O'Neill School of Public and Environmental Affairs

Syllabus

Climate Change Policy

V550 Spring 2023

3 Credits | #34106

Instructor Contact Information

Instructor: Dave Ehrlich, PhD
Email: ehrlich@indiana.edu
Phone: 312-545-4488

Video: Zoom: Full class meetings or one-on-one meetings will be through Canvas link "Dave's Mtg Rm." At https://iu.zoom.us/j/95183077707 for most full class meetings; see Canvas link; Skype: Ehrlich.Dave_1, or other means by appt.

Office Hours: We will have several scheduled optional meeting times evenings for the entire class (listed in EST). One-on-one meetings can be scheduled whenever convenient for you via phone, Canvas, Zoom, Skype, or other platforms. Feel free to call or text anytime with immediate questions.

Course Description

This course examines public policies to reduce GHG emissions, focusing on policies that are leading to a fast and just transition to clean energy. Using the best available cross-disciplinary evidence, the course analyzes and compares dozens of general approaches, and hundreds of specific emission reduction policies of national, state, and local governments. The course explores policies' cost-effectiveness, equity, and capacity to accelerate policy diffusion, as well as their acceptability given communities' energy portfolios and regulatory, administrative, and political contexts. The course explores a wide range of policy approaches, including their theoretical bases: mandates, incentives, markets, privatization, and voluntary actions by organizations and individuals. We'll also evaluate the promise of improving monitoring data and tradeoffs across climate policies and the barriers, aids, and lessons from their implementation. The course is most useful for those working for governments, nonprofits, for-profits, advocacy, or conducting related research.

In this course, we'll focus on mitigation policies except where they overlap adaptation policies, as some do from the local as well as the international levels.[1]

The failures of climate change policies are well known.[2] However, the favorable economics of greener energy, widespread innovation, cost savings from efficiency and electrification, and growing awareness and support for government climate policies warrant optimism that the transition can quicken. This course focuses on proven and promising policies that can lead to widespread, rapid, and sharp emissions reductions,[3] and the factors that can help or hinder these policies. Net global gains from fast emissions reductions could be $25 trillion by 2030, and $600 trillion in avoided damages by 2100.[4] Many combinations of effective policies could achieve these gains; individual governments and companies have proven their ability to reduce carbon emissions, but these have not been adopted universally or by most of the largest emitters.

Policy topics we'll examine include:

- top-down and bottom-up policies; top-down and bottom-up planning, and forward and backward mapping methods
- push (government policy or supply) and pull (consumer & investor demand) policies
- performance standards, benchmarks, & work to improve the precision & location of emissions
- standardization of global and national standards, including required, optional, and within industries
- approaches to point source and industry regulation to achieve emission & competitiveness goals
- an emphasis on accurate and third-party and government verification of emissions & markets
- broad education of decarbonization benefits, opportunities, and differences compared to conventional practices in loans and finance by banks, insurers, and actuaries
- Thousands of policies do and could further help reduce or stop emissions. With a focus on urgency, the course focuses primarily on policies that are working now or would likely work if enacted.

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[1] Adaptation policies include loss and damage policies to fund developing countries that have caused few GHG emissions (see R1 and R2).
[2] As Nobel Laureate William Nordhaus said in 2018: "The policies are lagging very, very far — miles, miles, miles — behind the science and what needs to be done."
[3] Or, as Amory Lovins (founder of Rocky Mountain Institute) puts it, governments should prioritize measures that are fast, cheap, and proven rather that those that are slow, costly, and speculative.
[4] If countries remain unable to achieve even their commitments to Nationally Determined Contributions (NDCs), damages could rise to nearly $800 trillion by 2100. Moody's bond rating agency, on the other hand, only estimates losses of $54 Trillion by 2100 at 1.5 degrees warmer and $69 trillion at 2 degrees.

Course Details

Learning Outcomes

This course is for public managers tasked with finding, adopting, adapting, revising, or communicating climate policies in communities with a variety of constituents, industries, demographics, political perspectives, and other factors. Climate policy knowledge and skills will be required in most jobs over the next decade and, to some extent, across every economic sector. By course end, students will be able to:

- **Learning Outcome 1:** Know the sources of GHG emissions, broken down in multiple ways to structure and improve, their risks, the ability of climate policies to address them, and natural and geoengineered sink solutions.

Part I: Risks, Models, the Problem, GHG Sources & Sinks (LO1)

- **Learning Outcome 2**: Develop a working knowledge of the many pathways and policies to reach stated emission goals, and the policy-driven contributions that government and other actors, behaviors, and technologies can make.

Part II: Pathways to Net Zero: Long & Short-Term, Benefits & Co-Benefits, & the Full Range of Policies (LO2)

- **Learning Outcome 3:** Understand and analyze the types and elements of the policy process. Understand the most important academic *theories* on which successful climate policies are based. Know how climate policy is influenced by science, economics, business, the courts, executive actions, regulation, & legislatures.

Part III: Climate Policy Processes, Players, Theories, Markets, Business Role (LO3)

- **Learning Outcome 4:** Understand how climate policies may be designed and analyzed, including their effectiveness, efficiency, equity, costs, benefits, diffusion, tradeoffs, and the broad types of climate policies. Apply policy analytic tools and the metrics of successful current, proposed, and promising climate policies.

Part IV: Analysis of Climate Policy Solutions, Policy Design, Prioritization (LO4)

- **Learning Outcome 5**: Learn the range of diverse current, proposed, and possible future policies across economic sectors.

Part V: Sector Policies: Energy, Renewables, Buildings, Transportation, Industry Sectors (LO5)

- **Learning Outcome 6**: Understand the *politics, stakeholders, and communication* of climate policies. Be able to summarize and identify, for an environmental policy, *how these policies may affect* individuals, group, governments. Be able to communicate both long-term imperatives and immediate local co-benefits of mitigation and adaptation policies, within governments and organizations and to the public, including benefits to air quality, health, electricity costs, equity, recreation, wildlife, flooding, heat emergencies, groundwater, and property values.

Part VI: Politics, Stakeholders, Communication, & Education (LO6)

- **Learning Outcome 7:** Understand the possible future scenarios and directions that climate policy might take, including R & D cycles, possible breakthrough technologies, and policies that enable and foster long-term technology and policy improvements.

Part VII: The Future: R & D, Breakthrough Technologies, Life Cycles Emissions, The Circular Economy

O'Neill School expectations of civility and professional conduct

The O'Neill School takes matters of honesty and integrity seriously because O'Neill is the training ground for future leaders in government, civic organizations, health organizations, and other institutions charged with providing resources for the public, and for members of society who are vulnerable and who are lacking in power and status. Precisely because O'Neill graduates tend to rise to positions of power and responsibility, it is critical that the lessons of honesty and integrity are learned early.

O'Neill requires that all members of its community – students, faculty, and staff – treat others with an attitude of mutual respect both in the classroom and during all academic and nonacademic activities

outside the classroom. A student is expected to show respect through behavior that promotes conditions in which all students can learn without interruption or distraction. These behaviors foster an appropriate atmosphere inside and outside the classroom:

Students must responsibly participate in class activities and during team meetings.
Students must address faculty members, other students, and others appropriately and with respect, whether in person, in writing, or in electronic communications.
Students must show tolerance and respect for diverse nationalities, religions, races, sexual orientations, and physical abilities.

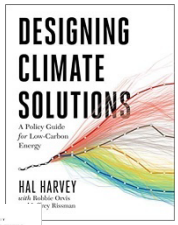
Course Requirements

The climate change policy literature is huge and growing daily. Given the diversity of well-researched and empirically-grounded journal articles, books, and viewpoints, I'm suggesting a wide range of excellent readings, nearly all published in the last several years. Some cover the same ground from different perspectives, often with different recommendations.

My goal is for you to have a good understanding of the basics of each of the dozens of module topics in the course by offering at least several short required readings on each topic – sometimes only excerpts -- with more recommended but optional readings. I also want you to understand differing perspectives, rationales, and arguments on each topic. I don't expect you to read every word of every reading marked recommended or optional, but at least skim them to get the main points. If you're interested or your team is responsible for that week's discussion, you should closely read all the week's readings if possible. The course has a greater than average reading load, but well within the d range of many US graduate elective courses. I want to offer you as broad a selection of viewpoints and research on current and possible policy approaches as possible.

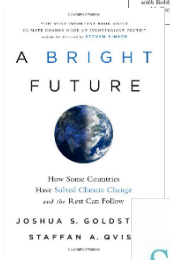
Required Textbooks

Primary Textbook

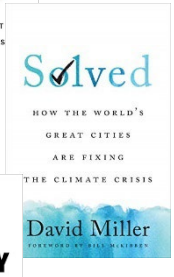


Harvey, Hal, Robbie Orvis, and Jeffrey Rissman. *Designing Climate Solutions: A Policy Guide for Low-Carbon Energy*. Washington: Island Press, 2018. Summary Amazon Others Online (IU Library) Price Used: $10-18

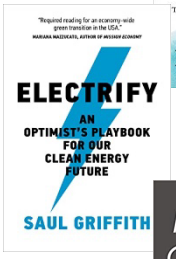
Required Books



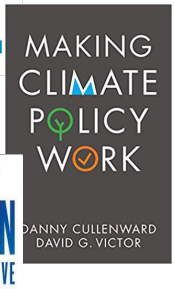
Goldstein, Joshua S., and Staffan A. Qvist. *A Bright Future: How Some Countries Have Solved Climate Change and the Rest Can Follow*. First edition. New York, NY: PublicAffairs, 2019. Summary Amazon Others P rice Used: $4-9



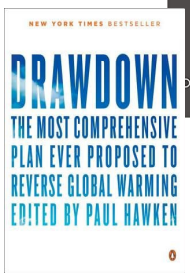
Miller, David, and Bill McKibben. *Solved: How the World's Great Cities Are Fixing the Climate Crisis*. Toronto ; Buffalo ; London: Aevo UTP, 2020. Summary Amazon Others IULibrary Price Used: $7-15



Griffith, Saul. *Electrify: An Optimist's Playbook for Our Clean Energy Future*. Cambridge, Massachusetts: The MIT Press, 2021. Summary Amazon Others Price Used: $10-18



Cullenward, Danny, and David G. Victor. *Making Climate Policy Work*. 1st edition. Cambridge, UK ; Medford, MA: Polity, 2020. Summary Amazon Others Price Used: $16-23



Hawken, Paul. *Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming*. Penguin, 2017. Summary Amazon Others Price Used: $3-9

[Climate Change 2021,The Physical Science Basis], Working Group I Contribution to the Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change [5] 6 Aug 2021

IEA. "[World Energy Outlook 2021 – Analysis.]"

National Academies of Sciences, Engineering, and Medicine. *Accelerating Decarbonization of the U.S. Energy System*. Washington, DC: The National Academies Press, 2021. [https://doi.org/10.17226/25932].

USGCRP. "Fourth National Climate Assessment." U.S. Global Change Research Program, Washington, DC, 2018. [https://nca2018.globalchange.gov].

/publications/2021/Jun/World-Energy-Transitions-Outlook. "World Energy Transitions Outlook: 1.5°C Pathway." [https://www.irena.org/publications/2021/Jun/World-Energy-Transitions-Outlook].

/publications/2022/Jan/NDCs-and-Renewable-Energy-Targets-in-2021. "NDCs and Renewable Energy Targets in 2021." [https://www.irena.org/publications/2022/Jan/NDCs-and-Renewable-Energy-Targets-in-2021].

World Resources Institute. "Accelerating Building Efficiency: Eight Actions for Urban Leaders." Accelerating Building Efficiency, 2016. [http://www.wri.org/buildingefficiency/].

[*The Drawdown Review: Climate Solutions for a New Decade*]. Place of publication not identified: Project Drawdown, 2020. Free on Drawdown website

U. S. Global Change Research Program. [*The Climate Report: National Climate Assessment-Impacts, Risks, and Adaptation in the United States*.] Illustrated edition. Brooklyn: Melville House, 2019.

Electronic versions of the books may be available through the IU library. Where possible, multiple ways to access readings are included in the course calendar.

[5] "IPCC_AR6_WGI_SPM_final.Pdf." Accessed November 23, 2021. [https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf].

Links: The syllabus contains many URL hyperlinks to related policy and government and university websites, government documents, academic journal papers, news articles, and other sources. These links are in a non-black color (usu. blue or green) and underlined in the syllabus. They're entirely optional, but I recommend at least browsing the linked websites and skimming the referenced documents. These links will deepen your understanding of the module and give you ideas for discussion posts and assignments. Websites and documents will occasionally go offline during the course; please let me know if you see a broken link and I'll try to find the document elsewhere.

Accessibility of Course Materials

Please let me know if you have any special requirements or preferences in the format or presentation of course materials, or if there is a way to make the materials easier to find, read, listen to, or watch. My goal is to make the course materials as accessible and easy to find and read as possible, in whatever format is most useful to you. Ideally, the technical and discussion equipment, long distances, and course formats we use should be frictionless and invisible. Nearly all hyperlinked (deep-linked) materials are available through the IU online library, as are many of the book excerpts included in our Course Resources through Canvas links. Where possible, they're both to their IU Library URL (you'll need to sign in to access) and also to online sites such as Google Scholar and other websites to save you time and allow you to better choose how you prefer to access, read, and organize your course readings. Please let me know if you have any special requirements or preferences in the format or presentation of course materials, or if there is a way to make the materials easier to find, read, listen to, or watch.

I've added topic introductory and overview comments to the syllabus to summarize and link you to a variety of further readings. As you know, public policy can be political, and rife with intentional and unintentional bias and spin. Reading with skepticism and developing an ability to recognize and value reliable evidence is a critical skill in public policy and public affairs. From my background in Congress and at the GAO, my preference is more support and citation whenever possible rather than less. [6]

Text to audio: It is possible to listen to written materials aurally in Word or pdf if you study on your commute, for example. Word, Acrobat, and many other apps now allow this.

Audio to text: If you prefer text to read quickly and highlight easily, or that's your preferred learning style, it's possible to convert audio or video to text transcripts (I subscribe to otter.ai and can convert audio or visual files to text if you prefer to learn that way).

Technical Requirements

You will need the following to participate in this course:

[6] At GAO, every stated fact and phrase has to be supported by one or more citations during internal reviews.

Computer
Reliable internet connection
Computer microphone

Technical Support

You may also receive support from
University Information Technology Services (UITS) (human support); 812-855-6789
IU Knowledge Base (IUKB) (guides)
IUware (download free software)

Course Website

Course participation will require using the **IU Canvas learning management platform system**. Once you are in the platform you can learn how to use Canvas effectively by clicking the "Help" link on the top right of the course page on Canvas. You can access this course directly at:
https://iu.instructure.com/courses/47062

Course Format (Online)

This is a web-based course. Most of our interaction will be via the internet. Our internet exchanges will, for the most part, be asynchronous (that is, not at the same time), which has advantages and disadvantages. Among the advantages are that the format gives you a good deal of flexibility about when you log in and contribute. It also gives you time to prepare thoroughly and reflect about the issues raised in the readings, cases, and exercises. Online discussions can allow deeper engagement than in a classroom, and greater inclusion of everyone's ideas. The electronic format for our interchanges also provides an opportunity for everyone to contribute without the constraints of limited time, limited depth, little direct access readings and evidence during discussions, the occasional overshadowing of more introverted students, and other limitations to in-class formats.

I will also host optional synchronous meetings to discuss the course and readings. The day will vary to allow for those with different schedules:

They are scheduled for:

January 12, Thursday, at 8:00 PM EST

January 24, Tuesday, at 8:00 PM EST

February 23, Wednesday, at 8:00 PM EST

March 29, Wednesday, at 8:00 PM EST

These sessions are informal and have no prior agenda. Their purpose is to allow for discussion or questions on anything (academic, administrative, or personal), to get to know each other, to put faces with discussion board names, and to have a beer or coffee together. We'll go as long as you like or until all questions have been answered and all discussions end.

I want to talk with each of you individually on Zoom in at least a 5-minute check-in at least once during the course, if not more often. I welcome more Zoom calls than that, but I know you're busy and, as much as possible, I want to be available when you are.

My philosophy of teaching is influenced by the growing body of research supporting constructivist learning – that students build their own knowledge through their own and others' empirical observation (a neo-behavioral approach), but then build on that through assimilation of conflicting evidence, which leads to accommodating new evidence into new perspectives. Our class discussions, particularly those that question conventional wisdom and theory, are particularly useful in this regard. We'll also use integrative approaches with case studies, collaborative approaches through discussion boards and discussion leader and policy memo teams. We use inquiry-based learning in discussion leader questions, and we use reflective learning in our weekly 1-page writings. I tried to organize the syllabus into digestible parts to reduce the cognitive load of the complexity of public policies, and to scaffold these small parts to build toward understanding climate policy interactions within a larger context.

These methods are largely self-led learning, mediated by continually interacting with others and trying to make sense of the environment, as well as learning from colleagues with deep and varied knowledge and experience in their fields. Our approach to learning also borrows from Bloom's taxonomy of learning and the Krathwhol & Anderson and others' revisions.

Each of you is an experienced professional and a valuable resource to the class. You will learn as much from your classmates as you can from me, especially in this online format where we will all interact almost daily. You will be asked to participate in numerous cases, discussions, and exercises. Each of you has different career and learning goals, so I've included many optional readings, links, and suggestions to "skim" readings and links to allow you to go beyond the required readings on topics that are particularly interesting or useful to you, at whatever depth you want and need given your professional experience and learning goals.

Most of our interactions will occur in the context of Canvas, a software system that provides a comprehensive set of tools for the creation, management, and viewing of sophisticated web-based teaching and learning environments. We'll also meet online synchronously in several optional full-class sessions, as well as meet online or by phone one-on-one. You'll also have the option in Canvas using open and available Zoom room links to chat anytime with your classmates 24/7 either individually or in groups throughout the term, as your schedule allows, and spontaneously if needed. I encourage you to share ideas and build a network of friends and colleagues that could last well beyond this course and well beyond your IU program.

Descriptions of Course Activities and Assignments

Overview of the Assignment Grades and Grading Scale

The table below provides an overview of how much each assignment is worth and when it is due.

Course Assignments	Percentage of Grade (subtotals)	Due Date/s
Participation	45%	
1) Discussion Board Forum (subtotal)	30%	Weekly
2) Discussion Leader (subtotal)	5%	Varies
3) Weekly Reflections <1 page	10%	Weekly
Writing Assignments	55%	
4) Policy Memo Regulatory Comments	10%	Feb 12, 11 p ET
5) Policy Memo Consulting Engagement	30%	Ap 23, 11 p ET
6) Final Exam	15%	May 1, 11 p ET

Grade	% Range
A	93-100
A-	90-92
B+	87-89
B	84-86
B-	80-83
C+	77-79
C	74-76
C-	70-73
D+	67-69
D	64-66
D-	60-63
F	<60%

Grading will be based on each assignment's assessment criteria or rubric rather than on a curve. More on IU's grading policies is here. Late assignments will be downgraded except for weekly Discussion Boards, which depend on concurrent participation. Makeup assignments will be limited to illness, unforeseeable events, or emergency circumstances.

Assignments (see details in *Assignment Details & FAQ* document in Course Resources)

Class Participation in Discussion Board as Poster and Leader You must participate actively and constructively in class discussions on discussion boards, which will be assigned most weeks. This primarily means contributing regularly to the discussion boards. You are expected to contribute with both quantity and quality. To participate effectively in discussions, you will need to have read the assigned readings prior to the start of the week and demonstrate your comprehension of them. In particular, I look for indications that you relate particular readings or topics to material previously discussed or otherwise covered in the course, to issues and concepts you have encountered in other courses, and/or to your own personal experiences. You will also be asked to introduce yourself on the introductions discussion board during the first week of class, work as a team to lead the discussion board one week, create questions for the board, lead the discussion, summarize and synthesize discussion highlights, create a reflection prompt for that week, and You can sign up for your preferred week to serve on a discussion board team on the signup sheet in the Course Resources folder accessible from the top left LMS menu.

1) Discussion Board Participation Posts on Readings & Cases (30%) (Weekly, Due Sundays at midnight)

A large part of your course grade is determined by your discussion board participation. Active and frequent participation is critical. You are expected to participate in all weekly online discussions. Each week, post 4 or more high-quality posts. You will be graded on both the quantity and quality of your participation. See the Course Guide for details. Additionally, you will have weekly questions that address the main points of the readings, the case or cases featured that week, as well as tie the readings together. Failure to participate and complete these questions will adversely affect your participation grade.

To get all ten points each week:

1) Post 4 high quality posts

2) Post half on more than 1 day, and

3) Post at least twice in the first half of the week (Monday to Thursday) and twice in the last half of the week (Friday to Sunday)

If you don't post 4 high quality posts:

4) You generally lose 3 points for the first missing post and 2 points for each post after that.

Strong suggestion: post more than four times.

Below these standards:

5) I'll drop the week of the lowest score, for a family emergency or any other reason

6) You lose 1 point for not posting twice in the front 4 or last 3 days of the week

7) You lose 3 points for posting all in 1 day

That said, my minimum for students who post is 3 points. The only way to get less than that is to not post at all. post at all.

Assessment: Largely pass/fail, 4 high-quality posts each week will be given full points, whether initial posts or replies. See the *Assignment Details & FAQ* document in Course Resources expanding and specifying all assignments and expectations. See the Instructions for All Assignments on Canvas for full details on these criteria. How will my participation be graded? In sum, the minimum number of posts for a given week will be four high quality posts in order to receive full credit. What is a high-quality post? Both quantity and quality are important. Not all posts count. To get all ten points each week, post high-quality posts on more than one day, with at least two posts in the first half of the week. High-quality posts include: 1) Effective use of the readings; 2) Analytic, substantive, evidence-based, or personal insights and examples; 3) Furthers the discussion; 4) Writing quality and citations; 5) Frequency & length; and 6) Awareness of others.

2) Team Leader Role for One Week's Discussions (5%)

You will be required to lead the discussion of one case during the semester. Sign up for the case discussion you wish to lead in the "Module Signup Sheet" (editable) linked on the LMS menu. If you are leading the week's discussion solo, I'm happy to help out talking through the questions that will be most helpful. If your team would like to add a short video, case, or reading on the same or another topic that illustrates the weekly policy development or process, you're welcome to do so. Please let me know two weeks ahead of the posting of the Sunday night posting of the assignment questions for those who are reading and

watching future material. Your team has four responsibilities during your chosen week: 1) create discussion questions; 2) moderate, lead, prompt, and raise further questions, 3) provide a concluding summary post of your discussion board; and 4) write a 1-3 paragraph prompt for a short Weekly Reflection Assignment (<1 page).

Purpose: Asking the right questions can be more important than having answers. Similarly, leading a discussion is often more important than presenting answers as an authority. In addition, summarizing a complex set of facts, perspectives, and discussions in a concise, informative, and educational way is critical for any leader.

Assessment: Your grade will be determined by the extent to which: 1) your *questions* meet the criteria outlined in number 1 (Create Questions) above and help to further everyone's learning; 2) your *leadership* results in a robust discussion and analyses applying and analyzing the readings, concepts, and the issues for the week; 3) your *concluding post* helps synthesize the discussion and generalize your lessons and takeaways from the assignment; and 4) the degree to which your reflection prompt elicits deep engagement and shared knowledge about the course material and topics. The instructor may do 360-degree team evaluation surveys at the end of the course to assess everyone's teamwork, workload, cooperativeness, and the quality of individual participation in team activities.

3) Write a short reflection paper each week (15%)

These short (1-page or less) weekly reflection assignments will address the main points of the readings as well as tie the readings together. Reflections can include opinions about the question and the week's topics by drawing on the readings, personal experience, and your own analyses and viewpoints. These should be high-quality and generally in the 300-500 word range, though I understand if you have to go a bit longer to cover your reflection goals. Reflective writing [7] is "a form of personal response to experiences, situations, events or new information; and a self-assessment and 'processing' phase where thinking and learning take place. It includes critically connecting "what you already know to what you're learning"[8] and to how you're learning it.

Purpose: This assignment gives everyone in the class another way to engage deeply in the week's course material, to provide more variety to weekly assignments, to work as a team with classmates if desired, and ideally to also make assignments interesting. It's also to more personally "identify, question, and critically evaluate"[9] somewhat similar to others in the course to the extent that they will ask you to analyze, discuss, and apply course concepts. Reflective writing offers many learning

[7] Ambrose, Susan A., Marsha Lovett, Michael W. Bridges, Michele DiPietro, and Marie K. Norman. *How Learning Works: Seven Research-Based Principles for Smart Teaching*. First edition. Jossey-Bass Higher and Adult Education Series. San Francisco, CA: Jossey-Bass, 2010. http://bvbr.bib-bvb.de:8991/F?func=service&doc_library=BVB01&doc_number=020217167&line_number=0001&func_code=DB_RECORDS&service_type=MEDIA.

[8] University of New South Wales, Sydney: https://www.student.unsw.edu.au/reflective-writing

[9] https://libguides.usc.edu/writingguide/assignments/reflectionpaper

benefits. Reflecting requires retrieval, elaboration, and generation of information, it can make learning more durable for students.[10]

Assessment: Assessing reflective writing is more challenging than other more narrowly defined learning assignments. Varied styles of reflective writing each have learning benefits (see rubric in the *Assignment Details & FAQ* document). Typically, I'll give full points to reflections that a) answer the prompt in a reflective way; and are b) well-written and organized, even with free-flowing discussion characteristics.

These will be graded somewhat similarly to high-quality discussion posts, using the same generic rubric minus the interactive requirements and suggested attribution and citations. Though these assignments vary widely, the general assessment rubric will be similar to those below, but with an emphasis on your personal response and your analytical connections between the week's subjects and readings and what you already know and think about the topics.

1) Effective use of the readings (cited)
2) Analytic, substantive, evidence-based, or *personal insights* and examples from the news.
3) Writing quality and citations
4) Quality & length

Writing Assignments: Two Policy Memos (40% total for both)

4) Policy Memo to Submit to the federal or state regulatory comments website on a federal or state public policy (10%)

5) Policy Memo to a city, state, or federal agency proposing a new policy or revision of current policy (30%)

For each of these memos, you should use the dozen guides to memo writing and the course resources folder for guidance and borrow ideas and formats as appropriate to achieve the purpose of your memo.

4) Memo Assignment #1: Comment on a Federal Climate Change Regulation (10%)

In the form of a policy memo, write and upload a comment on a government's regulatory comment website (federal, state, or local) while the proposed regulation is open for comment. The topic should be closely related to one or more course modules. This memo should be submitted to our LMS and uploaded to the actual federal website as required. It should be not more than 4 pages single-spaced, or

[10] Brown, Peter C., Henry L. Roediger III, and Mark A. McDaniel. *Make It Stick: The Science of Successful Learning*. Cambridge, MA: Belknap Press, 2014.

roughly 2,000 words per individual or teammate, not including reference lists or appendices. Usually, teams of two to three work best for this type of assignment. The memo's audience is expert government regulators who don't need any background on the topic. You should use the advice of at least some of the dozen guides to policy memo writing in the course resources folder. Ideally, it will also be a policy that you're very interested in and that will help you to build your expertise and experience in your current or intended career field. It may help to build your professional network and career contacts. If you're considering another regulation to comment on for a similar state or local comment period, let me know before you start your work.

5) Policy Memo Assignment #2: Actual Policy Memo for government or nonprofit organizations (30%)

Working with a federal, state, or local government agency, write a memo that will help them write or revise a policy. Most government agencies would appreciate your help in filling gaps in their knowledge, research, and policymaking. Given the wide range of policies related to the course, even State and local officials in related agencies may be unfamiliar with effective policies already in use elsewhere. The policy memo should be not more than 4 pages single-spaced, or roughly 2,000 words per individual or teammate, not including reference lists or appendices. Usually, teams of two to three work best for this type of assignment. For your grade, I will take into account the work you do finding a government or organization, meeting with them by Zoom if necessary, and in agreeing on a specific memo topic. If you prefer to do a hypothetical policy memo assignment, let me know and we can arrange it.

6) Final Exam (15%)

The final exam is a comprehensive open book/note exam cumulatively covering all previous course modules. The exams should integrate all content covered in the class up to that point. You will have 48 hours to complete the exams due on the dates listed in the syllabus; you can choose which 48-hour period within the window to complete the exam. The exam will include essay questions or a short policy memo, and will require you to synthesize and analytically reflect upon the course readings, discussions, and casework. Each student will select a 48-hour period during days before the due date when she or he can sit for the exam. You will download the exam and will need to upload your completed responses within 48 hours. One way to consider preparing for the exam is to study your notes of the readings, discussion recaps, and group discussion leader posts and summaries. **The final exam is due at the latest by 11:00 pm ET on Monday, May 1, or 48 hours from the time it is opened and started on Canvas. You can begin writing the exam anytime starting from Monday, April 24th, at 11:00 pm.**

Assessment: The exams will be graded on five elements according to the Writing Evaluation Rubric (see Canvas/Assignments for details):

1. Sharp Awareness of Your Target Audience

2. Thoroughness, Organization, and Clarity of analysis.
3. Support and Evidence.
4. Accurate and effective use of theory from the course readings and other sources
5. Presentation, Graphics, Tables, and Proofreading.

University Policies

Securing accommodations for a student with disabilities is a responsibility shared by the student, the instructor and the DSS Office. For information about support services or accommodations available to students with disabilities, and for the procedures to be followed by students and instructors: https://studentaffairs.indiana.edu/student-support/disability-services/index.html.

Religious Observation

In accordance with the Office of the Dean of Faculties, any student who wishes to receive an excused absence from class must submit a request form available from the Dean of Faculties for each day to be absent. This form must be presented to the course instructor by the end of the second week of this semester. A separate form must be submitted for each day. The instructor will fill in the bottom section of the form and then return the original to the student. Information about the policy on religious observation can be found at the following website: https://policies.iu.edu/policies/aca-59-accommodation-religious-observances/index.html.

Intellectual Dishonesty

All work should conform to O'Neill SPEA's Student Honor Code. All work must be your original product, unless explicitly noted otherwise. Any materials you reference or take from others should be properly cited. Cheating, plagiarism, or fabrication in any form will not be tolerated, regardless of any justification. For more detailed information see the Student Responsibilities section of the Code of Student Rights, Responsibilities, and Conduct. Academic misconduct will not be tolerated. The minimum consequence is failing the assignment. In a case of more serious offense, a student may fail the course. **Students should NOT present work from other courses in this class (i.e., using pieces of previous papers you have done is considered plagiarism).** I may use the services of Turnitin.com or other software to check for the originality of your written work.

Counseling and Psychological Services
For information about services offered to students by CAPS:
http://healthcenter.indiana.edu/counseling/index.shtml.

Disability Services for Students

Securing accommodations for a student with disabilities is a responsibility shared by the student, the instructor and the DSS Office. For information about support services or accommodations available to students with disabilities, and for the procedures to be followed by students and instructors: http://studentaffairs.iub.edu/dss/.

Sexual Harassment

As your instructor, one of my responsibilities is to help create a safe learning environment on our campus. Title IX and our own Sexual Misconduct policy prohibit sexual misconduct. If you have experienced sexual misconduct, or know someone who has, the University can help.

If you are seeking help and would like to talk to someone confidentially, you can make an appointment with:

The Sexual Assault Crisis Service (SACS) at 812-855-8900
Counseling and Psychological Services (CAPS) at 812-855-5711
Confidential Victim Advocates (CVA) at 812-856-2469
IU Health Center at 812-855-4011

For more information about available resources: http://stopsexualviolence.iu.edu/help/index.html. It is also important to know that federal regulations and University policy require me to promptly convey any information about potential sexual misconduct known to me to our campus' Deputy Title IX Coordinator or IU's Title IX Coordinator. In that event, they will work with a small number of others on campus to ensure that appropriate measures are taken and resources are made available to the student who may have been harmed. Protecting a student's privacy is of utmost concern, and all involved will only share information with those that need to know to ensure the University can respond and assist. I encourage you to visit http://stopsexualviolence.iu.edu/help/index.html to learn more.

Commitment to Diversity: Find your home and community at IU

Asian Culture Center
Address: 807 East Tenth Street, Bloomington, IN 47408
Phone: 812-856-5361
Email: acc@indiana.edu
Website: https://asianresource.indiana.edu/index.html

First Nations Educational & Cultural Center
Address: 712 E 8th St., Bloomington, IN 47408
Phone: 812-855-4814
Email: fnecc@indiana.edu
Website: https://firstnations.indiana.edu/contact/index.html

LGBTQ+ Culture Center
Address: 705 E 7th St., Bloomington, Indiana 47408
Phone: 812-855-4252
Email: glbtserv@indiana.edu
Website: https://lgbtq.indiana.edu/contact/index.html

La Casa Latino Culture Center
Address: 715 E 7th St., Bloomington IN, 47408
Phone: 812-855-0174
Email: lacasa@indiana.edu
Website: https://lacasa.indiana.edu/

Neal Marshall Black Culture Center
Address: 275 N Jordan Ave Bloomington, Indiana 47405
Phone: 812-855-9271
Email: nmgrad@indiana.edu
Website: https://blackculture.indiana.edu/index.html

Code of Student Rights, Responsibilities, and Conduct

Students are expected to adhere to the Code of Student Rights, Responsibilities, and Conduct at all times. Any inappropriate behavior, disruptive conduct (e.g., engaging in hostile or disrespectful commentary on the site, or discussing irrelevant evidence) or non-compliance with faculty directions can result in a charge of Academic and/or Personal Misconduct, the consequence of which could be a variety of sanctions either from the instructor or the Dean of Students. For more information see **The Code of Student Rights, Responsibilities, and Conduct.**

Note Selling

Several commercial services have approached students regarding selling class notes/study guides to their classmates. Selling the instructor's notes/study guides in this course is not permitted. Violations of this policy will be reported to the Dean of Students as academic misconduct (violation of course rules). Sanctions for academic misconduct may include a failing grade on the assignment for which the notes/study guides are being sold, a reduction in your final course grade, or a failing grade in the course, among other possibilities. Additionally, you should know that selling a faculty member's notes/study guides individually or on behalf of one of these services using IU email, or via Canvas may also constitute a violation of IU information technology and IU intellectual property policies; additional consequences may result.

Materials

The faculty member teaching this course holds the exclusive right to distribute, modify, post, and reproduce course materials, including all written materials, study guides, lectures, assignments, exercises, and exams. While you are permitted to take notes on the online materials and lectures posted for this course for your personal use, you are not permitted to re-post in another forum, distribute, or reproduce content from this course without the express written permission of the faculty member. Any violation of this course rule will be reported to the appropriate university offices and officials, including to the Dean of Students as academic misconduct. ***(see https://studentcode.iu.edu/)***

Course Expectations

Classroom Civility

Although this course is offered in a distance learning format, it does not alter our basic responsibilities to one another. It is your responsibility to do the following:

- Be prepared to contribute each week to the online discussions
- Complete assignments on time
- Participate in class discussion
- Inform me of any problem or situation that may be interfering with your learning or performance in the course
- Provide feedback on the strengths and weaknesses of the course in a professional manner

It is my responsibility to do the following:

- Provide activities designed to accomplish course objectives
- Assist in providing an atmosphere conducive to learning
- Grade and return assignments in a timely fashion and appraise students of their progress on a regular basis
- Respond to student concerns

Participation

You should be logging onto Canvas most days to view assignments, presentations, contribute to discussions, post questions, read posting of others, etc. Activities and assignments will be posted in advance to provide ample time for completion. Please plan your schedule accordingly.

Late Work

All assignments are due by the end of the day (U.S. Central time zone) on the date that the assignment is due. Late work will be downgraded one full letter grade for each day it is late. I will consider making individual exceptions to this policy, but only if an exception is requested in advance, is legitimate, and can be documented.

Plagiarism

Honesty requires that any ideas or materials taken from another source for either written or oral use must be fully acknowledged. Offering the work of someone else as one's own is plagiarism. The language or ideas thus taken from another may range from isolated formulas, sentences, or paragraphs to entire articles copied from books, periodicals, speeches, or the writings of other students. The offering of materials assembled or collected by others in the form of projects or collections without acknowledgment also is considered plagiarism. Any student who fails to give credit for ideas or materials taken from another source is guilty of plagiarism. (Faculty Council, May 2, 1961; University Faculty Council, March 11, 1975; Board of Trustees, July 11, 1975) Source comes from IU's Policies site.

According to the Indiana University Code of Student Rights, Responsibilities, and Conduct (2010), a student must give credit to the originality of others and acknowledge indebtedness whenever:

1. Directly quoting another person's actual words, whether oral or written;
2. Using another person's ideas, opinions, or theories;
3. Paraphrasing the words, ideas, opinions, or theories of others, whether oral or written;
4. Borrowing facts, statistics, or illustrative material; or
5. without Offering materials assembled or collected by others in the form of projects or collections acknowledgement.

Right of Revision

The instructor reserves the right to revise or adjust the course syllabus to best accommodate the pace and needs of the students.

COURSE CALENDAR

	Part i: Introduction
Jan 9-15	**WEEK 1: Introduction to The Transition**
Module 1.1	**1.1 Course Introduction and Overview**
Learning Objective	To introduce some of the major climate policy topics of the course. To understand the sources of GHG emissions and the range of policies to reduce and stop them.
Skills	Be able to easily identify GHG emission sources, overlapping and adjacent issues, and to identify policy goals and alternatives to stop or reduce emissions from multiple perspectives, organizational positions, and scenarios.
Topics	Even the most likely climate change scenarios, let alone the less likely but most extreme catastrophic scenarios -- are disturbing. However, there are promising developments in climate change policy even if you think that climate change is a "wicked" or insoluble problem, or a perfect storm of far-off, invisible, hard to address impacts.
Read (Required)	Harvey, Introduction & Chapter 1: Putting Us On Track for a Low-Carbon Future (pp. 1-33) Book is available online from IU Bloomington Library
Read or Skim (Recommended)	"Emissions Gap Report 2020 - Executive Summary" Programme, United Nations Environment. "Emissions Gap Report 2020 - Executive Summary," 2020. Also in Course Resources
Watch or Listen (Required)	Short Course Introduction Video These two podcasts are required listening. They touch on dozens of the topics we'll cover in this course, as well as many that are important but that we don't have time to cover. 1) What's in my Air, a podcast from Climate One (Transcript here). This is one of the best - and most optimistic, unlike some in this course -- podcasts I've heard on climate change. It also introduces the next, very promising phase of climate

	change policy: instrumentation advances measuring pollution that give increasing precision and resolution on what, where, and who is polluting, allowing policymakers the ability to target policies where they will have the biggest impact, at the lowest cost, and that are simplest to implement. 2) ESG Investing with Terrence Keeley, Energy 360 Podcast (CSIS, Center for Strategic & International Studies). This is a more financial, more centrist approach to the low-carbon transition. See also Porter & Kramer "Creating Shared Value" on the broad benefits of integrating environmental concerns into corporate goals.[11]
Watch (Required)	Basic Background on Climate Change (15 min): Dr. Peter Kalmus Q & A from Wired Magazine. He's with NASA's Jet Propulsion Laboratory.
Mini Case	"A tale of two lakes," pp. 12-13, Nordhaus, William D. *The Climate Casino: Risk, Uncertainty, and Economics for a Warming World*. Illustrated edition. New Haven London: Yale University Press, 2015. Note: Nordhaus won the 2018 Nobel Prize in Economics.
	Part I: Risks (LO 1)
Module 1.2	**1.2 Risks, Models, & Probabilities**
Learning Objective	To become more familiar with the context of climate change, which pollutants are most important, where GHGs have unequal impacts, and which are the highest priority policy areas. To know the global and local health and other risks caused by or co-occurring with GHG emissions that create public health, equity, economic, and environmental opportunities for local co-benefits of emissions reductions.
Topics	Continuing current warming trends and emissions will lead to warming between 1.5° and 5.7° C by 2100 under very low to very high emissions scenarios.[12] The IPCC predicts that even if nationally determined contributions are met (only Gambia; no others), the result will be a "catastrophic" 2.7 deg C temperature increase. Oil and gas use continues to grow, and global GHG emissions are not yet levelling off. A growing literature also finds that the economic costs of climate change are high and likely to grow dramatically without sharp reductions in GHG emissions.[13] The costs of addressing climate change are similarly debated, but are generally seen as costing a fraction of the economic, adaptation, environmental, and other costs of continuing current emissions levels.
Read (Required)	▪ Schimel, David. "I Was a Lead Author on the Climate Report That Won Al Gore the Nobel Prize. Here's What We Know Now That We Didn't Know Then | Fortune. ▪ Magazine, Smithsonian, and Margaret Osborne. "To Prevent Catastrophic Damage by 2100, Climate Experts Warn 'It's Now or Never.'" Smithsonian Magazine.

[11] Porter, Michael E., and Mark R. Kramer. "Creating Shared Value." *Harvard Business Review* 89, no. 1/2 (February 2011): 62–77.
[12] IPCC AR6, Table SPM 1, p. 14
[13] Reports intended for bipartisan audiences, such as from the Congressional Research Service, are more moderate in tone. Some advocacy groups present the data different ways to increase doubt that climate change is human-made and that climate scientists are objective.

	▪ UCL. "Economic Cost of Climate Change Could Be Six Times Higher than Previously Thought." UCL News, September 6, 2021. ▪ See Stern Review (2006), to critiques (& here & here2), to more current estimates.
Read or Skim (Recommended)	▪ Suhaib A. Bandh. *Climate Change : The Social and Scientific Construct*. Cham: Springer, 2022. Available at IU Library as e-Book ▪ McKibben, Bill. 2016. "Recalculating the Math." *The New Republic* 247, 11: 16-17. ▪ Tollefson, Jeff. 2018. "Can the world kick its fossil-fuel addiction fast enough?" *Nature* 556: 422-425. ▪ Xu, Yangyang, Veerabhadran Ramanathan, and David Victor. 2018. "Global warming will happen faster than we think." *Nature* 564: 30-32. ▪ Goodell, *The Long Goodbye*, Ch. 12, 216-219 In Course Resources Folder
Watch or Listen (Optional)	▪ Video on the history of climate change research: "Global Warming: An Inconvenient History"(31 Min) ▪ *What Will the World Look like in 2050 If We Reach Carbon Neutrality? | DW News*, 2021. https://www.youtube.com/watch?v=dJB2WAKqQ34. (12 min; climate starts to level off and stabilize at 1.5 degrees C, a best-case scenario)
Module 1.3	**1.3 Problem: GHG Sources, Trends, & Projections**
Learning Objective	To become more familiar with the scope of the GHG emission problem and its makeup. To identify the range of pollutants and polluters to explore where opportunities for immediate, low-cost, significant emissions reductions policies exist.
Topics	After more than forty years of accumulating evidence of the causes and effects of climate change as well as its high and growing risks, and after decades of international attempts to reverse GHG emissions at climate summits from Rio 1992 to Glasgow 2021, emissions continue to rise globally, and are only dropping marginally in the US. The IPCC predicts that even if nationally determined contributions are met (few are), the result will be a "catastrophic" 2.7 deg C temperature increase. Having risen 1.1 degrees C since 1880, *None* of 40 indicators of climate progress are on track (& R & R2) to reach the 1.5 degree 2030 targets. ▪ **Scope 1, 2, and 3 Emissions**: To help categorize organizations' emissions, the Greenhouse Gas Protocol developed the three scope distinctions to improve accounting and reporting of GHG emissions.[14] The Protocol: Scope 1 and 2 are mandatory to report, while Scope 3 is more difficult to measure. The GHG Protocol publishes a Scope 3 Corporate Value Chain Accounting and Reporting Standard. • **Scope 1 Emissions**: Direct burning of fossil fuels, such as by a natural gas water heater, from owned or controlled sources. • **Scope 2 Emissions**: Buying electricity from a utility; the utility is the emitter; indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed by the reporting company.

[14] The GHG Protocol is a joint initiative between the World Resources Institute and the World Business Council for Sustainable Development.

	• **Scope 3 Emissions**: Includes all other indirect emissions that occur in a company's value chain. For example, buying paper towels and the embedded carbon in products.
Read or Skim (Required)	▪ "Greenhouse Gas Bulletin," WMO, October 17, 2022. ▪ "2022 NDC Synthesis Report | UNFCCC." ▪ US EPA Background on environmental equity and justice ▪ Energy Justice & Equity: Sovacool, Benjamin K. "Who Are the Victims of Low-Carbon Transitions? Towards a Political Ecology of Climate Change Mitigation." *Energy Research & Social Science* 73 (March 1, 2021): 101916. https://doi.org/10.1016/j.erss.2021.101916. See also here ▪ Boehm, Sophie, Louise Jeffery, Kelly Levin, Judit Hecke, Clea Schumer, Claire Fyson, Aman Majid, et al. "State of Climate Action 2022," October 26, 2022. ▪ Goldstein, Joshua S., and Staffan A. Qvist. *A Bright Future: How Some Countries Have Solved Climate Change and the Rest Can Follow*. First edition. New York, NY: PublicAffairs, 2019. Ch. 6, pp. 78-84
Read or Skim (Recommended)	US National Climate Assessment (NCA5) 5th (Due 2023; still open to comments);4th (Completed 2014). Intro to GHG Sources (& here1 and here2 overview) Natural Gas (& here), Methane(CH_4); & here1 & here2& here3 & here4 & here5 refutes conventional wisdom) **1)** Introduction to Carbon Sinks **2)** Policies by level of government: International, national,[15] US federal, state (2), & local (2) **3)** GHG Inventory Development Process & Guidance US EPA (IPCC Guidelines) 4) Energy Flows Outline Sankey Diagrams (& Here1): IEA & Here2 & Detail (Otherlab; even more detail on energy use breakdowns Here3) The EPA tracks several air pollutants and makes the data publicly available (2), including equity-related data. WRI Sector/End Use/GHG Gas Sankey Diagram (interactive) Nitrous Oxide (N_2O), Fluorinated Gasses (F-Gas), GHG Warming Potential of Each Gas[16]

[15] https://www.lse.ac.uk/granthaminstitute/news/more-than-170-countries-have-national-policies-on-adaptation-to-manage-the-risks-of-climate-change-impacts/

[16] For detailed warming potential of several dozen GHGs and their chemical formulae, see Forster, Piers, Venkatachalam Ramaswamy, Paulo Artaxo, Terje Berntsen, Richard Betts, David W Fahey, James Haywood, et al. "Changes in Atmospheric Constituents and in Radiative Forcing," n.d., 106. IPCC, AR4, esp. pp. 210-215

	Renewable Fuels Lifecycle GHG Results (US EPA) Carbon intensity and carbon intensity of production.[17] The full IPCC Physical Science report (2021; 3,949 pages) Sources by US Fuel Used: Excellent Detailed Sankey Diagram from Saul Griffith's Otherlab. For even more detail & NAICS breakdowns, see interactive version Sources by GHG Gas: EPA Overview & here1 [18] Sources by Economic Sector & here, p. e77 Sources by Country (2) Sources by US City Sources by Scope 1, 2, or 3 Category US EPA Facility Reporting System (US)
Watch or Listen (Optional)	See Dave's Short Course Introduction Video on Canvas
Module 1.4	**1.4 GHG Sources by Country, Industry, & Sector**
Learning Objective	To further differentiate emissions sources by their sources and contexts. The idea of *common but differentiated responsibilities* is a key framing equity concept in international climate negotiations. Variations of the idea might be useful if applied more often to national, state, and local policies.
Topics	The United Nations Environment Programme (UNEP) estimates, based on updated national commitments (Nationally Determined Contributions, or NDCs) just before the Glasgow COP meeting, that even if all pledges are met, temperatures will rise to 2.7 degrees C by 2100, with "catastrophic" consequences.[19] Even if these recent commitments are met, GHG emissions will only fall 12% by 2030 rather than be cut in half by 2030, as is needed to keep warming below 1.5 degrees C by 2100, according to the UNEP.
Read (Required)	"About | Climate Watch." https://www.climatewatchdata.org/about/faq/ghg.
Read or Skim (Recommended)	Griffith book, 2021, See figs. 2.1, 2.2, 2.3, and 3.4. WRI: **4 Charts Explain Greenhouse Gas Emissions by Countries and Sectors**
Watch or Listen (Optional)	▪ Short Course Introduction Video (Dave) ▪ Watch (Optional): "The melting ice of the Arctic" (1/2) | DW Documentary 36:00-39:00

[17] "For example, in 2010, the US emitted 5.7 billion tons of CO2, and its real GDP was $14.8 trillion, which equals a carbon intensity of 0.386 tons of CO2 per $1000 of GDP. By 2015, carbon intensity declined to 0.328, for an average rate of decarbonization of 3.1% per year." Nordhaus Nobel Lecture, p. 459

[18] "Black carbon" is regulated separately, and is not yet considered a GHG by EPA

[19] Environment, U. N. "Emissions Gap Report 2021." UNEP - UN Environment Programme, October 25, 2021. http://www.unep.org/resources/emissions-gap-report-2021. "[T]the world [is] on track for a global temperature rise of 2.7°C by the end of the century. That is well above the goals of the Paris climate agreement and would lead to catastrophic changes in the Earth's climate. To keep global warming below 1.5°C this century, the aspirational goal of the Paris Agreement, the world needs to halve annual greenhouse gas emissions in the next eight years."

	▪ Watch (Optional): "Earth currently experiencing a sixth mass extinction, according to scientists" | 60 Minutes[20] 7:45-11:00 ▪ *Drawdown* longer lecture/webinar overview of sources and solutions (1 hr, 26 min)
Case Topics for Weekly Discussion Board	Before posting on the discussion board, please read and watch: ▪ Read: "NYT Installing Rooftop Solar Can Be a Breeze. Just Look at Australia" June 8, 2022 in Course Resources Library ▪ Read: See the Australian government's goals, guidance, regulation, and oversight of the solar industry. ▪ Watch:"*Australia Is on the Frontline for Climate Change, yet It Does Little to Fight It. Here's Why*," 2022 .(5 min)
Jan 16-22, Mon-Su	**WEEK 2: Sinks & Offsets**
Module 2.1	**2.1 Introduction to Sinks & Offsets**
Topics	**Sinks**: Most nature-based climate solutions are called *sinks* for their ability to absorb, or sequester, atmospheric GHGs, mainly carbon. "They're "Nature-based Climate Solutions (or NbCS): ....Unlike other CO2 removal strategies, NbCS confer well-known environmental co-benefits for biodiversity, air and water quality, and soil health, in addition to essential economic benefits for farmers, foresters, and other stewards of working lands."(Novick et al., IU-led Report, October 2022, Policymaker Summary)[21]**Offsets** refer to buying funding units (usually denominated in dollars per ton) dedicated to removing *additional* CO2 from the atmosphere beyond what *would have been removed otherwise (additionality)*.
Read (Required)	▪ Cullenward, Danny, and David G. Victor. *Making Climate Policy Work*. 1st edition. Cambridge, UK ; Medford, MA: Polity, 2020. Ch. 5, pp. 87-107 ▪ Hawken, *Drawdown*: Forests, 132-135; Coastal Wetlands, pp. 112-113; Peatlands, pp. 122-123; Temperate Forests, pp. 128-129
Read (Recommended)	Skim: Novick et al., "The Science Needed for Robust, Scalable, and Credible Nature-Based Climate Solutions in the United States: Full Report." IUScholarWorks, 2022.. Policymaker summary (3 pp), Summary Report (16 pp), and Full Report (58 pp).
Watch (optional)	Carbon Offsets: Last Week Tonight with John Oliver
Listen (optional)	▪ Podcast: "Strengthening Carbon Offsets: The Oxford Offsetting Principles" Myles Allen, HBS *Climate Rising* podcast Transcript ▪ Podcast: "How Carbon Offsets Went Wrong," Mark Trexler, Bloomberg *Zero* podcast. Transcript
Module 2.2	**2.2 Sinks & Negative Emissions**
Topics	Carbon Sinks (& here1 & here2) or Negative Emissions (or here1) are anything that removes more carbon from the atmosphere than it emits, whether natural (plants, oceans, soil) or human-made, such as mechanical carbon removal. Major questions are the possibilities and limits of taking in or removing carbon from the atmosphere

[20] Note: I'm not related to Paul Ehrlich and am somewhat more optimistic than he is.
[21] Novick et al., "The Science Needed for Robust, Scalable, and Credible Nature-Based Climate Solutions in the United States: Full Report." IUScholarWorks, 2022.

	through planting trees and other types of afforestation (growing trees on land without trees), including the costs and risks of assuming permanent maintenance and stewardship, including avoided costs (and likely societal investment value) in avoiding deforestation (& here1)?[22]
Read (Required)	Land Use, *Drawdown*, pp. 106-107 Coastal Wetlands, *Drawdown*, pp. 112-113 Peatlands, *Drawdown*, pp. 122-123 Tropical Forests, *Drawdown*, pp. 114-116
Module 2.3	**2.3 Preventing Deforestation**
Learning Objective	Conserving and restoring existing forests (sometimes called proforestation)
Topics	**Deforestation**: Natural Sinks including forests currently absorb twice as much carbon as they emit when cut down or degraded; their net absorbed CO_2 is 1.5 times US annual CO_2 emissions. The avoided costs (and likely societal investment value) in avoiding deforestation (& here1) are favorable.[23] Offsets from preserving existing forests are increasingly seen as a good business investment, and even a good source of government revenue, even when forests are not at high risk of being cut down. But pricing these offsets verifiably is difficult.
Read (Required)	▪ Moomaw, William R., Susan A. Masino, and Edward K. Faison. "Intact Forests in the United States: Proforestation Mitigates Climate Change and Serves the Greatest Good." *Frontiers in Forests and Global Change* 2 (2019). ▪ SKIM: Seymour, Frances, Michael Wolosin, and Erin Gray. "Not Just Carbon: Capturing All the Benefits of Forests for Stabilizing the Climate from Local to Global Scales," October 24, 2022. ▪ Hawken 2017, *Drawdown*, p. 109-11; 114-116
Read or Skim (Recommended)	World Resources Institute. "Forests" & "Global Forest Watch"
Module 2.4	**2.4 Sinks: Reforestation & Afforestation**
Learning Objectives	To understand forests' effects on emissions and policy implications.
Topics	**Afforestation** (or *reforestation* for areas previously forested): Planting trees is politically popular, with the highest degree of bipartisan popular support (US) among climate policies in polls. Preventing deforestation has the largest and most immediate impact, but afforestation and reforestation are also important tools, especially in the long term. However, afforestation has many practical challenges as a major or quick policy tool, even beyond even beyond the fact that is does not reduce emissions.
Read	Nature Conservancy. "New Tool: Most Comprehensive Analysis of Reforestation Potential in the United States." https://www.nature.org/en-us/newsroom/study-shows-reforestation-potential-us/.
Watch or Listen (Optional)	Western wildfires threaten carbon offsets (CBS; 8 min)

[22] Also referred to as Reducing Emissions from Deforestation and Degradation (REDD).
[23] Also referred to as Reducing Emissions from Deforestation and Degradation (REDD).

Module 2.5	**2.5 Sinks – Geoengineering (human-made changes in the atmosphere)**
Learning Objective	**The two major types of geoengineering are carbon dioxide removal (CDR)** and **solar radiation management (SRM)** to reflect sunlight from the atmosphere through albedo modification such as a volcano can do, or by airplanes regularly releasing reflective aerosols. Scientists generally believe that taking CO2 out of the atmosphere and burying it – a technology that now costs $500-1,200/ton when done mechanically, will likely help to stabilize global temperatures and may be a necessary step given the lack of progress at reducing carbon emissions. Even methods such as space mirrors to reflect sunlight are now being seriously considered, despite their risks.
Read (Required)	▪ CCS (Direct Air Capture of CO2): *Drawdown*, pp. 192-193 ▪ Goldstein, Joshua S., and Staffan A. Qvist. *A Bright Future: How Some Countries Have Solved Climate Change and the Rest Can Follow*. First edition. New York, NY: PublicAffairs, 2019. Pp. 170-173 ▪ Morrow, David R., Holly J. Buck, Wil C. G. Burns, Simon Nicholson, and Carolyn Turkaly. "Why Talk about Carbon Removal?," 2018. (& in Course Resources) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3295439
Read (Optional)	SKIM: IPCC 2005 Report on CCS
Watch or Listen (Optional)	Video TED talk: A new way to remove CO2 from the atmosphere https://www.ted.com/talks/jennifer_wilcox_a_new_way_to_remove_co2_from_the_atmosphere?language=en, Jennifer Wilcox (14 min) Video: Direct Air Capture Deep Dive with Dr. Jennifer Wilcox (1 hour 7 min)
	Part II: Pathways (LO2)
Jan 23-29, Mon-Sun	**WEEK 3: Pathways to Zero Emissions (LO2)**
Module 3.1	**3.1 Introduction**
Intro	Multiple policy paths can reduce emissions and decarbonize across sectors, industries, and policy types. Three-quarters of emissions are from electricity, heat, and transport; quickly electrifying buildings and cars while moving to renewable power is the goal of much climate policy. Many additional changes across polluting sectors and industries are economically and technically feasible now; others are many years away from technical and economic viability. Policy approaches are similarly diverse, ranging from mandates to incentives to markets to industrial policy to voluntary actions. Often policies combine several approaches, or take entirely separate policies take different approaches to target different parts of the same problem or different target populations.
Module 3.2	**3.2 Frames Informing Pathways to Zero Emissions**
Topics	**Framing Climate Policies:** Most framing of climate policies in contentious environments focuses on local, short-term benefits. For example, local climate policies can improve lives from health to heat to property values. While economic growth debates are sometimes framed as a competition between environmental

	regulation vs. economic growth, extreme climate risks include economic as well as environmental costs. "[M]any economists are optimistic about combining growth and a stable climate." Many environmentalists also see non-polluting growth as compatible with competitive markets. One way to prioritize specific possible policies to get at the easiest, fastest, or lowest-cost is to look at the financial benefits (cost savings) from various technologies or policy actions.[24] Marginal abatement cost MAC curves can also help frame general policy options.
Read (Required)	▪ Meckling, Jonas, Thomas Sterner, and Gernot Wagner. "Policy Sequencing toward Decarbonization." *Nature Energy* 2, no. 12 (2017): 918–22. ▪ Jonas Meckling, Nina Kelsey, Eric Biber, and John Zysman. 2015. "Winning Coalitions for Climate Policy." Science 349 (6253): 1170–71 ▪ Borick, Christopher P., and Barry G. Rabe. "A Reason to Believe: Examining the Factors That Determine Individual Views on Global Warming." *Social Science Quarterly (Blackwell Publishing Limited)* 91, no. 3 (2010): 777–800.
Read or Skim (Recommended)	• IPCC. 2018. "Summary for Policymakers," in *Global Warming of 1.5°*, pp. 3-26. • Climate Action Tracker. 2020. Update on Paris Agreement turning point; net zero targets would bring warming to 2.1 degrees C. • UN Environment Programme. 2020. "Emissions Gap Report 2020 - Executive Summary," Nairobi. pp. IV-XV.
Watch or Listen (Optional)	▪ Video: Broad framing of pathways: Taking the Temperature on the Climate Apocalypse PBS Terra (14 min) ▪ Video: 100 solutions to reverse global warming | Chad Frischmann (17 min.)
Module 3.3	**3.3 Benefits, Co-benefits, & Costs of Decarbonization**
Topic	We'll be examining costs in more detail in this course. It's often more difficult to estimate the benefits and co-benefits from climate change policy and from GHG emission reductions than the environmental risks. It's even more difficult to monetize externalities.[25] A few co-benefits (benefits in addition to those related to climate change): the reduction of more than 4 million annual premature deaths from air pollution, which most climate policies also reduce; cost savings from renewables, many of which now have lower levelized costs than fossil fuels; avoided economic damages; avoided damages to biodiversity; additional large and well-document human health benefits; local jobs; local and regional and national energy security, economic development for cities, state, and nations; and many others.
Read (Required)	▪ Goldstein, Joshua S., and Staffan A. Qvist. *A Bright Future: How Some Countries Have Solved Climate Change and the Rest Can Follow*. First edition. New York, NY: PublicAffairs, 2019. Ch. 5, pp. 53-77 ▪ Gallagher, Ciaran L., and Tracey Holloway. "Integrating Air Quality and Public Health Benefits in U.S. Decarbonization Strategies." *Frontiers in Public Health* 8 (2020): 520. https://doi.org/10.3389/fpubh.2020.563358.

[24] The McKinsey Cost Curve was developed jointly by McKinsey and the Vattenfall Institute of Economic Research.
[25] Note errors transposing energy and electricity figures here.

Read (Skim)	Reis, Lara Aleluia, Laurent Drouet, and Massimo Tavoni. "Internalising Health-Economic Impacts of Air Pollution into Climate Policy: A Global Modelling Study." *The Lancet Planetary Health* 6, no. 1 (January 2022): e40–48. https://doi.org/10.1016/S2542-5196(21)00259-X.
Topics	**Policy Databases:** Many databases, some Integrated Assessment Models (IAMs), examine current and potential policies to reduce emissions.[26] Here are a few: the **New Climate Institute's "Climate Policy Database";** an "Energy Policy Simulator" based on the Harvey book; the International Energy Agency's "Policies Database"; The LIMITS database used by the Harvey book;[27] the *Drawdown* book table of solutions: the International Institute for Sustainable Development IISD; the London School of Economic Grantham Institute work; the ACEEE state and city databases; Columbia/Sabin database organized by federal agency; a database of climate policy databases from Climate Cabinet education; and many others.
Read (Required)	NBER. Nordhaus, William, "Integrated Assessment Models of Climate Change."
Module 3.5	**3.5 International and National Climate Actions around Pathways**
Topics	**Pathways, assumptions, projections of current and possible emissions or climate outcomes**: In this module, we'll explore the range of climate policies that can help reduce emissions, focusing on the renewables, building, and transportation. The IPCC, IEA, books, the Grantham Institute, the US EPA, and many other organizations (such as here) list both national and subnational policies. The most successful, least politicized climate-related international negotiations success stories are the 1987 Montreal Protocol and Kigali Amendments in 2016, which were recently passed into law and ratified by the US Senate by bipartisan Congressional majorities.
Read (Required)	ClimateWorks Foundation. "COP27: Four Key Storylines That Will Shape the Climate Agenda in 2023."
Read or Skim (Recommended)	Tørstad, Vegard, Håkon Sælen, and Live Standal Bøyum. "The Domestic Politics of International Climate Commitments: Which Factors Explain Cross-Country Variation in NDC Ambition?" *Environmental Research Letters* 15, no. 2 (2020): 024021.
Module 3.6	**3.6 Paths to Half or Zero**
Topics	**Paths to Half or Zero Emissions** by 2030, 2040, 2050, or 2060 (compared to 2005) There is much debate over the best strategies and pathways to reduce carbon and other GHG emissions. Integrated Assessment Models (IAMs) (2) have been criticized for many reasons, such as their underestimates of actual temperature increases (here1, here2, here3), for their overestimates of feasible and economical global negative-emissions technology (both natural and engineered), for variances in their findings, and other issues such as their assumptions related to discount rates (2) and the relationship between temperature increases and economic damage to GDP. Each year

[26] We don't examine those based on adaptation policies here, as previously noted.
[27] I have so far been unable to access this LIMITS data despite writing the contacts. The data does not appear to have been updated recently.

	of delay in reducing emissions costs more than half a trillion dollars in adaptation. A *carbon budget* usually refers to a methodology to quantify CO_2 emissions' partitioning across the atmosphere, land, and ocean. A *carbon budget* can also be an estimate of how fast and deep decarbonization must proceed to limit warming to 1.5 degree C, 2.0 degrees, etc.
Module 3.7	**3.7 Global & Non-US Pathways to Half or Zero**
Topics	**Global, non-US country pathways**: These include the IPCC Mitigation Pathways Compatible with 1.5° C warming, , the net-zero by 2050 EU Plan, the IMFs plan to cut 2020 emissions in half by 2030, the Pathways to Net-Zero SBTi Technical Summary, the EuropeanClimate.org Net Zero 2050 Pathways, the US (Lawrence Berkeley Lab)-China Framework & Milestones for Carbon Neutrality, and many others. The International Renewable Energy Agency (IRENA) has made aggressive recommendations.
Module 3.8	**3.8 National Policies**
Topics	The recently passed federal infrastructure bill includes more than $50 billion toward climate change. (H.R.3684 - Infrastructure Investment and Jobs Act. (RPC summary: Compilation of Summaries). Its climate impacts are many, and outlays of nearly $400 billion, which could increase depending on how much progress is being made and which firms qualify for tax and other incentives. A good overview of federal policy is in this Congressional Research Service report (R46947). Many federal agencies are involved with climate change. Climate policy and public opinion on the severity of the problem and level of urgency is particularly partisan in the US, but with some areas of general agreement.
Required Reading	▪ Goldstein & Qvist, A Bright Future, Ch. 2,3,4 (pp. 20-52) (Sweden and Germany) & Ch. 13: China, Russia, India (pp. 174-190) ▪ Rabe, Barry G. "Beyond Kyoto: Climate Change Policy in Multilevel Governance Systems." *Governance* 20, no. 3 (2007): 423–44. ▪ Skim: Good RFF Overview of "Federal Climate Policy 101: Reducing Emissions"
Reading (Recommended)	▪ Lachapelle, Erick, and Matthew Paterson. "Drivers of National Climate Policy." *Climate Policy* 13, no. 5 (2013): 547–71. ▪ Aklin & Mildenberger, Prisoners of the Wrong Dilemma: Why Distributive Conflict, Not Collective Action, Characterizes the Politics of Climate Change 2020 ▪ SKIM (Available as IUL e-book): Anatol Lieven. *Climate Change and the Nation State: The Case for Nationalism in a Warming World*. New York, NY: Oxford University Press, 2020. Anderson-Samways summary Here & in our Resources ▪ Dubash, Navroz K., Aditya Valiathan Pillai, Christian Flachsland, Kathryn Harrison, Kathryn Hochstetler, Matthew Lockwood, Robert MacNeil, et al. "National Climate Institutions Complement Targets and Policies." *Science* 374, no. 6568 (November 5, 2021): 690–93. https://doi.org/10.1126/science.abm1157. ▪ Povitkina, Marina. "The Limits of Democracy in Tackling Climate Change." *Environmental Politics* 27, no. 3 (2018): 411–32

	▪ Council, Climate. "11 Countries Leading the Charge on Renewable Energy." Climate Council, August 15, 2022.
Module 3.9	**3.9 State and Provincial Policies**
Topic	Since the federal government has not had a comprehensive climate change policy, states have been primary drivers of clean energy, with widely varying policies (& here). Thirteen states have explicitly market-based approaches to GHG emission reductions. Except for the US southeast, most states (about 38) have enacted Renewable Portfolio Standards (RPS) (R1) to require utilities to gradually increase the amount and percentage of renewable energy sources they buy from. RPS policies have proven to be one of the most popular and successful government climate policies to date, in part due to their flexibility, and variable stringency (see also Canvas for the Carley & Miller and Carley, Nicholson-Crotty, and Miller papers). The federal government has not enacted an RPS.
Read (Required)	▪ Washington Post. "Analysis | What Climate Policies Do Americans Want from Their Legislatures?," July 6, 2022. ▪ US EPA, OAR. "State Renewable Energy Resources." July 5, 2017. ▪ Basseches, Joshua A.,Rebecca Bromley-Trujillo, Maxwell T. Boykoff,Trevor Culhane, Galen Hall,Noel Healy, David J.Hess,et al."Climate Policy Conflict in the U.S. States: A Critical Review and Way Forward."*Climatic Change* 170, no. 3 (Feb 16, 2022): 32. ▪ Barbose, Galen L. "U.S. Renewables Portfolio Standards 2021 Status Update: Early Release," 2021. (R2 or in Course Resources) ▪ Einloth, James. "The Past, Present and Future of Renewable Portfolio Standards." *Present and Future of Renewable Portfolio Standards (November 25, 2018)*
Read (SKIM)	▪ Indiana state environmental policies; bills to watch this year from the Indystar ▪ Rabe, Barry G. "The Complexities of Carbon Cap-and-Trade Policies: Early Lessons from the States," Brookings, 2008. ▪ SKIM: Rabe, Barry. "Race to the Top: The Expanding Role of US State Renewable Portfolio Standards." Pew Center on Global Climate Change, 2002 ▪ Carley, Sanya, Lincoln L. Davies, David B. Spence, and Nikolaos Zirogiannis. "Empirical Evaluation of the Stringency and Design of Renewable Portfolio Standards." *Nature Energy* 3, no. 9 (September 2018): 754–63 ▪ Mcallister, Lesley. "Regional Climate Regulation: From State Competition to State Collaboration," July 8, 2009. ▪ Rabe, Barry G. "States on Steroids: The Intergovernmental Odyssey of American Climate Policy." *Review of Policy Research* 25, no. 2 (2008): 105–28. ▪ Center for American Progress. "How States Can Use the Bipartisan Infrastructure Law To Enhance Their Climate Action Efforts." ▪ "State Energy and Environment Guide to Action: Interconnection and Net Metering," US EPA, 2022

	▪ Nicholson-Crotty, Sean, and Sanya Carley. "Effectiveness, Implementation, and Policy Diffusion: Or 'Can We Make That Work for Us?'" *State Politics & Policy Quarterly* 16, no. 1 (2016): 78–97. (in Course Resources)
Module 3.10	**3.10 Cities and other Local Policies**
Topic	Municipal emissions are about two-thirds from non-transportation sources; building electricity alone accounts for about 40% of US carbon dioxide emissions.[28] Local policies could potentially encourage, facilitate, and speed up required state emissions reductions. But municipalities vary widely in the type, implementation, and effectiveness of these policies. Many have not enacted *any* effective policies to meet energy efficiency and renewables goals. Policies that have been enacted have often been sporadic and fragmented, sometimes in response to broad sustainability plans, zoning disputes, or legal challenges. Local governments have been unable to rely on empirical evidence of policy effectiveness or the measurable policy results achieved by leading communities. Cities need to know what other cities are doing, whether those cities' policies are successful or not (here1 & here2). Many cities have already experimented with and now have proven policies that can be modeled. As US EPA Administrator Gina McCarthy said in a 2014 visit to Chicago, "… If you can do it in one city, you can do it in every city. All I'm asking people to think about is what's already been done in so many other places."[29]
Read (Required)	Understanding Local Adoption and Implementation of Climate Change Mitigation Policy Local carbon markets: Implementing Carbon Pricing at the Municipal Level; Aspen & Pitkin County Carbon Fee Program (1999) "9 Cities That Are Leading on Climate | Bloomberg Cities.". Badia, Mons. "Cities leading the fight against climate change." CitiesToBe, September 25, 2018. "Ten Cities Tackling Climate Change | Smart Cities Dive." .
Read (Recommended)	▪ Pitkin (CO) Building Codes; Evanston (IL) Green Building Ordinance ▪ Transit equity and ridership, building electrification, and many other city policies are in effect across the US. ▪ Joshi, Janak. "Do Renewable Portfolio Standards Increase Renewable Energy Capacity? Evidence from the United States." *Journal of Environmental Management* 287 (June 1, 2021): 112261. https://doi.org/10.1016/j.jenvman.2021.112261.

[28] Doris, Elizabeth, Jaquelin Cochran, and Martin Vorum. "Energy Efficiency Policy in the United States: Overview of Trends at Different Levels of Government." *National Renewable Energy Laboratory of the US Department of Energy, Colorado, US*, 2009. http://www.ourenergypolicy.org/wp-content/uploads/2013/08/Resource.pdf., p. 5

[29] Clean Energy Business Roundtable at Environmental Law and Policy Center, June 17, 2014. http://elpc.org/tag/gina-mccarthy/

	▪ Carley, Sanya. "The Era of State Energy Policy Innovation: A Review of Policy Instruments." *Review of Policy Research* 28, no. 3 (May 2011): 265–94.
Read (Recommended)	Pitkin (CO) Building Codes; Evanston (IL) Green Building Ordinance Transit equity and ridership, building electrification, and many other city policies are in effect across the US. Joshi, Janak. "Do Renewable Portfolio Standards Increase Renewable Energy Capacity? Evidence from the United States." *Journal of Environmental Management* 287 (June 1, 2021): 112261. https://doi.org/10.1016/j.jenvman.2021.112261. Carley, Sanya. "The Era of State Energy Policy Innovation: A Review of Policy Instruments." *Review of Policy Research* 28, no. 3 (May 2011): 265–94.
Module 3.11	**3.11 US Pathways to Half or Zero**
Topics	**US Pathways**: the Biden Plan to halve emissions by 2030 and reach net zero by 2050 (& here), the Lawrence Berkeley National Lab Net Zero by 2050 scenario, several scenarios to reach net zero by 2050 (Williams et al.; Jacobson et al. 2021)), and the McKinsey Net Zero by 2035 Pathway. Partial plans include the National Renewable Energy Laboratory's buildings component of the path to net zero. A middle of the road US approach of Brookings (& here). There's general agreement that methane and HCFCs should be high on the GHG reduction agenda along side gas, oil, and coal. Hundreds of US state and local governments (& here & here2 & here3) have comprehensive climate plans, many with 100% renewable energy goals.
	Part III: Policy Processes (LO6)
Jan 30-Feb 5, Mon-Sun	**WEEK 4: Policy Approaches & Context**
Module 4.1	**4.1 Introduction**
	We'll examine the domestic and international popular economic, legislative, executive, regulatory, industrial policy legal, and market approaches to climate action. A combination of factors may play a role in inducing climate actions, especially by business organizations and investors. For example, power plant emissions decreased 38% between 2005 and 2019, exceeding the Obama Administration's Clean Power Plan goals – which never went into effect – of 32% for the same period. One reason may be the greater awareness and preparation that power plants and states acquired by facing CPP regulations from 2 million comments during the original regulatory comment period and more than 1.5 million comments during the comment period to repeal the planned regulations. Power plants also may have foreseen the need to reduce emissions regardless of the CPP, whether for state regulations, future federal legislation and regulation, public pressure, investor demands (ESG & here), or Millennials' and Gen Z's concerns about climate change as employees and customers.
Module 4.2	**4.2 Policy Goals, Tools, &Types: Designing Generic & Enabling Policies**

Topics	What tradeoffs and policy mixes are necessary, possible, or desirable between mandates, incentives, markets, nudges, and voluntary policy types? What are the practical frameworks policymakers can use to balance the characteristics of these policy types, to understand their interactions and combinations, and to acknowledge and consider value and ideological considerations attached to policy types? How can the use of mandates and more politically popular, less coercive incentives and markets be designed to maximize their effectiveness, efficiency, and equity? To what extent can and should policies rely on transparency and risk disclosures to achieve emissions reduction goals? Many industries, technologies, and transportation modes are already available, at reasonable if not lower prices than current practices and equipment. These methods of emission reduction are often profitable for those investing in them, as well as saving electricity, fuel, heat, water, pollution, and other product inputs. Financing these upfront capital costs is a shift from current operating costs for direct beneficiaries, financial institutions such as mortgage and real estate companies, and for societal interests and government facilitators.[30]
Read (Required)	▪ The Big Five Policy Goals of Harvey et al. (the *only* five, they say): pp. 31-32 ▪ Harvey, Ch. 2, Energy Policy Design, and Ch. 3 How to Prioritize Policies for Emissions Reduction, pp. 34-68 ▪ Griffith, Saul. *Electrify: An Optimist's Playbook for Our Clean Energy Future*. Cambridge, Massachusetts: The MIT Press,2021.Ch.14,Rewrite the Rules, ~ 6 pp. ▪ Generic RFF Tools: Review Carbon Pricing, Technology & Innovation Subsidies, and Performance Standards. The policy mechanisms these tools use are usually based on economic incentives or prescriptive regulations.
Read or Skim (Recommended)	▪ SKIM: Galle, Brian. "The Tragedy of the Carrots: Economics and Politics in the Choice of Price Instruments." *Stanford Law Review*, 2012, 797–850. ▪ Young, Kayla M., Kayla Gurganus, and Leigh Raymond. "Framing Market-Based versus Regulatory Climate Policies: A Comparative Analysis." *Review of Policy Research* 39, no. 6 (2022): 798–819. https://doi.org/10.1111/ropr.12493
Module 4.3	**4.3 Introduction: Major Theories Related to Emissions Policies**
Topic	Dozens of major *theories* and *approaches* are commonly applied to climate and other environmental policies, and underpin much of what government officials, government agencies, academics, private and nonprofit organization officials, and advocates consider when they address environmental challenges. Performance Standards (& here) are a common policy tool, as are tax incentives, carbon prices, cap-and-trade markets, and more frequently recently, industrial policy. These and other climate change policies have a variety of theoretical underpinnings.

[30] For example, in 2007 Fischer and Newell ranked climate policy tools "roughly as follows: (1) emissions price, (2) emissions performance standard, (3) fossil power tax, (4) renewables share requirement, (5) renewables subsidy, and (6) R&D subsidy." These are not; Utility Regulation; GRID Upgrades & Regulation consensus priorities; varying political conditions require shuffling these broad approaches opportunistically. This class will likely disagree on these and many other climate policy topics.

Module 4.4	4.4 Legislative Climate Policies
Topic	Legislatures are either enabled or constrained by public opinion and the politicization of climate policies. Where government functions affect entire industries or are privatized or contracted,[31] an even wider range of lobbyists, advocates, the media, academic researchers, and others play direct roles in democratic policy processes.
Module 4.5	**4.5 Regulatory Policy: Major US Federal Climate Laws**
Topic	While carbon pricing will remain desirable where it is politically feasible in some contexts, and as a component of other policies, "most of the real work of emission control is done through regulatory instruments" (Cullenward & Victor, 2022)[32] Agencies are usually very careful to stay within the degree of authority granted by laws. Legal challenges are common, and the courts can attempt to clarify, limit, or expand agencies' regulatory authority by allowing more expansive or narrow interpretations of the authority granted by legislatures. In the case of the US EPA, it would no longer be politically possible to pass even the clean air laws currently in place, or to grant the regulatory authority EPA has to regulate GHGs under the Clean Air Act Amendments (& R1) of 1970, 1977, and 1990. However, it would also not be politically feasible now to repeal the Clean Air Act.
Module 4.6	**4.6 US National Executive Actions Related to Climate Change**
Topic	US Presidents have considerable power to affect climate policy. While presidents can't make laws directly, they can initiate and shape policy through congressional allies, through the power to veto congressional legislation, and through informal executive actions, formal executive orders, international treaties, and appointments. Internationally, President Biden could rejoin the Paris agreement of 2015 without Senate consent since it reiterated existing US obligations, already ratified by the Senate, in the 1992 UN Framework Convention on Climate Change (UNFCCC). The Obama Administration attempted several major climate policies: a 2009 cap-and-trade bill that passed the House and failed in the Senate. Although seen as a market-based bipartisan compromise, climate legislation had become increasingly partisan. The 2015 Clean Power Plan (CPP), issued under EPA's existing authority under the Clean Air Act, would have reduced carbon emissions 32% from 2005 levels from a thousand fossil fuel power plants. It was repealed in 2019, yet its target reductions were met anyway. The Biden Administration has achieved two major climate actions

[31] A potential inhibitor of climate policy is the international agreement The Energy Charter Treaty. The little-known, secretive treaty went into effect in 1998 and provides for the arbitrated legal resolution of disputes between energy companies and governments. The treaty is intended to protect foreign investments in investor-state disputes "against key non-commercial risks," which includes the that "each Contracting Party hereby gives its unconditional consent to the submission of a dispute to international arbitration" provision (p. 79). Two IPCC members, among others, have called for countries to withdraw from the treaty as incompatible with the Paris agreement and "impedes the transition to clean energy." The US has observer status and is not a signatory.

[32] Cullenward, Danny, and David G. Victor. *Making Climate Policy Work*. 1st edition. Cambridge, UK ; Medford, MA: Polity, 2020.(p. 10)

	legislatively: the Infrastructure Investment and Jobs Act (R1; R2; R3)and the Inflation Reduction Act (IRA) (R1; R2; R3; R4).[33]
Module 4.7	**4.7 Industrial Policy**
Topic	**Industrial Policy**: "Industrial policy" (R2; R3; R4; R5) is government support for certain industries, usually by subsidies, tax benefits, or protectionist trade barriers. Industrial policy is intended to increase the speed and likelihood of clean energy and other tech expanding to large-scale markets. It has often been criticized for picking winners and losers at the expense of the taxpayer, and for decades had been an unpopular term. Economic *clusters* (R2 in Indiana) are local or regional concentrations of similar and complementary industries. They combine talent, intellectual capital, businesses, and universities in a way that blends cooperation and competition to give sustained competitive advantages to a city, state, region, or country through heightened productivity. Government industrial policies can support or decrease demand for clean tech and products, and can play a role to leverage private and venture capital funding, and can supplement or replace policies such as government funding or market forces in the early stages of a technology's development.
Read or Skim (Recommended)	▪ Cullenward, Danny, and David G. Victor. *Making Climate Policy Work*. 1st edition. Cambridge, UK ; Medford, MA: Polity, 2020. Ch. 8, pp. 148-173 How government industrial policy interventions can speed tech development: ▪ "Moore's Law vs. Wright's Law." Forbes ▪ Wright's Law Is the Best Way to Predict the Future - Canadian Association for the Club of Rome," May 8, 2020. ▪ Experience Curve Effects
Module 4.8	**4.8 Courts & Litigation: Major Judicial Decisions**
Topic	The courts and legal factors affect climate policies in many ways, both directly and indirectly. Major environmental policies are often challenged in courts. Though less visible than legislative acts, these challenges and the rulemaking and enforcement of climate policies are critical to agencies' ability to continue climate policies under laws. While a full discussion of environmental law is beyond the scope of this course, we'll discuss a few major cases and the influence of courts on agency authority. We'll also discuss legal factors and decisions that will continue to affect climate policies at least into the near future. There are many landmark legal cases in environmental and climate law beyond the scope of this course, but we'll look at several. From a consortium of climate change organizations and universities, here are some global trends in climate change litigation. Among the major judicial precedents affecting climate policy are *Chevron Deference* (R1), *Endangerment Findings*, and the recent SCOTUS *Major Questions* doctrine (R1; R2). Supreme Court decisions decisions, such as in both *Massachusetts* and *Chevron*, can work for or against climate policy, depending on the presidential administration.
Reading (Required)	"Climate Change Cases Set for Another 'Exciting Year' in Court." .

[33] Executive Order 13990 (Jan. 20, 2021); 14057 (Dec. 8, 2021)

Reading (Recommended to SKIM)	▪ Peel, Jacqueline, and Hari M. Osofsky. 2020. "Climate Change Litigation," *Annual Review of Law and Social Science* 16: 21-38. ▪ Hunter, David, Wenhui Ji, and Jenna Ruddock. "The Paris Agreement and Global Climate Litigation after the Trump Withdrawal." *Md. J. Int'l L.* 34 (2019): 224. ▪ Setzer, Joana, and Catherine Higham. 2021. "Global trends in climate change litigation: 2021 snapshot." London: Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science, pp. 4-37.
Listen (Optional)	*West Virginia v. EPA* (SCOTUS): Amy Westerfeld podcast from Scotusblog, a nonpartisan SC website
Feb 6-12, M-Su	**WEEK 5: Markets**
Module 5.1	**5.1 Introduction**
Topics to Cover	**Overview**: Economists, many in government, and some voters[34] have seen Pigouvian-oriented carbon pricing, ideally set by efficient markets, as one of the best policy tools to reduce the negative externalities and market failures that result in GHG emissions. Markets - more than carbon taxes - give potential profits or savings to the producers best able to reduce emissions, while not unfairly harming industries where reducing emissions is very expensive, difficult, or even impossible with current technology.
Read (Required)	▪ Cullenward, Danny, and David G. Victor. *Making Climate Policy Work*. 1st edition. Cambridge, UK ; Medford, MA: Polity, 2020. Ch. 1-4, pp. 1-86; Ch. 6, pp. 103-118 ▪ Stern, Nicholas. *Why Are We Waiting?: The Logic, Urgency, and Promise of Tackling Climate Change*. Mit Press, 2015. Ch. 3, "Policies for Dynamic Change & Transition: Lessons from Economic History and Economic Theory" See esp. pp. 95-100 on climate change market failures. Google Books ▪ "10 Years on, Climate Economists Reflect on Stern Review | Climate Central." . ▪ Anderson, Soren, Ioana Elena Marinescu, and Boris Shor. "Can Pigou at the Polls Stop US Melting the Poles?" SSRN (& in CR). Rochester, NY, June 4, 2022.
Module 5.2	**5.2 Financing Policies & Tools: Public & Private**
Topics	The transition to a low-carbon economy requires investment. Some but not all investments by individuals and businesses will pay for themselves. However, many businesses and individuals are hesitant to make even investments that would benefit them directly with large energy savings. This "energy paradox" is a barrier to fast improvements in business and home rooftop solar, insulation, electric heating, cooling, and cooking. Emissions reductions goals can be reached with existing technology and at existing renewables and product price levels, and will yield benefit/cost ratios greater than 1, saving most American households several thousand dollars in energy costs each year.
Read (Required)	▪ Naran et al., CPI, "Global Landscape of Climate Finance: A Decade of Data"

[34] Two-thirds of Americans say the federal government should do more to reduce the impacts of climate change. Suprisingly, 29% of Michiganders are aware of whether the state has adopted a cap-and-trade program (it doesn't). Michigan does sponsor wetlands mitigation banking (R2) fund program, however, to cap and preserve wetlands.

	▪ Griffith, Saul. *The Big Switch: Australia's Electric Future*. Collingwood, VIC: Black Inc., 2022. Ch. 16, pp. 212-216 ▪ A Sankey diagram of climate finance sources, instruments, uses, & sectors by the Climate Policy Initiative from the above report
Read or Skim (Recommended)	▪ "Policy-Highlights-Financing-Climate-Futures.Pdf." ▪ Klaaßen,Lena, & Bjarne Steffen."Meta-Analysis on Necessary Investment Shifts to Reach Net Zero Pathways in Europe."*Nature Climate Change*, January 5, 2023, 1–9. ▪ Jaffe, Adam, and Robert Stavins. "The Energy Paradox and the Diffusion of Conservation Technology." *Resource and Energy Economics* 16 (1994): 91–122.
Module 5.3	**5.3 Markets: Theory & Evidence**
Topics	Supply and Demand Policies : Many policy approaches focus on using the market to reduce GHG emissions
Read (Required)	▪ (Harvey, Part II, Sec. V) 251 ▪ Ch 13: Carbon Pricing, p. 253 ▪ Ch. 14: Research & Development Policies, p. 278
Topic	**Carbon Markets & Pricing**: Putting a high enough price (& here) on emitting a ton of carbon gas will push emitters to reduce their emissions by a ton if they can do so more cheaply than the price of emitting carbon.[35] Credits may be allowance-based, avoidance-based, or project-based. Avoidance-based means that the project avoids GHG emissions that would otherwise take place, called additionality (counterfactual emissions) when a prediction of reductions beyond a baseline.[36] While the concept of carbon pricing is widely supported, 87% of global emissions have no carbon price at all, and less than 1% of carbon emissions have a price near adequate levels (Jenkins).[37] Carbon pricing could work if markets and pricing were suddenly accepted globally. It's possible that a political shift could cause legislators, voters, consumers, and businesses to change their past attitudes and behaviors. It's also possible that political conflict and resistance to climate policy could *increase* as policies proliferate. Stiglitz and Stern argue that a suite of policy approaches are needed to correct for market failures that will exist even after externalities are apparently internalized by carbon prices.
Read (Required)	▪ Williams, Jeffery R., Siân Mooney, and Jeffrey M. Peterson. "What Is the Carbon Market: Is There a Final Answer?" *Journal oF Soil and WatEr ConsErvation* 64, no. 1 (2009): 27A-35A.

[35] The Theory: "What is the most economically efficient way to reduce greenhouse gas emissions? The principles of economics deliver a crisp answer: reduce emissions to the point that the marginal benefits of the reduction equal its marginal costs. This answer can be implemented by a Pigouvian tax [DE NOTE: a tax on an activity with negative externalities], for example a carbon tax where the tax rate is the marginal benefit of the emissions reduction or, equivalently, the monetized damages from emitting an additional ton of carbon dioxide (CO2). The carbon externality will then be internalized and the market will find cost-effective ways to reduce emissions up to the amount of the carbon tax." Gillingham, Kenneth, and James H. Stock. "The Cost of Reducing Greenhouse Gas Emissions." Journal of Economic Perspectives 32, no. 4 (2018): 53–72.

[36] In most research and other contexts, *counterfactual* is used to describe events in the past, though not always.

[37] Kleinman Center for Energy Policy. "Why Carbon Pricing Falls Short" 2019

	▪ Galastegui, Alberto, and Ibon Galarraga. "Carbon Pricing as an Effective Instrument of Climate Policy: Searching for an Optimal Policy Instrument." In *Environmental Taxes and Fiscal Reform*, 145–67. Springer, 2012. in Course Resources
Read (Skim)	▪ Mazzotta, Marisa J., and Jeffrey Kline. "Environmental Philosophy and the Concept of Nonuse Value." *Land Economics* 71, no. 2 (1995): 244–49. in Course Resources
Watch	Report of the high-level commission on carbon prices, Interview with Co-Chairs of the High-Level Commission on Carbon Prices, World Bank 2017 (9 min)
Module 5.4	**5.4 Carbon Prices and the Social Cost of Carbon**
Topic	The **Social Cost of Carbon (SCC)** (& R2 & R3 & R4) **is t**he estimated cost of damages -- now and to future generations -- created by one ton of carbon dioxide emissions. Actual carbon prices set by governments don't yet reflect these damages, either those set by markets, taxes, or in the SCC used in cost-benefit analyses internally to make government agency decisions. Carbon prices are usually set based on the social cost of carbon, which in turn relies on many assumptions. The methods used to set the SCC are outdated and inaccurate, according to some economists (& here), and in a climate policy context may only be useful in comparing current emissions mitigation projects.[38] Recent US carbon prices were set by Executive Order 13990. More broadly, guidelines for how the federal government should set a social cost of carbon are in OMB Circular A-4. Recently (January 2023) the Biden Administration EPA is proposing raising the SCC to $190/ton (R2) based on the 2017 recommendations of the National Academies (also in Course Resources).[39]
Read or Skim (Recommended)	▪ Skim: NAS Executive Summary: Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide (2017) esp. paragraph 3 ▪ OECD. *Pricing Greenhouse Gas Emissions: Turning Climate Targets into Climate Action*. OECD Series on Carbon Pricing and Energy Taxation. OECD, 2022.(R2) https://doi.org/10.1787/e9778969-en. ▪ "Stern & Stiglitz. "The social cost of carbon, risk, distribution, market failures: an alternative approach," NBER Working Paper Feb 2021." ▪ Rabe, Barry G. *Can We Price Carbon?* MIT Press, 2018. (& here1) ▪ Carlton, Dennis W., and Glenn C. Loury. "The Limitations of Pigouvian Taxes as a Long-Run Remedy for Externalities." *The Quarterly Journal of Economics* 95, no. 3 (1980): 559–66. in Course Resources
Module 5.5	**5.5 Carbon Tax vs. Cap-and-Trade**
Topics	Most environmental economists and the US Congressional Budget Office argue that a carbon tax is superior to cap-and-trade programs for a variety of reasons, such as its low cost, flexibility, administrative simplicity, and that it can be tailored to meet industry, distributional, equity, and other goals. Some thinktanks and NGOs answer questions about a possible carbon tax directly, and other duck the question (R1; R2). It

[38] Nicholas Stern makes this point on page 2. Stern, Nicholas. "Public Economics as If Time Matters: Climate Change and the Dynamics of Policy." *Journal of Public Economics* 162 (2018): 4–17.

[39]

	would be possible to enact both to achieve different, complementary emission reduction goals. Recent experience with cap-and-trade programs in the EU, China, and US offer strong lessons that can avoid at least some of the early challenges they experienced. Though a carbon tax can provide an adjustable and predictable price to help businesses plan more easily, a carbon tax would likely to favor certain industries or practices. Broadly linking carbon markets and carbon taxes, despite the political challenges of border adjustments' effects on trade, is a long-term goal of some climate policy experts.
Read (Required)	Harvey, Ch. 13: Carbon Pricing, pp. 253-277
Read or Skim (Recommended)	▪ Towards a Global Carbon Market: Prospects for Linking the EU ETS to other Carbon Markets, Carbon Market Watch, May 2015 ▪ Skim: Avi-Yonah, Reuven S., and David M. Uhlmann. "Combating Global Climate Change: Why a Carbon Tax Is a Better Response to Global Warming than Cap and Trade." *Stan. Envtl. LJ* 28 (2009): 3.
Module 5.6	**5.6 Direct Carbon Pricing: A Carbon Tax**
Topic	**Economists and the CBO Prefer Carbon Taxes**: Carbon taxes (& here1) are a tax on carbon emissions. They are quick to put in place or adjust, create clear incentives, and are predictable, transparent, "relatively easy to implement" (says CBO on p. vii, compared to cap-and-trade systems), feasible to harmonize with EU ETS carbon prices if desired, more efficient than an income or capital-gains tax, and difficult to manipulate. The price of carbon can be gradually raised to encourage innovation, making business planning and investment more predictable.
Case	British Columbia Carbon Tax & Investor Response (Malhotra, 2021). Counterintuitively, Malhotra did not find "strong evidence of a relation between a firm's carbon intensity and its stock price effect following the announcement of the British Columbia carbon tax." The tax started at $20/ton in 2019 and rose to $50/ton in April 2022.
Read (Required)	▪ Gale, William G. "The Case For Environmental Taxes." *Brookings* (blog), November 30, 1AD. ▪ University, Stanford. Larry Goulder Q & A. "Finding an Effective, Low-Cost, and Fair U.S. Climate Policy."*Stanford News* (blog),February 22, 2018.(warning:upbeat)
Module 5.7	**5.7 Indirect Carbon Pricing: Cap & Trade Markets**
Topic	**Overview**: Cap and trade markets put a fixed total limit on GHG emissions and then divide that total amount of GHG into fixed allowances -- permits to emit a ton of CO_2 (or equivalent N_2O or PFCs in the EU ETS).[40] Prices fluctuate based on supply and demand; the intent is to make it less expensive for polluters to substitute or innovate to avoid emissions as prices rise.
Learning Objective	Experience and Lessons from Operating Cap & Trade Markets; comparisons with other carbon pricing mechanisms.

[40] The EU Emissions Trading System (ETS) was founded in 2005 and is the largest carbon cap and trade market in the world, covering 11,000 power stations and many manufacturers. It covers about 45% of the EU's GHG emissions.

Read (Required)	▪ Calel, Raphael. "Adopt or Innovate: Understanding Technological Responses to Cap-and-Trade."*American Economic Journal: Economic Policy* 12, no. 3 (2020): 170–201. ▪ Schmalensee, Richard, and Robert N. Stavins. "The Design of Environmental Markets: What Have We Learned from Experience with Cap and Trade?" *Oxford Review of Economic Policy* 33, no. 4 (2017): 572–88. In Course Resources
Read (Skim)	Combining cap-and-trade with offsets: lessons from the EU-ETS
Listen or Read Transcript	▪ Dollar, David G. Victor and David. "Market-Based Solutions to Climate Change Have Failed to Deliver."*Brookings*(blog),December 21, 2020.(24 min)w/Transcript ▪ Global Climate Governance, David Victor, Energy 360 podcast
Module 5.8	**5.8 Border Adjustment, Leakage, & Trade Policies**
Topics	National governments use many legislative and regulatory approaches to require and encourage emission reductions, and face a wide variety of economic and trade conditions. Both national governments and companies have booked emission reductions to themselves by offshoring production or exporting fossil fuels to other nations. These bookkeeping strategies may hide actual emissions, distort the intent and perceptions and results of international treaties, and provide disincentives to real emission reductions. In international emission reduction schemes, how should inter-governmental organizations (IGOs) treat national governments in varying economic, trade, and technological situations as they manage the design and implementation of international climate agreements?
Read or Skim (Recommended)	▪ Green, Jessica F. "Follow the Money." *Foreign Affairs*, July 12, 2022.. In CR ▪ Cullenward, Danny, and David G. Victor. *Making Climate Policy Work*. 1st edition. Cambridge, UK ; Medford, MA: Polity, 2020. Ch. 6, pp. 103-118
Module 5.9	**5.9 Carbon Credits, Permits, Offsets, & Projects: Benefits and Drawbacks**
Topic	Please review Week 2, which focuses on carbon sinks that can be used for offset and training markets. Offsets are a decrease in emissions to offset emitting behaviors, either to reduce emissions or prevent projects likely to increase emissions. Ideally they're only used when other ways to reduce emissions have been maximized. They should be real, permanent, additional, verifiable, and enforceable. See Oxford Offset Principles. To be most effective, their price should be high enough to incentivize changes by other parties to cut additional emissions that they would not have cut otherwise, and to sell the offsets (usually \$50-\$150/ton of avoided CO_2). They are challenging and complicated to measure, verify, and monitor. Voluntary offsets not required and monitored by a government trading system have a checkered history. They have a history of fraud and counterfactual proof, since it is difficult to fully prove that a project or emission reduction effort would not have taken place regardless of the offset payment scheme. In regulated markets, governments can set a carbon prices directly or indirectly at the national, state, and local levels. Well-regulated government carbon markets are necessary, since the illegitimate use of voluntary

	credits to offset emissions is common through promised tree-planting, often at prices as low as $2/ton. See Module 2.1 for more on offsets.
Read or Skim (Recommended)	▪Rogelj, Joeri, Oliver Geden, Annette Cowie, and Andy Reisinger. "Net-Zero Emissions Targets Are Vague: Three Ways to Fix." Nature Publishing Group, 2021. In Course Resources ▪Jenkins, Jesse. "Why Carbon Pricing Falls Short." *Kleinman Center for Energy Policy*, 2019.
Watch or Listen (Optional)	Tree planting issues podcast (Spotify)
Assignment Due Feb. 12	**Assignment Due Sun, Feb. 12 to Canvas at 11:00 pm**
Feb 13-19, M-Su	**WEEK 6: Business**
Module 6.1	**6.1 Disclosure & Risk Transparency**
Topics	Climate change poses many risks to businesses, sectors, and companies, including: * **Physical risks from** climate changes to businesses facilities and operations such as increased floods, storms, and extreme weather. * **Event risk**, such as a sudden reevaluation of asset prices that could be caused by unexpected reports, company projections, election results, regulatory actions, or other adjustments in expectations. * **Reputational risks** and brand identity to consumers and suppliers are unregulated by governments, they can be strong incentives for businesses to act; investigative reports and nonprofit company rankings can affect consumer loyalty in either direction. Deceptive reporting to governments can have even more severe consequences, both legal and reputational. Governments are considering mandatory reporting of some of these risks to investors, and nonprofits are encouraging voluntary reporting.
Module 6.2	**6.2 Accounting & Metrics**
Topic	**Carbon accounting** is making progress toward **standardized, consistent, comparable carbon accounting methods** to measure building, organization, industry, and government progress; and to help set targets for all stakeholders. It's important to investors, policymakers, and consumers. **Measurement standards** for carbon and other GHG emissions underpin efforts to identify clear problems and subproblems, identify policy solutions, implement and monitor policies fairly and effectively, and measure policy results to revise and fine-tune them. Accurate, transparent measurement, accounting, and reporting also allows broader international carbon markets to operate. For national, state, and local policies to be effective, especially in urban areas with widely distributed emissions sources, accurate and very localized point source measurements are necessary to gauge progress. Internationally, cross-border trade and country-specific GHG measures can create loopholes, or

	carbon "leakage" by offshoring production without standardized measures. For example, UN emission figures count only coal burned domestically, ignoring coal exports. Now, about 8,000 facilities are required to report emissions to the EPA. Accounting classifications matter, as the EU has shown by labeling wood pellet biomass as "carbon neutral." Legislation-affected companies appear to increase both their required and voluntary disclosures of GHG emissions (Perera et al 2019).
Readings (SKIM, Required)	**Carbon Accounting Standard-Setting Organizations** ▪ ANSI American National Standards Institute. A private, non-profit organization that administers and coordinates the U.S. voluntary standards and conformity assessment system ▪ ANAB: National Accreditation Board; accreditation of GHG Validation and Verification Bodies; Aviation efforts (& here) to reduce GHG emissions. ▪ NIST National Institute of Standards and Technology. "[F]ounded in 1901 and is now part of the U.S. Department of Commerce. NIST is one of the nation's oldest physical science laboratories. Congress established the agency to remove a major challenge to U.S. industrial competitiveness at the time — a second-rate measurement infrastructure that lagged behind the capabilities of the United Kingdom, Germany and other economic rivals." ▪ ISO 14064 International Organization for Standardization: General GHG Approach ISO 14064-1**:2018** Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals ISO 14064-2:2019 Greenhouse gases — Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements ISO 14064-3: 2019 Greenhouse gases — Part 3: Specification with guidance for the verification and validation of greenhouse gas statements Greenhouse Gas Protocol provides standards, guidance, tools and training for business and government to measure and manage climate-warming emissions (WRI role).
Readings (Recommended)	Patrick, Stewart M. "The International Order Isn't Ready for the Climate Crisis." *Foreign Affairs* 100, no. 6 (December 11, 2021): 166–76. In Course Resources Folder
Module 6.3	**6.3 Emissions Data is Improving Quickly**

Topics	**Better Data = Targeted & Enforceable Policy**: Better emissions data is important to policy and also to climate science, allowing a greater range of experimentation and modeling opportunities. Local and micro-local emissions data, even at the block level, allows much more precise and often the first possibility to measure policies accurately and locally. That's important because current climate policies have varying effectiveness, efficiency, and equity characteristics that are difficult to estimate in the aggregate and very, very difficult to estimate accurately at the micro-local level. New and less expensive micro-instrumentation makes it possible to monitor CO2 fairly accurately and cheaply, even from a single plant, for example. When combined with land-based and local measures, many climate policies will suddenly have the ability to monitor emissions compliance. Since all stakeholders -- from national governments to corporate leaders to advocacy organization to local residents and elected officials – will have the same information, polluters will be more likely to reduce and stop pollution faster. If information is widely available -- especially to those directly affected -- environmental laws can be much more easily enforced.
Watch or Listen (Optional)	Review a couple things you heard/watched earlier in the course on data, monitoring, and instruments used to measure emissions: ▪ REVIEW: What's in my Air, a podcast from *Climate One* (Transcript here) ▪ REVIEW (1 min): Dr. Peter Kalmus, Climate Scientist Q & A explanation of polar orbiting satellites and geostationary satellites and four types of sensors: optical imagers,infrared and microwave sounders, and radar (1 min. from :55 to 1:55).
	Part IV: Analysis (LO3, LO4)
Feb 20-26, Mon-Sun	**WEEK 7: Analysis I**
Module 7.1	**7.1 Policy Analytic Overview**
Topic	Policy analysis, when objectively done, is usually a goal-oriented effort to help policy-makers make better decisions: to design better policies, understand policy weaknesses, or to revise current policies. Most policy analysis explicitly includes political, economic factors that are likely to influence policy success, such as the views of interest groups, the political and administrative feasibility of policy alternatives, and the likely costs of enacting each alternative. Policy analysis also often incorporates difficult-to-quantify values and priorities, usually around the specific policy questions negotiated with clients or organizations. Some of the needed information for a policy to "diffuse" to other jurisdictions are reliable data on a policy's effectiveness, cost-effectiveness, efficiency, and equity; how frequently the policy has been used; whether the policy is part of a suite of policies or stands alone; the policy's approximate costs to government, consumers, and the private sector; rates of compliance; the success rate of incentives; other particular metrics for certain types of policies; and the policy's administrative, financing, and implementation challenges.
Module 7.2	**7.2 Policy Diffusion: Forces that Facilitate, Speed, or Slow (LO5)**

Topic	Policy change happens in many ways. One way that policy often changes – a way that may not require much advocacy – is policy diffusion, where policies are spread by example, published accounts of the policies and their success or failure, personal and professional contacts, and other means. When federal action on climate policy is weak, policy diffusion becomes even more important as states and cities adopt proven policies, often in policy areas where they have little or no expertise. Cities need to know what other cities are doing, whether those cities' policies are successful or not. Among the factors associated with more diffusion are longer legislative terms, ideological similarity, neighboring states adopting, larger states, and smaller legislatures (see Miller et al. Course Resources paper). Major factors associated with slow policy diffusion appear to be primarily among individuals, and often related to market failure issues (information problems, principal/agent problems, and unobserved costs) and non-market failures (private information costs, high discount rates, and diverse potential buyers).[41]
Read (Required)	▪ Carley, Sanya, Sean Nicholson-Crotty, and Chris J. Miller. "Adoption, Reinvention and Amendment of Renewable Portfolio Standards in the American States." *Journal of Public Policy* 37,no.4(December 2017):431–58 (& Course Resources) ▪ Goldstein, Joshua S., and Staffan A. Qvist. *A Bright Future: How Some Countries Have Solved Climate Change and the Rest Can Follow*. First edition. New York, NY: PublicAffairs, 2019. Ch. 15 pp. 207-226 (required book) ▪ Rabe, Barry G. "Reverse Diffusion and the Durability of State Cap & Trade Policy." SSRN Scholarly Paper. Rochester, NY, 2013. (& in Course Resources)
Read or Skim (Recommended)	SKIM: Graham, Erin R., Charles R. Shipan, and Craig Volden. "The Diffusion of Policy Diffusion Research in Political Science." (or here) *British Journal of Political Science* 43, no. 03 (July 2013): 673–701. . SKIM: Rabe, "Race to the Top: The Expanding Role of U.S State Renewable Portfolio Standards," pp. 10-16 (2006) (Course Resources) SKIM:Baldwin,Carley,& Nicholson-Crotty,"Why do countries emulate each others' policies? A global study of renewable energy policy diffusion 2019(Resources)
Module 7.3	**7.3 Tools to Analyze Emissions Policies**
Topic	**Policy Metrics**: Policies differ in their results both intuitively and empirically depending on how policy performance is measured. While some policies have unique characteristics, most share a few common generic metrics. ***Not-Cost-Based*** **Effectiveness:** Extent to which policy achieves its goal and gets stated results, regardless of cost. Example: City staff reached its goal of issuing 300 rooftop solar permits per month.

[41] Jaffe, Adam, and Robert Stavins. "The Energy Paradox and the Diffusion of Conservation Technology." *Resource and Energy Economics* 16 (1994): 91–122. https://doi.org/10.1016/0928-7655(94)90001-9.

	Equity: Fairness for similarly situated people (horizontal : i.e.all 25-year olds; or vertical equity across incomes in a progressive tax). (fairness for similarly situated people, or *horizontal equity*). *Vertical equity* is the idea that those in different circumstances *should* be treated differently to achieve greater fairness. For example, vertical equity would posit that high income taxpayers or high polluters, in a progressive taxation or contribution system, *should* contribute more to public services or solutions. Broader measures of equity include measures of each of the *JEDI* elements (see Module 9.4) *Cost-Based* **Cost:** Cost of a proposed alternative or policy in effect; usually funded and measured regularly **Cost-Benefit ratio:** Net benefits: costs per *monetized* results or benefits. Ex. 2.3 B/C ratio. Often measured as Benefit/Cost ratios as intuitively simpler to grasp the decision criteria or rule than cost\benefit ratios. Choose only projects greater than 1 B/C ratio, or choose among multiple proposed projects the highest B/C ratio. **Cost-Effectiveness**: Cost per *non-monetized* unit of result or benefit (ex. $3 cost to city to issue one rooftop solar permit; $15 cost to business to abate 1 ton of CO2). **Efficiency:** Resources (money, time, effort) per *monetized* unit of production, reduction, or result. Doing things right or at minimal cost. Achieving the greatest output per unit of input (ex. An appliance performing the same function as another requiring less electricity).
Feb. 27-Mar 5	**WEEK 8: Analysis II: Policy Process (Policy Design)**
Module 8.1	**8.1 Introduction**
	Policies share similar basic elements: The basic elements of any policy – whether policymakers are aware of them or not -- are similar across systems of government, across times and places, across policy types, and across geography, demographics, and context. Further, public policy processes are somewhat similar to organizational policymaking, though they obviously differ in the number and types of participants and stakeholders. **Policies have unique fingerprints**: Although each policy has a unique fingerprint, policies' basic building blocks are similar. Experienced legislators, K Street lobbyists, policy insiders, advocacy nonprofits, government bureaucrats, the news media, and academics know these basic elements. Many textbooks on policy analysis define several similar "stages" of the policy process, as the modules below show.[42] **Policies often develop nonlinearly**: This approach can be misleading, however, since policy processes are often nonlinear, fragmented, invisible, and overlapping. It can

[42] A few well-known "stage" theorists: Dunn, Weimer & Vining, Bardach, Patton & Sawicki, Stone, Birkland, others

	sometimes be difficult to distinguish these elemental characteristics of a policy. Still, it's conceptually useful to examine these simplified, almost stylized "stages" in detail to deepen understanding of a policy's elements as a practitioner or academic might see them.
Module 8.2	**8.2 Agendas, Problem Definition, Goals**
Topic	The **problem** of climate change is high on scientists' agendas, and is also high and rising on most societal and decision agendas. The problem definitions associated with climate change include severe health effects from outdoor and indoor coincident air pollution (PM 2.5, NOx, and SOx, weather changes (increasing heat & storm dangers), rising sea levels causing increasing economic damage and the need to relocate, threats to biodiversity and species extinction, changing agricultural patterns, and associated economic losses and increased inequities. The **cause** is clear: 417 ppm atmospheric carbon dioxide as of Dec. 25, 2021,[43] rising about 2 ppm per year, up from 280 in 1750 at the start of the industrial revolution. Climate policies' primary **goals** are simple: reduce GHG emissions quickly. Specific policies' subgoals vary from achieving equity in climate policies, reducing fossil use, to enabling the reduction of and measurement of fossil fuel use, to financing and building the infrastructure to replace fossil fuels.
Module 8.3	**8.3 Alternatives Overview**
Topic	**Cheap, fast and sure policy alternatives**: "The more urgent climate change is, the more we must invest to buy cheap, fast, sure options instead of costly, slow, speculative ones." Amory Lovins, RMI Founder Founder.[44] The range of climate change policy alternatives is broad, including existing policies compiled by the IPCC, IEA, and by research teams. Mandates – or government "command and control" policies are often the first choice of legislators, and increasingly favored as climate urgency increases and market-based policies alone have not achieved sufficient emissions results or effective carbon prices.
Module 8.4	**8.4 Mandates**
Topic	Mandates – or government "command and control" policies are often the first choice of legislators. But other tools can be as good or better at achieving goals at lower cost, such as incentives, subsidies, taxes, and even voluntary policies. Mandates are legal requirements by the government, either legislative, executive, or judicial, forcing emission reductions or the use other policies. They are usually issued as regulations. Mandates are often not practical or affordable if they involve extensive government spending; oversight; equity concerns; high staffing, inspections, or enforcement

[43] The longest continuous and direct measurements of atmospheric CO2 have been conducted at Mauna Loa Observatory, Hawaii. Though individual global measurements vary, Mauna Loa's are highly correlated with other measurements around the world. The National Oceanic and Atmospheric Administration (NOAA) publishes more detail on measurement methods. For methane increases over time, see here.

[44] Lovins is a physicist and energy efficiency expert of Rocky Mountain Institute (RMI). He has demonstrated several highly efficient properties: his own home (R1) and RMI's offices.

	spending; or where other types of proven, effective, and efficient policies are available.
Module 8.5	**8.5 Markets & Incentives**
Topic	Carbon markets, like carbon taxes, are intended to put a price on carbon emissions to incentivize emission reduction or abatement. Markets are a common solution to government failure, can achieve allocative efficiencies that governments often cannot, but they can lead to serious inequities. Governments can free, facilitate, simulate,[45] or create markets to help achieve social objectives. See Week 5 for more on carbon pricing and markets. Carbon markets can be private, such as many offset markets and the former Chicago Climate Exchange (CCX).
Module 8.6	**8.6 Privatization (contracting out/outsourcing)**
Topic	Governments may use a variety of public, private, and nonprofit tools in climate policy. For example, third party verification of carbon market requirements (government *compliance* or *voluntary* offsets) may be preferable, especially for smaller or decentralized markets. For nascent technologies, governments can provide some assistance to private sector development in basic research, research & development, or early commercialization. Some of this assistance can come from the departments of energy, commerce, and environment, and from government labs such as Argonne, Berkely Livermore, or the National Renewable Energy Lab (NREL).
Module 8.7	**8.7 Voluntary**
Topic	**Voluntary carbon markets**, of which there are many (& here), vary widely in the quality of their credits, their 3rd party verification practices, their prices, and many other factors, are not transparent to consumers, making many voluntary credits as questionable as some in early EU ETS fraud cases. Voluntary, unique one-to-one deals can be effective to reduce emissions, but they lack the trust and predictability of government-overseen markets. Voluntary carbon markets have the potential to contribute to GHG emission reductions, they face serious challenges. See the module on Offsets below for several drawbacks ranging from carbon price sufficiency to verification to fraud.
Module 8.8	**8.8 Implementation**
Topic	Successful implementation presents some of the biggest challenges to climate policies. To realize emission reduction, atmospheric carbon concentration, global temperature increase, and speed goals, climate policies will have to be more effective and efficient (in basic effectiveness, benefit-cost ratios, allocative efficiency, and other metrics) than most other public policies. To reach these goals, climate policies will also have to be equitable; beyond the goal of simple fairness, policies' effectiveness will depend on the inclusive participation of those in the most marginalized and lowest-income communities, the least well-capitalized small and medium sized businesses, and those

[45] Weimer, David L., and Aidan R. Vining. *Policy Analysis: Concepts and Practice*. Taylor & Francis, 2017. See chapter 10, Correcting Market and Government Failures: Generic Policies

	less inclined to participate for financial, business, or political reasons. Effective implementation may also require a mix of policy types and redundant, even partially delegated implementation, as is frequently privatized in contracted inspection and enforcement systems.
Read (Required)	McLaughlin, Milbrey Wallin."Learning from Experience: Lessons from Policy Implementation."*Educational Evaluation and Policy Analysis* 9,no.2 (Summer 1987):171–178.
Listen (Optional)	*Switched On* Podcast: COP27 Scorecard Comes Up Short After Overtime
Module 8.9	**8.9 Monitoring**
Topic	**Measuring Policy Progress & Prioritizing Policies:** Using metrics and indicators to measure policy results can be difficult but important.[46] Policy success is often impossible to quantify for a variety of reasons ranging from poor data collection, variations in the details or implementation of similar policies, inconsistent or invalid measures, the inability to estimate what would have happened if the policy had *not* been enacted (the counterfactual), and the inability to isolate the effects of a policy from other simultaneous policies, events, or actions. Measuring policy results can also be difficult because policies have different goals: some municipalities' climate plans' policy goals will be weighted toward emissions reduction, while others may weight their policy goals toward economic development or the strategic competitiveness of local business or the community. Still others may weight their climate plans toward equity goals, reducing consumer electricity costs, or toward improving citizens' health.
Module 8.10	**8.10 Evaluation**
	Evaluation: Of the several types of evaluation, ***impact evaluation*** is usually an effort to use more defensibly objective statistical tools to determine the extent to which the goals of a policy or program were achieved. Less often, ***process evaluation*** is used to analyze the extent to which the written policy *process* was or is being followed. Qualitative evaluation is a more inductive approach, or sometimes exploratory when theoretical models are insufficient, an in-depth or wide ranging analysis is needed, or the policy is seen as too complex to evaluate for the needed evaluation goals.
Mar 6-12, Mon-Sun	**WEEK 9: Analysis III: Prioritizing Policies**
Module 9.1	**9.1 Introduction**
Topics	As we saw examining policy diffusion, much policy change is taking proven, "off-the-shelf" policies already in use elsewhere. The innovation and design of new policies is difficult and risky (review Module 3.11). Many types of errors in the policy process, advocacy, public participation, and ignoring evidence can contribute to policy failure. That policies should be based on or at least informed by evidence seems intuitive, but

[46] "Measuring policy impact is critical for evaluating the effectiveness of policies at all levels of government." "Comments to the EPA and States on the Proposed Clean Power Plan Regulating Existing Power Plants Under Section 111(d) of the Clean Air Act." *SEIA*. Accessed December 7, 2014. http://www.seia.org/research-resources/comments-epa-states-proposed-clean-power-plan-regulating-existing-power-plants, p. 6

	many are obviously not since many fields have a specific reference term for "evidence-based" practice in comparison to normal practice. Still, the systematic use of evidence in policymaking can be intentionally improved. Review Module 7.3 for an overview of generic policy analysis metrics.
Reading (Recommended)	▪ Skim: Pindyck, Robert S. "The Use and Misuse of Models for Climate Policy." *Review of Environmental Economics and Policy*, 2017. ▪ Skim: Pindyck, Robert. The Climate Policy Dilemma (why he thinks Cost-Benefit Analysis is inappropriate for Climate Change), NBER, July 2012)
Module 9.2	**9.2 Effectiveness**
Topics	**Effectiveness:** The extent to which policy achieves its goal. Not just doing the right things, unless a process is the goal of the policy, but getting the stated and intended goal results, regardless of cost. Other metrics are almost always considered as important, but effectiveness at reaching the primary policy goal is usually most important analytically. An example is a city office reaching its goal of issuing 100 rooftop solar installation permits per day. Denmark has passed a 2020 law (R2) making not addressing climate change illegal; parliament is required to pass effective policy.[47]
Read (Required)	▪ Review Harvey, Ch. 3, Prioritizing Policies, pp. 53-69
Module 9.3	**9.3 Efficiency**
Topics	**Building codes**: State and local building codes are among the most important energy efficiency policy types, since builders and home buyers, renters, and building lessees are usually not focused on energy efficiency issues. Most current investments in climate policy, given ACEEE, IPCC, and much other research (see Amory Lovins' work on efficiency[48]) promise benefit-to-cost ratios far exceeding 1.[49] However, the costs and benefits may be unevenly distributed; direct investor returns are more difficult to predict than costs; health and environmental benefits are widely distributed and difficult to measure precisely; and future generations are not represented in policy debates. Also, in analyzing benefit to cost ratios, a major policy challenge is that, for many climate policies, "the benefits would not necessarily accrue to those incurring costs." Even when those incurring costs benefit directly, they and others are often unaware or unfamiliar with their own direct benefits, as are financial institutions and governments (the energy paradox, R2; R3).
Read (Required)	Harvey, Ch. 11: Industrial Energy Efficiency, pp. 217-234
Module 9.4	**9.4 Justice and Equity**

[47] Chapter 4, (4): "If it cannot be deemed probable that the national climate targets will be reached, the Minister for Climate, Energy and Utilities must in the climate programme present new initiatives with a reduction effect in the shorter term and initiatives with a reduction effect in the longer term, which together chart a path toward fulfilment of the national climate targets."

[48] Lovins, Amory B. "Energy Efficiency, Taxonomic Overview." In *Encyclopedia of Energy*, 383–401. Elsevier, 2004.

[49] The *American Council for an Energy-Efficient Economy* (*ACEEE*) is an excellent resource on energy efficiency policy.

Topic	**Climate policy justice and justice, equity, diversity, and inclusion (JEDI):** the effects of climate change, local air pollution, and many other environmental damages are often very local [50] and often affect low-income and minority (R1) communities most severely. These disparities – both internationally and within the US – are expected to increase in the future as climate change damages increase. Equity in climate policy can include many JEDI aspects (Justice, Equity, Diversity, and Inclusion). Equity can mean simple fairness, or more specific distributive justice, procedural justice, or restorative justice. Revenues from an eventual carbon tax or cap and trade program should facilitate the inclusion and representation of low-income and marginalized communities in climate policies.[51]
Listen	An excellent 8-episode IU podcast series by IU Energy Lab and O'Neill SPEA professors Sanya Carley and David Konisky is entirely focused on energy justice. The podcasts, recorded last year, are available from a variety of podcast hosting sites, and feature some of the most interesting and accomplished experts on energy justice. It's a tough call because all the interviews and interviewees add critical knowledge, but start with the Destinie Nock interview and then hear the rest.
March 12-19	**SPRING BREAK; NO CLASS**
	Part V: Policies (LO3 & LO4)
Mar 20-26, M-Su	**WEEK 10: Energy**
Module 10.1	**10.1 Intro**
Topics	"The energy sector is responsible for 72% of global greenhouse gas emissions, making decarbonization in the sector an important opportunity to fight climate change. Moving the energy system away from fossil fuels — combined with increasing investment in and deploying renewable energy — is critical to achieving a low-carbon future." WRI
Readings (Required)	▪ Gilstrap, Matt. "United States Electricity Industry Primer" US DOE. In Course Resources ▪ Energy, *Drawdown*, p. 1
Module 10.2	**10.2 Utilities**
Topic	Electrification of energy production and use will likely be necessary to achieve necessary emission reductions (& here1). The roles of existing fossil fuel-based electricity producers and electricity grid development are in flux. Within an extraordinarily complex set of regulations governing electricity production, distribution, use, markets, and buyback arrangements for household, small, and medium-sized renewables producers, government will continue to play a critical role

[50] See Courses Resources for "The Climate Impact…" article printout
[51] Konisky, David M., and Sanya Carley. "WHAT WE CAN LEARN FROM THE GREEN NEW DEAL ABOUT THE IMPORTANCE OF EQUITY IN NATIONAL CLIMATE POLICY." *Journal of Policy Analysis and Management* 40, no. 3 (June 2021): 996–1002. https://doi.org/10.1002/pam.22314.

	in guiding the development and regulation (& here1) of national electricity grids (and here1). While the Obama Administration mainly took a mandate approach to reducing power sector emissions in the Clean Power Plan (which never went into force), there's anecdotal evidence that the UK's electricity sector carbon taxes have reduced emissions over the last decade, though gains appear to be slowing.
Module 10.3	**10.3 Fossil Fuels**
Topic	Beyond climate concerns, the costs of renewables [52]are now lower than other electricity, renewable energy's levelized costs (LCOE) are less than fossil fuels and nuclear.[53] Still, the US EIA reports continuing growth in combined cycle gas turbine (CCGT). The US federal government gives fossil fuel subsidies estimated at $23 billion (about 2/3rd federal and a third from states) and an additional $121 billion in tax expenditures (tax breaks that would have been due without the break). Globally, support for fossil fuels doubled in 2021, according to the OECD & IEA. subsidies reach $500 billion (R2) Countries with the highest fossil fuel production and consumption subsidies could cut emissions sharply by removing their domestic subsidies. Coal use is declining in the US -- the 3rd largest coal consuming country -- but growing in China, India, and elsewhere. Policy efforts to reduce methane emissions, the next fossil fuel battleground, have increased sharply recently.
Read (Required)	IMF. "Fossil Fuel Subsidies."
Module 10.4	**10.4 Nuclear**
Topic	While nuclear power is important in the short and mid-term, the problems of nuclear waste, accidents, and proliferation remain to be solved. There is sharp disagreement on whether new nuclear power should play a role or not in the energy transition. Nuclear plants provide 20% of US energy and half of US carbon-free energy. Beyond safety concerns (accidents) and security concerns (proliferation), they take many years to build, and they are much more expensive than renewables, in part due to permitting requirements. Public support and trust will be critical if more nuclear power is built. Americans are split on whether to decommission or continue to use nuclear power. 63% of conservative Republicans would like to see expanded nuclear, compared to 51% of moderate/liberal GOP and 43/39% for Democrats.
Read (Required)	▪ Nuclear, *Drawdown*, pp. 19-21 ▪ Harvey, Part II, Sec. I ▪ Goldstein, Joshua S., and Staffan A. Qvist. *A Bright Future: How Some Countries Have Solved Climate Change and the Rest Can Follow*. First edition. New York, NY: PublicAffairs, 2019. Ch. 5, pp. 87-102; Keep What We've Got, Ch. 11, pp. 143-170 (SMR 163-164); Ch. 15, Waste: Ch. 9, pp. 117-127. Proliferation: Ch. 10, pp. 128-140

[52] Also available in Course Resources
[53] EIA's analyses include Levelized Avoided Cost of Electricity (LACE): the revenue available to a generator; and the Levelized Costs of Storage (LCOS).

	▪ Lovins, Amory, "Why Nuclear Power Is Bad for Your Wallet and the Climate."
Read or Skim (Recommended)	▪ Gas-ban-monitor-building-electrification-evolves-as-19-states-prohibit-bans ▪ SKIM: Sovacool, Benjamin K., Patrick Schmid, Andy Stirling, Goetz Walter, and Gordon MacKerron. "Differences in Carbon Emissions Reduction between Countries Pursuing Renewable Electricity versus Nuclear Power." *Nature Energy* 5, no. 11 (November 2020): 928–35. (& in Course Resources)
Module 10.5	**10.5 Grid Infrastructure & Modernization**
Topics	**Generation, transmission, & distribution**: The grid includes energy generation, transmission, and distribution to buildings and households. Ownership and coordination differs across regions, countries, and international transmission lines. The quality of the grid depends in part on government regulation, ownership type, temperature variability, and other factors. To modernize for renewables, energy use forecasts, communication, and arranging for electricity to be where and when it is needed is challenging for many reasons. Rapidly improving energy batteries and other types of storage are helping to smooth the distribution of renewables, which over multi-state grids can reduce intermittancy and be as or more reliable and predictable than stationary sources since they are more decentralized.
Read (Required)	▪ Grid Flexibility, *Drawdown*, pp. 30-31 ▪ Skim: Kelly-Detwiler, *The Energy Switch* (2021), Ch. 2, "How Electricity Actually Works" R1; R2 ▪ Skim: Bakke, Gretchen. *The Grid: The Fraying Wires Between Americans and Our Energy Future*. Reprint edition. Bloomsbury USA, 2017. R2
Watch (required)	▪ "What is the Smart Grid?" US DOE
Mar 27-Apr 2, M-Su	**WEEK 11: Renewables**
Module 11.1	**11.1 Introduction**
	Quick overview (& R1 & R2 & R3 & R4) & costs (R1 & R2) & projections of advancing technologies (R1 & R2 & R3 & R4) & technologies (R1); also review Week #1 data. Growth rates are accelerating. The most and least favorable areas for solar resources range from about 12% efficiency in the US Southwest to twice that in the US North and Germany. The Inflation Reduction Act (IRA) of 2022 has tax incentives for many renewables, from solar to geothermal that stay in place until 2034, giving technologies time to mature.
Read (Required)	▪ The Center for Resources Solutions, "Renewable Energy Certificates," (RECs) July 28, 2015.. ▪ Patnaik, Rayan Sud and Sanjay. "How Does Permitting for Clean Energy Infrastructure Work?" *Brookings* (blog), September 28, 2022
Read or Skim (Recommended)	▪ Jordaan, Sarah M., Jiyun Park, and Shreya Rangarajan. "Innovation in Intermittent Electricity and Stationary Energy Storage in the United States and Canada: A Review." *Renewable and Sustainable Energy Reviews* 158 (2022): 112149. ▪ *Drawdown*, p. 1 ▪ Storage (Utilities & Distributed), *Drawdown*, pp. 31-34

	▪ Carley, Sanya, and Chris J. Miller. "Regulatory Stringency and Policy Drivers: A Reassessment of Renewable Portfolio Standards." *Policy Studies Journal* 40, no. 4 (2012): 730–56. (R2) ▪ IEA, "20 Renewable Energy Policy Recommendations – Analysis." ▪ Cox, Sadie, and Sean Esterly. "Feed-in Tariffs: Good Practices and Design Considerations," January 2, 2016.. ▪ Greenstone, Michael, and Ishan Nath. "Do Renewable Portfolio Standards Deliver Cost-Effective Carbon Abatement?," n.d.
Module 11.2	**11.2 Renewable Energy: Hydro, Solar, Wind, Biomass, Geothermal, Tidal/wave energy**
Topic	Between 2019 and 2020, renewable power costs of solar and wind fell by 7% to 13%. Renewable energy, which makes up about 20 percent of US generation, has levelized costs that are less than fossil fuels and nuclear. US rooftop solar could be even more competitive with improved federal, state, and local policies, such as better zoning, building codes, and faster and less expensive installation. Since renewables are cost-competitive in much of the US now, many policies are designed to facilitate adoption and reduce the barriers to increased use.
Module 11.3	**11.3 Hydro**
Topics	Hydro is listed first here because it's the largest renewable source in many places, proving two-thirds of Washington State's electricity, 6.3% of all US electricity generation, and 31% of all US renewable generation. However, many of the most usable large-scale hydro opportunities are already in use, at least according to the conventional wisdom, since the growth rate of large hydro is small. Others disagree (R2). Small-scale hydro, however, shows promise for much wider use.
Read or Skim (Recommended)	**Hydropower overview of US DOE** **Skim and listen (6 min)**
Module 11.4	**11.4 Solar**
Topics	Solar has been getting cheaper and more efficient every year, unlike gas and oil and coal.[54] Solar, like wind, is now among the cheapest energy source as measured by the levelized costs of electricity per kWh. If energy costs are important, solar wins. Some oppose solar power for environmental and other reasons, such as bird strikes or that they take up farmland or that some of their materials would likely come from China in the near term. Solar power depends on location, but even in northern climates such as Germany, solar makes up 10% of gross electricity generation, and five times more solar power than the US, the despite lower efficiency than in the southern US or southern EU.
Read (Required)	▪ Solar Farms: *Drawdown*, pp. 8-9

[54] From Module 11.1 above, the introduction to Renewables, in case you skipped past it: Quick overview (& R1 & R2 & R3 & R4) & costs (R1 & R2) & projections of advancing technologies (R1 & R2 & R3 & R4) & technologies (R1);

	▪ Rooftop Solar: *Drawdown*, pp. 10-11 ▪ Concentrated Solar: *Drawdown*, p. 14-15 ▪ Solar Water, Drawdown, p. 36
Module 11.5	**11.5 Wind**
Topics	**Onshore** wind levelized costs are now lower than combined cycle gas plants. Government interventions, then, will likely be aimed at faster adoption, increasing renewables demand, and decreasing fossil fuel demand. Both onshore and offshore wind are growing quickly. In Germany at the start of the Russia-Ukraine war, onshore wind power provided 16% of gross power production, about the same as the EU. Germany got another 4.3% of its power from offshore wind. **Offshore** levelized costs appear to be more than three times the total system LCOE of onshore wind. Cost reductions of 20-30% are anticipated by 2030, and 35-41% by 2050. Floating wind installations' variable costs are lower than bottom-fixed installations, with transmission costs related to distance to shore the key cost factor.
Read (Required)	▪ Onshore wind: *Drawdown*, pp. 2-4 ▪ "Offshore Wind Energy 2021 CRS R46970.Pdf." ▪ NREL Offshore Wind Market Report: 2022 edition ▪ Micro wind: *Drawdown*, pp. 23
Read or Skim (Recommended)	▪ SKIM: Musial, Walter, Paul Spitsen, Patrick Duffy, Philipp Beiter, Melinda Marquis, Rob Hammond, and Matt Shields. "Offshore Wind Market Report: 2022 Edition." Washington, D.C.: U.S. Department of Energy, August 11, 2022. ▪ Center for Resource Solutions
Module 11.6	**11.6 Hydrogen**
Topic	Hydrogen fuel is clean to burn but, depending on the power, is often not clean to produce. It's popular despite commercial challenges for several reasons: it is already reasonably practical to use for industrial purposes such as to manufacture ammonia for fertilizers and for petroleum refining. However, it can be difficult and expensive to handle and ship. It's further along the R & D curve than many experimental fuels; it holds out the promise of reducing maritime, aviation, steel, and other sectors' carbon emissions. It's use -- particularly "blue" carbon with CCS -- requires many large plants and expertise similar to existing large oil and gas companies. Some research estimates that blue hydrogen has 20% higher GHG emissions than natural gas or coal for heat, and 60% greater than burning diesel oil for heat. Hydrogen fuel *can* be made using electrolysis from water using low-carbon-produced electricity, but that process is still expensive and inefficient, requiring more energy from renewables for hydrogen electrolysis than is contained in the finished hydrogen fuel.
Read (Required)	Davide Castelvecchi, Nature. "How the Hydrogen Revolution Can Help Save the Planet & How It Can't." (Scientific American. Nov. 23, 2022).
Watch/Listen (Optional)	The Hydrogen Hype, DW (12 min)
Module 11.7	**11.7 Biomass, Geothermal, Tidal/Wave**

Topics	We won't spend much time on biomass (R1; R2) or tidal/wave energy, though they both are important and receive growing and significant attention and funding. Geothermal energy makes up only 1.7% of renewable energy in the US, and about .34% of all US energy. Authoritative estimates of the potential of geothermal vary widely, from potentially 5% of US energy, to 9% of US energy if increased 26 times, to providing half or even *all* of US power (R2). Geothermal electricity can be produced at any scale from large scale plants (R2) to individual homes using ground source heat pumps (R2). Small-scale geothermal heat pumps typically pay for themselves in 5-10 years, but the systems last much longer than that. The US generates the most geothermal electricity in the world (R2); this should grow over the next ten years from Inflation Reduction Act incentives. For building heating and cooling with heat pumps, geothermal works anywhere in the US. Indiana is a leader in geothermal (R2), growing seven of the 23 US manufacturers of geothermal heat pumps are in Great Lakes states.
Read (Required)	Geothermal: *Drawdown*, pp. 6-7
Read (Recommended)	DOE Announces Intent to Release $13 Million to Support Community Geothermal Projects, May 2022 (R2). And here, including podcast & transcript (R3)
Watch or Listen (Optional)	▪ The Future of Geothermal Part 1: Technology Development, Bloomberg Podcast, Hidda Thorsteinsson, managing director for research and innovation at Reykjavik Energy, Bloomberg Dec. 3, 2021 (30 min) ▪ Geothermal Part 2: The Business Case, Paul Thomsen, Vice President of Business Development at Ormat Technologies, Bloomberg 2022 (31 min)
Module 11.8	**11.8 Other Renewables in Development**
Read (Required)	▪ Fusion: Goldstein & Qvist, pp. 169-170 ▪ Hydrogen-Boron Fusion: *Drawdown*, pp. 194-195
Apr 3-9, Mon-Sun	**WEEK 12: Buildings**
Module 12.1	**12.1 Introduction**
Topics	Efficiency is the fastest, simplest, cheapest, most direct, and most effective way to cut emissions quickly and deeply. "Of GHG total emissions, building operations are responsible for 27% annually, while building and infrastructure materials and construction (typically referred to as embodied carbon) are responsible for an additional 13% annually. Proven techniques and equipment are already available such as recently improved heat pumps, lighting, and insulation. Most pay for themselves in reduced energy costs in 1-7 years, regardless of any climate change concerns. LEED [55] US Green Building Council standards and ratings help building owners and occupants to quantify and plan upgrades to both current and new buildings. Energy Star standards are best known for consumer ratings of appliance efficiency, but US DOE also certifies buildings' energy use through 3rd party verified Energy Star ratings.
Reading (Required)	▪ Hawken, *Regeneration*, pp. 151-154

[3]

	▪ *Drawdown*, pp. 84-106 ▪ District Heating, *Drawdown*, pp 99
Module 12.2	**12.2 Buildings: Efficiency**
Topic	**Demand-Side Policy**: Efficiency has been called the "fifth fuel," after coal, oil, nuclear, and renewables, since it a resource that can provide increased capacity with decreased fuel use. Demand-side energy efficiency improvements reduce electricity use and lower carbon emissions – such as better building insulation or smart meters that reduce peak power usage. Building and appliance efficiencies can reduce carbon emissions where coal, gas, or oil heating continues to be used, or where renewables are in the process of replacing fossil fuel electricity generation. Efficiency policies are often the lowest-cost and most profitable way to meet emission goals. Efficiency gains can be difficult to monetize for utilities; public utility commissions require utilities to manage efficiency programs for customers despite the programs reducing utility revenues, and to increase consideration of equity, flexibility, and distributed electricity.
Reading (Required)	▪ Net Zero Buildings, *Drawdown*, pp. 84-85 ▪ District Heating, *Drawdown*, p. 99 ▪ Harvey, Ch. 10: Building Codes and Appliance Standards, p. 201-215
Watch (optional)	▪ NREL: https://www.youtube.com/watch?v=bNNdr_oSvuI&t=124s ▪ What is a zero-energy building? US DOE (2 min)
Module 12.3	**12.3 Buildings: Electrification**
Topic	Like EVs, building electrification is as clean as its electricity provider's processes are. If they are renewable, electrified buildings are very low emitters. If electricity is from utility coal or gas generators, building electrification may not reduce emissions as much. Electrification of end uses, along with power sector decarbonization, could reduce carbon emissions to 74% below 2005.[56] Building electrification such as for hot water and heat pumps, electric vehicles (2), and renewable power would dramatically lower carbon emissions immediately with current technologies. Radically lower costs in building and outdoor air quality sensors and cloud computing allow more point source and ambient measurements and can reduce building fuel use remotely, with no retrofits, by 10-30% permanently, a high return on equity.
Read (Required)	▪ "San Diego Decarbonizes New Building Development Starting 2023 for Residential and Commercial Development. Zurich starts in 2025" ▪ Heat Pumps, *Drawdown*, pp. 94-95
Module 12.4	**12.4 Predicting Building Policy Results (Emissions Reductions)**
Topic	A number of scenario calculators help states model and project emission reductions using equipment design specifications under various assumptions, such as annual

[56] Steinberg et al., Electrification & Decarbonization: Exploring U.S. Energy Use and Greenhouse Gas Emissions in Scenarios with Widespread Electrification and Power Sector Decarbonization, NREL 2017, page vi.

	energy use, total energy cost, energy and water consumption, or electricity used by ENERGY STAR certified products. Several ENERGY STAR calculators, for example, score buildings on a 1-100 ranking scale according to the use of energy efficiency measures in existing buildings, new buildings, or a portfolio of buildings.[57] Other calculators estimate statewide effects, for example - still using engineering data (specs & standards) - but also assume that annual goals will be achieved, such as a 1.5% or greater drop in demand every year. The models also make assumptions and predictions on factors such as "fuel prices, weather, unit availability, load levels and patterns, technology performance, future market structure and regulatory requirements."[58] Among calculators with policy inputs – and unspecified output assumptions - are US EPA's eGRID and the American Council for an Energy Efficiency Economy's (ACEEE) SUPR calculator.
Read (Optional)	Munns Jr, Wayne R., Anne W. Rea, Marisa J. Mazzotta, Lisa A. Wainger, and Kathryn Saterson. "Toward a Standard Lexicon for Ecosystem Services." *Integrated Environmental Assessment and Management* 11, no. 4 (2015): 666–73.
Apr 10-16, M-Sun	**WEEK 13: Transportation**
Module 13.1	**13.1 Introduction to Transportation**
Topics	**Electric Vehicles**: Delivery vehicles make up about half of light-duty emissions and drive many more miles. Transportation now makes up 29% of GHG emissions, varying widely across modes and vehicle types. Many changes in transportation can reduce emissions, from standards to gradually increase the use of blended renewable fuels (EPA Renewable Fuel Standard & here), demand-side changes ranging to actions to increase transit use, train travel, gas and electric vehicle taxes and subsidies, and supply-side policies that include phased-in fossil-fuel car bans, such as California's 100% ZEV policy by 2035.
Module 13.2	**13.2 Transportation: Ships, Planes, Large Trucks**
Topic	Transport emissions per person per mile depend on the mode, length of the trip, source of electricity on the local grid if an EV, occupancy of public transit, and the number of passengers in a private vehicle. If **shipping** were a country, its emissions would be 6th highest in the world; these emissions are rising, not falling. The United Nations International Maritime Organization has theoretical responsibility over maritime pollution. The IMO has set a goal of 50% carbon emissions by 2050 & 0% by 2100 (2008 baseline). Very few shipping companies – and no cruise ships lines – have announced serious plans to reduce their emissions and other pollution at sea (Maersk is an exception). About 40% of the global shipping fleet of 90,000 ships now transport fossil fuels; a hidden benefit of the transition to renewables will be to reduce shipping pollution substantially and organically by a natural reduction of the need for 40% of

[57] Several other calculators also project energy savings and emission reductions based on engineering data inputs, most at the building level: eCalc, PVWatts, WindPro, RETScreen, DSMore, fChart, PV-fChart, eQuest, ENERGY-10, and DOE-2.
[58] "Assessing the Multiple Benefits of Clean Energy: A Resource for States - Epa_assessing_benefits.pdf." p. 21. Accessed August 11, 2015. http://epa.gov/statelocalclimate/documents/pdf/epa_assessing_benefits.pdf.

	current shipping no longer necessary to ship fuel. Though broad commercial use of hydrogen and other low-carbon fuels are not on the immediate horizon, trains, ships, and airplanes will continue to reduce emissions through new planes, new engines (2), new fuels, and eventually electric jet engines.
Read (Required)	Airplanes: *Drawdown*, pp. 150-151
Watch/Listen (Mini-video required)	▪ Mini-Video: ClimateNow podcast: https://climatenow.com/video/shipping-industry-emissions/ (3 min) ▪ Full podcast video: https://www.youtube.com/watch?v=Iwq6-pn27nE **Can ammonia or wind propel carbon-free shipping?**
Module 13.3	**13.3 Vehicle Electrification: Cars, Trucks, Buses**
Topics	*"Prices are dropping fast, too, with Bloomberg NEF (New Energy Outlook) predicting EVs will be at price parity by 2026. This means an electric SUV, for example, will cost the same as a petrol SUV. By 2030, EV prices are expected to drop to around 80% of the price of their petrol counterparts."* After use in vehicles, batteries can be re-used for building electricity storage for a few more years. Recycling of EV batteries has lagged because a high percentage of car batteries are still in service. However, a number of EV battery recycling companies are ramping up.
Read (Required)	▪ "ZEV state_policy_rankings_embargo_6_14_2018.Pdf." ▪ EVs: *Drawdown*, pp. 142-143 ▪ Hybrids: *Drawdown*, pp. 148-149 ▪ Trucks: *Drawdown*, p. 153 ▪ E-Bikes: *Drawdown*, p. 146-147 ▪ Harvey, Ch. 6, Vehicle Performance Standard, p. 123 ▪ Harvey, Ch. 7, Vehicle and Fuel Fees and Feebates, p. 140 ▪ Harvey, Ch. 8, Electric Vehicle Policies, p. 154
Read or Skim (Recommended)	▪ Graham, John D. The Global Rise of the Modern Plug-in Electric Vehicle: Public Policy, Innovation and Strategy. Cheltenham, UK: Edward Elgar Publishing, 2021. ▪ Ch. 12, Persuading the Consumer, In Course Resources folder. ▪ SKIM: Hall, Dale, and Nic Lutsey. "Effects of Battery Manufacturing on Electric Vehicle Life-Cycle Greenhouse Gas Emissions," 2018 Ini Course Resources Folder ▪ Tabuchi, Hiroko, and Brad Plumer. "How Green Are Electric Vehicles?" *The New York Times*, March 2, 2021, sec. Climate. https://www.nytimes.com/2021/03/02/climate/electric-vehicles-environment.html. ▪ Morris, James. "Electric Cars Are As Green As You Think And Don't Produce More Polluting Particles." Forbes. https://www.forbes.com/sites/jamesmorris/2022/02/05/electric-cars-are-as-green-as-you-think-and-dont-produce-more-polluting-particles/. ▪ Verma, Shrey, Gaurav Dwivedi, and Puneet Verma. "Life Cycle Assessment of Electric Vehicles in Comparison to Combustion Engine Vehicles: A Review." *Materials Today: Proceedings* 49 (2022): 217–22. In Course Resources

	▪ Del Pero, Francesco, Massimo Delogu, and Marco Pierini. "Life Cycle Assessment in the Automotive Sector: A Comparative Case Study of Internal Combustion Engine (ICE) and Electric Car." *Procedia Structural Integrity* 12 (2018): 521–37.
Watch or Listen (Optional)	Video: What's Driving Electric Vehicle Growth (2.5 min)
Apr 17-23, M-Su	**WEEK 14: Industry & Sector Policies**
Module 14.1	**14.1 Introduction to Industry**
Topics	Steel: SSAB Steel in Sweden is making steel using only Hydrogen fuel (https://youtu.be/AGTjKJHu99c, about 3 min. into DW Video; Review Module 11.6). Aluminum, concrete, and refrigerants are other high-priority emitters that are difficult to produce with low-emission fuels, but would benefit from cleaner fuel as soon as possible.
Read (Required)	Harvey, Part II, Sec. IV (p. 215-250) Harvey, Ch. 11: Industrial Energy Efficiency, p. 217-234 Harvey, Ch. 12: Industrial Process Emission Policies, pp. 235-250 Alternative Cement, *Drawdown*, p. 162-163, and here (ACEEE) Refrigerant Management, p. 164-165
Module 14.2	**14.2 Industrial Sectors, Agriculture, Wastewater Treatment**
Topic	**Faster Development of Policies to reduce Industrial Emissions:** Government policies can and have improved the speed and likelihood of near-term technological developments across industries or activities. concrete & cement, steel, aluminum are all significant sources of GHG emissions. For example, in agriculture, soils can absorb large amounts of atmospheric CO_2 through no-till practices, minimally disturbing soil, and reducing soil erosion. Wastewater treatment and landfill methane emissions are significant shares of US emissions (3%) and can be reduced. These policies have support from at least some business communities.
Read (Required	
Module 14.3	**14.3 Food, Farms, & Agriculture**
Topics	"Scientists have estimated that soils—mostly, agricultural ones—could sequester over a billion additional tons of carbon each year.[4] This has led policymakers to increasingly look to soil-based carbon sequestration as a "negative emissions" technology—that is, one that removes CO_2 from the air and stores it somewhere it can't easily escape.[5] Cropland, which takes up 10% of the Earth's land, is a major target for soil-based carbon sequestration. Farmers can add more carbon to agricultural soils by planting certain kinds of crops. For example, perennial crops, which do not die off every year, grow deep roots that help soils store more carbon. "Cover crops" like clover, beans and peas, planted after the main crop is harvested, help soils take in carbon year-round, and can be plowed under the ground as "green manure" that adds more carbon to the soil. Farmers can also do less intensive tilling. By breaking up the soil, tilling prepares land for new crops and helps control weeds, but also releases a lot of stored carbon. Proponents argue that farming practices that

	store more carbon can also improve soil health and food production." - MIT Climate Portal
Read (Required)	Regenerative Agriculture: *Drawdown*, pp. 54-55 Tropical Staple Trees: *Drawdown*, pp. 66-67
Read or Skim (Recommended)	▪ Food, *Drawdown*, p. 37 ▪ Ohlson, Kristin. "The Soil Will Save Us - How Scientists, Farmers, and Foodies Are Healing the Soil to Save the Planet," pp. 121-127 ▪ Food Waste, *Drawdown*, pp. 42-43 ▪ Silvopasture, *Drawdown*, p. 50-51 ▪ Farmland Restoration, *Drawdown*, p. 41 ▪ Plant-Rich Diet, *Drawdown*, pp. 39-40 ▪ Regenerative Agriculture, *Drawdown*, pp. 54-55
Watch or Listen (Optional)	Making the Food of the future podcast
	No discussion or reflection this week to work on policy memo
Assignment Due Ap. 23	**Policy Memo #2 Assignment Due Sun, Ap. 23 to Canvas at 11:00 pm**
	Part VI: Politics
Apr 24-30, M-Sun	**WEEK 15: Politics**
Module 15.1	**15.1 Introduction**
	Partisan Frames: Stark partisan differences of opinion on whether climate policies do more good than harm for the environment can make climate policy challenging. 25% of Conservative Republicans say yes (more good than harm), while 81% of liberal democrats say yes. However, 81% of conservative Republicans favor expanding solar panel farms, and 71% favor expanding wind farms, compared to 98% and 94% for Democrats. 66% of conservative Republicans would like to see expanded fracking and coal mining.
Module 15.2	**15.2 Politics Introduction**
Topics	"Strong majorities of Americans back policies aimed at reducing the effects of climate change." (Pew Research, 2020; RFF Survey 2020). Popular support for climate policies is especially strong among younger voters. Political support for alternative energy sources is strong and increasing sharply (& here1 & here2) across both US political parties, but to much higher levels by Democrats than Republicans. Partisan differences are smallest for planting trees, with increasing partisan gaps for policies to develop carbon capture/storage, tough restrictions on power plant carbon emissions, corporate carbon taxes, and tougher fuel efficiency standards for cars. However, the five largest wind-producing states are all led by Republicans. Differences in partisan approaches between state and local and national governments can, but don't always

	seriously impede renewable energy policies. Here is the Glasgow COP 2021 White House Summary. What roles can nonprofits play in climate policy? How can and should governments help, use, nurture, and enable these efforts? Examples of environmental NGOs (WWF, WRI, NRDC, WWF, NWF, EDF, UCS, EWG, C2ES, & many others). (and the Charity Finance Group CFG here)
Required Reading	▪ Konisky, David M, Stephen Ansolabehere, and Sanya Carley. "Proximity, NIMBYism, and Public Support for Energy Infrastructure." *Public Opinion Quarterly* 84, no. 2 (Summer 2020): 391–418. https://doi.org/10.1093/poq/nfaa025.
Readings (recommended)	▪ You've likely read these in previous courses or as an undergrad, but they're valuable to put today's climate change policy challenges in a recent historical context. ▪ SKIM: Background: Kraft & Vig, "Environmental Policy Over Four Decades," Ch_1 of Env Policy book, 2010 in Course Resources ▪ SKIM: Vig, Norman J., Michael E. Kraft, and Barry G. Rabe, eds. *Environmental Policy: New Directions for the Twenty-First Century*. Eleventh edition. Thousand Oaks, California: CQ Press, 2021. Pp. 1-21 (click on book cover) ▪ SKIM to Review: Kraft, Michael E. *Environmental Policy and Politics*. Routledge, 2017, 6th edition. Google Books, pp. 8-26
Watch	Author's Presentation on Book: Short circuiting policy : interest groups and the battle over clean energy and climate policy in the American states / Leah Cardamore Stokes. (Or read ebook from the IU Library)
Module 15.3	**15.3 Government & Industry Organization Institutional Stakeholders**
Topic	Example Government-Oriented Stakeholders across climate policy issues: ▪ Individual State & local energy officials ▪ DSIRE National and Illinois; Database of State Incentives for Renewables & Efficiency ▪ NASEO (National Association of State Energy Officials) ▪ The State and Local Energy Efficiency Action Network (SEE Action) ▪ Local Governments for Sustainability (ICLEI) ▪ US EPA, Region 5 (Michigan, Illinois, Ohio, Indiana, Wisconsin, Minnesota) ▪ International City Management Association (ICMA) ▪ ACEEE (American Council for an Energy-Efficient Economy) ▪ National Association of Clean Air Agencies (NACAA) ▪ National Association of Regulatory Utility Commissioners ▪ National Association of State Energy Officials (NASEO) ▪ American Public Power Association ▪ Small and medium sized businesses (SME Climate Hub) ▪ Large efficiency and renewables companies such as Schneider Electric ▪ CleanEnergy States Alliance (CESA)

	▪ Ecological Restoration Business Association (ERBA) ▪ Hundreds of others
Module 15.4	**15.4 Communications, Perceptions, & Policy Narratives**
Topic	Government communications around climate policies are fraught for a number of reasons, including the political lag times caused by short electoral cycles, intergenerational politics, and the permanent and increasing damage even from current atmospheric carbon, excluding additional damage from future emissions. These problems are reduced as the current damages of climate become increasingly apparent to average citizens, casual observers, and voters. However, the most serious, potentially catastrophic impacts of current climate policies are still largely invisible. This module focuses on how government and political actors do and could improve communications around climate policies and better frame public perceptions. Climate change remains a divisive political issue nationally. Shifting the focus of government action and framing policy debates toward specific policy results important to a community can help depoliticize energy issues. Local politicians may see both efficiency and renewables as economic development tools to be pursued regardless of their carbon emissions benefits.[59]
Read (Required)	▪ Gross, Liza. "Confronting Climate Change in the Age of Denial." *PLoS Biology* 16, no. 10 (October 9, 2018): e3000033. Or here. ▪ Why people don't act on climate change. Dodds, Joseph. "The Psychology of Climate Anxiety." *BJPsych Bulletin* 45, no. 4 (n.d.): 222–26. ▪ Schmidt, Charles W. "A Closer Look at Climate Change Skepticism." *Environmental Health Perspectives* 118, no. 12 (December 2010): A536–40.
Read or Skim (Recommended)	▪ Dunlap, Riley E., and Peter J. Jacques. "Climate Change Denial Books and Conservative Think Tanks." *The American Behavioral Scientist* 57, no. 6 (June 2013): 699–731. ▪ Adam, Silke, Ueli Reber, Thomas Häussler, and Hannah Schmid-Petri. "How Climate Change Skeptics (Try to) Spread Their Ideas: Using Computational Methods to Assess the Resonance among Skeptics' and Legacy Media." *PLoS ONE* 15, no. 10 (October 5, 2020): e0240089. ▪ Boulianne, Shelley, and Stephanie Belland. "Climate Denial in Canada and the United States." *Canadian Review of Sociology* = *Revue Canadienne De Sociologie* 59, no. 3 (August 2022): 369–94.. Goldberg, Nicholas, LA Times (in Course Resources)
How to Communicate with Citizens & Stakeholders	Listen: NPR, How to Correct Misinformation (14 min.) (& here1 & here2 & here3 & here4)
	Part VII: The Future

[59] Carbon emissions are rarely considered in projects or contracts between parties that create negative externalities by increasing emissions. Energy efficiency and renewable energy projects create positive externalities in reducing emissions.

Module 15.5	15.5 Easy, Cheap, Broadly Supported Actions
Readings (Required	▪ Michael Pollan, "Why Bother?" in *Drawdown*, pp. 52-53 ▪ Harvey: Ch. 15: Policies for a post-2050 World, p. 290 – 299
Readings (Recommended)	9 things individuals can do
Read (Required)	Harvey, Ch. 15: Policies for a Post-2050 World, pp. 290-303
Module 15.6	**15.6 Embedded emissions, Measurement, Transparency, & Disclosure (Scope 3)**
Topic	Embedded emissions are those GHG emissions contained in a product, process, or service that are not accounted for in the more straightforward Scope 1 and Scope 2 classifications. Accounting for and addressing embedded emissions will become necessary to reach the second wave of emission reductions. A wide range of policy approaches to embedded emissions could allow government, organizational, and individual policies to work, and for voluntary actions to reduce emissions. For example, greater emissions transparency by producers can allow companies to monitor and improve their emissions profiles across their production, logistics, value, and supply chains. Greater embedded emissions profiles through accurate GHG labelling could help to improve companies ESG profiles, broaden the pool of potential investors, and help consumers and organizations to make better buying decisions.
Module 15.7	**15.7 Circular Economy & Life-Cycle Emissions**
Topic	What policies, including carbon emission and other pollution reduction goals, would start to move economies toward a sustainable future? The EU Commission's strategy is "focus on the sectors that use most resources and where the potential for circularity is high such as: electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, food, water and nutrients."
Read (Required)	What is a circular economy?, The MacArthur Foundation Circular economy action plan (EU)
Read (Recommended)	Herrington, Gaya. "Update to Limits to Growth: Comparing the World3 Model with Empirical Data." *Journal of Industrial Ecology* 25, no. 3 (June 2021): 614–26.
Watch or Listen	Humans Changed the Face of the Earth, Now We Rethink Our Future," MacArthur Foundation (2 min)
Module 15.8	**15.8 The Future of Carbon Capture & Storage**
Topic	Carbon capture, sequestration, and storage (point source or direct air capture) could contribute to decarbonization in a decade or two if technology improves and costs fall dramatically. The US federal government has many research and development efforts in progress across many agencies, such as USGS (with the Department of the Interior), the Department of Energy (DOE), the Department of Defense (DOD), and many others. The US DOE has been funding research on cleaner coal for decades without commercially viable results. Some CCS projects have been expensive but never built. The US $1 trillion infrastructure bill includes $9 billion to support Carbon Capture & Sequestration (CCS) development.

Read (Required)	Harvey, Ch. 14: Research and Development Policies, pp. 278-289
Read or Skim (Recommended)	REVIEW & SKIM: Morrow, David R., Holly J. Buck, Wil C. G. Burns, Simon Nicholson, and Carolyn Turkaly. "Why Talk about Carbon Removal?," 2018.
May 1-5, M-F	**WEEK 16: Finals Week**
Finals Week	**Final Exams: May 1-5 (Monday to Friday)** **Final Exam Due May 1, 11:59 pm uploaded to Canvas** **48 hours anytime between Monday, April 24 at 11:59 pm and Monday, May 1 at 11:59 pm. Open when you have a couple free days and have fully reviewed your notes and the course.**