ENERGY MANAGEMENT AND POLICY (ENMG)

ENMG 5020 Introduction to Energy Policy
This course provides an advanced introduction to the design and delivery of energy policy at various levels of government in the U.S. and beyond. Energy presents theoretical and practical challenges across many disciplines and professions, especially in the context of economic development and environmental sustainability at scales ranging from local to global. This course is intended to provide a broad overview of the institutions, legal frameworks, technologies, and markets involved in energy policy by exploring theories and case studies across these topics, with an emphasis on the energy transition necessitated by climate change. That said, a full introduction to energy policy requires multiple courses and Penn offers many salient ones across several schools including Law, Wharton, Weitzman, SAS, and SEAS. The primary goal of this course is to teach students how to think—rather than what to know—about energy policy. As such, this course provides both (a) a foundation for students who want to take additional courses on energy law, markets, technology, or policy and (b) a synthesis for students who have taken such courses and want to connect ideas and issues across disciplines and professions. Our seminar sessions will be largely discussion and exercise based to allow students to develop skills as energy policy analysts and to collectively theorize connections between laws, institutions, policy design, and outcomes.
Fall
1 Course Unit

ENMG 5030 Topics in Energy Policy
This seminar will explore a collection of ideas influencing energy policy development in the U.S. and around the world. Our platform for this exploration will be seven recent books to be discussed during the semester. These books each contribute important insights to seven ideas that influence energy policy: Narrative, Transition, Measurement, Systems, Subsidiarity, Disruption, Attachment. Books for 2018 will be chosen over the summer; the 2017 books are listed here as examples: Policy Paradox (2011) by Stone, Climate Shock (2015) by Wagner and Weitzman, Power Density (2015) by Smil, Connectography (2016) by Khanna, Climate of Hope (2017) by Bloomberg and Pope, Utility of the Future (2016) by MIT Energy Initiative, Retreat from a Rising Sea (2016) by Pilkey, Pilkey-Jarvis, Pilkey.
Spring
Also Offered As: CPLN 5350
1 Course Unit

ENMG 5080 Geopolitics of Energy in Russia and Eurasia
Russia is one of the major players in the international energy market: third largest oil producer after the U.S. and Saudi Arabia and second-largest (after the U.S.) natural gas producers (2019). It is also a top coal and nuclear power producer. But the geopolitical might that the country holds with respect to energy markets stems not as much from how much energy it produces as from how much energy it exports. Today Russia leads global natural gas exports and trails only the Kingdom of Saudi Arabia in oil exports. Russia is also reliably one of the top coal-exporting countries. This class will explore the geopolitics of energy focusing on the role of Russia as a leading global energy supplier. In doing so, it hopes to provide a slightly different understanding of global energy that is usually taught from either the U.S. or OPEC angle.
Fall
Also Offered As: REES 5640
1 Course Unit

ENMG 5100 Energy Grand Challenges at the Interface of Technology and Policy
This collaborative course -- co-taught by instructors from the Kleinman Center for Energy Policy, Weitzman School of Design and School of Engineering and Applied Science -- uses societal grand challenges as scenarios for identifying repeatable, process-oriented best practices for solving complex, systemic problems in the energy transition. This course is intended for graduate students with a background in either the social sciences (economics, political science, law, or policy) or who are in STEM programs (science and engineering). This course will complement the material covered in the Kleinman Center Introduction to Energy Policy course (ENMG 5020) taught in the fall. It will be an opportunity to learn from one another and build a holistic understanding of the technical and policy dimensions of the energy transition and the global response to climate change and environmental degradation. The course will be broken into three chapters. For the first third of the semester, we will focus on basics of policy and engineering literacy, with each student bringing their own expertise to the table. The best way to truly understand a topic is to teach it, and this chapter of the course will focus on learning how to talk across disciplines and approach challenges in new and unfamiliar ways. The middle third of this course will be built around case studies of grand societal challenges; some of which have seen considerable progress towards being solved, others which are still the subject of great uncertainty and disagreement. Among other topics, this course will explore: The impact of sweeping standards on building and appliance efficiency; the rapid development and mutual reinforcement of renewable energy technologies and policy; the ability of policy to facilitate healthy competition between technologies (hydrogen vs batteries, for example); The allocation of scarce CCUS resources to abate difficult to decarbonize products like cement, steel, and plastics; the importance of grid regulation and market design in ensuring future energy reliability and affordability; and the need for transition-ready environmental policies that protect ecosystems and communities without hindering access to critical resources (metals, minerals, land, etc.) The final third of the semester will be structured largely around group projects for which students with diverse expertise will work together to identify a grand societal challenge and isolate the technical and policy barriers to solving this challenge. These groups will give regular updates to the rest of the class and will work towards making a meaningful contribution to solving their challenge through collaborative problem solving, design, and research. This course will deliver content learning outcomes about technical, societal, and policy aspects of focal grand challenges, while providing all participants (including instructors) experience and skills to address community-derived problems in teams composed of members from disciplines that rarely collaborate. Over time, this course will serve as a working, iterative “laboratory” on parameters that affect the success of convergence style research and problem solving.
Spring
Also Offered As: EAS 5110
1 Course Unit

ENMG 5120 Energy Geopolitics and National Security
It's commonly accepted that national energy policies have direct impacts on regional security and global geopolitical dynamics. But what happens when energy itself becomes a national security issue? Contemporary headlines illustrate the risk of viewing energy policy strictly through an economic lens. Authoritarian states continue to weaponize energy resources against dependent global democracies, while democracies increasingly rely on high-profile energy sectoral sanctions and technology export controls as vital tools of economic statecraft. Both examples illustrate how actors can use energy strategically, in both offensive and defensive capacities. An understanding of these threats is essential to developing sound energy diplomacy strategies to ensure that the energy transition is realized in a way that supports regional stability, security, and human rights. This course will teach students how to develop multidisciplinary energy analysis, policy recommendations, and diplomatic strategies that can work to address these global energy security challenges. The course will assess as a case study the current European energy infrastructure landscape and ask students to propose infrastructure, regulatory, and physical/cyber security strategies from the perspective of a practitioner of energy diplomacy. The course will also teach students valuable skills related to open-source intelligence methods, including tapping into new commercial space industry data sets (each student will receive a free Planet satellite imagery account that can be used in research assignments). We will review recent U.S. and European sanctions policies through the framework of existing and proposed Russia sanctions, and understand how the commercial space technology renaissance can aid energy infrastructure protection and sanctions policy development. The course is designed to be fast-paced, highly-active, and exciting, combining primary source readings and guest lectures from senior energy officials, executives, and experts, with classroom simulations drawing on the historical, policy, science, and technology drivers of effective energy security strategies.
Fall
1 Course Unit

ENMG 5300 Energy Justice
Energy issues are among some of the most important and complex issues facing the modern world. Energy practices are related intimately to climate change, national security, air and water pollution, economic stability of nations, social inequality, and poverty. This seminar-style course takes an in-depth view at the issues surrounding energy, and both the policy approaches used across the world to address such issues and the justice and equity dimensions of energy systems. Of importance to the discussions in this course is not simply a consideration of which policies have been adopted and to what ends, but rather a comprehensive evaluation of the political environment in which policies are designed and implemented, the manner in which governments can redesign their approaches to energy, and how an energy justice approach has the potential to fundamentally redesign our energy systems. This year, we will also focus quite a bit on the intersections between energy inequalities and racial inequalities, with an objective to elucidate such intersections for the energy-curious public.
Spring
1 Course Unit

ENMG 5400 Decarbonization & Net Zero
This course covers the levers within government (policy, regulatory agencies, legislation) and outside of government (communities, businesses, NGOs.) Any organization in pursuit of either a new energy technology or a decarbonizing one must understand and engage with these entities. To meet our net-zero goals in time, we must scale up deployment for deep decarbonization in parallel with the annual removal of gigatons of carbon dioxide from the accumulating pool in the atmosphere. There are, however, multiple barriers to deployment: high costs for first-of-a-kind technology demonstrations; lack of policy frameworks across the broad portfolio of approaches that enable nth-of-a-kind technologies to become universally affordable; and a lack of public acceptance of energy technologies in environmentally impacted communities. That said, by following the path from inception to application to deployment, we will unpack the multiple levers of governance required: the relationship between a vote, a bill, and, ultimately, a law. We'll dig into the Bipartisan Infrastructure Law and the Inflation Reduction Act, explore existing policy levers like 45Q (a tax credit and direct pay that can line up financing to capitalize 2nd- and 3rd-of-a-kind demonstrations). We'll discuss the impact of non-governmental organizations, how think tanks can drive change, how communities can be engaged. Finally, we will examine the risks and benefits of technology demonstrations within communities: how regional resources, population density, availability of land and water impact the siting of projects; what legacy and future environmental justice impacts might result.
Fall
1 Course Unit

ENMG 5450 Greenhouse Gas Removals & Net Zero
As the impacts of global climate change are taking place in real time, the scientific consensus is becoming increasingly clear that in addition to reducing emissions and meeting our global climate goals we will need to remove CO2 from the accumulating pool in the atmosphere. The terrestrial biosphere and ocean each year remove roughly half of our anthropogenic emissions, but at the expense of ocean acidification. In addition, with increased warming we're realizing forests that once served as reliable carbon stores, are now becoming carbon sources. To achieve net-zero in time, we must recognize that for every molecule of CO2 we emit into the atmosphere, we must envision a path to pulling it back out. This course will cover the building blocks needed to responsibly estimate the scale of removals achievable, in the timeframe needed. It highlights the various components that will be critical as we continue building out and scaling up removals over the next decade. Removing greenhouse gases from the atmosphere is no one's first choice for climate restoration - it is the contingency, the backup plan. We know we will need it, but it is still unclear what its true scale of application will ultimately become. The question of scale for requirements in 2050 is fundamentally unknowable. The true scale of removal required will be dictated by how rapidly direct decarbonization alternatives scale, what the energy demand will be, what CDR cost reductions occur, and what barriers to future deployment will arise. Within this course, both nature-based and engineered solutions to greenhouse gas removal will be covered.
Spring
1 Course Unit