PDRA for UK Energy Futures Partnership at the University of Manchester

Job reference: SAE-031668
Location: Nancy Rothwell Building
Closing date (DD/MM/YYYY): 24/06/2026
Salary: UoM Grade 6 £37,694 - £46,049 per annum dependent on relevant experience
Employment type: Fixed Term
Faculty/Organisation: Science and Engineering
Division: Department of Chemical Engineering
Hours per week: 35
Contract Duration: 19 months
School / Directorate: Faculty of Engineering and Science

BACKGROUND

Backed by a significant investment from industry, this research will support the UK's energy transition and drive innovation in low-carbon technologies.

The UK Energy Futures research partnership will unite geoscientists, engineers, and social scientists from predominantly northern universities to advance geoenergy research. Participating institutions include Durham, Liverpool, Manchester and Newcastle universities, all members of the N8 university research partnership and Royal Holloway, University of London.

The research partnership has received major funding support from Eni S.p.A., a global energy tech company and operator of the CO2 transportation and storage infrastructures for the HyNet North-West England. Project lead and management is the Durham University with partners including University of Liverpool, University of Manchester, Newcastle University, Royal Holloway, and University of London. The research team is further strengthened by several project partners that will form the Advisory Board of the project, and that bring a wealth of complementary expertise and data to the project.

Funding support from Eni S.p.A allow the consortium of leading UK universities to assess the geoenergy resources of North-West England, North Wales, and the East Irish Sea Basin, and develop plans for a sustainable, low-carbon geoenergy sector. The research will be undertaken through a mix of postdoctoral researchers and PhD students.

There will be cross-institute, co-supervision of all projects, the creation of an energy research team with annual conference for staff, PDRAs, students and invited industry engineers and geoscientists. Active involvement of relevant staff from Eni U.K. and Eni Headquarters in Milan will take place in order to develop expertise in 'total geoenergy resource evaluation' within Eni and transfer of knowledge and skills between the academic researchers and Eni industry experts.

Overall Purpose of the Job

CO_2 Plume Geothermal (CPG) is an emerging carbon capture, utilization, and storage (CCUS) technology that uses supercritical CO_2 as a working fluid to extract geothermal energy while permanently storing CO_2 underground. Although sedimentary basins generally have relatively low heat density, their large natural pore-space volumes provide significant storage and heat-extraction potential. Compared with water, supercritical CO_2 has lower viscosity and greater thermal

expansibility, creating a strong thermosiphon effect that can circulate fluids without requiring energy-intensive pumping, thereby improving overall power generation efficiency.

Two key subsurface conditions are required for successful CPG operation. First, geothermal gradients of approximately 25–35°C per kilometre must be sufficient to generate and sustain the thermosiphon effect. Second, reservoir permeability and permeability architecture must allow dense-phase CO_2 to flow effectively through the formation and recover heat. This project focuses primarily on understanding how reservoir heterogeneity influences CO_2 flow and heat extraction, as previous studies have shown that homogeneous reservoir models can significantly overestimate power generation performance.

The research will begin with the development of advanced and computationally efficient thermodynamic and compositional reservoir simulations using GPU-based codes such as the MOOSE framework and validation against industry-standard software such as Schlumberger ECLIPSE and CMG. The models will account for complex processes including salt precipitation, temperature-dependent fluid properties, and variations in relative permeability and capillary pressure. These simulations will then be applied to realistic heterogeneous fluvial aquifers, where the effects of geological complexity on thermosiphon behaviour and energy production can be assessed. Here machine learning approaches can be utilised to enhance the computational efficiency of the codes.

The study will further investigate large-scale CPG deployment in realistic North Sea sandstone reservoirs developed by our partners and collaborators within the UK Energy Futures partnership. We will use detailed 3D geological models of fluvial and deltaic depositional systems for the Lower Carboniferous Limestone and Carboniferous to Permian sandstones. By integrating power generation using CO2 as the working fluid, from CO2 storage point of view the following questions will be answered:

- How much CO_2 can remain permanently stored while circulating?
- What fraction of injected CO_2 becomes immobilized?
- How does long-term storage interact with energy production?

Due to the computational intensity and technical complexity of the work, the project requires expertise equivalent to postdoctoral-level research in GPU based and machine learning enhanced fluid transport modelling in porous media.

Our University is positive about flexible working – you can find out more here

Blended working arrangements may be considered

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Enquiries about the vacancy, shortlisting and interviews:

Name: Masoud Babaei

Email: Masoud.babaei@manchester.ac.uk

General enquiries:

Email: People.Recruitment@manchester.ac.uk

Technical support:

Email: https://jobseekersupport.jobtrain.co.uk/support/home

This vacancy will close for applications at midnight on the closing date.
Please see the link below for the Further Particulars document which contains the person specification criteria.