

COURSE CONTENT

Academic Year	2022-2023	Semester	1
Course Coordinator			
Course Code	EN3006		
Course Title	Energy Resources Engineering		
Pre-requisites	Nil		
No of AUs	3		
Contact Hours	Lecture: 33 hrs; Tutorial: 6 hr; Lab: 0 hr		
Proposal Date	17 January 2022		

Course Aims

This course aims to provide you with a general understanding on the various sources of energy, their availabilities, qualities and impacts on the environment, economic and society in the context of sustainable development. You will be provided with an overview on the current energy trends, issues and challenges as well as overview on the choice of energy use and technologies to meet these challenges in future for sustainable development.

Intended Learning Outcomes (ILO)

By the end of this course, you (as a student) would be able to:

1. Explain current energy supply and demand situations;
2. Apply basic knowledge of the various sources of energy;
3. Describe the impact of energy on economy, society and the environment;
4. Assses various legislative and regulatory approaches to a sustainable energy management;
5. Evaluate alternative energy solutions that are sustainable.

Course Content

This introductory course provides an overview of energy resources management in the context of sustainable economic development. Topics include energy and human society, energy resources and reserves, supply, distribution, utilisation, recovery and conversion, environmental impacts of energy utilisation, energy economics and policies.

No	Topic	Lecture Hrs	Tutorial Hrs
1.	Introduction to Energy, Technology and Human Society	2	
2.	Overview on Non-Renewable Energy Resources	3	1
3.	Effect of Energy on Economy, Society and the Environment	5	1
4.	Energy Policy & Regulation	2	
5.	Energy Policy Efficiency: Trends, Benchmarking, Auditing & Incentives	2	1
6.	Energy Conservation and Efficient Energy Conversion Technology	6	1
7.	Clean Fuels and Fuel Harmonisation	2	
8.	Renewable Energy Sources	10	2
9.	Hydrogen Economy	1	
	Total	33	6

Assessment (includes both continuous and summative assessment)

Component	Course LO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/ Individual	Assessment rubrics
1. Final Examination	1, 2, 3, 4, 5	EAB SLOs A, C, G	50%	Individual	
2. CA 1: Quiz	1, 2, 3, 4, 5	EAB SLOs A, C, G	20%	Individual	
3. CA 2: Group Project Report	1, 2, 3, 4, 5	EAB SLOs B, E, F, G, H, I, J, L	30% x MF	Team & Individual	Appendix 1
Total			100%		

*Notes *: The group project assessment for this course is also reliant on you working closely as a team to complete the project. Hence, the Modification Factor (MF) will be applied to account for your individual contribution to the group project work. The MF is derived from panel judges' feedback, weekly discussion session and peer assessment. For more details on the MF calculation, please see Appendix 2.*

*SLOs = Student Learning Outcomes for Environmental Engineering Programme (per BEng Environmental Engineering Accreditation)

Related Programme LO or Graduate Attributes

- A. Engineering knowledge:** Apply the knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.
- B. Problem Analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- C. Design/development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- D. Investigation:** Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- E. Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- F. The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- G. Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for the sustainable development.

- H. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- I. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
- J. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- K. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- L. **Life-long Learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Formative feedback

The quiz results will be discussed, and you will be able to view your quiz grade individually through Blackboard Grade Centre.

Each group will submit their comments with respect to other groups' reports to the course instructor. The group project reports' results will be released through Blackboard Grade Centre.

Class meets once per week over 3 hours in lecture and tutorial format.

Approach	How does this approach support students in achieving the learning outcomes?
Lectures	Formal lectures on topics with in-class discussions
Tutorials	This helps you to understand the concept taught during lectures as well as promote life-long learning
Group Report	This helps you to achieve one or more of the outcomes as you need to do self-study and research as well as promote team works

Reading and References

1. J.A. Fay and D.S. Golomb: "Energy and the Environment", 2nd Edition, Oxford University Press, 2011
2. Edward S. Cassedy and Peter Z. Grossman: "Introduction to Energy: Resources, Technology & Society", 3rd Edition, Cambridge University Press, 2017
3. United Nation Environment Programme: www.unep.ch/etb/publications/envImpAsse.php

4. US Department of Energy: www.eia.doe.gov
5. UN Intergovernmental Panel on Climate Change (IPCC): www.ipcc.ch
6. Singapore's Energy Market Authority (EMA): www.ema.gov.sg

Course Policies and Student Responsibilities

(1) General

Students are expected to take all scheduled assignments and tests by due dates. Students are expected to take responsibility to follow up with course notes, assignments and course related announcements. Students are expected to participate in all group project discussions and activities.

(2) Absenteeism

Group work requires each member to contribute to team-work. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. There will be no make-up opportunities for in-class activities.

Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the [academic integrity website](#) for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office Location	Phone	Email
Tuti Lim	N1-1b-39	6790-5269	tmlim@ntu.edu.sg

Planned Weekly Schedule

Week	Topic	Course LO	Readings/ Activities
1	Introduction to Energy, Technology and Human Society	1	Lecture
2	Overview on Non-Renewable Energy Resources	1 and 5	Lecture and Tutorial

3 - 4	Effect of Energy on Economy, Society and the Environment	1, 2 and 3	Lectures Tutorial on week 4 only
5	Energy Policy & Regulation	4	Lecture
6	Energy Policy Efficiency: Trends, Benchmarking, Auditing & Incentives Energy Conservation	4 & 5	Lecture and Tutorial
7 - 8	Efficient Energy Conversion Technology	1, 2, 3, 4, 5	Lecture Tutorial on Week 8 only
9	Clean Fuels and Fuel Harmonisation	1, 2, 3, 4, 5	Lecture
10-13	Renewable Energy Sources Hydrogen Economy	1, 2, 3, 4, 5	Lecture Tutorial on Week 10 and 13 only

Appendix 1: Assessment Criteria for Group Project Report

The assessment of the group project report will be based on assessment by the tutor and peer review evaluation.

Assessment Rubric by Tutor (weightage = 30%)

Criteria	Good (8-10)	Ave (6-7)	Fair (4-5)	Poor (1-3)	Remarks
Introduction/Project Background (20%)					Appreciation of project background and description. Well defined project; clear objectives.
Discuss current specific energy technology and possible solutions (30%)					Basic knowledge and application of energy technologies including the pro and con as well as the current application status
Assess the feasibility of applying the specific energy technology in Singapore (20%)					Application of the specific energy technology for Singapore
Conclusion (10%)					Summarise the report clearly and concisely
Report format and layout including clarity of expression / Style of report (20%)					Clear and concise; good grammar and spelling with appropriate tables/graphs/figures; Report is presented well with logical sequence
TOTAL	100%				

Appendix 2: Criteria for Peer Assessment to obtain Multiplication factor (MF)

Criteria	Outstanding: 4	Good: 3	Average, meet expectation: 2	Below expectations: 1
<i>Collaborative behaviour</i>	Cooperative and always delivered assigned tasks on time. Take initiative to help other to ensure success of team project.	Cooperative and always delivered assigned tasks on time. Willing to assist others upon request.	Stop short at delivering assigned tasks, sometimes after reminder(s).	Uncooperative, non-committed, always miss deadlines.
<i>Quality of works</i>	Quality of works higher than overall group quality, or go extra miles to assist teammate to enhance the quality of group works.	Good quality of deliverables under individual responsibility.	Acceptable quality of deliverables under individual responsibility.	Quality of works not acceptable.
<i>Ideas & participations</i>	Active participation and initiatives, good ideas & suggestions in enhancing the quality of group works.	Contributed suggestions and ideas to enhance the quality of group works.	Somewhat contributed in enhancing the quality of group works.	Did not participate in group works.

Average Peer Assessment Score	MF
3.51 to 4.00	1.05*
3.01 to 3.50	1.00
2.51 to 3.00	0.95
2.00 – 2.50	0.9
Below 2.0	Separate Assessment

Note: * - The moderated score will be cap at 100%

Peer assessment exercise will be anonymous and done towards the end of the semester.

For student who has average peer assessment score below 2.0, Course Coordinator might contact/call up the student as well as the other team member(s) to further assess the appropriate MF.

In addition to peer assessment, MF might be moderated by Course Coordinator and panel judges from the interaction during consultation, and feedbacks from the team members.