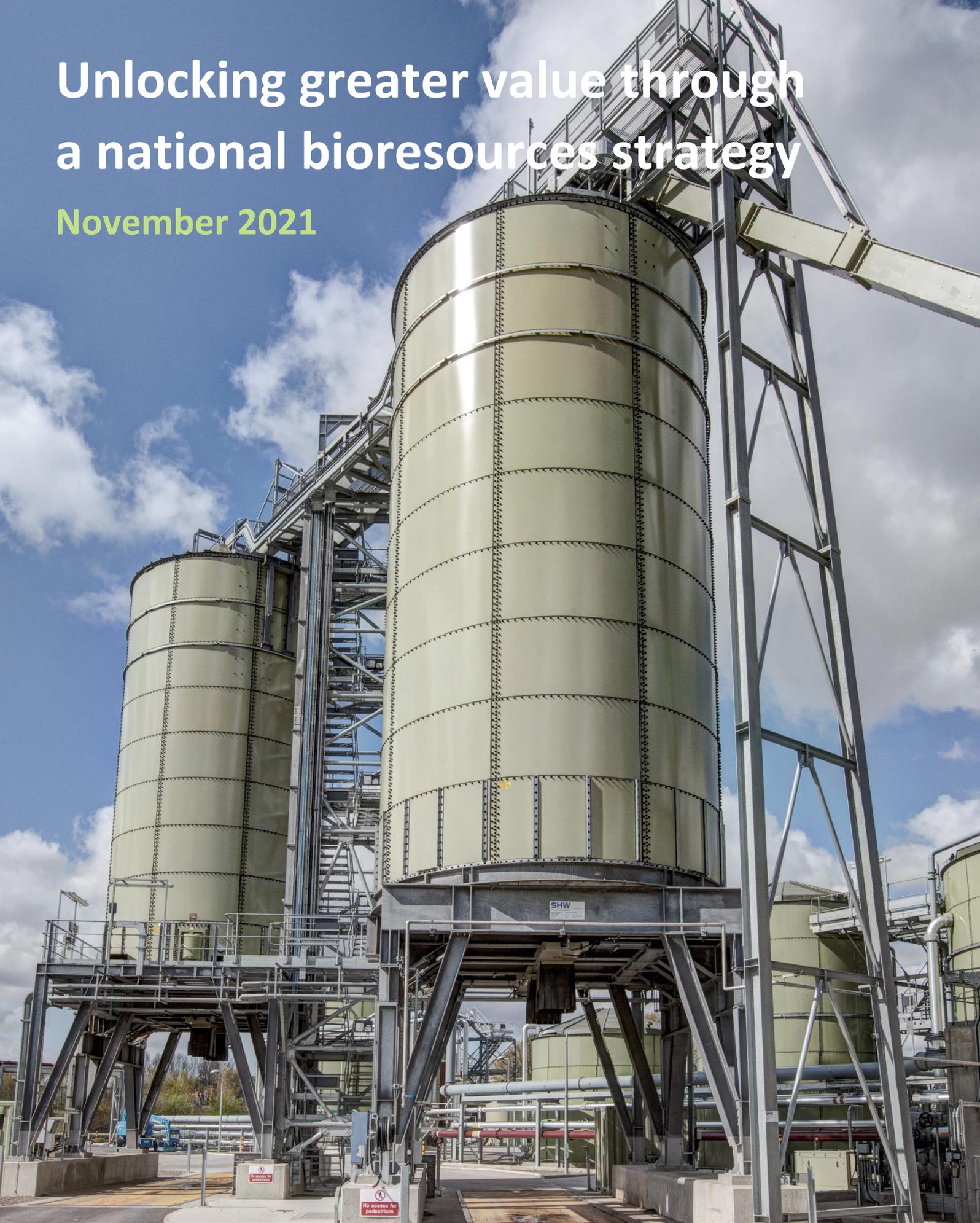


Unlocking greater value through a national bioresources strategy

November 2021



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Executive Summary

The bioresources industry needs to enter an unprecedented period of change, in order to respond to regulatory reforms driven by environmental concerns and economic drivers. However, the degree of uncertainty about the timing, coordination and impact of reforms means that, rather than being able to deliver changes to bioresources management in the short, medium and longer term, there is a risk that the industry becomes stuck in a state of inertia. We believe that the sector has reached a critical point and it is clear that greater understanding and consensus over the future direction of the sector is required.

Unless the industry, regulators and other key stakeholders come together to make conscious and congruent decisions about the direction of travel we risk inaction or - perhaps worse still - short term decision making leading to poorer environmental and customer outcomes. This not only has cost, quality and service implications but also risks harm to the future potential of the nascent competitive bioresources market.

The current approach to implementing change is through individual regulatory actions to deliver specific improvements. For example, the Industrial Emissions Directive (IED) impacts upon sludge treatment sites, whilst Farming Rules for Water (FRfW) and the EA Sludge strategy both separately impact the recycling of biosolids to agriculture. Whilst each individual change may lead to some environmental improvements, the approach is failing to look at the holistic environment, consider wider outcomes or understand the interdependencies between changes in environmental regulation. This approach is less of a problem when changes do not lead to significant investment requirements. However, some of the recent regulatory decisions (e.g. IED and FRfW) have not only led to the need for significant investment but also risk altering the whole delivery model for bioresources services (e.g. away from anaerobic digestion, towards incineration).

Uncertainty over the best end to end, long-term solution for managing sludge also impacts the development of a competitive bioresources market by deterring market entrants from having the confidence to make long-term investment in the delivery of future bioresources capacity. Although unintended, the recent changes will lead to inertia, preventing the water industry from being able to develop long-term asset plans and it is progressively undermining the sustainability of the sector.

Conversely, if there was greater long-term certainty, sludge treatment and recycling has the potential to support delivery of national priority outcomes including sustainable agriculture, a circular economy, net zero carbon and lower costs for customers.

As a major provider of bioresources services, we believe that unless the current degree of uncertainty is reduced there is a significant risk that:

- the industry will no longer be able to reach net zero carbon by 2030;
- confidence in recycling biosolids to land may be irrevocably undermined;
- there is a higher risk of inefficiency due to abortive investment; and
- a competitive bioresources market will not develop to its potential, reducing opportunities for customers to benefit from more efficient outcomes.

As a significant amount of the uncertainty arises from external requirements being placed on the sector, we are calling on regulators, DEFRA, Ofwat and the EA, as well as other key stakeholders in the bioresources sector, to come together and co-develop a workable vision for the sector which existing operators and future entrants can work towards implementing. This will need us all to embrace systems thinking and take a broad perspective across the entire sludge treatment system and wider environmental system. By using such an approach we can find solutions that deliver balanced and holistic environmental outcomes, at an affordable cost to society.

We believe there is a compelling need for the development of a national long-term bioresources strategy and this is required quickly, well ahead of the next price review (PR24). We set out our proposal for development of a holistic bioresources strategy and we identify three core principles to support its development:

- A long-term coherent vision with clear environmental outcomes and greater regulatory certainty
- Alignment of long-term environmental regulation and economic incentives
- Development of a collaborative research and innovation pathway

A long-term vision will support greater certainty in the best solutions for delivering bioresources services. This vision should also be accompanied by an appropriate transition plan, which encompasses reasonable expectations on the sector in moving to this new long-term vision, and will also enable effective planning for how this will support increased competition for the delivery of bioresources services.

In this paper we present a series of recommendations for changes in the sector to support the delivery of these three key principles and an overall sector strategy. With these elements in place it will enable water companies to deliver an adaptive asset plan to 2050 and ensure that PR24 plans are developed in the context of delivering long-term outcomes.

We are also outlining an indicative programme of activity to guide the sector through developing and delivering a long-term strategy. We have proposed that to instigate the work we use CIWEM, as an independent body, to coordinate and manage the development of a long-term strategy. This builds upon work we are leading through a joint Water UK and EA Bioresources Strategy Task and Finish Group and we believe that this work will go a long way towards delivering the outcomes set out in this paper. We encourage all stakeholders to participate in this work and support the delivery of a successful project outcome.

By acting together there is an opportunity to make a significant difference to the long-term sustainability of the bioresources sector and the wider outcomes that can be delivered.

We therefore ask that Defra, EA, Ofwat, water industry and other key stakeholders come together to set out the programme to develop this strategy and agree an action plan to ensure we realise the opportunities we have to deliver continual long-term value from bioresources. We hope that this paper provides a positive contribution towards delivering a sustainable and progressive future approach for a sector which provides essential services to customers and the environment. We welcome responses to this paper and anticipate the prospect of a productive discussion about the future of bioresources management.

For more information, or to take the discussion further, the UU Bioresources team can be contacted at UUBioresource@uuplc.co.uk.

1 Introduction

1.1 Background to bioresources management

Bioresources is the business of managing sewage sludge, which is an important national, renewable resource produced as a by-product from wastewater treatment. Typically within the UK, sludge is treated using anaerobic digestion, and the resulting biosolids are mostly recycled to agricultural land. This process has many significant environmental and economic benefits; anaerobic digestion creates the opportunity to generate renewable electricity or green gas; and biosolids applied to land are a valuable source of nitrogen and phosphorus, as well as other plant nutrients and organic matter, which can provide long-term benefits to soil structure and fertility.

The recycling of biosolids to land is recognised as being the best practicable environmental option by the European Union and UK Government in most circumstances (ABL, 2021). According to Assured Biosolids Limited, in the UK:

- 87% of biosolids are recycled to agriculture, with the remainder used in land restoration or incineration
- Recycling to land provides more than £25m of nutrient value to agriculture
- Biosolids is applied to about 1.3% of the UK's agricultural land per annum
- Gas from biosolids production in the UK supplies about 200,000 homes with renewable electricity

The past decade has seen attitudes to bioresources management shifting. It is no longer perceived as a waste disposal problem, but rather there is a growing recognition of sludge as a commodity, from which there is potential to recover valuable energy and nutrients. The water industry has increasingly invested in advanced anaerobic digestion to recover greater quantities of renewable energy, whilst also producing a higher quality biosolids product to recycle to agriculture and ensure that the value recovered is maximised.

1.2 A changing regulatory landscape

Against a backdrop of increasing challenges from climate change, environmental standards, market competition, sludge production and emerging risks posed by novel chemicals, we and the rest of the water industry, accept the need to continue to improve performance and we support regulatory change to protect and enhance the environment. The following regulatory changes are currently being implemented within the bioresources sector:

- **Industrial Emissions Directive (IED):** Biological treatment of waste (including sludge digestion) to be regulated under IED. Requirements will lead to new environmental control obligations which are determined by site specific permitting. Water companies have agreed a rolling permitting schedule running to August 2022 to establish these requirements.
- **EA Sludge Strategy:** Sets out a proposal for a fundamental change in sludge regulation to bring biosolids to land activity into the Environmental Permitting Regulations and revoke the Sludge Use in Agriculture Regulations. Proposed implementation date of 2023.
- **Farming Rules for Water (FRfW) Rule 1:** Changes to application of organic materials to land (including biosolids) to mitigate the risk of agricultural diffuse pollution. This particularly restricts biosolids applications in autumn to arable crops, from autumn 2021.

The implementation of these regulatory changes is having a significant and immediate impact on the current industry approach to delivering bioresources services. Taken in isolation the true impact of these changes is not immediately evident, but when the cumulative impact of all these changes is considered, and in combination with the ambition to develop a contestable bioresources market, it has become clear that the industry is at a critical juncture.

The unintended consequence of disparate environmental and economic regulatory changes is that it results in significant uncertainty over the management of sludge in the short, medium and longer term. The future direction of the sector, along with any future regulatory changes, are not known, and furthermore the changes are being imposed on the sector without sufficient consideration of the practicability, affordability,

interdependencies or impacts on wider environmental outcomes. The resulting uncertainty will likely lead to inertia in the short term.

The consequences of inertia in the sector include:

- **Underinvestment:** Lack of long-term certainty means that companies can't confidently develop long-term asset plans, likely resulting in underinvestment, hindering the ability of the sector to meet wider outcomes such as carbon net zero.
- **Limited competition:** New entrants to the bioresources market also won't be able to invest with confidence due to a lack of long-term certainty, hindering the development of a competitive market.
- **Inefficiency:** Successive changes in environment regulation, compounded by short timescales for implementation separate to economic regulatory cycles, leads to inefficient timing of delivery of new investment and missed opportunities to deliver greater value to customers and society over the long term.

In our view, the imposition of successive regulatory changes is occurring in the absence of a holistic bioresources strategy. We recommend a new approach to change, embracing systems thinking principles, whereby we all consider sludge as part of the wider, dynamic environmental system and the end-to-end wastewater treatment process. Where transformational change for the sector is endorsed by stakeholders and enabled through collaborative planning between environmental and economic regulators and companies. This will enable water companies and future market entrants to consider bioresources more fully, recognise interdependencies and deliver the greatest value.

1.3 Purpose and structure of this paper

This paper serves as a collective call to action for the industry, regulators and other key stakeholders to come together and ensure a positive future for bioresources, maximising the value it can deliver.

The paper is structured to simplify a complex topic and provide explanations of key subjects that warrant further discussion. The challenges and opportunities facing the sector are brought to life through several case studies.

- **Section 2 - Key organisations with an interest in developing a national bioresources strategy**
Details the key objectives of organisations fundamental to developing a national bioresources strategy.
- **Section 3 - Key outcomes for bioresources management**
Outlines the potential of the bioresources sector to deliver multiple benefits and support the delivery of priority national outcomes.
- **Section 4 - Problems with the current approach to regulatory change**
Highlights some of the significant barriers for water companies in developing long-term asset plans to support the delivery of efficient investment and long-term customer and environmental outcomes.
- **Section 5 - Unlocking greater value through a national bioresources strategy**
Sets out a proposal and indicative timeline of activity for the development of a holistic, national bioresources strategy, and identifies three core principles that we believe should underpin this strategy.
- **Section 6 – Conclusions**
A summary of the key conclusions that can be drawn from the review.

2 Key organisations with an interest in developing a national bioresources strategy

Multiple organisations have a role to play in enabling water companies to deliver greater value for customers for every pound of bioresources expenditure. Table 1 sets out the most pertinent drivers of the organisations involved, many of which are complementary. This table illustrates significant alignment of objectives with a focus on delivery of long-term outcomes, moving towards a circular economy, a net zero carbon future and the use of markets to deliver services where they offer innovative and efficient solutions.

Table 1 Drivers for each organisation with a key role in bioresources strategy development

Organisation	Key drivers with respect to bioresources
DEFRA	<p>DEFRA's 25 year Environment Plan sets out to leave our environment in a better state than we found it. Of particular relevance to bioresources is:</p> <ol style="list-style-type: none"> 1. the goal to use resources from nature more sustainably and efficiently 2. mitigating and adapting to climate change 3. minimising waste 4. using and managing land sustainably <p>The plan states; <i>"we will make sure that resources are used more efficiently and kept in use for longer to minimise waste and reduce its environmental impacts by promoting reuse, remanufacturing and recycling"</i>.</p> <p>The government's strategic policy statement for Ofwat (draft for consultation, July 2021) expects that Ofwat should:</p> <ul style="list-style-type: none"> • <i>Further promote the bioresources market.</i> • <i>Set clear expectations that water and sewerage companies should also take a leadership role to enable the market to deliver its full potential.</i>
Environment Agency (EA)	<p>The EA sludge strategy (2020) has a purpose to enable safe and sustainable sludge use on land. It refers to the DEFRA 25 year Environment Plan and sets out the following objectives:</p> <ol style="list-style-type: none"> 1. <i>Our investment choices deliver 75% of water at good status, and land and soil that is healthy and productive.</i> 2. <i>We have a priority to enable water companies to meet their environmental obligations through clear guidance and partnership working, assuring delivery and taking action when required.</i> <p>The EA WISER (2021) identifies the need to plan long term to deliver ambitious performance and urgently respond to the climate and biodiversity crisis, and states: <i>"Focusing on the key issues for PR24 alone will not be enough to deliver the step change in the water environment we require. This is especially important at a time when climate is more volatile. This means water companies need to consider a longer-term approach and vision"</i>.</p>
Ofwat	<p>The 2021 Review of the Bioresources Market consultation states, <i>with the right conditions, a market for bioresources will help the sector to meet its potential to create economic and environmental value by enabling and incentivising:</i></p> <ol style="list-style-type: none"> 1. <i>technological changes making treatment more cost effective and enabling greater generation of renewable energy;</i> 2. <i>economies of scale;</i> 3. <i>inter-company optimisation – such as through trading or development of joint capacity; and</i> 4. <i>co-digestion of sludge with other organic waste.</i> <p><i>Achieving this potential will play an important part in meeting the UK and Welsh governments' ambition of net zero emissions by 2050.</i></p>
Climate Change Committee (CCC)	<p>With regard to the net zero challenge the CCC sixth carbon budget warns; <i>"the utmost focus is required from government over the next ten years. If policy is not scaled up across every sector; if business is not encouraged to invest; if the people of the UK are not engaged in this challenge - the UK will not deliver net zero by 2050. The 2020s must be the decisive decade of progress and action"</i>.</p> <p>Specifically in relation to bioresources it further states: <i>"Process methane and nitrous oxide emissions from wastewater treatment are hard to mitigate. A combination of enhanced monitoring, operational measures and continued roll-out of advanced anaerobic digestion leads to a 21% improvement by 2030"</i>.</p>
Water companies	<p>Water UK discussion paper, 'Developing a 2050 vision for the water sector' states that to get the best value for money we need to work together on policy and regulatory changes:</p> <ol style="list-style-type: none"> 1. <i>We will develop better long-term plans to guide investment decisions. But we will be faced with difficult trade-offs that need to be assessed in the context of clear overarching policy and reflecting a long-term approach.</i> 2. <i>Clear guidance on overarching policy goals and focusing on outcomes and value over the long term will ensure that market mechanisms are used in the most appropriate way</i> <p>United Utilities' Review of options for further market participation in bioresources (2020) promoted further market participation in bioresources and identified the potential to promote competition, protect customers and encourage innovative delivery of bioresources.</p>

Whilst water companies are committed to protecting and enhancing the environment, and delivering efficient, high quality services to customers, it is apparent that companies are only one stakeholder, and are very dependent on the decisions and policies implemented by the other stakeholders highlighted above. We need to work together to manage the dependencies and unlock the potential value of bioresources, and to avoid undue harm that may arise from any individual decision being made independently by any of those stakeholders, including water companies.

3 Key outcomes for bioresources management

3.1 Environmental outcomes

The safe treatment and recycling of sludge is a critical part of our service to customers and the environment. With longer term certainty, the bioresources industry has the potential to support delivery of priority environmental outcomes including:

- Sustainable agriculture and soil health
- A circular economy
- Roadmap to net zero carbon
- Energy resilience

The technology choice to treat and recycle sludge has a significant impact on the environmental outcomes which can be achieved. It should be recognised that these outcomes will not be delivered without concerted and congruent focus, and we should agree on a workable vision for the future and the conscious outcomes we are working towards, to enable the full potential of the sector to be realised.

In achieving these outcomes, we must also balance the opportunities against any risks associated with sludge. Whilst biosolids recycling is carefully controlled through the Biosolids Assurance Scheme (BAS) to ensure risks are managed through best practice activities, it is becoming increasingly apparent that there are significant, emerging challenges. Diffuse agricultural pollution causes 40% of our rivers and groundwaters to fall short of required standards (EA, 2020). There are also a number of emerging issues such as microplastics or PFAS¹ content of biosolids for which further research is required.

Presented in Figure 1 is a summary of the main drivers acting on water companies in developing their management strategies. These risks and benefits are complex and often competing. There is currently no

management route which will remove all risk of harm.

There is a need for a systems thinking approach which considers sludge as part of the wider, dynamic environmental system and the end-to-end wastewater treatment process. Only through recognising any interdependencies and the full scope of bioresources, can the greatest value be delivered.

We call for a national debate to agree on how these risks and benefits should be balanced and prioritised to deliver the optimal overall outcomes.

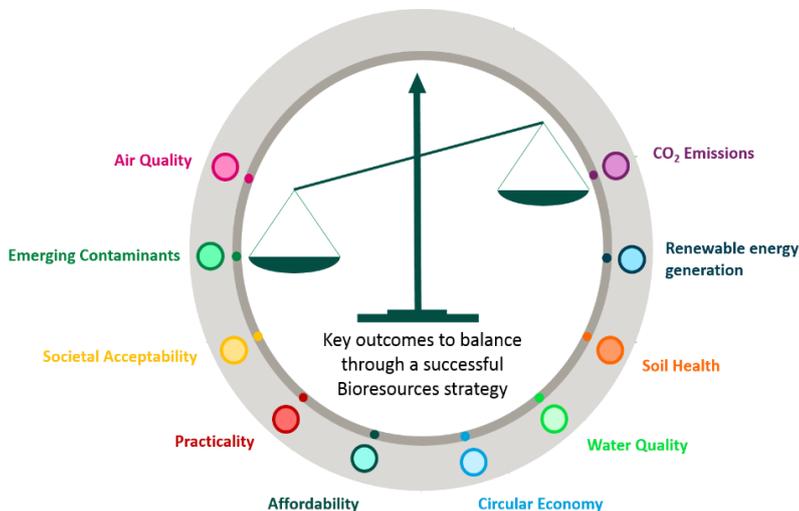


Figure 1. Key outcomes to balance in delivery of a successful bioresources strategy

To illustrate the need for a systems thinking approach we highlight in Case Study 1 the implementation of Farming Rules for Water (FRfW). Whilst having clear purpose to limit agricultural diffuse pollution, implementation is not giving sufficient consideration to wider factors such as air quality outcomes, carbon emissions, practicality or affordability. We highlight that the speed of implementation, combined with a sole focus on water quality benefits, risks leading (unintentionally) to the impossibility of immediately achieving compliance, and poorer overall environmental outcomes.

¹ Poly- and perfluoroalkyl substances (PFAS) are a class of synthetic organofluorine chemicals used widely as surfactants and stain repellents for their properties to resist chemical attack and withstand high temperatures.

Case study 1: Farming Rules for Water

We recognise the necessity to minimise diffuse agricultural pollution; however, this is one of many considerations in deciding how best to manage sludge. In August 2021, the EA issued a Regulatory Position Statement (RPS) 252 which sets numerous safeguards to land spreading of organic manures, the cumulative impact of which mean that few farmers or water companies can satisfy the requirements.

The position set out in the RPS is not shared by the water industry, and companies have shared scientific evidence about the unintended consequences this may actually increase pollution. Advice to the water industry from independent technical consultants closely mirrors work by the Agriculture and Horticulture Development Board (AHDB): Pursuing nitrate savings (which the AHDB suggests are as low as 1.5%) comes at the likely cost of an increase in phosphorus losses of 2% and increased ammonia emissions of 5%.

The RPS has constrained the practical use of biosolids so significantly that biosolids recycling to agriculture is no longer a sustainable or a resilient outlet, with the water industry having no outlet for between 70% - 100% of its biosolids production with immediate effect. There is no alternative outlet for this quantity of bioresources in the short or even medium term. Whilst the industry is committed to transitioning to alternative outlets or treatment technologies, as appropriate, an outlet such as incineration, would require an extended lead time of approximately eight to ten years, upfront capital investment for the sector estimated as being at least £1bn, with £55-£77m increase in ongoing annual operational expenditure. This will have an impact on the bill paying customers and the ability of the industry to achieve wider environmental outcomes.

Working together to agree on the outcomes we are seeking, and to develop an efficient, affordable, practical and expedient industry transition should be our collective focus moving forwards.

3.2 Developing a competitive bioresources market

We believe that in the right conditions market forces could help to create greater economic and environmental value within the provision of bioresources (United Utilities, 2020). However, it is recognised that environmental regulatory changes are having significant implications for the economic regulation and successful development of the bioresources market. Jacobs highlighted this in their 2021, Review of the Bioresources Market:

“the uncertainty created by regulatory change is making longer term investment decisions significantly more difficult and the implementation approach associated with environmental regulations has the potential to create immediate operational resilience issues, higher costs and unintentionally worse environmental outcomes”.

The uncertainty impacting upon bioresources is not limited to environmental regulatory changes. Bioresources has a part to play in national energy resilience. However, with the future of energy incentives and policy unclear this introduces further difficulty into making long-term investment decisions.

We are currently engaged in trying to determine how best to efficiently deliver, utilising market forces in the northern part of our area, to meet our treatment needs (further detail is provided in Case Study 2). The challenges we are experiencing in relation to this activity support the conclusion that a failure to address the wider barriers to the bioresources market will very likely lead to further disappointment as to the impact of market forces on bioresources. The current regulations and uncertainty reduce the potential for investment from third parties in developing new bioresources capacity. Anyone providing a market solution to bioresources treatment would have to account for these unknown costs within any bid. Alternatively the risks, and therefore potential costs, could sit with the incumbent water company or customers, but the very significant uncertainty about key regulatory requirements acts to impede our scope to plan and deliver efficient investments.

There is a need for collaboration between the EA and Ofwat, otherwise the aspirations of either organisation will not be achieved. The aims set out in the Ofwat Strategic Policy Statement (DEFRA, 2021) are to encourage markets to drive innovation, efficiencies, and promote longer term sustainable investment across the sector. A competitive market will fail and these outcomes will not be achieved, until we have longer term certainty in the

environmental regulatory framework, in a way that supports long-term investment in the sector, including entry from competitive providers.

Case study 2: Development of a 'northern hub' using the bioresources market

Through the development of our regional asset plan and long-term adaptive asset strategy we identified an opportunity to rationalise sites and look to build new sludge treatment capacity in the north of our region. This allows us to align investment drivers to invest efficiently to meet long-term outcomes: maintenance needs, IED compliance needs, population growth and increased sludge production, increase renewable energy production and reduce carbon emissions. Furthermore, potential alignment with biological phosphorus removal at Blackburn wastewater treatment works creates a potential phosphorus resource recovery opportunity.

To further explore the opportunity through use of market solutions we issued a Prior Information Notice (PIN) to market in 2020, for interest in solutions for sludge treatment upwards of 30,000 tDS/year (over 15% of United Utilities' regional treatment capacity).

Through attempting to procure this solution we have identified multiple challenges to using market solutions which we believe will ultimately lead to the failure of a successful competitive bioresources market to emerge. In seeking to find a long-term solution and develop a long-term contract (+20 years), uncertainty over long-term outcomes and the changing regulatory picture is evident. Anyone providing a market solution to bioresources treatment would have to account for these unknown costs within any bid. Alternatively the risks, and therefore potential costs, could sit with the incumbent water company, but the very significant uncertainty about key regulatory requirements acts to impede our scope to plan and deliver efficient investments. One option is that United Utilities retain the biosolids recycling risk by focussing the procurement purely on treatment but this risks creating an inefficient solution if future regulation drives us down the destruction technology route which wouldn't necessarily be the best option alongside a new advanced anaerobic digestion facility.

The current RPS252 enforcement position of the FRfW Rule 1 would remove much of the agricultural land as a biosolids recycling route. This would cause very significant cost increases and require an alternative disposal route to be found. Any third party taking on responsibility for disposal will need to factor this into consideration and this may well be a risk beyond anything they would be willing to accept. This leaves third parties unable to commit to providing a disposal service and incumbents unable to rely on third parties for robust service provision.

The result of this attempt to stimulate development through use of the Bioresources market is inertia. Progress in the development of a northern hub is halting, until clarity around long-term direction and regulations and asset base to meet those outcomes is reached. In the meantime this will lead to increased maintenance costs and missed opportunities to produce an enhanced biosolids product, increase green gas recovery and reduce our carbon emissions.

4 Problems with the current approach to regulatory change

a) Uncoordinated and piecemeal regulatory change

The bioresources industry needs to enter an unprecedented period of change, in order to respond to regulatory reforms driven by environmental concerns and economic drivers. However, the piecemeal approach to imposing very significant regulatory changes is undermining the ability of the industry to deliver efficient long-term investment and risks unintended consequences. A trajectory of many small changes, failing to look at the holistic environmental risks, is progressively undermining the sustainability of the sector.

There is an opportunity for greater cross sector collaboration as the regulation of bioresources lies at the centre of waste, water and agricultural regulations, and is further key to supporting energy and carbon policy outcomes. As illustrated by Figure 2, without close working between sectors, bioresources risks falling between the gaps driven by regulatory changes: Each regulatory change will impact upon bioresources, but not being the main driver for change, the impacts on bioresources management may not be specifically considered.

Single oversight of these regulatory changes, adopting a systems thinking approach, to develop a clear and workable vision of what is the best practicable environmental option would provide a framework to look at the holistic environmental and economic impacts of regulatory change.

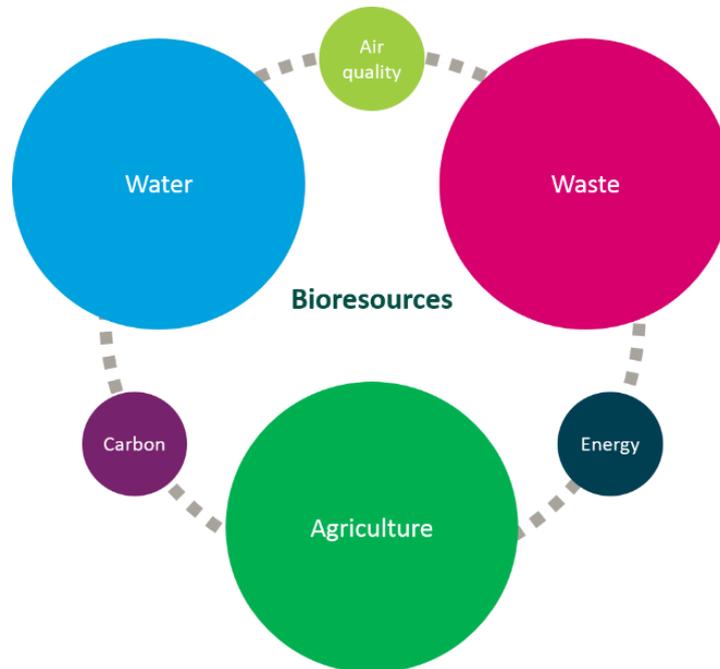


Figure 2. Environmental regulatory framework around bioresources

b) Short timescales to plan and deliver regulatory change

The timing of regulatory changes is currently misaligned, both with each other, and water industry price review cycles, limiting the industry's ability to create and deliver the most efficient long-term plans.

The current timescales for IED implementation are driving us, and other water companies, to lock in investment at aging anaerobic digestion sites in order to meet the short timescales for permit compliance. Furthermore, the current RPS252 enforcement position of the FRfW Rule 1 potentially alters the whole delivery model for bioresources services away from anaerobic digestion, and towards incineration. As such, short-term investment to meet IED or FRfW compliance, given uncertainty over the best end to end, long-term solution for managing sludge, risks inefficient and potentially abortive spend in the order of tens of millions of pounds. If the timescales for IED implementation and RPS252 compliance were aligned with other regulatory, customer or economic drivers, it would enable the industry to deliver the most efficient long-term plans and provide the opportunity for innovation in the sector.

In Case Study 3 we highlight the potential for aligned IED investment to accelerate site rationalisation, with centralisation of treatment at advanced anaerobic digestion centres, resulting in better environmental outcomes including greater green gas generation, and a lower carbon footprint to support net zero ambitions. Furthermore, if FRfW requirements severely restrict biosolids recycling to agriculture, then the significant asset base changes, and different IED site permitting requirements across all sludge handling and treatment sites to facilitate destruction technologies, can be considered holistically to ensure we can respond as efficiently as possible.

Case study 3: Development of an adaptive asset strategy to deliver long-term outcomes

Our regional asset planning tool is central to our asset investment strategy over the next 25 years. It allows us to interrogate our understanding of assets, costs and market opportunities so that we can ensure that the service we are delivering for customers is at the most efficient cost and a tolerable level of risk. This modelling capability allows our plans to be adapted to continually identify and exploit opportunities, as well as address the challenges the business faces in the most efficient way.

Through this modelling we have identified a long-term direction of travel to rationalise older, less efficient anaerobic digestion sites and build advanced anaerobic digestion capacity. This provides benefits in terms of:

- economies of scale;
- enhanced quality biosolids product providing greater flexibility for agricultural use;
- more green gas production to support decarbonisation of the National Grid; and
- reduced carbon emissions to support the journey to carbon net zero.

Enhancement investments required to meet IED compliance were identified as a potential opportunity to accelerate rationalisation of bioresources treatment centres and deliver our adaptive asset strategy. Using our asset planning tool we identified the opportunity to close four older sludge treatment centres, avoiding investment of over £10m capex at these sites. Instead we would engage the bioresources market to find a solution to manage 23,000 tDS/year of sludge. This represents approximately 12% of regional sludge produced in 2020 and is equivalent to the capacity of the four digestion sites. The solution would also provide resilience to the regional system of treatment centres. The reference solution (the actual solution to be defined through market engagement) is an advanced anaerobic digestion and gas to grid plant at Ellesmere Port built to meet IED requirements. Overall the work would reduce company carbon emissions by 9% or 14,200 tCO₂e. Whilst this solution has a high upfront capital cost, it delivers a more sustainable outlet for biosolids, and at a lower whole life cost.

However, we have not been able to pursue this optimal solution as the timescale for delivering IED compliance has prevented sufficient time to engage markets and collaboratively plan, develop and deliver an innovative solution. In order to maintain the required regional treatment capacity we need to invest separately at these four sites to meet IED compliance, the cost of which is over £10m. This locks investment into these aging anaerobic digestion sites and further delays movement towards advanced treatment centres and wider holistic outcomes.

Extrapolating this situation nationally, the scale of the opportunity missed by implementing IED, without alignment with water industry planning cycles or wider environmental drivers, is significant. Therefore, we all need to come together to better manage the dependencies between environmental regulation, economic regulation and industry delivery.

c) Ensuring companies are able to finance the delivery of future regulatory obligations

The ability of the industry to finance meeting statutory environmental obligations, and be in a position to support the development of the bioresources market, is at risk without effective, co-ordinated planning between regulators.

The statutory requirement for water companies to be compliant with IED has been acknowledged, alongside the fact that there will be a significant scope of works and cost in order to achieve compliance. The misalignment of regulatory timetables has led to this change in obligations not having been reflected in water company price controls and subsequently being rejected from Green Recovery proposals. In this instance the regulatory framework has failed to provide the industry with the financial resources to deliver its statutory obligations. It is not unreasonable for there to be a mechanism to recover costs to meet our IED obligations so as to enable a level playing field for our future participation in the bioresources market both opposite other appointed companies and other waste operators.

We risk further misalignment unless the EA, Water Industry Strategic Environmental Requirements (WISER) and Water Industry National Environment Programme (WINEP) are expanded to reflect the full range of water companies' environmental obligations. These documents aim to help water companies understand the statutory and regulators' expectations so these can be embedded in the outcomes, performance commitments and investment decisions underpinning company business plans. However, the documents

currently focus on environmental water quality and do not fully reflect drivers around resource recovery, air quality or waste management which all impact sludge treatment and recycling.

Regulatory certainty and a clear understanding of the trajectory of statutory and regulatory expectations on water companies will enable companies to deliver environmental compliance in a timely manner, allow sufficient planning to deliver optimal environmental outcomes, and avoid further damage to the bioresources market. Enhancement investments will enable the delivery of an adaptive asset plan to meet long-term requirements.

d) Uncertainty in long-term planning

There is no long-term future regulatory roadmap set out for bioresources and the overall vision for the sector is unclear. The implementation of FRfW, alongside emerging risks from novel chemicals such as PFAS or microplastics is introducing uncertainty over the sustainability of biosolids recycling to agriculture. It is no longer clear if anaerobic digestion, green gas recovery and recycling to agriculture, remains to be viewed by all stakeholders, as the best practicable, environmental option for bioresources management.

In Figure 3 we have outlined several possible scenarios for how the sector may develop from the current baseline. Each of these options will have different costs, practicalities, timescales, risks and benefits. No option will remove all risk, and a workable vision for the future must be co-developed, fully cognisant of the risks or benefits.

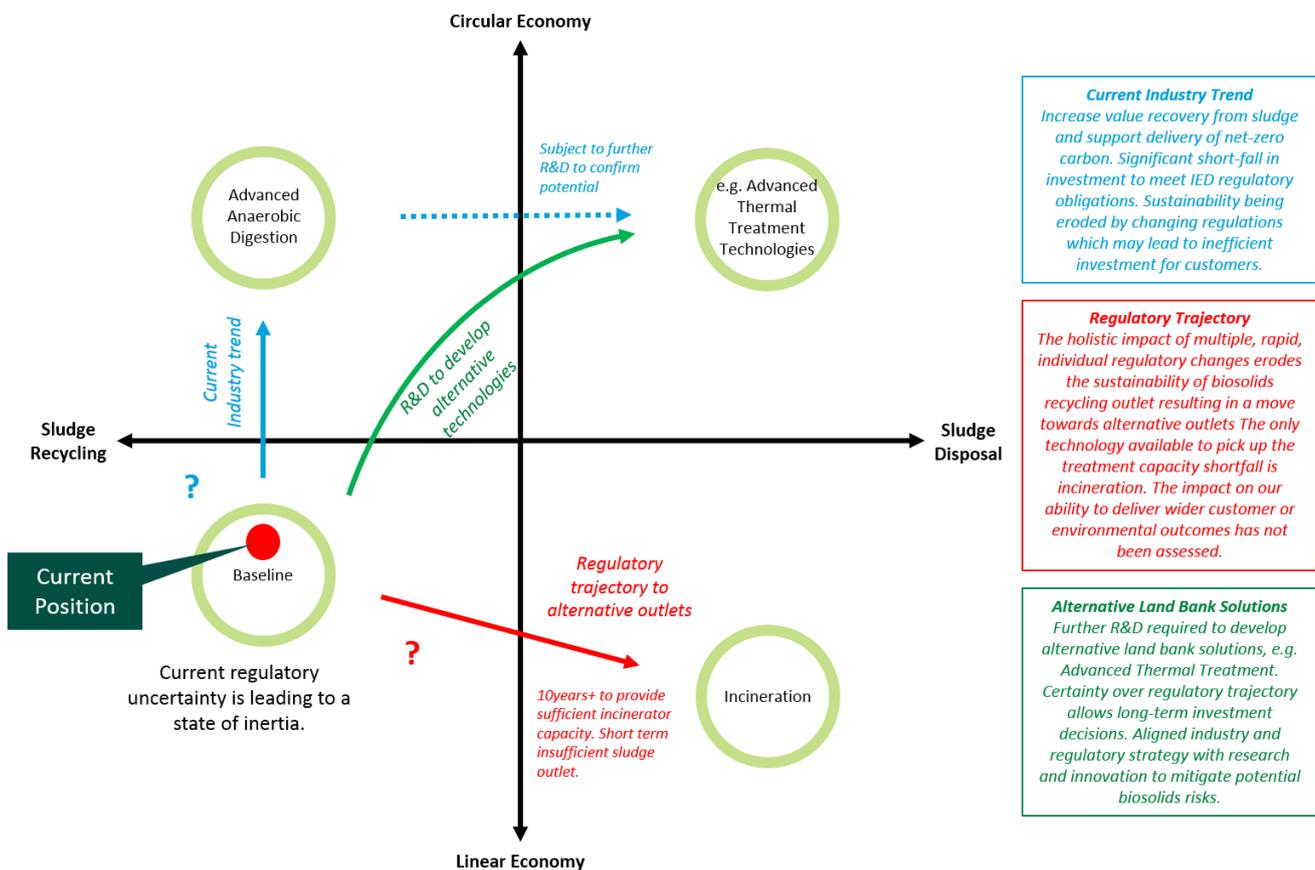


Figure 3. Scenarios for the future of sludge treatment and disposal

We are committed to delivering long-term asset strategies to 2050, using scenario testing and planning tools to identify a long-term adaptive asset plan to ensure delivery of long-term outcomes. This is the only way that issues such as carbon net zero, sustainable agriculture, circular economy and affordability can be addressed. However, the uncertainty faced at this point, with no long-term policy framework or clear legislative timeline, risks causing inertia as investment cannot be made for fear of this becoming abortive in the near term.

FRfW implementation in the short term and the consequential move away from biosolids recycling to land, will require an immediate alternative outlet for sludge. At present the only practicable alternative outlet for sludge at scale is incineration; however, there is insufficient incineration capacity today and significant investment lead time will be required to develop new capacity. Moreover, the full impact of these changes on holistic

environmental outcomes or customer affordability has not yet been assessed. We risk unintentionally developing sludge incineration as the default option for bioresources management in England without fully appreciating the impact for the next 25-50 years.

Technology will improve with time, particularly low carbon or sludge destruction technologies, so we need to ensure that we are making the right investment, at the right time to meet the long-term requirements. It is widely accepted that technological innovation must be part of the solution to reduce environmental risks and maximise the value recovered from sludge. A short-term shift away from biosolids recycling to land, without allowing time for innovation or research into scientific uncertainty, will limit opportunities for development of an adaptive asset strategy to meet long-term outcomes. Ultimately, this will harm customers and the environment, and tarnish the reputation of the sector and its regulators.

5 Unlocking greater value through a national strategy

5.1 Proposal for development of a national bioresources strategy

We believe the issues outlined in Section 4 make a compelling case for development of a long-term, holistic bioresources strategy. Water companies cannot address these issues alone and we need effective collaboration between regulators and industry.

As presented in Figure 4 we identify three core principles that we believe should underpin this strategy:

1. A long-term, coherent vision with clear environmental outcomes and greater regulatory certainty
2. Alignment of long-term environmental regulation and economic incentives
3. Development of a collaborative research and innovation pathway

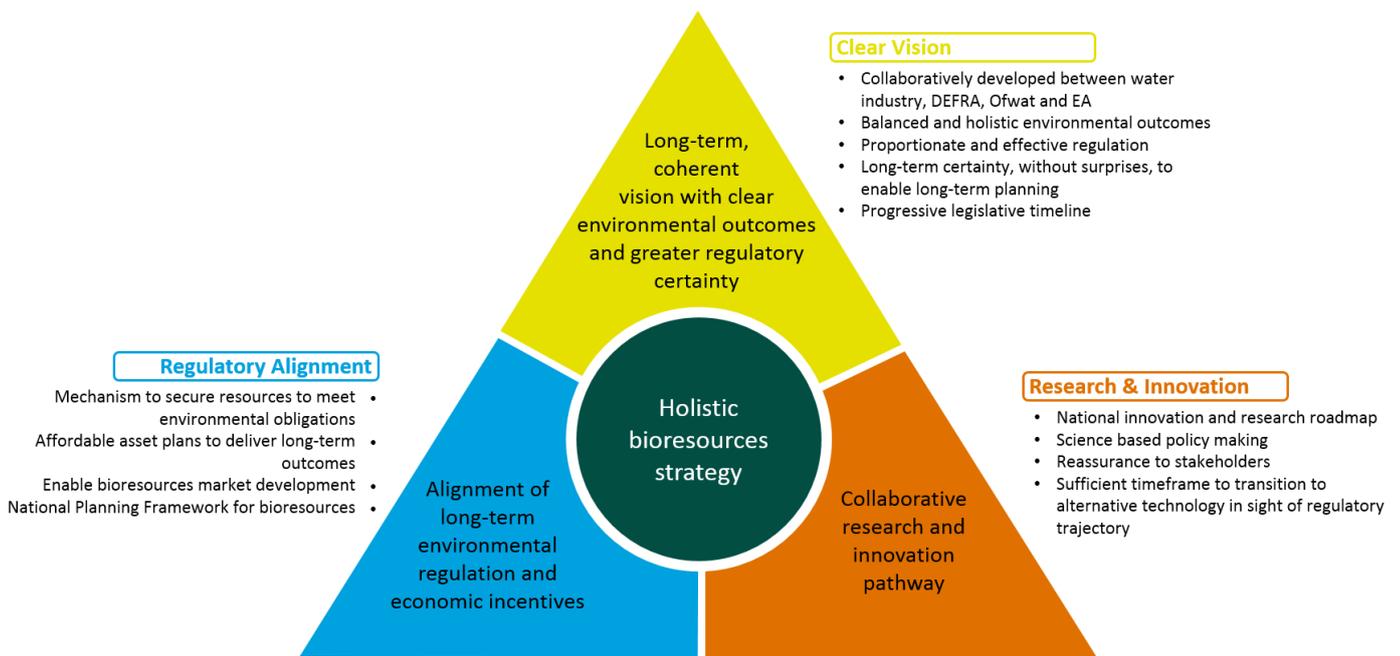


Figure 4. Proposed development of a national bioresources strategy, underpinned by three core principles

a) Principle 1: Long-term coherent vision with clear environmental outcomes and greater regulatory certainty

A clear long-term sector vision to 2050 and agreed outcomes, balancing all the drivers impacting upon the sector, is essential to the development of long-term asset plans. A smooth and planned transition towards conscious,

long-term outcomes can only be enabled by a clear policy framework with a progressive and pragmatic legislative timeline. In Table 2 we identify the key changes that will need to be delivered to support development.

Table 2 Recommendations to support the delivery of Principle 1

Recommendation	Key activities and outcomes
Review of strategic drivers	Bring key stakeholders together to review strategic drivers impacting upon the sector and the principal drivers and timescales of each stakeholder. Whilst the current regulatory changes are understood, we need support to understand how these drivers will develop in the future.
Prioritisation and balancing of outcomes	Agree outcomes the sector should deliver. Where drivers are competing, agree how outcomes can be prioritised to maximise overall value.
Identify long-term vision for 2050	Develop a clear long-term vision for bioresources management in England. Enable the industry to develop long-term asset plans targeting delivery of long-term outcomes. A clear vision and no surprises will reduce the risk of abortive investment or investment in soon to be obsolete technology.
Build a policy framework and clear legislative timeline	A roadmap for legislative change extending beyond one Asset Management Plan (AMP) to enable the development of long-term asset plans, cognisant of future change. Ensure timescales are sufficient to be pragmatic, affordable to customers and optimise alignment with other drivers to ensure we can develop and deliver the most efficient plan for the sector.

b) Principle 2: Alignment of long-term environmental regulation and economic incentives

Alignment of environmental and economic regulation is a key enabler for the sector to be able to deliver the agreed vision and outcomes. In Table 3 we outline our recommendations for changes in regulation that would support the delivery of a national bioresources strategy.

Table 3 Recommendations to support the delivery of Principle 2

Recommendation	Key activities and outcomes
Develop a bioresources strategic planning framework	Development of a bioresources strategic planning framework will support consistent and nationally optimised outcomes providing an agreed process for companies to jointly plan new capacity. Furthermore it will ensure consistent future forecasts of sludge treatment and liquor capacities and identify opportunities for redevelopment of sites to align activities for increased efficiency and promote development of the bioresources market.
Provide environmental regulatory certainty	Provide certainty over the direction and timescales for environmental regulatory change. Long-term certainty will enable any new entrants into the bioresources market, increasing opportunities for customers benefitting from more efficient outcomes.
Incorporation of bioresources outcomes into WISER & WINEP	Bioresources environmental regulatory obligations to be identified and recognised through the WISER and WINEP. These are the tools by which Ofwat recognise any regulatory obligations on the industry and will enable the industry to secure efficient resources for delivery of these outcomes, ensuring companies are able to deliver compliance in a timely manner and deliver optimal environmental outcomes.
Review timescales for any short term implementation (AMP7)	Time is required to enable the agreed long-term vision to inform the most efficient interventions to meet IED compliance in combination with other drivers such as FRfW. With market opening, companies may be able to show that rationalising sites across company borders has significantly greater environmental and/or customer benefits, this will necessarily require more time for planning.

c) Principle 3: Collaborative research and innovation pathway

There are a number of unknowns which require further understanding to support setting science based policy and legislative requirements in delivery of a long-term strategy. Additionally, recognising that technology will improve with time, there is a need to align the roadmap for legislative change with the technology development roadmap to promote development of innovative solutions and accelerate deployment to full scale.

In light of these considerations we make recommendations in Table 4 for change to support the delivery of a collaborative research and innovation pathway.

Table 4 Recommendations to support the delivery of Principle 3

Recommendation	Key activities and outcomes
National collaborative research programme	<p>Continue to develop our understanding of the potential risks and benefits associated with bioresources management. We must work proactively to address any identified risks or gaps in our understanding. We need a coordinated research roadmap which will have the dual benefits of supporting science based policy making and providing reassurance to stakeholders.</p> <p>Some issues, such as the fate of chemicals in wastewater, have been helpfully identified by the EA (WINEP, 2021) and collaborative research and investigations will be developed through AMP8. However, we propose that research must be wider between the industry, academia, and regulators. Key areas for research include pressing issues such as:</p> <ul style="list-style-type: none"> • nutrient cycling in agriculture; • fate of contaminants in the environment and where appropriate safe levels for recycling to agriculture; • carbon emission reductions; and • the role of bioresources in developing wider catchment solutions.
Align the roadmap for legislative change with an innovation roadmap	A full understanding of the future regulatory trajectory for bioresources will ensure innovation objectives can be optimised to guide the industry to ensure optimal environmental outcomes. Moreover, a clear strategic direction will provide impetus to the industry and our research collaborators to accelerate development and deployment of new technologies. Sufficient pragmatic timeframes must be allowed for the industry to transition to alternative technologies, given the scale of innovation which could be required in the sector.
Bioresources innovation funding	We welcome the Ofwat Innovation Fund and monies set aside by water companies in AMP7 for collaborative innovation. We must ensure that this delivers good outcomes for bioresources to tackle the key challenges faced, and ensure it continues into AMP8.

5.2 Indicative programme of activity

In Figure 5 we set out an indicative programme to implement the recommendations listed above. If the industry, regulators and other key stakeholders come together to deliver Steps 1, 2 and 3, this should enable existing operators and future entrants to develop and deliver transitional plans through Steps 4, 5 and 6, in order to meet agreed sector outcomes in a timely and efficient manner.

In order to prompt and stimulate national conversation about the future of bioresources management and the challenges faced, we lead a Water UK and EA joint Bioresources Strategy Task and Finish Group. Through this group, we have proposed the development of a project, to be led by the Chartered Institution of Water and Environmental Management (CIWEM) who can act in an independent capacity, to coordinate and manage the development of a long-term strategy. We believe this CIWEM led work can be the vehicle to deliver Steps 1 and 3. We invite everyone to participate in this work and support the development of a successful project outcome in 2022.

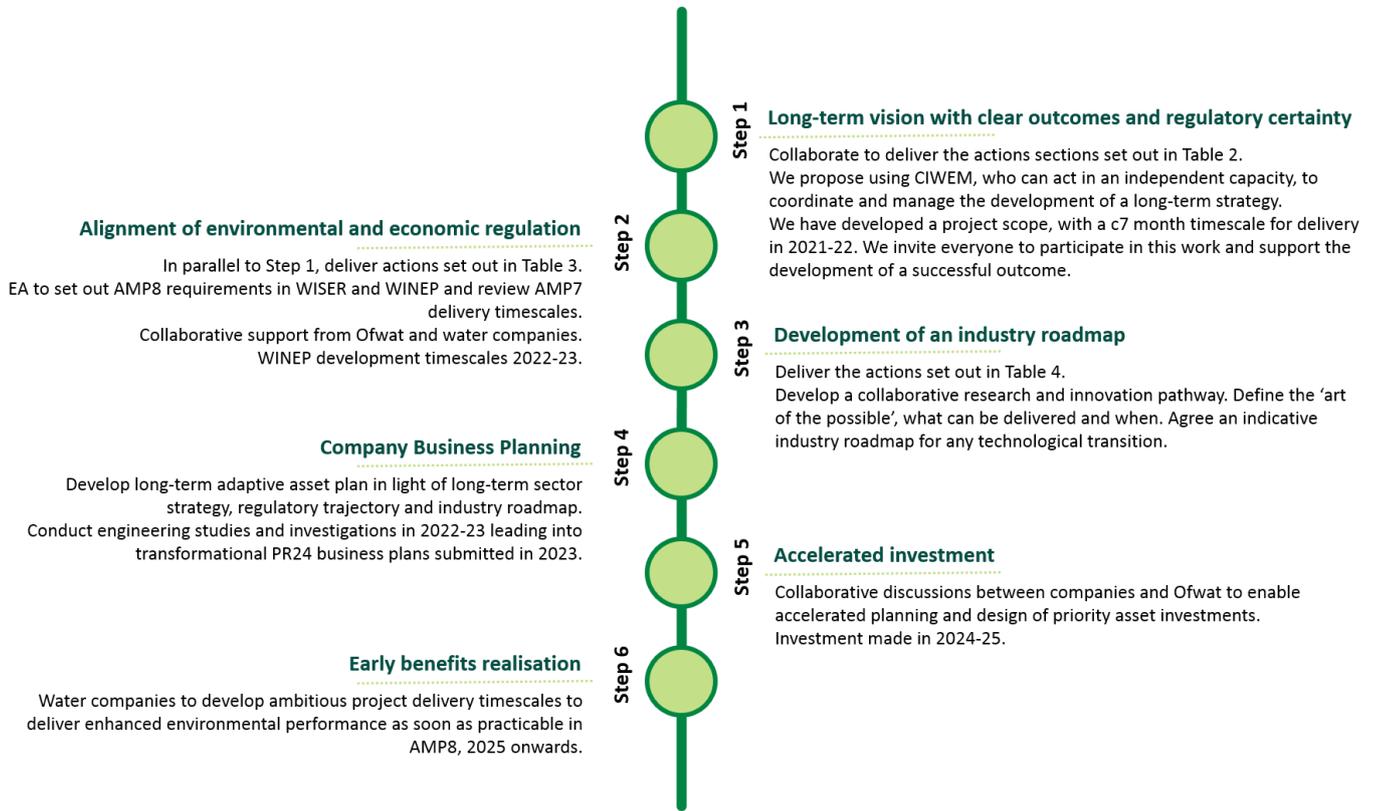


Figure 5. Indicative timeline of activity to deliver a national bioresources strategy

6 Conclusion

There are many challenges facing the stakeholders within the Bioresources sector. By acting together there is an opportunity to make a significant difference to the long-term sustainability of the sector and the wider outcomes that can be delivered for customers and the environment.

We believe that our proposal to develop a national bioresources strategy will ensure sufficient clarity for the water industry and potential market entrants, to develop long-term asset plans to enable a smooth and planned transition towards a clearly defined outcome. By adopting a systems thinking approach we can find solutions that deliver balanced and holistic environmental outcomes, at an affordable cost to society.

We have proposed a series of recommendations and an indicative programme of activity to deliver a national bioresources strategy. Furthermore, we have proposed that to instigate the work we use CIWEM to coordinate and manage the development of a long-term strategy. This builds upon work we are leading through a joint Water UK and EA Bioresources Strategy Task and Finish Group and believe that this work will go a long way towards delivering the outcomes set out in this paper. We encourage everyone to participate in this work and support the delivery of a successful project outcome.

The time for change is now and we need to act swiftly to plan for a transformational step change. We rely on the collaborative support of all key stakeholders to ensure bioresources management is a priority so that the sector can fully play its part in supporting the delivery of national priority outcomes including sustainable agriculture, a circular economy, net zero carbon and supported by an effective bioresources market.

Whilst we have outlined an indicative programme for the next few years, we recognise that we don't have the answers to all of these questions. We hope that this paper provides a positive contribution towards delivering a sustainable and progressive future approach for a sector which provides essential services to customers and the environment. We welcome responses to this paper and anticipate the prospect of a productive discussion about the future of bioresources management.

For more information, or to take the discussion further, the United Utilities Bioresources team can be contacted at: UUBioresource@uuplc.co.uk.

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United Utilities Water Limited
Haweswater House
Lingley Mere Business Park
Lingley Green Avenue
Great Sankey
Warrington
WA5 3LP
unitedutilities.com



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