

JOB TITLE: Research Associate – Biomethane Fuel Purification

Algae-based biomethane fuel purification and carbon sequestration: an integrated approach

Job Ref: REQ190430

As part of the University's ongoing commitment to redeployment, please note that this vacancy may be withdrawn at any stage of the recruitment process if a suitable redeployee is identified.

School/Department summary

Research and teaching in the School of Architecture Building and Civil Engineering (ABCE) is driven by 63 academic staff, 34 technical and clerical support staff, 40 contract researchers and over 120 doctoral students. The School benefits by having academic staff from a wide variety of backgrounds, with a resulting rich diversity of perspectives.

The undergraduate programmes include Civil Engineering, Construction Engineering Management, Commercial Management and Quantity Surveying, Architectural Engineering and Design Management, Air Transport Management, and Transport and Business Management.

At MRes level we train the next generation of multi-disciplinary researchers in energy demand. At MSc level, we offer programmes in Low Energy Building Services Engineering and Low Carbon Building Design as well as in Water and Waste Engineering, Construction Management, Transport Policy and Business Management. These programmes are all accredited by the Professional Institutions. The EPSRC Centre for Doctoral Training in Energy Demand will support over 50 PhD students.

In all courses the academic content is directly aligned to the needs of the industry and there is a high level of sponsorship in our portfolio of programmes. Our record of graduate employment is second to none and we have been ranked 1st or 2nd in the National Student Survey for the last 6 years.

Further information may be found from - <http://www.lboro.ac.uk/departments/civil-building/>

In the 2014 Research Excellence Framework, the School was ranked fifth in the Architecture and Built Environment Unit of Assessment with 87% of the work judged as either "world leading" or "internationally excellent". Importantly, this was achieved whilst still returning 100% of staff; world class research pervades the School. The research environment was ranked first overall; Loughborough is the best place in which to build a career in energy research.

The international standing of our research is exemplified by our growing portfolio of collaborations with other leading universities and research institutes worldwide. These include: the UNSW Sydney, University of California at Berkeley, MIT, Chongqing, Hong Kong, Iowa State, Oklahoma State, RMIT, Georgia State and Penn State.

We are equally proud of our collaborations with industry where we count organisations such as Willmott Dixon, Electricite de France, The BRE, Honeywell, Anglia Water and Biffa. Built Environment research is increasingly informing government policy through, for example, the Department of Energy and Climate Change and The Committee on Climate Change.

For more on our research go to: <http://www.lboro.ac.uk/schools/cv/research/index.html>

Project Description

With almost 500 operational plants in the UK, anaerobic digestion (AD) is already a well-established industrial process that is used to treat and recover energy from a wide range of biological feedstocks, including food wastes, agricultural residues, sewage sludge and even specifically grown crops. Compared to other biological treatment techniques, biogas, the main AD product, is easily recovered from the fermentation broth. Biogas consists predominantly of methane (~55 – 65%) and CO₂ (35 – 45%), together with minor impurities, and can be further upgraded into biomethane, which can be directly exported to the national grid. Alternatively, purified biomethane can be directly used as a clean fuel for NGVs, achieving CO₂ reductions of up to 84% compared to equivalent new diesel fuel vehicles.

The EPSRC (via Supergen Bioenergy Hub) funded project “Algae-based biomethane fuel purification and carbon sequestration: an integrated approach” aims to develop and assess an innovative process for the simultaneous production of high purity biomethane as a potential natural gas vehicle (NGV) fuel, together with the sequestration of remaining biomass and biogas carbon into algal co-product and biochar. The proposed system combines AD of biomass with an algae-based CO₂ extraction and recovery process to yield fuel-grade biomethane and algal biomass, which can either be recycled to increase AD gas yields or sold as a separate higher value product. Hydrothermal carbonisation (HTC) is used to dry and stabilise the AD digestate into solid biochar for long-term carbon storage, whilst residual nutrients are recovered and used for further algae cultivation.

The outcomes from the proposed project have the potential to have numerous important impacts on the UK’s anaerobic digestion industry and the wider bioenergy sector. This process would make the AD technology more economically competitive by introducing additional value streams and help to lower the barriers for the installation of new AD systems, changing the marketability of biomass and helping to realise the predicted growth potential. An additional benefit of using algae to sequester carbon is the potential to recycle this additional biomass as a feedstock for more biogas production which would result in additional profit. This increased profitability would decrease the price of the process, opening opportunities for investment in new plants.

Job Description:

Job Grade: Specialist and Supporting Academic 6

Job Purpose

The Postdoctoral Research Associate will develop and assess an innovative process which combines anaerobic digestion of biomass with hydrothermal carbonisation of digestate and algae-based CO₂ extraction and recovery to yield fuel-grade biomethane product and sequester remaining biomass and biogas carbon into algal co-product and biochar.

Job Duties

Research

- To select and test suitable microalgae/cyanobacteria species for cultivation in bicarbonate-rich growth medium in presence of HTC aqueous phase.
- To investigate CO₂ absorption into algal growth medium to determine the optimum conditions to yield fuel grade biomethane.
- To establish a sequential AD-HTC system to produce biogas and solid biochar, which optimizes the carbon retention in the biochar and nutrient recovery to the aqueous phase.
- To evaluate the overall system energy and carbon balance.

General, technical

- To assist the PI in project management and develop project delivery plan.
- To actively engage with industrial and other non-academic stakeholders to determine system requirements and identify and address potential barriers for implementation
- To report research progress and present project results at Supergen Bioenergy Hub’s annual assembly.
- To write research papers suitable for publication in high quality academic journals and for presentation at specialist scientific conferences.
- To supervise student projects in related areas.
- To attend and contribute to project meetings and engagement events.

General and administrative

- To work effectively with relevant administrative, technical and academic staff in the School and across the University.
- To engage in training programmes in the University (e.g. through Staff Development) which are consistent with your needs and aspirations and those of the project team and the host School.
- To carry out specific other duties as may be reasonably requested by the project leaders and that are commensurate with the nature and grade of the post.

Points to Note

The purpose of this job description is to indicate the general level of duties and responsibility of the post. The detailed duties may vary from time to time without changing the general character or level of responsibility entailed.

Special Conditions

All staff have a statutory responsibility to take reasonable care of themselves, others and the environment and to prevent harm by their acts or omissions. All staff are therefore required to adhere to the University's Health, Safety and Environmental Policy & Procedures.

All staff should hold a duty and commitment to observing the University's Equality & Diversity policy and procedures at all times. Duties must be carried out in accordance with relevant Equality & Diversity legislation and University policies/procedures.

Successful completion of probation will be dependent on attendance at the University's mandatory courses which include Respecting Diversity and, where appropriate, Recruitment and Selection.

Organisational Responsibility: Reports to Dr Tanja Radu

Person Specification

Your application will be reviewed with respect to meeting the essential and desirable criteria listed below. Your application will be reviewed against the essential and desirable criteria listed below. Applicants are strongly advised to explicitly state and evidence how they meet each of the essential (and desirable) criteria in their application. Stages of assessment are as follows:

- 1 – Application
- 2 – Test/Assessment Centre/Presentation
- 3 – Interview

Essential Criteria

Area	Criteria	Stage
Experience	Background in engineering or science	1,3
	Experience of microalgae or cyanobacteria cultivation in solid and liquid media	1,3
	Experience of optimization of cultivation conditions	1,3
	Experience of presenting research findings at all levels, adapted to specific audience needs, ranging from academic experts to general public	1,3
	Publication of academic articles or papers on engineering or science topics	1
Skills and abilities	Ability to undertake the duties and responsibilities of the post	1,3
	Interest and knowledge in algae systems for scale-up	1,3
	Ability to work across multiple fields and readily understand new and challenging concepts	1,3
	Excellent communication, organisational and problem-solving skills	1,3
	Excellent written and oral communication skills in English	1
	Ability to work independently and as part of a team	3
	Analytical skills	1,3
	Interest and knowledge in algae systems for scale-up	1,3
Training	Willingness to undertake appropriate further training and to adopt new procedures as and when required	1
Qualifications	A PhD in algae cultivation or related area	1
	Undergraduate degree in Science or Engineering with 1 st class Hons. or equivalent	
Other	Commitment to observing the University's Equal Opportunities policy at all times.	1,3
	Willingness to travel	3

Desirable Criteria

Area	Criteria	Stage
Experience	Experience of anaerobic digestion of biomass	1,3
	Experience in hydrothermal conversion of biomass/residues, product recovery and analysis	1,3

	Experience in using process simulation software, e.g. Hysys/Aspen/Unisim	1,3
	Teaching and / or supervision of students in relevant areas	1,3
	Writing research proposals for funding from internal/external sources	1,3
Skills and abilities	Ability to interact with external collaborators from both industry and academia	1,3
	Ability to think creatively about problem-solving in scalability issues	1,3
	Ability to work with communities and stakeholders	1,3
Qualifications	Academic degree in geomatics/GIS related fields	1

Conditions of Service

The position is full time, for a fixed term period of 9 months available to start July 2019 ending no later than 31 March 2020. Salary will be within Specialist and Supporting Academic Grade 6 (£30,395 to £36,261) per annum at a starting salary to be confirmed on offer of appointment.

The appointment will be subject to the University's normal Terms and Conditions of Employment for Academic and Related staff details of which can be found [here](#).

The University is committed to enabling staff to maintain a healthy work-home balance and has a number of family-friendly policies which are available at <http://www.lboro.ac.uk/services/hr/a-z/family-leave-policy-and-procedure---page.html>.

We also offer an on-campus nursery with subsidised places, subsidised places at local holiday clubs and a childcare voucher scheme (further details are available at: <http://www.lboro.ac.uk/services/hr/a-z/childcare-information---page.html>)

In addition, the University is supportive, wherever possible, of flexible working arrangements. We also strive to create a culture that supports equality and celebrates diversity throughout the campus. The University holds a Bronze Athena SWAN award which recognises the importance of support for women at all stages of their academic career. For further information on Athena SWAN see <http://www.lboro.ac.uk/services/hr/athena-swan/>

Applications

The closing date for receipt of applications is 19 June 2019.