ENEC/PLAN 547: Energy, Transportation & Land use

Fall 2021

Class Room: Dey 203
Time: 3:30 PM - 4:50 PM
Instructor: Nikhil Kaza
Office Hours: 2 PM -3 PM (Thu) or by appt
Email: nkaza@unc.edu

Course Description & Objectives

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.

Prerequisites & Preparation

This course does not require any prior preparation apart from basic physics and economics. It does extensively use spreadsheets, so experience in using them is helpful.

The course moves quickly and has voluminous readings. The course requires vigorous in-class participation, ability to digest, interpret and critically evaluate large amount of technical literature and extensive out-of-class research.

Course Policies

The following set of course policies is not meant as an exhaustive list. If in doubt, ask for permission and clarification.

COVID-19

We are expected to meet in person for most of the course. Regardless of vaccination status, everyone is expected to wear a mask in the classroom in accordance with the University Community Standards. We will revisit this policy as things change.

If the pandemic gets worse, we will meet online using Zoom https://unc.zoom.us/j/99556045272

On days, we have guest lectures, I am asking the guests to lecture via zoom for safety and convenience. On those days we will meet online at the above zoom link.

Grading

- **30%** (Mostly) Weekly homeworks
- **20%** Group project 1 (Critically evaluate an Environmental Impact Statement)
- **30%** Group project 2 (Consulting report to a client)
- **10%** Pop quizzes (best 5 of 6)
- **10%** Class participation

It is your responsibility to show to the instructor/grader how you arrived at the conclusions that you did.

Assignments, including homeworks, are submitted in Sakai usually due on Fridays by 5PM. Please do not send them by email.

The homework problem sets provide practise for analytical techniques described in the class and in the textbook. You are expected to use spreadsheets 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 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. All tables should be sourced.

Follow a consistent citation style. I recommend UNC citation builder. Also see, the Writing Center's advice.

Every week, students do a peer grading of a random peer's homework submission. The point really is not to grade the HW but to learn how others are approaching the material.

For the group projects, graduate students in the class are expected to explore the issues in-depth and demonstrate your understanding of key issues in the field of energy planning. Usually, graduate students team up with other graduate students for the group projects. 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.

Attendance

Students are responsible for keeping up with the material this course covers. During the pandemic, it is imperative that you do not attend the class, especially if you are symptomatic or had an exposure. You do not need to seek permission to miss classes. This is a graduate class and I expect that you will act responsibly towards yourself and your classmates.

Assigned Readings

The following textbooks are required for this class:

- Randolph, J. and G. M. Masters (2018). Energy for Sustainability, Second Edition: Foundations for Technology, Planning, and Policy. En. Island Press.

(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:

- Luque-Ayala, A. and J. Silver, ed. (2018). Energy, Power and Protest on the Urban Grid: Geographies of the Electric City. 1 edition. S.l.: Routledge.
- Mitchell, T. (2011). Carbon Democracy: Political Power in the Age of Oil. London; New York: Verso.
- Stokes, L. C. (2020). Short Circuiting Policy: Interest Groups and the Battle Over Clean Energy and Climate Policy in the American States. New York, NY: Oxford University Press.

Most of the other readings are derived from journal articles and book chapters. These readings, excluding the chapters from the textbook, are posted on the Sakai. Usual copyright notices apply. **Students should read the material before class and be prepared to discuss it in class.**

E-mail & Calendar

Sakai messaging system is the preferred way to communicate with me. If you insist on sending messages using your email client, please use "PLAN547" in the subject line, so that it is not trapped by the aggressive spam filtering, I implement. I will do the same, in my emails to you.

The class has a group email list. Please be considerate to your colleagues.

The course calendar should list the most up to date information about topics, guest lectures, field trips, due date etc. Please pay attention to it and subscribe in your calendaring software. The schedule described in this document is very tentative.

You can set up an appointment on my calendar, if you want to meet outside office hours.

Academic Integrity

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.

Schedule (Tentative)

Preliminaries

Aug 19 (Thu): Introduction

- RM Chapters 1 & 4
- Smil, V. (1994). Energy in World History. Boulder: Westview Press.

Aug 24 (Tue): Basic Economic Analyses

- RM Chapter 5

Production, Transmission & Distribution of Energy

Aug 26 (Thu): Environmental Impacts of Energy Production

- Kaza, N. and M. P. Curtis (2014). "The Land Use Energy Connection". In: Journal of Planning Literature 29.4, pp. 355–369.
- Pimentel, D., M. Herz, M. Glickstein, et al. (2002). "Renewable Energy: Current and Potential Issues". In: BioScience 52.12, pp. 1111–1120.
- Trainor, A. M., R. I. McDonald, and J. Fargione (2016). "Energy Sprawl Is the Largest Driver of Land Use Change in United States". In: PLOS ONE 11.9, p. e0162269. DOI: 10.1371/journal.pone.0162269.
- Ishiyama, N. (2003). "Environmental Justice and American Indian Tribal Sovereignty: Case Study of a Land Use Conflict in Skull Valley, Utah". En. In: Antipode 35.1, pp. 119–139. DOI: 10.1111/1467-8330.00305.

Aug 31 (Tue), Sep 2 (Thu): Conventional Electricity Production & District Energy Systems

- RM Chapters 9 & 10
- King, M. (2012). Community Energy: Planning, Development & Delivery. Westborough, MA: International District Energy Association.

Sep 7 (Tue): Campus Energy Planning (Guest Lecture: Lew Kellogg)

Sep 9 (Thu): Photovoltaic & Other Solar

- RM Chapters 11 & § 12.1 & 12.4
- Stromberg, S. F. (2010). "Has the Sun Set on Solar Rights? Examining the Practicality of the Solar Rights Act." En. In: NATURAL RESOURCES JOURNAL 50.1, p. 45.

Sep 14 (Tue): Siting Solar & Design (Guest Lecture: Gabe)

- MADOER (2015). Clean Energy Results: Question & Answers Ground Mounted Solar Photovoltaic Systems. Tech. rep. Boston,MA: Massachusetts Department of Energy Resources and Massachusetts Department of Environmental Protection and Massachusetts Clean Energy Center. URL: https://www.mass.gov/files/documents/2016/08/rn/solar-pv-guide.pdf.

Sep 16 (Thu): Machine learning Applications in Solar (Guest Lecture: Kyle Bradbury)

- Malof, J. M., K. Bradbury, L. M. Collins, et al. (2016). "Automatic Detection of Solar Photovoltaic Arrays in High Resolution Aerial Imagery". In: Applied Energy 183, pp. 229–240. DOI: 10.1016/j.apenergy.2016.08.191.
- Camilo, J., R. Wang, L. M. Collins, et al. (2018). "Application of a Semantic Segmentation Convolutional Neural Network for Accurate Automatic Detection and Mapping of Solar Photovoltaic Arrays in Aerial Imagery". In: arXiv:1801.04018 [cs]. arXiv: 1801.04018 [cs]. URL: http://arxiv.org/abs/1801.04018 (visited on Aug. 15, 2018).

Sep 21 (Tue): Wind Energy

- RM Chapters 12

Sep 23 (Thu): Biofuels & Alternatives

- RM Chapters 14

Sep 28 (Tue): Shale & Unconventional Oil

- Rao, V. (2012). Shale Gas: The Promise and the Peril. Research Triangle Park, NC: RTI Press.
- Maugeri, L. (2012). Oil: The Next Revolution. En. Discussion Paper 2012-10. Belfer Center for Science and International Affairs,: Harvard University. URL: https://www.belfercenter.org/publication next-revolution (visited on Aug. 14, 2018).
- Vidic, R. D., S. L. Brantley, J. M. Vandenbossche, et al. (2013). "Impact of Shale Gas Development on Regional Water Quality". En. In: Science 340.6134. DOI: 10.1126/science.1235009.

Sep 30 (Thu), Oct 5 (Tue), Oct 7 (Thu): Project 1 Presentations

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Energy Politics, Policy & Institutions

Oct 12 (Tue): Role of Public Utility Commissions (Guest Lecture: Jeff Hughes)

- Trebing, H. M. (1984). "Public Utility Regulation: A Case Study in the Debate over Effectiveness of Economic Regulation". In: Journal of Economic Issues 18.1, pp. pp. 223-250. URL: http://www.jstor.org/stable/4225419.

Oct 14 (Thu): Integrating spatial and energy planning

- Pasqualetti, M. J., T. E. Jones, L. Necefer, et al. (2016). "A Paradox of Plenty: Renewable Energy on Navajo Nation Lands". English (US). In: Society and Natural Resources, pp. 1–15. DOI: 10.1080/08941920.2015.1107794.
- Shuford, S., S. Rynne, and J. Mueller (2010). Planning for a New Energy and Climate Future. American Planning Association.

Oct 19 (Tue): Energy Politics

- RM Chapters 17 & 18

Oct 26 (Tue): Evolution of North Carolina Clean Energy Policy (Guest Lecture: Daniel Brookshire)

Consumption, Conservation & Efficiency

Oct 28 (Thu): Transportation energy use

- RM Chapter 13

Nov 2 (Tue): Electrification of Transportation

- TBD

Nov 4 (Thu): Interactions of Land Use and Transportation

- TRB and BEES (2009). Driving and the Built Environment: Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions. Special Report 298. Chapters 5 & 6. Washington, D.C.: National Research Council of the National Academies.

Nov 9 (Tue): Residential Energy Consumption

- RM Chapter 6

Nov 11 (Thu): Green buildings

- Kok, N., M. McGraw, and J. Quigley (2012). "The Diffusion over Time and Space of Energy Efficiency in Building". In: The Annals of Regional Science 48.2, pp. 541–564. DOI: 10.1007/s00168-011-0494-9.
- Retzlaff, R. C. (2009). "The Use of LEED in Planning and Development Regulation". In: Journal of Planning Education and Research 29.1, pp. 67–77. DOI: 10.1177/0739456X09340578.
- Simons, R., E. Choi, and D. Simons (2009). "The Effect of State and City Green Policies on the Market Penetration of Green Commercial Buildings". In: The Journal of Sustainable Real Estate 1.1, pp. 139–166. URL: http://ares.metapress.com/content/75N6412448G4Q117 (visited on Mar. 04, 2012).

Nov 16 (Tue): Commercial/Institutional energy consumption/EQUEST tutorial

- TBD

Nov 18 (Thu), Nov 23 (Tue), Nov 30 (Tue): Project 2 Presentations

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