

Department	School of Engineering and the Built Environment
Supervisors	Mina Jowkar, Suha Jaradat
Project Title	Application of moveable constructions in sustainable building alteration and addition: an innovative retrofit strategy across the UK

PROJECT DESCRIPTION

Building sector in the UK contributes to nearly half of the UK energy use and about 30% of the national Greenhouse Gas (GHG) emissions. According to Committee on Climate Change (CCC), to meet the UK zero emission target by 2050, 29 million of existing homes in this country must be made low carbon, and resilient to the future climate change [1]. This highlights the need for a more focused attention to optimise retrofit strategies across the UK. Additionally, given the carbon-intensive process of constructing new buildings [2], retrofit plans can also provide the opportunity for alteration and addition of the existing buildings rather than constructing new buildings.

Nevertheless, reports and statistics show that UK building stock is relatively old, 50% of which accounts for residential buildings built before 1970. Retrofit and alteration of such old properties tends to be challenging in the UK as they indicate early mass urban living in this country and, consequently, have strong cultural and architectural value [3]. Thus, more considerations are required to sustainably renovate and alter the function of these buildings whilst maintaining their aesthetic and cultural value. This requires using technologies and innovative solutions to minimize GHG emissions whilst improve amenities for the buildings' occupants in a cost-efficient way.

This project aims to investigate the application of nearly zero-emission moveable constructions as enablers of environmentally friendly building retrofit, alteration and addition across the UK. This project will address various aspects of such moveable constructions including energy consumption, environmental impact, cost-efficiency and occupants' comfort and wellbeing.

This study will be carried out through a combination of Building Information Modelling (BIM), building performance monitoring (simulation and actual measurements) and field experiment. After a thorough literature review, this includes: 1) data collection on the environmental and energy performance of some selected buildings; 2) propose and finalize the method of construction of the moveable building; 3) modelling, validation and simulation of the indoor environment and energy performance; 4) laboratory examination of the optimum scenarios resulted from simulation; 6) final simulation and laboratory examinations to evaluate the performance of the retrofit strategies using the mobile construction.

Should you have any questions please do not hesitate to contact the Supervisor Dr Mina Jowkar (m.jowkar@napier.ac.uk) before submitting your applications.

Academic qualifications

A first degree (at least a 2.1) ideally in Civil, Construction or Architectural Engineering, Building Information Modelling (BIM), Sustainable Engineering, or other relevant subjects, with a good fundamental knowledge of construction, building performance and construction materials.

English language requirement

IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. [Full details of the University's policy](#) are available online.

Essential attributes:

- Experience of fundamental in construction, material, building performance monitoring and energy consumption
- Competent in BIM, building performance simulation (in IES, IDA ICE, etc.)
- Knowledge of Architectural design, ambient environment quality, occupants wellbeing
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

- Teamwork skill
- Critical thinking skill
- Confidence and productivity
- The ability to work independently

Indicative Bibliography	<p>[1] Committee on Climate Change (2019), UK housing: Fit for the future, London, Committee on Climate Change</p> <p>[2] World Green Building Council (2017), Global Status Report 2017, UN Environment and the International Energy Agency</p> <p>[3] Power, A. (2008). Does demolition or refurbishment of old and inefficient homes help to increase our environmental, social and economic viability? Energy Policy, 36(12), pp.4487-4501.</p>
Enquiries	For informal enquiries about this PhD project, please contact m.jowkar@napier.ac.uk
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process