

Belfast School of Architecture and the Built Environment

Research & Innovation Annual Report

1 August 2021-31 July 2022







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Foreword





1. Foreword: Research Director Dr Jayanta Mondol

I am very pleased to report that the results of the 2021 Research Excellence Framework (REF), published on May 12th May 2022, placed the Ulster University Architecture, Built Environment and Planning (**UoA13**) research unit in the **top 10** in of UK universities. The REF is the system by which the quality of research in UK universities is assessed. The **REF2021** results show that overall, **91%** of our research is world-leading or internationally excellent with **34%** of our published research outputs having achieved the highest 4* rating, indicating a level of quality that is world-leading in terms of originality, significance, and rigour. Furthermore, **49%** were rated as being 3*, i.e., internationally excellent research in terms of originality, significance, and rigour. Based on these excellent results we are the top Architecture, Built Environment and Planning research unit within Northern Ireland.

Our research unit constitutes of four established Research Centres (Centre for Sustainable Technologies (CST), Fire Safety Engineering Research and Technology Centre (FireSERT), Hydrogen Safety Engineering and Research Centre (HySAFER), Centre for Research on Property and Planning (RPP)) and two Research Groups (Studies Allied to the Built Environment Research (SABER) and Architecture Research Group (ARG)) and have over 140 research-active staff (Academics, Contract Research Staff and Post Graduate Researchers) spanning across all disciplines within Built Environment.

We returned **55** academic and research staff to the REF2021, an increase of **37.8%** compared to the previous exercise in 2014. Of the staff returned in this REF assessment period, **55.4%** are first-time participants which indicates a well-balanced team of new and experienced researchers within this unit.

We have been highly successful in generating external funding in this REF cycle in a very competitive funding environment and increased our research spend by **74%** compared to REF2014 with total spending of circa **£22.9M**. Our Research Council income grew by **91%** and EU funding from government bodies and other sources by **118%**.

During the REF2021 period, a total of **74** PhDs were awarded, which was **20%** higher than REF2014 and includes a high percentage (**39.2%**) of female researchers.

Central to this performance is our Research Impact and Research Environment both of which were rated as **100%** for world-leading and internationally excellent. Additionally, we ranked **5th** within the UK in terms of Research Environment indicating that we offer excellent training supports and research facilities that allow our staff to grow in their career. This clearly signifies that we are a leading internationally focused research unit delivering our research towards the creation of a more sustainable and resilient built environment with improved health and livelihoods.

Our extensive partnerships have provided for international recognition of our scientific expertise and indicate that we are influencing global research agendas. Our research is contributing to "Sustainable Smart City Infrastructure" ensuring that we build sensitively (SABER) with respect to our existing built environment and associated communities (ARG), legislative compliance, procurement, and financial sustainability in construction and operation (RPP) and that ensures that systems are smart and low/zero carbon (CST/HySAFER) and that buildings are safe (HySAFER/FireSERT).

In this reporting period, the Centre for Sustainable Technologies (CST) has continued to address key areas of technological development in decarbonising and securing our energy supplies which are complimented by economic, environmental, and social analysis of technology development, deployment and end-use. Current projects include: LotNet (EPSRC, £1,298,000, 2018-2023) – addressing low temperature heat networks, CCB (EPSRC, £199,716 2019-2023) for developing domestic heat pumps and thermal storage systems based on global best practice, DELTA PHI (EPSRC, £268,593, 2020-2023) which is developing heat pumps to decarbonise industrial heat processes, HP-FITS (EPSRC, £601,001, 2020-2024) for development of a novel close coupled heat pump and thermal store for domestic applications, Biowaste Gasification (Co-Innovate/Interreg, £92,125, 2020-2022) which is addressing waste to energy challenges, CE-SEA (InvestNI/CASE, £260,000, 2020-2023) for development of pre-fabricated modular, multi-function building envelope providing thermal insulation, renewable energy and daylight control. Other projects pf note are: Novel building Integration Designs for increased Efficiencies in Advanced Climatically Tunable Renewable Energy Systems (European Space Agency, £44,895, 2020-2024), FASTER (Interreg VA, £1,259,834, 2020-2023) installing Rapid EV chargers in Rural Northern Ireland, Data Centre Decarbonisation with Geothermal Energy (Invest NI CASE, £206,841, 2021-2023) using geothermal energy in Northern Ireland), and Intelligent Data Harvesting for Multi-Scale Building Stock Classification and Energy Performance Prediction (US-Ireland-DfE, £230,965, 2021-2024) predicting energy needs and decarbonisation/energy poverty for our housing stock.

HySAFER has continued to engage in several research projects that are funded through H2020, EPSRC, Invest NI and Innovate UK. Ongoing projects include **HYLANTIC**: Atlantic Network for Renewable Generation and Supply of Hydrogen for promotion of High Energy Efficiency (H2020, €290k); **SH2APED**: Storage of hydrogen: alternative pressure enclosure development (H2020, €418k); Breakthrough safety technologies for fabrication of hydrogen storage vessels in Northern Ireland (Invest NI, £205k); **Kelvin-2** (EPSRC) aiming to establish a unique High-Performance Computing (HPC) centre in Northern Ireland to accelerate research activity in a range of specialist areas.

HySAFER is also continuing to make research contributions in the area of regulations, codes and standards on hydrogen fuel safety such as ISO TC197 Hydrogen Technologies: implementing results of **PRESLHY** project into standard ISO/TR 15916 "Basic considerations for the safety of hydrogen systems"; UN ECE Global technical regulation on hydrogen and fuel cell vehicles No.13; CEN/CENELEC/JTC6 Hydrogen in Energy Systems: contribution to draft standard on terminology and safety recommendations for use of hydrogen vehicles in underground transportation systems.

The **RPP** Research Centre continues to make a significant contribution to housing, planning and fiscal policy development across the Island of Ireland. The research conducted by RPP has served to inform the NI Department of Finance on market intervention and funding relief packages for businesses, Regional Government Departments and Local District Councils during the Covid Pandemic. Internationally, RPP research projects have achieved a significant impact on key societal and environmental challenges. The RPP researchers have contributed to the development of Carbon Risk Real Estate Monitor (CRREM) tools and science-based decarbonisation pathways which were adopted by several key international data providers including GRESB and EPRA. The CRREM pathways have also been endorsed by the Partnership for Carbon Accounting Financials (PCAF). Additionally, the CRREM project was awarded ESG Data Initiative of the Year (2022) at the Environmental Finance Sustainable Investment Awards. On the societal side, the ASGARD project which focussed on improving data collaboration across European Law Enforcement Agencies won the European Commission's 2022 Collaborative Technology Award. The RPP has secured **£300K** in research funding from the Northern Ireland Housing Executive (NIHE) to continue the NI House Price Index Report series. This project has served as a platform for informing housing policy nationally and internationally over the years

FireSERT is currently involved in three ongoing projects funded by the Korean National Fire Agency. These projects include (i) Development of Emergency Response Training Facilities, (£330,000), (ii) Development of

Optimum Firefighting Strategy for Battery Electric Cars, (£133,053), and (iii) Fire Safety Evaluation Technology and Infrastructure Development project for High Energy Lithium Rechargeable Batteries, (£133,053). In collaboration with South-West College, **FireSERT** is developing a novel processing technology to tackle hard-to-recycle plastic food waste packaging. **FireSERT** is also investigating fire safety mechanisms for High-Rise buildings in Northern Ireland via funding from the NI Housing Executive. **FireSERT** is working with Fuzhou University (China) to develop a two-way coupled 3D simulation model for forest fire meteorology using fine scale observed data. The project is funded by NNSFC (National Natural Science Fund of China).

In collaboration with the MJM Marine Group and the School of Computing at Ulster University, **SABER** researchers are delivering a KTP project entitled "Marine Digital Twinning Platform" funded by Innovate UK (£284,226). **SABER** researchers are also involved in experimental-based research with roads, runways and racing circuit industries around the world. The researchers are providing expert advice on the racing track development for various racing circuits worldwide such as Mandalika Motor Racing Circuit, Lombok, Indonesia; Miami International Autodrome in Miami Gardens, Florida, USA.

In a partnership with Belfast City Council (BCC), **ARG** and **CST** researchers were engaged in the 'Architecture of Change' project to deliver a student lead training programme to educate senior business leaders on netzero carbon buildings and the sustainable built environment. Three training workshops focusing on innovative concepts for design, planning, construction, and management of climate-resilient, net zero emission buildings and communities were delivered on 16th, 23rd and 30th March 2022 at our new Belfast campus.

Post Graduate Researchers continue to represent a major source of research innovation within our research centres. Over the reporting period, **60** students were registered for PhD study on either a part-time or full-time basis with **16** successfully graduating. Our PhD researchers have been recognised internationally for their outstanding research. For example, PhD researcher Robert Bray has received a Fulbright Scholarship (May 2022) and will visit WPI in Massachusetts (USA) next year. Hossein Tavanarezaei was awarded the prestigious Dr Guylene Proulx OC Scholarship and was invited to present his work at the SFPE 2022 Performance Based Design Conference and Expo (23-25 March 2022).

I would encourage you to read through this Annual Report on the activities of the Architecture, Built Environment and Planning Research Unit, Ulster University over the period August 2021 to July 2022 and look forward to receiving any comments or queries that you have.



Further details of our REF2021 results can be found at (<u>https://www.ulster.ac.uk/ref/unit-of-assessment/architecture-built-environment-and-planning</u>)

Further details of our research, facilities, staff profiles and research expertise can be found at <u>https://www.ulster.ac.uk/research/topic/built-environment</u>

or by contacting Marcella McCann (Academic Excellence Executive Assistant) at Email: <u>m.mccann1@ulster.ac.uk</u>; Ph: +44 28 9536 7356

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Dr Jayanta Deb Mondol Research Director- Architecture, Built Environment & Planning



The following research students were registered on research degree programmes during 2021-22.



2. Research Students

Name	Project Title		
Ademulegun, Oluwasola	Locational Net Benefit Analysis (LNBA) for Mass Energy Storage		
Alkadi, Sanaa	An Investigation of the Adaptation of the Southern Syrian Vernacular Dwelling		
Baby, Aloshy	Synergistic Effect of Phosphorus and Nitrogen Containing Groups in Fire Retardancy of Polystyrene		
Bradley, Briegin	Healthy Urban Environments. Assessing the needs and expectations of Young People across European Cities		
Bray, Robert	An experimental and computational study of flame ignition and extinction of polymeric materials in under-ventilated environments		
Byrne, Raymond	A heuristic evaluation of the energy performance of a Vestas V52 wind turbine in a peri-urban wind environment		
Carlin, Kieran	Urban universities as catalysts for public-private regeneration strategies to benefit more liveable and healthy inner-city communities		
Casey, Thomas	Friction after polishing a probabilistic framework for improved roads management on national roads in Ireland		
Cassidy, Peter	Design and evaluation of community fire safety educational programmes		
Chang, Roma	Multifunctional Building Integrated Solar Technologies		
Charlier, Marion	Characterization of travelling fires in large compartments		
Collen, Peter	Further investigation of surface dressing failures through 2D and 3D modelling		
Comiskey, David	The Quality Dimension (qD) – Improving quality assurance in relation to fire barriers in ventilated façade systems		
Diamond, Declan	Sustainable City Regeneration through Infrastructure Investment		
Donkoh, Emmanuel	Improving project performance: Application of system dynamics modelling in managing construction stakeholders influences and challenges		
Ebne Abbasi, Hazhir	Assessment and mitigation of hydrogen-fuelled vehicle hazards		
Ferguson, Jason	The detrimental effect of water on asphalt pavement durability		
Ghoraishi, Mohammad	Advanced Multifunctional Energy Efficient Building Facades		
Hasnain, Syed Ali	Experimental and Numerical Investigation of Fire in Li Ion Battery Energy Storage System		
Hermans, Lucas	Model-to-Model Validation: an Extended Framework for Quality Assessment and Comparison of Automated Valuation Models for Residential Real Estate		
James, Ben	Climate Resilient, Net and Autonomous Zero Emission Buildings and Communities (NZEB) – Definitions and Prototypes for the UK/Northern		
Johnston, Ryan	Visualisation and Immersive technology to improve stakeholder participation in net Zero Emission Buildings and Neighbourhoods (ZEN) in Smart Cities		
Kazemi, Mina	Prevention and mitigation of accidents with hydrogen-powered vehicles in confined spaces		
Kearney, Matthew	Regeneration and Resilience: Practical Solutions to Real World Problems		
Kennedy, Robert	Legibility in Urban Design and Conservation Area Practice		
Liang, Hongyuan	The Development of a Strategic Performance Measurement Framework for Assessing Xiongan New Area in China		
Lynch, Frances	Healthy place-making and youth wellbeing: Role of neighbourhood heritage		
MacIntyre, Sean	Solar PV in NI. An examination of the user profile and experience together with an assessment of its future potential for household generation and use via behavioural and technological changes		

Magennis, Lawrence	Saving Earth from Humans: Earth-focussed Sustainable Development			
Mahon, Clare	To develop an economic operator prequalification model to assist in the award of public contracts			
McGuinness, Siobhan	Co-Designing Child Friendly Places: Growing the Resilience of Children through Inclusive Planning			
Murray, Martin	Passive House Strategies, using Ireland as an exemplar.			
Nair, Ajay	Phase Change and Alternative Materials for Domestic Thermal Energy			
Muraleedharan	Storage			
Oakes, Luke	Development and evaluation of innovative, fibre-reinforced geopolymer composite solutions as permanent formwork for geopolymer cement concrete structures			
Obasi, Gerard	Advanced Heat Pumps and Power Cycles			
Parke, Daniel	Renewable Energy and Storage for Outdoor Events Sector (RESOES)			
Ramirez, Miguel	Design & development of a High Temperature Heap Pump (HTHP) for district heating and industrial applications			
Robinson, Amy	The Impact of policy and the application of regulatory controls on the achievement of overarching sustainability goals.			
Rolfe, Angela	Advanced simulation and modelling to ensure techno-economic and environmental sustainability of new process development			
Shahzadi, Iram	Energy system model for Northern Ireland			
Sheldon, Lisa	An investigation of flood risk awareness, flood interventions and flood communication for residents living in Areas of Potential Significant Flood Risk in Northern Ireland			
Sivaraman, Srinivas	Safety of Using Ammonia in for the Hydrogen Economy			
Son, Kwangho	Development of Emergency Response Training Facilities for Alternative Vehicles under Fire			
Sreekumar, Sreehari	Nanoparticles based Solar Energy and Energy Storage (Nano_SEES) System			
Sulaiman, Adam Yussef	Advanced Heat Pump Systems Accommodating High Temperature Evaporation			
Tavanarezaei, Hossein	Investigation into the microscopic characteristics of pedestrian movement in congested space			
Umer, Muhammad	Biohydrogen from waste through biomass electrolysis: challenges and opportunities			
Velanparambil Ravindran, Rahul	Reversible Heat Pump/Organic Rankine Cycle			

Graduated December 2021

Name	Thesis Title
Aghanaya Ocary	Assessing demand flexibility as a new business model for decarbonising social
Agbonaye, Osaru	housing
Czerwinska , Anna	Fuel poverty – Retrofitting as a policy solution
El Comero Kristino	The City Other. A people-centred analysis on the detachment of the Beirut
El Samra , Kristine	Central District
Tierney , Christopher	The friction measuring tyre contact patch: Studies on the interaction of tyres
	and pavement texture

Graduated July 2022

Name	Thesis Title
Abid, Mohammad	Variable speed heat pump compressor for demand side management and
	network stability
Alnaseem, Nijood	Private equity infrastructure investment in emerging infrastructure markets
Ansong, Joseph	Pathways towards integrated cross-border marine spatial planning
Bani Mostafa Motasam	Battery energy storage systems in hospitals for flexibility, resilience and
Balli Mostala, Motaselli	arbitrage
Bhutta, Rumeel	Thermal protective performance of turnout gear at high heat flux intensity
Coyles, David	Cartographies of conflict: Belfast's hidden architectures of territory and
	division
	Performance study and validation of the downdraft biomass gasification
De Priall, Oisin	process for combined heat & power plants from under-utilised biomass and
	bio-waste
	Evaluation of cost effective and recycled anode materials in microbial
Islam, A K IVI Knabirul	electrolysis cells for hydrogen production from wastewater
Jankawiah Canantin	Optimal integrated energy storage solutions for the electrification of heat
Jankowiak, Corentin	and transport at a domestic level
Nakkasunchi, Shalini	Water-energy nexus of the wastewater treatment plants
Ratajczak, Leonia	The smart city: Spatial planning, partnership, governance
Sanders, Peter David	The characterisation of road surface friction as a factor in vehicle safety

Publications

Details of all Publications by the School of Architecture, Built Environment and Planning are on the Ulster University's Institutional Repository - PURE



3. Publications

This section reports those outputs published over the period of this report and classified as either journal articles, books/chapters in books, research reports and published conference papers. https://pure.ulster.ac.uk/.

3.1 Journal Articles

Abid, M, Hewitt, N, Huang, M-J, Wilson, C & Cotter, D 2021, 'Domestic Retrofit Assessment of the Heat Pump System Considering the Impact of Heat Supply Temperature and Operating Mode of Control—A Case Study', Sustainability, vol. 13, no. 19, 857. <u>https://doi.org/10.3390/su131910857</u>

Abid, M, Hewitt, N, Huang, M-J, Wilson, C & Cotter, D 2021, 'Performance Analysis of the Developed Air Source Heat Pump System at Low-to-Medium and High Supply Temperatures for Irish Housing Stock Heat Load Applications', Sustainability, vol. 13, no. 21, 11753. <u>https://doi.org/10.3390/su132111753</u>

Agbonaye, O, Keatley, P, Huang, Y, Ademulegun, O & Hewitt, N 2021, 'Mapping demand flexibility: A spatio-temporal assessment of flexibility needs, opportunities and response potential', Applied Energy, vol. 295, 117015. <u>https://doi.org/10.1016/j.apenergy.2021.117015</u>

Agbonaye, O, Keatley, P, Huang, Y, Odiasec, OF & Hewitt, N 2022, 'Value of demand flexibility for managing wind energy constraint and curtailment', Renewable Energy, pp. 1-20. https://doi.org/10.1016/j.renene.2022.03.131

Alam, N, Nadjai, A, Charlier, M, Vassart, O, Welch, S, Sjöström, J & Dai, X 2022, 'Large scale travelling fire tests with open ventilation conditions and their effect on the surrounding steel structure– The second fire test', Journal of Constructional Steel Research, vol. 188, 107032. https://doi.org/10.1016/j.jcsr.2021.107032

Alam, N, Nadjai, A, Hanus, F, Kahanji, C & Vassart, O 2021, 'Experimental and Numerical investigations on Slim Floor Beams Exposed to Fire', Journal of Building Engineering, vol. 42, 102810. https://doi.org/10.1016/j.jobe.2021.102810

Ansong, J, Ritchie, H & McElduff, L 2022, 'Institutional barriers to integrated marine spatial planning on the island of Ireland', Marine Policy, vol. 141, 105082, pp. 1-30. https://doi.org/10.1016/j.marpol.2022.105082 Arun, M, Bigger, S, Guerrieri, M, Joseph, P & Tretsiakova-McNally, S 2022, 'Thermal and Calorimetric Investigations of Some Phosphorus-Modified Chain Growth Polymers 1: Polymethyl Methacrylate', Polymers, vol. 14, no. 7, 1447. <u>https://doi.org/10.3390/polym14071447</u>

Arun, M, Bigger, S, Guerrieri, M, Joseph, P & Tretsiakova-McNally, S 2022, 'Thermal and calorimetric investigations of some phosphorus-modified chain growth polymers 2: Polystyrene', Polymers, vol. 14, no. 8, 1520. <u>https://doi.org/10.3390/polym14081520</u>

Baby, A, Tretsiakova-McNally, S, Joseph, P, Arun, M, Zhang, J & Pospiech, D 2022, 'The Influence of Phosphorus- and Nitrogen- Containing Groups on the Thermal Stability and Combustion Characteristics of Styrenic Polymers', Journal of Thermal Analysis and Calorimetry. <u>https://doi.org/10.1007/s10973-022-11404-6</u>

Bani Mustafa, M, Keatley, P, Huang, Y, Agbonaye, O, Ademulegun, O & Hewitt, N 2021, 'Evaluation of a battery energy storage system in hospitals for arbitrage and ancillary services', Journal of Energy Storage, vol. 43, 103183. <u>https://doi.org/10.1016/j.est.2021.103183</u>

Barone, G, Buonomano, A, Chang, R, Forzano, C, Giuzio, GF, Mondol, J, Palombo, A, Pugsley, A, Smyth, M & Zacharopoulos, A 2022, 'Modelling and simulation of building integrated Concentrating Photovoltaic/Thermal Glazing (CoPVTG) systems: Comprehensive energy and economic analysis', Renewable Energy, vol. 193, pp. 1121-1131. <u>https://doi.org/10.1016/j.renene.2022.04.119</u>

Barone, G, Zacharopoulos, A, Buonomano, A, Forzano, C, Giuzio, GF, Mondol, J, Palombo, A, Pugsley, A & Smyth, M 2022, 'Concentrating PhotoVoltaic glazing (CoPVG) system: Modelling and simulation of smart building façade', Energy, vol. 238, 121597. <u>https://doi.org/10.1016/j.energy.2021.121597</u>

Barone, G, Zacharopoulos, A, Buonomano, A, Forzano, C, Giuzio, GF, Mondol, J, Palombo, A, Pugsley, A & Smyth, M 2022, 'Concentrating PhotoVoltaic glazing (CoPVG) system: Modelling and simulation of smart building façade', Energy, vol. 238, 121597. <u>https://doi.org/10.1016/j.energy.2021.121597</u>

Bhutta, R & Choi, S 2022, 'Thermo-physical evaluation of firefighter outer garment in high flux environments', Textile Research Journal, vol. 92, no. 13-14, pp. 2461-2475. https://doi.org/10.1177/00405175221086043

Boyce, KE, Tavana, H & Aghabayk, K 2021, 'A comparative study of flows through funnel-shaped bottlenecks placed in the middle and corner', Collective Dynamics. https://doi.org/10.17815/CD.20XX.X Byrne, R, Hewitt, NJ, Griffiths, P & MacArtain, P 2021, 'A comparison of four microscale wind flow models in predicting the real-world performance of a large-scale peri-urban wind turbine, using onsite LiDAR wind measurements', Sustainable Energy Technologies and Assessments, vol. 46, 101323, pp. 1-19. <u>https://doi.org/10.1016/j.seta.2021.101323</u>

Charlier, M, Franssen, J-M, Dumont, F, Nadjai, A & Vassart, O 2021, 'Development of an Analytical Model to Determine the Heat Fluxes to a Structural Element Due to a Travelling Fire', Applied Sciences, vol. 11, no. 19, 9263. <u>https://doi.org/10.3390/app11199263</u>

Charlier, M, Glorieux, A, Dai, X, Alam, N, Welch, S, Anderson, J, Vassart, O & Nadjai, A 2021, 'Travelling fire experiments in steel-framed structure: numerical investigations with CFD and FEM', Journal of Stuctural Fire Engineering, vol. 12, no. 3, pp. 309-327. <u>https://doi.org/10.1108/JSFE-11-2020-0034</u>

Charlier, M, Glorieux, A, Dai, X, Alam, N, Welch, S, Anderson, J, Vassart, O & Nadjai, A 2021, 'Travelling fire experiments in steel-framed structure: numerical investigations with CFD and FEM', Journal of Stuctural Fire Engineering, vol. 12, no. 3, pp. 309-327. <u>https://doi.org/10.1108/JSFE-11-2020-0034</u>

Choi, S, Kang, S, Bhutta, R, Kwon, M & Choi, J 2022, 'Development of a bench-scale apparatus to assess thermal protective performance of garments under highly intensive heat-flux exposures', Measurement and Control, pp. 1-17. <u>https://doi.org/10.1177/00202940211064197</u>

Choi, S, Kang, S, Kwon, M & Choi, J 2022, 'Development of a full-scale apparatus to assess thermal protective performance of garments under highly intensive heat-flux exposures', Measurement and Control. <u>https://doi.org/10.1177/00202940211064212</u>

Cirrone, D, Makarov, D, Lach, AW, Gaathaug, AV & Molkov, V 2021, 'The Pressure Peaking Phenomenon for Ignited Under-Expanded Hydrogen Jets in the Storage Enclosure: Experiments and Simulations for Release Rates of up to 11.5 g/s', Energies, vol. 15, no. 1, 271, pp. 1-21. <u>https://doi.org/10.3390/en15010271</u>

Cirrone, D, Makarov, DV, Kuznetsov, M, Friedrich, A & Molkov, V 2022, 'Effect of heat transfer through the release pipe on simulations of cryogenic hydrogen jet fires and hazard distances', International Journal of Hydrogen Energy, vol. 47, no. 50, pp. 21596-21611. <u>https://doi.org/10.1016/j.ijhydene.2022.04.276</u>

Clarke, P 2021, 'WaterLands III: Studio Research Work' Perspective: The Journal of the Royal Society of Ulster Architects, vol. 30, no. 4, pp. 58.

Colclough, S 2021, 'The Costs, Benefits and Stakeholder Analysis of an Irish Social Housing Deep Energy Retrofit Case Study', Journal of Physics: Conference Series, vol. 2069, no. 1, 012110. <u>https://doi.org/10.1088/1742-6596/2069/1/012110</u>

Colclough, S, O'Hegarty, R, Murray, M, Lennon, D, Rieux, E, Colclough, M & Kinnane, O 2022, 'Post occupancy evaluation of 12 retrofit nZEB dwellings: The impact of occupants and high in-use interior temperatures on the predictive accuracy of the nZEB energy standard', Energy and Buildings, vol. 254, 111563, pp. 1-17. <u>https://doi.org/10.1016/j.enbuild.2021.111563</u>

De Priall, O, Brandoni, C, Gogulancea, V, Jaffar, M, Hewitt, N, zhang, K & Huang, Y 2022, 'Gasification of Biowaste Based on Validated Computational Simulations: A Circular Economy Model to Handle Poultry Litter Waste', Waste and Biomass Valorization, vol. 13, no. 9, pp. 3899-3911. <u>https://doi.org/10.1007/s12649-022-01815-9</u>

De Priall, O, Brandoni, C, Gogulancea, V, Johnston, C, Onofrei, G, Hewitt, N & Huang, Y 2021, 'Modelling and experimental investigation of small-scale gasification CHP units for enhancing the use of local biowaste', Waste Management, vol. 136, pp. 174-183. <u>https://doi.org/10.1016/j.wasman.2021.10.012</u>

de Silva, D, Alam, N, Nadjai, A, Nigro, E & Ali, FA 2021, 'Finite Element Modelling for Structural Performance of Slim Floors in Fire and Influence of Protection Materials', Applied Sciences, vol. 11, no. 23, 11291, pp. 1-17. <u>https://doi.org/10.3390/app112311291</u>

Gonzalez, J, Sargent, P & Ennis, C 2021, 'Sewage treatment sludge biochar activated blast furnace slag as a low carbon binder for soft soil stabilisation', Journal of Cleaner Production, vol. 311, 127553, pp. 1-12. https://doi.org/10.1016/j.jclepro.2021.127553

Gupta , A, Das, B, Biswas, A & Mondol, J 2021, 'An environmental and economic evaluation of solar photovoltaic thermal dryer', International Journal of Environmental Science and Technology. <u>https://doi.org/10.1007/s13762-021-03739-8</u>

Gupta, A, Das, B, Biswas, A & Mondol, J 2022, 'Sustainability and 4E analysis of novel solar photovoltaicthermal solar dryer under forced and natural convection drying', Renewable Energy, vol. 188, pp. 1008-1021. <u>https://doi.org/10.1016/j.renene.2022.02.090</u>

Hermans, L, Bidanset, P, McCord, M & Davis, PT 2022, 'Using Object-Level Ratio Studies for the Incorporation of Validation Models in Single Family Residential Real Estate Assessment', Journal of Property Tax Assessment and Administration, vol. 19, no. 1, pp. 83-102.

Hussein, H, Brennan, S & Molkov, V 2021, 'Hydrogen Jet Fire from a Thermally Activated Pressure Relief Device (TPRD) from Onboard Storage in a Naturally Ventilated Covered Car Park', Hydrogen, vol. 2, no. 3, pp. 343-361. <u>https://doi.org/10.3390/hydrogen2030018</u>

IAAO Artificial Intelligence Task Force 2022, 'A Review of the Methods, Applications, and Challenges of Adopting Artificial Intelligence in the Property Assessment Office', Journal of Property Tax Assessment and Administration, vol. 19, no. 1, pp. 21-80.

Kashkarov, S, Makarov, D & Molkov, V 2021, 'Performance of Hydrogen Storage Tanks of Type IV in a Fire: Effect of the State of Charge', Hydrogen, vol. 2, no. 4, pp. 386-398. <u>https://doi.org/10.3390/hydrogen2040021</u> Kearney, M & Ritchie, H 2021, 'Developer contributions and community benefits: understanding the regulatory context for the implementation of a value capturing instrument in Northern Ireland', Town Planning Review, vol. 92, no. 5, pp. 615-642. <u>https://doi.org/10.3828/tpr.2021.33</u>

Lo, D, Chau, KW, Wong, SK, McCord, M & Haran, M 2022, 'Factors Affecting Spatial Autocorrelation in Residential Property Prices', Land, vol. 11, no. 6, 931, pp. 1-16. <u>https://doi.org/10.3390/land11060931</u>

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3.2 Books/Chapters in Books

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3.3 Research Reports

Lawson, A & Vaganay, M 2021, An investigation of hand washing facilities and practices in various settings on the island of Ireland.

Lawson, V, Purohit, R, Samuel, F, Brennan, J, Farrelly, L, Golden, SM & McVicar, M 2022, Public participation in planning in the UK: A review of the literature. UK Collaborative Centre for Housing Evidence, United Kingdom. <u>https://housingevidence.ac.uk/wp-content/uploads/2022/04/220406-Public-participation-in-planning-in-the-UK_v3.pdf</u>

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3.4 Published Conference Papers

Baby, A, Tretsiakova-McNally, S, Joseph, P & Zhang, J 2021, 'Phosphorus-Nitrogen Synergism in Fire Retarding Styrenic Polymers: Some Preliminary Studies', European Meeting on Fire Retardant Polymeric Materials, Budapest, Hungary, 29/08/21 - 1/09/21.

Cirrone, D, Makarov, DV & Molkov, V 2022, 'Pressure limit of spontaneous ignition of cryogenic hydrogen in a T-shaped channel system', Paper presented at International Seminar on Fire and Explosion Hazards, Oslo, Norway, 22/05/22 - 27/05/22.

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McClements, S, Cunningham, G, McKane, M & Duggan, B 2021, 'Re-Imagining Quantity Surveying', Paper presented at CITA BIM GATHERING CONFERENCE 2021, Belfast, United Kingdom, 21/09/21 - 23/09/21.

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Tretsiakova-McNally, S, Bray, R & Zhang, J 2022, 'Polymeric Materials in Under-ventilated and Vitiated Environments - An investigation into control variable sensitivity for the controlled atmosphere cone calorimeter', ACS Fire and Polymers, Napa, United States, 5/06/22 - 8/06/22.

Vennard, A, Cairns, P, Tretsiakova-McNally, S, Harvey, I, Harrison, J & Farrell, C 2022, 'Dealing with plastic packaging contaminated with residual amounts of food', 32nd Irish Environmental Researchers Colloquium, Belfast, 20/06/22 - 22/06/22 pp. 112.

Research Funding

Ongoing and Active Research Projects







4. Research Funding

Ongoing and Active Research Projects, notably:

Unit of Assessment Member	Title of Award	Funding Body	Value	Project Dates
Prof Neil Hewitt Max Morrow	FASTER (Facilitating A Sustainable Transition to EVs in the Regions)	INTERREG IVA	£1,187,129	25/01/2021
Prof Vladimir Molkov Dr Dmitriy Makarov Dr Volodymyr Shentsov	SH2APED Storage of hydrogen: alternative pressure enclosure development	CEC-H2020-JTI- FCH-2020-1	£367,778	5/01/2021
Prof Neil Hewitt Prof Ming Jun Huang Dr Inna Vorushylo Dr Nikhilkumar Shah	HP-FITS Heat Pump Fully Integrated with Thermochemical Storage	EPSRC	£601,000	28/09/2020
Dr Aggelos Zacharopoulos Dr Jayanta Mondol Dr Mervyn Smyth	CE-SEA - Community Energy from Solar Envelope Architecture	Invest NI	£202,438	12/03/2020
Dr Seng-Kwan Choi	Development of Emergency Response Training Facilities	Korean National Fire Agency	£330,000	23/01/2020

Portfolio of Research Grants awarded during period 1 August 2021 - 31 July 2022

Unit of Assessment Member	Title of Award	Funding Body	Value	Date
Prof Vladimir Molkov Prof Alistair McIlhagger Dr Dmitriy Makarov Dr Sergii Kashkarov Dr Volodymyr Shentsov	Northern Ireland Green Seas	Innovate UK	£98,347.00	02/09/21
Prof N Hewitt	USI 167: Intelligent Data Harvesting for Multi-Scale Building Stock Classification and Energy Performance Prediction	US Ireland - DfE, Invest NI	£236,015.00	12/10/21
Prof Y Huang Dr C Brandoni Prof N Hewitt Prof C Snape, Nottingham Uni	ABSALT - Accelerating Basic Solid Adsorbent Looping Technology	CEC - H2020 Accelerating CCS Technologies	£149,776.00	01/11/21

Dr Yaxin Bi Prof Ming Jun Huang	Seismic Deformation Monitoring and Electromagnetism Anomaly Detection by Big Satellite Data Analytics with Parallel Computing	ESA European Space Agency	£85,346.08	15/11/21
Dr SK Choi	Fire Safety Evaluation technology and infrastructure development project for high energy lithium rechargeable batteries.	Korea Testing Certification	£48,485.55	01/12/21
Dr Svetlana Tretsiakova	Development of novel processing technology to tackle hard-to-recycle plastic food waste packaging	Ecosurety Limited	£33,165.00	07/12/21
Prof N Hewitt	Collaborative Research Support Fund - Theme Leader Energy (NICP) 2022	Department for the Economy	£65,835.00	01/01/22
Prof Ming Jun Huang Prof Neil Hewitt Prof Ye Huang	Assessing Effect of Carbon Emission Reduction with Integrating Renewable Energy in Urban Range Energy Generation Systems	ESA European Space Agency	£42,372.87	04/02/22
Prof JG Wallace Mr M McKane Prof I Motawa Dr IR McChesney Dr J Martinez Carracedo Prof R Bond	KTP Programme between University of Ulster and MJM Marine Limited	Innovate UK/INI and MJM Marine Ltd	£284,226.00	07/02/22
Dr Nikhilkumar Shah Dr Jayanta Mondol	Performance enhancement of PV/T system using hybrid nanoparticles.	The Royal Society	£12,000.00	28/02/22
Dr Sile Brennan Prof Vladimir Molkov	Pre-normative research on safety of gas networks with hydrogen blends	Gas Networks Ireland	£23,020.74	25/04/22
Prof A Nadjai Dr J Zhang Mr N Alam	High Rise Tower Blocks Spandrel Wall Construction Research	NI Housing Executive	£74,178.00	01/06/22