University of the West of Scotland

Module Descriptor

Session: 2024/2025

Title of Module: /Sustainable Energy: Sources & Storage			
Code: ENGG11053	**SCQF Level: 11 (Scottish Credit and Qualifications Framework)**	**Credit Points: 20**	**ECTS: 10 (European Credit Transfer Scheme)**
School:	School of Computing, Engineering and Physical Sciences		
Module Co-ordinator:	Qaisar Abbas		

Summary of Module

It has been widely acknowledged that fossil fuels which are the main source of energy for the world today are highly unsustainable and directly related to air pollution, land and water degradation and climate change. To counter this, the use of low-carbon and renewable energy sources is already growing. Renewable energy depends on diverse sources like wind, solar, geothermal, , hydro, and biomass, while the widespread use of nuclear technology has done much to displace fossil fuels. Moreover, this must be associated with applying different techniques to derive better energy efficiency from existing systems and to store the generated energy and/or any captured carbon dioxide in different forms. Storage systems include fuel cells, supercapacitors, and batteries, as well as schemes to prevent CO2 from combustion reaching the atmosphere.

The main aim of this module is to outline the fundamentals and the up-to-date technologies associated mainly with Biomass and Energy storage systems and compare them to more long-established but less sustainable systems. Also sources such as wind, solar, bio-energy, nuclear and hydro energy will be included. As mentioned before an overview of the storage systems that are popularly linked to the renewable energy resources and different types of fuel cells systems, supercapacitors and batteries will be studied.

Evaluation techniques such as Energy Returned over Energy Invested and Carbon Emission Pinch Analysis (CEPA) are used to target efforts in replacing energy generation and for carbon capture and storage (CCS)

Different applications and case studies will be investigated and strength and weakness of each case will be clarified. The cases studies include diverse geographical and economic situations. Discussion regarding common technical and non-technical barriers and issues limiting the wide spread use and dissemination of renewable energy will also be covered. The limits of available technology and of the potential of new and emerging technology will be discussed.

During the course of this module students will develop their UWS Graduate Attributes (https://www.uws.ac.uk/current-students/your-graduate-attributes/). Universal: critical thinking and analytical & inquiring mind and research-minded. Successful : autonomous, driven and resilient. Work- ready: effective communicator.

Module Delivery Method					
Face-To-Face	**Blended**	**Fully Online**	**HybridC**	**Hybrid 0**	**Work-Based Learning**

☒	☐	☐	☐	☐	☐
See Guidance Note for details.					

Campus(es) for Module Delivery						
The module will **normally** be offered on the following campuses / or by Distance/Online Learning: (Provided viable student numbers permit) (tick as appropriate)						
Paisley:	Ayr:	Dumfries:	Lanarkshire:	London:	Distance/Online Learning:	Other:
☒	☐	☐	☐	☐	☐	Add name

Term(s) for Module Delivery					
(Provided viable student numbers permit).					
Term 1	☒	Term 2	☐	Term 3	☐

Learning Outcomes: (maximum of 5 statements) **These should take cognisance of the SCQF level descriptors and be at the appropriate level for the module.** At the end of this module the student will be able to:	
L1	Outline the fundamentals associated with both current energy sources and storage systems and their likely, sustainable replacements.
L2	Critically evaluate all of the studied energy technologies and storage systems, comparing them to each other in terms of sustainability, capacity, durability and cost.
L3	Evaluate the limits of available technology and of the potential of new and emerging technologies in different geographical and socioeconomic environments
L4	Evaluate the technical and non-technical barriers that are limiting the wide spread of renewable energy.

Employability Skills and Personal Development Planning (PDP) Skills	
SCQF Headings	During completion of this module, there will be an opportunity to achieve core skills in:
Knowledge and Understanding (K and U)	SCQF Level **11** Critical understanding of sustainable energy in the global context and the underlying key theoretical positions, principles and concepts. Critical understanding of the inherent challenges faced by environmental issues. Extensive, detailed and critical knowledge and understanding of the benefits of sustainable energy. Critical awareness of challenges facing sustainable energy.

Practice: Applied Knowledge and Understanding	SCQF Level **11** Understanding of sustainable energy and energy storage systems principles, methodologies and techniques. Developing leadership awareness on the environmental related issues. Practice the use-case utilisation of digital technologies in a predefined context and library resources.	
Generic Cognitive skills	SCQF Level **11** Apply critical analysis, evaluation and synthesis to issues which are at the forefront of, or informed by, developments at the forefront of sustainable energy. Identify, conceptualise and define new and abstract problems and issues related to sustainable energy. Critically review, consolidate and extend knowledge, skills practices and thinking in sustainable energy. Understand complex issues regarding sustainable energy and storage systems and relate these issues to environmental protection.	
Communication, ICT and Numeracy Skills	SCQF Level **11** Use of appropriate computer software for written and oral presentation. Discussion of appropriate use of ICT in support of research objectives (e.g. data collection and analysis of sustainable energy project).	
Autonomy, Accountability and Working with others	SCQF Level **11** Responsibility of leading research topic (Continuous Assessment Energy Project), ownership of sustainable energy project process including integrity of source usage (e.g. literature, ethical practice).	
Pre-requisites:	Before undertaking this module the student should have undertaken the following:	
	Module Code:	**Module Title:**
	Other:	
Co-requisites	**Module Code:**	**Module Title:**

*Indicates that module descriptor is not published.

Learning and Teaching	
In line with current learning and teaching principles, a 20-credit module includes 200 learning hours, normally including a minimum of 36 contact hours and maximum of 48 contact hours.	
Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Normally totalling 200 hours): (Note: Learning hours include both contact hours and hours spent on other learning activities)

Lecture/Core Content Delivery	24
Tutorial/Synchronous Support Activity	12
Independent Study	164
	200 Hours Total

****Indicative Resources: (eg. Core text, journals, internet access)**

The following materials form essential underpinning for the module content and ultimately for the learning outcomes:

Da Rosa, Aldo Vieira.; Ordóñez, Juan Carlos. Fundamentals of renewable energy processes. London : Academic Press, 2022. 4th ed.

Michael Sterner, Ingo Stadler. Handbook of energy storage: demand, technologies, integration. Berlin : Springer (2019)

Guerrero-Lemus, Ricardo and Martínez-Duart, José Manuel (2012) Renewable Energies and CO2 Cost Analysis, Environmental Impacts and Technological Trends, Springer

Cossuta, Matteo; Foo, Dominic and Tan: Carbon emission pinch analysis (CEPA) for planning the decarbonization of the UK power sector, Sustainable Production and Consumption 25 (2021) 259-270

William D. Fletcher, Craig B. Smith. Reaching Net Zero [electronic: what it takes to solve the global climate crisis, Amsterdam, Netherlads ; Cambridge, MA : Elsevier, 2020

Beggs, Clive. Energy: management, supply and conservation, 2nd, Amsterdam; London : Elsevier Butterworth-Heinemann, 2009.

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Please ensure the list is kept short and current. Essential resources should be included, broader resources should be kept for module handbooks / Aula VLE.

Resources should be listed in Right Harvard referencing style or agreed professional body deviation and in alphabetical order.

(**N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)

Attendance and Engagement Requirements

In line with the Student Attendance and Engagement Procedure: Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time.

For the purposes of this module, academic engagement equates to the following:

Attendance at lecture and tutorial sessions Submission of coursework items during the term, not just at end of term

Equality and Diversity
The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code. Please ensure any specific requirements are detailed in this section. Module Co-ordinators should consider the accessibility of their module for groups with protected characteristics..
(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)

Supplemental Information

Divisional Programme Board	Engineering
Assessment Results (Pass/Fail)	Yes ☐No ☒
School Assessment Board	Engineering
Moderator	Mojtaba MIrzaeian
External Examiner	Format: First initial + Surname. No titles. Please only enter if examiner has been approved for this module.
Accreditation Details	e.g. ACCA Click or tap here to enter text.
Changes/Version Number	2

Assessment: (also refer to Assessment Outcomes Grids below)
Assessment 1 35% - Project on renewable energy and energy storage systems (includes report and MS Power Point presentation). 35% - assignment on Carbon Emission Pinch Analysis 30% - critical analysis of renewable energy policy of a given country or state.
(N.B. (i) **Assessment Outcomes Grids** for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed. (ii) An **indicative schedule** listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.)

Assessment Outcome Grids (See Guidance Note)

Component 1							
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Learning Outcome (4)**	**Learning Outcome (5)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Case study	☒	☒	☒	☒	☒	30	0
Report of practical/field/clinical work	☒	☒	☒	☒	☒	35	0
Presentation	☒	☒	☒	☒	☒	35	0