Institution of MECHANICAL ENGINEERS

PROCESS INDUSTRIES DIVISION

LATEST NEWS, RESEARCH, THOUGHT LEADERSHIP, JOBS, EVENTS AND TRAINING IN YOUR INDUSTRY OR SECTOR

From Effluent to Asset: Wastewater Recovery in Food & Beverage



Technical Talk

12:00 BST on **Thursday, 27 August 2026**

MS Teams Online Webinar

This webinar explores how the food and beverage industry is transforming wastewater from an operating cost into a source of value.

Featuring PepsiCo, Carlsberg Britvic, and Grundfos, it covers water standards, proven recovery technologies, and emerging circular-economy opportunities.

Aimed at engineers and sustainability professionals working in process industries.

Improving the world through engineering

HOUSE KEEPING.

Institution of MECHANICAL ENGINEERS

- This event will be **recorded** and made available in our Process Industries Division YouTube playlist.
- All attendee media are disabled to allow for a smoother presentation.
- Registered delegates will receive a **CPD certificate** depending on their attendance duration.
- **Questions** to be submitted through the **Q&A** or **Chat tabs** available at the top right, and we will answer as many of them as possible within our limited time.
- **Slides** may be made available at speakers' discretion.
- To ensure privacy and data security, **AI chatbots** are not permitted to create notes or transcripts.

Disclaimer: CPD certificate provided is not a qualification, and it does not indicate the level of knowledge or skills attained during the event, nor is it a substitute for any formal qualification or credential. The content of this event, including any presentation slides, is intended solely for the use of confirmed delegates. Delegates may use this information for their own personal or professional purposes. However, the reproduction, distribution, or publication of any portion of this event or its materials, including presentation slides, without the express written consent of the Institution of Mechanical Engineers (IMechE) and the respective speaker, is strictly prohibited.

Institution of MECHANICAL ENGINEERS

PROCESS INDUSTRIES DIVISION

LATEST NEWS, RESEARCH, THOUGHT LEADERSHIP, JOBS, EVENTS AND TRAINING IN YOUR INDUSTRY OR SECTOR

Who We Are & What We Do

We serve as a central point for mechanical engineers to connect, share expertise, and promote best practices within the process industries.

Improving the world through engineering

Industry Focus:

- Bulk Materials Handling
- Food and Drink
- Oil, Gas and Chemicals
- Pharmaceuticals
- Upstream Oil and Gas
- Water and Wastewater

Key Activities:

- Organising specialised lectures, seminars, and conferences.
- Representing the process industries to government and international bodies.
- Promoting education, training, and continuous professional development.

EQUITY, DIVERSITY AND INCLUSION.

Institution of MECHANICAL ENGINEERS

- At IMechE, we believe engineering is for everyone. Our vision is to foster an inclusive culture where all members, employees, and the wider engineering community feel valued, develop a sense of belonging, and are empowered to thrive.

- We are committed to embedding inclusion into every aspect of our Institution with support from the People and Culture team, our Culture and Inclusion Committee and our Culture Ambassador Network. We celebrate diversity amongst our members, employees and the wider engineering community to ensure we meet the needs of our global community, driving progress and innovation in engineering for the benefit of all.

Improving the world through engineering

OUR SPEAKERS TODAY

Food and Drink Engineering Committee of the Process Industries Division of the IMechE

Dr Yianni Alissandratos



- Senior Manager Digital Manufacturing – Carlsberg Britvic
- Member IMechE Food & Beverage Committee
- Fellow of the IFST
- Co-Author – KCL on Beverage to Waste Research

Stephen Rowe



- Engineering Director, PepsiCo Supply Chain Engineering
- IMechE FDEC Vice chair

Lou Wright



- Head of Sustainability – Carlsberg Britvic

Martyn Ralph



- Freelance Brewery Engineering Consultant.
- Chair, IMechE Process Industries Division Food & Drink Engineering Committee.
- Member, IMechE Process Industries Division Board

Water story: why bother?

A cubic metre of water costs about the same as a bag of crisps. So why invest & build a circular economy around it?

THE PRICE NOW

It is almost free.

£1–3 / m³ to buy and discharge
= £1–3 per **1,000 litres**

≈ the cost of a bag of crisps per tonne of water

So Why Bother trying to save it, so we don't.
And that is exactly the problem.

THE TRAP

We Pay for it Twice

1.4–3.9 L effluent per litre sold
+42% business water charges, (2025–30 *Ofwat PR24)*
+9.6% effluent charge in one year *(NI Water)*

The cost is low.
The exposure is not.

THE WAGER

Act before you have to.

- **5 bn L/day** England shortfall by 2055 *(EA)*
  +1 bn L/day for industry & food
- **61%** of F&D firms already hit by water limits;
  22% cancelled projects *(Water Resilience Survey 2024)*

Not ethics versus economics.

Protecting our water is not only the right thing. To do its also securing our production a decade in advance

We are not doing this because water is expensive but because one day it will be… and by then it is too late to start.
The cheapest resource on our books is the one we can least afford to lose.

CARLSBERG BRITVIC pepsico Institution of MECHANICAL ENGINEERS

WHO IS PEPSICO?

2025 PERFORMANCE

Nearly $94 B net revenue

SCALE

200+ countries & territories and 1,000+ manufacturing sites

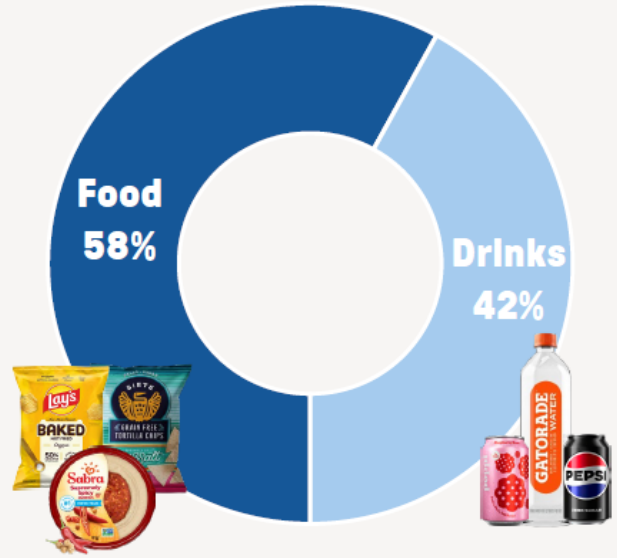
PEOPLE

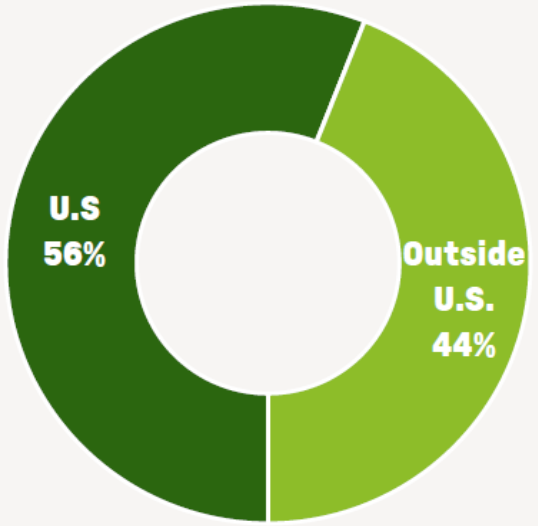
~306,000 employees
~100,000 suppliers

BRANDS

Many iconic billion-dollar brands

CATEGORIES





GEOGRAPHY

PEPSICO IS HEAVILY GROUNDED IN AGRICULTURE

Approximately 50 agricultural crops & ingredients from ~60 countries



10MM+ acres of farmland in our agricultural footprint



300,000 farmers in our direct and indirect supply chains



63 regenerative agriculture demonstration farms



4.7 MM acres used regenerative agriculture, restorative or protective practices in 2025[1]



70% of our key ingredients were sustainably sourced in line with our guidelines in 2025[2]



1 Refined goal announced on May 22, 2025. 2024 performance calculated retroactively. For more information, see Calculation Methodology

2 Sustainably sourced refers to in-scope ingredient volumes that meet the established criteria outlined in PepsiCo's Sustainable Sourcing Guidelines. Sustainable Sourcing practices can help manage risks, but challenges like deforestation or social issues can persist in some regions. Refined goal announced on May 22, 2025.

PEP+ OVERVIEW

Our vision is to **Be the Global Leader in Convenient Foods and Drinks by Winning with PepsiCo Positive (pep+).**

pep+ is our strategic end-to-end transformation that places **sustainability at the center of our business strategy**, seeking to drive growth and build a stronger, more resilient future for PepsiCo and the communities where we operate.

PEP+ has 3 interconnected pillars:



POSITIVE AGRICULTURE

We are working to source our crops and ingredients in ways that restore the earth and strengthen farming communities.



POSITIVE VALUE CHAIN

We are helping to build a circular and inclusive value chain.



POSITIVE CHOICES

We are inspiring consumers through our brands to make choices that create more smiles for them and the planet.

POSITIVE VALUE CHAIN GOALS – WATER

WATER GOALS

2030 OPERATIONAL WATER-USE EFFICIENCY

Reach average water-use efficiency ratios of 1.4 liters/liter of production in beverages sites and 1.7 liters/kilogram of production in convenient foods sites for 100% of high water-risk PepsiCo and franchise bottler manufacturing facilities by 2030*

*Contract manufacturers and co-packers are excluded. Our progress toward this goal relies in part on water-use efficiency at high water-risk franchise bottler manufacturing facilities. We are working to integrate their data into future calculations

2025 REPLENISHMENT

Achieved 100% water replenishment at company-owned facilities designated in high water- risk areas by 2025*

*World Resource Institute's Aqueduct water stress assessment tool is used to reconfirm high water-risk areas every three years. We continue to measure progress against our original 2025 goal and our extended 2030 goal. In 2022, an updated water risk assessment identified additional company-owned high water-risk facilities, which are in-scope for calculating progress against our 2030 goal only. The reported replenishment volumes for company-owned facilities are currently being capped at 100% per location. Once we achieve 100% for each company-owned location, we will start to then report progress of more than 100% replenishment at site as applicable.

2030 REPLENISHMENT

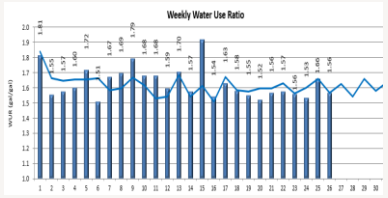
Replenish back into the watershed 100% of the water we use in high water-risk PepsiCo and franchise bottler manufacturing facilities by 2030*

*Contract manufacturers and co-packers are excluded. Our progress toward this goal relies in part on replenishment associated with high water-risk franchise bottler manufacturing facilities. We are working to integrate their data into future calculations

WATERSHED (AWS)

Adopt the Alliance for Water Stewardship (AWS) Standard in high water-risk manufacturing facilities by 2025









PepsiCo and Water Sustainability - Replenishment

Water Replenishment Strategy

PepsiCo replenishes water in high-risk watersheds through projects that restore and protect local freshwater ecosystems. Replenishment projects focus to:

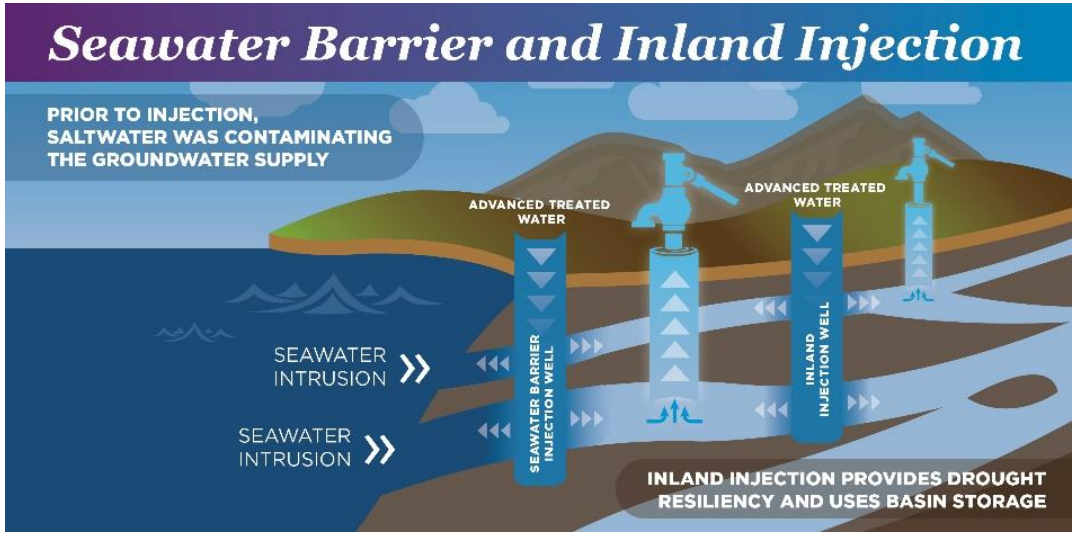
- Conserve and restore land to reduce **runoff** and increase **groundwater recharge**
- Enhance **water supply reliability** through efficiency improvements
- Restore **wetlands** and protect **aquatic ecosystems**

In 2025, PepsiCo supported more than **60 active replenishment projects**, returning nearly **29 billion litres of water** to local watersheds and advancing net water positive goals in high water-risk areas.

Water Replenishment Case Study

Leo J. Vander Lans Advanced Water Treatment Facility
Long Beach, CA

- PepsiCo provided a $1.5M grant supporting aquifer storage and recovery
- Uses aquifer injection wells to prevent sea water intrusion
- Expected to replenish up to 7.6M litres per day to the local aquifer
- Improves long-term water resilience for the region



PepsiCo and Water Sustainability - Replenishment

Water Replenishment Case Studies Cont.

Each watershed is unique, so PepsiCo works with local partners to implement replenishment strategies tailored to the local environmental conditions.

Rainwater Harvesting



Guatemala

Rainwater harvesting systems were installed at three school communities in the Motagua Basin. The systems improve **local water access** while contributing to regional **water replenishment goals**.

Watershed Reforestation



Dominican Republic

More than **160,000 trees** were planted in the Ozama River Basin. The project replenished approximately **110M litres of water in 2024** while reducing erosion and flood risk.

River Restoration



Segura, Spain

Near the Alvalle facility in Andalusia, invasive species are being replaced with native vegetation to improve river flow, increase **water availability**, and reduce **flood risk**.

Ecosystem Restoration



Florida Everglades

Removal of invasive hardwood species helps increase **water retention capacity** and restore natural **hydrologic connectivity** across the Everglades watershed.

PepsiCo and Water Sustainability – Operational Efficiency

Operational Efficiency Strategy

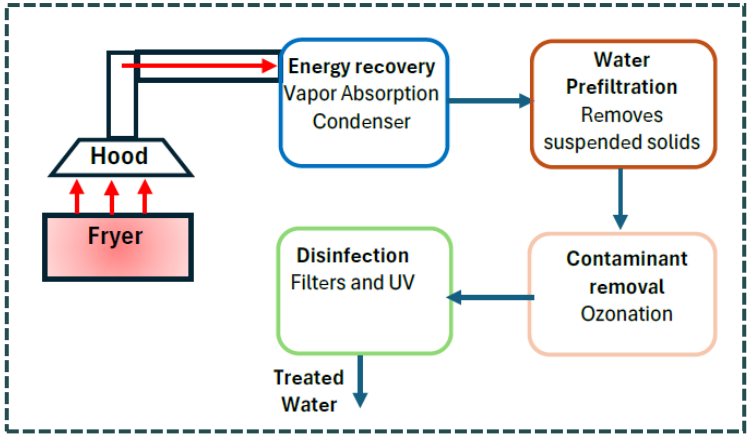
PepsiCo improves water efficiency across manufacturing and agriculture by recovering water, reducing losses, and embedding sustainable design practices into operations. Operational efficiency initiatives focus on:

- **Water reuse and recovery** within manufacturing processes
- **Resource Conservation (ReCon)** programs that scale successful practices across PepsiCo
- **Sustainable facility and agricultural design** to reduce long-term water demand

Operational Efficiency Case Studies

India Snacks Facility

Potatoes are ~80% water, and the frying process releases significant water vapor. Technology used at facilities in India captures and condenses process vapor while recovering heat and removing fats, oils, and grease. Recovered water is reused in potato processing operations saving **60 million litres per year** at a single site.



Florida Agriculture

In partnership with N-Drip and Netafim, PepsiCo converted nearly 700 acres of sugar cane farmland to drip irrigation systems in 2025. This delivers water directly to the root zone and reduces water losses.



Credit: PepsiCo

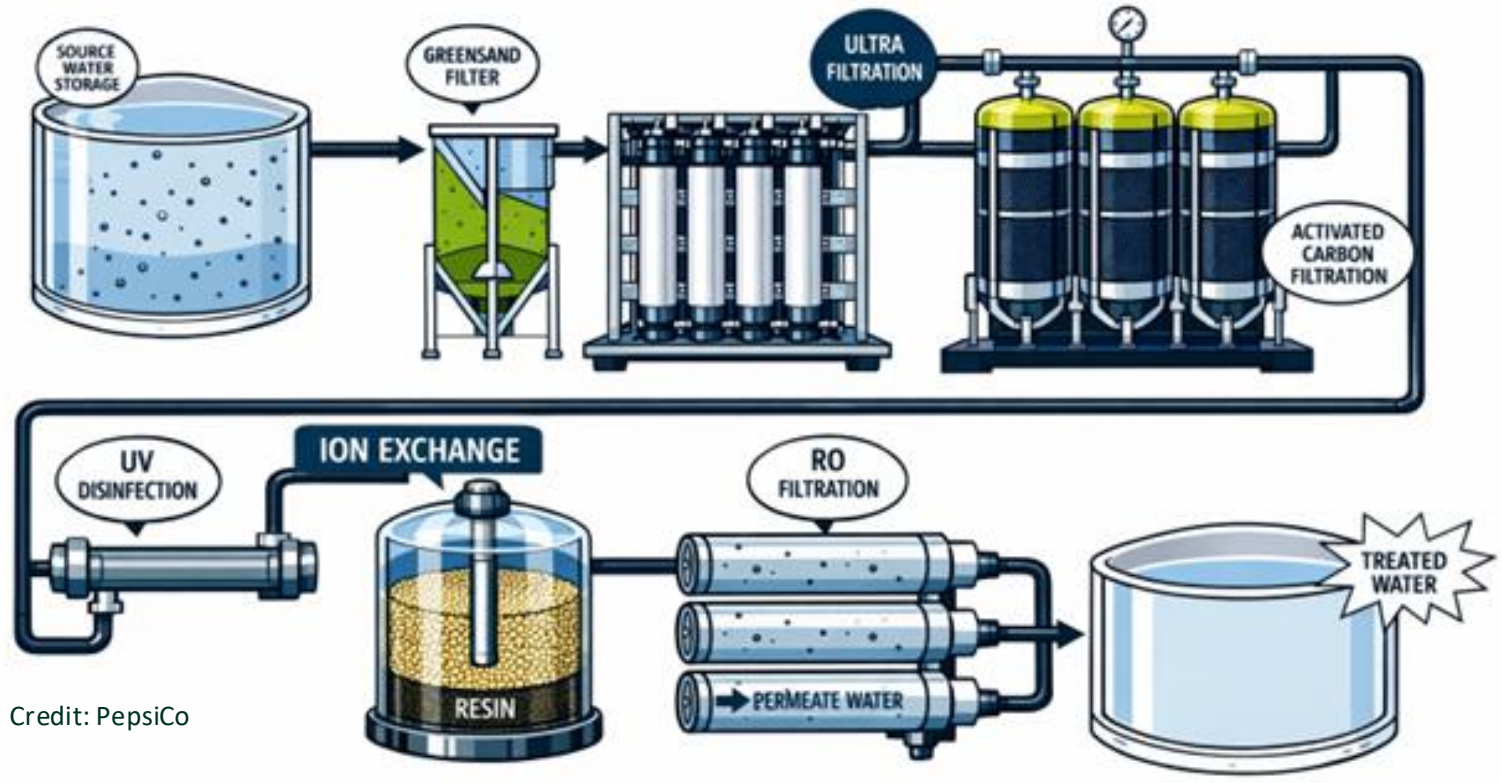
PepsiCo and Water Sustainability – Operational Efficiency

PepsiCo Beverage Water Quality Requirements

PepsiCo uses water in product formulation, cleaning, processing, utilities, etc. Because water is the primary ingredient in many beverages, ingredient water quality must be tightly controlled to ensure product consistency, taste, and shelf-life.

Key Water Quality Parameters
Total Dissolved Solids
Total Alkalinity
Total Hardness
Chloride
Sulfate
Potassium
pH

Typical Beverage Water Treatment Process



Credit: PepsiCo

The extent of water treatment can adversely impact the **product/water use ratio**, for example, filter back washing & RO brine…

PepsiCo and Water Sustainability – Operational Efficiency

Water Treatment Efficiency Strategy

Reducing water losses through process optimization, water recovery, digital monitoring, and sustainable facility design.

Filtration Backwash Optimization
Schedule backwash based on filter performance rather than fixed intervals. Reuse backwash where feasible.

RO Optimization
Improve water recovery through optimized RO performance, reducing wastewater while maintaining ingredient water quality.

Flush Optimization & Reuse
Minimize water consumption during rinsing and sanitation and reuse rinse water in appropriate non-ingredient applications.

Digitalization & Submetering
Monitor water consumption in real time to identify leaks, abnormal usage, and improvement opportunities.

Sustainable Facility Design
Design facilities with water reuse, recovery, and conservation technologies. Replicate best practices across beverage network.

PBNA HWR Water Use Ratio:

1.8 L/L (2017) → **1.6 L/L (2026)** → **1.4 L/L (2030 Goal)**

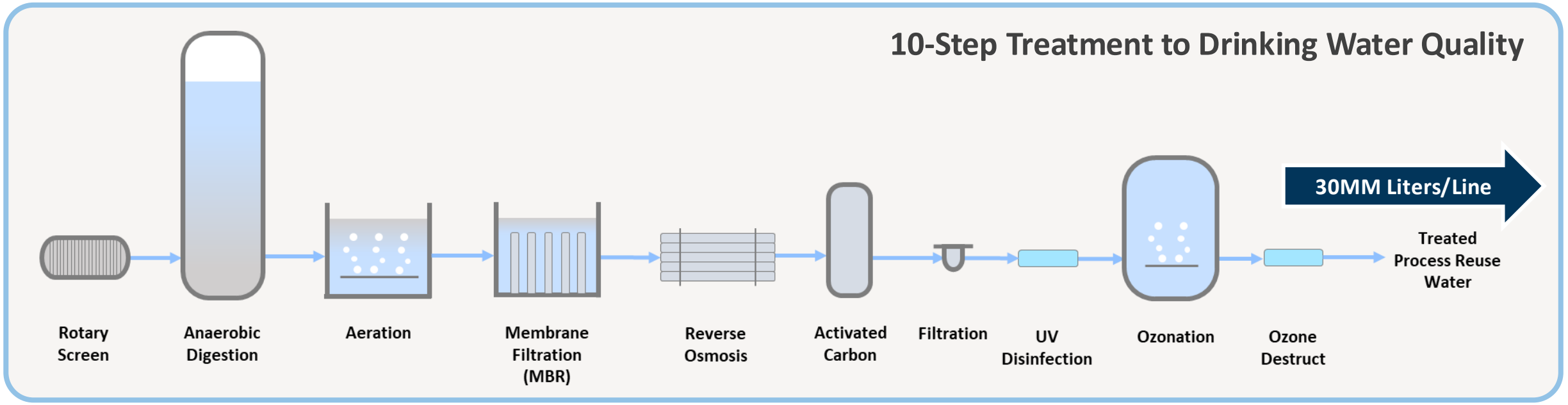
Water sustainability is a continuous journey

PepsiCo and Water Sustainability – Operational Efficiency

How can we extend our operational efficiency even further?

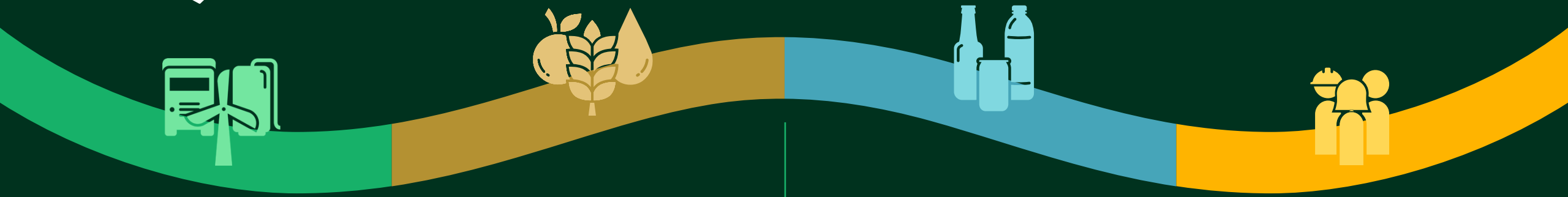
Sustainable facility design:

- Facility design with integrated process-water reuse systems
- Advanced treatment processes produce water suitable for non-ingredient uses
- **Potential for 30MM+ liters** process water recovered annually across **each beverage line***



*water recovery volume will vary based on specific line speed and utilization

Carlsberg Group **BREWING TOMORROW**



CUTTING CARBON

Our 2032 targets for reducing emissions & building climate resilience

Net Zero

90% reduction in emissions from own operations

31% reduction in value chain emissions

All electricity must come from new renewable assets (eg via PPAs)

Net zero value chain by 2040

Circularity

100% recyclable, compostable or reusable packaging

90% recycling rate for bottles and cans

50% reduction of virgin fossil-based plastic

60% recycled content in bottles and cans

PROTECTING NATURE

Our 2032 targets for safeguarding & restoring the ecosystems that sustain us

Regeneration

50% of our raw materials sourced from regenerative agricultural practices

Water

Water usage efficiency of 2.1 hl/hl globally and 1.9 hl/hl at sites in high-risk areas

100% replenishment of water consumption at sites in high-risk areas

INSPIRING CHOICE

Our 2032 targets for innovating & enabling informed & mindful consumption

Consumer behaviour

All global alcohol brands carry e-labels

All brews carry relevant consumer information

All relevant markets run a responsible alcohol consumption campaign with a strategic partner

Portfolio expansion

35% of our brews are no- or lower alcohol and alcohol-free brews are available in all relevant markets

75% of our soft drinks are no-or lower sugar

EMPOWERING PEOPLE

Our 2032 targets for creating a safe, respectful & inclusive growth culture where everyone can thrive

Safety, health & well-being

Zero accidents culture

Diversity, equity & inclusion

42% women in senior leadership roles

Be among top 10% in external benchmark for employee inclusion experience

OUR COMMITMENT TO RESPONSIBLE BUSINESS CONDUCT

PEPSICO'S LEADING PARTNER IN EUROPE

- Sole partner for PepsiCo beverage portfolio in Great Britain
- Partner in Great Britain since 1987, agreement extended to 2040
- Increased investment to accelerate growth
- Access to a global portfolio and enhanced innovation capability



It’s not just a standard it’s a *Culture*

PepsiCo sets the standard for the brands we bottle in the UK, We manage it inside our factories, as targets, as KPIs, and as engineering decisions on real production lines: This is where **paper becomes plant**.

The standard	How we manage it	What we track on site
Net Water Positive by 2030	Aligned to Carlsberg Group's Brewing Tomorrow: replenishment in priority basins.	Site water balance; watershed accounting alongside consumption.
Water use ratio	Above 1.7 L/L historically, 1.61 today, 1.4 as the next step.	Litres of water per litre of product, by line and by site.
Non-ingredient reuse	Adopted as the floor. Pushed onto product-contact surfaces where the engineering supports it.	Volume recovered and returned; quality held continuously.
Digitisation and submetering	Instrumentation specified into every project as a deliverable.	SCADA trending, remote monitoring, energy per cubic metre.

CARLSBERG BRITVIC

What we have delivered

Three projects along the same line: **securing supply**, **controlling quality** at capacity, **keeping treated water inside the factory**.

Two are running. The third is proven on a line and scaling.

DELIVERED

Securing supply

Rugby

Rising production needed more water at the right pressure, with **less energy, less real estate**, and **no downtime for the install**.

- **+70% flow capacity**
- **–45% energy cost**

DELIVERED

Quality at capacity

Beckton, 2023

A new production line had **pushed the treatment plant beyond capacity**,
At the same time **chlorine in the incoming utility water was degrading our de-alkalisation resin bed**s, forcing annual replacement.

- **–60% pump energy**
- **630 MWh a year**
- **240 m³/h**

PROVEN, SCALING

Closing the loop

Beckton, 2024

By 2024 the question had shifted from 'how do we treat water more efficiently?' to 'why is treated water leaving the site at all?' **Bottle rinse water** was already **beverage-grade** so we started with that**.**

- **60M litres reused (500 households equiv.)**
- **0.5 kWh / 1,000 L**

CARLSBERG BRITVIC

Project focus

DELIVERED

Securing supply : Pumping *less* to deliver *more*

Rugby site · soft drinks production · water supply upgrade

WHAT WE WERE TRYING TO DO

Rising production needed more water at the right pressure, with **less energy, less real estate**, and **no downtime for the install**.

HOW WE APPLIED IT

- An on-site energy audit built the baseline.
- Delivered a containerised booster system:
  - variable-speed control,
  - dosing,
  - disinfection
  - full PLC integration.
- Built, tested and commissioned off-site, then slotted in.

The insight: *The energy saving paid for the project. The data made the next one possible.*

CARLSBERG BRITVIC



WHAT IT DELIVERED

+70%	−45%	€69.5k
Water flow capacity	Energy cost	Annual saving

https://www.grundfos.com/uk/about-us/cases/soft-drink-manufacturer-lowers-energy-costs-by-45

Project focus

DELIVERED

Quality at Capacity: Doubling *flow* while halving *water & energy footprint*

Beckton, East London · ~14 million cases/year · water treatment plant

WHAT WE WERE TRYING TO DO

A new production line had **pushed the treatment plant beyond capacity**, At the same time **chlorine in the incoming utility water was degrading our de-alkalisation resin bed**s, forcing annual replacement at six figures apiece.

HOW WE APPLIED IT

- Four months of monitoring built the baseline.
- A full replacement of the pump stack, incoming water, contact tank control, degassing, carbon bed feed and backwash,
- Implementation of a single control philosophy with cloud-connected monitoring network.
- Zero downtime during install.

The insight: *When a Thames Water main burst in late 2023, the pre-upgrade plant would have stopped. The post-upgrade plant kept running.*

CARLSBERG BRITVIC



WHAT IT DELIVERED

−60%	630 MWh	2 X
Pump system energy	Saved per year	Treatment throughput

https://www.grundfos.com/uk/about-us/cases/britvic-grundfos-increases-production-capacity

Project focus

PROVEN - SCALING

Closing the Loop: Rinse water that never leaves

Beckton, East London · Closed Loop Water Recovery

WHAT WE WERE TRYING TO DO

By 2024 the question had shifted from 'how do we treat water more efficiently?' to 'why is treated water leaving the site at all?' **Bottle rinse water** was already **beverage-grade** so we started with that**.**

HOW WE APPLIED IT

- Rinse water captured, filtered, treated and disinfected back to high-quality process water & returned to the rinse cycle.
- In-line quality testing on the SCADA system protects production continuously.
- Chemistry footprint far lighter than conventional treatment.

The insight: *PepsiCo demonstrated non-contact reuse case study at 65M gallons a year, we pushed the principle into contact re-use.*



WHAT IT DELIVERED

500k L	60M L	500
Monthly avoided	Reused annually	UK households equiv.

CARLSBERG BRITVIC

https://www.grundfos.com/uk/about-us/cases/carlsberg-britvic-reuses-water-before-it-s-wastewater

What the projects actually returned

Project	What was saved	*Annual value
Rugby — water supply	€69,500 of energy a year; 45% of pumping cost	**≈ £60,000**
Beckton — treatment plant	630 MWh a year, plus de-alkalisation beds lasting three years instead of one at £100,000 each	**£218,000 – £268,000**
Beckton — bottle rinse loop	60,000 m^3 of treated water retained on site, and the effluent charge that went with it	**£77,000 – £188,000**

**Published savings, priced at published UK rates. Energy at 24–32p per kWh for industrial users; water at 90p–£2.40 per cubic metre and trade effluent at 50–85p, on business tariffs.Indicative, not audited. Savings are as published in the case studies; the money is our own arithmetic at current market rates*

CARLSBERG BRITVIC

Why the next leap in water conservation is *harder*

Water is cheap & the prize is capped

- **The prize is capped.** Our effluent bill is approx. £520k a year across 500 million litres*. Add back the water we buy to replace it and the entire theoretical prize, sits near £1.3 million a year. That is the ceiling.
- Rising prices flatter us. Business wholesale water charges rise 42% across 2025–30, with 27% in the first year.

The funding wars: Water *vs* Energy

- Energy does the heavy lifting in ESG. The 630 MWh at Beckton was worth more than any water we recovered. These were energy projects that happened to be about water.

Efficiency Case Has a ceiling: What's next

- A ratio of >1.7 down to 1.6 was the accessible step. 1.61 to 1.4 is harder.



The efficiency case has a ceiling: and we can see it from here; we need a new approach

CARLSBERG BRITVIC

**Internal Calculation based on 2024-2025 Britvic Soft Drinks Ltd Production Data*

The tipping point

- **You cannot optimise your way to zero**
  Every cubic metre we save costs more than the last, and the prize stops at £1.3 million. Past that, saving water is not the business we are in.
- **What if the effluent is not the cost?**
  We treat it as the thing to be got rid of. It is also the only stream on site that still contains material we paid for.

CARLSBERG BRITVIC

What the effluent actually costs

UK trade effluent is priced by the Mogden formula — partly by volume, but mostly by how loaded the effluent is.

$$C(£) = R(£) + (V + B_v) + B\left(\frac{O_t}{O_s}\right) + S\left(\frac{S_t}{S_s}\right) \qquad Where\ C = 3.16\,{}^{£}/_{m^3}\ for\ O_t = 2000\,mg_{/L}\ \&\ O_s = 360\,mg_{/L}$$

HOW IT IS PRICED

Whilst all other parameters are fixed, Ot is the COD of our effluent, Os the settled-sewage reference fluctuate, the ratio of which scale linearly with biological load

(Published components: primary treatment 8.8–62.9p per m³, biological oxidation 10.9–92.8p, sludge 9.4–55.4p. The two ratio terms scale linearly with load.

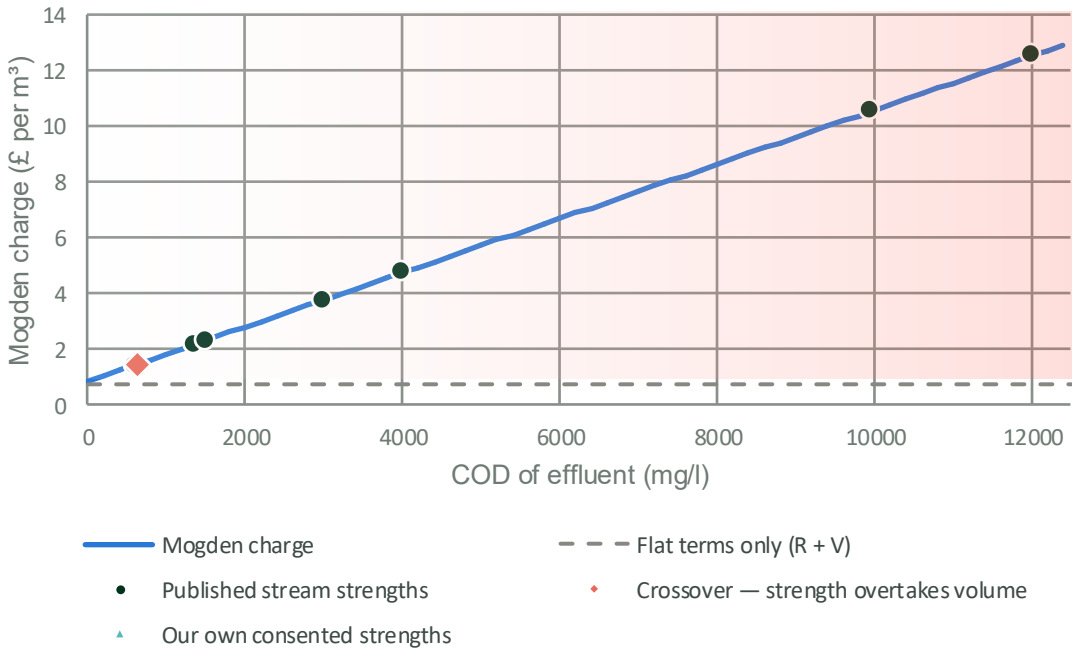
What are our cost drivers

Sugar, acid & organics, the same material we bought as ingredient and failed to put in a bottle.

So we pay twice. Once at the front gate as raw material, and again at the back gate as strength on a Mogden bill.

Cost to CB: Approximately 500M Lit* annual output >£520K/annum expected to grow 8.6% yoy.

**Internal Calculation based on 2024-2025 Britvic Soft Drinks Ltd Production Data*



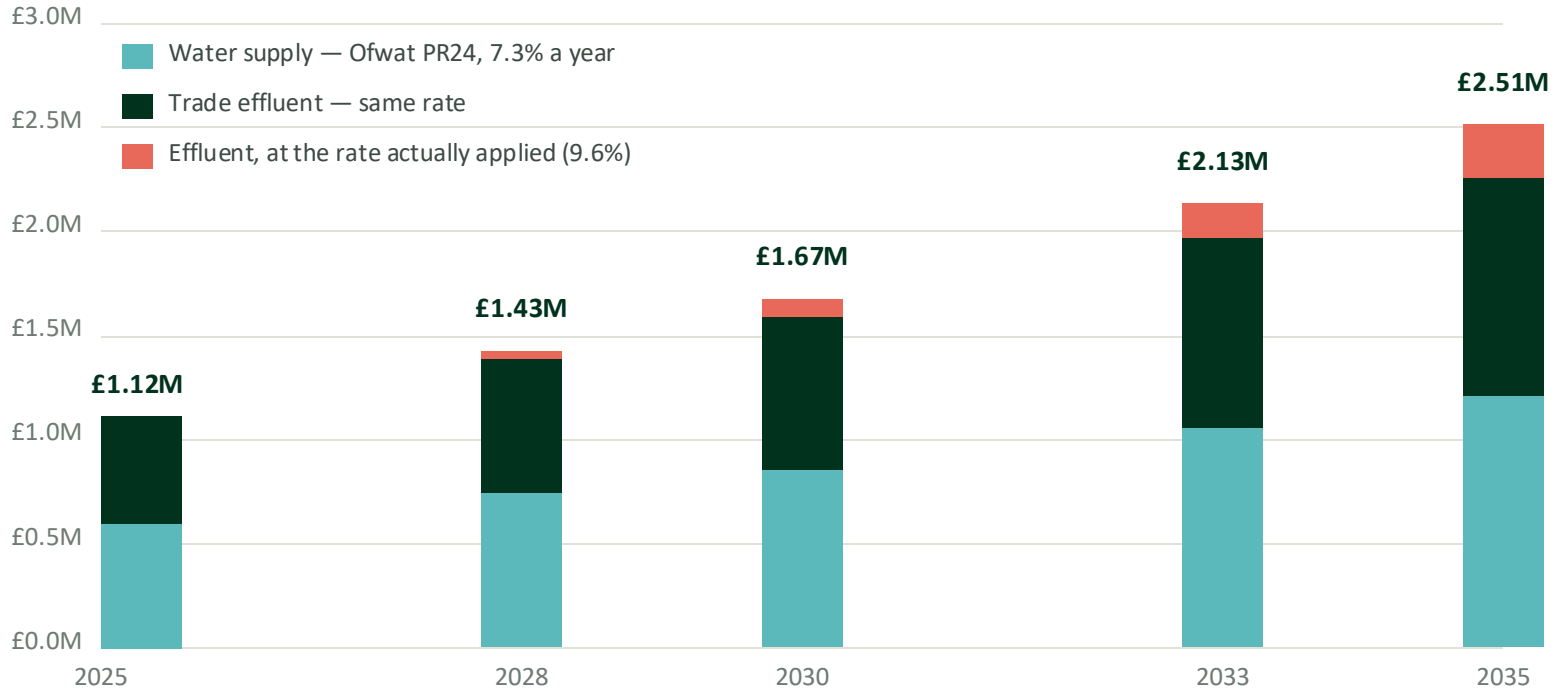
Rates: NI Water Scheme of Charges 2025-26, Table 5.1 (R 0.3390, V 0.3823, B 0.2530, S 0.2952; Os 260, Ss 240 mg/l). COD values: Ariffin et al. 2021 (PMC8235490); Condorchem Enviro Solutions 2025. Suspended solids held at 100 mg/l throughout (Ariffin: 77–120). Illustrative — not site-specific.

CARLSBERG BRITVIC

The Squeeze : What water will cost us by 2035

Water-related charges roughly double by 2035 — £1.12M to £2.26–2.51M.
That is £5.6M–£6.7M of extra spend across the decade, for the same production.

Not a forecast — published escalation rates applied to what we already pay. Supply at Ofwat's PR24 determination; effluent bracketed between that and the rate water companies are actually applying.



FOUR PRESSURES, ALL COMPOUNDING

Price Ofwat's PR24 determination raises non-household wholesale charges 42% before inflation across 2025–30, with the largest single rise in year one.

Charges Water companies are applying more than that. NI Water's Mogden standard unit charge rose 9.6% in a single year, 2024-25 to 2025-26.

Scarcity The Environment Agency projects a 5 billion litre a day public supply shortfall by 2055, plus 1 billion a day for industry and food.

Strength Our charge scales with COD, and the load that makes it expensive is material we bought.

CARLSBERG BRITVIC

Base year: our own effluent charges (£520k) and 500,000 m³ supply at £1.20/m³, toward the lower end of published business rates to reflect large-user tariffs. Escalation: Ofwat PR24 Final Determinations and NI Water Scheme of Charges 2024-25 / 2025-26. Scarcity: EA National Framework for Water Resources 2025. Full sourcing on the following slide. Indicative — not a budget forecast.

How we approached this

You can only squeeze efficiency so far. After that you have to redesign the loop, and stop treating combined effluent as the unit of analysis.

Rather than chasing a single water-in equals water-out closed system, we set out to build an integrated liquid resource recovery loop.

Phase one answers the first question. With Dr Miao Guo at King's College London.

What is in it?	**Can we recover it?**	**Can we sell it?**
What will it cost?	**Who would buy it?**	**Is it sustainable?**



KING'S College LONDON

01 Experiment

Randomised mass sampling and validation to establish what is actually in each stream, in real time.

02 Analyse

Composition overlaid on production patterns, so the profile can be predicted from the schedule rather than measured after the fact.

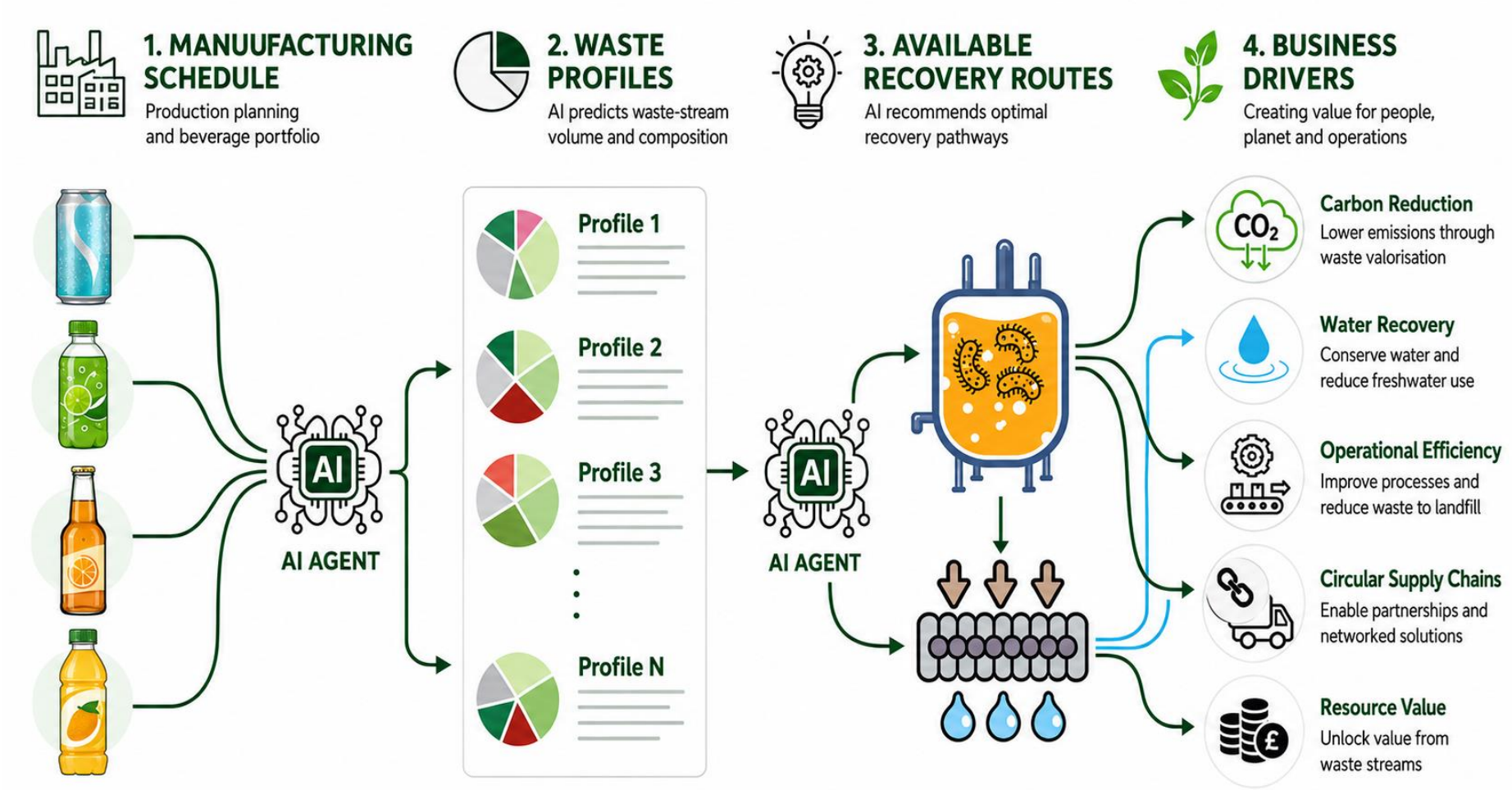
03 Predict

An **optimisation model reads** across those predictions and proposes the highest-value recovery route for the stream in front of it.

CARLSBERG BRITVIC

The output

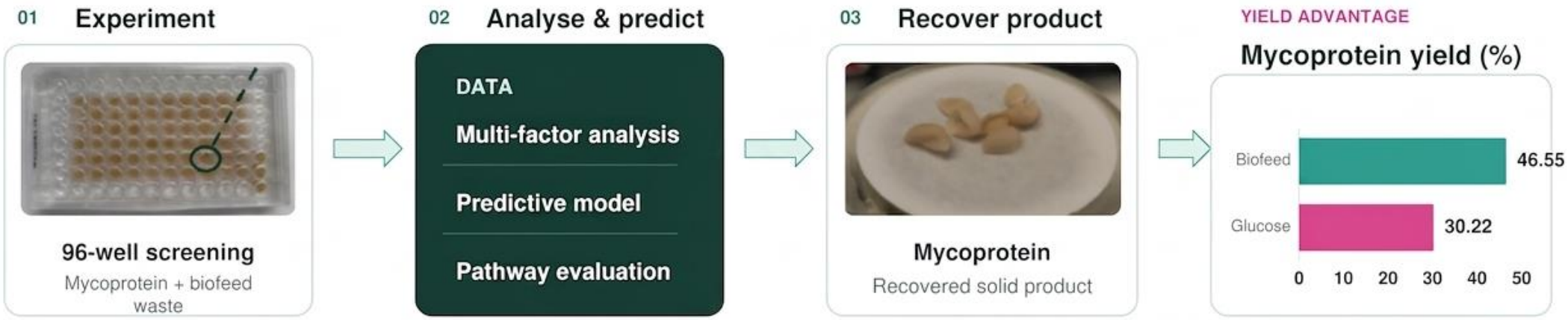
The aim of the Integrated recovery loops were simple – to build a data framework that steer each stream towards its highest-value recovery route.



CARLSBERG BRITVIC

Case Study: Waste to biofeed

A waste profile matched to a family of fungi used to produce mycoprotein



Two commercialization routes

Capacity and product-income estimates shown per m³ KICK

PATHWAY	CAPACITY	PRODUCT INCOME
Anaerobic digestion (a) Biomethane	29,200 t/year	6.7 $/m³ Reference price: 0.5 $/m³ biomethane
Mycoprotein fermentation (b) Food-grade protein	12,500 t/year	246.9 $/m³ Reference price: 11.61 $/kg mycoprotein

CARLSBERG BRITVIC

PUBLISHED OUTPUTS

He Y. Effective resource recovery system design for expired functional drinks through biotechnologies. PhD thesis, King's College London, 2025.

He, Zuo, Alissandratos, Willson, Kazmi, Brogan and Guo. High resource recovery potential of wasted and expired functional drinks. 2025.

Case study: Waste to Biofeed

We did not stop at a laboratory result. We sent our waste to an industrial alternative protein producer and had it run at Kg scale where the results where validated

01 Laboratory PROVEN

Screening on our own waste streams with King's College London. Yield on our biofeed came out ahead of the reference substrate it would replace.

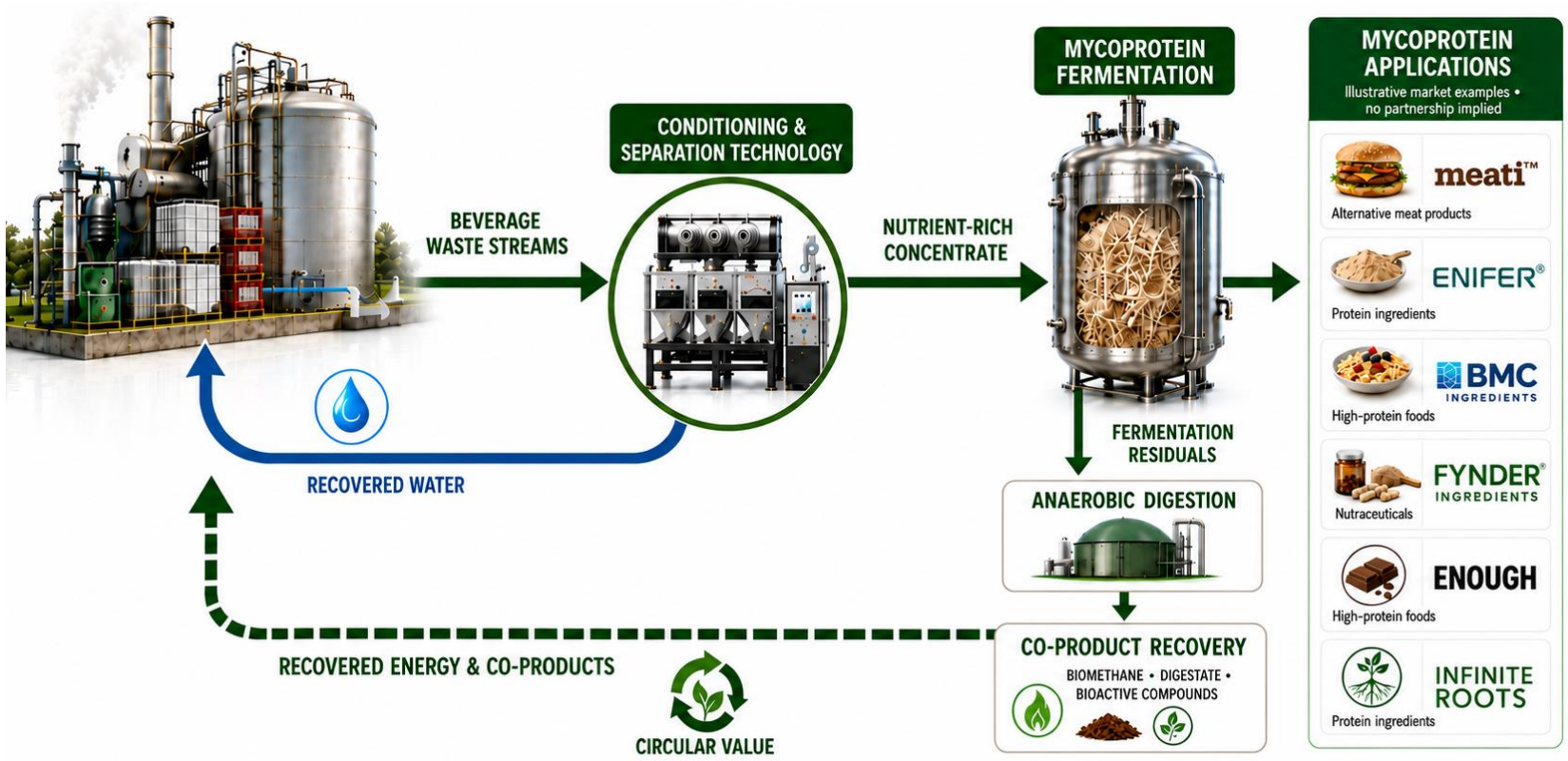
02 Pilot VALIDATED

Waste sent to an alternative-protein producer, concentrated thirty-fold and run at kg scale. The pathway held outside the lab. Results are commercially confidential.

03 Plant CONCEPT

A circular economy built around the recovered streams — clean water back to process, concentrated sugars out to fermentation partners.

WHAT PLANT SCALE LOOKS LIKE



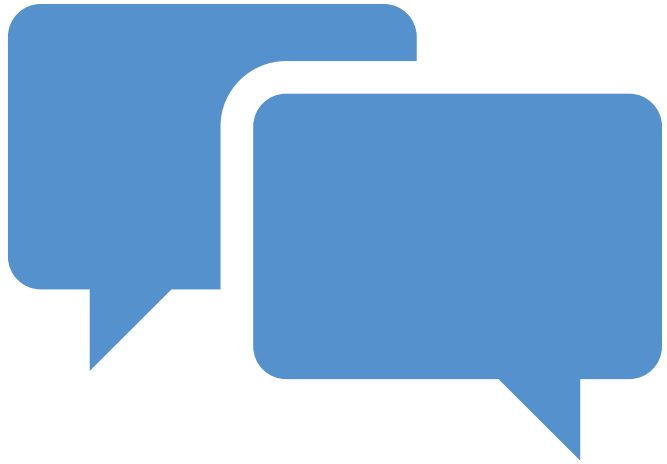
CARLSBERG BRITVIC

The takeaways

1. The efficiency case has a ceiling, and most of us are closer to it than we admit.
2. Old facilities are being closed rather than modernised ? Is there a case ?
3. Effluent recovery works in the brewing industry, do the financials hold in Soft Drinks
4. The next generation of engineering projects look more like trading relationships, are waste based circular economies a rising trend?

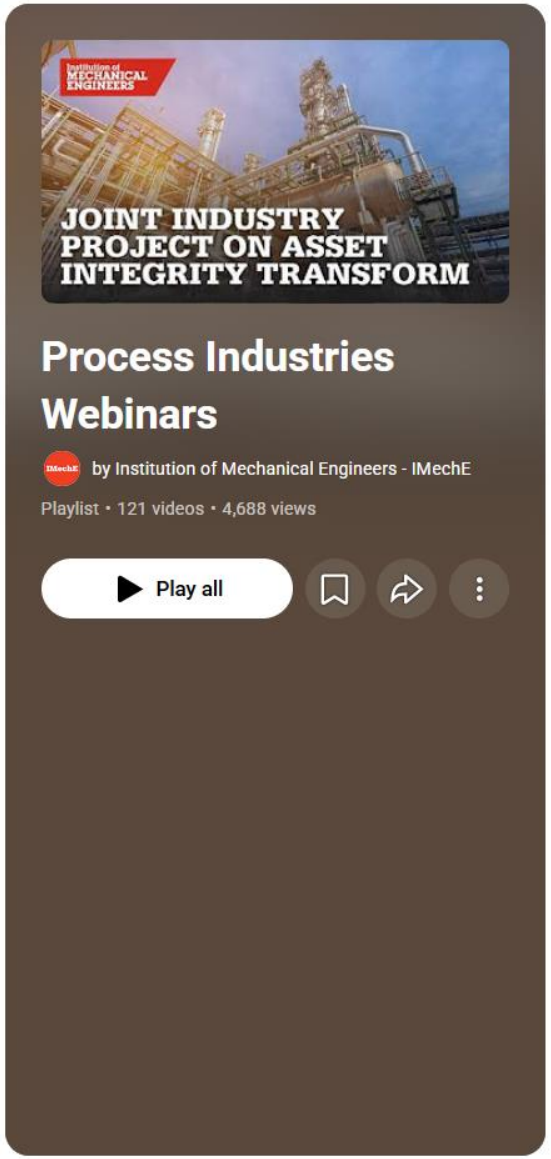
Over to the audience. What would you push back on?

Q&A PANEL DISCUSSION





WEBINAR RECORDINGS





Joint Industry Project on Asset Integrity Transformation
Institution of Mechanical Engineers - IMechE
122 views • 4 weeks ago



An Introduction to Valves in the Hygienic Process Industries
Institution of Mechanical Engineers - IMechE
98 views • 4 weeks ago



Climate Leadership: A New Training Standard for Top Management
Institution of Mechanical Engineers - IMechE
66 views • 1 month ago



Pneumatic Conveying: Performance, Problems, and the Economics of Getting It Right
Institution of Mechanical Engineers - IMechE
93 views • 1 month ago



Non-Intrusive Inspection: From Classic to Custom Made – a Dutch Perspective
Institution of Mechanical Engineers - IMechE
156 views • 2 months ago



Introduction to TANICS: The Automated Nuclear Irradiated Container Solution™
Institution of Mechanical Engineers - IMechE
101 views • 2 months ago

www.youtube.com/imecheuk

Institution of MECHANICAL ENGINEERS

PROCESS INDUSTRIES DIVISION

LATEST NEWS, RESEARCH, THOUGHT LEADERSHIP, JOBS, EVENTS AND TRAINING IN YOUR INDUSTRY OR SECTOR

Hopper, Silos and Dischargers: Ensuring safe, reliable and efficient operation



Seminar

09:15 to 16:30 BST

on **Tuesday 22nd September 2026**

In Person

Featuring users, designers and trouble-shooters, who will show how smart choices in silos and dischargers can maximise plant performance for powders, granules, biomass and other bulk materials. Attendees will learn how to avoid flow issues, prevent failures, enhance safety and ensure reliable feed. Expert insight and industrial case studies will equip attendees with the know-how to avoid costly mistakes and make sure they invest in systems that deliver reliable, predictable flow.

Improving the world through engineering

Institution of MECHANICAL ENGINEERS

PROCESS INDUSTRIES DIVISION

LATEST NEWS, RESEARCH, THOUGHT LEADERSHIP, JOBS, EVENTS AND TRAINING IN YOUR INDUSTRY OR SECTOR.

Engineering Challenges: AI's future role in the Process & Manufacturing Industries



Technology delivers value only when it enables people, strengthens resilience, and transforms the way we operate.

Join our webinar to explore how AI is impacting productivity, efficiency, and reliability - and what it means for engineers.

Hear real-world insights and case studies from industry experts as we cut through the hype and focus on practical value.

Stay ahead of the curve - register now

Technical Talk

12:00 BST on **Wednesday 9 September 2026**

MS Teams Online Webinar

Improving the world through engineering

Institution of MECHANICAL ENGINEERS

PROCESS INDUSTRIES DIVISION

LATEST NEWS, RESEARCH, THOUGHT LEADERSHIP, JOBS, EVENTS AND TRAINING IN YOUR INDUSTRY OR SECTOR.

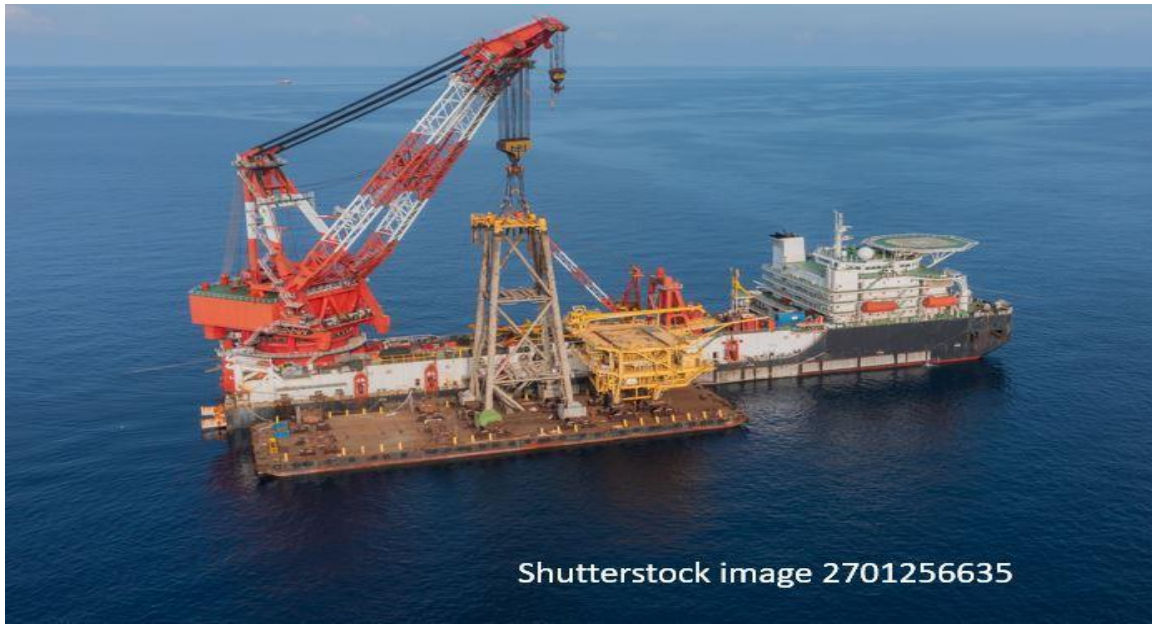
Offshore Decommissioning: Getting structures out of the sea

Technical Talk

12:00 BST on **Thursday 10 September 2026**

MS Teams Online Webinar

Improving the world through engineering



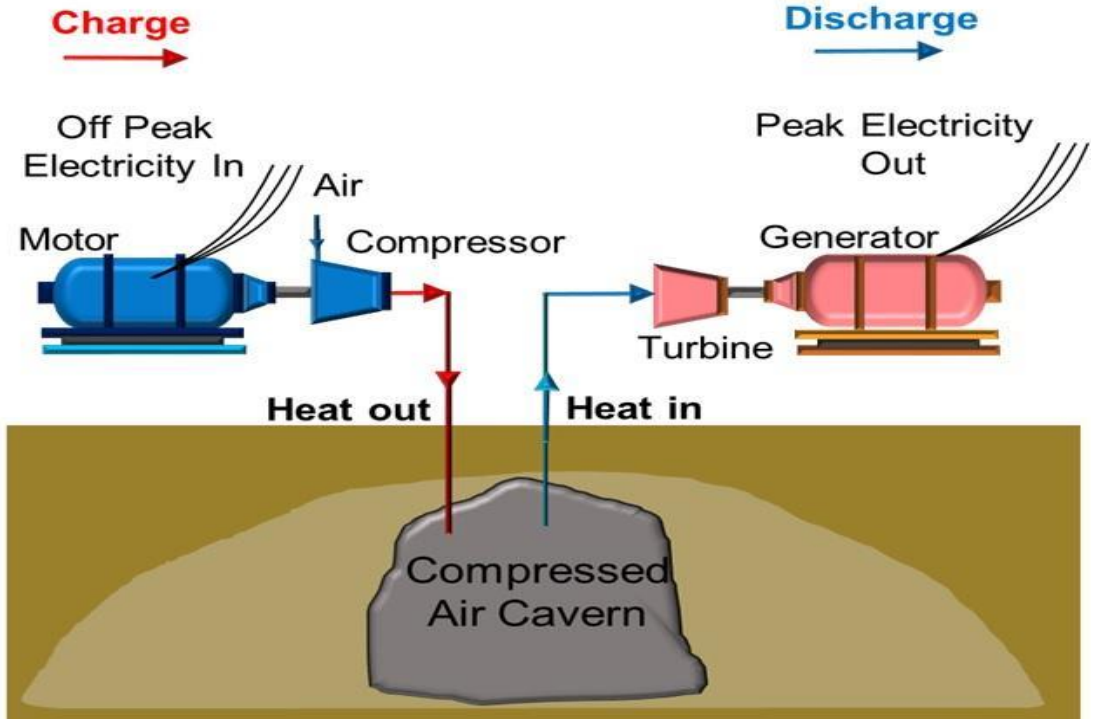
One of the defining engineering achievements of the latter half of the twentieth century was the installation of offshore oil and gas structures in oceans around the world. Today, the industry faces the equally complex challenge of safely and efficiently removing these assets after decades of exposure to harsh marine environments. This presentation provides a high-level overview of the key challenges associated with offshore decommissioning and the solutions currently being applied.

Institution of MECHANICAL ENGINEERS

PROCESS INDUSTRIES DIVISION

LATEST NEWS, RESEARCH, THOUGHT LEADERSHIP, JOBS, EVENTS AND TRAINING IN YOUR INDUSTRY OR SECTOR.

Isothermal Compressed Air Energy Storage



Technical Talk

12:00 BST on **Tuesday 15 September 2026**

MS Teams Online Webinar

Improving the world through engineering

As renewable energy continues to expand, maintaining a stable and reliable electricity supply becomes increasingly challenging due to the variable nature of these sources. Energy storage is a key solution to this challenge.

This webinar introduces compressed air energy storage (CAES), a technology capable of storing electricity for extended periods, outlining the basic principles of CAES, system components and recent developments supporting renewable integration and long-duration energy storage.

WE LOOK FORWARD TO HEARING FROM YOU.

Institution of MECHANICAL ENGINEERS

Member Engagement Team: membernetworks@imeche.org / +44 (0)20 7304 6996

Process Industries Division: www.imeche.org/industry-sectors/process

Event Enquiries: eventenquiries@imeche.org / + 44 (0)20 7973 1251

/imeche

/imeche

/imecheuk

/imecheteam

/institution-of-mechanical-engineers

Improving the world through engineering

Call for Operations Thought Leaders:
forms.office.com/e/fVp0u2UbTK

Speaker Nomination Form:
forms.office.com/e/SNDPnqUbvC

Event Feedback Form:
forms.office.com/r/6syv77u4SD