Module Descriptor

Title	Sustainable Energy: Sources & Storage		
Session	2025/26	**Status**	Published
Code	ENGG11053	**SCQF Level**	11
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	Q 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 with Renwable Sources of Energy and 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. Furthermore, industry experts in the field of renwable energy, energy storage system and sustainbility will be invited as guest lectures.

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	On-Campus[1] ☒	Hybrid[2] ☐	Online[3] ☐	Work -Based Learning[4] ☐
Campuses for Module Delivery	☐ Ayr ☐ Dumfries	☐ Lanarkshire ☐ London ☒ Paisley	☐ Online / Distance Learning ☐ Other (specify)	

Terms for Module Delivery	Term 1	☒	Term 2	☐	Term 3	☐
Long-thin Delivery over more than one Term	Term 1 – Term 2	☐	Term 2 – Term 3	☐	Term 3 – Term 1	☐

Learning Outcomes	
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.
L5	N/A

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 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.

[1] Where contact hours are synchronous/ live and take place fully on campus. Campus-based learning is focused on providing an interactive learning experience supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus contact hours will be clearly articulated to students.

[2] The module includes a combination of synchronous/ live on-campus and online learning events. These will be supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus and online contact hours will be clearly articulated to students.

[3] Where all learning is solely delivered by web-based or internet-based technologies and the participants can engage in all learning activities through these means. All required contact hours will be clearly articulated to students.

[4] Learning activities where the main location for the learning experience is in the workplace. All required contact hours, whether online or on campus, will be clearly articulated to students

Practice: Applied Knowledge and Understanding	**SCQF 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 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 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 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).

Prerequisites	**Module Code**	**Module Title**
	Other	
Co-requisites	**Module Code**	**Module Title**

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** (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
n/a	0
n/a	0

n/a	0
TOTAL	200

Indicative Resources
The following materials form essential underpinning for the module content and ultimately for the learning outcomes: Da Rosa, Aldo Vieira.; Ordóñez, Juan Carlos (2022) Fundamentals of renewable energy processes. London : Academic Press, 4th ed. Michael Sterner, Ingo Stadler 92019) Handbook of energy storage: demand, technologies, integration. Berlin : Springer. 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 2021) Carbon emission pinch analysis (CEPA) for planning the decarbonization of the UK power sector, Sustainable Production and Consumption 25, 259-270 William D. Fletcher, Craig B. Smith (2020) Reaching Net Zero: what it takes to solve the global climate crisis, Amsterdam, Netherlads ; Cambridge, MA : Elsevier. Beggs, Clive (2009) Energy: management, supply and conservation, 2nd, Amsterdam; London: Elsevier Butterworth-Heinemann.
(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 Physical Sciences**
Overall Assessment Results	☐ **Pass / Fail** ☒ **Graded**

Module Eligible for Compensation	☐ **Yes** ☒ **No** **If this module is eligible for compensation, there may be cases where compensation is not permitted due to programme accreditation requirements. Please check the associated programme specification for details.**
School Assessment Board	Design
Moderator	C Alutu
External Examiner	P Weston
Accreditation Details	N/A
Module Appears in CPD catalogue	☒ **Yes** ☐ **No**
Changes / Version Number	2 Module reviwed prior to acedemic year 2025/2026 in line with ILR recomendations. Indicatives Resources updated

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).
Assessment 2
35% - assignment on Carbon Emission Pinch Analysis
Assessment 3
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.)

Component 1							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Case study	☒	☒	☐	☒	☐	35	

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Report of practical/field/clinical work	☐	☒	☒	☒	☐	35	

Component 3							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Presentation	☐	☒	☒	☒	☐	30	
Combined total for all components						100%	hours

Change Control

What	When	Who
Module reviwed prior to acedemic year 2025/2026 in line with ILR recomendations. Indicatives Resources updated Moderator updated to C Alutu	March 2025	Q Abbas