Objectives:

- Learn fundamental physical, chemical and economic principles underlying energy conversion and energy end use technologies.
- Understand environmental impacts of energy uses, and ways to mitigate these.
- Understand linkages between energy policy and other public policies.
- Understand the current status of the U.S. energy system.
- Understand the future challenges for domestic and international energy systems.
- Assess energy technologies, energy systems and energy policies using alternate evaluation frameworks.
- Rationalize, present and defend positions on energy policy options.
- Develop, articulate and assess future energy scenarios.

Week 1: Introduction and overview: fundamentals.

Readings:
- (Smil 2006, 1–25)
- (Tester et al. 2012, 293–327)
- (Bardach 2011)

Week 2: The US energy system and energy policy
Current and past consumption and supply patterns. Milestones of US energy and related policies. Perspectives on and interpretations of US energy policies.

Readings:
- (Geri and McNabb 2011, 45–61 and 63–82)
- (Bamberger 2007, 1–14)
- (Grossman 2013, 45–66)
Week 3: Extraction and conversion of fossil fuels

Readings:
- (Everett et al. 2012, 141–177 and 213–273)
- (Ground Water Protection Council 2009)
- (Jacob, O’Sullivan, and Paltsev 2012) (16pp)

Week 4: Topics in energy economics and energy markets

Readings:
- (Krautkraemer and Toman 2003) (27pp)
- (Tietenberg and Lewis 2011, 118–139)
- (Kelman 1992) (9pp)
- (Viscusi, Harrington, and Vernon 2005, 671–687)

Week 5: Energy and the environment
Climate Change: the greenhouse effect & carbon cycle dynamics; impacts; overview of mitigation options; Waxman-Markey and the 2014 US-China agreement.
Air pollution: co-pollutant emissions and control technologies; impacts on health and ecosystems. Water pollution related to extraction.

Readings:
- (Tester et al. 2012, 161–239(247))
- (Everett et al. 2012, 505–569)

Week 6: Electricity and the grid

Readings:
- (Everett et al. 2012, 315–371)
- (Griffin and Puller 2005, 1–28(23))
- (Joskow 2012) (17pp)
- (Warwick 2002)
**Week 7: Carbon capture and sequestration (CCS) and Nuclear Energy**

Readings:
- (Socolow 2005)
- (Van Noorden 2014) (1 page)
- (Everett et al. 2012, 381–464)
- (Hamilton 2012, 40–75)

**Week 8: Renewables**

Readings:
- (Boyle 2012)
- (Sobin 2007, 171–199)

**Week 9: Bioenergy & Energy Efficiency**
Sources of biomass; fundamentals of biomass conversion technologies; competition between biomass uses; competition over land and indirect land use change. Bioenergy policy. Assessing energy efficiency of transformations and systems efficiency. Barriers. Standards and other policies.

Readings:
- (Tilman et al. 2009; Various 2009) (5 pages total)
- (O’Malley, Schleich, and Scott 2004, 25–93)
- (Doris, Cochran, and Vorum 2009, 1–43)

**Week 10: Future scenarios**
This week we explore plausible energy futures during two scenario workshop sessions. In the first sessions we will frame in broad terms the dimensions of the scenario landscape we will consider. In the second sessions we use systems analytical tools to develop simple alternative energy scenarios and discuss pathways.

Readings:
- (Dahl 2004, 22–37)
- TBA
**Week 11: Broadening the horizon: selected issues abroad & international cooperation**
Depending on students’ interest and background we may cover: e.g. EU energy policy, e.g. the German Energy Transition; e.g. Chinese energy policy. International institutions: UNFCCC, IEA, IRENA.

Readings:
- (Bradshaw 2014, 23–49)
- (Barrett 2010, 1–22)
- (Graaf 2013, 1–20 and 44–63 and 64–83)
- e.g. (Archer and Banks 2014) (webpage)
- e.g. (Schreurs et al. 2009)

**Week 12: Innovation, Research & Development**

Readings:
- (Grübler and Wilson 2013, 11–29 and 54–74)
- (Lester and Hart 2011, 29–55)

**Other, generally useful references that students are encouraged to consult during the course:**
- Read *Today in Energy* on a daily basis: [www.eia.gov/todayinenergy/](http://www.eia.gov/todayinenergy/)
- (Smil 2006) is a useful introduction into the various forms of energy and its significance for human life, beyond what you typically read in introductions by economists.
- *The Global Energy Assessment* (GEA Writing Team 2012) is large scale assessment of current international energy issues and links to sustainable development. Not a textbook, but offers some interesting vantage points.
- (Goldthau 2013) complements GEA, has more grip on selected topics; at times somewhat idiosyncratic.
- (Hunt and Evans 2009) is a collection of compact essays by energy economists, some quite technical.
- (Chu and Majumdar 2012) is a recent overview of new energy technologies. Reviews of this type, however, tend to age fairly quickly.
References


Various. 2009. “Responses to Tilman et Al.”
http://www.sciencemag.org/content/326/5958/1346.2.full.pdf.


Week 7: Electricity (part 2), Solar and other renewables (part 1)

Readings:
- (Everett et al. 2012, 315–371)
- (Griffin and Puller 2005, 1–28(23))
- (Joskow 2012) (17pp)
- (Warwick 2002)
- (Boyle 2012) - browsing

Week 8: Solar and other renewables (part 2); Carbon capture and storage (CCS)

Readings:
- (Boyle 2012) – browsing
- (Socolow 2005)
- (Van Noorden 2014) (1 page)

Week 9: Nuclear energy; Energy Efficiency

Readings:
- (Everett et al. 2012, 381–464)
- (Hamilton 2012, 40–75)
- (O’Malley, Schleich, and Scott 2004, 25–93)
- (Doris, Cochran, and Vorum 2009, 1–43)
Week 10: Bioenergy; Energy and Water nexus
Sources of biomass; fundamentals of biomass conversion technologies; competition between biomass uses; competition over land and indirect land use change. Bioenergy policy.

- (Tilman et al. 2009; Various 2009) (5 pages total)
- TBA

Week 11: Innovation, Research & Development; scenario workshop

Readings:
- (Grübler and Wilson 2013, 11–29 and 54–74)
- (Lester and Hart 2011, 29–55)

Week 12: Presentations of National Energy Plans
Student presentations.