webinar was on the PAS 110 liquid digestate sampling requirements and guidelines.

The webinar provided an opportunity to address the pros and cons of different sampling methods, as well as which sampling methods are most suitable for different processes. It also provided a useful precursor to the 'Understanding PAS 110 Testing Webinar' with some attendees joining both.

The webinar addressed the following topics:

- Updates to scheme rules
- REAL's guidance on sampling liquid digestate in accordance with BSI PAS 110:2014
- Sampling in practice
- Transport logistics
- Developing SOPs

The webinar assists new operators and those who have received non-conformances relating to sampling practice, with a view to helping them meet required standards. It will be held again in Autumn 2024 alongside the testing webinar.

ICAW and compostables

CCS joined the rest of the world in May to celebrate International Compost Awareness Week (ICAW).

This year's celebration highlighted the need to reduce waste to landfill and raise awareness about the environmental and economic benefits of composting. ICAW was also aimed at raising awareness about the importance of using compost to enhance soil health. The theme for this year was: 'Compost ...Nature's Climate Champion.'

As part of ICAW celebrations, CCS shared several social media posts, an article highlighting the value and importance of compost and composting and published a compostables report at the end of the week.

RESEARCH HUB

Reports

The Research Hub was pleased to publish two original reports in the first half of 2024:

Carbon accounting for compost and digestate: A methodology was developed to enable compost and digestate producers to conduct a carbon footprint assessment. This methodology builds upon established carbon accounting principles and frameworks contained within the Greenhouse Gas Protocol.

Residual Biogas Potential (RBP) test improvements and alternatives: This project aimed to understand challenges related to the RBP Test specified under PAS 110, explore potential improvements to the method, and/or identify suitable alternatives. A report detailing the findings of this investigation is now available.

To learn more, please email **megan@realschemes.org.uk**

Ongoing projects

The Research Hub also continues to work on several ongoing projects:

Plastic contamination method assessment: This project aims to evaluate the current PAS 100 and PAS 110-specified methods for testing plastic and explore alternative methods, including area-based and microplastic test methods. A report containing the findings will be published in Summer 2024.

Plant Response Test (PRT) interpretation and comparison: This project aims to address challenges related to the PRT specified under PAS 100 by testing spring barley growth alongside the PRT to aid interpretation of test failures. We are working with the relevant stakeholders to take this project forward.

Risk Assessment to support Quality Protocol (QP) revision: This project aims to support the revision of the Compost and AD QPs by updating industry risk assessments. We are working with the relevant stakeholders to take this project forward.

Reducing waste in the biogas and biomethane sector

David Reay, Head of Strategic Partnerships at CPL/Puragen Activated Carbons, outlines the recent breakthrough in the treatment of high-sulphur spent activated carbons from renewable energy facilities.

CPL/Puragen Activated Carbons has been a proud member of the REA for many years, via our parent company Invica Industries (formerly CPL Industries), a group with varied interests including activated carbon, smokeless fuels and biomass-based energy sources.

What is activated carbon?

Activated carbon is a high purity form of carbon with a very high surface area, characterised by microscopic pores. What do we mean by a high surface area? Well, a typical dessert spoon containing activated carbon would provide a surface area equivalent to 1.5 football pitches!

It is this vast surface area and porous structure which allows activated carbon to be used as a filtration medium in both gas-phase and liquid-phase purification applications. Unwanted contaminants are trapped by molecular forces within the pores of the carbon, allowing the desired process fluid (air, biogas, water, etc) to pass through.

Activated carbon is used in an impressive array of purification applications, from biogas and biomethane to drinking water, waste water and flue gas treatment at energy-from-waste facilities.

In the case of the renewable energy sector, activated carbon removes hydrogen sulphide (H_2S), ammonia (NH_3), siloxanes and other volatile organic compounds (VOCs) from biogas streams, to protect CHP engines or allow upgrading of the biomethane for grid injection. The use of activated carbon filters reduces maintenance costs and downtime, as well as contributing to improving the output of renewable energy from these facilities.

Spent carbon reactivation: the problem with biogas plants

When activated carbon is 'spent' and requires replacement, it can generally be recycled via a process called thermal reactivation. For a number of years, CPL/Puragen has operated two reactivation kilns at our facility in Immingham, North East Lincolnshire – one dedicated to the treatment of spent carbons from drinking water facilities, the other to environmental/industrial applications, such as biogas, odour control, VOC abatement and wastewater treatment. Recycling spent carbon in this way offers a carbon footprint reduction of over 90 per cent compared with the use, and subsequent disposal, of virgin material.

One particular issue facing the biogas/biomethane sector, when it comes to spent carbon, is the high levels of sulphur caused by the presence of H2S within the gas stream. Traditionally, it has not been possible for the activated carbon industry to accept these 'high-sulphur' spent carbons into their reactivation processes. Applying any heat to the carbon results in large amounts of elemental sulphur being deposited within the reactivation equipment, causing significant damage to the sensitive (and expensive) kiln internals. The presence of any moisture can also result in the formation of corrosive sulphurous acid within the equipment – essentially high-temperature acid rain! For these reasons, these high-sulphur spent carbons from the biogas sector have historically been considered as non-treatable and would therefore have to be disposed of as waste.

Recycling of high-sulphur spent carbons

After extensive R&D work, CPL/Puragen has devised a proprietary method for handling this type of high-sulphur spent carbon, allowing it to be safely and economically recycled at the Immingham facility. This development represents a major technological breakthrough, unique within the sector, which has been commercially operational since the second half of 2023. The technology effectively saves many hundreds, possibly thousands, of tonnes of spent carbon from being disposed of as waste by the biogas sector. This new technology firmly demonstrates CPL/Puragen's commitment to the circular economy, and was recently awarded a Highly Commended prize in the ultra-competitive Innovation category of the 2024 British Renewable Energy Awards, an extremely proud achievement for the whole team.

Green Gas Steering Group

David Hurren reflects on how carbon dioxide has been viewed since its discovery in 1754, and how biogenic CO2 may change the narrative for 'Fixed Air' going forward.

David Hurren,
Renewable Energy Consultant

It has been 43 years since I entered the industrial gas sector, and I have always had an interest in and connection to its history. The second half of my career has seen my focus grow on renewable gases.

I grew up with names like Priestley, Lavoisier, Cavendish and Ramsay, but Joseph Black didn't get a mention despite the fact that in 1754, he discovered 'Fixed Air'. Nowadays it is better known as carbon dioxide (CO2) and our concern is to fix it back into sinks. Like Pandora's box, we opened the lid wide to liberate fixed dinosaur-era carbon molecules and now we rely on the hope that we can put it back in the ground.

102 years later, there was another unheralded scientist called Eunice Newton Foote working in her home laboratory, putting different gases into cylinders and taking observations. She noted that – when placed in full sunlight – a cylinder of CO2 heated up more quickly than the one full of air. She postulated that an atmosphere containing more CO2 would result in a warmer planet. 168 years ago, the concept of greenhouse gases was discovered.

Carbon dioxide is now seen as bad, a thing to be eliminated in some parts of social media. That overlooks the fact that the carbon cycle is part of the beating heart of the planet, essential to every living organism on Earth. How do we reconcile this and what role does the organics and biogas sector play in returning this molecule to being seen as a force for good? The answer is all about biogenic carbon dioxide.

Biogas typically contains 40-45 per cent biogenic CO2. Existing utilisation markets cover everything from extraction of hops; packaging of foodstuffs, and putting the fizz into beverages, to things like fire extinguisher filling. A recent report by the Biomethane Industrial Partnership Task Force 4.1 highlighted the potential for biogenic CO2 in the European market as being around 10 times the current industrial gas market across Europe. New markets are emerging for storage and utilisation, as a feedstock in sectors such as building materials, biopolymers, e-fuels, and others.

In my view, there is no Net Zero without biogenic CO2. Now is the time to seize the opportunity and change the narrative.

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Organics Steering Group

Malcolm Marshall explores the opportunities for the organics sector to contribute to Net Zero, via compost, enhanced weathering and carbon sequestration.

Malcolm Marshall MBA, General Manager - Compost & Wood Recycling, Veolia

As the world grapples with the challenges of climate change, it's clear that we need innovative solutions to reduce our carbon footprint. Compost, enhanced weathering, and carbon capture technologies may not be the most glamorous solutions, but they have the potential to make a real difference.

Compost, for instance, can capture and store carbon in the soil, improving soil health and reducing the need for synthetic fertilisers. Enhanced weathering with basalt can react with atmospheric CO2 to form stable minerals that can store carbon for thousands of years. As enhanced weathering sequesters inorganic carbon, it is a stackable technique that enhances the organic carbon stored in the soil. Similarly, enhanced weathering also benefits from feeding soils with various micro and macronutrients, reducing the need for synthetic fertilisers and the liming of fields.

Veolia, an environmental services company, has set objectives to reduce its carbon footprint and contribute to a more sustainable future. We have invested in composting facilities that convert organic waste into nutrient-rich soil amendments to improve soil health, increase crop yields, and reduce carbon footprint. We also work with farmers to develop sustainable agricultural practices that incorporate composting and reduce the use of synthetic fertilisers. Further, we are investing in research and development to improve the efficiency of enhanced weathering.

In conclusion, compost, enhanced weathering basalt, and carbon capture may not be the sexiest solutions to climate change, but they have the potential to make a real difference. By thinking outside the box and embracing innovative solutions, we can create a more sustainable future for ourselves and future generations.

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THE REA MAGAZINE FOR ORGANICS & GREEN GAS

The REA Organics Recycling and Biogas Magazine has been a staple in the UK for over 27 years! But as our industry and the world continue to change, so must our magazine.

We're now exploring new ways to distribute the magazine and want to keep all our readers, members and non-members, fully informed. If you enjoy our curated policy updates, industry news, articles and opinion pieces, then please take just 3 minutes to fill out our contact form using the QR code opposite so we can keep you up to date. We would really love to know what you're interested in and what you'd find useful for us to feature.

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