

Energy and Environment

Course Synopsis

The course aims to provide students with an understanding of the scientific and technological principles underlying the usage of various energy sources, and their impact on the environment from a scientific perspective. To provide students with a scientific understanding of energy-related issues, the scientific principles underlying energy and electricity will first be introduced. The science of most non-renewable, renewable and emerging energy sources such as their origins, forms, efficiency and reserve on the earth, and the technological principles for generation, transmission and storage of energy from them will be introduced. The pros and cons, scientific prospect and environmental issues brought by different energy sources in specific environmental scenarios will be illustrated. Energy-related innovative technologies will also be introduced. Examples and the benefits in utilizing renewable energy and other energy-related innovations in Hong Kong, China, the Greater Bay Area and around the world will be discussed. Upon completion of the course, students will be able to make informed decisions on energy-related issues from a scientific and technological perspective.

Course Intended Learning Outcomes (CILOs)

Upon completion of this course, students will be able to:

- CILO₁ Demonstrate a fundamental understanding on energy and electricity.
- CILO₂ Demonstrate an understanding on the origins, forms and efficiency of various energy sources.
- CILO₃ Develop an understanding on the scientific and technological principles underlying generation, transmission, storage and usage of energy from different energy sources.
- CILO₄ Develop the knowledge and ability to compare the utilization of various energy sources in specific scenarios and evaluate their impact on the environment from a scientific perspective.

Course Title: Energy and Environment
Course Code: SES3057
Department: Science and Environmental Studies
Instructor: Dr. LEUNG Chi Fai & Dr. LI Tin Lok Matthew
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 Multimedia (STEM) Lab/
Venue/ Time: Tue (9:30 – 12:30 am) & (1:30 – 4:30 pm)
 Thu (9:30 – 12:30 am) & (1:30 – 4:30 pm)

1) Course Schedule:

Session	Date	Content	Remark
1	7 July (am)	The science of energy: – Energy as a physical quantity – Forms of energy – Conservation and transformation of energy – Heat as a form of energy – Combustion, Heat and Energy	Lecture/Case studies/ Exercise/ Discussion
2	7 July (pm)	Fossil fuel: – Different forms of fossil fuels (coal, petroleum and natural gas); – Geographical distribution and natural abundance, – Extraction and environmental impact – Storage and transmission – Usage and environmental impact	Lecture/Case studies/ Exercise/ Discussion
3	9 July (am)	Electricity: – Electricity as a major means of energy carrier – Basic concepts of electrical circuits – Mechanisms for generating, transmitting, storing and dissipating electricity – Environmental impact	Lecture/Case studies/ Exercise/ Discussion
4	9 July (pm)	Experiment 1: Electrochemical cells	Lab. practical
5	14 July (am)	E-learning Exercise (1): Energy, Fossil Fuels and Electricity	Moodle
6	14 July (pm)	Renewable energy (1): photoelectrochemical and biochemical approaches – Carbon-neutral Economy	Lecture/Case studies/ Exercise/ Discussion

		<ul style="list-style-type: none"> – Basic Electrochemistry: Cells, Batteries and Fuel Cell – Emerging energy technology and their relation to the environments (HEVs and EVs; Green Building) – Materials & resources for energy technology 	
7	16 July (am)	Renewable energy (2): photoelectrochemical and biochemical approaches <ul style="list-style-type: none"> – Solar energy and technologies – Artificial photosynthesis: hydrogen, solar fuels and fuel cells – Biofuels: Bio-fermentation and anaerobic digestion 	Lecture/Case studies/ Exercise/ Discussion
8	16 July (pm)	Experiment 2: Dye-sensitized Solar Cell	Lab. practical
9	21 July (am)	Visit: Zero-carbon Building	
10	21 July (pm)	Consultation for Poster Presentation (Zoom)	Moodle
11	23 July (am)	Poster Presentation	
12	23 July (pm)	E-learning Exercise (2): Renewable energy technology	
13	28 July (am)	Quiz	
14	30 July (am)	Submission of Reports	

Assessment:

Activity	Weighting
Experimental Reports (group) Participation in the lab sessions is compulsory	32 %
Poster Presentation (group)	18 %
Exercises and Quiz (individual)	25 + 25 %

Guidelines for Poster Presentation:

- Please study a class of energy technology and its applications. Critically examine the various factors affecting its application and development, as well as corresponding influences on the society and environment. Students also need to examine how these issues are to be addressed.
- The **written content** will be **strictly confined to less than ½ of the poster (A0 size)** area. A large font size (> 24) is expected for the written content.
- Please use visual means, e.g. schemes, figures, photos and tables to present your findings. The written paragraphs should occupy less than ½ of the A0 page.
- It depends on the topic you work on, but a **poster title, conclusion** and **reference** are must in a poster. You may divide your poster into different sections according to your

topic, so that other can understand it quickly. Generally, it is suggested including the following parts:

- **Title and authors (group members)**
 - **Introduction: environmental issue to be addressed and importance of the energy technology**
 - **Scientific theories and technological background of the energy technology**
 - **Application of the energy technology globally and in the Greater China Region (especially in GBA area)**
 - **Advantages, limitations, and influences (social and environment) and future development**
 - **Conclusion**
 - **Reference (citation)**
- Each group will have **15 min** to present their poster, which are followed by **3 min** Q&A.
 - The final poster (pdf file) should be submitted to the Turnitin link provided.

Recommended Readings

- Andrews, J., & Jelley, N. (2017). *Energy Science: Principles, Technologies, and Impacts*. Oxford: Oxford University Press.
- Chorafas, D. N. (2011). *Energy, Environment, Natural Resources and Business Competitiveness: The Fragility of Interdependence*. Farnham: Burlington, Vt., Gower.
- Halliday, D., Resnick, R., & Walker, J. (2013). *Fundamentals of Physics* (10th ed.). Hoboken, NJ: John Wiley & Sons.
- Hinrichs, R. A., & Kleinbach, M. H. (2013). *Energy: Its Use and the Environment* (5th ed.). Boston, MA.: Brooks/Cole Cengage Learning.
- International Energy Agency (IEA). (2016). *Key World Energy Statistics 2016* (Key World Energy Statistics). Paris: IEA.
- Kanoğlu, M., Çengel, Y. A., & Cimbala, J. M. (2020). *Fundamentals and Applications of Renewable Energy*. London: McGraw-Hill Education.
- Michaelides, E. E. (2018). *Energy, the Environment, and Sustainability*. New York: CRC Press.
- Miller, B. G. (2016). *Clean Coal Engineering Technology* (2nd ed.). Amsterdam: Elsevier.
- Misak, S., & Prokop, L. (2016). *Operation Characteristics of Renewable Energy Sources*. Berlin: Springer.
- Nelson, V. C., & Starcher, K. L. (2015). *Introduction to Renewable Energy*. Boca Raton: CRC Press.
- Rez, P. (2017). *The Simple Physics of Energy Use*. Oxford: Oxford University Press.
- Ristinen, R. A., Kraushaar, J. J., & Brack, J. (2015). *Energy and the Environment* (3rd ed.). Hoboken, NJ: John Wiley & Sons.
- Rincón-Mejía, E., & De Las Heras, A. (Eds.). (2017). *Sustainable Energy Technologies*. Boca Raton: CRC Press.
- Sørensen, B. (2017). *Renewable Energy: Physics, Engineering, Environmental Impacts, Economics and Planning* (5th ed.). Amsterdam: Elsevier Academic Press.
- Wolf, E. L. (2018). *Physics and Technology of Sustainable Energy*. Oxford: Oxford University Press.
- Zito, R., & Ardebili, H. (2019). *Energy Storage: A New Approach* (2nd ed.). Hoboken, NJ: John Wiley & Sons.

Recommended Websites

Clean Energy Asia, USAID ECO-Asia Clean Development and Climate Program

<http://www.cleanenergyasia.net>

Energy Industry Today, Hong Kong Energy News

<https://energy.einnews.com/country/hongkong>

Financial Times, Energy

<https://www.ft.com/companies/energy>

US Government, Energy Information Administration <https://www.eia.gov/>

US The Department of Energy <https://www.energy.gov/>

US The Department of Energy, Energy Efficiency and renewable Energy

<https://www.eere.energy.gov>

Electrical and Mechanical Services Department, Hong Kong

https://www.emsd.gov.hk/en/energy_efficiency/index.html

Related Journals

Energy & Environmental Science. Royal Society of Chemistry *International*

Journal of Sustainable Energy. Taylor & Francis.

The Energy Journal. International Association of Energy Economists

Academic Honesty

The University upholds the principles of honesty in all areas of academic work. We expect our students to carry out all academic activities honestly and in good faith. Please refer to the *Policy on Academic Honesty, Responsibility and Integrity* (<https://www.eduhk.hk/re/uploads/docs/00000000016336798924548BbN5>). Students should familiarize themselves with the Policy.