

# Engineering Resilience in System Design

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## Module Descriptor

Module Code: REN7ERS  
Version: V1.00  
Status: Final  
Date: 05/11/2025

## Summary Module Details

### Module details

**Module Title:** Engineering Resilience in System Design

**Module Leader:** TBC

**Module Mode:** Supported online learning

**Semester:** Autumn (UK) and Spring (UK)

**Level:** 7

**Credits:** 20

**Learning Hours:** 200

### Contact & Study Hours

**Directed Study Time:** 60 hrs (30%)

**Self-directed Study Time:** 70 hrs (35%)

**Assessment Study Time:** 70 hrs (35%)

### Assessment Type

**Coursework:** 100%

## Module Summary

This module provides students with the knowledge and skills to design, evaluate, and optimise energy systems with resilience and sustainability at their core. It introduces lifecycle assessment, techno-economic analysis, and strategies for managing uncertainty, risk, and long-term performance in renewable energy systems.

Learning is supported through lectures, case studies, and practical modelling labs that use real-world industry datasets and international case material. Students will engage with resilience-based engineering design frameworks, applying lifecycle and techno-economic methods to propose robust, cost-effective, and adaptive solutions for future energy infrastructure.

## Taken on which Programmes

MSc Renewable Energy and AI (C)

**Core (C) or Elective (E)**

## Module Aims

This module aims to:

- Introduce the principles of resilience engineering and lifecycle-based system design in energy contexts.
- Provide students with methods to evaluate system robustness, reliability, and adaptability under uncertainty.
- Equip learners with the ability to apply techno-economic modelling tools to assess system performance and cost-effectiveness.
- Foster critical awareness of resilience strategies for energy transitions, including sustainability and policy implications.
- Enable students to apply lifecycle and techno-economic analysis to authentic case studies, strengthening their professional competence in designing resilient energy systems.

## Module Learning Outcomes

- LO1. Critically analyse and apply the principles of resilience engineering and lifecycle analysis in sustainable system design.
- LO2. Apply resilience and techno-economic modelling methods to evaluate renewable and sustainable energy projects.
- LO3. Critically assess trade-offs between cost, performance, risk, and sustainability in energy system design.
- LO4. Propose engineering solutions that enhance system resilience and support long-term energy transition goals.

## Indicative Module Content

### Module topics

- Foundations of Resilience Engineering: Concepts of robustness, redundancy, adaptability, and flexibility.
- Lifecycle Approaches: Lifecycle assessment (LCA), cradle-to-grave design principles, embodied energy and emissions.
- Techno-Economic Analysis: Cost-benefit modelling, levelised cost of energy (LCOE), sensitivity and scenario analysis.

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- Risk and Uncertainty Management: Probabilistic modelling, resilience under climate, economic, and technological uncertainties.
- Resilience Strategies for Energy Systems: Grid resilience, renewable integration, and hybrid system approaches.
- Policy and Governance Dimensions: Regulatory frameworks supporting resilience and sustainability.
- Practical Application: Applied modelling of lifecycle and techno-economic case studies using real-world datasets and industry-informed scenarios.

This content will be reviewed and updated regularly to reflect the legal, moral and financial changes in professional standards and practice, and the evolving body of knowledge regarding social science research.

## Overview of Summative Assessment

Module learning outcomes	Assessment	Word count or equivalent	Weighting
LO1, LO2, LO3, LO4	Assessment 1 Coursework	5,000	100%

**Module Pass Mark (as a weighted average of all assessments): 50%**

## Key Module Learning Resources

### Core Sources and Texts

The core reading resources within each module will be provided via the specific Virtual Learning Environment (VLE) module pages and within the e-Library. Additional reference material and supplementary resources to support your studies are available through the University e-Library.

### Module tools

Students will have access to study materials, dedicated academic support, student forums, and learning activities via an online learning platform (VLE).

The module page on the VLE is broken down into structured study weeks to help students plan their time, with each week containing a mixture of reading, case studies, videos/recordings and interactive activities to go through. Online

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webinars/seminars led by the Module Leader can be attended in real time and provide opportunities to consolidate knowledge, ask questions, discuss topics and work through learning activities together. These sessions are recorded to support students who cannot attend and to enable students to recap the session and work through it at their own pace. Module forums on the VLE provide further opportunities to discuss topics with other students, complete collaborative work and get extra help from the module team.

## Professional online resources

The e-Library provides access to trusted, quality online resources, selected by subject specialists, to support students' study. This includes journals, industry publications, magazines, academic books and a dissertation/work-based library. For a list of the key industry specific and education resources available please visit [the VLE e-Library](#).

## Other relevant resources

Access is also provided to further information sources that include the British Library and Open University UK catalogues, as well as providing a monthly current awareness service entitled, **Knowledge Foundations** - a compendium of news, research and resources relating to the educational sector and the Built Environment.

The module resource list is available on the module VLE page and is updated regularly to ensure materials are relevant and current.