

Energy and Resources

About the Energy and Resources Group

The Energy and Resources Group is a collaborative community of graduate students, core faculty, more than 150 affiliated faculty and researchers across the campus, and more than 500 alumni across the globe. The Energy and Resources Group provides advanced training in interdisciplinary analysis and research with the goal of creating transformative knowledge for the planet and its people.

As one of the first interdisciplinary programs in the field, Energy and Resources faculty and students have established an impressive track record of undertaking engaged, cutting-edge research and turning these ideas into effective actions from local to global levels.

Courses cover current developments in the field and emphasize a variety of disciplinary perspectives and methodologies: core areas include economics, social sciences, engineering, humanities, and environmental sciences.

Ph.D. in Energy and Resources

The Energy and Resources Group admits highly qualified applicants into the Ph.D. program, designed to support and empower doctoral students to pursue rigorous, interdisciplinary, and original research in the fields of energy, resources, and the environment. The Ph.D. Degree in Energy and Resources is typically completed four years beyond the Master's Degree.

Master's Degrees in Energy and Resources (M.A. or M.S.)

The Energy and Resources Master's Degree is a two-year program designed to educate the next generation of interdisciplinary leaders. The curriculum is intended to serve those students for whom the Master's Degree will be the final formal education in support of a professional career. It also serves as an interdisciplinary foundation for doctoral students preparing for dissertation research.

Students are taught the range of methods and subjects that they should be able to understand, advance, and critique, in order to address critical challenges stemming from the interaction of humans and the environment. To that end, the requirements for the Energy and Resources Master's Degree are both broad and deep, stressing analytic, theoretical, and practical approaches to problems in energy, resources, and the environment.

The course requirements provide for a substantive introduction to the disciplinary approaches that are employed in studying energy and resource issues. These approaches are codified as the A-F Breadth Requirements. For more detail on the A-F requirements please go to <https://erg.berkeley.edu/>

The program also ensures experience in interdisciplinary analysis applied to key resource concerns. The curriculum provides an opportunity, through a topical course cluster and an independent capstone project, to extend and deepen the areas of investigation and understanding to satisfy the intellectual interests of each student.

Concurrent Master's Degree of Public Policy and Energy and Resources

The Energy and Resources Group and The Goldman School of Public Policy offer a three-year concurrent Master's Degree program that integrates the strengths of public policy analytical tools with the interdisciplinary knowledge and expertise in energy and resources.

Undergraduate Minor in Energy and Resources

The ERG Minor offers knowledge and skills to enable students to address the complex and interdependent issues associated with the interaction of social, economic, political, technical, and environmental factors. Students in any major may add the ERG minor, which is composed of two core and three elective upper division courses. Several of these courses have prerequisites in mathematics or science.

Undergraduate Summer Minor in Sustainability

This summer program offers a practical and relevant interdisciplinary approach at the intersection of environmental, economic, social, political, and cultural issues. It is open to matriculated UC Berkeley undergraduates, students from other institutions, and the general public. Upon completion, UC Berkeley undergraduates receive a Minor in Sustainability, while other participants receive a Certificate in Sustainability from UC Berkeley.

Admission to the University

Minimum Requirements for Admission

The following minimum requirements apply to all graduate programs and will be verified by the Graduate Division:

1. A bachelor's degree or recognized equivalent from an accredited institution;
2. A grade point average of B or better (3.0);
3. If the applicant comes from a country or political entity (e.g., Quebec) where English is not the official language, adequate proficiency in English to do graduate work, as evidenced by a TOEFL score of at least 90 on the iBT test, 570 on the paper-and-pencil test, or an IELTS Band score of at least 7 on a 9-point scale (note that individual programs may set higher levels for any of these); and
4. Sufficient undergraduate training to do graduate work in the given field.

Applicants Who Already Hold a Graduate Degree

The Graduate Council views academic degrees not as vocational training certificates, but as evidence of broad training in research methods, independent study, and articulation of learning. Therefore, applicants who already have academic graduate degrees should be able to pursue new subject matter at an advanced level without the need to enroll in a related or similar graduate program.

Programs may consider students for an additional academic master's or professional master's degree only if the additional degree is in a distinctly different field.

Applicants admitted to a doctoral program that requires a master's degree to be earned at Berkeley as a prerequisite (even though the applicant already has a master's degree from another institution in the same or a closely allied field of study) will be permitted to undertake the second master's degree, despite the overlap in field.

The Graduate Division will admit students for a second doctoral degree only if they meet the following guidelines:

1. Applicants with doctoral degrees may be admitted for an additional doctoral degree only if that degree program is in a general area of knowledge distinctly different from the field in which they earned their original degree. For example, a physics PhD could be admitted to a doctoral degree program in music or history; however, a student with a doctoral degree in mathematics would not be permitted to add a PhD in statistics.
2. Applicants who hold the PhD degree may be admitted to a professional doctorate or professional master's degree program if there is no duplication of training involved.

Applicants may apply only to one single degree program or one concurrent degree program per admission cycle.

Required Documents for Applications

1. **Transcripts:** Applicants may upload *unofficial* transcripts with your application for the departmental initial review. *If the applicant is admitted*, then *official* transcripts of all college-level work will be required. Official transcripts must be in sealed envelopes as issued by the school(s) attended. If you have attended Berkeley, upload your unofficial transcript with your application for the departmental initial review. *If you are admitted*, an official transcript with evidence of degree conferral *will not* be required.
2. **Letters of recommendation:** Applicants may request online letters of recommendation through the online application system. Hard copies of recommendation letters must be sent directly to the program, not the Graduate Division.
3. **Evidence of English language proficiency:** All applicants from countries or political entities in which the official language is not English are required to submit official evidence of English language proficiency. This applies to applicants from Bangladesh, Burma, Nepal, India, Pakistan, Latin America, the Middle East, the People's Republic of China, Taiwan, Japan, Korea, Southeast Asia, most European countries, and Quebec (Canada). However, applicants who, at the time of application, have already completed at least one year of full-time academic course work with grades of B or better at a US university may submit an official transcript from the US university to fulfill this requirement. The following courses will not fulfill this requirement:
 - courses in English as a Second Language,
 - courses conducted in a language other than English,
 - courses that will be completed after the application is submitted, and
 - courses of a non-academic nature.

If applicants have previously been denied admission to Berkeley on the basis of their English language proficiency, they must submit new test scores that meet the current minimum from one of the standardized tests. Official TOEFL score reports must be sent directly from Educational Test Services (ETS). The institution code for Berkeley is 4833. Official IELTS score reports must be mailed directly to our office from the British Council. TOEFL and IELTS score reports are only valid for two years.

Where to Apply

Visit the Berkeley Graduate Division application page (<http://grad.berkeley.edu/admissions/apply/>).

Admission to the Program

The Energy and Resources Group seeks students who have excelled academically, whatever their discipline; who show promise of ability to cross disciplinary boundaries; and who want not only to understand problems of energy, resources, and environment but to help solve them. ERG deliberately admits students with a wide variety of interests, perspectives, disciplines, research methods, and experience so that each can help the others see the whole picture.

Admission to ERG is highly competitive, with a class of approximately 20 students (Master's and Ph.D. combined) selected annually from approximately 300 applicants. Those admitted to the program have strong academic records and letters of recommendation, balanced and strong GRE scores, and, where applicable, related work experience and publications. The statement of purpose, supplemented by the personal history statement, is vital in demonstrating an applicant's commitment to the program.

You may apply to the two-year Master's Degree (M.S. or M.A.), three-year ERG/Public Policy Concurrent Master's Degree, or the Ph.D. program.

Equity, Inclusion and Diversity at ERG

At ERG, we believe that diversity drives innovative research and discovery, expands our capacity for teaching and learning, and prepares our graduate students to be effective leaders in the transition towards a more sustainable environment and a just society. To learn how ERG actively promotes intellectual, racial, ethnic, and gender inclusion, visit our Equity, Inclusion, & Diversity (<https://erg.berkeley.edu/about/diversity/>) page.

Admission to the Master's Program, M.A. or M.S.

The minimum requirement for admission to the master's degree program is completion of a Bachelor's Degree or its equivalent at a fully accredited US institution of higher learning or international equivalent. Because the program is fundamentally interdisciplinary, there are no other formal requirements for consideration, although, as discussed above, successful candidates will demonstrate academic and intellectual excellence.

Admission to the Ph.D. Program

The first two years of the Ph.D. involve coursework, taught jointly with the Master's Degree students, and a Final Project in the second year. Please see the Master's Degree Curriculum (<https://erg.berkeley.edu/academics/program/masters-degree-curriculum-requirements/>) for further details. Doctoral students will receive a Master of Science or Master of Arts Degree in Energy and Resources upon completion of the first two years' requirements.

In some cases for highly qualified students, ERG may waive some course or project requirements for Ph.D. students who already hold a Master's Degree and who can demonstrate a strong interdisciplinary academic background.

Recommended Preparation

We recommend at least one term of college-level calculus, courses in fundamental science (e.g., physics, chemistry, and biology), as well as [1] (p.) upper division social science (for example political science, sociology, or anthropology) and humanities courses.

Application Process

All applicants must use the online application system at <http://grad.berkeley.edu/admissions/apply/>. Applications open in the first

week of September for the fall of the following year. There are no spring admissions at ERG. The application deadline is the first week of December.. All admissions are subject to approval by the UC Graduate Division. The following information will be requested in the application.

1. **Statement of Purpose and Personal History Statement:** ERG requires two essays and places considerable weight on the Statement of Purpose and the Personal History Statement. Each statement should be no longer than three pages (double spaced, 10–12 point font).
 - **The Statement of Purpose** should discuss your motivations for wanting to enter a graduate degree program, and specifically why you would like to study at ERG. This is an open-ended opportunity for you to tell us how you envision this degree furthering your plans and dreams for the future. We are not looking for a summary of your dissertation topic or master's focus, but a general statement of how this program fits into your goals.
 - **The Personal History Statement** should not be a narrative summary of your CV, but a more introspective look what has brought you to this point of wanting to pursue a degree at ERG. It can be a place to share formative experiences, inspiring influences, or personal challenges.
2. **Transcripts:** Unofficial copies of your transcripts will be accepted for the application. If you are admitted, you will be required to submit official transcripts for all college-level work. For coursework completed in the fall term of your admissions cycle, ERG will accept amended transcripts and late grade reports until the first Friday in January. There is a section of the application that will allow you to document coursework in progress.
3. **Letters of Recommendation:** ERG requires three letters of. You are welcome to use recommenders from your professional as well as your academic career, however at least one letter must be from a professor who is in a position to assess your potential for advanced academic work.

It is strongly preferred that your recommenders use the UC Berkeley online portal to upload letters to your application. On your application, you will find a section that asks you for name and email address for your recommenders. When you submit that information, the system will automatically send an email request to your recommenders with a link where they can upload their recommendation letter as a PDF. You should review your application periodically to see if the letters from your recommenders have been uploaded. You will have the option to electronically send a reminder request. If a recommender is unable or unwilling to upload a letter electronically, we will accept hard copies mailed in a sealed envelope (with signature over the seal) to: CONFIDENTIAL Admissions, Energy & Resources Group, 310 Social Sciences Building #3050, Berkeley, CA 94720–3050. We will then upload the letter to your file for them.

1. **GRE scores:** All applicants are required to submit GRE scores. International applicant GRE scores will be viewed with an understanding of the challenges of taking this test in a second language. ETS transmits scores to UC Berkeley directly, but you may self-report scores until we are able to verify your official score. To submit your official score, on your test registration list the Berkeley Graduate Division institutional code **4833**. **You do not need a department code.** We recommend taking the GRE no later than October. To be valid, the GRE must have been taken within the past 5 years.

- **Language Proficiency Scores:** International applicants from countries in which the official language is not English must provide official evidence of English proficiency. There are two standardized tests you may take: the Test of English as a Foreign Language (TOEFL), and the International English Language Testing System (IELTS). To submit your TOEFL score, on your test registration please list the institution code for Berkeley, **4833**. **You do not need a department code.** Scores more than two years old will not be accepted. For more information about language testing and scores, as well as applicants from which countries will be required to submit scores, please refer to the Graduate Division website.

Energy and Resources Ph.D.

The primary focus of the Ph.D. is the research and writing of the student's dissertation. After satisfying the first two years' course requirements, Ph.D. students will prepare for their Qualifying Examination and commence their Dissertation research.

Coursework

In most cases, entering Ph.D. students complete the ERG Master's Degree during their first two years. Please see the Master's Degree Curriculum (<https://erg.berkeley.edu/academics/program/masters-degree-curriculum-requirements/>) for further details. This is designed to ensure doctoral students possess sufficient breadth and foundational knowledge to begin their original research.

After completion of the Energy and Resources Master's Degree, Ph.D. students prepare for their Qualifying Examination and commence their dissertation research.

Faculty advisors, at their discretion, may waive some course or project requirements for Ph.D. students who have sufficient academic preparation. If an admitted Ph.D. student previously has completed a two-year Master's Degree in a program closely equivalent to the Energy and Resources Master's Degree, they may begin preparing immediately for their qualifying examination and dissertation research. In these cases, any additional coursework required to support the student's research plan will be identified in consultation with the student's primary faculty advisor.

Qualifying Exam

When the doctoral student and his or her faculty advisors have agreed on a subject for the dissertation, the student must defend in a three-hour oral examination the suitability of the topic and his/her preparation for conducting original research in it. This Qualifying Examination is conducted by a committee of four faculty members chosen by the student, in consultation with his/her faculty advisor and subject to the approval of the Graduate Dean.

Dissertation

The final requirement for the Ph.D. is the completion of the dissertation to the satisfaction of a committee consisting of three faculty advisors chosen by the student, subject to approval by the Graduate Dean. The Ph.D. degree in Energy and Resources is typically completed four years beyond the Master's Degree.

Energy and Resources Master's Degree

The Energy and Resources Master's Degree is a two-year program designed to educate the next generation of interdisciplinary leaders. The curriculum is intended to serve those students for whom the Master's

Degree will be the final formal education in support of a professional career. It also serves as an interdisciplinary foundation for doctoral students preparing for dissertation research.

Students are taught the range of methods and subjects that they should be able to understand, advance, and critique, in order to address critical challenges stemming from the interaction of humans and the environment. To that end, the requirements for the Energy and Resources Master's degree are both broad and deep, stressing analytic, theoretical, and practical approaches to problems in energy, resources, and the environment.

Students may elect to seek either a Master's of Arts (M.A.) or a Master's of Science (M.S.) degree. Differentiation of M.A. or M. S. degree is based on the substantive content of coursework and master's project.

Energy and Resources Degree Curriculum

The course requirements provide for a substantive introduction to the disciplinary approaches that are employed in studying energy and resource issues. These approaches are codified as the A - F Breadth Requirements. To obtain a master's degree in Energy and Resources, each student must meet the following requirements:

Breadth Requirements (A - F)

- Complete one course in Area A
- Complete one course in four of the five B-F requirements. The four required courses will be decided by each student in consultation with their faculty advisor, based on their previous academic preparation. Students may not elect to drop the area in which they have the least preparation.

A: Interdisciplinary analysis

B: Environmental science

C: Resource and environmental economics

D: Social science approaches to energy, resources, and the environment

E: Engineering approaches to energy, resources, and the environment

F: Humanities relevant to energy, resources and the environment

For suggested courses to satisfy the A-F requirements, sample course lists and additional information please visit the Energy and Resources website at <http://erg.berkeley.edu/>

Course Cluster

Complete a topical cluster of three courses (minimum of 9 units) in a subject area defined by the student and approved by his/her advisor. Only one of these three may be a course selected to satisfy the A-F requirements.

capstone Project

The final capstone project is the undertaking of an independent investigation that culminates in an oral presentation before the Energy and Resources Group community and a written report approved by two faculty readers.

Additional Course Requirements

- Four semesters in the ERG Master's Degree Seminar Series.
- Two semesters of ERG Colloquium
- A minimum of 40 post-baccalaureate units.

- A minimum of 18 units of graduate-level study in energy and resources topics, some of which may be fulfilled by courses from other departments and school.
- Six additional units of approved graduate-level courses.

Energy and Resources

Expand all course descriptions [+] Collapse all course descriptions [-]

ENE,RES 24 Freshman Seminar 1 Unit

Terms offered: Fall 2015, Spring 2012, Spring 2011

The Freshman Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small-seminar setting. Freshman Seminars are offered in all campus departments, and topics may vary from department to department and semester to semester.

Freshman Seminar: Read More [+]

Rules & Requirements

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of seminar per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.

Freshman Seminar: Read Less [-]

ENE,RES 39A Freshman and Sophomore Seminar: Complex Systems, Information Theory, and Big Data 2 Units

Terms offered: Fall 2016

Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester. Enrollment limits are set by the faculty, but the suggested limit is 25.

Freshman and Sophomore Seminar: Complex Systems, Information Theory, and Big Data: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of seminar per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Final Exam To be decided by the instructor when the class is offered.

Instructor: John Harte

Freshman and Sophomore Seminar: Complex Systems, Information Theory, and Big Data: Read Less [-]

ENE,RES 98 Directed Group Study for Lower Division Students 1 - 4 Units

Terms offered: Fall 2017, Fall 2016, Spring 2016

Lectures and small group discussions focusing on topics of interest that vary from semester to semester.

Directed Group Study for Lower Division Students: Read More [\[+\]](#)

Rules & Requirements

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Repeat rules: Course may be repeated for credit under special circumstances: Course may be repeated with consent of department.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Directed Group Study for Lower Division Students: Read Less [\[-\]](#)

ENE,RES 99 Supervised Independent Studies for Freshmen and Sophomores 1 - 4 Units

Terms offered: Fall 2021, Spring 2021, Fall 2020

Supervised research on specific topics related to energy and resources.

Supervised Independent Studies for Freshmen and Sophomores: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Consent of faculty adviser directing research; lower division standing (3.3 GPA or better)

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Supervised Independent Studies for Freshmen and Sophomores: Read Less [\[-\]](#)

ENE,RES C100 Energy and Society 4 Units

Terms offered: Fall 2021, Fall 2020, Fall 2019, Fall 2018

Energy sources, uses, and impacts: an introduction to the technology, politics, economics, and environmental effects of energy in contemporary society. Energy and well-being; energy in international perspective, origins, and character of energy crisis.

Energy and Society: Read More [\[+\]](#)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer:

8 weeks - 6 hours of lecture and 1.5 hours of discussion per week

10 weeks - 6 hours of lecture and 1.5 hours of discussion per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Kammen

Also listed as: PUB POL C184

Energy and Society: Read Less [\[-\]](#)

ENE,RES W100 Energy and Society 4 Units

Terms offered: Summer 2021 8 Week Session, Fall 2020, Summer 2020 8 Week Session

Energy sources, uses, and impacts: an introduction to the technology, politics, economics, and environmental effects of energy in contemporary society. Energy and well-being; energy in international perspective, origins, and character of energy crisis.

Energy and Society: Read More [\[+\]](#)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of web-based lecture and 1 hour of web-based discussion per week

Summer: 8 weeks - 6 hours of web-based lecture and 1.5 hours of web-based discussion per week

Online: This is an online course.

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Kammen

Also listed as: PUB POL W184

Energy and Society: Read Less [\[-\]](#)

ENE,RES 101 Ecology and Society 3 Units

Terms offered: Summer 2021 8 Week Session, Summer 2020 8 Week Session, Summer 2019 8 Week Session

This course introduces students to the many ways in which our lives are intertwined with the ecosystems around us. Topics will include ecological limits to growth, climate change and other threats to biodiversity, the value of ecosystem goods and services, the ecology of disease, ecotoxicology, the evolution of cooperation in ecosystems, industrial ecology, and the epistemology of ecology.

Ecology and Society: [Read More](#) [+]

Rules & Requirements

Prerequisites: One college level course, or high school Advanced Placement, in either physics or biology; introductory calculus

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Summer:

6 weeks - 7.5 hours of lecture per week

8 weeks - 6 hours of lecture per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: TBA

Ecology and Society: [Read Less](#) [-]

ENE,RES 102 Quantitative Aspects of Global Environmental Problems 4 Units

Terms offered: Spring 2021, Spring 2020, Spring 2019

Human disruption of biogeochemical and hydrological cycles; causes and consequences of climate change and acid deposition; transport and health impacts of pollutants; loss of species; radioactivity in the environment; and quantitative models to understand these environmental problems.

Quantitative Aspects of Global Environmental Problems: [Read More](#) [+]

Objectives & Outcomes

Course Objectives: Application of basic principles of natural science to the analysis of human influence on environmental conditions and processes at continental to global scale. Topics covered include dimensions of the physical world and of human modifications of it; techniques of estimation and back of the envelope calculation; box models of environmental stocks and flows: equilibrium and feedback; chemical equilibria in the environment; nutrient cycles and their disruptions; acid deposition and its consequences; climate change and its consequences; stratospheric ozone depletion; sources, fate and effects of toxic substances in the global environment; radioactivity and radiation; macroecology; carrying capacity and human population growth; biodiversity and its diminution; epidemics.

Student Learning Outcomes: Students will also have gained insight into the multi-disciplinary nature of environmental science, having used physical, chemical, and biological principles to create and solve analytical models.

Students will be familiar with and able to apply a diverse set of quantitative tools for understanding and analyzing environmental problems.

Rules & Requirements

Prerequisites: Upper division standing; calculus (Mathematics 1A-1B or 16A-16B); Physics (7A-7B or 8A-8B), Chemistry (1A or 4A), Biology (1B), or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Summer: 8 weeks - 6 hours of lecture and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Kueppers

Quantitative Aspects of Global Environmental Problems: [Read Less](#) [-]

ENE,RES 131 Data, Environment and Society 4 Units

Terms offered: Fall 2021, Fall 2020, Fall 2019

This course will teach students to build, estimate and interpret models that describe phenomena in the broad area of energy and environmental decision-making. Students leave the course as both critical consumers and responsible producers of data-driven analysis. The effort will be divided between (i) learning a suite of data-driven modeling and prediction tools (including linear model selection methods, classification and regression trees and support vector machines) (ii) building programming and computing expertise and (iii) developing capacity to formulate and answer resource allocation questions within energy and environment contexts.

Data, Environment and Society: Read More [+]

Rules & Requirements

Prerequisites: Required: Foundations of Data Science (Computer Science C8/Information Systems C8/ Statistics C8) and high school or college calculus Recommended: An introductory computer programming course (Computer Science 61A or Computer Science 88) and Linear Algebra (Mathematics 54, Electrical Engineering and Computer Science 16A, or Statistics 89A)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Instructor: Callaway

Data, Environment and Society: Read Less [-]

ENE,RES 160 Climate Justice 4 Units

Terms offered: Spring 2021

Climate change is transforming our world in ways we are only beginning to understand, and in many ways we cannot yet imagine. The emerging theoretical and practical lenses of social and environmental justice (EJ) provide tools with which to examine and understand this new world. Using literature, media, and engaged field experiences, this course brings together the scholarship, scientific and engineering innovation, policy, literature and media, and activism around the interacting themes of climate change and social justice.

Climate Justice: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Instructor: Kammen

Climate Justice: Read Less [-]

ENE,RES 170 Environmental Classics 3 Units

Terms offered: Summer 2021 8 Week Session, Summer 2020 8 Week Session, Summer 2019 8 Week Session

What is the history and evolution of environmental thinking and writing in the USA? How have certain 'environmental classics' shaped the way in which we think about nature, society and progress? Why did these become 'classics' and why/how did they influence environmental thought and policy? What is their relevance today? This course includes substantial reading assignments.

Environmental Classics: Read More [+]

Objectives & Outcomes

Course Objectives: This course will use a selection of books and papers from the last 6 decades that have had a profound impact on academic and wider public thinking -- primarily in the USA -- about the environment and society to probe these issues. In class, we will situate the key reading in its historical context and discuss its contributions, critiques and consequences. Through these classics the class will explore: the evolution of environmental thought; the connections between environment, perception and policy; and the links between scientific thought and public perception.

Hours & Format

Summer: 8 weeks - 4 hours of seminar per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Environmental Classics: Read Less [-]

ENE,RES 171 California Water 3 Units

Terms offered: Summer 2021 8 Week Session, Summer 2020 8 Week Session, Summer 2019 8 Week Session

The story of water development in California provides compelling examples of water politics, the social and environmental consequences of redistributing water, and the relationships between water uses, energy, and climate. This course provides the historical, scientific, legal, institutional, and economic background needed to understand the social and ecological challenges of providing water for California's growing population, agricultural economy, and other uses - all of which are made more complex by climate change.

California Water: Read More [+]

Objectives & Outcomes

Course Objectives: Students will grasp the historical, scientific, legal, institutional, and economic background needed to understand the social and ecological challenges of providing water for California's growing population, agricultural economy, and other uses - all of which are made more complex by climate change.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Summer:

6 weeks - 6 hours of lecture per week

8 weeks - 4 hours of lecture per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

California Water: Read Less [-]

ENE,RES W174 Water and Sanitation Justice 3 Units

Terms offered: Summer 2021 8 Week Session, Summer 2020 8 Week Session, Summer 2019 8 Week Session

This course will explore the many manifestations of water and sanitation justice and injustice on interlocking scales (i.e. local, national, transnational) while illustrating analytical ideas connecting to a range of social processes including claims for human rights, deprivation and exclusion, urbanization and infrastructure development, and privatization of land and water. We will look at various case studies in high-income and low-income countries and use key technical and social concepts to examine rights, equity, and justice with respect to water and sanitation. This course partially satisfies requirements for the ERG Summer Minor/Certificate in Sustainability.

Water and Sanitation Justice: Read More [+]

Objectives & Outcomes

Course Objectives: This course will acquaint you with theoretical and practical knowledge about water and sanitation justice.

Student Learning Outcomes: Analyze water and sanitation through a variety of disciplinary perspectives: Arts, Engineering, Humanities, and in the social sciences of Sociology, Geography, Environmental Studies, Politics, Economics, Anthropology

Compare issues at local to global scales

Explain key issues of water and sanitation justice

Explain water and sanitation policy and governance historical examples, locally and globally

Identify factors influencing water and sanitation justice and injustice

Seriously consider strategies for addressing water and sanitation injustice

Understand impacts of water and sanitation injustice on quality of life

Hours & Format

Summer: 8 weeks - 6 hours of web-based lecture and 2.5 hours of web-based discussion per week

Online: This is an online course.

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Instructor: Ray

Water and Sanitation Justice: Read Less [-]

ENE,RES 175 Water and Development 4 Units

Terms offered: Spring 2016, Spring 2014, Spring 2013

This course introduces students to water policy in developing countries. It is a course motivated by the fact that over one billion people in developing countries have no access to safe drinking water, three billion do not have sanitation facilities, and many millions of small farmers do not have reliable water supplies to ensure a healthy crop. Readings and discussions will cover: the problems of water access and use in developing countries; the potential for technological, social, and economic solutions to these problems; the role of institutions in access to water and sanitation; and the pitfalls of the assumptions behind some of today's popular "solutions."

Water and Development: [Read More](#) [+]

Rules & Requirements

Prerequisites: Upper division standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Instructor: ERG Faculty

Water and Development: [Read Less](#) [-]

ENE,RES C176 Climate Change Economics 4 Units

Terms offered: Fall 2021, Summer 2021 8 Week Session, Fall 2020

This course is a self-contained introduction to the economics of climate change. Climate change is caused by a large variety of economic activities, and many of its impacts will have economic consequences. Economists have studied climate change for more than two decades, and economic arguments are often powerful in policy decisions. The course will familiarize students with these arguments and equip them with the tools to participate in discussions of climate change policy through an economic lens.

Climate Change Economics: [Read More](#) [+]

Objectives & Outcomes

Course Objectives: The course will start with a brief review of the science of climate change, discuss scenarios of economic growth and the greenhouse gas emissions caused by economic activities and investigate various emission reduction opportunities and their economic costs. A significant amount of time will be spent on studying the impacts of climate change, their economic evaluation and how adaptation can lower the costs of climate damages.

We will then study various theoretical frameworks economists have developed that answer the question how estimates about the costs and benefits of climate policy can be combined to find "good" climate policies. We then study three more specialized topics that turn out to be of great importance when analyzing climate change policy: first, how do we compare costs and benefits of generations that live many centuries apart? Second, how do we design climate policy when our projections of both the costs and the benefits of climate policy are highly uncertain? And third, how can equity considerations be accounted for in an economic assessment of climate change policy? The course will close with a look at international cooperation on climate policy and why it has been so difficult to agree on effective treaties that implement climate change policy.

Student Learning Outcomes: Students will also have gained insight into the practical aspects of modeling the economics of climate change by building a simple integrated assessment model in Excel. They will be able to use that model to do simple analysis of climate change policy themselves.

Students will be familiar with the tools economists use to analyze climate change policy. They will have studied empirical estimates of the costs and benefits of climate policy and have an understanding of the analytical issues that drive research on the economics of climate change.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Summer: 8 weeks - 6 hours of lecture and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Anthoff

Also listed as: ENVECON C176/IAS C176

Climate Change Economics: [Read Less](#) [-]

ENE,RES 180 Ecological Economics in Historical Context 3 Units

Terms offered: Fall 2016

Economists through history have explored economic and environmental interactions, physical limits to growth, what constitutes the good life, and how economic justice can be assured. Yet economists continue to use measures and models that simplify these issues and promote bad outcomes. Ecological economics responds to this tension between the desire for simplicity and the multiple perspectives needed to understand complexity in order to move toward sustainable, fulfilling, and just economies.

Ecological Economics in Historical Context: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Summer:

6 weeks - 7.5 hours of lecture per week

8 weeks - 6 hours of lecture per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Ecological Economics in Historical Context: Read Less [-]

ENE,RES 190 Seminar in Energy and Resources Issues 3 Units

Terms offered: Summer 2020 8 Week Session, Spring 2019, Summer 2018 Second 6 Week Session

Critical, cross disciplinary analysis of specific issues or general problems of how people interact with environmental and resource systems.

More than one section may be given each semester on different topics depending on faculty and student interest.

Seminar in Energy and Resources Issues: Read More [+]

Rules & Requirements

Prerequisites: Upper division standing and consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-3 hours of lecture per week

Summer:

6 weeks - 7.5 hours of lecture per week

8 weeks - 2-6 hours of lecture per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Seminar in Energy and Resources Issues: Read Less [-]

ENE,RES 190B Energy and Environmental Issues 4 Units

Terms offered: Spring 2021

Critical, data-driven analysis of specific issues or general problems of how people interact with environmental and resource systems. This course will teach students to build, estimate and interpret models that describe phenomena in the broad area of energy and environmental decision-making. More than one section may be given each semester on different topics depending on faculty and student interest.

Energy and Environmental Issues: Read More [+]

Rules & Requirements

Repeat rules: Course may be repeated for credit when topic changes.

Students may enroll in multiple sections of this course within the same semester.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Energy and Environmental Issues: Read Less [-]

ENE,RES 190C Energy and Environmental Issues 4 Units

Terms offered: Fall 2020, Fall 2018

Critical, data-driven analysis of specific issues or general problems of how people interact with environmental and resource systems. This course will teach students to build, estimate and interpret models that describe phenomena in the broad area of energy and environmental decision-making. More than one section may be given each semester on different topics depending on faculty and student interest.

Energy and Environmental Issues: Read More [+]

Rules & Requirements

Prerequisites: 1. Foundations of Comp Sci: COMPSCI C8 or STAT C8 or INFO C8: Foundations of Data Science 2. Computing: COMPSCI 61A: The Structure and Interpretation of Computer Programs or COMPSCI 88: Computational Structures in Data Science 3. Math: MATH 54: Linear Algebra and Differential Equations or ELENG 16A: Designing Information Devices and Systems I or STAT 89A: Linear Algebra for Data Science

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Energy and Environmental Issues: Read Less [-]

ENE,RES C192 Business, Sustainability, and Society 3 Units

Terms offered: Summer 2021 8 Week Session

As corporations have grown in influence, concerns over their impact on people and the planet have also grown, pushing sustainability, corporate social responsibility, and the wider impact of business into the spotlight. This course focuses on business ethics, supply chains, resource constraints, labor issues, innovation, and environmental externalities, as well as the internal challenges, competitive pressures, external stakeholders, and other issues that businesses must consider while trying to act responsibly.

Business, Sustainability, and Society: Read More [+]

Hours & Format

Summer: 8 weeks - 6 hours of lecture per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Final exam required, with common exam group.

Instructor: Rochlin

Also listed as: UGBA C192R

Business, Sustainability, and Society: Read Less [-]

ENE,RES 198 Directed Group Studies for Advanced Undergraduates 1 - 4 Units

Terms offered: Fall 2021, Fall 2020, Fall 2019

Group studies of selected topics.

Directed Group Studies for Advanced Undergraduates: Read More [+]

Rules & Requirements

Prerequisites: Upper division standing, plus particular courses to be specified by instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Directed Group Studies for Advanced Undergraduates: Read Less [-]

ENE,RES 199 Supervised Independent Study and Research 1 - 4 Units

Terms offered: Fall 2021, Spring 2021, Fall 2020

Individual conferences.

Supervised Independent Study and Research: Read More [+]

Rules & Requirements

Prerequisites: Enrollment restricted by regulations in General Catalog

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Summer: 8 weeks - 1.5-15 hours of independent study per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Supervised Independent Study and Research: Read Less [-]

ENE,RES C200 Energy and Society 4 Units

Terms offered: Fall 2021, Fall 2020, Fall 2019, Fall 2018

Energy sources, uses, and impacts; an introduction to the technology, politics, economics, and environmental effects of energy in contemporary society. Energy and well-being; energy international perspective, origins, and character of energy crisis.

Energy and Society: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer:

8 weeks - 6 hours of lecture and 1.5 hours of discussion per week

10 weeks - 6 hours of lecture and 1.5 hours of discussion per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Instructor: Kammen

Also listed as: PUB POL C284

Energy and Society: Read Less [-]

ENE,RES W200 Energy and Society 4 Units

Terms offered: Summer 2021 8 Week Session, Fall 2020

Energy sources, uses, and impacts: an introduction to the technology, politics, economics, and environmental effects of energy in contemporary society. Energy and well-being; energy in international perspective, origins, and character of energy crisis.

Energy and Society: Read More [+]

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of web-based lecture and 1 hour of web-based discussion per week

Summer: 8 weeks - 6 hours of web-based lecture and 1.5 hours of web-based discussion per week

Online: This is an online course.

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Instructor: Kammen

Also listed as: PUB POL W284

Energy and Society: Read Less [-]

ENE,RES C202 Modeling Ecological and Meteorological Phenomena 3 Units

Terms offered: Fall 2015, Fall 2014, Fall 2013

Modeling methods in ecology and meteorology; stability analysis; effects of anthropogenic stress on natural systems. Offered alternate years.

Modeling Ecological and Meteorological Phenomena: Read More [+]

Rules & Requirements

Prerequisites: Integrative Biology 102 or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Instructor: Harte

Also listed as: ESPM C211

Modeling Ecological and Meteorological Phenomena: Read Less [-]

ENE,RES C205 Quantitative Methods for Ecological and Environmental Modeling 3 Units

Terms offered: Fall 2015, Fall 2013, Fall 2012, Fall 2011, Fall 2009

This course will review the background mathematical and statistical tools necessary for students interested in pursuing ecological and environmental modeling. Topics include linear algebra; difference equation, ordinary differential equation, and partial differential equation models; stochastic processes; parameter estimation; and a number of statistical techniques. This course will be recommended as a prerequisite for advanced modeling courses in Integrative Biology, Energy and Resources Group, and Environmental Science, Policy, and Management. Quantitative Methods for Ecological and Environmental Modeling: Read More [+]

Rules & Requirements

Prerequisites: Consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Also listed as: ESPM C205/INTEGBI C205

Quantitative Methods for Ecological and Environmental Modeling: Read Less [-]

ENE,RES C221 Climate, Energy and Development 3 Units

Terms offered: Fall 2019, Fall 2018, Fall 2017

Graduate seminar examining the role of energy science, technology, and policy in

international development. The course will look at how changes in the theory and practice

of energy systems and of international development have co-evolved over the past half-

century, and what opportunities exist going forward.

A focus will be on rural and decentralized energy use, and the issues of technology, culture,

and politics that are raised by both current trajectories, and potential alternative energy

choices. We will explore the frequently divergent ideas about energy and development that

have emerged from civil society, academia, multinational development agencies, and the

private and industrial sector.

Climate, Energy and Development: Read More [+]

Rules & Requirements

Prerequisites: Graduate student standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Instructor: Kammen

Also listed as: DEVP C221/PUB POL C221

Climate, Energy and Development: Read Less [-]

ENE,RES C226 Photovoltaic Materials; Modern Technologies in the Context of a Growing Renewable Energy Market 3 Units

Terms offered: Fall 2015, Spring 2013, Spring 2011

This technical course focuses on the fundamentals of photovoltaic energy conversion with respect to the physical principals of operation and design of efficient semiconductor solar cell devices. This course aims to equip students with the concepts and analytical skills necessary to assess the utility and viability of various modern photovoltaic technologies in the context of a growing global renewable energy market.

Photovoltaic Materials; Modern Technologies in the Context of a Growing Renewable Energy Market: Read More [+]

Rules & Requirements

Prerequisites: Material Science and Mineral Engineering 111 or 123 or equivalent. Should have a firm foundation in electronic and optical props of semiconductors and basic semiconductor device physics

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Also listed as: MAT SCI C226

Photovoltaic Materials; Modern Technologies in the Context of a Growing Renewable Energy Market: Read Less [-]

ENE,RES 254 Electric Power Systems 4 Units

Terms offered: Spring 2020, Spring 2019, Spring 2017

Provides an understanding of concepts in the design and operation of electric power systems, including generation, transmission, and consumption. Covers basic electromechanical physics, reactive power, circuit and load analysis, reliability, planning, dispatch, organizational design, regulations, environment, end-use efficiency, and new technologies.

Electric Power Systems: Read More [+]

Rules & Requirements

Prerequisites: Physics 7B or 8B or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Instructor: Callaway

Electric Power Systems: Read Less [-]

ENE,RES 270 Environmental Classics 3 Units

Terms offered: Fall 2013, Fall 2011, Fall 2009

Motivation: What is the history and evolution of environmental thinking and writing? How have certain "environmental classics" shaped the way in which we think about nature, society, and development? This course will use a selection of 20th-century books and papers that have had a major impact on academic and wider public thinking about the environment and development to probe these issues. The selection includes works and commentaries related to these works that have influenced environmental politics and policy in the U.S. as well as in the developing world. Through the classics and their critiques, reviews, and commentaries, the class will explore the evolution of thought on these transforming ideas.

Environmental Classics: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Graduate standing

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of seminar per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Instructors: Kammen, Ray

Environmental Classics: Read Less [\[-\]](#)

ENE,RES C271 Energy and Development 3 Units

Terms offered: Spring 2016

This advanced graduate seminar will examine the theoretical frames and models used to examine the linkages between energy and development, and the impacts of one on the other.

Energy and Development: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Energy and Resources ENE,RES C100 or C200 or Public Policy PUB POL C184 or C284 Energy and Resources ENE,RES 102 Environmental Economics and Policy ENVECON C151 or ECON C171 or equivalent Economics course

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of seminar per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Instructor: Kammen

Also listed as: PUB POL C271

Energy and Development: Read Less [\[-\]](#)

ENE,RES 273 Research Methods in Social Sciences 3 Units

Terms offered: Fall 2021, Fall 2019, Fall 2017

This course aims to introduce graduate students to the rich diversity of research methods that social scientists have developed for the empirical aspects of their work. Its primary goal is to encourage critical thinking about the research process: how we "know," how we match research methods to research questions, how we design and conduct our information/data collection, what we assume explicitly and implicitly, and the ethical dilemmas raised by fieldwork-oriented studies.

Research Methods in Social Sciences: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Instructor: Ray

Research Methods in Social Sciences: Read Less [\[-\]](#)

ENE,RES 275 Water and Development 4 Units

Terms offered: Spring 2020, Spring 2018, Spring 2016

This class is an interdisciplinary graduate seminar for students of water policy in developing countries. It is not a seminar on theories and practices of development through the "lens" of water. Rather, it is a seminar motivated by the fact that over 1 billion people in developing countries have no access to safe drinking water, 3 billion don't have sanitation facilities and many millions of small farmers do not have reliable water supplies to ensure a healthy crop. Readings and discussions will cover: the problems of water access and use in developing countries; the potential for technological, social, and economic solutions to these problems; the role of institutions in access to water and sanitation; and the pitfalls of and assumptions behind some of today's popular "solutions."

Water and Development: Read More [\[+\]](#)

Hours & Format

Fall and/or spring: 15 weeks - 4 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Instructor: Ray

Water and Development: Read Less [\[-\]](#)

ENE,RES 276 Climate Change Economics 4 Units

Terms offered: Fall 2021, Fall 2020, Fall 2019

This course is a self-contained introduction to the economics of climate change. Climate change is caused by a large variety of economic activities, and many of its impacts will have economic consequences. Economists have studied climate change for more than two decades, and economic arguments are often powerful in policy decisions. The course will familiarize students with these arguments and equip them with the tools to participate in discussions of climate change policy through an economic lens.

Climate Change Economics: Read More [+]

Objectives & Outcomes

Course Objectives: The course will start with a brief review of the science of climate change, discuss scenarios of economic growth and the greenhouse gas emissions caused by economic activities and investigate various emission reduction opportunities and their economic costs. A significant amount of time will be spent on studying the impacts of climate change, their economic evaluation and how adaptation can lower the costs of climate damages.

We will then study various theoretical frameworks economists have developed that answer the question how estimates about the costs and benefits of climate policy can be combined to find “good” climate policies. We then study three more specialized topics that turn out to be of great importance when analyzing climate change policy: first, how do we compare costs and benefits of generations that live many centuries apart? Second, how do we design climate policy when our projections of both the costs and the benefits of climate policy are highly uncertain? And third, how can equity considerations be accounted for in an economic assessment of climate change policy? The course will close with a look at international cooperation on climate policy and why it has been so difficult to agree on effective treaties that implement climate change policy.

Student Learning Outcomes: Students will also have gained insight into the practical aspects of modeling the economics of climate change by building a simple integrated assessment model in a scientific programming language of their choice. They will be able to use that model to do simple analysis of climate change policy themselves. Students will be familiar with the tools economists use to analyze climate change policy. They will have studied empirical estimates of the costs and benefits of climate policy and have an understanding of the analytical issues that drive research on the economics of climate change.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Summer: 8 weeks - 6 hours of lecture and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Instructor: David Anthoff

Climate Change Economics: Read Less [-]

ENE,RES 280 Energy Economics 3 Units

Terms offered: Fall 2016, Fall 2015, Spring 2015

Input-output and cost benefit analysis applied to energy; exhaustion theory and economics of energy supply; patterns of energy use; trade-offs in energy conservation; the effect of energy policy on supply and demand; projecting future energy and resource supply and use.

Energy Economics: Read More [+]

Rules & Requirements

Prerequisites: Economics 100A or equivalent; basic calculus or linear algebra

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Summer: 6 weeks - 7.5 hours of lecture per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Energy Economics: Read Less [-]

ENE,RES 290 Seminar in Energy and Resources 1 - 4 Units

Terms offered: Fall 2021, Fall 2019, Fall 2018

Graduate student presentations and faculty-student discussions of advanced topics in energy and resources. Specific topics vary according to faculty and student interest.

Seminar in Energy and Resources: Read More [+]

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2-3 hours of seminar and 0-1 hours of discussion per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Seminar in Energy and Resources: Read Less [-]

ENE,RES 290A Seminar in Energy and Resources 3 Units

Terms offered: Fall 2021, Spring 2021, Fall 2020

Graduate student presentations and faculty-student discussions of advanced topics in energy and resources. Specific topics vary according to faculty and student interest.

Seminar in Energy and Resources: Read More [\[+\]](#)

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of seminar per week

Summer: 8 weeks - 6 hours of seminar per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Seminar in Energy and Resources: Read Less [\[-\]](#)

ENE,RES 291 Special Topics in Energy and Resources 1 - 3 Units

Terms offered: Fall 2016, Spring 2012, Spring 2011

Study and critical analysis of advanced topics in energy and resources using interdisciplinary approaches. Specific topics vary according to faculty and student interest.

Special Topics in Energy and Resources: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-3 hours of lecture per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Special Topics in Energy and Resources: Read Less [\[-\]](#)

ENE,RES 292A Tools of the Trade 2 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016

Quantitative methods for energy and resource analysis. Topics include linear algebra, differential equations, statistical methods, chemical equilibrium theory, and thermodynamics.

Tools of the Trade: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Tools of the Trade: Read Less [\[-\]](#)

ENE,RES 293A Master's Seminar I: Interdisciplinary Analysis and the Environment 3 Units

Terms offered: Fall 2021

ENERES 293A is the first of 4 required seminars of the ERG Masters' sequence. It provides an intellectual and practical orientation to the Energy and Resources Group and to what makes us "ERG". It's at once an understanding interdisciplinary approaches class and a cohort-building class. ERG is a community of scholars and researchers who are actively engaged in academic research, policy design, and engagement with civil society. ENERES 293A provides a space in which interdisciplinary approaches to domains, methods / tools and worldviews are explored, individually and collaboratively, for the fields that comprise energy and resources research.

Master's Seminar I: Interdisciplinary Analysis and the Environment: Read More [+]

Objectives & Outcomes

Course Objectives: 1.

Develop a cohort among incoming students and connect with the larger ERG community.

2.

Explore the foundations of the environmental field by reading seminal papers and books in the space.

3.

Introduce interdisciplinary thinking and problem-solving frameworks through a unifying topic throughout the semester.

Rules & Requirements

Prerequisites: Open to ERG graduate students only

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of seminar per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Instructor: Ray

Formerly known as: Energy and Resources Group 201

Master's Seminar I: Interdisciplinary Analysis and the Environment: Read Less [-]

ENE,RES 293B Master's Seminar II: Methods for Interdisciplinary Analysis 3 Units

Terms offered: Not yet offered

This is the second semester of the ENERES 293 sequence for all ERG Master's Degree students. The primary purpose of the sequence is to support students in the process of doing independent interdisciplinary research. ENERES 293B is designed to help students learn to identify and develop tractable and impactful interdisciplinary research projects. Master's Seminar II: Methods for Interdisciplinary Analysis: Read More [+]

Objectives & Outcomes

Course Objectives: 1.

Discuss career paths and research with experts in students' area(s) of interest – some of whom are eligible to be a reader of the students' capstone Master's Project.

2.

Develop and refine an individual development plan.

3.

Read and discuss several frameworks for the process of doing interdisciplinary research, and interpret existing research in the context of those frameworks.

4.

Complete group activities to identify and argue for research in a new area.

5.

Encourage students to think carefully about their mentoring needs and how they will fulfill those needs.

6.

Develop a refined research question for the ERG capstone Master's Project, as well as a supporting annotated bibliography, a list of anticipated methods and data to be used, and a plan for obtaining them.

Rules & Requirements

Prerequisites: Energy and Resources ENERES 293A

Credit Restrictions: Students will receive no credit for ENE,RES 293B after completing ENE,RES 292B. A deficient grade in ENE,RES 293B may be removed by taking ENE,RES 292B, or ENE,RES 292B.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of seminar per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Instructors: ERG Faculty, Callaway

Formerly known as: Energy and Resources Group 292B

Master's Seminar II: Methods for Interdisciplinary Analysis: Read Less [-]

ENE,RES 293C Master's Seminar III - Master's Project Development for Interdisciplinary Analysis, Part 1 3 Units

Terms offered: Fall 2021

This is the third semester of the ERG master's seminar series. This semester shifts from a focus on intellectual exploration to the design and execution of the master's project. While some students may have already started their projects through summer research and/or fieldwork experiences, others may be starting fresh. This semester is designed to meet students wherever they are in the process of developing their research. It will also focus on building communication/translation skills and continuing the professional development work started in ENERES 293B.

Master's Seminar III - Master's Project Development for Interdisciplinary Analysis, Part 1: [Read More](#) [+]

Objectives & Outcomes

Course Objectives: 1.

Develop verbal and written communication skills and techniques

- a. Project pitches
- b. Peer presentations
- c. Individual presentations
- d. Optional presentation to lab group
- e. Writing workshop
- f. Written outline of Master's project

2. Network with people in and outside of the ERG community

- a. Determine the appropriate scope and focus for a Master's project
- b. Begin to plan for a career beyond the Master's degree

3. Develop project management and leadership skills

- a. Practice managing and executing a research plan
- b. Lead discussions on individual research
- c. Provide constructive feedback on peers' research
- d. Ask for specific types of guidance and mentorship from advisors and readers

4. Define the scope of a Master's project that can answer an interdisciplinary question

- a. Identify a gap in existing literature and/or a field of research
- b. Develop a question that is actionable under the timeline of the master's project
- c. Bound the project with a defined literature search and analysis

5. Complete the initial steps of the Master's project

- a. Read past Master's projects and identify how to design a research thesis/

ENE,RES 293D Master's Seminar IV: Master's Project Development for Interdisciplinary Analysis Part II 3 Units

Terms offered: Not yet offered

Required of, and open only to, fourth-semester Energy and Resources Master's Degree students. Topics include structuring and writing a research paper, crafting and delivering a clear, engaging presentation on the Master's project, supporting classmates with these goals, and professional development. In addition to whole-class sessions, students will work in small groups throughout the semester and conduct individual professional way-finding exercises. Students will apply the interdisciplinary approaches and perspectives learned in the core curriculum and previous courses in this series.

Master's Seminar IV: Master's Project Development for Interdisciplinary Analysis Part II: [Read More](#) [+]

Objectives & Outcomes

Course Objectives: Complete and file the masters project paper.

Develop and deliver a clear and engaging presentation on their master's project.

Prepare for post-graduation activities.

Rules & Requirements

Prerequisites: Energy and Resources ENERES 293A, ENERES 293B, ENERES 293C

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of seminar per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Instructor: ERG Faculty

Formerly known as: Energy and Resources Group 292D

Master's Seminar IV: Master's Project Development for Interdisciplinary Analysis Part II: [Read Less](#) [-]

ENE,RES 295 Special Topics in Energy and Resources 1 Unit

Terms offered: Fall 2021, Spring 2021, Fall 2020

Presentations of research in energy issues by faculty, students, and visiting lecturers. Master's degree students required to enroll for two semesters.

Special Topics in Energy and Resources: Read More [\[+\]](#)

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of colloquium per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Special Topics in Energy and Resources: Read Less [\[-\]](#)

ENE,RES 296 Doctoral Seminar 2 Units

Terms offered: Fall 2021, Spring 2021, Fall 2020

Lectures, reports, and discussions on current research in energy and resources. Particular emphasis on topics of research interest for current Ph.D. students in the Energy and Resources Group.

Doctoral Seminar: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of independent study per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Formerly known as: 298

Doctoral Seminar: Read Less [\[-\]](#)

ENE,RES 298 Doctoral Seminar 2 Units

Terms offered: Fall 2021, Spring 2021, Fall 2020

Lectures, reports, and discussions on current research in energy and resources. Sections are operated independently and under direction of different staff.

Doctoral Seminar: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Doctoral Seminar: Read Less [\[-\]](#)

ENE,RES 298N Directed Group Study 1 - 3 Units

Terms offered: Fall 2016, Spring 2016, Fall 2015

Informal group studies of special problems in energy and resources.

Directed Group Study: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Graduate standing and consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-3 hours of directed group study per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Directed Group Study: Read Less [\[-\]](#)

ENE,RES 299 Individual Research in Energy and Resources 1 - 12 Units

Terms offered: Fall 2021, Spring 2021, Fall 2020

Investigation of problems in energy and resources from an interdisciplinary perspective.

Individual Research in Energy and Resources: [Read More](#) [+]

Rules & Requirements

Prerequisites: Graduate standing

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-12 hours of independent study per week

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Individual Research in Energy and Resources: [Read Less](#) [-]

ENE,RES 301 Graduate Student Instructor Practicum 3 Units

Terms offered: Spring 2013, Fall 2012, Spring 2012

Course credit for experience gained in academic teaching through employment as a graduate student instructor.

Graduate Student Instructor Practicum: [Read More](#) [+]

Rules & Requirements

Prerequisites: Appointment as a graduate student instructor in the Group and permission of the graduate advisor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of seminar per week

Additional Details

Subject/Course Level: Energy and Resources Group/Professional course for teachers or prospective teachers

Grading: Offered for satisfactory/unsatisfactory grade only.

Graduate Student Instructor Practicum: [Read Less](#) [-]