PubAff 809: Introduction to Energy Analysis and Policy

Fall, 2019
University of Wisconsin
EnvSt-809, PubAff-809, URPL-809

3 credits
Room: 175 Science Hall
Tue., Thu. 9:30–10:45am

INSTRUCTOR

Professor Greg Nemet
La Follette School of Public Affairs
209 Observatory Hill Office Bldg. email: nemet@wisc.edu

Office hours, Fall 2019: Tuesday 11–noon, Thursday 11–noon, Room 209 La Follette. 
Expect some changes over the semester, announced at least 1 week in advance.

Teaching Assistant: TBD
Office hours: Mon. 11–12p, Wed. 4–5p, in Room 175A Science Hall

Grader: TBD

Course Description

Heightened concern about both the availability of energy resources and their environmental impacts has increased demand for leaders and analysts who can navigate the political, economic, scientific, and technological dimensions of these issues to inform critical policy decisions. Few are able to do so; and those who can provide valuable insight. In this course, you will develop an understanding of the dynamics of the global energy system, focusing on ways that public policy can affect these changes in societally beneficial directions. The perspective taken is that of a policy maker confronting decisions about the design and implementation of energy policy.

Learning Objectives

The goal of this course is for students to master a set of simple tools that will enable them to independently analyze problems, and be able to critically assess the work of others.

Students will become familiar with the breadth of energy-related problems at stake through development of methods, tools, and perspectives to analyze them. Topics covered span the full life cycle of energy production and use, including: material extraction, energy conversion, power generation, energy transportation, end use, and environmental impacts. The class surveys the types of energy used historically—from traditional biomass, to coal, to natural gas, to nuclear and renewables, as well as the increasingly diverse possibilities for future use discussed in current policy debates. Coverage also includes a historical review of regulation and policy in the energy industry. The geographic scope is international.

— PRELIMINARY VERSION —
The field of energy analysis and policy is inherently interdisciplinary. As such the class draws on a set of tools and perspectives derived from multiple disciplines, and includes students from diverse backgrounds. While students are welcome to take this course alone, this course is the introductory seminar for the Energy Analysis and Policy certificate program and as such provides preparation for subsequent courses in the program. It emphasizes the learning objectives of Knowledge, Applied Research, and Professional Skills within the LaFollette School of Public Affairs MPA and MIPA programs.

Requirements
The reading load for this class is typical for a graduate-level class; students are expected to read the required texts before class and participate actively in class discussions. Five problem sets will help develop analytical tools and methods. There will be a midterm exam and a final exam, both of which will include qualitative and quantitative questions. The course credit count of 3 is based on 45 Hours per Credit criterion, which equates to 9 hours of work per week for this class.

Please note that I do not distribute problem sets or solutions electronically—although I do accept completed problem sets electronically if necessary. Keep this in mind for your planning of research travel etc. during the semester.

Also note that I will work with students to accommodate absences for Eid-al-Adha, Rosh Hashana, Yom Kippur, and other religious holidays.

People with disabilities will be fully included in this course. Please inform me if you need any special accommodations in the curriculum, instruction, or assessments of this course to enable you to participate fully. Confidentiality of the shared information will be strictly maintained. Certain accommodations may require the assistance of the UW-Madison McBurney Disability Office - http://www.mcburney.wisc.edu/.

Evaluation
5% Class participation.
30% Five problem sets.
30% Midterm exam.
35% Final exam.

Readings
There are two required books for this course, which are available at the UW Bookstore:

All other readings are available on the Canvas website.

Academic Integrity
By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison’s community of scholars in which everyone’s academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the
integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to studentconduct.wiscweb.wisc.edu/academic-integrity/.

A Safe and Welcoming Classroom
Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals. Safe and welcoming classrooms encourage that continual and fearless sifting and winnowing by which alone the truth can be found by fostering an environment of free speech consistent with US law and safe from threats or violence. The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background people who as students, faculty, and staff serve Wisconsin and the world.

Mental Health Resources
School is a context where mental health struggles can be exacerbated. If you ever find yourself struggling, please do not hesitate to ask for help. The University and larger Madison community offer mental health resources to support a range of psychological issues in a confidential and safe environment. Confidential Counseling Services: University Health Service (UHS) for 24/7 confidential consultation, 608-265-5600 (option 9).

Instructor Bios
Gregory Nemet is Professor at the University of Wisconsin in the La Follette School of Public Affairs and the Nelson Institute Center for Sustainability and the Global Environment (SAGE). His research and teaching focus on improving analysis of the environmental, social, economic, and technical dynamics of the global energy system. This work is motivated by a general interest in understanding how to expand access to energy services while reducing environmental impacts. He teaches courses in energy systems analysis, governance of global energy problems, and international environmental policy. His research analyzes the process of technological change in energy and its interactions with public policy. He received a Romnes Faculty Fellowship in 2015 and an Andrew Carnegie Fellowship in 2017, which he used to write a book on how solar energy became cheap. He has been an author for the Intergovernmental Panel on Climate Change (IPCC) and the Global Energy Assessment (GEA). He received his doctorate in energy and resources from the University of California, Berkeley. His A.B. is in geography and economics from Dartmouth College.

TA and grader: TBD
Class Schedule and Reading List

1) September 5:

Cheap, clean, and reliable: three energy policy challenges
- Nemet: Foreword and Preface
- https://www.howsolargotcheap.com

optional:

2) September 10*:

* Optional math review session 3-4p.

U.S. energy policy 1973–2018

optional:

3) September 12:

EAP Tools 1: Units, magnitudes, and rates of change
- Nemet: Chapter 1 Introduction
- GEA, Energy Primer (section 4–5)
- Rubin 524–529, section 12.9.1 on IPAT.
- Rubin 681–683

optional:
• Holdren, Harte, and Koomey, “Constants and conversions.”


• Swartz, C. E. (1993). Used Math for the First Two Years of College Science, American Association of Physics Teachers. [Ch 1 and 2]

Problem set #1 handed out

4) September 17:

Historical development of the production and use of energy

• Nemet: Chapter 2 Answer

• GEA, Energy Primer (section 2–3)

optional:


5) September 19:

EAP Tools 2: Combustion

• GEA, Energy Primer (section 6–7)

• Rubin: Ch 1

• Rubin: Ch 2

recommended:


Problem set #1 due
6) September 24:

**EAP Tools 3: Power plant operation and efficiency**
- Nemet Chapter 3 Science
- Rubin: 5.1–5.4

*optional:*

7) September 26:

**Energy and development, Part I**
- GEA, Energy Primer (section 8)

*optional:*
- Rubin 15.4, 15.5

*Problem set #2 handed out*

8) October 1:

**Energy and development, Part II**
- Nemet Chapter 4 US
optional:

9) October 3:
Fossil fuels: coal and gas

optional:

Problem set #2 due

10) October 8:
EAP Tools 4: Levelized electricity costs for policy analysis
- Nemet Chapter 5 Japan
- GEA, Energy Primer (section 9, A.6)
- Rubin: Ch. 13

optional:
11) October 10:

**Nuclear power** (*Guest lecture Prof. Mike Corradini*)

- Rubin 2.6, 5.6.1,

*optional:*

- MIT Study, full report

*Problem set #3 handed out*

12) October 15:

**Transmission and distribution**

- Nemet Chapter 6 Germany

*optional:*


13) October 17:

**The electricity industry, markets, and restructuring**

optional:


Problem set #3 due

14) October 22:

Wind power

- Nemet Chapter 7 China
- Rubin 5.6.5

optional:


15) October 24:

MIDTERM EXAM
16) October 29:

Solar power
- Nemet Chapter 8 Local learning
- Rubin 5.6.7

optional:

17) October 31:

Mobility and transportation energy
- Rubin: Ch 3

optional:

18) November 5:

Discussion: how did solar energy become cheap?
- Nemet: review chapters 1–8 for discussion, focus on Chapter 2
- Nemet Chapter 9 Solar as a Model to Follow
19) November 7:

**Storage: Batteries, PHEVs, H₂, and fuel cells** (*Guest lecture: Will Sierzchula, Navigant Consulting*)


*optional:*


*Problem set #4 handed out*

20) November 12:

**EAP Tools 5: Resource depletion, Hubbert and Hotelling**

- Nemet Chapter 10 Applying the Model

*optional:*

21) November 14:

EAP Tools 6: Modeling technological change

- Rubin ch 15, (read 15.6 particularly closely)

optional:


Problem set #4 due

22) November 19:

Energy efficiency

- Nemet Chapter 11 Accelerating Innovation
- Rubin Ch 6.6–6.8, pp 262–275

optional:

23) November 21:

**EAP Tools 8: Climate change and the energy system**
- Rubin Ch 12

*optional:*

24) November 26

**Climate policy and low-carbon energy technologies**
- Letters in response to Hoffert et al.

*optional:*

*Problem set #5 out*

November 28:

*No class: Thanksgiving*
25) December 3:

Discussion: How Can Solar Energy be a Model to Follow?
- Nemet: review last 3 chapters (9–11) for discussion

Problem set #5 due

26) December 5:

International energy governance

optional:

27) December 10:

Review of semester

28) December 12:

FINAL EXAM
9:30-11:30am, 175 Science Hall.
ADDITIONAL RESOURCES:

Energy Journals

- Annual Review of Energy and the Environment
- Climatic Change
- Energy Economics
- Energy Policy
- Energy
- Energy Research & Social Science
- The Energy Journal
- Environmental Research Letters
- Environmental Science and Technology
- Issues in Science and Technology
- Nature Climate Change
- Renewable and Sustainable Energy Reviews
- Science
- Wiley Interdisciplinary Reviews: Energy and Environment

Energy Data

U.S. Energy Information Administration http://www.eia.doe.gov/
E.I.A. mapping http://www.eia.gov/state/maps.cfm
U.S. Bureau of Economic Analysis http://www.bea.gov/

Other Help

- Scientific notation http://www.nyu.edu/pages/mathmol/textbook/scinot.html