EK-225
Introduction to Energy Conversion and Environmental Engineering

Instructor
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office hours:
7:30-8:00 pm Tue/Thu

Course Summary

This class examines the existing state of the world's energy use and its impact on society and the planet. A quantitative framework is provided in order to evaluate current and potential technologies. Individual energy generation, conversion, and end use options are evaluated within this framework. Both renewable energy generation technologies: wind, solar, biomass, and hydro, and conventional sources such as nuclear and fossil fuels will be compared. Energy conversion is discussed with regards to batteries and fuel cells, liquid bio- fuels, and grid level storage systems. These technologies are then put into a social context and their use around the world is discussed. Evaluations are based on homework and class discussions, midterms, and a final.

Texts – Recommended

- Tester, Jefferson W., Elisabeth M. Drake, Michael J. Driscoll, Michael W. Golay, and William A. Peters. *Sustainable Energy: Choosing Among Options.* 2nd edition. MIT Press, 2012. ISBN: 9780262017473
- McKay, David J. C. *Sustainable Energy – Without the Hot Air.* UIT Cambridge, Ltd., 2009. ISBN: 9780954452933.
- *Introduction to Environmental Engineering*, Richard O. Mines and Laura W. Lackey, ISBN-10: 0132347474, ISBN-13: 9780132347471, Publisher: Prentice Hall, Copyright: 2010

Evaluation

10% - Homework
10% - Class participation, involvement in discussions
20% - Exam 1: Lectures 1 through 7
25% - Exam 2: Lectures 8 through 14
30% - Final Exam: Cumulative

Schedule (Subject to change due to guest speaker availability):

Section I: Energy Use in Context

Lectures:

1. Introduction and a short history of energy use
2. Overview of energy use and issues of sustainability
3. Energy transfer and conversion methods
4. Thermodynamics and efficiency calculations
5. Natural Cycles and Sustainable Development
6. Climate Change: Science and policy
7. Hydro-Power I: History Impacts/Safety

Exam I – 20 %

Section II: Energy Technologies:

Lectures:

8. Nuclear Energy: Basics and current status
9. Biomass: Resources and uses
10. Hydro-Power II: The water-energy Nexus
11. Wind Energy: Technologies and policy
12. Fossil Energy: Overview, and introduction to exploration technology
13. Solar Energy
14. Sustainability at BU

Exam II – 25%

Section III: Energy end use

Lectures:

15. Other energy technologies: geothermal, wave
16. Electrochemical energy conversions I: batteries
17. Electrochemical energy conversions II: fuel cells, piezoelectric
18. Metal Recycling: old batteries to huge profits.
19. Energy Storage Systems
20. Pollution Control I: Air/Water
21. Pollution Control II: Waste management, Life-cycle analysis
22. Outlook for sustainability Panel discussion
23. Review

Final Exam – 35%