



E3B

The Elements of
Bioremediation,
Biomanufacturing
& Bioenergy

Metals in Biology



PROJECT PARTNERS: Pavlina
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Bio-hydrogen production from metal-rich sludge return liquors via bio-electrochemical systems: modelling the technology's impact in the UK water sector

“The project helped us prove that the technology can bring an economic and environmental impact to the water sector and encouraged us to push forward the commercialisation of this technology.” Dr Pavlina Theodosiou - CEO & co-founder, METzero

PROJECT AIMS: We previously developed a technology that extracts the trapped energy in wastewater. This retrofittable bio-electrochemical technology exploits the biological processes of metal-reducing bacteria in wastewater, resulting in enhanced wastewater treatment without the need for aeration and simultaneous resource recovery. In the current project, we collaborated with VEOLIA, using their in-house software to model and assess the impact of this innovation on hydrogen production and energy reduction in wastewater treatment plants.

RESULTS:

In collaboration with VEOLIA we performed a series of consultations and workshops where we used 20 years of data from pilot microbial electrochemical technologies (MET) reactors to develop modelling scenarios of treatment plants of different capacities.

The results showed that if existing wastewater treatment plants implement an MET system for treating their return sludge liquor/digestate, it can save them up to 30% in CO₂ emissions, up to 12% in energy costs and can increase their capacity by 20%.

Our results helped prove the commercial impact of this technology. The results formed the basis of a business case presented to the Newcastle University Company Creation team, which gave birth to the spin-out METzero. METzero aims to bring to the market the first retrofittable wastewater treatment technology, that saves money, increases capacity, and recovers hydrogen from wastewater.

Change in technology readiness level: 5 to 6

OUTCOMES & NEXT STEPS:

- The results formed the basis for Newcastle University spinout METzero. The project is now taken forward through the commercialisation of METzero.
- The project results were presented at the following conferences: ACCADUEO H2O Event, Bologna, Italy. October 2023 | Institute of Water Annual Seminar, Newcastle, November 2023 | Environmental Biotechnology Network Bio-electrochemical Systems Workshop, Newcastle November 2023.
- Results from this project have been used to build 3 further proposals, 2 have been funded so far: Innovate UK ICURE Exploit Funding in collaboration with ISLE Utilities | Royal Academy of Engineering Enterprise Fellowship in collaboration with Newcastle University | OFWAT Innovation Challenge Catalyst in collaboration with Northumbria Water and others.
- Pavlina's RAEng Enterprise Fellowship funds her transition from academic to the CEO of METzero.

A slide from the ACCADUEO Water International conference presentation where the results of this project were presented.

METzero
— WASTE. NO MORE —

Cost and CO₂ savings

Treatment Plant Size (PE)	Max Energy Reduction (%)	Max CO ₂ Emissions Reduction (%)	Max Savings Per Year (GBP)
20 000	12%	22%	£ 12,171
50 000	11%	16%	£ 27,045
250 000	11%	29%	£ 138,715
1 000 000	11%	30%	£ 555,773

Results based on 95% COD removal efficiency by METzero reactor