



<b>Research Centre</b>	School of Mechanical and Manufacturing Engineering, Faculty of Engineering and Computing
<b>Post title</b>	Postdoctoral Researcher in Advanced Thermal Energy Storage Systems
<b>Level on Framework</b>	Level 1
<b>Post duration</b>	3 Year Fixed Term Contract

### **Dublin City University**

Dublin City University (DCU) is a leading innovative European University. It is proud to be one of the world's leading Young Universities and is among the world's top 2% globally. DCU is known as Ireland's University of Impact, with a mission to 'transform lives and societies' and focuses on addressing global challenges in collaboration with key national and international partners and stakeholders.

DCU has over 20,000 students in five faculties spread across three academic campuses in the Glasnevin-Drumcondra area of North Dublin. Thanks to its innovative approach to teaching and learning, the University offers a 'transformative student experience' that helps to develop highly sought-after graduates. DCU is currently No. 1 in Ireland for Graduate Employment Rate, and for graduate income (CSO).

DCU is a research-intensive University and is home to a number of SFI-funded Research Centres. The University participates in a range of European and international research partnerships. DCU is also the leading Irish university in the area of technology transfer as reflected by licensing of intellectual property.

As a 'People First' institution, DCU is committed to Equality, Diversity and Inclusion - a University that helps staff and students to thrive. The University is a leader in terms of its work to increase access to education, and is placed in the world's Top 10 for reducing inequalities in the Times Higher Education Impact Rankings.

### **School of Mechanical and Manufacturing Engineering**

The School of Mechanical and Manufacturing Engineering has been at the forefront of Teaching, Learning, Research and Innovation in Engineering since its establishment in 1987. Current programmes include Mechanical and Manufacturing Engineering, Biomedical Engineering, Mechatronics Engineering and Mechanical and Sustainability Engineering. The School is a

research-intensive school that is home to key researchers affiliated to research centres including I-Form, Insight, ESIPP, MEDeng and the Water Institute, and has particular strengths in Biomedical Engineering, Advanced Manufacturing, and Sustainable Systems and Applied Energy Research. At postgraduate levels, the school offers taught Master's programmes with majors in Biomedical Engineering, Simulation-Driven Design and Mechanical and Sustainability Engineering, each with a pathway integrated with Bachelor's degrees.

### **The Project**

HYSTORE project is an interdisciplinary project funded by European Commission Horizon Europe Framework Programme (HORIZON) under the call Sustainable, Secure and Competitive Energy Supply (HORIZON-CL5-2022-D3-01) Thermal Energy Storage Solutions, Type of Action: Innovation Actions, with Grant Reference Number: 101096789. HYSTORE aims at developing and demonstrating novel compact thermal energy storage systems for cooling, heating, domestic hot water, and electricity load shifting, and fighting climate change. In HYSTORE project 18 partners from industry, academia, and recognised R&D centres from Spain, Italy, Sweden, Austria, Germany, Romania, Belgium, and Ireland will collaborate to develop innovative, and sustainable integrated energy systems with advanced energy storage systems.

HYSTORE will improve the integration of energy systems in buildings for peak load reduction, energy saving, and energy cost reduction. One of the highlighted activities in HYSTORE project will be developing and implementing advanced energy storage systems for overall energy optimisation of buildings and integrated energy systems and to improve energy efficiency. Other important objectives of HYSTORE project are promoting the UN Sustainable Development Goals (SDGs), equality, diversity, teaching, and education.

The mission of HYSTORE project is to develop and validate an innovative set of Thermal Energy Storage (TES) concepts, based on the combination of cutting-edge technology components, namely, ALL-IN-ONE PCM solution, Low-Temperature PCM Heating & Cooling solution, and Thermo-chemical Heating & Cooling energy storage solution. The four novel concepts –attain different but thorough applications on heating/cooling, Domestic Hot Water (DHW) configurations, and further enable the provision of hybrid – meaning energy and power- services. It follows the current European Strategic Energy Technology Plan (SET-Plan) that promotes the implementation of thermal storage technologies, to increase the share of Renewable Energy Systems (RES) or Variable Renewable Energy (VRE). It also encourages TES as an enabler to improve the flexible and reliable operation of building both power and thermal systems as decentralised energy resources, exploiting the increasing share of renewables, context maximising the exploitation and harnessing local RES generation and electrical grid peak load shedding and management. Four use case applications in different climates and EU countries both for District Heating/Cooling connected and non DHC-connected buildings with high-impact and replication potential will be considered. Regarding cost-effectiveness, the aim of HYSTORE is to achieve technological advancement of thermal energy storage (TES) with up to +150% energy density and -50% CAPEX compared to state-of-the-art.

A key challenge in the transition to decarbonisation is the development of sustainable urban neighbourhoods. This presents the challenge of aggregation and validation of energy profiles of individual buildings into a single community model while maintaining the essential granularity at an individual building level. From the social perspective, it is essential to analyse how such models can capture prosumer behaviour and needs and how policy can support such an important

transition. The whole system and main applications will be achieved thanks to the following general objectives:

- **GO1:** to deploy plug-and-play TES solutions for daily and monthly storage that are perfectly integrated with the building energy system and with the electric and thermal networks.
- **GO2:** to eliminate technical barriers linked to storage installation and operation complexity by acting at (i) engineering level, (ii) technical training level, (iii) interoperability level of the storage with the other smart appliances.
- **GO3:** to reduce the LCOE associated to the use of storage, making TES competitive with the widely adopted EES solutions and in line with SET Plan targets
- **GO4:** to operate the TES solutions as assets for the grid in the flexibility and frequency market, while proposing business and operational schemes for Capacity as a Service.
- **GO5:** to validate at TRL6/7 the proposed TES solutions and the operational platform in: (1) a residential/mixed use building in Nordic climate, (2) an office building in the Mediterranean climate, (3) an apartment dwelling in Continental climate, and (4) a district-connected hospital complex in Mediterranean climate.

### **The Role**

This competitive Postdoctoral Researcher position will be aligned within the different goals of the project mentioned above and focus on the development, testing, integration, and analysis of Hybrid Metaheuristic Optimization Algorithms for technical and economic analysis of the integrated energy systems with energy storage components in different demonstration sites located in various European countries. The candidate must show strong and proven background in data analysis. The main tasks this Postdoctoral Researcher will be involved in include:

- Pilots' audits, stakeholder roles, use cases, and framework scenario identification
- KPI-driven approach for assessment of technologies and pilot operation
- Ontology-driven model-based energy storage service integration
- Developing hybrid metaheuristic optimisation tools for technical-economic analysis
- Development, testing and evaluation of thermal energy storage (TES) ICT tools
- Integration and smart operation platform for the pilots
- Demonstration and cost validation
- Dissemination activities

The role of the Postdoctoral Researcher offers a suitable candidate the opportunity to work in a High-Profile European research-industry collaborative project, both internally with DCU researchers and externally with consortium partners from across the EU, European Commission (as a funding agency) and industry companies, in relation to external engagement and reporting, as required. This is a full-time role. As part of this role the researcher will be required to participate in the DCU Research Career Framework. This framework is designed to provide significant professional development opportunities to Researchers and offer the best opportunities in terms of a wider career path.

Applications are invited from suitably experienced candidates for the post of HYSTORE Postdoctoral Researcher in Advanced Thermal Energy Storage Systems in the DCU School of Mechanical and Manufacturing Engineering. Working with the HYSTORE Principal Investigator (PI) and Work Package leader, Dr. Mohammad Saffari, and the HYSTORE Consortium partners.

### **Duties and Responsibilities: Principal Duties and Responsibilities**

Key knowledge and skills associated with this position include but is not limited to the following:

- Experience of working in energy-related research environment across the public sector, academia or industry.
- A good knowledge of EU's energy-related research strengths and opportunities.
- An understanding of the European Union sustainable energy policy priorities and how research can support achievement of these priorities.
- A good knowledge of the assessment of building physics, building services, energy systems and sub-systems specifically energy storage and HVAC systems, engineering economics, environmental policy and engineering standards.
- Experience of the assessment of whole engineering systems.
- An understanding of the challenges and opportunities for thermal energy storage (TES) systems in the built environment.
- A good knowledge of numerical optimisation algorithms and data science.
- Conduct individual and/or collaborative research to the highest ethical standards in a variety of settings.
- Engage in the dissemination of the results of the research in which you are engaged in for the relevant research stakeholders in the appropriate form.
- Prepare grant proposals, if necessary.
- Engage in the wider research and scholarly activities of your research group, centre or unit and contribute to its profile by participating in promotional activity.
- Participate in internal networks for the exchange of information and to form relationships for future research collaboration.
- Participate in limited teaching in furtherance of your own development and contribute to your unit's teaching and tutoring approaches where appropriate. The extent of this must not adversely impact the primary research role.
- Provide day-to-day advice and assistance to research graduate students (B.Eng, M.Eng.) associated with your research group, centre or unit.

### **Qualifications, Skills and Experience Required**

Applicants must have a qualification at Ph.D level in Mechanical Engineering, Computer Science, Electrical Engineering, Building Engineering, or other relevant areas.

### **Criteria**

- Understanding of energy systems and grids as well as integration of local sources.
- Experience, knowledge, or willingness to learn energy modelling tools, such as Modelica, TRNSYS, EnergyPlus etc.
- Experience, knowledge or willingness to undertake on site energy monitoring; installation of sensors, data capture and processing.
- Experience, knowledge, or willingness to learn data analysis and simulation tools.
- Willingness to travel to project sites.
- Good report writing experience, excellent English communication skills.
- Willingness to work as part of a team of researchers and excellent interpersonal skills.
- Willingness to work closely with a wider cohort of stakeholders.
- A strong knowledge of national/international energy-related research strengths and Opportunities.
- Minimum five years' experience of working in an energy-related area or equivalent, preferably in an area related to Energy Assessment of Buildings and Energy Systems (where relevant, this may include time spent on post-graduate level studies).
- Ability to plan and execute projects with input from a number of stakeholders.

- Excellent communication (written and oral) and interpersonal skills, including ability to communicate technical information to non-technical audiences where full responsibility needs to be taken for the quality of oral and written communication.
- Strong project management and organisation skills.
- Candidates must demonstrate an awareness of equality, diversity, and inclusion agenda.

#### **Desirable**

- Demonstrated track record of development, delivery, monitoring and review of programmes or activities.
- Strong proactive approach to achieving results, including managing scope, time, cost, and quality.
- Knowledge of Excel, MATLAB, R, Python, Modelica, TRNSYS, EnergyPlus, etc.
- Well-developed research skills, both qualitative and quantitative.
- Attention to detail and strong organisational skills.
- Experience in stakeholder engagement.
- Awareness of equality, diversity, and inclusion agenda.
- Ability to manage a complex workload and work to tight deadlines.
- Speaking knowledge in another EU language e. g. Spanish, Italian, French, German is a plus.

#### **Benefits**

- Work-related travel budget
- Budget for PC/laptop
- Materials budget (books, computer consumables and general disposables)

#### **Candidates will be assessed on the following competencies:**

**Discipline knowledge and Research skills** – Demonstrates knowledge of a research discipline and the ability to conduct a specific programme of research within that discipline

**Understanding the Research Environment** – Demonstrates an awareness of the research environment (for example funding bodies) and the ability to contribute to grant applications

**Communicating Research** – Demonstrates the ability to communicate their research with their peers and the wider research community (for example presenting at conferences and publishing research in relevant journals) and the potential to teach and tutor students

**Managing & Leadership skills** - Demonstrates the potential to manage a research project including the supervision of undergraduate students

#### **Essential Training**

Training required for the role should be entered here. At a minimum, the following should be entered in addition to other applicable, role specific mandatory training:

The postholder will be required to undertake the following essential compliance training: Orientation, Health & Safety and Data Protection (GDPR). Other training may need to be undertaken when required.

