Pathways to a Circular Bioeconomy: Strategic Systems Modelling for Sustainable Biomass Valorisation into Biofuels

Keywords:
• Bioeconomy • Circular Economy • Systems Modelling • Sustainability Assessment • Decision Support • Biomass Valorisation • Biofuels

Overview:
Applications are invited for a fully funded four-year PhD studentship under the prestigious EPSRC Industrial Doctoral Landscape Award (IDLA), co-sponsored by Arup. This project will explore how the UK can transition towards a circular bioeconomy by developing systems-based approaches to convert bio-waste and biomass residues into sustainable biofuels. The successful candidate will be based in the Resilience and Sustainability Group, Department of Civil and Environmental Engineering, Imperial College London, supervised by Professor Evina Katsou, and will collaborate closely with Arup through ongoing mentorship and short industrial placements.

Working at the intersection of systems engineering and sustainability/circular economy policy, the research will deliver new guidance, frameworks, and tools to help decision-makers identify optimal biomass pathways that maximise environmental, economic, and social value. The project directly supports the UK's Net Zero and circular economy goals, and will provide evidence-based guidance for sustainable technology deployment and investment strategies in the bio-based sector.

Project Details:
The UK must urgently reimagine its approach to biomass, not just as a combustion feedstock, but as a strategic enabler for industrial decarbonisation, resource efficiency, and circular value creation. This PhD project addresses that challenge by developing strategic systems models to identify optimal pathways for valorising bio-waste streams (such as agricultural residues, wastewater sludge, and industrial by-products) into sustainable biofuels and bioproducts. As global pressures on land, energy, and resources intensify, the efficient use of bio-waste is emerging as a cornerstone of the circular economy. However, decisions on which feedstocks to use, where to process them, and which technologies to prioritise are complex and often fragmented. This project will provide the strategic guidance and decision support frameworks/tools needed to align these choices with the UK's 2030 and 2050 decarbonisation targets.

This research offers a systems perspective on bio-waste valorisation for the UK circular bioeconomy. While most studies focus on individual technologies or feedstocks, this project will integrate technological, spatial, economic, and policy dimensions into a unified decision-support framework. Key innovations include:

- Developing a systems model linking bio-waste generation, conversion technologies, logistics, and regional industrial clusters;
- Embedding environmental and social sustainability metrics (e.g., life-cycle assessment, resource efficiency, and regional employment indicators) into decision-making;
- Producing evidence-based scenarios to inform national investment, infrastructure, and policy choices under different climate and circular economy strategies.

The outcomes will include tools and strategic insights to support national and local decision-makers, industry, and investors in deploying sustainable biofuel and bioproduct pathways. Beyond academic impact, the work will generate actionable outputs for Arup and other stakeholders, enabling them to design and plan resilient, low-carbon systems with tangible societal and environmental benefits.

ARUP Sponsorship
A detailed description of support the successful candidate will receive as part of this ARUP-sponsored studentship is provided at the end of this advert. This includes an overview of the ARUP research programme, ARUP University, ARUP Skills Network, and Skills Leader Supervision.

Requirements
The ideal candidate will demonstrate:

- First Class or strong Upper Second-Class degree (or international equivalent) in engineering, environmental science, sustainability, or a related discipline.
- A Master's degree in a relevant field (e.g., systems engineering, process design, energy systems, or environmental modelling) is desirable but not essential.
- Strong analytical and quantitative skills, with experience in systems modelling, data analysis, or sustainability assessment.
- An understanding of sustainability assessment methods such as life-cycle analysis (LCA) or circular economy frameworks.
- Excellent communication skills and a willingness to engage with industry, policy, and academic stakeholders.

Applicants must meet the UKRI eligibility requirements for PhD funding, including UK residency or equivalent criteria for home-fee status.

How to apply:
Applicants are recommended to contact Prof Evina Katsou (e.katsou@imperial.ac.uk) for further details, informal discussions and information about the project. Applicants wishing to be considered for this opportunity should send the following application documents to Prof Katsou:

1. Current CV including details of their academic record, and if possible, class ranking (2 pages maximum).
2. Covering letter explaining their motivation, suitability, skills and/or experiences (1 page maximum).
3. Contact details of two academic referees.

Application via the Imperial College Registry is not necessary at this stage. Applications will be regularly reviewed until the position is filled. Administrative questions should be emailed to civilphdadmin@imperial.ac.uk.

Funding:
The studentship will provide funding for 4 years from the start date of the PhD. The start date of the scholarship will be 1 October 2026. The funding includes tuition at the UKRI rate and a tax-free stipend at the standard UKRI London rate (for 2025/26 this is £22,780 year). The successful candidate will receive the to-be-announced equivalent 2026/27 funding.

ARUP

Arup-sponsored PhDs through EPSRC IDLA voucher programme: Content for inclusion in studentship advertisements

December 2025

Arup University overview

Arup University provides services and solutions for our clients, partners, and stakeholders to help solve complex problems and prepare for the future. Established in 2009, Arup University is home of the firm's strategic foresight capability, our research and innovation function and membership upskilling programmes.

Focussed on future needs, Arup's corporate university is tasked with focusing on future needs, preparing our clients and our membership for the opportunities and challenges that lie ahead.

We partner with world class academic institutions and professional bodies all around the world to ensure the technical expertise held in Arup is state of the art and to participate in raising standards throughout the natural and built environment across the sectors and geographies in which we work.

Shaping a better world - Arup's investment in Arup University ensures we are turning our commitment to raising standards and creating a sustainable future for all into a reality across the natural and built environment.

Arup Research programme

Through research we 'shape a better world' by creating innovative solutions for our clients, the planet, and the communities we serve.

Arup has a long track record of delivering world-class, award-winning research. We collaborate with our clients and world-leading institutions to carry out pure and strategic research, applied research and experimental development. We are particularly interested in applied research as it allows us to gather new knowledge to benefit our clients and enables us to evolve our project work.

Research is a highly creative and rigorous process. Our people are enabled to participate in purposeful research activities as part of their career at Arup, and to influence the markets in which we operate to drive change in practice and policy. We deliver research to transform our client's future.

Complex problems, solved together - each year, we invest in hundreds of research projects globally, engaging in over 200 external research projects with clients, world-leading universities, and research institutes. The ethos of research is an essential part of our culture of excellence and is a vital enabler of our strategic objectives at Arup. Our research programme drives outcomes relevant to industry transformation and triggers innovation in sustainable development.

Arup Skills Networks

Arup University hosts our Global Skills Networks – discipline specific communities of experts connected to work together in pursuit of technical excellence. Our global skills networks are a

fundamental mechanism within Arup to ensure that our clients benefit from the latest innovations, deep insights, and global expertise on any project anywhere in the world.
Embedding 'Total Design' in everything we do - by empowering our expert communities to consistently elevate their proficiency – and foster an environment of creativity, innovation, collaboration and technical excellence – we aim to provide services that consistently adhere to the most stringent professional standards, reflect the latest advancements in practise, and deliver results that surpass client expectations.

Arup-sponsored PhD studentships

At Arup we have a long history of sponsoring and supporting PhD studentship projects across a range of disciplines and with a world-leading academic and research institutions.

Nurturing new knowledge, innovation, skills and future talent – PhD candidates benefit from being supervised by Arup Skill Leaders and other recognised technical experts, working in partnership with the academic supervision team. Additionally there is access to the global network of experts through the Arup Skills Networks and other Arup University resources such as the Arup Library resources that includes access to databases including ScienceDirect, Scopus and Construction Information Service.

We strive for excellence in industrial research supervision and are active participants in the ongoing UKRI-sponsored RSVP initiative '*Next Generation Research Supervision Project'* led by University of York. Arup-sponsored PhD students will spend part of their time working from an Arup office and will have the opportunity to apply their research to real-world problems on Arup client projects. They will be encouraged and nurtured to become active participants in the broader Arup global research programme that includes over 1,500 people.

Specific to this advertised project – the PhD candidate will join a thriving community of Arup members involved in the Arup Global Research Challenges in Water, Energy, and SIT (Science, Industry and Technology). Through this challenge programme there will be opportunities to share ideas with and contribute to dozens of other ongoing 'Invest in Arup' funded research, and to engage directly with Arup clients and other collaborators to explore solutions to the following challenge statements:

- (Water) ***How can we reimagine our relationship with water — to regenerate ecosystems, build climate resilience and create healthier, more equitable places to live and thrive?***

- (Energy) ***How can we shape future energy systems that are reliable, equitable and sustainable during rapid energy transition?***

- (SIT) ***How can we accelerate a transformation to low-carbon, resource-efficient and resilient science, industry, and technology (SIT) systems?***