



THE CHINESE UNIVERSITY OF HONG KONG
INTERNATIONAL SUMMER SCHOOL (JULY SESSION)
28 JUNE – 1 AUGUST 2022

UGEB1307 ENERGY AND GREEN SOCIETY

No. of Credits: 3

Time: Tuesday, Wednesday & Thursday 09:30 – 12:15 (GMT +8)

Location: Online (Zoom)

Instructor: Prof. H. S. UDAYKUMAR

Mechanical Engineering, University of Iowa

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Teaching Assistant: TBC

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COURSE DESCRIPTION

This course is designed to help students to acquire a comprehensive understanding of the global energy situation and environmental issues our society is currently facing. The history of energy consumption shows how important energy is to the quality of life for the human beings. With economic development and the increase of world population, the planet is challenged by an unprecedented energy demand in 21st century. At the same time, global warming and climate change are also demanding changes in our way of life. How can we meet future energy demands? What are the energy options we currently have and what are their impacts on the environment? How can we meet our energy needs without damaging the environment? The first half of this course will tackle the above-mentioned questions by examining our current energy options and their respective impacts on the environment. Then, to address both energy and environmental concerns, possible routes to develop a green society will be discussed in the second half of this course with a focus on renewable energy resources, smart grid, eco-friendly vehicles, and carbon sequestration and carbon audit. (No technical background is required)

Remarks

Not for Energy Engineering; Energy and Environmental Engineering; and Mechanical and Automation Engineering Majors.

Co-requisite: UGFH1000, UGFN1000 or UGFN1001 (only applicable to students admitted to the 4-year curriculum)

LEARNING OUTCOME(S)

This course aims at enabling non-technical students to develop a comprehensive understanding on the energy crisis and environmental issues. Upon completion of the course, students should have achieved the following outcomes:

1. Understand how we produce and consume energy and how the issue of energy impacts humans and the environment, including climate change, pollution and energy resource availability.
2. Gain a basic understanding of the scientific basis for climate change.
3. Understand the policies and global agreements undertaken by countries across the world to combat climate change impacts.
4. Be able to connect historical, social, economic, and ecological trends in analyzing and interpreting human response to energy and climate issues.

REQUIRED TEXTBOOK

None. Instructor Notes and References will suffice.

READING(S)/REFERENCE(S)

- David JC McKay, Sustainable Energy: without the hot air, UIT, Cambridge, England, 2009.
- Amory Lovins, Reinventing Fire: Bold Business Solutions for the New Energy Era, Chelsea Green Publishing, 2011.
- Vaclav Smil, Energy at the Crossroads: Global Perspectives and Uncertainties, *The MIT Press*, Cambridge, 2005.
- Paul Hawken (Editor), Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming, Penguin Books (Paperback), 2017.
- Saul Griffith, Electrify, MIT Press, 2021.

Links to assigned viewings (to be discussed in class):

Hans Rosling talk¹: <https://www.youtube.com/watch?v=6sqnptxlCcw> IPCC AR5 Report²:

<http://www.ipcc.ch/report/ar5/wg1/>

James Hansen³:

https://www.ted.com/talks/james_hansen_why_i_must_speak_out_about_climate_change?language=en David

Suzuki 59th minute⁴: <https://www.youtube.com/watch?v=15mJEwcdRIA>

Gavin Schmidt⁵:

https://www.ted.com/talks/gavin_schmidt_the_emergent_patterns_of_climate_change?language=en James

Balog⁶: http://www.ted.com/talks/james_balog_time_lapse_proof_of_extreme_ice_loss?language=en Smil

video⁷: <https://www.youtube.com/watch?v=NxO3s0U5WdY>

Jacobson talk⁸: <https://www.youtube.com/watch?v=NnrdrvWz6BIQ> Follette Video⁹:

<https://www.youtube.com/watch?v=9KN83QJfkgY> MacKay talk¹⁰:

<https://www.youtube.com/watch?v=E0W1ZZYIV8o>

Video on Geothermal In Ireland¹¹: <https://www.youtube.com/watch?v=xST-FcYT9hk> Jonathan Foley TED talk¹²:

https://www.ted.com/talks/jonathan_foley_the_other_inconvenient_truth?language=en Nuclear Energy

debate¹³: https://www.ted.com/talks/debate_does_the_world_need_nuclear_energy?language=en How wolves

changed the rivers¹⁴: <https://www.youtube.com/watch?v=ysa5OBhXz-Q> Rob Dunbar TED talk¹⁵:

<https://www.youtube.com/watch?v=evfgbVjb688>

Alex Steffen TED talk¹⁶: https://www.ted.com/talks/alex_steffen_sees_a_sustainable_future?language=en Life is

Easy talk¹⁷: https://www.youtube.com/watch?v=21j_OCnLuYg

Dillinger¹⁸: https://www.ted.com/talks/paul_gilding_the_earth_is_full

Diamandis¹⁹: https://www.ted.com/talks/peter_diamandis_abundance_is_our_future?language=en Solutions

Solutions Project Website²⁰: <http://thesolutionsproject.org/>

GRADING WEIGHTS

Students will be evaluated on attendance (10%), two assignments (total of 20%), summative weekly online quizzes (40% total), online final exam (10%), and a 5-page final paper (20%).

Students should report all leave and absences, including sick leave and absences from class, to their course teacher and the Office of Academic Links. In case of illness/injury necessitating absence, a medical certificate is required as documentary evidence. A student who has been absent for a continuous period exceeding two consecutive days shall be considered to have withdrawn from the International Summer School. All fees paid will not be refunded.

GRADE DESCRIPTOR

A, A-: EXCELLENT -- Exceptionally good performance far exceed expectation in all or most of the course learning outcomes. Demonstration of superior understanding of energy crisis and environmental issues, ability to apply extensive knowledge and skillful use of concepts and materials to analyze the energy and environmental problems.

B+, B, B-: GOOD -- Good performance in all course learning outcomes and exceed expectation in some. Demonstration of good understanding of energy crisis and environmental issues, ability to use proper concepts and materials to analyze most of the energy and environmental problems.

C+, C, C-: FAIR -- Adequate performance in all course learning outcomes. Demonstration of adequate understanding of energy crisis and environmental issues, ability to analyze simple energy and environmental problems.

D+, D: MARGINAL -- Performance barely meet the expectation in all or at least the essential course learning outcomes. Demonstration of partial understanding of energy crisis and environmental issues and ability to solve simple problems.

F: FAILURE -- Performance does not meet expectation in most of the course learning outcomes. Demonstration of serious deficiencies.

ASSIGNMENT SUBMISSION & FEEDBACK

Unless otherwise specified by the instructor all assignments will be submitted online using the CUHK Blackboard online portal.

- All weekly quizzes will be posted on Blackboard on Friday of each week and will be due before class the following Tuesday.
- 1st assignment will be posted on 30 June, due on 5 July and returned on 12 July.
- 2nd assignment will be posted on 7 July, due on 14 July and returned on 19 July.
- Final paper will be posted on 21 July, due on 30 July and returned on 2 August.

Students are required to cite reference works appropriately in their written reports. The format for citations in reports and papers should be in author-date (Chicago) style; see:

https://www.chicagomanualofstyle.org/tools_citationguide.html.

CLASS SCHEDULE

Week	Date	Topics	Readings/Assignment
1	1 <i>Tue, June 28</i>	Definitions and Foundations What is energy? What are the different forms of energy? What do we need energy for? Some fundamental concepts on energy – Natural Laws, Measures of energy, green-ness	
	2 <i>Wed, June 29</i>	Current and Future Energy Needs The distribution of energy needs – by region and use The trajectory of energy use Production of energy around the world Where energy comes from and where it goes – countries around the world	Watch Hans Rosling TED talk ¹
	3 <i>Thu, June 30</i>	Inputs, Outputs and Byproducts – Basics of balance laws and intro to systems analysis Basic chemistry of fossil-fuel energy production – CO ₂ , CH ₄ , other products Concerns for World energy profile: Running out of inputs, harmful byproducts?	

2	4 <i>Tue, July 5</i>	Greenhouse gases (GHGs) and their sources The energy balance for Earth-Sun system Greenhouse effect Sources of GHGs Climate sensitivity and energy imbalances	Quiz 1 Due Online
	5 <i>Wed, July 6</i>	Evidence of warming How do we know that warming is happening? Modeling – what it means and what it says about the future What can/will humans do?	Download and peruse IPCC AR6 Report ²
	6 <i>Thu, July 7</i>	Fueling the future – “Sustainable” sources of energy What is sustainability? The three P’s Are renewables sustainable? Always? What are the various sources of renewable energies? Renewable energy paradigms – distributed, location- specific, base load, capacity factor	Watch Gavin Schmidt TED talk ⁵ Watch James Balog TED talk ⁶
3	7 <i>Tue, July 12</i>	Renewables – Solar Power The prospects for solar Types of solar energy systems What are the promises and challenges of solar? Examples: Solar in US, China, Germany	Quiz 2 Due Online MacKay talk ¹⁰
	8 <i>Wed, July 13</i>	Renewables – Wind The prospects for wind How to evaluate wind potential? What are the promises and challenges for wind? Examples: wind in US, China, Germany	Watch Smil video ⁷
	9 <i>Thu, July 14</i>	Renewables – Other Wave/Tide Geothermal Biomass; Energy and Food	Watch Jacobson talk ⁸
4	10 <i>Tue, July 19</i>	What about nuclear power? Types of nuclear power The promise and challenge of nuclear power Nuclear pre- and post-Fukushima	Quiz 3 Due Online Watch Video on Geothermal In Ireland ¹¹ Watch Jonathan Foley TED talk ¹²
	11 <i>Wed, July 20</i>	The big picture- Energy and Ecology How does our production and consumption of energy affect the ecology of the earth? Energy-Food-Water nexus	Watch Nuclear Energy debate ¹³ (TED)
	12 <i>Thu, July 21</i>	The big picture- Energy and Society Population and consumption: what it means for our energy future Rise of megacities What does “green society” mean?	Watch: How wolves changed the rivers ¹⁴ Watch Rob Dunbar TED talk ¹⁵
5	13 <i>Tue, July 26</i>	Solutions to the problem- what to do? Production versus consumption (supply side and demand side) Can we run the world on renewables? Can we cut energy use by 50%?	Quiz 4 Due Watch Dillinger ¹⁸ , Diamandis ¹⁹ TED talks

	14 <i>Wed, July 27</i>	Charting a course for the 21st century and beyond – the future of advanced human societies COP21 and the prospects for zero carbon by 2050.	Watch Life is easy talk ¹⁷
	15 <i>Thu, July 28</i>	Final Exam Posted Online	

ACADEMIC POLICIES

Attention is drawn to University policy and regulations on honesty in academic work, and to the disciplinary guidelines and procedures applicable to breaches of such policy and regulations. Details may be found at <http://www.cuhk.edu.hk/policy/academichonesty/>.

With each assignment, students will be required to submit a signed declaration that they are aware of these policies, regulations, guidelines and procedures.

- In the case of group projects, all students of the same group should be asked to sign the declaration, each of whom is responsible and liable to disciplinary actions should there be any plagiarized contents in the group project, irrespective of whether he/she has signed the declaration and whether he/she has contributed directly or indirectly to the plagiarized contents.
- For assignments in the form of a computer-generated document that is principally text-based and submitted via VeriGuide, the statement, in the form of a receipt, will be issued by the system upon students' uploading of the soft copy of the assignment. A user manual of VeriGuide can be found at: [https://academic.veriguide.org/academic/documents/VeriGuide Academic Student User Manual CUHK .pdf](https://academic.veriguide.org/academic/documents/VeriGuide%20Academic%20Student%20User%20Manual%20CUHK.pdf).

Assignments without the properly signed declaration will not be graded by teachers. Only the final version of the assignment should be submitted via VeriGuide.

The submission of a piece of work, or a part of a piece of work, for more than one purpose (e.g. to satisfy the requirements in two different courses) without declaration to this effect shall be regarded as having committed undeclared multiple submission. It is common and acceptable to reuse a turn of phrase or a sentence or two from one's own work; but wholesale reuse is problematic. In any case, agreement from the course teacher(s) concerned should be obtained prior to the submission of the piece of work.