

# Ofwat Innovation Fund

Learning report

**Circularity in water:** resource recovery  
and circular economies in the water sector

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Ofwat, the Water Services Regulation Authority for England and Wales, has established the Water Innovation Fund. Ofwat is a non-ministerial government department established in 1989, when the water and sewerage industry in England and Wales was privatised. Ofwat regulates the water sector in England and Wales.

The Ofwat Innovation Fund is delivered in partnership with Challenge Works, Arup and Isle Utilities.



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# Circularity in water:

resource recovery and circular economies in the water sector

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# About this report

**Sharing knowledge, information and data is fundamental to ensure successful Innovation Fund projects are scaled up and adopted across the sector. It also reduces the need for multiple companies to trial the same solution.**

It is important that knowledge and data are shared at all stages of a project – not just at the end – so that we can all learn from what works and, crucially, what doesn't.

That is why these learning reports are so important. By sharing and learning from each other we can all help the sector meet the challenges it faces and build public trust.

**Helen Campbell,**  
Senior  
Director  
of Sector  
Performance,  
Ofwat



## Ofwat Innovation Fund

The Ofwat Innovation Fund is a £200 million initiative established by Ofwat, the Water Services Regulation Authority for England and Wales. It aims to enhance the water sector's capacity to innovate and enable it to better meet the evolving needs of customers, society and the environment.

As of May 2024, over £150m of funding has been distributed to 93 projects.

The Ofwat Innovation Fund has always sought transformational change. At its core is learning, knowledge exchange and disseminating data and knowledge across the sector. With this comes the opportunity to deploy the solutions developed by the funded projects, realising impact at the greatest scale possible.

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## What you will learn from this report

This report is aimed at all water sector stakeholders, including water companies and their supply chain partners, academia, policymakers, (E)NGOs and third sector/civic society organisations.

Its purpose is to shine a light on partners' experiences, insights and learnings from across the breadth of the portfolio of funded projects. Sector feedback suggests there is appetite to see more active dissemination of

knowledge and learning from funded projects, in line with Ofwat's ambitions to support the sector's innovation maturity and collaborative nature.

As we approach the latter stages of Asset Management Period (AMP) 7, covering 2020-2025 and projects are near completion or have made good progress towards their aims and objectives, now is the time to reflect, build connections and amplify the learnings and insights from the Fund. We see this report as a starting point for connections both within and outside the sector.

## Circularity in water

Resource recovery and wider circular economy applications are a key driver in the UK water sector's goal to decarbonise its operations and reach net zero by 2030, yet much of this journey is still uncertain and further research and innovation is needed to meet these targets.

Recognising the importance of this topic, and the bottom-up demands of the sector to make more breakthroughs using disruptive innovation, five projects have been funded by the Ofwat Innovation Fund as at May 2024. These projects collectively total £7.3 million of funding and bring together partnerships from across the UK water sector – utilities, engineering firms, universities, non-governmental organisations and the private sector – to collaboratively tackle the challenges currently found in resource recovery and circular systems in the water industry across the UK.



	COMPETITION	LEAD WATER COMPANY	PROJECT DELIVERY	FUNDING AWARDED	PARTNERS
<b>Industrial Symbiosis</b>	Innovation in Water Challenge	<b>United Utilities</b> Water for the North West	Complete	<b>£199,504</b>	International Synergies Ltd, Dŵr Cymru Welsh Water, Jacobs, Severn Trent Water plc
<b>Unlocking bioresources market growth</b>	Water Breakthrough Challenge	love every drop anglian water	Complete	<b>£314,316</b>	Business Modelling Associates UK Ltd, Thames Water, Yorkshire Water, Northumbrian Water, Southern Water
<b>HyValue – Hydrogen from Biogas</b>	Water Breakthrough Challenge	Dŵr Cymru Welsh Water	Complete	<b>£267,954</b>	Costain, University of South Wales
<b>Biopolymers in the circular economy (BICE)</b>	Water Breakthrough Challenge	<b>United Utilities</b> Water for the North West	In progress	<b>£6,149,362</b>	Aquaminerals, Cellvation, Cranfield University, Glasgow Caledonian University, Royal HaskoningDHV, Severn Trent Plc, South West Water Limited, United Utilities Water Limited, Yara
<b>SuPR Loofah (Sustainable Phosphorus Recovery)</b>	Water Breakthrough Challenge	<b>NORTHUMBRIAN WATER</b> living water	In progress	<b>£445,577</b>	The University of Newcastle upon Tyne, University of Northumbria at Newcastle, Dŵr Cymru Welsh Water

# Introduction

## Resource recovery and circular economies in the water sector

Recovering resources and adopting circular economy models are widely seen as crucial ways the water sector can respond to the pressures it faces due to climate change, water scarcity and population growth, as well as the impact of global instability and dwindling primary resources.

Circular economy models encourage the reuse and recycling of resources, reducing waste and the use of raw materials. In the context of the water sector, this means transforming waste products such as sludge and wastewater into valuable resources – energy, fuel, clean water and nutrients. Such practices not only help reduce landfill use and greenhouse gas emissions but also contribute to conserving increasingly scarce natural resources.

Through circular economy practices, water companies can derive new revenue streams

via the sale of recovered resources such as biogas, biosolids, or recycled water. This leads to more financially sustainable business models, ultimately reducing customer bills, as well as driving technological advancements in water treatment and resource recovery methods.

Regulatory drivers also play a significant role in the push towards resource recovery and circular economy models within the water sector. UK government and European directives increasingly focus on reducing waste, enhancing energy recovery and promoting sustainable, ESG-focused outcomes.

Together, these economic incentives and regulatory drivers align with the environmental goals of the sector (to reach net zero by 2030), creating a productive innovation loop and collaborative partnerships that benefit water companies, their customers and wider society.

In the UK water sector, resource recovery and circularity feature widely in innovation and longer term delivery strategies as we move into AMP8 (2025-2030). For example,

partnerships with the agricultural sector are exploring new techniques to develop biochar-based soil conditioners, collaboration with the energy sector is seeing a focus on optimising biogas production and use, the transportation industry is looking into using hydrogen fuels to aid the green transition, and partnerships with the construction sector are investigating new recovery techniques in the creation of aggregate from wastewater. These are just a handful of the opportunities currently being explored across the sector.

Despite these advances, there are significant steps to be taken to capitalise on the opportunities offered by resource recovery and circular economy models. Research suggests that although there are pockets of excellence, circular economy approaches are generally not considered in a systematic way. However, the pioneering efforts of the projects in this report show how, through funding, collaboration and innovation leadership, these emergent futures can be reached, bringing benefits for both people and planet.

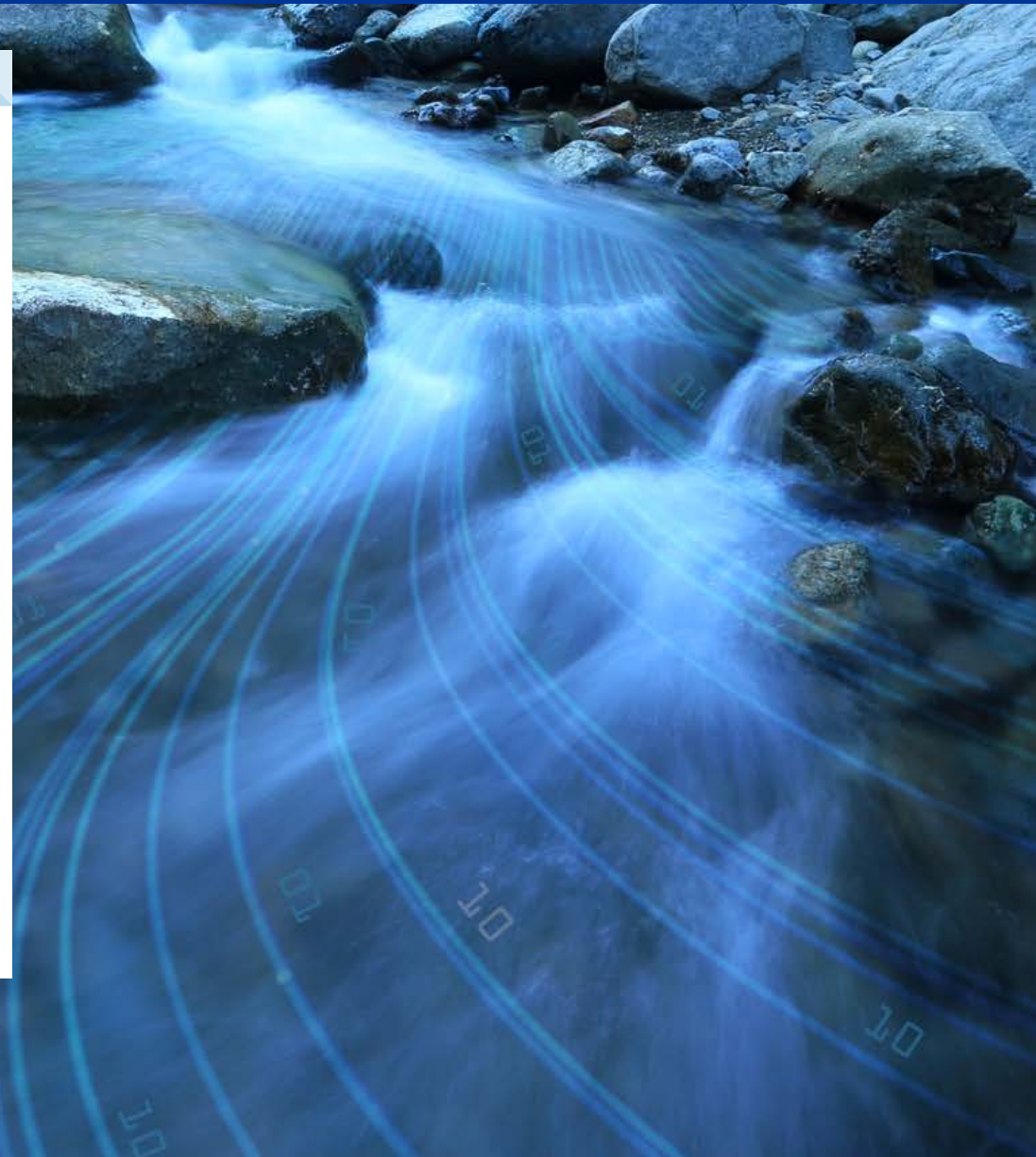


# Building our knowledge




**These project-specific learnings and insights were drawn from a series of workshops and interviews. They aim to inform innovative practices and approaches as well as catalyse new relationships to create impact across the UK water sector – for the benefit of customers, the environment and society.**

The Ofwat Innovation Fund delivery team worked alongside partners that had received funding and had completed projects, or were part of projects still in flight. Through the course of a 90-minute workshop with partners, as well as other sources of information, the team surfaced insights and learnings that are applicable to others, whether they are delivering projects in similar fields, or looking to apply to future rounds of the Ofwat Innovation Fund.

Knowledge exchange remains a barrier to scaling innovation in the water sector and this has been recognised across a wide range of stakeholders, from water companies and supply chain entities to regulators and policymakers. These reports are part of a suite of measures the Ofwat Innovation Fund is taking, alongside other sector bodies, to catalyse the implementation of knowledge, outputs and tools generated across all the funded projects. In doing so we increase the capacity and capability of the sector to solve the challenges it faces through collaborative innovation.



# Industrial Symbiosis

COMPETITION	LEAD WATER COMPANY	PROJECT DELIVERY	FUNDING AWARDED	PARTNERS
			<div style="background-color: #c8e6c9; padding: 5px; display: inline-block;">£199,504</div>	International Synergies Ltd, Dŵr Cymru Welsh Water, Jacobs, Severn Trent Water plc

The Industrial Symbiosis (IS) project explored new ways to reduce water sector waste and by-products by repurposing them for other processes. With a focus on the built environment, the project team worked collaboratively to find, test and adopt new ways to keep construction materials, such as aggregates and concrete,

in use for longer, reducing the need for new materials. The method improves resource efficiency within the water sector, and enhances operating margins and environmental benefits from reduced waste and lower carbon emissions.

The project worked with partners to identify potential waste savings from the IS approach

for United Utilities’ capital delivery projects. The team analysed the data through a resource-matching database provided by International Synergies. They also created and shared an implementation blueprint for the UK water sector, so that more organisations can benefit and accelerate their own circular economy plans.

**“ Combining the resource-matching expertise of International Synergies with the water company partners’ experience of their own in-house operations, we have tackled head-on the traditional blockers that have held us back. And our adoption plan sets a clear path for others to follow. At our dissemination events we can already see other water companies showing interest in adopting the new method; we have delivered a truly sector-changing opportunity. ”**

**Keiran Brocklebank, Head of Innovation at United Utilities**







## Key learnings and insights

- ▶ **Unlocking waste as a resource:** water company systems record ‘waste’ retrospectively for compliance rather than for circular economy opportunities. Dedicated systems, like those developed by International Synergies, could unlock key opportunities for IS.
- ▶ **Changing contract models:** partners found it hard to change supplier behaviour because of a lack of consistency in contract models between water companies and the construction supply chain, and because suppliers’ capital project management processes are mature and embedded.
- ▶ **Internal functions need to collaborate to enable IS opportunities:** aligning partners’ internal functions more closely – such as in fit-for-purpose contracts, supply chain procurement and asset strategy planning and design – can ensure a frictionless path to enabling IS.
- ▶ **Responsibility and behaviour change:** demonstrating how reporting on and brokering for waste materials contributes to company objectives and KPIs is fundamental to ensuring increased buy-in to, and individuals taking responsibility for, circular economy opportunities in their companies and across their supply chains.
- ▶ **Realising opportunities:** the size and scale of the opportunity is large for individual companies; and even more so sector-wide for achieving key targets such as net zero. Collaboration also presents significant opportunities with new value chains and sustainable growth in agriculture, energy, construction, manufacturing, mining and metals, and even food and beverage and pulp and paper industries.
- ▶ **Space to grow:** the IS sector is not overly crowded and offers multiple Environmental Social and Governance (ESG) benefits to water companies and their supply chains. More competition and suppliers could enable the sector to grow and bring mutual wins to those creating the waste resource, those using it as a raw material – and those in between.
- ▶ **In-house development as a first step:** it is necessary to gain buy-in from internal stakeholders in the water companies, across the different business functions that interact with IS processes, as well as building systems and processes that interact with and operate across these different functions. As a result, these project activities are more likely to succeed when done in-house, rather than being outsourced to providers that may not know the intricacies and differences in approach of different water company contexts across the UK sector.
- ▶ **Liability:** partners felt that liability assurance may be required to guarantee the quality of waste materials destined for reuse as challenges can arise around who is liable for any quality issues, or unforeseen problems arising from their use. Uncertainty in this area can lead to companies being put off from reusing waste products or enabling others to use them as they do not want to be exposed to any unnecessary and disproportionate levels of risk.
- ▶ **Specialist resources:** central client coordination supported by experts in matchmaking and waste regulations enabled the process to run smoothly and efficiently. Project partners stressed the importance of this multidisciplinary approach to their collaboration being successful and would advocate for anyone taking on an IS project to follow suit.

## Benefits

### Water company and environmental benefits

For **United Utilities**:

- ▶ Potential for savings of up to 1.4% of capital budget (this would equate to £15 million annual savings based on AMP7 values).
- ▶ Over £250,000 cost savings and associated carbon were realised through facilitation during the project's life.

For **Severn Trent Water**:

- ▶ Over £1 million cost saving potential on disposal and new material procurement for 135,000 tonnes of material and associated 12,337 tonnes CO<sub>2</sub>e potential reduction.
- ▶ Potential £365,000 cost savings.
- ▶ There are potential cost savings each year:
  - ▷ £13.5 million through lower material purchase outlay.
  - ▷ £1.2 million through diverting material otherwise destined for landfill.
  - ▷ 57,500 tCO<sub>2</sub>e embodied carbon emission through averted new material use.
  - ▷ 82 tCO<sub>2</sub>e embodied carbon emission reduction through landfill material diversion.

### Wider partner and sector benefits

- ▶ A deeper understanding of IS in practice.
- ▶ Identifying key supply chain partners for AMP8 delivery.
- ▶ Accelerated learning around the internal systems and processes required to take up the opportunities linked to IS and broader circular economy models.

## Challenges and gaps

**Market fragmentation:** there were multiple stakeholders and no centralised function or body that oversees circular economies across the water sector and cycle, so galvanising the right people at the right time was a challenge.

**Blueprint for the sector:** wider co-creation and engagement with other stakeholders would have made the blueprint created by project partners more inclusive and perhaps more widely applicable and therefore used by more companies.

**No overarching sector-wide IS target:** a sector-wide target would rapidly accelerate the thinking and practice around IS applications, as well as the resulting supply chain and regulations.

**Collaboration is king:** a sector strategy to continue to build critical mass of IS in the UK and globally is desperately needed. The best path to realising the savings potential is through the widest possible collaboration.



**Deliverables, tools and resources:** see Industrial Symbiosis' Spring Showcase and any updates on this project on the **Fund website**



**Find out more:** [Ideas@uuplc.co.uk](mailto:Ideas@uuplc.co.uk)

# Unlocking Bioresources Market Growth

COMPETITION	LEAD WATER COMPANY	PROJECT DELIVERY	FUNDING AWARDED	PARTNERS
			<div style="background-color: #d4edda; padding: 5px; display: inline-block;"><b>£314,316</b></div>	Business Modelling Associates UK Ltd, Thames Water, Yorkshire Water, Northumbrian Water, Southern Water

Anglian Water worked with four other water companies to develop a collaborative strategic planning capability. It identified opportunities to move bioresources across existing regional borders and recommended the optimal blend of inter-company investments for different scenarios.

The project built on the opportunity created by Ofwat in establishing a price control for bioresources, separate from wastewater, which includes the collection, transport, treatment and disposal of sewage sludge and associated by-

products. This aims to stimulate bioresources markets between Water and Sewerage Companies (WaSCs) and third-party service providers. The estimated benefits from greater use of these markets are between £370 million and £1.39 billion over 30 years.

In the most recent Bioresources Market Reviews, Ofwat indicates that short-term marginal trades have limited potential to unlock the full benefits of markets and more focus should be put into inter-company optimisation, such as the development

of joint capacity and exploiting the benefits of economies of scale.

This project aimed to do this by integrating the bioresource value chains of Anglian Water, Thames Water, Southern Water, Northumbrian Water and Yorkshire Water into one single decision support platform, covering around 50% of the total sludge production for England and Wales. It was underpinned by Business Modelling Associates' adaptive systems planning software.

***“ This project will challenge the traditional siloed business planning approach for bioresources and clearly demonstrate the benefits of collaboration and adaptive systems planning, applied to strategic asset management decision-making. ”***

**Stephen Riches, formerly Portfolio Lead at Anglian Water, now Associate Director – Bioresources, at Atkins Réalis**





## Key learnings and insights

- ▶ **Innovation hypothesis validated:** the Business Modelling Associates' digital twin system was able to report on complex scenarios, assess carbon impacts and contributions to net zero ambitions, along with opportunities for emerging technologies and optimised approaches. This confirmed that there are opportunities from moving sludge across borders and sharing new capacity, but also indicated that sludge trading is not going to be the only answer to deal with strategic drivers.
- ▶ **Regulatory barriers:** regulators need to reconsider their approach to bioresources in relation to net benefit and efficiencies as sludge moves from one location to the next and is traded across borders or geographic boundaries. Regulatory uncertainty also hampered the ability to enable shared asset investment between producers and end users and between trading companies.
- ▶ **Data availability:** in certain areas the availability of published data on bioresources was limited. Information was most lacking on growth projections and the impact of Water Industry National Environment Programme (WINEP) schemes, asset age, wastewater treatment headroom to deal with return liquors, constraints on future plant expansion, reasons for reported reductions in capacity and landbank availability.
- ▶ **Far beyond business as usual:** as an innovative whole systems approach bringing together water companies, the project needed to operate as a test bed to inform future practice. Iteratively changing business as usual practices would not have achieved the same results, in the short space of time.
- ▶ **Long-term collaboration creates more robust networks:** when investments into the bioresources market are allowed, the difference between open networks (no border constraints) and closed networks (constrained by existing operational borders) becomes more significant.
- ▶ **More the merrier:** there is demonstrable benefit from wide-ranging collaboration; the challenge in the future will be to integrate all WaSCs and other stakeholders in to realise the potential value and benefit the project has demonstrated.
- ▶ **Timing is essential:** while the tool and methodology has been referenced in the PR24 process and in water companies' AMP8 and Long-Term Delivery Strategy plans, it may be too early to use across the fullest of contexts. Once PR24 is finalised, it can be deployed more widely and scaled to meet the challenges of the sector.
- ▶ **Optimisation of current networks:** the difference in costs seen across different operational contexts is led by better use of capacity, optimised logistics and no double-handling of materials. Using a digital twin to model and optimise a scenario allowed the project to understand what a best case might look like. Partners were not always confident that in practice this could be achieved due to current operational constraints in the water companies and lack of cohesive cross-company forward planning. This presents an opportunity for the sector to unlock further efficiencies through better collaboration and use of advanced planning tools.

## Benefits

### Water company and environmental benefits

- ▶ The short-term benefits from cross-border sludge movements can generate a potential reduction in end-to-end unit cost, when modelled using the available data, the unit cost decreased on average by 5.4 £/tDS (£ per dry tons of sludge).
- ▶ In annualised terms this is an opportunity of around £2.4 million/year for the project's five WaSCs. Overall, it is demonstrated that total limed sludge (the least desirable treatment, due to high cost) can be reduced significantly through cross-border trading.
- ▶ Long-term benefits, achievable from moving bioresources and cross-company asset investments, can offset between £10 million and £80 million in TOTEX over 15 years. The range depends on cost of capital and assumed asset availability.
- ▶ The output of the scenario analysis quantified the range of cumulative emissions (and offsets) that the sector can generate (between +3.2 MtCO<sub>2</sub>e and -0.2 MtCO<sub>2</sub>e), indicating that policy and the correct investment will determine if the sector will be a net emitter or net off setter of emissions.

### Wider partner and sector benefits

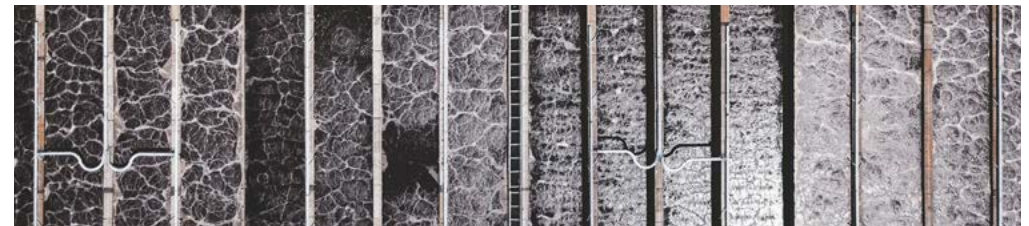
- ▶ The project demonstrated that it is technically feasible to take a joined-up national view through such a digital platform, benefiting those beyond the immediate partnership.
- ▶ Stemming from this project, Business Modelling Associates has developed a national bioresources platform, which can be licensed for future investigations. These could include supporting the second phase of the National Bioresources strategy or ad-hoc assessment for shared investments and for third-party entrants in the bioresources market.

## Challenges and gaps

**Consistency is key:** there were issues with data consistency across the various available datasets making it challenging to prepare the datasets for ingestion into the model and often requiring WaSC input to interpret then validate the assumptions/outputs presented.

**A lack of clarity in business as usual funding:** unclear who should be funding a solution beyond the innovation phase to enable collaboration between WaSCs and different stakeholders across the supply chain.

**Regulatory and legislative barriers:** as the bioresources space is very fluid at present, it was necessary to flex the scope of the project to keep aligned with the current regulatory/legislative framework, which at times felt inhibitive. A closer dialogue is necessary to reap further benefits from future regulatory plans and there is clear need and opportunity, validated by this innovation project, to truly unlock the potential for bioresource markets, aligning both financial and environmental regulation to enable much needed growth through circular systems and economies.







**Deliverables, tools and resources:** [www.businessmodelling.com/bioresources-market-growth](http://www.businessmodelling.com/bioresources-market-growth) and any updates on this project on the **Fund website**



**Find out more:** [opportunities@businessmodelling.com](mailto:opportunities@businessmodelling.com)  
[awinnovationhub.co.uk/project/unlocking-bioresource-market-growth](http://awinnovationhub.co.uk/project/unlocking-bioresource-market-growth)

# HyValue – Hydrogen from Biogas

COMPETITION	LEAD WATER COMPANY	PROJECT DELIVERY	FUNDING AWARDED	PARTNERS
				Costain, University of South Wales

HyValue seeks to convert sewage-derived biogas into hydrogen, increasing the decarbonisation potential of biogas by up to 10 times, while maximising the CO<sub>2</sub> capture at source and minimising emissions (such as methane, NO<sub>x</sub> and particulates) when displacing conventional vehicle fuels with fuel cells. The collaboration between Dŵr Cymru Welsh Water, Costain and the University of

South Wales studied hydrogen production as an alternative use for the biogas. The project compared its sustainability to the other mainstream uses of biogas, incorporating the impact of Carbon-Capture-Utilisation-Storage (CCUS).

The project team's hypothesis is that producing hydrogen from biogas provides the highest

potential environmental and decarbonisation benefits, combined with the best value for money for customers. The partners' aim was to produce a feasibility study of a plant at one of Dŵr Cymru Welsh Water's anaerobic digestion facilities, showing the next steps for a subsequent pilot scale and future full demonstrator project.

**“ HyValue is a major stepping stone towards the industry becoming the bio-refineries of the net zero future, in which hydrogen will play a major role. The project enables the industry to maximise the financial and environmental value that can be extracted from sewage sludge. ”**

**Andrew Dixon, Head of Energy Efficiency, Dŵr Cymru Welsh Water**





## Key learnings and insights

- ▶ **First of its kind:** this innovation provides the UK water sector with the strategic opportunity to use a biogenic carbon emission source (sewage gas) and convert it into high purity hydrogen and carbon dioxide, providing great decarbonisation benefits to end users.
- ▶ **It works:** hydrogen can be produced to low-carbon hydrogen standard requirements and there are sufficient hydrogen users to create a viable business case, when implemented at scale.
- ▶ **Managing uncertainty and risk is an inherent part of innovation:** detailed lessons from the project identified risks and mitigations, and that specific future workstreams for the project are targeted at uncertainties (or opportunities) to quantify and inform the business case.
- ▶ **We go further, together:** the partnership with Costain brought in learning from the South Wales Industrial Cluster and specific hydrogen expertise in emerging markets and opportunities for carbon sequestration. The project also brought forward interest from additional partners in a potential next phase.
- ▶ **When opportunity presents:** the proposal originally identified a five-fold improvement on renewable electricity production from sewage gas, which has been verified by the carbon reduction sustainability work during this feasibility phase.
- ▶ **Going above and beyond:** the project has arguably exceeded its expected impact, given the realisation that additional carbon capture, use and storage opportunities alongside the hydrogen facility can turn an advanced anaerobic wastewater treatment works into a carbon sink.
- ▶ **Looking to the future:** a full-scale plant could secure multiple benefits on many fronts – air quality, public health, carbon capture, net zero, energy security, technology advancement and proof of concept. The project is looking for future funding opportunities to continue to scale the pilot infrastructure and implement the learnings.
- ▶ **Key stakeholder support:** government, regulators, supply chain, academia and other stakeholders are needed to enable the scaling of this technology and opportunity.



## Benefits

### Water company, wider partner and sector and environmental benefits

- ▶ Hypothesis validated and new level of understanding to Dŵr Cymru Welsh Water and the wider sector that a hydrogen production facility could produce hydrogen for fuel cell use in vehicles to meet substantial decarbonisation goals.
- ▶ Greater understanding of health and safety legislative requirements is invaluable as a key criterion to embed a hydrogen facility into a wastewater treatment facility.
- ▶ Better understanding of environmental and sustainability benefits.
- ▶ Business case established.



## Challenges and gaps

**Capitalisation funds:** to accelerate the uptake of project outcomes and move to the next stage, further funding and clarity on the reward schemes available is needed.

**Uncertainty in the energy market and global insecurity:** due to the process being relatively energy-intensive, the rising cost of electricity can be a barrier to implementation, as experienced recently, due to huge fluctuations in the energy market and geo-political instability. Possible optimisation of this process could look to reduce dependency on the electricity grid and leverage other, more secure, sources of energy.

**Capital-intensive process:** deriving sufficient quality and quantity of hydrogen from biogas is a very capital-intensive process. This may be a challenge for companies assessing this process from a singular financial bottom line. A more mature multi-capitals assessment approach to the business model would assess its true benefit to water companies, customers, the wider sector and its supply chains and the environment.

**More clarity required in hydrogen-based economy applications:** currently there is difficulty in distinguishing between hydrogen-based industry and hydrogen-based transport, with much of the current discussion focused on the latter. Greater benefits could be seen if attention were turned to wider uses of hydrogen to truly unlock its potential.



**Deliverables, tools and resources:** see HyValue's [Spring Showcase](#) and any updates on this project on the [Fund website](#)



**Find out more:** see any updates on this project on the [Fund website](#)



# Biopolymers in the Circular Economy (BICE)

COMPETITION	LEAD WATER COMPANY	PROJECT DELIVERY	FUNDING AWARDED	PARTNERS
			<div style="background-color: #c8e6c9; padding: 5px; display: inline-block;">£6,149,362</div>	Aquaminerals, Cellvation, Cranfield University, Glasgow Caledonian University, Royal HaskoningDHV, Severn Trent Plc, South West Water Limited, United Utilities Water Limited, Yara

Biopolymers are produced naturally by bacteria in wastewater treatment. If this material can be extracted it could be used across multiple industries instead of manufactured chemicals. The production and marketing of biopolymers from wastewater and sludge could realise several routes to circular economies and support the water industry in achieving net zero carbon by 2030 by reducing the need to procure manufactured polymers currently used for daily operational activities, and open up new markets.

Resource recovery can also solve internal

problems, such as the impact of materials, energy and operational costs. The cost of treating sludges generated in the wastewater treatment process is significant (approximately £357/tonne dry solids, tDS). Currently 90% is processed through anaerobic digestion, recovering energy as biogas, but biogas revenue faces further erosion as subsidies end. Sludge volumes are increasing due to population growth and tightening treatment requirements, alongside regulatory risks around the security of treated sludge recycling to land, so water companies require investment to increase

capacity or reduce sludge production. Biopolymer extraction could offer a higher value production model for water companies while also addressing the above issues.

Despite substantial technical innovation in this area, only a few technologies have been implemented at scale. The problem is that recovering the resource is only a small piece of the puzzle. Water companies need to consider market potential, regulatory aspects, public perception and end user requirements.

***“ This truly collaborative project will really open the door for the water industry with regards to the potential for biopolymer recovery from our wastewater and bioresources facilities. This diverse partnership will offer fantastic perspectives on circular economy approaches, reducing our carbon emissions while driving greater value for our customers. ”***

**Pat Horne, Head of Strategy and Commercial Bioresources, Energy and Carbon at United Utilities**





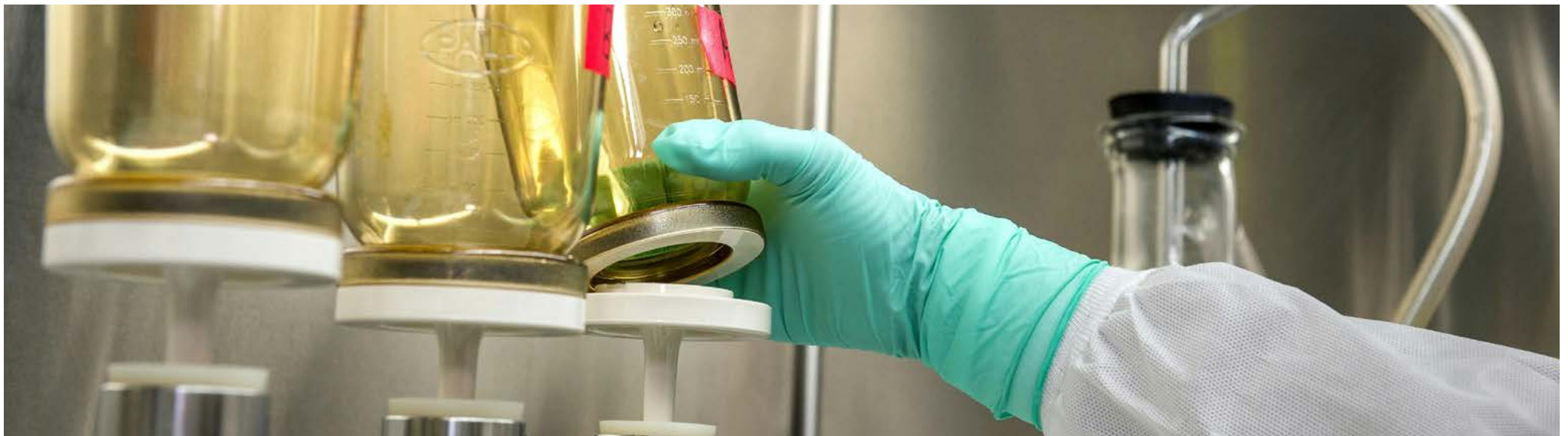
## Key learnings and insights

- ▶ **Regulatory barriers impede circularity:** there may be sector-wide issues due to the potential lack of regulatory support to circular economy projects. To truly unlock the value of circularity across the water cycle, regulatory change is needed.
- ▶ **Quality assurance:** project partners are currently examining internal processes to identify areas that may require improvements to ensure the raw material recovered from this

process is of the requisite quality to be usable in other processes, sectors and/or commercial applications. Partners remarked “we need to start thinking like a factory operation to guarantee product quality or run the risk of non-sale. For this we need to think and operate differently”.

- ▶ **Pre-empting future challenges:** the operational costs of the extraction processes

are potentially high, requiring further analysis within the project lifespan to suggest mitigating actions or system optimisations. Also, the broader sustainability, uptake and/or viability of scaling the solution could be compromised, compared to standard operations (for example biogas generation through AD), if it cannot compete against key financial, environmental and operational measures.



## Benefits

This project is very much in the early days of delivery and so has not been able to demonstrate applied benefits from the work carried out in the project, as yet. Expected water company and environmental benefits could include:

- ▶ Understanding of clear design parameters, based on actual operating data, for biopolymer extraction, allowing both large- and small-scale future systems to be technically and commercially assessed.
- ▶ New revenue streams for water companies in the \$125 billion global polymers market as they attract high-value returns from their wastewater while meeting regulatory requirements.
- ▶ Biopolymers offer WaSCs an alternative to cationic polyacrylamide copolymers (PAMs) for thickening and dewatering, and can also be used as an alternative to metal-based coagulants for phosphorus removal, saving up to £39 million/year (60,000 tonnes CO<sub>2</sub>e).
- ▶ Reduced sludge volumes increase available capacity in existing digesters for future population growth and water quality improvements.



## Challenges and gaps

**Knowledge gaps:** water companies' understanding of biopolymers and their potential uses in a circular economy context is not as mature as in other industries, requiring additional external input to realise potential.

**In tune with the seasons:** as biopolymers are used to help increase nutrient uptake in soils, the project has noted, and is managing, the risk and potential complexity with field tests of their solution, if a growing season is missed. Missing a growing season could hamper their ability to perform trials and gain insights and data to inform future developments.



**Deliverables, tools and resources:** This project is just getting started at the time of publication of this report. See the **project's webpage** on the Fund website for any updates.



**Find out more:** [Ideas@uuplc.co.uk](mailto:Ideas@uuplc.co.uk)

# SuPR Loofah (Sustainable Phosphorus Recovery)

COMPETITION	LEAD WATER COMPANY	PROJECT DELIVERY	FUNDING AWARDED	PARTNERS
			<div style="background-color: #c8e6c9; padding: 5px; display: inline-block;">£445,577</div>	The University of Newcastle upon Tyne, University of Northumbria at Newcastle, Dŵr Cymru Welsh Water

Northumbrian Water, with the University of Newcastle upon Tyne, University of Northumbria at Newcastle, Dŵr Cymru Welsh Water, is trialling the use of an innovative loofah to remove and recover phosphorous from wastewater. This prevents it from causing damaging algal blooms which can suffocate local ecosystems. This innovative SuPR Loofah treatment system will place micro-algae on a loofah material and use this to capture phosphorous from wastewater. As well as being a more affordable and sustainable process, this world-leading circular approach will generate a vital form of phosphorous for use as fertiliser.

Recovering phosphorus from sewage is a growing problem for the water industry. Phosphorus can cause algae blooms in watercourses that harm animals and plants and affect drinking water quality. To protect the environment, the discharges from wastewater treatment works are regulated and, by 2027, 95% of the population in England will have phosphorus removal technologies at the sewage treatment works.

Typically, phosphorus is removed using a chemical called ferric – a finite resource with reliability issues around supply, transport and sustainability. Once

removed, the phosphorus is not routinely recycled. Meanwhile, largely mined phosphorus is used as a fertiliser for farmers, causing further environmental damage; by 2050, its supply will be challenging. By recovering the phosphorus from wastewater, the approach piloted in this project can remove the reliance on phosphorus sourced through environmentally damaging methods and also remove the supply-chain-related reliability issues of ferric production and delivery.

**“ This innovative project has groundbreaking potential for the UK water sector and beyond. Using microalgae to enhance phosphorus removal is truly exciting and will minimise the use of expensive chemicals such as ferric and reduce impact on the environment. ”**

**Richard Warneford, Wastewater Director at Northumbrian Water Group**





## Key learnings and insights

- ▶ **Trust in nature:** it is widely known that algae can effectively extract nitrogen and phosphorous in wastewater treatment processes. Early indicators from the project show that algae in combination with fungi and bacteria can also effectively tackle other challenging pollutants such as heavy metals, pesticides, organic and inorganic toxins, and waterborne pathogens, even microplastics.
- ▶ **Pleasant surprises:** the biodegradability of starch coating is particularly promising. Wool also has the potential to be used given that it is relatively cheap, is itself a waste product and is biodegradable. A robust phosphate-processing composite can be made that can be submerged in water for weeks or months to enable the solution to be implemented at scale.
- ▶ **Demonstrating results to engage others:** the polysaccharide-based coatings used in this project have been the basis for pilots elsewhere. This has been a useful tool to engage other partner organisations to collaborate in developing this solution further and proving its capability across other wastewater treatment contexts.
- ▶ **Fail fast, fail forward:** the team adapted the micro-algae that was intended to be used in the biocomposite as it proved to be unsuitable. Chlorella, a microalgae species that does remove phosphorous, is being used now and there are other organisms growing in the loofah, which provide the potential for further investigation and spin-offs.
- ▶ **Future horizons:** iterations of this technology have been tried and tested by Northumbrian Water Group and have shown their effectiveness. Partners are now in conversation with other sectors to leverage other funding sources (Horizon Europe) to optimise sustainable and biodegradable features.



## Benefits

### Water company and environmental benefits

- ▶ **Opportunity for wide implementation:** the project team is seeking to incorporate this technology into the WINEP as part of its technology selection process, to support other water companies in their approach to sustainable, low-carbon wastewater treatment.
- ▶ **Opportunity for wider applications:** the bioreactor could have positive impacts on the removal of other Contaminants of Emerging Concern (CECs) and micropollutants. This bodes well for future developments and will ultimately provide a multi-algae in-series treatment system that could be attractive to the water sector, once operationalised.
- ▶ **Support to reach net zero ambitions:** this type of technology can represent a more sustainable treatment for phosphorous removal, removing the reliance on chemical-oriented treatment and dosing processes. Being a low carbon technology, when scaled, there are very promising results emerging that could indicate a significant reduction in overall lifecycle carbon usage and could be part of a suite of measures in wastewater treatment to decarbonise this area of the water cycle.
- ▶ **Wider use by industry as source control:** removing phosphorous and other micropollutants and contaminants at source alleviates pressures at sewage treatment works to ultimately reduce cost and carbon.
- ▶ **Academic benefits:** this project provides a real benefit for university partners as it is a strong impact case study for the Research Excellence Framework (REF) – a framework against which universities are measured and funded regarding the impact of their research – with the applied, industrial framing of the research and development. Both university partners are primed to deliver more and use the fullest extent of their capacity and capability to push the solution and the wider field and research forward.

## Challenges and gaps

**Effectiveness at scale and in operational contexts:** the emergent nature of the technology and the fact that it is still progressing through technology readiness levels mean there are potential challenges around repeatability and scalability. Lab and field test results are very encouraging but the next phase will see the technology put to the test at a larger scale, across varying operational contexts and parameters.

**Connecting with regulators and wider strategies:** new algal-based treatment solutions such as this have significant benefits in reducing the carbon associated with removal of phosphorus from wastewater. While this aligns closely to net-zero strategies it may conflict with tightening regulatory standards for phosphorous. More work is needed to collaboratively assess alternatives to conventional solutions with regulators, to enable a more flexible approach to treatment if sustainable solutions are to continue gaining traction.



**Deliverables, tools and resources:** see any updates on this project on the [Fund website](#)



**Find out more:** [innovation@nwl.co.uk](mailto:innovation@nwl.co.uk)



# Insights from the global community

## International case studies

**This section shares insights and best practice from the global water community, showcasing projects and broader initiatives that push the envelope of innovative practice within resource recovery and circular economy models.**

By providing this context, UK water sector stakeholders can reflect where there might be gaps in our knowledge or operations, as well as where there are areas of excellence in the UK that could inform global practice on these topics at the core of sustainable water and wastewater management. By sharing these learnings, we aim to further increase the ambitions of the water innovation ecosystem and forge new and lasting connections, in the UK and across the world.





**Industry:** water company  
**Location:** EU  
**Date:** 2020  
**Duration (if applicable):** ongoing


**Organisation(s) involved:** Confindustria Brescia, RAFFMETAL SPA, O.R.I. MARTIN – ACCIAIERIA E FERRIERA DI BRESCIA SPA, FONDERIA DI TORBOLE S.R.L, FERALPI SIDERURGICA SPA, Sidenor Aceros Especiales S.L, WA3RM AB, Energieinstitut an der Johannes Kepler Universität Linz, LAT Nitrogen Linz GmbH, VOESTALPINE STAHL GMBH, K1-MET GMBH, Türkiye Petrol Rafinerileri Anonim Şirketi, İstanbul Mineral and Metals Exporters' Association, Institute of Communication and Computer Systems, Energy Efficiency in Industrial Processes asbl, RINA CONSULTING SPA, Scuola Superiore di Studi Universitari e di Perfezionamento Sant'Anna, WHITE RESEARCH SRL, European Aluminium, INDUSTRIAL MINERALS ASSOCIATION EUROPE

## Summary

The CORALIS project tackles the challenge of industrial symbiosis (IS) by showcasing real-world implementations across Europe. By turning one industry's waste into another's resource, it aims to drive decarbonisation in energy-intensive sectors. Initial demonstrations in Spain, Italy and Sweden have paved the way for replication in three more industrial parks.

## Key outcomes

CORALIS conducted demo cases that resulted in best practices relating to the efficient design of an IS. These include engaging with stakeholders early to build trust and establish clear communication channels, and learning about an industry's resource flows and waste streams to identify potential resource exchange opportunities. CORALIS is launching a tool to help assess the technical, economic and environmental feasibility of an IS project. It will allow companies to determine how much they can save in costs and emissions before investing. Another tool aimed at minimising risk and failure will enable companies to store all data on products and processes and manage the products' entire lifecycle.

 [www.coralis-h2020.eu/partners](http://www.coralis-h2020.eu/partners)



**Industry:** manufacturing and process industries  
**Location:** Europe  
**Date:** 2020  
**Duration (if applicable):** 4 years

**Organisation(s) involved:** ISQ, INEGI, LINKS Foundation, ATB Institute for Applied Systems Technology Bremen GmbH, Fraunhofer FIT, University of Cambridge – Institute for Manufacturing, Lean Enterprise Institute Polska, SINERGIE Soc. Cons. a r. l. (SINERGIE), IZNAB Sp. z o.o. (IZNAB), Microprocessor, MCG mind for metal, GLN Plast, J.W. Ostendorf, OAS, Worlée

## Summary

MAESTRI's Total Efficiency Framework integrated management systems, assessment tools and industrial symbiosis concepts. Through real-world application in four industrial settings, the project optimised resource and energy usage, identified waste streams for reuse, and established key performance indicators for monitoring and reporting. MAESTRI's approach fostered a culture of continuous improvement, driving eco-competitiveness and enhancing environmental stewardship in the manufacturing and process industries.

## Key outcomes

MAESTRI: developed a flexible and scalable Total Efficiency Framework for process industries; integrated management systems for decision-making and continuous improvement; introduced efficiency assessment tools to optimise resource and energy usage; and implemented industrial symbiosis concepts to identify and use waste as a resource.

 [maestri-spire.eu/project](http://maestri-spire.eu/project)



# AFTERLIFE

**Industry:** water company  
**Location:** Europe (7 countries)  
**Date:** 2017  
**Duration (if applicable):** 4 years

**Organisation(s) involved:** Celabor Scrl, Teknologian Tutkimuskeskus Vtt Oy, Jake S.A., Heritage 1466 S.A., Idener, L'urederra Fundación Para El Desarrollo Tecnológico Y Social, Agencia Estatal Consejo Superior De Investigaciones Científicas, Citromil S.L., Innoven Srl, Mi-Plast Ltd., Ctc- Centro Tecnológico Nacional De La Conserva Y Alimentación, Bio Base Europe Pilot Plant Vzw, Nova-Institut Für Politische Und Ökologische Gmbh, Nova. Id.Fct – Associação Para A Inovação E Desenvolvimento Da Fct

## Summary

AFTERLIFE demonstrates a wastewater treatment process that recovers valuable compounds and converts organic matter into high-volume biopolymers. It involves developing filtration systems, purifying valuable compounds and optimising resources following a circular economy approach. The project pushes beyond conventional wastewater treatment methods and contributes to new cross-sector interconnections, cooperation projects and bio-based value chains, demonstrating innovation and sustainability in wastewater management.

## Key outcomes

AFTERLIFE has: recycled or reused at least 10% of suspended solid fractions; established cooperation projects through cross-industry clusters; developed at least one new bio-based value chain and one new bio-based material; and had introduced 30 new consumer products by 2020.

# SCALIBUR

**Industry:** water management and recycling  
**Location:** Europe (Spain, Italy, Greece, Poland)  
**Date:** 2017  
**Duration (if applicable):** 4 years

**Organisation(s) involved:** Itene, Aeris, A&A, Cener, Clube, SSCP, FCC, Greenovate! Europe, Kour Energy, Anci Lazio, City of Lund, Madrid, Novamont, Nutrition Sciences, Aqualia, Unimore, Iris, Wetsus, Brabantse Delta, Zetadec

## Summary

The SCALIBUR (Scalable Technologies for Bio-urban Waste Recovery) project focuses on transforming urban food waste and sewage sludge into high-value products, increasing recycling rates and creating new business opportunities within the circular economy. Its development of best practices, demonstration of value chains and creation of new business models push beyond traditional waste management practices.

## Key outcomes

SCALIBUR has: developed best practices for the collection, transport, sorting and pre-treatment of biowaste; demonstrated value chains to convert bio waste into bioplastics, biopesticides and other biobased products; reduced the environmental impact of waste by diverting bio waste from landfills and incineration; and created new circular economy business models and opportunities.



**Industry:** water company  
**Location:** Europe (10 countries)  
**Date:** 2017  
**Duration (if applicable):** 4 years

**Organisation(s) involved:** TU Delft, Sealeau B.V., Evides, Europiren BV, TYPASA, Tubitak MAM, REVOLVE, IQE, Arvia, DLR, EURECAT, FACSA, IVL, Lenntech, SUT, UNIPA, University of Aberdeen, Witteveen + Bos, Water Europe

## Summary

Zero Brine involves 22 partners in 10 countries from research institutes, SMEs, construction companies and end users. The project aims to recover minerals such as magnesium and clean water from industrial processes for reuse in other industries. This circular economy approach focuses on resource recovery from industrial wastewater and develops technological solutions and business models to implement the circular economy package. The project's large-scale demonstrations and policy briefs demonstrate its commitment to pushing beyond traditional industrial practices.

## Key outcomes

Zero Brine developed new configurations for recovering minerals such as magnesium, calcium and sodium chloride from saline-impaired effluents (brines) generated by process industries. It has integrated new and existing technologies to recover high-quality end-products and developed large-scale demonstration plants in Rotterdam Port, with pilot plants in Poland, Turkey and Spain. The project's technology has led to a reduction in greenhouse gas emissions through more efficient process design and energy savings.

 [zerobrine.eu](http://zerobrine.eu)



**Industry:** wastewater treatment and agriculture  
**Location:** Sweden  
**Date:** 2002  
**Duration (if applicable):** ongoing

**Organisation(s) involved:** Svenskt Vatten (Swedish Water & Wastewater Association), Swedish Environmental Protection Agency, and various municipal wastewater treatment plants in Uppsala, Helsingborg and Stockholm

## Summary

In Sweden, advocacy efforts by environmental groups and researchers led to regulatory changes that mandated nutrient recovery from wastewater streams. This drove the implementation of measures such as the REVAQ certification system – a voluntary programme that aims to ensure the safe and sustainable recycling of nutrients and resources from wastewater treatment plant (WWTP) sludge in agriculture. Annual independent audits verify compliance and issue certifications.

## Key outcomes

The REVAQ certification system sets rigorous standards for the treatment and monitoring of wastewater and sewage sludge to minimise the presence of harmful substances and pollutants. The certification process involves continuous improvement, regular monitoring, and transparency to build trust among stakeholders, including farmers, regulators and the public, and reduces contaminants entering WWTPs through upstream work, providing traceability and quality assurance for sludge used as fertilisers.

 [conferences.aquaenviro.co.uk/wp-content/uploads/sites/7/2015/07/6-IOns-D.-Gryaab-AB.pdf](http://conferences.aquaenviro.co.uk/wp-content/uploads/sites/7/2015/07/6-IOns-D.-Gryaab-AB.pdf)



**Industry:** wastewater treatment  
**Location:** Copenhagen, Denmark  
**Date:** initiated in 2010  
**Duration (if applicable):** ongoing

**Organisation(s) involved:** BIOFOS

## Summary

BIOFOS is Denmark's largest wastewater utility, responsible for treating the wastewater from 1.2 million inhabitants in the Copenhagen metropolitan area, and operating three major wastewater treatment plants. BIOFOS recovers resources from wastewater and produces energy in the form of electricity, biogas and district heating for the grid. A key aspect of BIOFOS's operations is the production of biogas from sewage sludge generated during wastewater treatment. The biogas produced at BIOFOS's plants is treated and injected into the natural gas grid, contributing to Copenhagen's goal of achieving 100% green gas by 2025.

## Key outcomes

The BIOFOS project in Copenhagen plays a crucial role in the city's sustainability efforts by producing renewable biogas from sewage sludge, aligning with its green gas goals, improving energy efficiency and reducing emissions. Moreover, by adopting methods such as sludge incineration and heat recovery, the project has effectively shifted sludge disposal from being energy consuming to energy producing.

 [en.biofos.dk/produktion/energi-og-ressourcer](https://en.biofos.dk/produktion/energi-og-ressourcer)





# 3 Collaboration in practice

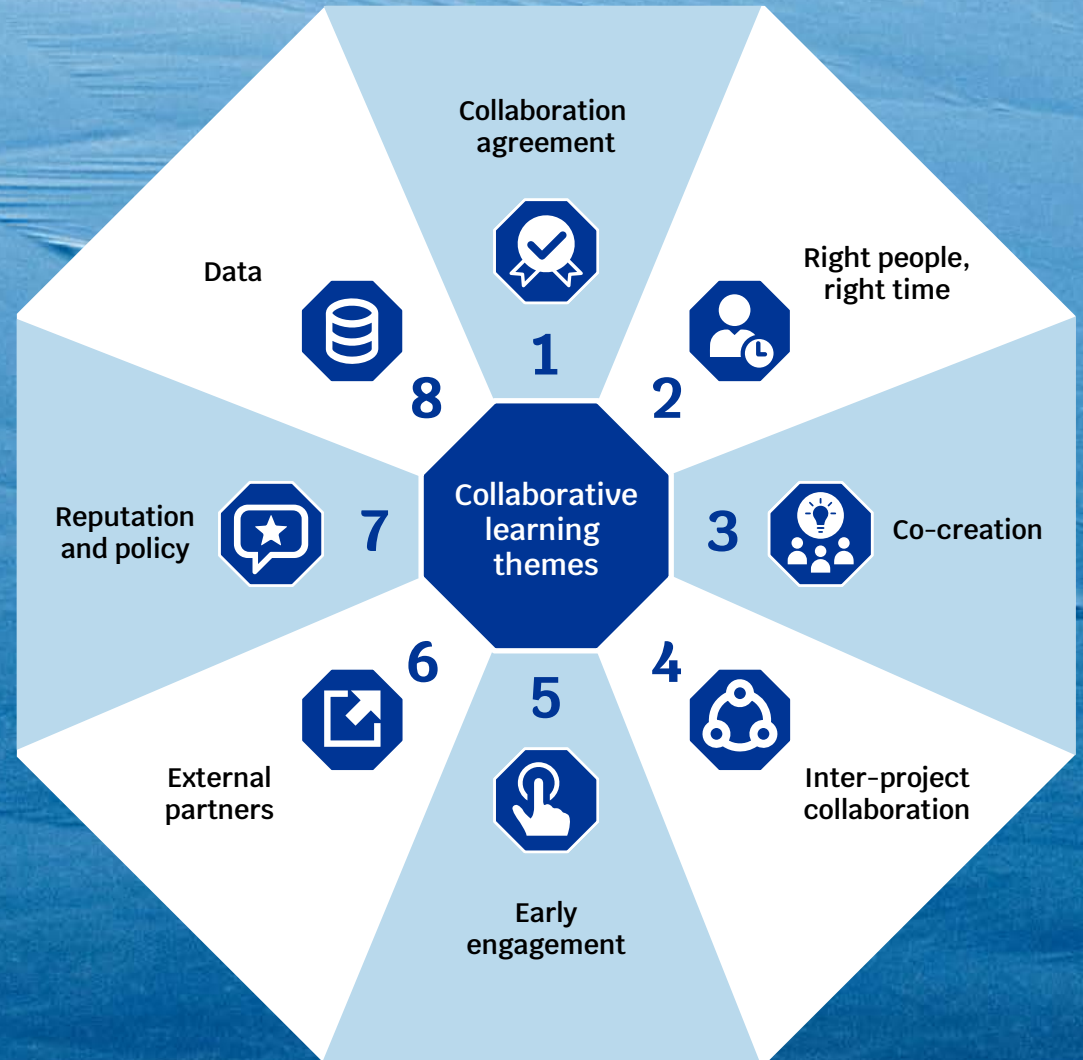
**A notable success of the Ofwat Innovation Fund in the period 2020-2025 has been the step change in collaboration across the UK water sector. The increase in partnership activities and maturity of the sector in its approach to knowledge sharing and pursuit of mutual benefits will be a lasting positive legacy of the fund.**

Beyond the project and topic-specific learnings and insights highlighted in this report, partners across the Ofwat-funded portfolio have also gathered valuable experience in other aspects of project delivery, management and governance.

In this section we delve deeper into these learnings, across topics such as partnerships, legal agreements and other collaborative learning themes.

We also shine a light on the challenges and barriers to effective scaling and implementation of project tools, outputs and results.

We hope that by acknowledging these learnings we enable future applicants and stakeholders to overcome these challenges, improving the outcomes and impact of the Ofwat Innovation Fund and its portfolio of funded projects.





## 1. Collaboration Agreement (CA)

Drafting and signing the CA took significantly longer than expected for nearly all project teams. It is valuable to start the CA process with partners as early as possible to allow time to focus on the project scope, delivery planning and recruitment. Without an agreement in place, many partners were working on goodwill and were exposed to an unfavourable degree of risk, especially for smaller organisations. More experienced partners now start drafting a high-level CA as part of the application process, preparing and agreeing the CA, up to proceeding to signature, between the announcement and the project start.



## 2. Right people, right time

Transdisciplinary teams with a diversity of skills and expertise, and clear roles and responsibilities, work best. Any gaps should be identified early as recruiting the right talent, especially if on short-term contracts, can take time. Partners all agreed that the lead partner organisation should ensure appropriate project management capacity is in place from the start. Recruiting communications and marketing roles early enables robust communications and dissemination plans, which are essential for the widest impact and uptake of project outcomes. Adopting an agile methodology allowed projects to adapt swiftly to changing requirements, especially with an iterative approach with frequent feedback loops and user-centric design. Some partners felt that the Ofwat reporting cycle didn't align with this way of working, with its more rigid quarterly monitoring and reporting cycle.



## 3. Co-creation

The need for co-design and co-creation with end users was stressed by projects. Taking time to plan these engagements and thinking through how a project engages across different end users pays dividends. Using human-centred design techniques to ensure the customer/end user voice is at the heart of design processes is highly effective, yielding longer-lasting, more profound impact. Some partners suggested a funded co-creation phase to enable a deeper understanding of the problem space – its people, their needs and pain points. This would ensure the relevance and targeted nature of future project interventions.

Partners stressed the need for a transparent and collaborative culture of co-creation within the project, too. Without this, learnings were less easily shared, and risks less well managed.



## 4. Inter-project collaboration

Some partners reflected that, within the portfolio of projects in a theme or a grouping of inter-related themes, there is currently a missed opportunity to come together and share learnings, insights and resources. This would enable greater and more systematic alignment between project partners, throughout the lifetime of the projects. One suggestion was the creation of a network of project leads within these thematic areas. This network would drive the agenda on behalf of the sector and create a discernible community of innovation practitioners and excellence to engage within the sector, the supply chain and regulators alike.

## 5. Early engagement

Considering and defining what success looks like before project delivery starts enables far better evaluation of objectives and key results, ensuring a continuous reflective culture from the outset. Partners shared insights on the merits of engaging the breadth of end users and adopters early in the project to ensure the project offer is relevant and can secure adoption. Consultative, consensus-driven planning with the regulators, other external partners, water companies, customers and even internal colleagues is critical to an innovation project's smooth delivery. It enabled partners to secure engagement, creating relationships that would benefit the project, plugging resource and skill gaps and helping shape the delivery programme.

## 6. External partners

Some of the projects shared insights around how water companies' hard and soft infrastructure, as well as processes and systems, were significant barriers to project delivery and how they were unable to capitalise fully on the expertise, technology or capabilities of external partners as a result of this. Providing data to external partners could be a challenge due to the sensitivity of the data or attempts to link incompatible systems.

## 7. Regulation and policy

Many partners cited current regulations and the policy landscape as a significant barrier to achieving the full potential of their innovation projects, highlighting fragmented regulations working against a systemic approach. There is an opportunity for these innovation projects to act as a sandpit/testbed to trial new regulatory models, with dispensation that may impact their regulatory compliance in the short-term as these new models are embedded in water company operations. Given that one of the fundamental principles of innovation is that if a project is delivered in a collaborative, consultative way then regulation can and will change, if necessary, partners should not be deterred. Partners also remarked on the importance of a project's alignment to strategies beyond the water sector that can enable change at a wider deeper level, as they cross government agendas and other investment opportunities.

## 8. Data

Partners reported concerns over access to data from project partners, in particular water company-held datasets. Lack of access to data meant that some projects had to rely solely on publicly available data that was of lesser quality and lacked the granularity required in certain cases, reducing their impact. It often required interpretation and wider input to validate assumptions, introducing inefficiencies and margin for errors.

# Reflections

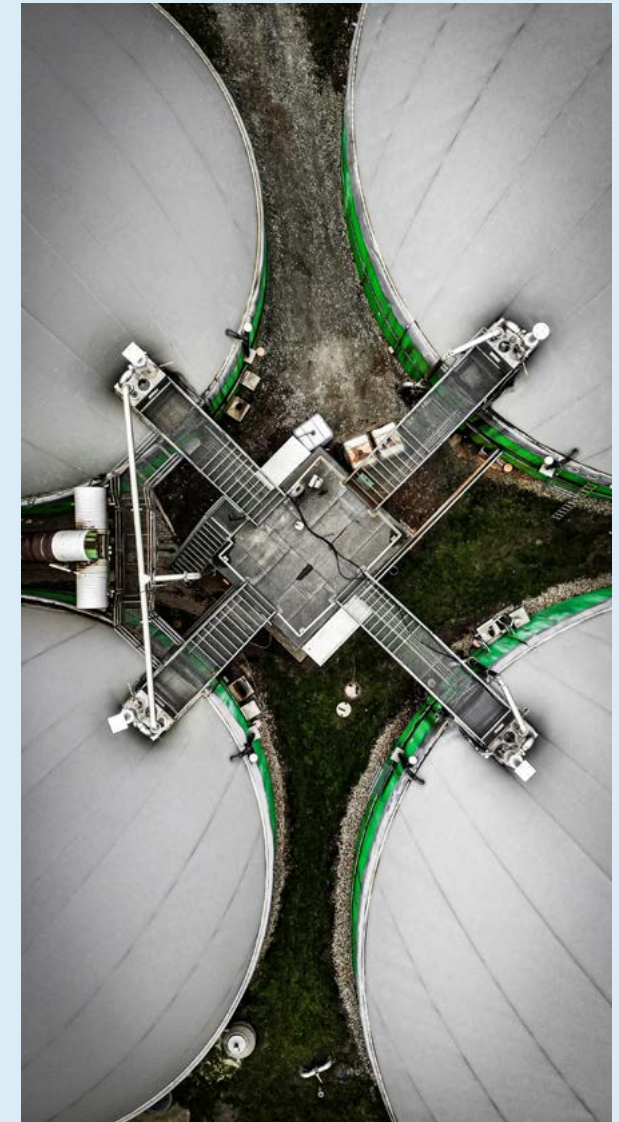
**Unlocking waste as a resource within the water sector requires a shift from retroactive compliance recording to proactive circular economy opportunities. Implementing dedicated systems, like those developed by the projects in this report, can help identify and leverage these opportunities. Aligning internal functions, such as contract management, supply chain procurement, innovation functions and asset strategy planning, is crucial for enabling industrial symbiosis, resource recovery and broader circularity in water systems – something the water sector in the UK, and globally, needs to address.**

The experiences of the projects showcased in this report underline the importance of waste material reporting to company objectives regarding bioresources and wider resource recovery. Capturing, monitoring and reporting the value of circular systems through KPIs and multi-capitals approaches can foster buy-in, responsibility and ownership among stakeholders to either adopt or more deeply embed the systems and processes that can enable water companies and their supply chains to unlock the potential of circularity in water.

The potential for sector-wide benefits, such as achieving net-zero targets and creating new value chains in various industries, is significant and remains underdeveloped. Increased competition and suppliers could drive sector growth, with mutual wins for waste creators, users and intermediaries.

However, market fragmentation and the lack of a centralised body overseeing circular economy opportunities for the water sector poses a challenge to the scalability and business as usual adoption of the practices highlighted in this report. Creating sector-wide targets and collaborative strategies to build critical mass in the UK is essential to realise the full potential of circular economies in water and achieve sustainable growth.

These projects have highlighted barriers that impede the circularity of the water sector and have shone a light on possible changes that would unlock the full value of circular economy projects, but what's next? How can we overcome the barriers faced by these innovation projects to effectively scale and demonstrate impact at the widest possible level?



Below we explore ways to collectively shape collaborative actions and suggest ways to overcome the challenges highlighted throughout this report.

**Advocate for regulatory change:** engage with regulatory bodies to develop and implement policies that support circular economy projects within the water sector. This will help unlock the value of circularity and the adoption of innovative solutions.

**Adopt multi-capitals assessment:** using a multi-capitals assessment approach to evaluate the comprehensive benefits of the processes and project outcomes, considering environmental, social and economic impacts, will enable broader adoption and a transition away from purely financial measurement of the impact of these approaches.

**Expand knowledge and collaboration:** address knowledge gaps by fostering collaboration between water companies and external experts in resource recovery and circular economy practices. This will help water companies better understand the potential uses and benefits of their raw materials in applications outside their current practice and the industry status quo.

**Enhanced data collection and sharing:** develop a standardised data collection and sharing protocol among water companies to ensure consistent and detailed data availability. This would support better decision-making and scenario modelling, addressing current limitations in data and barriers to exploiting circular economy growth opportunities.

**Enhance quality assurance processes:** for those projects looking at resource recovery for circular economy applications, developing and implementing factory-like quality assurance processes to ensure that recovered materials meet the necessary standards for commercial use is paramount. This will increase the marketability and usability of these materials in the sectors where there are value creation and impact opportunities.

**Scale-up and operational testing:** conduct large-scale trials across various operational contexts to ensure the technologies trialled in these projects are effective, repeatable and scalable. This phase will validate lab and field test results in real-world scenarios to strengthen the business case and further increase the potential for adoption, scale-up and wider deployment.

**Long-term investment and funding clarity:** secure long-term funding beyond the innovation phase (Ofwat Innovation Fund and other earlier stage funding programmes) to support continued collaboration between water companies, the supply chain and other stakeholders. Engage the broader investment and green finance community to ensure sustained investment in innovative solutions and infrastructure, beyond pilot and proof of concept scale.



# Call to action

**Ofwat's hope is that this report and the insights and learnings in it will be useful in implementing and scaling the knowledge and resources shared by partners of the projects highlighted.**

As stated at the outset of the report, this is a starting point for connections, further collaboration and development, as well as a catalyst for change that can bring about positive impact for the water sector, its customers, society and the environment. If you would like to discuss any of the topics in the report we invite you to reach out directly to the projects and their partners, or to the Ofwat Innovation Fund delivery team at **[waterinnovation@challengeworks.org](mailto:waterinnovation@challengeworks.org)**

The time for action is now. Pick up the baton from here and seize the opportunity to collectively drive circularity, circular systems and economies in the water sector, as tools to meet and overcome the challenges we face, today and into the future.



# Further reading

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# Ofwat Innovation Fund

Ofwat Innovation Fund is overseen by Ofwat, the Water Services Regulation Authority for England and Wales. The Ofwat Innovation Fund is delivered by Challenge Works, supported by Isle Utilities and Arup.

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Challenge Works, the new name for Nesta Challenges, is part of Nesta, a registered charity in England and Wales 1144091 and Scotland SC042833. Our main address is 58 Victoria Embankment, London, EC4Y 0DS.

