

## Syllabus &amp; Schedule

Location: 209 Stone

Instructor: Nikhil Kaza

email: nkaza [at] unc [dot] edu

Office hours: Tue 10 AM -11 AM NE 315

Time: MW 11:15 AM – 12:30PM

TA: Joseph Seymour

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Thu 1 PM-2 PM NE Reading Room

## Objective

Recent interest in climate change, in general, as well as large projects like Keystone XL. 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-fall15>. 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 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://meetme.so/nikhilkaza>. 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 315 New East.

Joseph, the TA, can be reached via email and you can seek his help outside his office hours by appointment. He holds his office hours in the New East reading room.

Email to the class, TA and instructor is through Sakai 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.

In addition, you are required to attend any three of the four Energy and Environment lunches sponsored by Institute for the Environment. The first one is Sep 9 by Prof. Ashlynn Stillwell at Noon on Wednesday Sep 9, on ‘Energy & Water’. The others are about ‘Financing Waste to Value Projects’, ‘A Reporters View on National Energy Issues’ & ‘Data Analytics in the Energy Industry’. More details will follow and will be posted on the Calendar. If you are unable to attend these lunches (free food!), please find acceptable substitute events on campus and share them with class via email and in class.

## Grading and Assignments

The course grade is based on four problem sets, quizzes, blog posts and three 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.

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 Udo (reisinge (at) unc (dot) edu) know. In addition, I will arrange of licenses for Tableau software that you will use to visualise some datasets.

Each of the problem sets accounts for 10% of the grade. 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/>.

For the three projects, the students work in groups of two and each student should be part of three 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. Each of the term papers account for 15% of the grade. Both presentations and reports are evaluated.

The remaining 5% 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, 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 is available at the University Bookstore 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

### Introduction & Administrative Details (Aug 19)

- RM Chapter 1

## Production and Distribution of Energy

### Patterns of Energy Use & Fundamentals of Energy Science (Aug 24)

- RM Chapter 2 & 4
- Vaclav Smil. *Energy in world history*. Westview Press, Boulder, 1994(Chapter 6)
- Monthly Energy Review (July 2015) (Sections 1 & 2)
- Executive Summary of the Annual Energy Outlook 2015

### Economic Analysis of Energy (Aug 26)

- RM Chapter 5

### Conventional Energy Production (Aug 31)

- RM Chapter 9 & 10

### Field trip to Cogeneration Plant (Sep 2)

### Shale Gas & Hydraulic Fracturing (Sep 9)

- 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)

### Photovoltaics & Other Solar Power (Sep 14)

- 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

### Biofuels and Alternatives (Sep 16) - Guest Lecture (David Dayton, RTI)

- RM Chapter 14

## Wind Energy (Sep 21)

- RM Chapter 12 & §10.7
- Gijs Kuik, Bart Ummels, and Ralph Hendriks. Perspectives on wind energy. In K. Hanjalić, K. Van de Krol, and A. Lekić, 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

## Federal, State and Local Frameworks

### Land and Water Interactions with Energy (Sep 23)

- 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

### Energy Politics (Sep 28)

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

### Group presentations (Oct 5 and 7)

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

## Energy Consumption

### Residential Energy Consumption (Oct 19) (Guest Lecture: Aaron Lubeck, Trinity Design Build)

- RM Chapter 6

## Simulating Building Energy Consumption - eQuest Tutorial (Oct 21)

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

## Transportation Energy use (Oct 26)

- RM Chapter 13

## Alternative Transportation Technologies (Oct 28)

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

## Group presentations (Nov 2 and 4)

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

## Emerging issues in Energy & Transportation (Nov 9)

TBD

## Energy in Freight (Nov 11)

- 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

## Operational Sustainability (Nov 16) (Jeff Dunbar, Sustainability Director, Verdani Partners)

## Interactions of Land Use and Transportation (Nov 17)

- 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)

## Energy Based Economic Development (Nov 23) (Sara Lawrence, RTI)

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

## **Group Presentations (Nov 30 and Dec 2)**

Each group will present for about 15 min. The presentation schedule will be posted on Sakai later.