

MODULE DESCRIPTOR

Module Title

Hydrogen Energy Systems

Reference	ENM506	Version	1
Created	June 2023	SCQF Level	SCQF 11
Approved	September 2023	SCQF Points	15
Amended		ECTS Points	7.5

Aims of Module

This course aims to demonstrate the current strategic importance of hydrogen and its role in the ongoing energy transition while establishing critical awareness and understanding of the advanced technologies implemented in hydrogen production, storage and utilization in different sectors. This course will provide participants with the technical and business development skills required to take forward hydrogen projects and deliver the UN Sustainable Development Goals 7 & 11 creating a sustainable future with the hydrogen technology.

Learning Outcomes for Module

On completion of this module, students are expected to be able to:

- 1 Evaluate the role of hydrogen as an energy carrier in the ongoing energy transition while looking into its production, storage, transportation, safety, and application across various sectors.
- 2 Critically appraise the advanced technologies applied in hydrogen energy systems considering prospects, challenges and future.
- 3 Make informed judgment on the viability of hydrogen in different contexts based on hydrogen-related concepts.
- 4 Evaluate hydrogen adoption considering factors such as technological advancements, economic feasibility, safety, environmental impact, infrastructure, as well as regulatory and policy considerations.

Indicative Module Content

Introduction to hydrogen properties. An overview of hydrogen as an energy carrier and its role in the route to Net Zero and in supporting the renewable industry. Hydrogen production and Color Code Nomenclature. Electrolyser types and materials. Current and potential applications of hydrogen. Hydrogen prospects, challenges and future. Hydrogen storage and transportation. Hydrogen applications. Hybrid Renewable-Hydrogen Energy Systems and fuel cells to unlock the renewable potential. Hydrogen infrastructure. Hydrogen safety and public acceptance. Hydrogen economic and regulatory considerations, legal aspects and policy.

Module Delivery

Blended Delivery - Lectures and Guided Self-Study.

Indicative Student Workload

	Full Time	Part Time
Contact Hours	35	35
Non-Contact Hours	115	115
Placement/Work-Based Learning Experience [Notional] Hours	N/A	N/A
TOTAL	150	150
<i>Actual Placement hours for professional, statutory or regulatory body</i>		

ASSESSMENT PLAN

If a major/minor model is used and box is ticked, % weightings below are indicative only.

Component 1

Type:	Coursework	Weighting:	100%	Outcomes Assessed:	1, 2, 3, 4
Description:	Individual written report.				

MODULE PERFORMANCE DESCRIPTOR**Explanatory Text**

Component 1 comprises 100% of the module grade. To pass the module, a D grade is required.

Module Grade	Minimum Requirements to achieve Module Grade:
A	A
B	B
C	C
D	D
E	E
F	F
NS	Non-submission of work by published deadline or non-attendance for examination

Module Requirements

Prerequisites for Module	None but a background in engineering will be beneficial.
Corequisites for module	None.
Precluded Modules	None.

INDICATIVE BIBLIOGRAPHY

- 1 Macro Alvera 2021. The Hydrogen Revolution: a blueprint for the future of clean energy.
- 2 Antonio Scipioni, Alessandro Manzardo, Jingzheng Ren 2023. Hydrogen Economy. Processes, Supply Chain, Life Cycle Analysis and Energy Transition for Sustainability. 2nd Edition - January 17, 2023. Paperback ISBN: 9780323995146 eBook ISBN: 9780323995436
- 3 Alexei Kotchourko, Thomas Jordan 2022. Hydrogen Safety for Energy Applications. Engineering Design, Risk Assessment, and Codes and Standards. 1st Edition - March 25, 2022. Paperback ISBN: 9780128204924. eBook ISBN: 9780128204955
- 4 Peter Hoffmann; Byron Dorgan 2012. Tomorrow's Energy: Hydrogen, Fuel Cells, and the Prospects for a Cleaner Planet.
- 5 S.A. Sherif, D. Yogi Goswami, E.K. (Lee) Stefanakos, Aldo Steinfeld 2014. Handbook of Hydrogen Energy. 1st Edition.
- 6 The Hydrogen Economy: Opportunities, Costs, Barriers, and R&D Needs by National Academy of Engineering and National Research Council.
- 7 Bent Sørensen. Hydrogen and Fuel Cells: Emerging Technologies and Applications.
- 8 The Future of Hydrogen: Seizing Today's Opportunities; by International Energy Agency. ALI, D.M.M. 2019. Hydrogen energy storage. Energy storage devices. London: IntechOpen [online], chapter 8. Available from: <https://doi.org/10.5772/intechopen.88902>