

# Energy and Resources

The graduate courses in ERG provide advanced training in interdisciplinary analysis and research. Individual courses review current developments in the field or emphasize particular disciplinary perspectives: economics, resources, politics, public policy, or environmental sciences.

## Master's Degrees in Energy and Resources

The purpose of the ERG Master's program is to educate the next generation of interdisciplinary leaders. Students are taught the range of methods and subjects they should be able to understand, advance, and critique to address critical issues stemming from the interaction of humans and the environment. To that end, the requirements for the ERG master's degree are both broad and deep, stressing analytic, methodological, 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. The requirements also ensure experience in interdisciplinary analysis applied to a key resource concern. The curriculum provides an opportunity—through a topical cluster and an independent project—to extend and deepen the areas of investigation and understanding to satisfy the intellectual interests of each student.

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 and also those students who intend to continue their education, for example by pursuing a PhD in Energy and Resources.

## Master's/PhD Track

A small number of highly qualified applicants will be selected for the Master's/PhD Track. The track is both an indication of your intent to continue to the PhD program at ERG, and ERG's expectation that you will be qualified to continue to doctoral work after satisfying the master's degree requirements. It does not obligate you, or ERG, to your eventual matriculation to the PhD. Candidates admitted into the joint Master's/PhD track will be expected to complete all the requirements of the ERG Master's Degree before continuing.

## ERG Concurrent Degree Programs (MPP/MA or MMP/MS)

The Energy and Resources Group (ERG) and the The Goldman School of Public Policy (GSPP) offer a MPP-ERG (MA or MS) concurrent degree program that integrates the strengths of public policy analytical tools with the interdisciplinary knowledge and expertise in energy and resources. Students complete both programs in three years and receive a master's of public policy (MPP) as well as a master's degree in Energy and Resources (MA or MS).

## Matriculation from the Master's to the PhD

Students who begin on the Master's/PhD Track, as well as those who are admitted to the two-year master's degree program, will have an opportunity to declare their interest in continuing to the PhD during the third semester of the two-year master's program.

To officially matriculate into the PhD program, all master's degree students must meet the following criteria: 1) they must meet all the requirements of the master's degree program and 2) they must have a letter

from one ladder-rank faculty member in the ERG core or affiliate pool that indicates a commitment to serve as the student's PhD adviser and an assessment of the types of projects the student could work on during PhD studies. If the student does not meet these criteria he or she will be given the opportunity to finish any additional course work, if necessary, to complete the requirements of the master's degree, but will not matriculate to the PhD program.

## PhD in Energy and Resources

The admission requirement for the PhD is that the totality of the student's coursework after the bachelor's degree, including courses taken at other universities and inside and outside of ERG at Berkeley, must meet the substantive and unit requirements for the ERG MA or MS degree.

There is no formal language requirement for the PhD degree. However, those students conducting research in a non-English speaking country must demonstrate competency in the language of the country.

After the doctoral student and his or her advisers 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 attacking it. This exam, called the qualifying examination, is conducted by a committee of four faculty members chosen by the student, in consultation with his/her faculty adviser and subject to the approval of the graduate dean.

This examination should be taken at least one year before the expected completion of the dissertation. The final requirement for the PhD is completion of the dissertation to the satisfaction of a committee consisting of three faculty advisers/readers chosen by the student, subject to approval by the graduate dean. The PhD degree in Energy and Resources is typically completed three to five years beyond the master's degree.

## 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 (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 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.

## 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 20 students (Master's and PhD 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 (MS or MA), ERG/ Public Policy Concurrent master's degree or the PhD program. Within the master's applications there is checkbox to indicate your interest in the Master's/PhD Track.

## Admission to the Master's Program, MA or MS

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 Master's/PhD Track

A small number of highly qualified applicants will be selected for the Master's/PhD Track. The track is both an indication of your intent to continue to the PhD program at ERG, and ERG's expectation that you will be qualified to continue to doctoral work after satisfying the master's degree requirements. It does not obligate you, or ERG, to your eventual matriculation to the PhD. Candidates admitted into the joint Master's/PhD track will be expected to complete all the requirements of the ERG master's degree before continuing. Candidates for admission to the master's program whose ultimate goal is to continue on for a PhD at ERG should select either the MA or MS degree application and select the Master's/PhD track checkbox. Other master's students may apply to the PhD program upon successful completion of the two-year master's program.

## Admission to the PhD Program

Students admitted directly to the PhD program must have a two-year master's degree from a fully accredited US institution of higher learning or international equivalent. They also must be able to demonstrate a highly interdisciplinary academic background, either through a combination of bachelor's and master's degree coursework, or an interdisciplinary master's program equivalent in breadth and depth to the ERG

master's program. Doctoral students must also demonstrate their readiness for independent research with no additional foundational work required. Applications from students with one-year master's degrees, or with single-discipline professional degrees (e.g., law, public health) will usually be redirected to the ERG Master's program for consideration.

## Recommended Preparation

We highly recommend at least one term of college-level calculus and courses in fundamental science (e.g., physics, chemistry, and biology), as well as four or more 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 Friday in 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 them—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 recommendation and will accept up to five. You are welcome to use recommenders from your professional as well as your academic career. 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 Bar-

rows Hall #3050, Berkeley, CA 94720–3050. We will then upload the letter to your file for them.

4. **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.
5. **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.

The primary focus of the PhD is the research and writing of the student's dissertation. There are no formal course requirements for PhD students, although many PhD students take classes to support their research and breadth of knowledge. Students may determine which, if any, courses they should take in consultation with their faculty advisers.

PhD students are encouraged to register for, and attend the weekly ERG Doctoral Seminar (ENE,RES 296) where ERG PhD students share their ongoing work and solicit feedback from the ERG community.

After the doctoral student and his or her advisers 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 attacking it. This exam, called the qualifying examination, is conducted by a committee of four faculty members chosen by the student, in consultation with his/her faculty adviser and subject to the approval of the graduate dean.

This examination should be taken at least one year before the expected completion of the dissertation. The final requirement for the PhD is completion of the dissertation to the satisfaction of a committee consisting of three faculty advisers/readers chosen by the student, subject to approval by the graduate dean. The PhD degree in Energy and Resources is typically completed three to five years beyond the master's degree.

## Curriculum

### Master's Degree Series

ENE,RES 201	Interdisciplinary Analysis in Energy and Resources	3
ENE,RES 292B	Master's Project Seminar	2
ENE,RES 292C	Master's Project Seminar	2
ENE,RES 292D	Master's Project Seminar	2
ENE,RES 295	Special Topics in Energy and Resources (two semesters are required)	1

## Additional Course Requirements

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, and also those students who intend to continue their education,

for example by pursuing a PhD in Energy and Resources. Differentiation of MA or MS degree is based on the substantive content of coursework and master's project. To obtain a master's degree from ERG, each student must meet the following requirements:

- Complete a minimum of 40 post-baccalaureate units. A maximum of 4 units of 299 (individual research) credits can be counted; 298 units (group study) cannot be counted.
- Complete a minimum of 18 units of graduate-level study in energy and resources, some of which can be fulfilled by courses from other departments and school.
- Complete the ERG Masters Degree Series (see above).
- Six additional units of approved graduate-level courses.
- Complete a master's project. An undertaking of an independent investigation that culminates in an oral presentation before the ERG community and a written report approved by two faculty readers.
- Complete a cluster of three courses (minimum of 9 units) in a subject area defined by the student and approved by his/her adviser.
- Complete one course in each of the A-E requirements areas listed below.

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

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

## Energy and Resources

### ENE,RES C200 Energy and Society 4 Units

Terms offered: Fall 2017, Summer 2017 8 Week Session, Fall 2016  
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 201 Interdisciplinary Analysis in Energy and Resources 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

Introduction to interdisciplinary analysis as it is practiced in the ERG. Most of the course consists of important perspectives on energy and resource issues, introduced through a particularly influential book or set of papers. The course also provides an introduction to the current research activities of the ERG faculty as well as practical knowledge and skills necessary to successfully complete graduate school in an interdisciplinary program.

Interdisciplinary Analysis in Energy and Resources: Read More [ + ]

#### Rules & Requirements

**Prerequisites:** Open to ERG graduate students only 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.

**Instructors:** Harte, Kammen, Ray

Interdisciplinary Analysis in Energy and Resources: 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/INTEG BI C205

Quantitative Methods for Ecological and Environmental Modeling: Read Less [\[-\]](#)

## ENE,RES C221 Climate, Energy and Development 3 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015, Fall 2014

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 3 Units

Terms offered: Spring 2017, Fall 2015, Fall 2014

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 per week

### Additional Details

**Subject/Course Level:** Energy and Resources Group/Graduate

**Grading:** Letter grade.

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<BR/>Energy and Resources ENE,RES 102<BR/>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 2017, Fall 2015, Spring 2014

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 2018, Spring 2016, Spring 2014

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 2017, Fall 2016

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: Spring 2016, Fall 2015, Spring 2015

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.

### 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: Spring 2018, Fall 2017, Spring 2017

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 [\[+\]](#)

### 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.

### 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 2017, Fall 2016, Fall 2015

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 292B Master's Project Seminar 2 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Required of second-semester Energy and Resources Master's candidates. Topics include the adoption of a research project, research design, presentation of work, and statistical analyses. Introduction to research skills, including Human Subject Research Protocols, research ethics and methodologies. Critical reading and analysis of research papers; development and discussion of project ideas. Students begin to identify and solicit faculty readers for their projects. Students will apply the interdisciplinary methods, approaches, and perspectives learned in the core curriculum.

Master's Project Seminar: Read More [+]

### Rules & Requirements

**Prerequisites:** Energy and Resources 201

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Energy and Resources Group/Graduate

**Grading:** Letter grade.

**Instructor:** ERG Faculty

Master's Project Seminar: Read Less [-]

## ENE,RES 292C Master's Project Seminar 2 Units

Terms offered: Fall 2017, Fall 2016, Fall 2015

Required for ERG Master's students in the semester previous to the one in which they plan to file their Project. Development of Master's Project outline and research plan. Identification and solicitation of faculty readers. Evaluation and integration of critical feedback from readers and cohort on project. Topics include the adoption of a research project, research design, presentation of work, and statistical analyses. Students will apply the interdisciplinary methods, approaches, and perspectives learned in the core curriculum. Course requirements include:

Attendance and active participation in the sharing and critique of the cohort's final master's projects (50%); draft project outline and final readers confirmed by end of term (50%).

Master's Project Seminar: Read More [+]

### Rules & Requirements

**Prerequisites:** Energy and Resources 201 and Energy and Resources 292B

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Energy and Resources Group/Graduate

**Grading:** Letter grade.

**Instructor:** ERG Faculty

Master's Project Seminar: Read Less [-]

## ENE,RES 292D Master's Project Seminar 2 Units

Terms offered: Spring 2018, Spring 2017, Spring 2016

Required of all ERG Master's students in the semester during which they plan to file their Final Master's Project. This course is intended to assist students in completing their required Master's Projects, and to provide constructive feedback to students on their Final Master's Project oral presentations. The goal is to improve the quality of the research for the ERG Master's Projects and to learn and refine presentation skills for an academic/professional audience.

Master's Project Seminar: Read More [+]

### Rules & Requirements

**Prerequisites:** Energy and Resources 201, 292B, and 292C

### Hours & Format

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

### Additional Details

**Subject/Course Level:** Energy and Resources Group/Graduate

**Grading:** Letter grade.

**Instructor:** ERG Faculty

Master's Project Seminar: Read Less [-]

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

Terms offered: Spring 2018, Fall 2017, Spring 2017

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.

### 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: Spring 2018, Fall 2017, Spring 2017

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.

### 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: Spring 2018, Fall 2017, Spring 2016

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.

### 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.

### 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: Spring 2018, Fall 2017, Spring 2017

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.

### 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.

### 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](#) [-]