



TMS10 Bioresources: AMP8 and Market Strategy

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1. Executive Summary

This document sets our strategy regarding the bioresources market and our plans through AMP8 and beyond.

Although customers provided no specific feedback regarding bioresources, through our customer and stakeholder engagement, we have identified the following outcomes that are important to customers and are relevant to our bioresources business:

- I want you to stop polluting rivers and to improve their quality
- I want you to reduce emissions and reach net zero
- I want fair and affordable bills
- I want you to reduce your impact and restore the environment
- Our customers are also clear that they expect us to be compliant with all relevant regulations and legislation

Delivery of a safe, sustainable, value for money and compliant bioresources business is therefore essential to these outcomes.

In its recent Strategic Policy Statement (2022)¹, Government outlined its expectation that the water industry will protect and enhance the environment and highlights its 25 Year Environment Plan. Our bioresources strategy and plan reflects these priorities:

- Using and managing land sustainably by recycling biosolids in compliance with all legislation such as the Sludge (use in Agriculture) Regulations² and Farming Rules for Water³
- Increasing resource efficiency by optimising the amount of renewable energy we can recover from sludge
- Reducing pollution and waste by complying with regulations such as the Industrial Emissions Directive to ensure that the treatment process either does not or will not have an adverse effect on the environment

Customers want us to ensure we deliver our core business of providing water and sewage services (which includes sludge management), but they also want us to⁴:

- Help tackle climate change by maximising green energy production and achieve our net-negative carbon strategy
- Reduce the strain on the environment and restore environmental habitats

Looking to the medium and long term we need to increase our resilience to external pressures regarding the reducing availability of land for recycling⁵ biosolids; to reduce our environmental footprint to help address the climate change crisis; and make our processes more efficient to help protect customers from increasing costs.

¹ February 2022: The government's strategic priorities for Ofwat - GOV.UK (www.gov.uk)

² <https://www.legislation.gov.uk/ukxi/1989/1263/contents/made>

³ <https://www.legislation.gov.uk/ukxi/2018/151/made>

⁴ What Customers, Communities and Stakeholders Want v18.1, Sia Partners, July 2023

⁵ Under the waste hierarchy biosolids are technically 'recovered' to land but for easier understanding of the concepts recycled is used in this document, which has a different legal meaning.

We recognise that biosolids have value and that markets can bring efficiencies and innovation that will benefit our customers and the environment. The opportunities created by markets are not only about delivering service at a lower cost, but also about making the best use of resources, improving resilience, and finding new, innovative ways of delivering the service. We have adopted Ofwat's policy regarding the opening of the bioresources market and are assessing opportunities such that we can evolve our long-term strategy to become the market leader.

1.1. Developing our Bioresources Strategy

As part of our long-term vision, we are developing a strategy to take a leadership role in developing and exploiting the bioresources market. We already have contracts with neighbouring water companies which offer provision to import and export sewage sludge. We will also use markets to drive innovation where the use of markets has not been fully explored, for example, gas to grid or pyrolysis.

To help further develop our strategy we have taken on board the recommendations from the Jacobs Bioresources Market Review⁶. The review found that there is untapped market potential and made recommendations on incremental actions which could be implemented to realise this potential, noting that some of the biggest opportunities are long term and will unfold over the next two AMP cycles.

Our bioresources strategy will focus on contributing to deliver four key outcomes for our customers, communities, and the environment in the longer term:

1. **Develop and use markets:** To drive efficiency, innovation, and benefits through the better use of bioresources.
2. **Deliver great customer service and value for money:** This is linked to the health of our assets to perform when required and provide potential headroom.
3. **'Achieve our net-negative carbon strategy':** This is associated with maximising the green energy we produce and contribute to addressing climate change targets. (However, we recognise customers have told us that this should not be at the cost of other core activities).
4. **Deliver improvements for the environment:** By managing the treatment and disposal of sewage sludge responsibly without causing pollution. It is incumbent on us to recycle the subsequent biosolids to land in full compliance with the regulations.

Further, through enhanced treatment at sewage treatment works, (e.g. phosphorous removal), which in turn is improving river health, we are removing ever increasing volumes of sludge which we need to ensure can be treated in a fully compliant manner.

Finally, we need to implement a strategy allowing us to operate and maintain our sludge treatment centres in compliance with the Industrial Emissions Directive.

⁶ Jacobs Bioresources Market Review <https://www.ofwat.gov.uk/wp-content/uploads/2021/05/Jacobs-report-Bioresources-Market-Review.pdf>

1.2. Our AMP8 performance, targets and activities

As there are no common Performance Commitments defined for bioresources, to hold ourselves to account for each of these outcomes, we have proposed to monitor ourselves against the following key performance indicators (KPI's) and externally audited assessments of our service/processes, through the Biosolids Assurance Scheme (BAS) and the environment Agency's Environmental Performance Assessment.

Table 1.1: Our internal bioresources performance measures for AMP8

Outcome	Driver	Measure/Indicators
Develop and use markets	Cost efficiency and innovation	Continue to publish market data annually in line with Annual Report rules.
Deliver great customer service and value for money	Asset health	Restore 15% headroom capacity to manage outages. 90% of planned digester cleans and refurbishments completed within AMP
Achieve our net-negative carbon strategy'	Renewable Energy Production	Maximise energy production through maintenance and refurbishment of CHP engines. Generate at least 290 GWh per annum of renewable energy from biogas (subject to final Gas to Grid proposals)
Lead the improvement of the environment	Environmental stewardship	100% of IED Permits duly made (note that permits will need to be updated/modified as AMP8 interventions are undertaken)
		100% Biosolids Assurance Scheme (BAS) compliance.
		100% compliance with 'Satisfactory Sludge disposal' metric in the Environment Agency Environmental Performance Assessment

Whilst we have maintained compliance with regulations regarding the treatment and disposal of sewage sludge, changes in regulations and the growing asset debt across our operation will, in the short-term, put pressure on our sludge treatment processes as well as having a potentially negative impact on our operational performance.

The transposition of the IED regulations under the Environmental Permitting Regulations (EPR) and the delay in clarification of permit requirements has resulted in us not being able to achieve the required permit compliant status by the original deadline of December 2024.

We are targeting to have all sites requiring permits to have them 'duly made' by this deadline, however any permit improvement conditions, following monitoring and risk assessments, will take longer to resolve. We have made the planning assumption that the required monitoring and risk assessments will take place during the remainder of AMP7 and AMP8, with any capital investment post 2030. All operational requirements outlined in the permits will be implemented in full during AMP8. We continue to work with the EA regarding this phased approach.

1.2.1. Activities included within base expenditure

We have developed wide-ranging and comprehensive plans based on a detailed analysis of our historic performance, specifically around utilisation of biogas and acting on condition-based evidence from of digester, CHP and thermal hydrolysis plant inspections. Additionally, as requested by Ofwat⁷, we will be expected to carry out asset condition assessments on our civil

⁷ [IED-Letter-from-Ofwat-to-Companies-1-August-2023-Web-Version.pdf](#)

assets, which will identify improvement plans for this asset cohort. Key base expenditure activities to be delivered in AMP8 include:

- Ongoing opex expenditure, at similar levels as recently incurred
- Digester inspection and cleaning programme
- THP and CHP annual inspection and maintenance services
- CHP replacement of end-of-life inefficient assets
- Base Operation & Maintenance tasks (e.g., pump replacement, thickening and dewatering plant maintenance, gas bag replacement)
- Large capital maintenance, such as digester replacement at Swindon, dewatering plant at Aylesbury, Mogden digester roof replacements

1.2.2. Activities included within enhancement expenditure

In order to meet the requirements of the Industrial Emissions Directive (IED) we will need to implement new and enhanced operational practices including emissions monitoring, implementing waste acceptance procedures, risk assessments and the sampling/measurement of return liquors. The details of this case can be found in TMS29 Enhancement Case: IED.

Progress to our Net Zero Carbon targets through upgrading end of life assets with carbon neutral technology (e.g. digester boilers) and the installation of 7 gas to grid plants are subject to a successful net zero bid. (Refer to TMS49 Our AMP8 Carbon Reduction Strategy & Net Zero Bid).

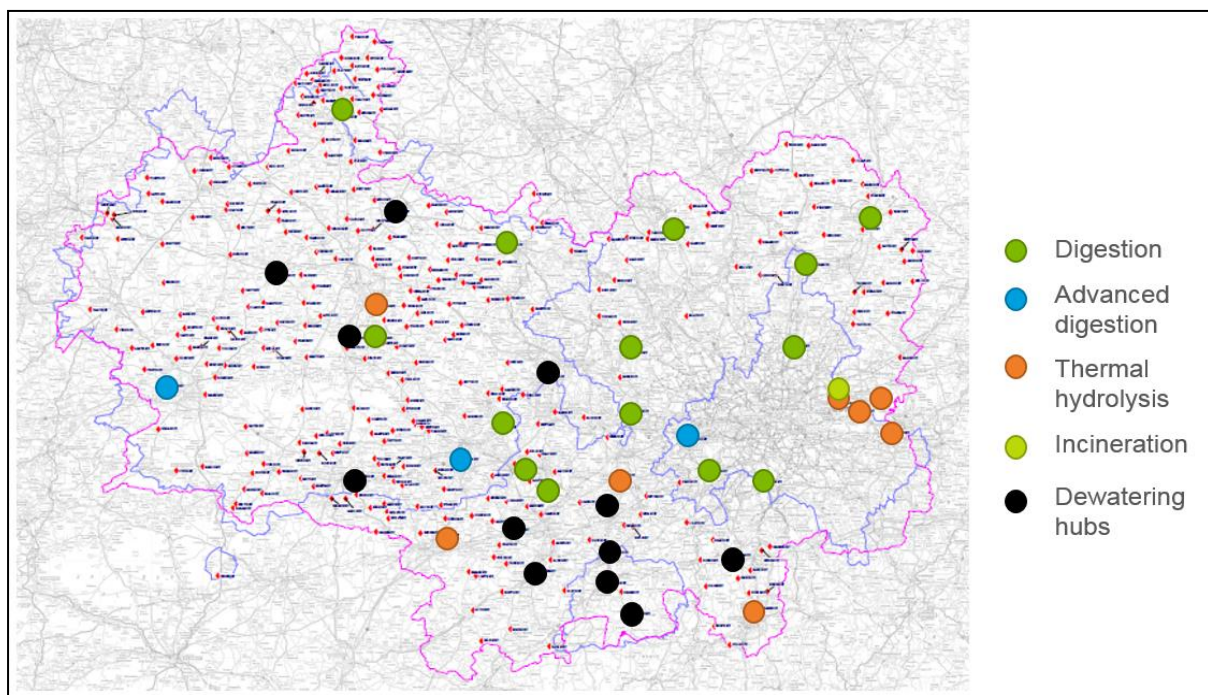
2. Introduction

Sludge, the by-product of the sewage treatment process, is a valuable resource not a waste.

We have a legal obligation, a duty of care, to treat and dispose of sludge correctly; we have over 350 sewage treatment works (STWs) that produce approximately 1,000tDS (tonnes of dry solids) every day. The sludge is treated at our 25 sludge treatment centres (STCs), as shown in Figure 2.1, via anaerobic digestion (AD) which breaks down harmful materials in the sludge, producing stable organic biosolids and biogas. In addition, we have one sludge powered generator at Beckton (which treats around 15% of our raw sludge), which is capable of processing 180tDS/d, however this plant is now beyond its economic life and is a major source of our greenhouse gas emissions, and as such will need to be replaced in AMP9.

We have 12 dewatering hubs across London and the Thames Valley that act as intermediate treatment facilities where liquid sludge is imported into, and then transferred onwards as a dewatered cake; this is to allow greater transport distances to be used at lower cost. About 88% of our sludge is produced at co-located sewage and sludge treatment sites. The remaining 12% of sludge is produced at smaller sites and results in around 38,000tDS of sludge being hauled between them and our STC's annually, equivalent to 47,000 tanker movements.

Figure 2.1: Bioresource asset locations



Source: Thames Water, Asset Management Team

Currently we can economically and practically recover renewable energy (heat, electricity and biomethane) and biosolids (an organic and nutrient rich fertiliser). These are key products that can be recovered and/or recycled and are essential for the circular economy and in combating the climate crisis.

These products are used to offset some of the processing costs incurred; biogas is used to avoid buying fossil fuels for process heating; electricity generated in CHP (combined heat and power) engines used to offset purchasing electricity, biomethane is sold to the grid and biosolids sold to farmers as a fertiliser.

Other materials (such as ammonia, carbon dioxide, fibres, biopolymer, metals) can all theoretically be recovered from sewage sludge but many are not yet technically viable or there are currently no commercially viable outlets for them. As such we continue to keep a watching brief on how these other markets develop so we can consider whether to invest in other resource recovery options at the correct time.

Every year, we recycle around 1,000,000 tonnes of biosolids as a fertiliser in a safe and sustainable way out to agriculture. We have always recycled this material in line with all relevant legislation and since introduction have been 100% compliant with the Biosolids Assurance Scheme⁸; the water industry quality protocol around biosolids management. The fertiliser we produce is used on approximately 50,000 hectares of land, and we take over 3000 soil samples to ensure our fertiliser is right for that land. Our biosolids are a fantastic source of phosphate, organic matter, and a range of other nutrients to help improve soil health. It acts as a high-quality alternative to manufactured fertilisers, at a competitive and cost-effective price. Recycling biosolids from the wastewater treatment process to use in agriculture is one of the most sustainable ways we can support the United Kingdom's goal of achieving a regenerative, circular economy that eliminates waste. However, changing regulations, competition, and public perception around the perceived safety of biosolids is putting increasing pressure on the amount of available land that we can access.

To ensure that we can continue to safely and sustainably manage our bioresources activities we must ensure that:

- We have, or have access, to sufficient processing capacity to treat the sludge to the required quality
- A compliant product is produced that meets all the requirements for safe and sustainable disposal
- Drive reliability and efficiency in our plants so the most economic benefit can be recovered from the raw product

Which in turn will allow us to explore opportunities to open up markets to improve services, realise efficiencies and bring innovative ways of delivering service.

2.1. Our ambition for 2050

We are evolving our strategy to take a leadership role in developing and exploiting the bioresources market. We will use existing markets and support the opening of new markets to drive innovation where the use of markets has not been widely explored, for example, gas to grid and pyrolysis. We continue to develop our strategy through continuous assessment of markets, exploring innovation with partners and in collaboration with other water companies.

We have taken on board the recommendations from the Jacobs Bioresources Market Review⁹. The review determined that there is untapped market potential and made recommendations on incremental actions which could be implemented to realise this potential, noting that some of the biggest opportunities are long term and will unfold over the next two AMP cycles.

⁸ <https://assuredbiosolids.co.uk/>

⁹ Jacobs Bioresources Market Review <https://www.ofwat.gov.uk/wp-content/uploads/2021/05/Jacobs-report-Bioresources-Market-Review.pdf>

A foundational element of our bioresources strategy is to ensure the asset base operates as originally designed. Our assets need to be well maintained with sufficient headroom to meet current and future demand, and we need to recognise that we are part of a complex set of stakeholders who need to work together to deliver optimal customer and environmental outcomes.

We have developed four strategic outcomes which are aligned with our customer expectations and our aspiration regarding market development:

- Develop and use markets
- Deliver great customer service and value for money through asset health
- Achieve net negative carbon
- Deliver improvements for the environment

2.1.1. Develop and use markets

To develop a leadership position in the bioresources market we will need to work with businesses and local authorities to explore opportunities and potential markets. This may mean looking at joint opportunities, new business models to work with third parties to deliver services differently and ultimately to drive for a more efficient service for our customers.

As we explore new business models to take full advantage of these opportunities, we will review the number of STCs we currently have and look to consolidate where beneficial and expand if there are opportunities to offer services to others.

Sewage sludge is a valuable product, from which we can recover many potential products. We already do this with energy recovery, but we need to be flexible and adaptable to market drivers that may identify viable opportunities to recover additional products from our bioresources.

We will recover more energy from sludge with the aim that more than 55% of the potential energy will be recovered. Currently anaerobic digestion allows us to recover 40% but moving to more efficient and advanced processes will allow greater energy to be captured and utilised.

As the market matures, we will consider harvesting other products where technically and economically viable, including ammonia, phosphates, fibres, enzymes and metals. Some of these are currently at low technology readiness levels (TRL¹⁰) but as market demand for these changes from virgin material produced to sourcing from recycled products the viability will change.

We will continue to look at utilising waste heat from our assets and use this to operate our processes more efficiently without importing heat, and where viable consider how we can help promote district heating systems.

Currently we recover 100% of biosolids (the residual treated product after lime stabilisation or digestion) to agriculture, but pressures on this outlet mean this may not be a resilient solution in the longer term. We will seek partners and opportunities to diversify away from this, partially to recover more products resulting in less material to go to land, but also by looking at alternative outlets such as thermal conversion or using biosolids as a feedstock for other outlets (e.g. fuels for industrial applications). By 2050 we are forecasting that the land recycling route will be sufficiently stressed that we need to reduce our use of this outlet by 50%.

¹⁰ <https://www.gov.uk/government/news/guidance-on-technology-readiness-levels>

2.1.2. Deliver great service and value for money

To allow us to manage our bioresource activities efficiently we need a robust and resilient asset base. We have invested in predominantly digestion-based processes to allow us to process sludge, whilst generating renewable energy to offset some of our operating costs.

We have sufficient assets to process the sludge now, however we recognise we have a legacy backlog of capital maintenance that has resulted in periods where the asset base hasn't been resilient to current threats. We therefore need to increase our investment, particularly in our digesters to ensure adequate headroom to both cope with threats and provide opportunities in the market.

We aim to be a leader in the bioresources market and use this position to drive value within our plan through greater efficiencies and cost reductions. We operate our bioresource assets as a company-wide system, which means we can flex our haulage operation to meet the current demand using the available headroom across the company. We have included in our plans the need for additional capacity in AMP8 to deal with growth and changing regulations.

2.1.3. Net Negative Carbon

We have made a commitment to be carbon neutral in line with UK government commitments by 2050, however we need to start this journey in AMP8.

By extracting more energy from bioresources activities and reducing process emissions we can significantly contribute to reducing our greenhouse gas footprint.

Sewage sludge is a resource. Our plans will recover more renewable energy from sludge and start to evaluate how we can harness other products that help contribute to the circular economy. Biogas is a significant revenue stream - last year we generated c£42m in renewable energy and plan to do more in the future.

2.1.4. Deliver improvements for the environment

Our bioresource assets generally operate in a compliant manner, however we know there is a significant amount of work needed to ensure compliance with the Industrial Emissions Directive, specifically with regards secondary containment and the covering of open tanks.

Our strategy is to undertake a three phased approach to deliver all aspects of compliance, which ensures appropriate risk assessments are undertaken at each stage, allowing cost beneficial investment and ensuring our customer's money is spent wisely.

- Phase 1 AMP8 will see all 25 Sludge Treatment Centres secure new permits, and we will introduce new operating practices, monitoring, sampling and risk assessments in compliance with the new permits
- Phase 2 AMP9/10 will see the investment in new assets that resolve fugitive emissions that have been identified through the sampling and risk assessments in AMP8, alongside the provision of any secondary containment deemed necessary. Investment will be based on Best Available Techniques. It is possible that we may need to upgrade 108 tanks across our estate and cover our bioresources storage areas. This will put pressure on capacity while these are taken out of service, and hence we believe the investment will need to be spread over a number of years
- Phase 3 considers the results of the investment in phase 2 and if deemed a higher standard is required ('Appropriate Measures'), further investment will be made

As mentioned previously, we have included in our plans the need for additional capacity in AMP8 to deal with increased sludge production as we introduce higher standards of treatment across our STW's, especially to deliver low phosphorous discharges.

In the following sections we consider each of our four strategic outcomes in more detail.

3. Outcome 1: Taking a leadership role to develop a dynamic, effective and open market

Prior to PR19 it was identified that bioresources activities could help to create increased economic and environmental value and the use of markets could drive a step change in performance and a significant cost reduction. Our ambition is to help develop a competitive market for bioresources (sewage sludge alongside the wider organic waste market) and provide greater scrutiny of sludge treatment costs.

3.1. Our intent

We aim to be a market leader in the bioresources market; we want to be recognised as an exemplar organisation in leading the development of the market and exploiting the market for the best outcome for customers. An open and effective market can improve sector cost efficiency, allow suppliers to bring innovation in new technologies, and drive environmental benefits from collaborative working and deliver products that benefit the wider circular economy.

We will work collaboratively with businesses and local authorities to explore opportunities to work collaboratively regarding co-treatment (e.g. co-digestion or co-combustion¹¹), which will allow us to produce more green energy, and in turn offset our demand or be used locally for the benefit of communities.

We will continue to investigate the potential market opportunities to drive innovation, improve efficiency and provide added resilience. In doing so, we will explore new business models to take full advantage of these opportunities, which may result in reviewing the number of STCs we currently have, consolidate where beneficial and expand if there are opportunities to offer services to others.

Ofwat has identified several main areas where the industry needs to take action:

- Encourage greater sector collaboration
- Improve information remedies
- Ensure more joined up, pro-market outcomes

We have identified several areas within the Jacobs Bioresources Market Review where we feel sector collaboration will be key to unlocking markets and bringing the benefits to customers and the environment. Table 3.1 below outlines the actions we are taking to help unlock the potential bioresources market.

¹¹ Subject to satisfactory discussions with the EA to resolve differences in permitting regulations regarding wastewater and other wastes.

Table 3.1: Action taken to unlock Bioresources market

Jacobs Action Reference	Action Description	TWUL Progress
R1	<p>Research into safety of Biosolids</p> <p>The report highlights emerging issues with the recycling of biosolids to land. One being that they could contain contaminants within sewage sludge which may affect human health and the environment including PFAS and microplastics. These issues have caused uncertainty in the Bioresources market and could affect the success of any market if not mitigated.</p>	<p>Thames Water are taking a leading role in several groups looking into the safety of Biosolids including the Chemicals Investigation programme working in collaboration with the EA and other water companies to investigate the substances and potential impacts to the environment from biosolids. As part of the Water UK Biosolids network, we are also looking to resolve the uncertainty around the Farming Rules for Water and have drawn up proposals which aim to answer the EA's concerns. We are also working with the industry to explore alternative routes solutions, including pyrolysis as an option.</p>
R2	<p>Deliver the Environment Agency sludge strategy.</p> <p>The sludge strategy is due to be implemented in 2023.</p>	<p>We are working with the EA and other water companies via the various working groups set up by the EA to discuss proposals. The time frame has slipped and implementation not likely for another 3 years. This links into action R3 Farming Rules for Water (FRfW) uncertainty as any EA based strategy will include their interpretation of FRfW.</p>
R3	<p>Resolve uncertainty around the Farming Rules for Water.</p> <p>Issue around the Farming Rules for Water which aim to manage pollution from agriculture as well as develop good practice agricultural practice and nutrient management and planning.</p>	<p>As part of the Water UK Biosolids network, we are aiming to resolve the uncertainty around the Farming Rules for Water and have drawn up proposals which aim to answer the EA's concerns.</p>
R5	<p>Create joint planning partnerships</p> <p>Lack of synchronisation and joint planning</p>	<p>We have worked with several other water companies regarding trading opportunities both as short term, emergency, and longer-term trades. These allow us to share data on sludge forecasts, capacity data and operational experiences of different technologies. We will also continue to undertake market monitoring and more in-depth analysis of markets to assess viability, this will explore how we could work with other companies on co-location opportunities</p>
R7	<p>Simplify permitting requirements by demonstrating safety and reliability of specific mixed waste streams</p> <p>The report identified how co-digestion is one of the top two opportunities for markets to bring material benefits to the water sector. This involves the comingling of waste streams or feedstocks and treating of them in the same assets providing access to a large amount of potentially high-value feedstock for energy generation.</p>	<p>We are in discussions with the EA to give permission for industry to run trials to demonstrate mixed waste streams are safe to apply to land or otherwise. (See R2)</p>
R12	<p>Change approach to pricing 'headroom' trades</p> <p>Overcharging gate fees (for example during a long-term headroom trade) could suppress market activity, particularly where other costs made the transaction only marginally beneficial.</p>	<p>Currently we accept sludge from Southern Water. Water companies follow different practices depending on their individual compliance and assurance processes (e.g. some require testing at collection and disposal) so at the moment it is difficult for to import/export sludge outside of</p>

Jacobs Action Reference	Action Description	TWUL Progress
		region. There is also the need to have an agreed commercial agreement across all water companies with a streamlined process when assistance is needed. Both of these issues will be worked through in our bioresources strategy and collaboratively across the sector through WaterUK.
R20	<p>Develop sector level measures for sludge quality</p> <p>Sludge is a complex substance and there is no commonly accepted scale on which to measure its quality. We believe this may discourage trading activity because the value of sludge depends on its energy generation potential, the amount of work required to treat it, the ability to process it and potentially its value as a soil improver.</p>	<p>We have started to identify measures including work to improve percentage dry solids (DS%) for both liquid & cake products. As part of our industry leading work on Farming Rules for Water a minimum DS% figure was included as one of the measures to improve infield stability and reduce leaching and potential slumping.</p>

During AMP7, we have undertaken the following engagement activities/initiatives to develop the market, including:

- Continuing our work with universities and equipment suppliers to find innovative solutions to help in resource recovery and Advanced Thermal Conversion (ATC) Research Work
- We have been involved in the Ofwat Innovation fund project with BMA, Anglian Water, Southern Water, Yorkshire Water and Northumbrian Water to build a model to look at trading and investment opportunities across the eastern region. This work is unlikely to assist in AMP8 solutions but may help inform long-term solutions
- We have been actively engaged with the Sludge Working Groups run by Ofwat and Jacobs. These are cross company discussions focused on how the industry can work more collaboratively. Information is shared on current capacity and processing issues, thoughts around how blockers can be overcome and shared information on longer term growth
- We have regular discussions with Anglian, Wessex, Southern and Severn Trent regarding trading opportunities both as short term, emergency, and longer-term trades. These allow us to share data on sludge forecasts, capacity data and operational experiences of different technologies
- We have discussed with technology suppliers about shared investment. For example, our biomethane partner has provided a turnkey solution whereby they have designed, constructed, and now operate a gas to grid plant at Deephams STC

3.2. Market Analysis – Boundary Imports/Exports

We have been assessing market opportunities that we could leverage through an independent study commissioned with Atkins. These opportunities will be developed in the next iteration of our strategy during 2025-2030.

The analysis of industry data share suggests we are in the upper quartile companies in terms of operational unit rate, haulage costs and overall Botex investment. Therefore, it appears sensible to continue to operate our current asset base at this optimal level. We propose to continue

reviewing our comparative position to ensure the investments we are making drive efficiency and maintain a competitive market position.

We have looked at opportunities to trade sludge with neighbouring companies. Approximately 4% of the total raw sludge production across the industry has potential to be traded with other WaSCs as there are closer treatment locations outside incumbent region than within it.

We have looked at options to export over the longer term to our neighbours and a small amount would be viable (1% of the sludge that we transport), with the majority of this export opportunity with Southern Water (69%) and Severn Trent (26%); whilst this would give some marginal benefits around transport cost it relies on those companies having capacity, and following inter-company discussions it doesn't appear viable at the moment.

Conversely there are also short-term import opportunities whereby our analysis has shown that 13,700 tDS/annum is closer to our sludge treatment centres than the incumbent, and hence are commercially viable for import. This could provide a potential income stream where we can maintain sufficient headroom at those treatment centres, whilst providing cost benefits to the incumbent and their customers. Table 3.2 below shows the potential revenue we could gain and the saving the incumbent could achieve through trading at our regional boundaries. These are based on calculated average cost to treat rates from data in the Annual Return Data Share, rather than site specific costs to treat. Our average cost to treat is £303/tDS, therefore we would need to charge a gate fee greater than this to cover the service cost and make some margin to share with our customers. Additionally, the trading company would only do so if the gate fee (as a short-term trade with no charge for capex included) were lower than their current cost to treat. In the example below we have taken this as 80% of that cost. This shows that we could achieve a margin of £2.16m, with the other WaSCs saving £1.58m between them.

Table 3.2 - Potential revenues from sludge trading

WaSC	Cost to treat £/tDS	Potential Sludge Import tDS/a	Gate fee charged £/tDS	TWUL profit on trade (£m)	Exporter saving benefit (£m)
TWU	303	-	-	-	-
AWL	661	8,392	529	1.89	1.11
SWS	395	3,616	316	0.05	0.29
WXW	592	1,215	474	0.21	0.14
SVT	416	486	333	0.01	0.04
TOTAL		13,709		2.16	1.58

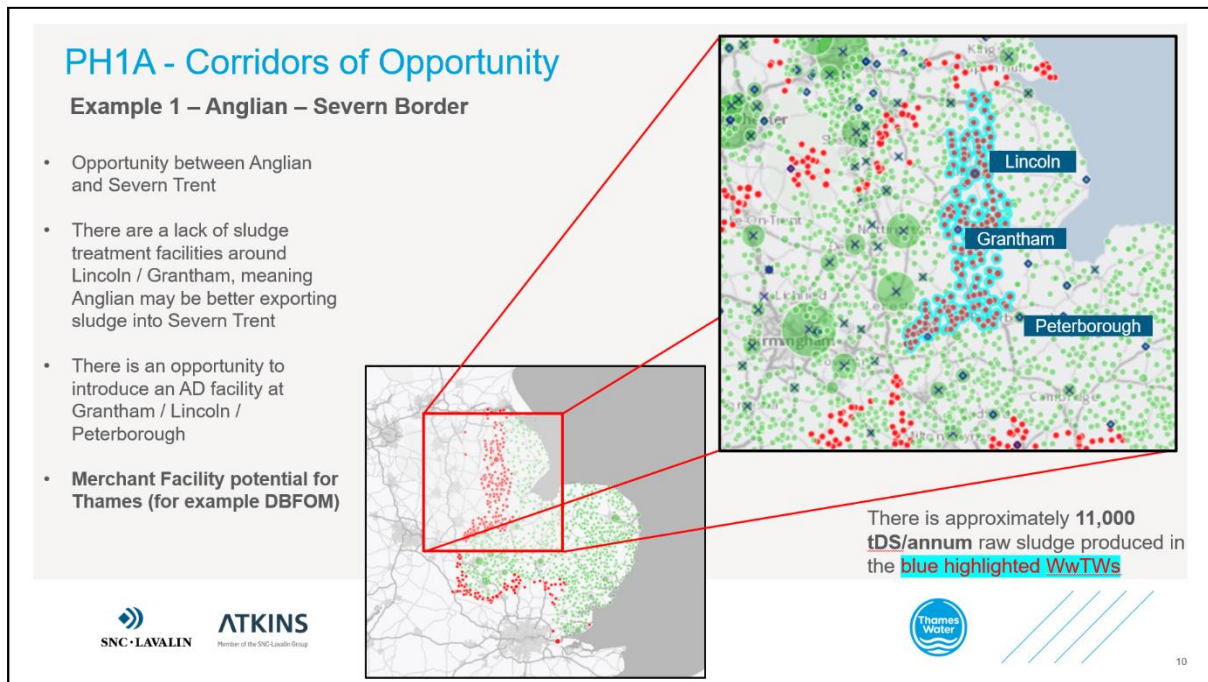
Source: Thames Water, Asset Management Team – Atkins markets assessment

3.3. Market Analysis – Corridors of Opportunity

The market analysis has also identified several opportunities to offer sludge treatment solutions around the UK, where there is a lack of local treatment facilities (i.e., the sludge is hauled significant distances to the current STCs). These 'corridors of opportunity' (see Figure 3.1 below) could be considered for a new sludge treatment facility accepting sludge from several other companies via a gate fee mechanism. This would require new assets within these locations, but that may be more cost efficient than providing new facilities at the more remote existing sites, thereby saving on the capex and haulage costs. It is, however, unlikely that a new entrant would

find this economic compared to the incumbents, unless there was a significant deficiency in capacity.

Figure 3.1: Example 'Corridor of Opportunity' in sludge treatment



Source: Thames Water, Asset Management Team –markets assessment

3.4. Market Analysis – Co-treatment of Wastes

There are potential opportunities for us to offer a treatment service to other organic waste producers due to our expertise in operating digestion facilities; potentially this could be done by utilising any headroom that is available in our system subject to issues around co-treatment and the legislative burden regarding permits being resolved. Or alternatively this could be a co-located operation (if land is available) with some sharing of services and operational and maintenance staff. We have completed a high-level assessment of which of these markets may be practical.

3.4.1. Supermarkets

To date, the supermarket’s strategy has been to reduce food waste by half by 2030. If this is not practicable then the waste food is to be reused as animal feed before recovery technologies such as AD are considered. We have concluded that food waste from supermarkets is a diminishing market.

Table 3.3 - Supermarket food waste analysis

Supermarket (Year)	Total waste (Tonnes)	Quantity of waste for AD/ Energy Recovery (Tonnes)	Partnership for AD
Tesco (2020/2021)	84,124	35,046	Green Generation/ Veolia
Sainsburys (2020/2021)	36,338	26,545	Own facility
Asda (2019)	31,881	28,832	Biogen
Coop (2020)	20,800 approx.	13,000 approx.	Biffa
Aldi	No info	No info	No info

3.4.2. Kerbside food waste

c.17.9% of domestic and non-domestic waste is food waste (validated with known waste data from London Council Area). Of this c60% is assumed as separated, with predictions that this will increase to c90% by end 2023. Over half of London Boroughs have no current contracts or contracts will expire within 5-years. We believe there is a potential market available for co-digestion or co-located AD opportunities mainly around London.

3.4.3. Farm waste

There are 339 farm-fed AD sites across the UK. These are generally widely dispersed, and numbers are limited with the TWUL region (29No), with most located on the farms where the slurries are spread to land. As such there is limited opportunity to offer facilities within our area and the additional haulage costs are likely to be prohibitive to an industry that already operates on tight margins. However, some of these plants are poorly run with several having recently been prosecuted by the EA over pollution issues. Therefore, there is the opportunity to offer a consultancy service or 'Technical Facility Management' to assist in improving their performance, but this would be outside the regulated business activity in what is already a well-supplied market sector.

Further work will be needed to explore the opportunities in more detail and any benefits that may arise from co-treatment of wastes through anaerobic digestion. Further work with regulatory bodies will also be needed to understand and resolve the legal framework regarding the different permitting approaches to different forms of wastes and industries.

3.5. Market Engagement

We are planning on carrying out a market engagement exercise by the end of AMP7 regarding the provision of sludge treatment and disposal activities. We will set out what key activities we need to deliver; what additional capacity we require and where these are needed. This invites potential suppliers and investors to contribute to the exercise and allow us to better understand market capability and appetite and shape any subsequent tenders accordingly.

We will use the Bioresources Bid Assessment Framework to assess how we deliver work including how to use our developing Public Value Framework to further alignment to Ofwat's public value principles.

We will continue to periodically undertake market monitoring and more in-depth analysis of markets to assess viability, this will explore how we could work with other companies on co-location opportunities (e.g. Wessex / Anglian), exploring the 'corridors of opportunity' further and aid us in building relationships with other waste providers. We will publish the results of this exercise to disseminate the information and encourage participation from markets. There is also an opportunity to consider how we might use Open Data to support the facilitation of the market in the short to medium term.

3.6. Market Opportunities

As part of our plans to proactively engage with the development of the market. We are considering where the market could deliver activities more efficiently than our in-house service, such as using short term trading and long-term shared investment (especially around more capacity). In particular markets can bring innovation to the sector, and we will continue to explore these opportunities whether through the Ofwat Innovation Fund or through our own in-house innovation

team. For example, this may involve looking at how co-digestion / co-location of other waste streams could provide added benefits, subject to it being cost effective or as regulations change.

The market may be able to introduce innovative technologies or modes of operation to extract more benefits from sludge (more renewable energy, other products etc.). There is a rapidly growing market in Advanced Thermal Conversion technologies, but these are new and are potentially risky for a water company to adopt at this stage of their maturity, but the market may be willing to accept this level of risk especially if they are the technology developer.

A further area where markets could provide efficiencies and innovation is in relation to our gas to grid projects where we are proposing alternative project funding, ownership and maintenance.

Over the last few years, we have been reviewing the use of external third parties to undertake operational activities, with many of these services previously being provided by the supply chain. In some cases, it has proven beneficial to insource (e.g. liquid sludge haulage, and inter-site cake movements), delivering efficiencies in excess of 30% and providing operational flexibility and resilience which proved invaluable during the HGV driver shortage.

Over the last few years, we have discovered that the markets do not offer all the answers and the balance between those activities a water company undertakes and how the markets support, is nuanced and must be considered on a case-by-case basis.

As such we are looking at appropriate options that are available to us, including six potential market opportunities. Each come with their own advantages and disadvantages which are set out below:

3.6.1. Headroom Trades

Headroom trades involve short-term 'renting' of spare capacity within our or other WASCs existing assets. Some capacity will have been provided to accommodate future growth, which isn't currently needed, but could be used to provide a bridging position. The risk is relatively low to either party as the trade will be short-term, with marginal benefit to both parties in terms of greater efficiency in operations and delayed investment.

We've continued dialogue with neighbouring WaSCs including Anglian Water, Southern Water and Wessex Water to maintain our understanding of their available capacity and need for additional treatment services. Our previous assessments have highlighted some sites around our region where it could be beneficial to trade sludge out of the region and other options where there is theoretical headroom that could allow us to trade in. To date limited trades have taken place when capacity has been available, but these were not under formal trading agreements but rather ad-hoc contingency plans.

3.6.2. Joint capacity

Through discussions with Wessex Water we know there is a shortfall in their capacity around our western borders. We will consider options to consolidate treatment in this region, whereby we could share investment in new capacity to aid both parties. However, we haven't been able to resolve this to date due to the timing of when capacity is required and the potential contractual relationship longer-term. Discussions remain on-going.

3.6.3. Co-treatment

We have identified potential for co-treatment opportunities, especially in London, with food waste collection, however this needs further exploration and development of potential relationships to fully establish the benefits case.

The key blocker to this market developing is the differing regulatory regimes that sewage sludge and food wastes operate under. The Jacobs Bioresources Market Review identified that regulatory restraints are generally caused by uncertainty. It is currently not cost effective to blend these wastes, but we continue to engage with the Environment Agency in developing their Sustainable Sludge Strategy which may address some of these regulatory and hence cost barriers to adoption.

Going forward, we will continue to investigate further any options with other organic waste specialists in or near our operational area.

3.6.4. Co-location with other waste processing

Similar to co-treatment options we have not identified any realistic options thus far. However, we know there are several London boroughs that are evaluating their food waste collection and treatment options and we are ideally suited to offer our expertise in operating digestion plants. Additionally, several of our STCs are situated in or close to these boroughs presenting potential collaboration opportunities could be achieved if suitable land is identified.

3.6.5. Project finance

Where beneficial we will look at alternative funding regimes for large capital investment, this could be through alternative project funding options through either our shareholders or a third-party. This type of investment is likely to be more flexible both in terms of the level and pace of investment/benefits required, but may be less efficient (e.g., higher borrowing rates).

We are exploring alternative project funding options to resolve investment needs at Maple Lodge STC, where the site needs major investment. Third party funding paid back over the life of the asset may be a means to limit short term financing issues but with a potential overall higher whole life cost.

Further work is being undertaken to explore alternative capital investment options, including looking at Direct Procurement for Customers (DPC). DPC is intended to make the process of delivering certain large infrastructure projects more competitive and, in turn more efficient, resulting in better value for customers and more innovative solutions. The suitability of DPC is specifically aimed at large infrastructure projects, such as delivering new, discrete works and while we have not identified any that immediately fit requirements within bioresources in this submission, we will continue to assess as new projects emerge through an established process we devised to use 'DPC by default'.

3.6.6. Outsourcing

Funding options also include the potential for us to lease some (or all) of our STCs to a third-party which would invest in, build, and operate all of the bioresources assets in return for a gate fee over a whole life term. Whilst this option would shift the challenging task of designing a sustainable solution for bioresources to another entity, we would need to understand and account for the reliance on a third party as we would still retain a 'Duty of Care' and legal obligation for waste management. In doing so we need to achieve the right balance between risk transfer and construction / operational costs.

Alternatively, a third party could build a standalone treatment plant similar to the way that the food waste AD industry works, where our sludge / contract would provide the base load portion and the contracted entity then uses the wider market to maximise throughputs. This could lever the benefit from a 'corridor of opportunity' previously identified.

We envisage that our Gas to Grid programme will be delivered through either a DPC type approach or outsourcing engagement.

3.7. Summary

We will monitor, evaluate, and use the market where there is benefit in doing so. The market may be able to provide more efficient investment options, provide services and technology to mitigate risks, or provide additional income streams to offset our costs.

To monitor our performance, we will ensure that we publish our Market Information data in line with Annual Reporting guidelines.

Table 3.4 - Outcome 1 AMP8 Measures

Outcome	Driver	Measures/Indicator
Develop and use markets	Cost efficiency and innovation	Continue to publish market data annually in line with Annual Report rules.

4. Outcome 2: Ensuring our assets deliver a value for money service

4.1. Asset Health - Context

The foundation of our strategy is to ensure the asset base operates as designed. This provides a baseline against which new partnerships and market opportunities may be tested. It also provides a platform for contributing to our carbon delivery reduction strategy and ensuring cost efficient delivery which is reflected in customer bills.

Our assets should be well maintained, with sufficient headroom to meet current and future demands. However, our evolving asset health modelling has revealed we have an 'asset debt' across our bioresources asset base especially associated with our primary and secondary digesters.

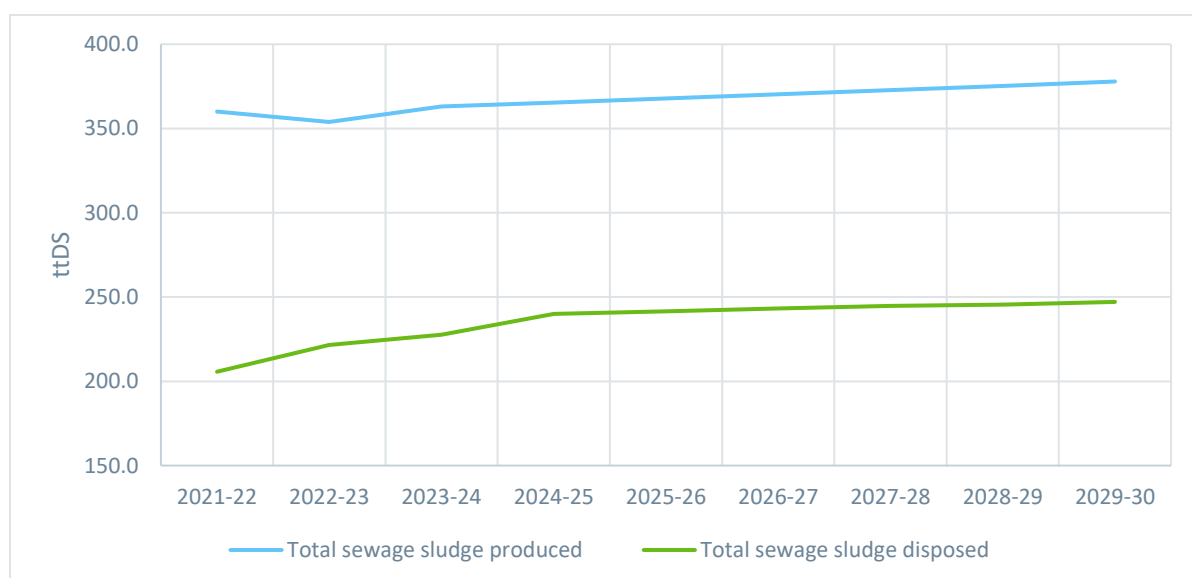
Failure to manage digesters and biogas is our single largest area of asset debt. This is driven by the fact we have 33 digesters which we have been unable to inspect and refurbish, out of our total asset base of 128. Our standard requires that these digesters are physically and structurally inspected every 10 years, however, we are now finding that the digesters need more extensive work during the outage which in turn is causing challenges of taking assets out of service whilst maintaining treatment capacity across the estate. This is a key area of focus, and we expect to invest over £90m on our digesters in AMP8 to address this risk.

4.2. Our long-term ambition

Any assets we have will be working to design, maintained effectively, integrated within a market system and secured for 2100 (i.e. we are on a path that is adaptable to future system stresses). In the short term we need to recover our asset health, but this will not be achieved in AMP8 alone, especially in light of the large investment needed to bring all our sites in line with IED requirements.

Additionally, we need to be aware of the future demand on the system, i.e. how much additional capacity will be needed to manage system-wide population growth (see Figure 4.1), but also from increasing external pressures such as restrictions to current recycling outlets, and ensuring that the system is more resilient to the shocks and stresses that are applied to it.

Figure 4.1: Bioresources volume forecast



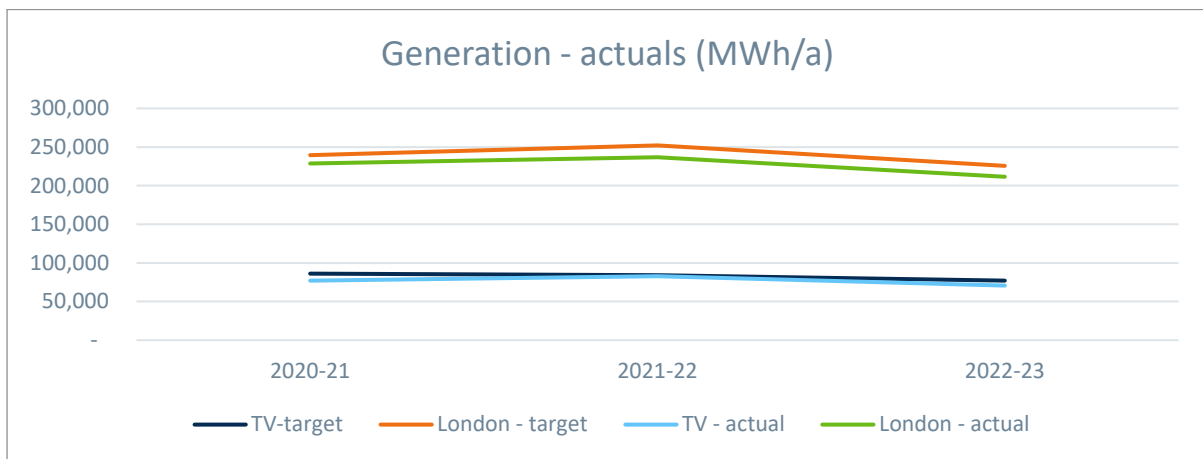
We will increase our resilience to external pressures such as the likely reduction in available agricultural land for recycling, the need to reduce our environmental footprint to help address the climate change crisis and make our processes more efficient to help protect customers from increasing costs. Impacts posed by climate change, such as wetter winters and hotter summers, are also likely to limit our ability to access agricultural land.

4.3. Current performance

Our performance across bioresources has been inconsistent.

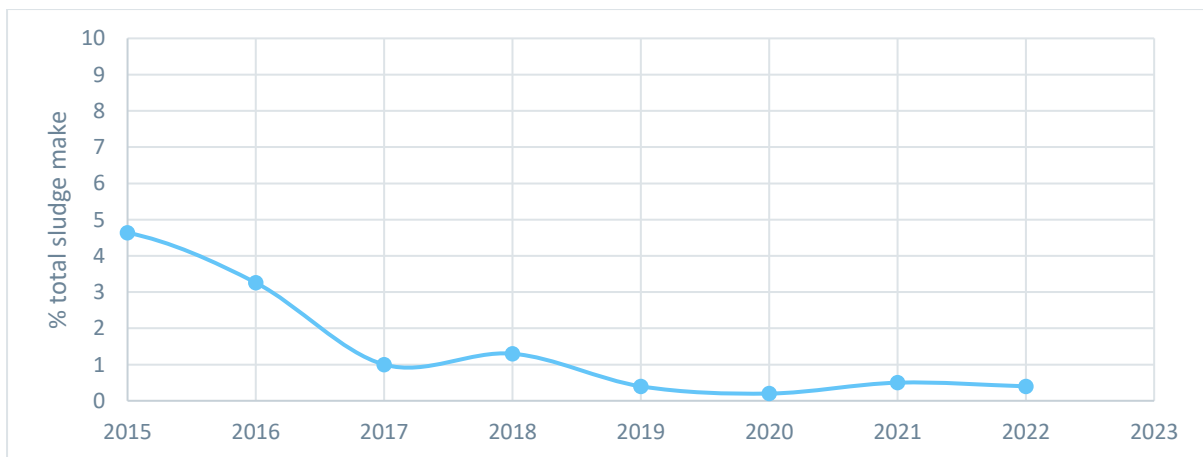
We have not always hit our performance self-generation targets due to plant outage (see Figure 4.2 below which shows that we have been generating approximately 5-10% below target).

Figure 4.2: Graph of CHP energy use over time



We have relied on restoration outlets for some sludge to maintain 100% compliance with BAS (see Figure 4.3). However, this provides a lost opportunity for treatment and gas generation. Whilst the treatment processes at our STC's have continued to produce compliant biosolids that can be recycled to land, a number of asset failures have occurred within the digestion asset cohort (such as leaking roofs, mixing systems and dewatering plant failure), that have put pressure on our ability to maintain this service. As a result of these failures, we have needed to transport untreated sludge greater distances for treatment, continued to rely on restoration outlets and hired in plant resulting in an increase in both opex and carbon footprint.

Figure 4.3: percentage of volume of Bioresources sent to land restoration activities.



We have a backlog in capital maintenance, specifically around our digestion assets, and some large asset replacement needs which we have not been able to progress due to other asset outages. As such several assets are beyond their nominal book life and are operating below optimal efficient (e.g. several CHP engines do not produce as such energy from the biogas as would be expected from a more modern asset). This will start to be addressed in AMP8.

The age and condition of some of our larger assets at our STCs, especially civil assets, have meant that a greater number are 'Out of Service' than planned, leading to reduced treatment capacity. This in turn has resulted in sludge 'events' which has resulted in increased emergency expenditure reducing the opportunity to invest in proactive maintenance plans.

4.4. Activities included within base expenditure

4.4.1. Digester Refurbishment

Our executive-led 'digester and biogas working group' is continuing to identify essential asset cohorts to assist with the prioritisation of investment, so that the highest risk/impact assets/sites can be targeted. The initial focus has been on the re-prioritisation of our 10-year digester inspection programme with a greater focus being put on the risk and consequence of the failures on the overall system.

4.4.2. Improved Outage Planning

We continue to develop our decision support tool to identify the actual treatment capacity at each STC based on planned outages and other impacts. This will allow a more proactive plan of where treatment capacity needs to be secured to allow maintenance and outage planning in other regions. Our sludge DST can assist in understanding system headroom to better assess how the market, via short term trades, could be utilised.

4.4.3. Capital Maintenance

We will recover and maintain the asset health of our existing asset base with a particular focus on digesters in AMP8 as they are essential to throughput capacity. This is a multi-AMP strategy, linked to our market strategy and will continue through to 2050.

We will undertake the key following maintenance activities in AMP8:

- Digester inspection and cleaning programme
- THP and CHP annual inspection and maintenance services
- CHP replacement of end-of-life assets
- Base operation & maintenance tasks (e.g. pump replacement, thickening and dewatering plant maintenance, gas bag replacement)
- Large capital maintenance, such as digester replacement at Swindon, dewatering plant at Aylesbury, Mogden digester roof replacements

We will also improve monitoring within the system to improve our understanding of asset performance including the sub-metering of energy requirements and return liquor quality.

4.5. Activities included within enhancement expenditure

There is no enhancement investment planned in AMP8 to deliver this outcome.

4.6. Summary

In summary we will aim to recover treatment capacity to manage 100% of the demand, restoring nominally 15% system headroom. In turn this will improve generation performance, avoid us having to haul sludge excessive distances or use untreated sludge restoration outlets in normal circumstances and retain this as a tactical option only.

To monitor our performance, we have developed a series of internal key performance indicators outlined below in Table 4.1.

Table 4.1 - Outcome 2 – asset health indicators

Outcome	Driver	
Deliver great customer service and value for money	Asset health	85% of proactive maintenance tasks completed.
		100% of emergency maintenance tasks completed.
		80% of reactive maintenance tasks completed.
		Restore 15% headroom capacity to manage outages.
		90% of planned digester cleans and refurbishments completed.

5. Outcome 3: Achieve our net-negative carbon strategy

5.1. Context

This section should be read in conjunction with TMS49 Our AMP8 Carbon Reduction Strategy & Net Zero Bid.

We, along with the other water companies, have committed to reduce our Operational Greenhouse Gas Emissions. We plan to achieve this in line with UK Government expectations. Our operational activities across both sewage treatment and sludge treatment currently release a combination of carbon dioxide, methane, and nitrous oxide.

By capturing emissions from our bioresources assets, this not only prevents fugitive emissions but also provides the opportunity to generate renewable energy either through CHP engines or gas to grid projects. Bioresources therefore provide the greatest opportunity for renewable energy across our operation.

5.2. Our long-term ambition

By 2050, our ambition is to achieve the targets set out by government to deliver their overall aim of net zero for the UK economy. In practice this means we will be a carbon neutral company with bioresources potentially being net negative.

Our bioresources operation can help contribute to delivering net zero by offsetting many of our carbon emissions through the production of renewable energy, specifically biomethane as this will help to decarbonise the gas network or provide fuel to run our transport fleet.

Currently we can economically and practically recover renewable energy (heat, electricity and biomethane). These are key resources that can be recovered which are essential for meeting circular economy principles and in combating the climate crisis.

Other materials (fibres, biopolymer, metals) can all theoretically be recovered from sewage sludge but may not yet be technically or commercially viable due to low technology readiness levels and market maturity. These are all being developed and can help reduce the need to use natural products or products derived from fossil fuel. We need to be able to leverage benefits as and when the time is right.

In the long term we will maximise the recovery of resources where economically and practically viable, including:

- Maximising biomethane benefits
- Adopting principal treatment processes based on Anaerobic Digestion (AD) technologies, supplemented by Thermal Hydrolysis Processes (THP) where cost effective
- Adoption of new processes to recover other resources as the technology for these mature
- Bolt on technology to AD (e.g., ammonia recovery from return liquors; carbon dioxide (CO₂) recovery from reject gas streams, cellulose from biosolids etc)
- Advanced thermal conversion to recover hydrogen and char derived products

5.3. Activities included within base expenditure

5.3.1. Energy Generation

Utilising our suite of CHP engines across our 25 Sludge treatment centres we will continue to generate in excess of 290GWh/annum of renewable energy from biogas.

As CHP engines come to the end of their useful life, we will either replace through base expenditure, or using Ofwat's new carbon bidding process to secure the additional investment to convert the plants to gas to grid.

We have delivered our first large scale biomethane facility at Deephams STC, which is able to offset up to 9158¹² tCO₂ over what an equivalent CHP could achieve. Work is currently ongoing to install our second plant at Mogden STC.

Further, where we have sites that floating roof digesters during the refurbishment programme identified in Section 4.4, we will replace with fixed roofs allowing for greater capture of biogas.

5.3.2. Waste Heat

We are actively looking to utilise waste heat from our assets and use these to operate our processes more efficiently without relying on fossil fuel imports and also where viable consider how we can help promote district heating systems. By extracting more energy from bioresources activities and reducing process emissions we can contribute to reducing our greenhouse gas footprint.

5.4. Activities included within enhancement expenditure

Progress to our Net Zero Carbon targets through upgrading end of life assets with carbon neutral technology (e.g. digester boilers) and the installation of 7 gas to grid plants are subject to a successful net zero bid. (Refer to TMS49 Our AMP8 Carbon Reduction Strategy & Net Zero Bid).

5.5. Summary

In summary we are committed to delivering the government's targets of net zero by 2050. Our bioresources business is key in achieving this target, as we reconsider sludge as a resource rather than a waste, and recovery both energy and other materials in the long term.

In AMP8 we will focus on generating energy from biogas or providing biomethane into the gas grid and have set ourselves the following generation target.

Table 5.1: Outcome 3 – Energy Generation target

Outcome	Driver	Energy Generated
Achieve our net-negative carbon strategy'	Renewable Energy Production ¹³	290GWh per annum from biogas through the period 2025-2030 (subject to final Gas to Grid proposals)

¹² The actual figure depends on the reporting methodology in a specific year and decision on Renewable Gas Guarantees of Origin (RGGOs) which can change over time.

¹³ Bioresources contribution only, i.e., excluding solar, wind, network heat recovery.

6. Outcome 4: Deliver improvements for the environment [and clean-up of rivers]

6.1. Context

Increasing levels of sewage treatment rely on removing sewage sludge in a timely and effective manner, therefore, to maintain this symbiotic relationship between sewage treatment and sludge treatment capacity, we need to look after our sludge assets.

With the increased production of sludge coupled with aging assets, we need to ensure we deliver improvements that allow us to comply with specific pieces of legislation impacting bioresources and will deliver improved environmental outcomes, including:

- Farming Rules for Water 2018
- Industrial Emissions Directive 2011

6.2. Our long-term ambition

Our ambition is to ensure our bioresource management activities mitigate potential risks posed due to fugitive emissions to atmosphere and from the potential risk of diffuse pollution to land and water both from our STC assets and our recycling to agricultural land activities. In practice this means we will not cause any pollution from our sites and ensure they are fully compliant with all environmental regulations and permits, as such we will provide great environmental stewardship.

6.3. Environmental stewardship

6.3.1. Farming Rules for Water

Currently (in 2022-23) we recover the majority of our sludge as treated biosolids to agriculture (84.5%), additionally we have sent 0.5% of untreated sludge to land restoration activities with the remaining 15% incinerated with energy recovery at our sludge powered generator at Beckton.

We will continue to utilise biosolids as a nutrient rich fertiliser for use on farmers' fields and adhere to the Farming Rules for Water (FRfW) whilst addressing the Environment Agency's (EA) diffuse pollution concerns. We will do so by improving the product quality of our biosolids and ensuring its correct application to agricultural land through continued compliance to the industry's Biosolids Assurance Scheme (BAS).

In doing so, we will maximise the recovery of resources by economically and practically recycling our biosolids to agricultural land. Recycling sludge to land remains important as biosolids are a cost-effective fertiliser that helps keep farming costs manageable whilst also adding essential organic matter back to the land.

We do though recognise that the 'Farming Rules for Water' has led to an increase in the landbank required to maintain the application of biosolids in agriculture. Furthermore, understandably there is continuing uncertainty relating to future regulation of contaminants such as microplastics. To ensure long-term resilience for our biosolids management, we will look to diversify our treatment and disposal options. We will do so partially by recovering more products (e.g., bespoke fertiliser pellets) resulting in less material to go to land, but also by looking at alternative outlets such as advanced thermal conversion or using biosolids as a feedstock for other outlets (e.g. fuels for industrial applications).

6.3.2. Industrial Emissions Directive

We are currently awaiting the determination and issue of Environmental Permits from the Environment Agency (EA) following the submission of 25 applications for our anaerobic digestion activities of sewage sludge under the Industrial Emissions Directive (IED).

The scope and scale of the investment required to comply with these permit conditions is subject to an Enhancement Case. Refer to Technical Appendix TMS29 Enhancement Case: IED.

The transposition of the IED regulations under the Environmental Permitting Regulations (EPR) and the delay in clarification of permit requirements has resulted in us not being able to achieve the required permit compliant status by the original deadline of December 2024.

We are though, targeting to have all sites requiring permits to have them 'duly made' by the December '24 deadline, with any permit improvement conditions requiring capital investment, being identified through monitoring and risk assessments. We have made the planning assumption that the required monitoring and risk assessments will take place during the remainder of AMP7 and AMP8, with any capital investment post 2030. We continue to work with the EA regarding this phased approach.

During AMP8 we will deliver all operational requirements outlined in the permits, including:

- Installation of flow meters and sampling points at all 25 STC's to meet the requirements of the return liquor monitoring standard
- Improving our waste acceptance procedures
- Sampling of return liquors and waste imports
- Undertaking monitoring of bioaerosols and emissions
- Risk assessments to understand the scale of emissions or risk due to loss of containment and identification of appropriate investment for delivery in AMP9

6.3.3. Summary

We are committed to ensuring our investment in bioresources delivers environmental benefits as well as delivering a value for money service that takes advantage of the emerging market.

In AMP8 we will focus on the delivery of our first phase of investment to ensure compliance with the Industrial Emissions Directive and continue to achieve 100% compliance with the EA's Satisfactory Sludge Disposal measure and the third party accredited Biosolids Assurance Scheme.

Table 6.1: Outcome 4 – Delivery of environmental improvements

Outcome	Driver	Measure/Indicator
Lead the improvement of the environment	Environmental stewardship	100% of IED Permits duly made (note that permits will need to be updated/modified as AMP8 interventions are undertaken)
		100% Biosolids Assurance Scheme (BAS) compliance.
		100% compliance with 'Satisfactory Sludge disposal' metric in the Environment Agency Environmental Performance Assessment



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