L-Università ta' Malta

Faculty for the Built Environment
Department of Environmental Design

RESEARCH VISION FOR THE DEPARTMENT OF ENVIRONMENTAL DESIGN

2024 - 2028

Foreword

As we embark on the next five years, the Department of Environmental Design at the Faculty for the Built Environment is poised to lead innovative research initiatives that address pressing research challenges and shape sustainable built environments for the future. Our research vision is rooted in a multidisciplinary approach, bringing together experts from various fields to tackle complex issues at the intersection of design, sustainability, and building and environment science.

At the heart of our research agenda lies a commitment to fostering collaborations and partnerships both within the university community and beyond. We recognize the value of interdisciplinary collaboration in generating novel insights and solutions, and we will actively seek out opportunities to collaborate with other departments, research institutions, industry partners, and government agencies. These collaborations will not only enhance the impact and relevance of our research but also facilitate knowledge exchange and capacity-building initiatives.

To support our ambitious research goals, we will actively pursue funding opportunities at both the local and EU levels. We will leverage our expertise and track record of excellence to compete for research grants, fellowships, and other funding mechanisms that align with our research priorities. By securing external funding, we will be able to expand our research capacity, support graduate student research, and invest in cutting-edge infrastructure and equipment.

As part of our research vision, we will carry out targeted research campaigns focused on key thematic areas that will be outlined in this document. These campaigns will involve fieldwork, data collection, experimentation, and analysis, allowing us to generate new knowledge and insights that will be published through peer reviewed articles in conferences and journals world wide. In addition, our research can directly inform policy and practice.

Central to our research vision is the development of robust research infrastructure that enables high-quality research and innovation. The University of Malta has already invested in state-of-the-art laboratories, research facilities, and computing resources relevant to our department that will support the diverse needs of our research teams.

Finally, building and nurturing research teams will be a priority for the Department of Environmental Design. We will recruit and retain top talent, fostering a culture of collaboration, mentorship, and excellence. We will provide support and resources to early-career researchers, encourage interdisciplinary collaboration, and create opportunities for professional development and advancement.

In conclusion, our research vision for the Department of Environmental Design is ambitious, forward-thinking, and multidisciplinary. By fostering collaborations, securing funding, conducting research campaigns, building infrastructure, and cultivating research teams, we will position ourselves as leaders in the field of environmental design and make significant contributions to sustainability and resilience in the built environment.

Prof. Ing. Daniel Micallef
Head of Department
29th April 2024

Research topic areas

The department, through its academic members of staff, specialises in the following areas:

- **Heating and Cooling Demand Analysis in Buildings** - Heating and cooling demand analysis in buildings examines the energy required to maintain indoor thermal comfort, considering factors like design, insulation, and climate. This analysis is crucial for enhancing energy efficiency and reducing operational costs. The department has expertise in the use and development of whole building energy simulation tools.
- **Ventilation** - The department's research is mostly focused on studying natural ventilation potential and assessing micro-climatic impacts of ventilation. The department's research has thus far mainly focused on aspects of cross-ventilation or single sided ventilation and related aspects such as air-quality in both indoor and outdoor areas.
- **Integration of Services** - The integration of services in buildings involves the seamless incorporation of various systems such as heating, ventilation, air conditioning (HVAC), lighting, water supply, and security into a cohesive infrastructure. This holistic approach ensures that all systems work synergistically to enhance the overall efficiency, comfort, and functionality of the building.
- **Indoor and outdoor micro-climate** - Micro-climate is important in relation to aspects such as human thermal comfort and health and well-being, amongst other factors. The department uses both numerical and experimental tools to assess micro-climatic factors such as temperature and air-flow.
- **Wind engineering** - The department is active in research related to wind energy, environmental wind engineering, computational wind engineering and urban aerodynamics. Tools employed vary from Computational Fluid Dynamics with advanced turbulence modelling to wind tunnel testing and Particle Image Velocimetry.
- **Renewable energy integration in buildings** - Topics such as building integrated wind energy and building integrated photovoltaics are key areas of specialisation of the department.
- **Smart Glazing technology** - Smart glazing technology incorporates advanced materials and coatings that dynamically adjust their properties, such as transparency and heat insulation, in response to environmental conditions. The department is developing glazing technologies that enhance indoor thermal performance without compromising on natural lighting conditions.
- **Thermal Comfort** - Thermal comfort research explores how indoor environmental conditions affect human comfort, focusing on temperature, humidity, and airflow. This research aims to optimize building designs and HVAC systems to enhance occupant well-being and energy efficiency.

Research methodologies and tools

Our academics and their research teams adopt various methods to carry out their research. Their experience in using these methods allows the department to be dynamic, with evolving research interests.

- Building energy simulation
- Measurements in situ
- Computational Fluid Dynamics

- Wind tunnel testing
- Particle Image Velocimetry

Equipment and facilities

The state of the art equipment and facilities available at the Faculty for the Built Environment and at the University of Malta enables cutting edge research to be carried out.

- Energy and CO2 meters
- Data Loggers, light meters, sound meters
- Thermographic camera
- Wind tunnel
- Particle Image Velocimetry
- Artificial sky
- Noise and vibration meters
- Artificial nose
- High Performance Computing Cluster
- Commercial Software licenses

Key Performance indicators

- Number of peer reviewed journal articles*
- Number of conferences attended
- Number and amount of research grants secured
- Number of researchers recruited

*The department will endeavour in ensuring that peer reviewed journals are Q1 journals having a high impact factor. This will be prioritised when considering this KPI.

Collaborators

Within the University of Malta

- Department of Mechanical Engineering, Faculty of Engineering
- Department of Electrical Engineering, Faculty of Engineering
- Department of Conservation and Built Heritage, Faculty for the Built Environment
- Institute for Sustainable Energy
- Department of Construction and Property Management, Faculty for the Built Environment
- Department of Artificial Intelligence, Faculty of ICT

Industry and academic collaborations

The following is a list of entities with which the department has collaborated or is currently collaborating with:


Halmann
VELLA


THE
ENERGY
&WATER
AGENCY


WINTECH


Attard Bros
GROUP


Consiglio Nazionale
delle Ricerche


eurac
research


BALLUT BLOCKS LTD.
WIED FILEP L/o NAXXAR - MALTA.


BASWA acoustic®


INDRESMAT®
INDUSTRIAL RESINS & MATERIALS


Gauzy


FLOATGLASS
LIMITED