UNSW Course Outline

SOLA1070 Sustainable Energy - 2024

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General Course Information

Course Code : SOLA1070
Year : 2024
Term : Term 2
Teaching Period : T2
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Photovoltaic and Renewable Engineering
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

Students will be introduced to the central concepts of energy and sustainability with a particular focus on sustainable energy systems. Energy efficiency will be introduced as an effective way in which to conserve our natural fuel reserves and reduce environmental damage in a cost-effective

way. This course will also introduce students to a range of renewable energy technologies such as photovoltaics, wind generators and solar thermal and allow them to explore ways in which these technologies and energy efficiency can be used to improve the sustainability of electrical power systems. Finally students will attempt to address the challenges involved in balancing between energy security (ability to meet demand), energy equity (affordability) and environmental sustainability in the design of an energy infrastructure for a community.

Course Aims

The course aims to introduce:

- The concept of sustainability and increase awareness of the different sustainability indicators and the challenges imposed by climate change and natural resource reserves.
- The concept of energy, energy conversion, and energy efficiency.
- A range of renewable energy technologies and develop an understanding in students of how these technologies can be used to improve the sustainability of electrical power systems.
- Expose students to the challenges involved in balancing between energy security (ability to meet demand), energy equity (affordability) and environmental sustainability in the design of an energy infrastructure for a community.

The development foundational knowledge on sustainability and renewable energy technologies supports strengthening of renewable energy engineering knowledge and serves as pre-requisite knowledge.

Relationship to Other Courses

This is both a General Education course and a recommended elective for students studying in the Renewable Energy stream of the Bachelor of Engineering.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Identify the key economic and environmental sustainability indicators.
CLO2 : Describe the operation of a range of renewable energy technologies.
CLO3 : Perform calculations based on energy conversion and transfer processes.
CLO4 : Design an energy infrastructure by making decisions based on energy security (ability to meet demand), energy equity (affordability) and environmental sustainability.

Course Learning Outcomes	Assessment Item
CLO1 : Identify the key economic and environmental sustainability indicators.	• Assignment 1 • Online Quizzes • Assignment 2 • Final Exam (Interview)
CLO2 : Describe the operation of a range of renewable energy technologies.	• Assignment 1 • Online Quizzes • Assignment 2 • Final Exam (Interview)
CLO3 : Perform calculations based on energy conversion and transfer processes.	• Assignment 1 • Online Quizzes • Assignment 2 • Final Exam (Interview)
CLO4 : Design an energy infrastructure by making decisions based on energy security (ability to meet demand), energy equity (affordability) and environmental sustainability.	• Assignment 1 • Online Quizzes • Assignment 2 • Final Exam (Interview)

Learning and Teaching Technologies

Moodle - Learning Management System | PlayEnergy, Kahoot!

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Assignment 1 Assessment Format: Individual Short Extension: Yes (7 days)	15%	
Online Quizzes Assessment Format: Individual	45%	
Assignment 2 Assessment Format: Individual	20%	
Final Exam (Interview) Assessment Format: Individual	20%	Start Date: Not Applicable Due Date: Not Applicable

Assessment Details

Assignment 1

Assessment Overview

The critical thinking assignment will involve students engaging with controversial statements about the transition to renewable energy. They will argue for and against a statement of their choosing. Generative AI will be used as part of the communication for this assignment. Students are expected to spend 10-12 hours on this assignment. Work will be marked against assessment criteria. Feedback will be provided within 10 days of the submission due date through the learning management system.

Course Learning Outcomes

- CLO1 : Identify the key economic and environmental sustainability indicators.
- CLO2 : Describe the operation of a range of renewable energy technologies.
- CLO3 : Perform calculations based on energy conversion and transfer processes.
- CLO4 : Design an energy infrastructure by making decisions based on energy security (ability to meet demand), energy equity (affordability) and environmental sustainability.

Online Quizzes

Assessment Overview

Students have to complete 3 quizzes over the term. The first quiz is untimed and is expected to take 4-5 hours. Quizzes 2 and 3 are timed and will take 1 hour. Feedback will be provided after the respective quiz due date through the learning management system.

Course Learning Outcomes

- CLO1 : Identify the key economic and environmental sustainability indicators.
- CLO2 : Describe the operation of a range of renewable energy technologies.
- CLO3 : Perform calculations based on energy conversion and transfer processes.
- CLO4 : Design an energy infrastructure by making decisions based on energy security (ability to meet demand), energy equity (affordability) and environmental sustainability.

Assignment submission Turnitin type

This is not a Turnitin assignment

Assignment 2

Assessment Overview

This is related to PlayEnergy. Students' gameplay will be assessed for a range of scenarios related to renewable energy and energy efficiency. Students will play the game for ~20 hours throughout the term. Work will be marked against assessment criteria.

Course Learning Outcomes

- CLO1 : Identify the key economic and environmental sustainability indicators.
- CLO2 : Describe the operation of a range of renewable energy technologies.
- CLO3 : Perform calculations based on energy conversion and transfer processes.
- CLO4 : Design an energy infrastructure by making decisions based on energy security (ability to meet demand), energy equity (affordability) and environmental sustainability.

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

Final Exam (Interview)

Assessment Overview

A final examination will be conducted as an interview to ascertain students' knowledge of the course. This will be a ~15 minute interview.

Course Learning Outcomes

- CLO1 : Identify the key economic and environmental sustainability indicators.
- CLO2 : Describe the operation of a range of renewable energy technologies.
- CLO3 : Perform calculations based on energy conversion and transfer processes.
- CLO4 : Design an energy infrastructure by making decisions based on energy security (ability to meet demand), energy equity (affordability) and environmental sustainability.

Assignment submission Turnitin type

Not Applicable

General Assessment Information

Grading Basis

Standard

Requirements to pass course

There are no hurdle assessments - you require 50% in total over the term.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Topic	Introduction • Course details • Introduction to Sustainability • Identify the dimensions of sustainability Identify economic, environmental, and social sustainability indicators. • Discuss complementarities and conflicts between the dimensions of sustainability
Week 2 : 3 June - 9 June	Topic	Energy & Thermodynamics • Define the concepts of energy and power in terms of: (a) power applied over time; and (b) rate of energy flow. • Perform calculations using dimensional analysis to verify the above concepts. • Perform calculations based on energy conversion and transfer processes.
	Assessment	Quiz 1 opens!
	Tut-Lab	First PlayEnergy Computer Laboratory.
Week 3 : 10 June - 16 June	Topic	Economics • Define, calculate and apply basic technoeconomic parameters, including LCOE, the time value of money, and marginal cost of energy generation. • Describe the relationships between energy efficiency and costs of electricity
	Tut-Lab	Second PlayEnergy Computer Laboratory
Week 4 : 17 June - 23 June	Topic	Solar Photovoltaic Power • Explain why the entire solar spectrum cannot be harvested • Describe the dependence of solar radiation intensity on: time of day; time of year; and location. • Identify the energy conversion processes in a photovoltaic cell • Calculate the power and energy generated by a photovoltaic array considering derating factors • List the functions and desired properties of inverters
	Assessment	• Quiz 1 is DUE! • Critical Writing Assignment opens
Week 5 : 24 June - 30 June	Topic	Wind Power (Guest Lecturer: Dr Merlinde Kay) • Explain the basic underlying science of wind energy, and engineering aspects of wind turbines. • Perform basic statistical analysis of wind data • Perform calculations of annual energy output and determine the capacity factor of a wind turbine • Have a good appreciation of some of the wider economic, social and environmental aspects of wind energy systems.
Week 7 : 8 July - 14 July	Topic	Solar Thermal, Storage & The Electricity Grid (Guest Lecturer: A/Prof. Robert Taylor) • Compare solar thermal to solar photovoltaics in terms of key metrics and feasible applications • Be able to explain and calculate the energy output of a solar thermal module as a function of direct and diffuse insolation, wind speed, ambient temperature, and operating temperature. • Be able to distinguish between different solar thermal technologies and their suitability to different environments/applications. • Describe the implications of implementing large-scale renewable energy technologies on the electricity grid. • Describe the current challenges facing energy storage technologies • Calculate required battery capacities and charging times
	Assessment	• Critical Writing Assessment is DUE! • Quiz 2 Opens
Week 8 : 15 July - 21 July	Topic	Energy Efficiency (Guest Lecturer: Prof. Alistair Sproul) • Identify methods of reducing energy usage such as using low-energy whitegoods, appropriate building materials, and smart metering • Assess the effects of increased energy efficiency on lowering CO_2 emissions
	Assessment	• Quiz 2 is DUE!
Week 9 : 22 July - 28 July	Topic	Climate Change (Guest Lecturer: Prof. Jason Evans) • Describe the potential impacts of CO_2 emissions, and define and calculate related parameters such as CO_2 emission intensity. • Identify strengths and weaknesses in public and academic debate about climate change.
	Assessment	• Quiz 3 Opens
Week 10 : 29 July - 4 August	Topic	Course Wrap-up/Catch-up

	Assessment	• Quiz 3 is DUE!

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

You should attend the lectures and one workshop per week. Please only attend the workshop which you are timetabled for - check your personal timetable.

While attendance isn't mandatory, you will struggle if you don't attend!

Course Resources

Prescribed Resources

Academic online textbook: https://academia.games.playconomics.com/

UNSW Library website: https://www.library.unsw.edu.au/

Moodle: https://moodle.telt.unsw.edu.au/login/index.php

Playconomics/PlayEnergy: https://playconomics.com/accounts/login/

MATLAB Online: https://matlab.mathworks.com/

Course Evaluation and Development

Feedback on the course is gathered periodically using various means, including the UNSW myExperience process, informal discussion in the final class for the course, and the School's Student/Staff meetings. Your feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

In this course, recent improvements resulting from student feedback include:

- Slides updated with colour-coded backgrounds to identify examinable material
- Increased the number of worked examples
- Lecture notes available prior to lectures
- In 2024 we will attempt hybrid lectures/tutorials if in-person attendance is high enough (details in Lecture 1!)

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Murad Tayebjee		TETB 242	+61 2 90656128	Microsoft Teams	No	Yes
Demonstrator	Hyunsun Song					No	No

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at

the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also

be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School-specific Information

SPREE Student Information Hub

Students are welcome to visit the SPREE Student Information Hub for information such as sample study plans, course outlines, thesis project, industrial training etc.

School Contact Information

For course-related matters, please contact course convenor directly via emails. Please email spreeteaching@unsw.edu.au for any other matters.