**PLAN 547 - Energy, Transportation & Land Use** **Fall 2016**

Syllabus & Schedule

Location: 210 Stone
Time: MW 11:15 AM – 12:30PM
Instructor: Nikhil Kaza
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Office hours: Tue 10 AM - 11 AM NE 314
Wed 1 PM - 2 PM NE Reading Room

## Objective

Recent interest in climate change, in general, as well as large projects like Ivanpah Solar Facility, Three Gorges Dam, Keystone XL, Hinkley Point, in particular, has focussed the attention of urban planners on the impacts of land use and transportation planning on energy use. This course seeks to explore the reciprocal connections between all aspects of energy (production/conversion, distribution and use), land use, environment and transportation. Evaluation of Federal, state and local policies on energy conservation, alternative energy sources are emphasised. At the end of the course, the students are expected to have learnt the skills to critically analyse impacts, interdependencies and uncertainties of various energy conservation measures and production technologies on different sectors, organisations and communities.

## Student Responsibilities

This class is meant for upper class undergraduates and beginning graduate students interested in issues of energy planning. There are no prerequisites for the class, however, you are required to be familiar with basic principles of energy, economics and public policy.

The course moves quickly and cover a lot of ground and techniques. It is your responsibility to keep up, learn the material and expertise. I expect that, on average, you will be working 10 hours/week for this class (including class time).

The main course website is https://sakai.unc.edu/portal/site/plan547-fall16. The course materials and assignments, announcements are all posted there. You should be familiar with using Sakai including submitting assignments and editing Wiki. If in doubt, please ask for help.

The librarian, Philip McDaniel has kindly created a library website for the course at http://guides.lib.unc.edu/plan547. This is a very useful resource that will list information of various data sources. It also has information on how to cite various resources.

You are responsible for reading the assigned readings **before** the class. The lectures proceed quickly and cover only the main topics and therefore are not exhaustive. Please be prepared to take notes as I do not usually provide powerpoint slides. It is your responsibility to keep up and/or request additional clarification on particular topics and techniques.

The weekly problem sets and assignments are meant to supplement lectures and discussion and build skills. You are expected to do research, make assumptions, find data, to figure out the problem sets. In other words, the problem sets as well as papers require problem framing, research and analysis.

My calendar is available at http://nikhilkaza.youcanbook.me. You can directly setup an appointment for a time that is mutually convenient. I will automatically get an email when you set

the meeting up, so please add a title as to the purpose of the meeting so that I can know it is you. Office hours and meetings are typically held in my office at Rm 314 New East.

Ashley, the TA, can be reached via email and you can seek her help outside her office hours by appointment. Her office hours will be held in the lobby of Stone Center.

Email to the class, TA and instructor is through Sakai Messaging tools to enable archival and automatic filtering. If you use a different mode (such as Outlook etc.), your email subject should include "PLAN547" in the subject line for easy filtering.

Course calendar is at http://tinyurl.com/plan547-fall15. You can subscribe to it using any calendar program such as Microsoft Outlook, Apple iCal, Mozilla Sunbird etc. I will keep this calendar up to date with dates for seminars on campus, guest lectures in class and field visits. I strongly urge you to subscribe to it and keep an eye on it. This calendar is also visible through Sakai. The dates mentioned in the attached schedule are tentative. The calendar, rather than the schedule below, is the most up-to-date calendar and should be viewed as definitive for due dates, topics, field trips and guest lectures.

You are accountable to the integrity of the work you submit. You are allowed and encouraged to consult with your peers and use the resources in the library and on the web for many of your assignments. However, all help (including your peers'), all verbatim text and images that are not your own, should be explicitly acknowledged and cited. Non-attribution carries severe penalties.

I am in the process of setting up various field visits as well as guest lectures by eminent experts and practitioners. Since these depend on others' schedules, the class schedule will adapt. Logistical details about the field visits will be provided later.

## Grading and Assignments

The course grade is based on weekly problem sets, quizzes, blog posts and two group projects.

On random days, a total of six, short quizzes are administered in the class. The top five count towards the grade. In total, these account for 10% of the grade. Absolutely, no make up quizzes.

Ten problem sets/homeworks account for 30% of the course grade and are to be completed individually. They are usually due on Wednesdays 5 PM. The problem sets provide practise for analytical techniques described in the class and in the textbook. You are expected to use spreadsheet and other statistical software for completing the problem sets. It is expected that you are familiar with these software, or would avail yourself of the resources on the web and at the university to troubleshoot. If you do not have access to a computer with required software, please let me or the TA know. A submission to a problem set is a single document (pdf). Emphasis is placed on the readability of your argument and solution. Points will be deducted, if the information is scattered in multiple places and files. I strongly suggest that you get familiar with writing math equations in electronic documents. All equations, data, tables, research and help should be cited. Follow a consistent citation style. I recommend UNC citation builder http://library.unc.edu/citationbuilder/. Also see http://writingcenter.unc.edu/handouts/why-we-cite/.

Two projects account for 50% of the grade. For these two projects, the students work in groups of two and each student should be part of two distinct groups. In general, graduate students pair up with other graduate students and undergraduates pair up with other undergraduates. Each of these papers are preceded by presentations, where your work will be critiqued by the rest of the class. Both presentations and reports are evaluated. The first project (20% of the grade) is critically evaluating an Environmental Impact Statement (EIS) of an energy project and think

carefully about the social and political implications of the project that the EIS does a poor job at addressing. The second project (30% of the grade) is a semester long project that is a consulting report to a local client. You will have to pick a narrow scope of work, perhaps collect your own data, figure out proper analytical methods and present your results and conclusions.

The remaining 10% of the grade is based on participation in the class, including attendance and engagement, and will be evaluated throughout the semester. Part of this participation grade is based on blog postings on Sakai. Each student is expected to post at least 5 blog posts during the semester (approximately once every two weeks). These blogs are short responses ($\sim$ 400 words) to a talk you attended on a topic related to the class, a newspaper article you read, a point you want to elaborate on or a critique you want to express. I expect that these posts are spread relatively evenly throughout the semester. The quality of each blog post is more important than the number of posts. These blogs serve as a out-of-class online interaction and are viewable by everyone in the class.

If you are a graduate student taking this class, you are expected to explore the issues in-depth and demonstrate your understanding of key issues in the field of energy planning. The papers and presentations will be graded differently than your undergraduate peers. H (High Pass) for graduate students is equivalent to A for undergraduate students.

Appropriate planning and time management significantly reduces stress at the end of the semester. Participation in class and timely completion of problem sets and other assignments is imperative.

## Textbooks and Readings

The following textbooks are required for this class:

- John Randolph and Gilbert M. Masters. *Energy for Sustainability: Technology, Planning, Policy*. Island Press, Washington, D.C., 1 edition, June 2008 (henceforth RM)

The textbook should be available at the Student Stores and is on reserve at the Undergraduate library. The textbook contains a lot of information on the technology aspects of various types of energy production and distribution. Proficiency of these materials is not the goal of this course, however, they should be understood to a sufficient depth that would allow for better land use, transportation and environmental planning and policies.

Other books that are recommended (not required) for purchase are:

- Daniel Sperling and Deborah Gordon. *Two Billion Cars: Driving Toward Sustainability*. Oxford University Press, USA, January 2009
- Ferdinand E Banks. *Energy economics: a modern introduction*. Kluwer Academic, Boston, 2000

Most of the other readings are derived from journal articles and book chapters. These readings are posted on the Sakai. Usual copyright notices apply.

# Very Tentative Schedule

# Production and Distribution of Energy

### 8/24(Wed) Patterns of Energy Use & Fundamentals of Energy Science

- RM Chapter 1, 2 & 4
- Vaclav Smil. *Energy in world history.* Westview Press, Boulder, 1994(Chapter 6)

### 8/29(Mon) Economic Analysis of Energy

- RM Chapter 5

### 8/31(Wed) Shale & Hydraulic Fracturing

- R. D. Vidic, S. L. Brantley, J. M. Vandenbossche, D. Yoxtheimer, and J. D. Abad. Impact of Shale Gas Development on Regional Water Quality. *Science*, 340(6134), May 2013. PMID: 23687049
- Vikram Rao. *Shale gas: the promise and the peril.* RTI Press, Research Triangle Park, NC, 2012 (Chapter 1 & 5)

### 9/05(Mon) No Class - Labor Day Holiday

### 9/07(Wed) Conventional Electricity Production

- RM Chapter 9 & 10

### 9/12(Mon) Field trip to Cogeneration Plant

### 9/14(Wed) Photovoltaics & Other Solar Power

- RM Chapter 11 & §12.8
- S. F Stromberg. Has the Sun Set on Solar Rights? Examining the Practicality of the Solar Rights Acts. *Natural Resources Journal*, 50:211–539, 2010

### 9/19(Mon) Operating and Siting a Solar Power Plant, Guest Lecture (Brandon Durham)

- http://www.mass.gov/eea/docs/doer/renewables/solar/solar-pv-guide.pdfhttp://www.mass.gov/eea/docs/doer/renewables/solar/solar-pv-guide.pdf
- Brownfield Re-powering (TBD)

### 9/21(Wed) Wind Energy

- RM Chapter 12 & §10.7
- Gijs Kuik, Bart Ummels, and Ralph Hendriks. Perspectives on wind energy. In K. Hanjali'c, K. Van de Krol, and A. Leki'c, editors, *Sustainable Energy Technologies*, pages 75–97. Springer Netherlands, Dordrecht, Netherlands, 2008
- Patrick DevineWright. Beyond NIMBYism: towards an integrated framework for understanding public perceptions of wind energy. *Wind Energy*, 8(2):125–139, April 2005

### 9/26(Mon) Biofuels and Alternatives

- RM Chapter 14

## Federal, State and Local Frameworks

### 9/28(Wed) Role of Public Utility Commissions - Guest Lecture (Kim Duffley, NCPUC)

- Robert Millward. The political economy of urban utilities. In Martin Daunton, editor, *The Cambridge Urban History of Britain*, chapter 11, pages 315–350. Cambridge University Press, Cambridge, 2001
- Harry M. Trebing. Public utility regulation: A case study in the debate over effectiveness of economic regulation. *Journal of Economic Issues*, 18(1):223–250, 1984

### 10/03(Mon) Land and Water Interactions with Energy

- N. Kaza and M. Patane. The land use energy connection. *Journal of Planning Literature*, 29(4):355–369, 2014
- Gordon Walker. Renewable energy and the public. *Land Use Policy*, 12(1):49–59, January 1995
- David Pimentel, Megan Herz, Michele Glickstein, Mathew Zimmerman, Richard Allen, Katrina Becker, Jeff Evans, Benita Hussain, Ryan Sarsfeld, Anat Grosfeld, and Thomas Seidel. Renewable Energy: Current and Potential Issues. *BioScience*, 52(12):1111–1120, December 2002
- US Department of Energy. Energy demands on water resources: Report to the congress on interdependency of energy and water. Technical report, Sandia National Laboratories, 2006

### 10/05(Wed) Energy Finance, Guest Lecture (Jeff Hughes, School of Government)

- TBD

### 10/10(Mon) Term paper 1 presentations

### 10/12(Wed) Term paper 1 presentations

### 10/17(Mon) Term paper 1 presentations

Each group will present for about 12-15 min. Four groups will present in each class. Presentations will be peer-graded. The presentation schedule will be posted on the Sakai later.

### 10/19(Wed) Energy Politics

- Timothy Mitchell. *Carbon democracy: political power in the age of oil.* Verso, London; New York, 2011 (Chapter 1 & 2)
- Jim Rossi. Trojan Horse of Electric Power Transmission Line Siting Authority, The. *Environmental Law*, 39:1015, 2009

### 10/24(Mon) Energy Poverty & Environmental Justice

- Shonali Pachauri and Daniel Spreng. Energy Use and Energy Access in Relation to Poverty. *Economic and Political Weekly*, 39(3):271–278, January 2004. ArticleType: research-article / Full publication date: Jan. 17-23, 2004 / Copyright © 2004 Economic and Political Weekly
- Noriko Ishiyama. Environmental Justice and American Indian Tribal Sovereignty: Case Study of a Land–Use Conflict in Skull Valley, Utah. *Antipode*, 35(1):119–139, 2003
- M. Schweitzer. Nonenergy Benefits from the Weatherization Assistance Program: A Summary of Findings from the Recent Literature. Technical Report ORNL/CON-484, ORNL Oak Ridge National Laboratory (US), April 2002

### 10/26(Wed) Energy Based Economic Development, Guest Lecture (Sara Lawerence, RTI)

- Carley, S. and Lawerence, S. *Energy-Based Economic Development - How Clean Energy can Drive Development and Stimulate Economic.* Springer, New York, 2014(Chapters 1 & 7)

## Energy Consumption

### 10/31(Mon) Residential Energy Consumption

- RM Chapter 6

### 11/02(Wed) Simulating Commercial Building Energy Consumption - eQuest Tutorial

- James Hirsch & Associates, *eQuest Tutorial*(reference only)

**11/07(Mon) Green Buildings, Guest Lecture/Field Trip (TBD)**

**11/09(Wed) Interactions of Land Use and Transportation**

- TRB and BEES. Driving and the built environment: Effects of compact development on motorized travel, energy use, and co2 emissions. Special Report 298, National Research Council of the National Academies, Washington, D.C., 2009 (Chapters 5 & 6)

**11/14(Mon) Transportation Energy use**

- RM Chapter 13

**11/16(Wed) Alternative Transportation Technologies**

- Daniel Sperling and Deborah Gordon. *Two Billion Cars: Driving Toward Sustainability.* Oxford University Press, USA, January 2009 (Chapter 4, 5 & 9)

**11/21(Mon) Energy in Freight**

- D. McCollum, G. Gould, and D. Greene. Greenhouse gas emissions from aviation and marine transportation: Mitigation potential and policies. Technical report, Pew Center on Global Climate Change, 2009
- Fatumata Kamakaté and Lee Schipper. Trends in truck freight energy use and carbon emissions in selected OECD countries from 1973 to 2005. *Energy Policy*, 37(10):3743–3751, October 2009
- Rommert Dekker, Jacqueline Bloemhof, and Ioannis Mallidis. Operations research for green logistics – an overview of aspects, issues, contributions and challenges. *European Journal of Operational Research*, 219(3):671–679, June 2012

**11/23(Wed) No class - Thanksgiving Break**

**11/28(Mon) Local Energy Planning**

- RM Chapter 15 & 18
- E. Sussman. Reshaping municipal and county laws to foster green building, energy efficiency, and renewable energy. *NYU Environmental Law Journal*, 16:1, 2008
- D. Peterson, E. Matthews, and M. Weingarden. Local energy plans in practice: Case studies of austin and denver. Technical Report NREL/TP-7A20-50498, National Renewable Energy Laboratory, Golden, CO, 2011

**11/30(Wed) Final paper group presentations**

**12/05(Mon) Final paper group presentations**

**12/07(Wed) Final paper group presentations**

Each group will present for about 10-15 min. Four groups will present in each class. The presentation schedule will be posted on the Sakai later.