

**Research Proposal for International MSc thesis
(In collaboration with The University of Sheffield)**

Enhancing Resilience in Net Zero Energy Systems

Project Description:

As societies transition to net zero carbon emissions and sustainable energy, the focus on energy efficiency often overlooks the resilience of net zero energy systems. These systems, with limited operational experience, introduce new risks, especially with technologies like green hydrogen, compounded by increasing extreme weather due to climate change. While resilience engineering has advanced, it typically addresses operational challenges, leaving a gap in early design phase resilience. This research proposes a quantitative resilience assessment framework for net zero energy systems at the early design stage, enabling the creation of systems that are both energy-efficient and resilient, ensuring long-term sustainability.

Keywords:

Net Zero Energy Systems; Resilience; Sustainable Energy; Early Design Phase; Risk Mitigation

Skills Required:

Motivation and skills for data collection, analysis, and modelling. Ability to work collaboratively and communicate effectively. Critical thinking and problem-solving skills.

Learning Outcomes for Students:

By completing this project, students will gain:

- Knowledge of Net Zero Energy Systems: Understanding design principles and operational challenges.
- Resilience Engineering Skills: Ability to assess and mitigate risks during early design stages.
- Data Analysis Proficiency: Skills in collecting, analysing, and modelling data for energy systems.
- Critical Thinking and Problem-Solving: Capability to identify vulnerabilities and develop solutions.
- Collaboration and Communication: Enhanced teamwork and effective communication of technical findings.
- Sustainable Design Application: Integration of resilience and sustainability principles into design.
- Project Management Experience: Competence in managing research projects and presenting results.

Extra Information or Reading List:

Vesey, Freya, Seyed Mojtaba Hoseyni, and Joan Cordiner. "Development of an industrially applicable model for the qualitative resilience assessment of process systems at the early design stage." *Journal of Loss Prevention in the Process Industries* 86 (2023): 105199.

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Hickford, Adrian J., Simon P. Blainey, Alejandro Ortega Hortelano, and Raghav Pant. "Resilience engineering: theory and practice in interdependent infrastructure systems." *Environment Systems and Decisions* 38, no. 3 (2018): 278-291.

Xu, Luo, Kairui Feng, Ning Lin, A. T. D. Perera, H. Vincent Poor, Le Xie, Chuanyi Ji, X. Andy Sun, Qinglai Guo, and Mark O'Malley. "Resilience of renewable power systems under climate risks." *Nature Reviews Electrical Engineering* 1, no. 1 (2024): 53-66.

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