

Energy and Sustainability EVSC 715 Course Syllabus, Spring 2017

Instructor: MP Bonchonsky EVSC 715, Spring 2017...Monday 6-9 PM FMH 209

Office hours M 3-5:30 (before class) and other see Moodle

Textbook: Sustainable Energy, Choosing Among Options; Second ed. Jefferson W. Tester, Elisabeth M. Drake, Michael J. Driscoll, Michael W. Golay and William A. Peters 2012; MIT Press; ISBN 978 0 262 01747 3

Grading: 40% Midterm, 40% Final, 20% Essay/Presentation

Lectures, dates:

Week-1, M Jan 23, Introduction...review of syllabus, assignments, selected readings; introduction to energy, natural energy and the environmental implications of its production and distribution

Week-2, M Jan 30, Energy Fundamentals

- Energy basics

 - Forms of energy

 - Power

 - Units of energy

- Transformation of Energy from one form to another

Week-3, M Feb 6, Energy Use in Industrial Societies

- Energy Consumption in the United States

- Comparative Energy Use Internationally

- Nonrenewable Energy Sources

- Renewable Energy Sources

Week-4, M Feb 13, Fossil Fuels...

Debate, For and Against: "Considering the abundance of coal, should we develop our coal fueled power plants to the maximum extent possible?"

- (Conventional sources)

 - Petroleum

 - Petroleum Resources

 - World production

 - Petroleum resources in the United States

 - Petroleum Refining

 - Natural Gas

 - History of use of Natural Gas

 - Natural Gas resource in the World

 - Natural Gas resource in the United States

 - Coal

 - (and non-conventional sources)

 - Shale Oil Tar Sands tight geo formations

 - CO₂ Capture and Storage (CCS) Technologies

Week-5, M Feb 20, Heat Engines...Lecturer: Dr. B. S. Mani, NJIT ME Dep't.... tour of engine lab at MIE bldg...Debate, For and Against: "The Development of Nuclear Energy systems is critical to meeting our future energy needs"

- Mechanical Equivalent of Heat

- Thermodynamics of Heat engines

- Common Heat Engines

 - Steam Engines

 - Gasoline Engines

 - Diesel engines

 - Gas Turbines

- Heat Pumps, Cogeneration

Week-6, M Feb 27 Renewable Energy Sources II ...Lecturer: Mr. Darren Kelly of TerraGen, Inc.
engineering manager (windpower) Debate, For and Against: "Alternative Energy source development is progressing adequately in the world"

- Hydropower
 - Dynamic
 - Tidal
 - Wave
- Windpower
- Geothermal Energy
- Ocean Thermal energy conversion
- Biomass as energy Feedstock
 - Types of Biomass Derived Fuels
- Municipal solid waste as feedstock

Thursday March 2...tentative schedule for PSEG Nuclear plant tour

Week 7 M March 06 Midterm

Week 8 Spring Break March 11-18

Week-9 M March 20 Dr. Som Mitra Solar Energy: Photovoltaic cells
Solar energy

- Introduction: energy from the sun
- The Conversion of Solar energy to Electrical energy
- The flat plate collector system
- Passive solar
- Solar Thermal Electric power generation,
 - Power Towers, Parabolic Dishes

Week 10 M March 27 Review of Issues associated with hydraulic sedimentary rock fracturing

Week 10, M April 3 Renewable Energy Sources I ...Mr. Michael Hornsby, PSEG Community Solar Program

Debate, For and Against: Proposition: "Solar Energy systems should be the dominant global alternative energy source for the future"

Week 11, M April 10 lecture re: tour of PSE&G...plant tour of Nuclear Power Plant, date TBD: Nuclear plants

Issues of Nuclear Energy Production

- Summary of nuclear energy history
- Radioactivity
- Nuclear Reactor Formats
 - E.G. The boiling water reactor
- The Fuel Cycle, Uranium
- Environmental and safety aspects of nuclear energy
 - Chernobyl Incident
 - Nuclear weaponry
 - Storage of Radioactive Waste
- Nuclear Fusion as a Potential Energy source

Week 12, M April 17.....Energy Conservation...to include presentation and discussion of the New Jersey energy plan
(debate topic and participants, to be confirmed)

Week 13, M April 24...
Electricity and Transmission Issues...Planned Tour of Hudson Plant, Jersey City
Debate: For and Against: "The use of energy resources for transportation should be restricted"
Automobiles
Mass transit

Week 14, M May 1 ...Review and summary, current energy issues, remaining student presentations

May Final Exam period begins May 5

Learning Outcomes:

Attending students will be able to:

Trace the historical and current contributions of fossil fuels to human progress

Understand principal patterns of energy transformations in the natural environment and anthro built environment

Calculate the technical performance of energy systems: efficiencies, physical transport of heat

Examine environmental implications of various forms of energy production including major contaminants and modes of mitigation

Understand the technical fundamentals of fossil fuels in energy production

Understand the technical fundamentals of the production of electricity from wind turbines,

....for photovoltaic cells and solar thermal energy systems

Understand the technical formats of nuclear power systems and the environmental implications

Analyze the New Jersey Energy Master Plan in the context of national energy policy development