Prifysgol Wrecsam
Wrexham University

Module specification

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Module Code	ENG5D5
Module Title	Energy Storage and Network Integration
Level	5
Credit value	20
Faculty	FACE
HECoS Code	100175
Cost Code	GAME
Pre-requisite module	N/A

Programmes in which module to be offered

Programme title	Core/Optional/Standalone
BEng (Hons) Sustainable Energy Engineering BEng (Hons) Renewable Energy Engineering	Core

Breakdown of module hours

Learning and teaching hours	18 hrs
Placement tutor support hours	0 hrs
Supervised learning hours e.g. practical classes, workshops	18 hrs
Project supervision hours	0 hrs
Active learning and teaching hours total	**36 hrs**
Placement hours	0 hrs
Guided independent study hours	164 hrs
Module duration (Total hours)	**200 hrs**

Module aims

This module develops applied understanding through a balance of theory and practice. Learners undertake both classroom study and supervised practical activity to explore design, implementation, and evaluation processes. Collaborative work and enquiry-based learning foster communication, teamwork, and the confidence to apply problem-solving techniques in varied contexts.

This module aims to introduce students to the principles and technologies of energy storage systems and their integration within electrical networks. It develops understanding of system design, operation, and optimisation to enhance stability, reliability, and efficiency in modern power systems.

Module Learning Outcomes

At the end of this module, students will be able to:

1	Analyse the performance of a range of energy storage technologies and their impact on electrical network operation, applying natural sciences, engineering principles and quantitative methods.
2	Design and evaluate energy storage integration solutions within electrical networks, considering technical, operational, and economic factors.
3	Apply engineering tools and techniques to model, optimise, and simulate energy storage systems and their interaction with the grid.

Assessment

Indicative Assessment Tasks:

This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

Assessment 1: Coursework

This module is assessed through coursework in which students analyse energy storage technologies and develop integration solutions within electrical networks. The assessment requires students to apply system modelling and optimisation techniques to meet defined technical, operational, and economic requirements.

Assessment number	Learning Outcomes to be met	Type of assessment	Duration/Word Count	Weighting (%)	Alternative assessment, if applicable
1	1-3	Coursework	3000	100	N/A

Derogations

Credits shall be awarded by an Assessment Board for those modules in which a pass mark 40% has been achieved, with a minimum mark of 30% in each assessment element.

Learning and Teaching Strategies

Learning integrates conceptual study with practical investigation to deepen understanding and enhance problem-solving ability. Students participate in lectures, laboratory work, and team-based projects that encourage collaboration and communication. Online materials, recordings, and discussion forums support blended engagement. Tutorials promote reflective learning and increasing autonomy in preparation for advanced study.

Welsh Elements

This module will be delivered through the medium of English; however, students have the option to submit their assessments in the medium of Welsh. While this module is not currently offered fully through Welsh, Welsh language support and guidance are available, and some learning materials or tutorial discussions may incorporate Welsh elements where appropriate. To further promote bilingual learning, all students have the opportunity to take the 20-credit *Welsh for STEM* short course, designed to develop confidence and subject-specific language skills in both English and Welsh.

Indicative Syllabus Outline

Energy Storage Technologies and Performance Metrics: Analysis of the technical characteristics and performance measures of major energy storage technologies, including batteries, pumped hydro, supercapacitors, and flywheels, using appropriate engineering and quantitative methods.

Impact on Electrical Network Performance: Evaluation of the role of energy storage in enhancing network stability, load balancing, and peak demand management within modern electrical power systems.

Storage Sizing and Technology Selection: Application of engineering principles to determine appropriate sizing and selection of energy storage systems for different network applications and operational requirements.

Economic and Operational Evaluation: Assessment of storage integration strategies considering economic viability, cost–benefit analysis, operational performance, and relevant regulatory constraints.

Simulation and Modelling of Storage Systems: Use of computational and simulation tools to model energy storage system performance and analyse interactions with electrical networks.

Optimisation of Storage Operation: Application of optimisation techniques to manage energy storage systems under varying demand, generation profiles, and network constraints to improve system efficiency and performance.

Indicative Bibliography

Please note the essential reads and other indicative reading are subject to annual review and update.

Essential Reads:

R. Viral, A. Tomar, D. Asija, U. M. Rao, and A. Sarwar, *Smart Grids for Renewable Energy Systems, Electric Vehicles and Energy Storage Systems*, 1st ed. Boca Raton, FL, USA: CRC Press, 2023.

Other indicative reading:

J. M. Andújar Márquez, F. S. Manzano, and J. Rey Luengo, *Energy Storage Systems: Fundamentals, Classification and a Technical Comparative*. Cham, Switzerland: Springer, 2023.

Administrative Information

For office use only	
Initial approval date	June 2026
With effect from date	September 2026
Date and details of revision	
Version number	1