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


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 Feb13, 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
  C02 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