E.J. Bloustein School of Planning and Public Policy, Rutgers University, Revised 9/4/24

34:833:680:0 Energy Sustainability and Policy

Course Information:
Thursdays 9:00 am to 12:00 pm
Fall 2024
Civic Square Building, Room 170

Instructor Information:
Dr. Abigail Andrews (she/her)
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Civic Square Building, Room 162
Office Hours: Mondays 10:00-11:00 and Thursday 2:30-4:00

Course Description:
Energy planning and policy are essential for a sustainable future for both people and the planet. Our heavy reliance on fossil fuels is a major driver of global climate change. Energy is a key component in local, state, national, and international planning and public policy. These policies and plans influence energy supply and demand at all levels, with strategies and programs adopted by the public and private sectors directly affecting our lives. Furthermore, energy generation, distribution, consumption, and security have extensive economic, environmental, and equity implications. Understanding these impacts will help advance sustainable development and mitigate global climate change as will the development and implementation of sustainable energy plans and policies.

This graduate seminar will explore energy planning and policies through an analytical and practical approach. The course will evaluate supply and demand, policy and institutions, and energy innovation through the lens of energy security, environmental impact, and equity. The course is designed to provide students with insights into the energy systems, infrastructures, markets, and technologies that shape energy sustainability policy. Each session will include student lightning talk presentations, 45 to 60 minutes of lecture, and discussions on assigned readings.

Learning Objectives:
- Learn about the role and potential of policy and planning to shape the energy system.
- Develop the tools to understand the data and trends for energy supply and demand.
- Understand how security, environment, and economics influence energy policy and systems.
- Evaluate the economic, environmental, and equity attributes of various energy systems, infrastructures, markets, and technologies.
- Identify key points and issues for future energy policy, planning, and management.

Core Competencies:
Upon successful completion of this course, students will possess the following core competencies for the MPP degree:

- Primary core competency: To analyze, synthesize, think critically, solve problems & make evidence informed decisions in a complex and dynamic environment.
    - By understanding quantitative and qualitative approaches to energy policy in *Problem Sets, Policy Memos, and Final Paper.*
    - By applying economic, environmental, security, and equity analysis to energy policy in *Problem Sets, Policy Memos, Lighting Talks, Discussions, and Final Paper.*
    - By synthesizing and critiquing research and analysis in existing and potential energy policy in the *Final Paper*.
- Secondary core competency: To communicate and interact productively and in culturally responsive ways with a diverse and changing workforce and society at large and to participate in, and contribute to, the policy process.
    - By identifying economic, environmental, security, and equity challenges in the energy system in *Discussions*.
    - By writing *Policy Memos* and giving *Lighting Talks* for diverse audiences.
    - By providing the quantitative tools to analyze the impacts of various energy policies in *Problem Sets*.

Prerequisites:
Students from all departments and programs are welcome. No formal prerequisites are required or necessary.

Course Website:
https://canvas.rutgers.edu/

Textbook:
No textbook required. Weekly readings will be posted online on Canvas by 12pm Friday. You will be expected to understand and remember the basic ideas and principles of the readings, and to demonstrate your understanding of the readings during the discussions in class and through assignments. In addition, I encourage you to follow energy policy issues in the news and think about how they relate to the course.

Grading:
A rubric with instructions and evaluation criteria will be made available on Canvas for each assignment.

- Homework Assignments 30%
- Lighting Talk Presentation 25%
- Final Paper and Presentation 30%
- Course Attendance and Participation 15%

Coursework:
Policy Papers: Each student will submit three short policy paper, 600- to 800-word, throughout the course. The policy paper will be a summary of the assigned readings and your recommendations on how to implement a related policy. Each paper is due on Canvas at 11:59 PM the day before class.

Technical Problem Sets: Each student will submit three technical problem sets throughout the course. Each technical problem set will be based on the discussion in class. Each paper is due on Canvas at 11:59 PM the day before class.

Lighting Talks: Students will be asked to introduce and facilitate a short discussion for two "lighting topics" during the quarter. Students should identify an article related to the class meeting topic. By 11:59 PM Monday before the class, please send me the article as a PDF and 2-3 questions for the class to discuss, so I can distribute them to the class Tuesday morning. Students should prepare a short 5-minute PowerPoint presentation summarizing the article then lead a 15-minute discussion of the article and the discussion questions. You will be graded on your effort and preparation on your presentation of a lighting topic and your effort and engagement during your peers lighting topics.

Final Paper: Each student will prepare a 5000-word final paper on topics related to the class due December 17th. Paper topic and style guidelines will be provided during the semester. Students will submit a paper abstract, annotated bibliography, and draft throughout the semester. The final paper should synthesize what you learn over the semester by considering a planning, policy, or technological innovation for a private entity or any level of government.

Final Presentation: Each student will give a 15-minute presentation on their final paper topic during the final Class December 5th.

Course Attendance and Participation: Each student will be expected to attend course lectures and engage in discussions. I also recognize that students may need to miss class for a variety of personal, cultural, and professional reasons. When you must miss class please notify me so that we can discuss make-up assignments.

Course Protocols:

- Assignments are due by 11:59 PM the day before class via Canvas. An assignment schedule is available in the syllabus and on Canvas.
- Assignments submitted late will incur a penalty of 10% of total points per day late without prior approval from the instructor.
- All files submitted should be a PDF with the following naming convention: Lastname_Date_AssignmentTitle.pdf (e.g., Andrews_Oct31_ProblemSet2).
- Assignments should be written in Times New Roman, 12-pt font, 1.5 spacing, justified text.
- You may use generative AI programs (e.g., tools like ChatGPT) to help generate ideas and brainstorm. However, please note that the material generated by these programs may be inaccurate, incomplete, or otherwise problematic. Beware that use may also stifle your own independent thinking and creativity. You may not submit any work generated by an AI program as your own. If you include material generated by an AI program, it should be cited like any other reference material (with due consideration for the quality of the reference, which may be poor).
- Individual submissions are required. While you may work with other students in solving the problem the written response you hand in must be your own. Please list any

collaborators in the heading of your document. Any collaborators must understand and be able to explain the process.

- In order to avoid plagiarism and gain a deeper understanding of academic writing, it is imperative to use proper and consistent citations. For this class, please use *APA 7th edition*. There are several good basic writing guides available online. I recommend Purdue's online writing lab. Please let me know if you have any questions.
- The syllabus, schedule, assignments, and readings are subject to change. A revised syllabus will be provided if this occurs.
- I will reply to all emails within 24-hours of receiving them. If I am unable to give a robust reply to your email within the time frame I will let you know and provide you a time you can expect a full reply.

Respect for diversity and commitment to inclusion:
It is my intent that students from all diverse identities, backgrounds, perspective, and situations be well served in this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength, and benefit. It is my intent to present materials and activities that are respectful of diversity, which may include but is not limited to: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, religion, political affiliation, and culture. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our course meetings conflict with your religious or cultural events, please let me know so that we can make arrangements for you.

All people have the right to be addressed and referred to in accordance with their personal identity. In this course, students will have the chance to indicate the name that they prefer to be called and, if they choose, to identify pronouns with which they would like to be addressed. I use she/her pronouns for myself, and you may address me as "Dr. Andrews" or "Abigail" in email or verbally.

Students with disabilities:
Students with disabilities are encouraged to contact the instructor so that appropriate accommodations can be made. See also https://ods.rutgers.edu/ for more information. Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation.

If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: https://ods.rutgers.edu/students/registration-form

Academic integrity:
Rutgers' academic integrity policy will be strictly enforced in this course. Failure to comply with this policy can result in severe sanctions up to and including expulsion from the University. See the full text at http://nbacademicintegrity.rutgers.edu/home/academic-integrity-policy/. The

following excerpt serves as a reminder that the student must: properly acknowledge and cite all use of the ideas, results, or words of others; properly acknowledge all contributors to a given piece of work; make sure that all work submitted as their own in a course or other academic activity is produced without the aid of unsanctioned materials or unsanctioned collaboration; obtain all data or results by ethical means and report them accurately without suppressing any results inconsistent with their interpretation or conclusions; and treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress; and uphold the canons of the ethical or professional code of the profession for which they is preparing.

Schedule of Classes

WEEK	DATE	LECTURE TOPIC
		Part I: Background
1	Sep. 5	*History of Energy and Sustainability Policy*
2	Sep. 12	*Energy, The Science and Physics of Energy*
3	Sep. 19	*Global Sustainable Development* Guest Lecture: Dr. Shwom Professor, Human Ecology
		Part II: Supply and Demand
4	Sep. 26	*Renewable Resources and Distributed Generation* Guest Lecture: Dr. Rodgers Assistant Professor, Supply Chain Management
5	Oct. 3	*Understanding Consumption and Managing Energy Demand*
6	Oct. 10	*Siting Renewables*
		Part III: Policy and Institutions
7	Oct. 17	*Regulation and Ownership* Guest Lecture: Senator Gordon Former NJ State Senator, Commissioner of the Board of Public Utilities
8	Oct. 24	*Energy Security*
9	Oct. 31	*The "Grid"*
10	Nov. 7	*Energy Markets* Guest Lecture: Dr. Mieth Assistant Professor, Industrial and Systems Engineering
11	Nov. 14	*Energy, Economic, and Environmental Analysis*
		Part IV: Emerging Topics
12	Nov. 21	*Decarbonization*
13	Nov. 26	*Climate Governance* Guest Lecture: Dr. Braneon | Dr. Elszasz Columbia Climate School | Mayor's Office of Climate & Environmental Justice
14	Dec. 5	*Final Student Presentations*

Schedule of Topics, Objectives, and Readings

Part I: Background

Week 1 Sep. 5 Introduction and Overview

This class will include an introduction of the instructor, class syllabus and logistics. Students will be asked to introduce themselves and describe their interest in energy, sustainability, and policy. Discussion of the history of energy and sustainability policies and how it may impact current energy planning at the state, local, federal, or global level.

Objectives:

- Determine how the history of energy and sustainability policies help shape current energy and sustainability policies and planning.
- Assess how the public policy and planning process fits in the context of energy.
- Evaluate the tools to implement energy policy.
- Understand the history and context of New Jersey, United States, and global energy policy.

Required Readings:

- Sovacool, B. (2016). Maxims for informed energy analysis and policy. In R. Heffron & G. F. M. Little (Eds.), *Delivering Energy Law and Policy in the EU and the US: A Reader* (pp. 5–11). Edinburgh University Press. [available for free online at Rutgers library]
- Cole, D. and Grossman, P. (2016). A Brief History of US Energy Policy. In R. Heffron & G. F. M. Little (Eds.), *Delivering Energy Law and Policy in the EU and the US: A Reader* (pp. 57–60). Edinburgh University Press. [available for free online at Rutgers library]
- Lipton, E. (2022, November 29). With Federal Aid on the Table, Utilities Shift to Embrace Climate Goals. *New York Times*. https://www.nytimes.com/2022/11/29/us/politics/electric-utilities-biden-climate-bill.html
- Tollefson, J. (2022). What the war in Ukraine means for energy, climate and food. *Nature*, 604, 232-233. https://doi.org/10.1038/d41586-022-00969-9
- **Optional:** Gates, B. (2019, August 27). Here's a question you should ask about every climate change plan. *gatesnotes.com*. https://www.gatesnotes.com/A-question-to-ask-about-every-climate-plan

Week 2 Sep. 12 Understanding Energy

This class will serve as a primer on what is energy, the forms and sources of energy, energy flow, the physics of energy, and energy conversions.

Objectives:

- Understand the basic science and physics of energy.
- Overview of the global energy flow.

- Identify various energy sources and what energy sources may shape a more sustainable future.
- Perform simple energy unit conversions.
- Appreciate the regional variations in energy resource availability and economic composition.

Required Readings:

- Cullen, J. M., & Allwood, J. M. (2010). The efficient use of energy: Tracing the global flow of energy from fuel to service. *Energy Policy*, 38(1), 75–81. https://doi.org/10.1016/j.enpol.2009.08.054
- Fanchi, J. R. (2023). *Energy in the 21st Century: Energy in Transition* (5th Edition). World Scientific. Chapter 1 (available for free online at Rutgers library)

Week 3 Sep. 19 Pursuing Sustainable Development

This class will provide students with an understanding of global sustainable development efforts and a strategic framework for linking knowledge and action for sustainable development.

This class will include a guest lecture from Professor Shwom on the politics of getting energy policy made and the role of non-government organizations (NGOs) at 10:00 am.

Objectives:

- Understand the three pillars of sustainable development.
- Evaluate economic growth and inequality in the global energy sector.
- Develop a framework for evaluating sustainability.
- Acknowledge the imbalance of payments for energy-rich and energy-poor countries.
- Discuss if the energy transition can be both fast and efficient? Fast and fair?

Required Readings:

- The General Assembly. (2015). Transforming Our World: The 2030 Agenda for Sustainable Development. https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E. Pages 1-18
- IPCC. (2018). Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.* https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SPM_version_report_LR.pdf
- Diffenbaugh, N. S., & Burke, M. (2019). Global warming has increased global economic inequality. *Proceedings of the National Academy of Sciences*, 116(20), 9808–9813. https://doi.org/10.1073/pnas.1816020116
- Schneider, F., Tribaldos, T., Adler, C., Biggs, R., De Bremond, A., Buser, T., Krug, C., Loutre, M., Moore, S., Norström, A. V., Paulavets, K., Urbach, D., Spehn, E., Wülser, G., & Zondervan, R. (2021). Co-production of knowledge and sustainability transformations: a strategic compass for global research networks. *Current Opinion in Environmental Sustainability*, 49, 127–142. https://doi.org/10.1016/j.cosust.2021.04.007

- Ostrom, E. (2009). A General Framework for Analyzing Sustainability of Social-Ecological Systems. *Science*, 325(5939), 419–422. https://doi.org/10.1126/science.1172133
- Dunlap, A., & Arce, M. C. (2021). The Supply Side of Climate Policies: Keeping Unburnable Fossil Fuels in the Ground. *Global Environmental Politics*, 22(4), 1–14. https://doi.org/10.1162/glep_a_00691

Part II: Supply and Demand

Week 4 Sep. 26 Renewables

This class will focus on renewable energy systems, their significance and implementation, barriers to renewable growth, and emerging technologies.

This class include a guest lecture from Professor Rodgers at 10:30 am.

Objectives:

- Understand the basic principles, operations, and applications of renewable technologies.
- Evaluate the barriers for renewable energy expansion.
- Introduce microgrids, distributed energy resources, and other emerging technologies.

Required Readings:

- Way, R., Ives, M. C., Mealy, P., & Farmer, J. D. (2022). Empirically grounded technology forecasts and the energy transition. *Joule*, 6(9), 2057–2082. https://doi.org/10.1016/j.joule.2022.08.009
- Renewables 2020 Global Status Report. Executive Summary and Chapter 1.
- Stefes, C., & Laird, F. N. (2010). Creating path dependency: the divergence of German and U.S. renewable energy policy. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1667615
- Interstate Renewable Energy Council (IREC). (2017). *Charging Ahead: Energy Storage Guide for Policymakers*. https://irecusa.org/resources/charging-ahead-energy-storage-guide-for-policymakers/
- Johnson, S. K. (2019, June 11). *US report finds sky is the limit for geothermal energy beneath us*. Ars Technica. https://arstechnica.com/science/2019/06/report-geothermal-could-power-up-to-16-of-us-grid-by-2050/
- MacKay, D. J. C. (2009). Sustainable energy: Without the Hot Air. UIT Cambridge. https://withouthotair.com/ Ch: 4, 6, 8, 10, 16, 18 (skim)

Week 5 Oct. 3 Demand and Consumption

This class will evaluate energy use in the industrial, building, and transportation sector. In addition to assessing current and future energy demand and how planners and policy makers may manage and forecast demand.

Objectives:

- Understand energy use and efficiency in industrial, building, and transportation sectors.

- Discuss the role of buildings as the largest contributor to climate change and the role of energy use from building's operational and embodied energy.
- Identify key factors of energy demand (e.g., economic growth, technological innovation, societal behavior) and model future energy demand under different scenarios.
- Evaluate various demand-side management programs such as incentives, regulations, and technologies.

Required Readings:

- Jenn, A., Springel, K., & Gopal, A. R. (2018). Effectiveness of electric vehicle incentives in the United States. *Energy Policy*, 119, 349–356. https://doi.org/10.1016/j.enpol.2018.04.065
- Technological learning in the transition to a Low-Carbon energy system. (2020). In Elsevier eBooks. https://doi.org/10.1016/c2018-0-04547-8. Chapter 9- Electric Vehicles.
- Hong, T., Yan, D., D'Oca, S., & Chen, C. (2017). Ten questions concerning occupant behavior in buildings: The big picture. *Building and Environment*, 114, 518–530. https://doi.org/10.1016/j.buildenv.2016.12.006
- Miotti, M., Supran, G. J., Kim, E. J., & Trancik, J. E. (2016). Personal Vehicles Evaluated against Climate Change Mitigation Targets. *Environmental Science & Technology*, 50(20), 10795–10804. https://doi.org/10.1021/acs.est.6b00177
- Brown, H. (2010). Toward Zero-Carbon buildings. In R. Heinberg & D. Lerch (Eds.), *The Post Carbon Reader: Managing the 21st century's sustainability crises*. https://www.resilience.org/stories/2010-11-22/cities-towns-and-suburbs-toward-zero-carbon-buildings/
- Gillingham, K., Rapson, D., & Wagner, G. (2016). The rebound Effect and energy efficiency policy. *Review of Environmental Economics and Policy*, 10(1), 68–88. https://doi.org/10.1093/reep/rev017
- Blumstein, C., Krieg, B., Schipper, L., & York, C. (1980). Overcoming social and institutional barriers to energy conservation. *Energy*, 5(4), 355–371. https://doi.org/10.1016/0360-5442(80)90036-5

Week 6 Oct. 10 Siting

This class will cover renewable project siting, the regulation of power generating facilities, and explore common financing mechanisms.

Objectives:

- Understand how public policy affects renewable development, including key aspects of the Inflation Reduction Act (IRA) and local, state, and federal level goals.
- Define the role of the various stakeholders in the siting process.
- Describe the major steps in the interconnection process.
- Evaluate commonly used project financing structures.

Required Readings:

- Alagappan, L., Spencer, S., Shenhar, J., Danielyan, E., Charles, P., & Energy+Environmental Economics. (2023). *Assessment of renewable energy siting and permitting policies* [Slide show; Presentation]. https://www.ethree.com/wp-

content/uploads/2024/04/Renewable-Siting-and-Permitting-Policies-E3-Public-Version-04.17.2024.pdf

- Penn, I. (2020). Atlantic Coast pipeline canceled as delays and costs mount. *New York Times*. https://www.nytimes.com/2020/07/05/business/atlantic-coast-pipeline-cancel-dominion-energy-berkshire-hathaway.html?smid=url-share
- Environmental Protection Agency. (2012). RE-Powering America's land: Siting renewable energy on potentially contaminated properties: liability considerations. https://www.bia.gov/sites/default/files/dup/assets/as-ia/ieed/ieed/pdf/idc1-021627.pdf
- Susskind, L., Chun, J., Gant, A., Hodgkins, C., Cohen, J., & Lohmar, S. (2022). Sources of opposition to renewable energy projects in the United States. *Energy Policy*, 165, 112922. https://doi.org/10.1016/j.enpol.2022.112922
- Carley, S., Konisky, D. M., Atiq, Z., & Land, N. (2020). Energy infrastructure, NIMBYism, and public opinion: a systematic literature review of three decades of empirical survey literature. *Environmental Research Letters*, 15(9), 093007. https://doi.org/10.1088/1748-9326/ab875d

Part III: Policy and Institutions

Week 7 Oct. 17 Regulation and Ownership

This class will provide an overview of regulatory and ownership frameworks in the United States energy sector.

Objectives:

- Understand the role of regulatory bodies in overseeing energy generating, distribution, transmission, and consumption.
- Analyze various ownership (IOU, co-op, municipal) models of energy generation and infrastructure.
- Evaluate regulatory challenges such as the balance of energy security with sustainability, innovation, and competition.

Required Readings:

- Nordhaus, R. R. (2015). The Hazy Bright Line: Defining Federal and State Regulation of Today's Electric Grid. *Energy LJ*, 36, 203.
- Train, K. E. (1991). Optimal regulation: the economic theory of natural monopoly. *MIT Press Books*, 1. Chapter 1
- Peskoe, A. (2010). A Challenge for Federalism: Achieving National Goals in the Electricity Industry. *Mo. Envtl. L. & Pol'y Rev.*, 18, 209.
- Kwoka, J. E. (2005). The comparative advantage of public ownership: evidence from U.S. electric utilities. *Canadian Journal of Economics*, 38(2), 622–640. https://doi.org/10.1111/j.0008-4085.2005.00296.x
- Wara, M. (2016). Fostering Competition in the 21st Century Electricity Industry. *Harv. Envtl. L. Rev. F.*, 40, 41.

Week 8 Oct. 24 Energy Security

This class will discuss how energy is a matter of national security. We will look out how the distribution of energy resources and technologies affect national security, the connection between energy and military security and power, energy related geopolitical challenges, and the security of cyber-physical systems.

Objectives:

- Understand national security and energy for military power projects and national defense.
- Learn about energy related geopolitical risks.
- Contribute to the ongoing conversation of climate change as a national security threat.
- Discuss how cyber-physical energy systems are vulnerable to cyber-attacks.
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Required Readings:

- Sun, C., Liu, C., & Xie, J. (2016). Cyber-Physical system security of a power grid: State-of-the-Art. *Electronics*, 5(4), 40. https://doi.org/10.3390/electronics5030040
- Samaras, C., Nuttall, W. J., & Bazilian, M. (2019). Energy and the military: Convergence of security, economic, and environmental decision-making. *Energy Strategy Reviews*, 26, 100409. https://doi.org/10.1016/j.esr.2019.100409
- Cherp, A., & Jewell, J. (2014). The concept of energy security: Beyond the four As. *Energy Policy*, 75, 415–421. https://doi.org/10.1016/j.enpol.2014.09.005
- Su, C., Khan, K., Umar, M., & Zhang, W. (2021). Does renewable energy redefine geopolitical risks? *Energy Policy*, 158, 112566. https://doi.org/10.1016/j.enpol.2021.112566
- Giroux, J., Burgherr, P., & Melkunaite, L. (2013). Research note on the Energy Infrastructure Attack Database (EIAD). *DOAJ (DOAJ: Directory of Open Access Journals)*. https://doaj.org/article/74ea1c4942844ffdbe33f644fa619a93
- Campbell, K. M., Gulledge, J., McNeill, J. R., Podesta, J., Ogden, P., Fuerth, L., Woolsey, R. J., Lennon, A. T., Smith, J., & Weitz, R. (2007). *The Age of Consequences: The foreign policy and national security implications of global climate change*. https://doi.org/10.21236/ada473826

Week 9 Oct. 31 The "Grid"

This class will explore the role of the grid in energy planning and policy. Students will explore the revenue requirement, systems operation and planning, and rate design.

Objectives:

- Overview of the U.S. Electric Grid.
- Learn about electricity economics.
- Understand the rate design process.
- Discuss electricity security in extreme weather and disaster events.

Required Readings:

- Von Wald, G., Mastrandrea, M. D., Cullenward, D., & Weyant, J. (2020). Analyzing California's framework for estimating greenhouse gas emissions associated with retail electricity sales. The Electricity Journal, 33(8), 106818. https://doi.org/10.1016/j.tej.2020.106818

- Delivery to consumers - U.S. Energy Information Administration (EIA). (n.d.). https://www.eia.gov/energyexplained/electricity/delivery-to-consumers.php
- Dennis, K., Colburn, K., & Lazar, J. (2016). Environmentally beneficial electrification: The dawn of 'emissions efficiency.' *The Electricity Journal*, 29(6), 52–58. https://doi.org/10.1016/j.tej.2016.07.007
- Welton, S. (2020). Rethinking grid governance for the climate change era. *SSRN Electronic Journal.* https://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID3564682_code2101879.pdf?abstractid=3564682&mirid=1
- Stürmer, J., Plietzsch, A., Vogt, T., Hellmann, F., Kurths, J., Otto, C., Frieler, K., & Anvari, M. (2024). Increasing the resilience of the Texas power grid against extreme storms by hardening critical lines. *Nature Energy*. https://doi.org/10.1038/s41560-023-01434-1

Week 10 Nov. 7 Energy Markets

This class will provide an overview of the United States energy markets for oil, natural gas, and electricity across various local, state, and federal agencies.

This will include a guest lecture by Dr. Mieth at 9:30 am.

Objectives:

- Determine how energy markets impact energy and sustainability planning and policy.
- Evaluate current energy market indicators.
- Assess how the energy market can be used to advance sustainability.
- Investigate the role of carbon markets in the United States energy system.

Required Readings:

- Cullenward, D., & Welton, S. (2018). The quiet undoing: how regional electricity market reforms threaten state clean energy goals. *JREG Bulletin*, 36, 106.
- Kaplan, R. S., Ramanna, K., & Roston, M. (2023). Accounting for carbon offsets–Establishing the foundation for carbon-trading markets.
- Federal Energy Regulatory Commission. (2015). Energy primer: A handbook of energy market basics. *Federal Energy Regulatory Commission*: Washington, DC, USA.

Week 11 Nov. 14 Impact Analysis

This class will equip students with various modeling tools and approaches to evaluate energy planning and policies.

Objectives:

- Understand how energy, economic, environmental, and equity analysis shape energy policies and planning.
- Learn how cost benefit analysis, life cycle analysis, and market potential studies are used in energy policy.
- Interpret data such as levelized cost of analysis, cost performance curves.
- Evaluate non-energy benefits and positive- and negative-externalities.

Required Readings:

- NREL (2020). Simple Levelized Cost of Energy (LCOE) Calculator Documentation.
- Levelized cost of energy+. (2024). https://www.lazard.com. https://www.lazard.com/research-insights/levelized-cost-of-energyplus/
- Fanchi, J. R. (2023). *Energy in the 21st Century: Energy in Transition* (5th Edition). World Scientific. Chapter 12 (available for free online at Rutgers library)

Part IV: Emerging Topics

Week 12 Nov. 21 Decarbonization

This class will introduce students to decarbonization and evaluate local, state, and federal decarbonization policies as well as introduce innovations in decarbonized energy systems.

Dr. Andrews is at a conference this week therefore, this lecture will be taught by Dr. Senick.

Objectives:

- Understand the energy systems role in reducing carbon emissions to mitigate climate change.
- Identify and evaluate different decarbonization strategies.
- Assess the resistance to decarbonization and strategies to mitigate them.
- Evaluate decarbonization practices and policies.

Required Readings:

- Hsu, D., Andrews, C. J., Han, A. T., Loh, C. G., Osland, A. C., & Zegras, C. P. (2022). Planning the built environment and land use towards deep decarbonization of the United States. *Journal of Planning Literature*, 38(3), 426–441. https://doi.org/10.1177/08854122221097977
- Ziegler, M. S., Mueller, J. M., Pereira, G. D., Song, J., Ferrara, M., Chiang, Y., & Trancik, J. E. (2019). Storage requirements and costs of shaping renewable energy toward grid decarbonization. *Joule*, 3(9), 2134–2153. https://doi.org/10.1016/j.joule.2019.06.012
- Wallace, N., Zerbe, A., Wara, M., & A Sivas, D. (2020). *Removing Legal Barriers to Building Electrification*. Stanford Woods Institute for the Environment. https://law.stanford.edu/wp-content/uploads/2020/10/2020-10-20_Natural-Gas-Memo_formatted.pdf

Week 13 Nov. 26 Just Transition

This class will ask students to discuss the planning and development of sustainable communities and the role that community engagement, environmental justice, and climate governance may play in ensuring and equitable and just climate transition.

This class will include a guest lecture from Dr. Braneon and Dr. Elszasz at 11:00 am.

Objectives:

- Understand the principles of equity, fairness, and inclusivity in the low-carbon energy transition.
- Learn about measures to ensure equitable distribution of benefits and burdens.
- Highlight the role of community engagement in implementing climate policies.

Required Reading:

- Sheats, N. (2017). Achieving emissions reductions for environmental justice communities through climate change mitigation policy. William and Mary Environmental Law and Policy Review, 41(2), 377. https://scholarship.law.wm.edu/cgi/viewcontent.cgi?article=1674&context=wmelpr
- Heffron, R. J., & McCauley, D. (2018). What is the 'Just Transition'? *Geoforum*, 88, 74–77. https://doi.org/10.1016/j.geoforum.2017.11.016
- Rees, W. (2010). Thinking 'Resilience'. In R. Heinberg & D. Lerch (Eds.), *The Post Carbon Reader: Managing the 21st century's sustainability crises*. https://www.postcarbon.org/publications/thinking-resilience/
- Pai, S., Harrison, K., & Zerriffi, H. (2020). *A systematic review of the key elements of a just transition for fossil fuel workers*. Smart Prosperity Institute. https://institute.smartprosperity.ca/sites/default/files/transitionforfossilfuelworkers.pdf
- Cong, S., Nock, D., Qiu, Y. L., & Xing, B. (2022). Unveiling hidden energy poverty using the energy equity gap. *Nature Communications*, 13(1). https://doi.org/10.1038/s41467-022-30146-5

Week 14 Dec. 5 Final Student Presentations

Present results of student projects; solicit feedback.

Objectives:

- Clearly present your research.
- Learn about other energy policy topics from fellow students.
- Provide constructive feedback to other students on their research.

Each student should prepare a 12-minute PowerPoint presentation about their project, upload it to canvas by 11:59 PM December 3rd and be prepared for 3-minute question and answer session from the class. This feedback should be used to improve each student's final paper.

Final paper due at 11:59 PM December 17th via Canvas

Schedule of Assignments

WEEK	DATE	ASSIGNGED	DUE (Wednesday 11:59 PM)
1	Sep. 5	-	-
2	Sep. 12	Problem Set 1	-
3	Sep. 19	-	Problem Set 1
4	Sep. 26	Policy Paper 1	Final Paper: Abstract
5	Oct. 3	-	Policy Paper 1
6	Oct. 10	Policy Paper 2	-
7	Oct. 17	-	Policy Paper 2
8	Oct. 24	Problem Set 2	Final Paper: Annotated Bibliography
9	Oct. 31	-	Problem Set 2
10	Nov. 7	Policy Paper 3	-
11	Nov. 14	Problem Set 3	Policy Paper 3
12	Nov. 21	-	Problem Set 3
13	Nov. 26	-	Final Paper: Draft
14	Dec. 5	-	Final Paper: Presentation
Final	Dec. 17	-	Final Paper