Energy and Resources Group

Overview

The Energy and Resources Group (ERG) is an interdisciplinary academic unit of UC Berkeley, conducting programs of graduate teaching and research that treat issues of energy, resources, development, human and biological diversity, environmental justice, governance, global climate change, and new approaches to thinking about economics and consumption. Established in 1973, ERG offers two-year MA and MS degrees in Energy and Resources as well as a PhD and an undergraduate minor.

The faculty of ERG consists of eight professors of energy and resources plus some 100 affiliated faculty members whose main appointments span all five colleges and four of the schools of the Berkeley campus as well as the University's Lawrence Berkeley and Lawrence Livermore National Laboratories. The chair is normally drawn on a rotating basis from the affiliated faculty.

There are approximately 60 graduate students enrolled in ERG degree programs, about half of them doctoral candidates. The students come from a wide variety of backgrounds—engineering, natural sciences, social sciences, and humanities. The characteristics they have in common are an interest in interdisciplinary approaches to energy and resource issues and the intellectual credentials to succeed in a rigorous academic program. All receive training at ERG in the technological, environmental, economic, and sociopolitical dimensions of energy and resource issues while pursuing additional coursework and individual research tailored to their interest and backgrounds.

ERG graduates are employed across the US and around the world in universities, governmental and international agencies, legislative staff positions, national laboratories, public and private utilities, other energy and resource companies, consulting firms, and public-interest organizations.

Undergraduate Program

Energy and Resources (http://guide.berkeley.edu/archive/2014-15/undergraduate/degree-programs/energy-resources) : Minor

Graduate Programs

Energy and Resources (http://guide.berkeley.edu/archive/2014-15/graduate/degree-programs/energy-resources) : MA, MS, and PhD

Energy and Resources

ENE,RES 24 Freshman Seminar 1 Unit
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.
Rules & Requirements

Repeat rules: Course may be repeated for credit as topic varies. 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.

ENE,RES 98 Directed Group Study for Lower Division Students 1 - 4 Units
Lectures and small group discussions focusing on topics of interest that vary from semester to semester.
Rules & Requirements

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

Repeat rules: Course may be repeated with consent of department.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.

ENE,RES 99 Supervised Independent Studies for Freshmen and Sophomores 1 - 4 Units
Supervised research on specific topics related to energy and resources.
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. Course may be repeated for credit when topic changes.

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.

ENE,RES C100 Energy and Society 4 Units
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.
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.

Instructor: Kammen

Also listed as: PUB POL C184

ENE,RES 101 Ecology and Society 3 Units
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. Offered alternate years.
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

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

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

Instructor: Harte

ENE,RES 102 Quantitative Aspects of Global Environmental Problems 4 Units
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; epidemics.
Rules & Requirements

Prerequisites: Upper division standing; calculus (MATH 1A-1B or 16A-16B); physics (7A-7B or 8A-8B), chemistry (1A or 4A), biology (1B or 11), 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. Final exam required.

Instructor: Harte

ENE,RES 170 Environmental Classics 3 Units
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.
Rules & Requirements

Prerequisites: Upper division standing

Hours & Format

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

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

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

Instructors: Kammen, Ray

ENE,RES 175 Water and Development 4 Units
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."
Rules & Requirements

Prerequisites: Upper division standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 4 hours of seminar per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructor: Ray

ENE,RES C180 Ecological Economics in Historical Context 3 Units
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, just economies.
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.

Instructor: Norgaard

Also listed as: ENVECON C180

ENE,RES 190 Seminar in Energy, Environment, Development and Security Issues 3 Units
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.
Rules & Requirements

Prerequisites: Upper division standing and consent of instructor

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

Hours & Format

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

Summer: 3 weeks - 15 hours of lecture per week

Additional Details

Subject/Course Level: Energy and Resources Group/Undergraduate

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

ENE,RES 198 Directed Group Studies for Advanced Undergraduates 1 - 4 Units
Group studies of selected topics.
Rules & Requirements

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

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

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.

ENE,RES 199 Supervised Independent Study and Research 1 - 4 Units
Individual conferences.
Rules & Requirements

Prerequisites: Enrollment restricted by regulations in General Catalog

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

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.

ENE,RES C200 Energy and Society 4 Units
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.
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: Kammen

Also listed as: PUB POL C284

ENE,RES 201 Interdisciplinary Analysis in Energy and Resources 3 Units
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.
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

ENE,RES C202 Modeling Ecological and Meteorological Phenomena 3 Units
Modeling methods in ecology and meteorology; stability analysis; effects of anthropogenic stress on natural systems. Offered alternate years.
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

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

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

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

ENE,RES 254 Electric Power Systems 3 Units
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.
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.

ENE,RES 270 Environmental Classics 3 Units
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.
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

ENE,RES 273 Research Methods in Social Sciences 3 Units
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.
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

ENE,RES 275 Water and Development 4 Units
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."
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

ENE,RES 280 Energy Economics 3 Units
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.
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

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Letter grade.

Instructor: Norgaard

ENE,RES C283 Information and Communications Technology for Development 3 Units
This seminar reviews current literature and debates regarding Information and Communication Technologies and Development (ICTD). This is an interdisciplinary and practice-oriented field that draws on insights from economics, sociology, engineering, computer science, management, public health, etc.
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: Ray, Saxenian

Also listed as: INFO C283

ENE,RES 290 Seminar in Energy and Resources 1 - 4 Units
Graduate student presentations and faculty-student discussions of advanced topics in energy and resources. Specific topics vary according to faculty and student interest.
Rules & Requirements

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

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.

ENE,RES 291 Special Topics in Energy and Resources 1 - 3 Units
Study and critical analysis of advanced topics in energy and resources using interdisciplonary approaches. Specific topics vary according to faculty and student interest.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

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

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.

ENE,RES 292A Tools of the Trade 2 Units
Quantitative methods for energy and resource analysis. Topics include linear algebra, differential equations, statistical methods, chemical equilibrium theory, and thermodynamics.
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.

ENE,RES 292B Master's Project Seminar 2 Units
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.
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

ENE,RES 292C Master's Project Seminar 2 Units
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%).
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

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

ENE,RES 295 Special Topics in Energy and Resources 1 Unit
Presentations of research in energy issues by faculty, students, and visiting lecturers. Master's degree students required to enroll for three semesters.
Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Energy and Resources Group/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

ENE,RES 296 Doctoral Seminar 2 Units
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.
Rules & Requirements

Prerequisites: Consent of instructor

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

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

ENE,RES 298 Doctoral Seminar 2 Units
Lectures, reports, and discussions on current research in energy and resources. Sections are operated independently and under direction of different staff.
Rules & Requirements

Prerequisites: Consent of instructor

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

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.

ENE,RES 298N Directed Group Study 1 - 3 Units
Informal group studies of special problems in energy and resources.
Rules & Requirements

Prerequisites: Graduate standing and consent of instructor

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

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.

ENE,RES 299 Individual Research in Energy and Resources 1 - 12 Units
Investigation of problems in energy and resources from an interdisciplinary perspective.
Rules & Requirements

Prerequisites: Graduate standing

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

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.

ENE,RES 301 Graduate Student Instructor Practicum 3 Units
Course credit for experience gained in academic teaching through employment as a graduate student instructor.
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. Course may be repeated for credit when topic changes.

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.