EBNet
Environmental Biotechnology

Engineering and Physical Sciences Research Council

Biotechnology and Biological Sciences Research Council

ENVIRONMENTAL BIOTECHNOLOGY NETWORK

Process Integration and Sustainability Assessment WG

Process Integration & Sustainability Assessment (PISA WG)

Led by Prof Jhuma Sadhukhan, University of Surrey

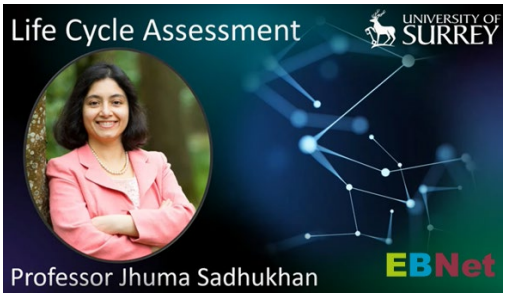
The goal of this WG is to identify grand challenges in *Pollutants & Media* and *Biosciences for Engineering* and propose ways to address them.

ACTIVITY SYNOPSIS

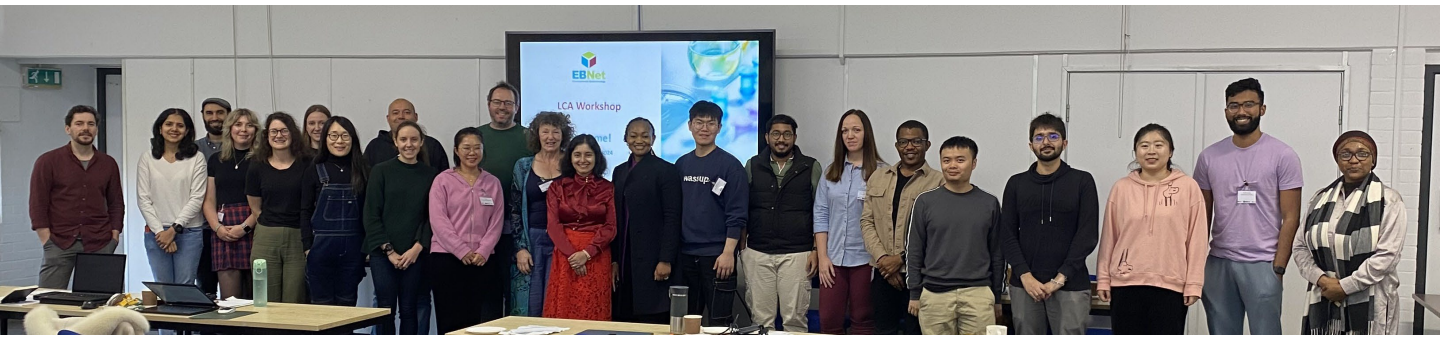
This WG ran a pair of webinars in 2022 and 2023 on *Life Cycle Assessment Tools* and *LCA for Biotechnology Problems,* with guest speakers Dr James Joyce of Unilever, Dr Adrian Higson of the National Non-Food Crops Centre (NNFCC) and Dr Siddharth Gadkari, University of Surrey. Presentations from these workshops have been widely viewed on EBNet's YouTube channel.

Webinar *LCA for Biotechnology Problems: targeted fundamental methodology*
Webinar *Life Cycle Assessment Tools for Environmental Biotechnology*

This was followed by three oversubscribed 'live' workshops and training events for members. The first, held at the University of Surrey in October 2023, examined *LCA for the EBNet Industrial AD Community*. Two more events took place in 2024 – a workshop on *LCA for Practitioners and the Industrial Community* in Southampton and a 3-day Training Course on *LCA in Practice*.



This group has collaborated with several others in EBNet, especially the AI & Machine Learning (AI/ML) WG and the Anaerobic Fermentation WG. It has been involved in successful applications for large-scale follow-on funding, including EPSRC grant *Artificial Intelligence Enabling Future Optimal Flexible Biogas Production for Net-Zero* (AI4AD, EP/Y005600/1) in which Prof Sadhukhan is a Co-Investigator; ELEMENTAL Engineering Biology Hub BB/Y008456/1 which she co-Leads; NSF/UKRI-funded *Global Center for Sustainable Bioproducts* for which Prof Sadhukhan is the UK Lead; and the EPSRC-funded *C-Loop Sustainable Biomanufacturing Hub* in which she is a Co-I.



LCA workshop at the University of Surrey

WG Publications

The WG has published four journal papers as a result of its activities in EBNet, three in conjunction with the AI/ML WG; and has contributed to two more as part of the AI4AD project.

Strategic navigation of world-leading biorefineries and Mexico's policy landscape: A gateway to a sustainable circular bioeconomy. Sadhukhan, J., Martinez-Hernandez, E., Allieri, M.A.A., Eguía-Lis, J.A.Z., Castillo, A., Dominguillo, D., Torres-García, E. and Aburto, J., 2023. Journal of cleaner production, p.140386.

Novel Life Cycle GHG Formulations of Anaerobic Digestion Systems Aligned with Policy. Zhang, R., Sadhukhan, J., Zhang, D., Short, M., McKechnie, J., Liu, Y., Bywater, A., Murali, R., Dolat, M., Zhang, D. and Zarei, M. Available at SSRN 4837715.

Carbon credits monetary value for anaerobic digestion systems and energy policy implication in the UK. Zhang, D., Li, D., Bywater, A., Short, M. and Sadhukhan, J., 2025. The Innovation Energy, 2(1), pp.100066-1.

Framework for optimal energy storage duration for maximum-reliability renewable electricity. Sadhukhan, J., Sen, S. and Randriamahefasoa, T.M.S., 2024. Frontiers in Energy Research, 12, p.1430413.

Dynamic feed scheduling for optimised anaerobic digestion: An optimisation approach for better decision-making to enhance revenue and environmental benefits. Dolat, M., Murali, R., Zarei, M., Zhang, R., Pincam, T., Liu, Y.Q., Sadhukhan, J., Bywater, A. and Short, M., 2024. Digital Chemical Engineering, 13, p.100191. *(with AI4AD)*

Optimal feed scheduling and co-digestion for anaerobic digestion sites with dynamic demands. Dolat, M., Murali, R., Zhang, R., Zarei, M., Zhang, D., Zhang, D., Sadhukhan, J. and Short, M., 2024. In Computer Aided Chemical Engineering (Vol. 53, pp. 1705-1710). Elsevier. *(with AI4AD)*

The activities of this WG were also popular at EBNet's ECR events, with many presentations directly or indirectly concerned with process optimisation and comparative assessment of economic and environmental benefits and impacts.

In recognition of leading Engineering Biology activities in tandem with scale-up, sustainability analysis and further industrial projects, Prof Sadhukhan has twice received the University of Surrey's Vice Chancellor's Award for Researcher of the Year in 2024 and 2025.

For more information see the WG Webpage, News tag and YouTube Playlist

‘I am an Environmental Biotechnologist because...’

Selected examples from EBNet ECR Conferences in 2023 and 2024

I am an Environmental Biotechnologist because some of the most environmentally beneficial and cost-effective solutions come through utilising living systems.

Nicholas Davison, University of Reading

I am an environmental biotechnologist because I'm doing Life Cycle Assessment and Techno-Economic Assessment research on biochar for Greenhouse Gas removal.

Yuzhou Tang, University of Leeds

I am an environmental Biotechnologist because I work on the field of biomass-based productions and their life cycle and techno-economic assessments. I'm mainly focusing on biochar production in the UK in recent years due to its importance as a greenhouse gas removal technology.

Disni Gamaralalage, University of Nottingham

My work is primarily devoted to biomass conversion through biochemical and thermochemical methods. Due to ever-increasing waste production along with population growth, it is better to use biomass to decrease the amount of waste and increase energy production.

Arian Shabruhi Mishamandani, University of Huddersfield

I am a PhD student in environmental engineering focusing on recovering carbon and nutrients in food processing wastewater using biotechnologies; simulating and optimising integrated recovery process systems via computational modelling and mathematical optimisation.

Yiying He, King's College London

I am an environmental biotechnologist because I have a passion for renewable energy solutions. My focus lies in Anaerobic Digestion Modeling and Control, as I firmly believe in the transformative potential of this alternative energy source to enhance our world.

Benaissa Dekhici, University of Surrey

My research is helping to develop a surrogate model which captures the synergistic effects of feedstocks by incorporating microbial communities and applying data driven approaches for control. This will result in developing a tool for AD sites to use with key decision making while considering a balance between profits and emission reductions.

Rohit Murali, University of Surrey

My presentation is on ‘Valorisation of Poultry Litter – A Socio-environmental cost-benefit comparison’. My goal is to reduce the environmental impact of land-spread poultry litter by using anaerobic digestion, ammonia side-stream stripping and electrocoagulation to aggregate nitrogen, phosphates and potassium into a stable, bioavailable fertiliser.

Deborah Hall, Harper Adams University

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For more information see the WG News tag and YouTube Playlist

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