Energy Systems in Transition Fall 2023

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Office hours: For questions regarding assignments or course content please contact Steve via email. You can also find him in room A206 from 1-4pm on Mondays. You can also email me to set up a meeting and I will usually come to class early and stay after class ends.

On health: Please take care of your physical and mental health first. If you have a positive COVID-19 test, have COVID-like symptoms, or have been instructed to quarantine, you should not attend class. If you need a mental health day, please take one. For mental health resources, please see the bottom of the syllabus and contact CAPS and Timelycare. Be kind to yourself and those around you. If there is anything we can do to decrease stress or make a safer and healthier environment for you, please reach out.

Our class will be held in-person in PV 276 on Tuesday and Thursday 11:30am – 12:45pm

This is a graduate level highly interdisciplinary *overview* course that introduces the basic elements of energy and energy systems. We will learn about energy sources, how they work, and how the nature of sources shapes their roles within the energy sector. We will have a few guest lectures throughout the course to learn about different perspectives about energy systems.

The course goal: Students will acquire the ability to think and write critically about energy systems and energy transitions. Students will gain a level of familiarity with the complex problems associated with energy use to understand how to begin solving the challenges related to decarbonization.

Please note: This is my first time teaching this course, and I will be learning with you and asking for your feedback. I also have carpal tunnel and need to minimize my computer use. Our class will be more discussion based so we can learn together and go through examples together. Given the wide-ranging issues, there will be a lot of reading, digesting, summarizing, and some calculations in this course. I am grateful to Prof. Dustin Mulvaney (San Jose State University), Prof. John Rupp (IU), and Prof. Joule Bergerson (University of Calgary) for sharing their valuable course materials with me, which I will use liberally throughout this course.

Textbooks: There are two books for this course:

(1) Sustainable Energy Transitions by Dustin Mulvaney (free .pdf available online), http://dustinmulvaney.com/set shortened to Transitions in the syllabus

(2) Introduction to Energy Analysis (3rd edition) by Kornelis Blok and Evert Nieuwlaar, shortened to Analysis in the syllabus

We will also read articles and reports as they come up and listen to informative interviews and podcasts. Please have a look at Canvas to see if there are additional readings for the week. Some readings may be dry and more technical than you are used to -- you are not alone in finding them challenging to understand. If you find better learning resources along your learning journey, please share with the class.

Special needs: Please let me know by the first week of classes if you have any special needs and what accommodations you need.

Course requirements

1. Attend class. Attendance is *not* graded, so if you need a mental or physical health day, please take it. Class participation is an important part of the course. Ask good questions and be part of the discussion. Effective participation means making space for people who do not feel comfortable participating in a class discussion to participate. Avoid phones or computers in class, as it breaks deeper discussions and understanding.

2. Do the readings. Some readings will take time to digest, and you will benefit from discussion with other students prior to class and during class. Work with other students and bring your questions to class. I have also created a list of resources (news, journals) for you to start off learning about our field more broadly. Please add to the list as you go.

3. Individual assignments: There will be five assignments (2 problem sets and 3 memos). Answer questions in thoughtful, carefully reasoned, well-crafted responses. Please use 12-point font. Assignments that are one class period late will be docked 5%, two class periods late will be docked 10% and so on. If you have a legitimate reason for turning in homework late, please keep our TA informed.

+ Problem sets will have both qualitative and quantitative questions. Calculations should be clear with all assumptions and uncertainties explained. Your answers should be typed, not hand-written (unless you are doing a calculation which you cannot type). You will need to submit your assignments electronically by uploading your document to Canvas under assignments.

+ Memos will range in size and scope and will test both your understanding of the material and ability to digest, synthesize, and communicate. These will need to be submitted online through Canvas *and* in paper copy the day that they are due.

4. Paired in-class presentations: Each student will do *two paired in-class presentations* over the semester. Presentations should be no longer than 20 minutes (not including questions from the class). This assignment is designed to ensure you can understand, digest, critically examine, and report on the topic of class and news. One presentation will be on the topic of the class – you can read the materials assigned and research the topic in far more detail and teach the class what you have learned. The second presentation will be on the latest news relating to energy systems and dig into the topic deeply and understand what the issues are and why this news is relevant. Feel free to use PowerPoints if that will help. Please work *cooperatively* with each other. Pick different partners for each of the pairings and sign up early on the google sheet reserving your spot with our TA.

Grading

The grading scale for this class will be the following: min of 97 A+, min of 93 A, min of 90 A-, min of 87 B+, min of 83 B, min of 80 B-, min of 77 C+, min of 73 C, min of 70 C-, min of 67 D+, min of 63 D, min of 60 D-, and less than 60 F. I reserve the right to adjust this scale (i.e., lower it) to account for variability in testing results. **There are no exams in this course.**

Problem set 1	10%	Sep 19
Memo 1	10%	Oct 3
Problem set 2	10%	Oct 19
Memo 2	20%	Nov 2
Memo 3	30%	Nov 30
Class presentation	10%	rolling
News presentation	10%	

Schedule

Date	#	Topic	Readings	Assigned	Due
Aug 22	1	Overview of course and introduction to energy issues	No readings		
Aug 24	2	Energy and society – what are the challenges	Transition: Ch 1 energy transitions	What questions do you have about energy transitions?	
Aug 29	3	Energy transitions	Analysis: Ch 1 energy and society Enroad: https://www.climateinteractive.org/en-roads/		
Aug 31	4	Energy Units and Trends	Transition: Ch 2 fundamentals of energy science Analysis: Ch 2 what is energy Smil, V. (2006). *Energy: Beginners guide*: Oneworld. (Introduction and Ch 5: Energy in everyday life). Podcast: https://xenetwork.org/ets/episodes/episode-119-energy-basics-parts-1-3/	Start paired presentations	
Sep 5	5	Calculating energy use	Transition: Ch 3 energy and the social sciences	Problem set 1	

Sep 7	6	Net zero emissions and climate change	Transition: Ch 10 sustainability and just energy strategies Analysis: Ch 16 climate-neutral energy systems Outlook: Part B, pg 119- 175		
Sep 12	7	Efficiency	Analysis: Ch 10 energy efficiency and Ch 13 volume, structure, and energy efficiency		
Sep 14	8	Demand side management	Analysis: Ch 3 energy services and demand Outlook: Ch 5 pg 233-272		
Sep 19	9	Oil	Transition: Ch 4 fossil fuels Analysis: Ch 5 energy extraction and conversion Outlook: Ch 7 – Liquid fuels	Memo 1	Problem set 1
Sep 21	10	Coal	Transition: Ch 4 fossil fuels Analysis: Ch 5 energy extraction and conversion		
Sep 26	11	Natural gas	Transition: Ch 4 fossil fuels Analysis: Ch 5 energy extraction and conversion Outlook: Ch 8 – Gaseous fuels		
Sep 28	12	Nuclear	Analysis: Ch 5 energy extraction and conversion Transition: Ch 5 nuclear and renewables		
Oct 3	13	Hydropower	Outlook: Ch 9 – Solid fuels	Problem set 2	Memo 1
Oct 5	14	Solar	https://www.energy.gov/eere/solar/how-does-solar-work https://www.nrel.gov/research/re-solar.html		
Oct 10	15	Solar deployment in Indiana	**Guest lecture**: Al Jarvis renewable energy professional Indiana since 2006		
Oct 12	16	Wind	https://www.energy.gov/eere/wind/wind-energy-basics		
Oct 17	17	Energy Indicators	Transition: Ch 6 energy indicators Analysis: Ch 11 Economic analysis		

Oct 19	18	Grids and storage	Transition: Ch 7 low carbon electricity systems Articles: https://www.nytimes.com/interactive/2023/06/12/climate/us-electric-grid-energy-transition.html https://www.cfr.org/backgrounder/how-does-us-power-grid-work https://www.nrel.gov/research/power-grid.html https://www.nrel.gov/research/eds-hydrogen.html	Memo 2	Problem set 2
Oct 24	19	Energy markets	Analysis: Ch 6 energy markets		
Oct 26	20	Life cycle analysis	Analysis: Ch 8 analysis of energy chains and Ch 9 life-cycle energy analysis		
Oct 31	21	Transportation	Transition: Ch 8 low carbon mobility		
Nov 2	22	Energy policies	Analysis: Ch 14 energy policies and evaluation	Memo 3	Memo 2
Nov 7	23	Energy efficient economy + Inflation Reduction Act (IRA)	**Guest lecture:** Steve Nadel Executive Director of American Council for an Energy-Efficient Economy (ACEEE) https://www.aceee.org/about/aceee-staff/steven-nadel		
Nov 9	24	Energy and the built environment	Transition: Ch 9 industries and the build environment Analysis: Ch 4 energy use in industry, analysis and management of energy use https://www.nrel.gov/research/re-net-zero-buildings.html		
Nov 14	25	Energy transitions and the EPA	**Guest Lecture:** Former EPA Deputy Bob Sussman https://oneill.indiana.edu/about/deans-council/sussman-robert.html		
Nov 16	26	Energy Models	Analysis: Ch 15 models and scenarios		
Nov 28	27	Citizen action	**Guest Lecture:** Ben Inskeep Program Director at Citizens		

			Action Coalition in Indiana https://www.beninskeep.com/		
Nov 30	28	Energy Security	**Guest Lecture:** Stephen Bessasparis Outlook: Part C, pg 179-232		Memo 3
Dec 5	29	Final discussion and next steps			
Dec 7	30	Rest up -- no class: As part of free care week, please use this time to take a mental health break before you wrap up the semester.			

Energy Resources

The Energy Transition show by Chris Nelder
David Roberts: https://www.volts.wtf/p/welcome-to-volts
Rewiring America: https://www.rewiringamerica.org/
Energy wire: https://www.eenews.net/publication/energywire/
Climate wire: https://www.eenews.net/publication/climatewire/
IEA news: https://www.iea.org/news
IEA energy systems: https://www.iea.org/energy-system
The Conversation: https://theconversation.com/us/environment
EERE: https://www.energy.gov/eere/office-energy-efficiency-renewable-energy

Student Resources

Students Needing Additional Financial or Other Assistance: The Student Advocates Office (SAO) can help students work through personal and academic problems as well as financial difficulties and concerns. SAO also assists students working through grade appeals and withdrawals from all classes. SAO also has emergency funds for IU students experiencing emergency financial crisis
https://studentaffairs.indiana.edu/studentadvocates

Sexual misconduct: As your instructor, one of my responsibilities is to create a positive learning environment for all students. IU policy prohibits sexual misconduct in any form, including sexual harassment, sexual assault, stalking, sexual exploitation, and dating and domestic violence. If you have experienced sexual misconduct, or know someone who has, the University can help. If you are seeking help and would like to speak to someone confidentially, you can make an appointment with the IU Sexual Assault Crisis Services at 812-855-5711, or contact a Confidential Victim Advocate at 812-856-2469 or cva@indiana.edu

Counseling and Psychological Services (CAPS): Students can contact CAPS 24/7 to speak to a crisis counselor. Call 812-855-5711, option 1 or contact your local hospital emergency department. You may also contact the National Suicide Prevention Lifeline at 1-800-273-8255. If you need to talk to a trained professional staff for confidential support, please visit:
http://healthcenter.indiana.edu/counseling/index.shtml

Another new resource available to students is Timely Care:
https://app.timelycare.com/auth/login

Accessible Educational Services for Students (AES): Every attempt will be made to provide accessibility measures (accommodations) to students with qualifying medical conditions (e.g. mental health, learning, chronic health, physical, hearing, vision, neurological, etc.), under the Americans with Disabilities Act. You must have established your eligibility for support services through Accessible Educational Services for qualifying medical conditions. Note that services are confidential, may take time to put in place, and are forward moving. Captions and alternate media for print materials may take three or more weeks to get produced. Please contact Accessible Educational Services (AES) at 812-855-7578 as soon as possible if accessibility measures are needed. The office is located on the basement floor of Eigenmann Hall, #001.