

Energy and Resources Group

Master's Degree Requirements

The purpose of the ERG Master's program is to educate the next generation of interdisciplinary leaders. Specifically, 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.

To obtain a Master's degree from ERG, each student must meet the following requirements:

- Complete a minimum of 40 post-baccalaureate units.
- 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 schools. The following elements must be included:
 - o ER 201 — Interdisciplinary Analysis in Energy and Resources (4 units)
 - o ER 292C/292D — Master's Seminar (2 × 2 units)
 - o ER 295 — ERG Colloquium (2 × 1 unit) (Two semesters are required to ensure exposure to a broad array of topics and approaches.)
 - o ER 299 — Master's Project (2 units count towards the graduate-unit requirement)
 - o Six additional units of approved graduate-level courses
- Complete one course from each of the areas A-E listed below.
- Complete a Master's project. The Master's project entails two semesters of participation in the ERG Master's seminar, ER 292C/292D (4 units), plus undertaking an independent investigation that culminates in an oral presentation before the ERG community and a written report approved by two faculty readers (ER 299, 2 units).
- Complete a cluster of three courses (minimum of 9 units) in a subject area defined by the student and approved by his/her advisor. This cluster is designed to ensure depth of study in a topic within the domain of Energy and Resources. At least one of these courses (3 units) must be a graduate-level course. Suitable areas include (but are not limited to) climate change, energy, water, environmental justice, and development. The cluster may include one of the courses used to satisfy the area A-E requirement, and cluster courses can fulfill the requirement of 18 units of graduate-level study in energy and resources.
- The following limits and restrictions apply on credit toward the 40-unit requirement:
 - o A maximum of 4 units of credit can be granted for 299 units (individual research)

- The following courses do not count toward the 40-unit Master's coursework requirement: 298 (group study) and 301 (GSI practicum).

All courses that are used to satisfy degree requirements must be taken for a letter grade if that option is available. A minimum GPA of 3.0 ("B") in all courses completed must be achieved.

To ensure effective early planning and consultation, ERG Master's students are expected to submit a completed "Proposed Course of Study" form by the last day of class in their first semester. This form will indicate the courses that the student intends to take to meet the requirements given above. It will be completed by the student in consultation with the process advisor, and is reviewed by the entire ERG Core faculty, who will provide feedback early in the student's second semester. Of course, a student's interests may change, so the proposed course of study can change as well. At the end of the third semester, students are expected to submit a revised course of study, plus their proposed Master's Project title and abstract to the ERG Core faculty, who will provide feedback. The student's process advisor must approve a final Course of Study early in the student's final semester to meet the requirements for graduation.

The ERG Master's program can lead to either an MA or MS degree in Energy and Resources. In consultation with the advisor, each student makes a request of the MA or MS degree *based on the substantive content of coursework and Master's project*. Each student, with the cooperation of his or her first faculty reader and also the instructor(s) of the Master's seminar, will prepare a proposed project title and abstract for the Master's project by the end of the student's third semester. The ERG core faculty as a whole makes a final determination of the appropriateness of the MA/MS selection based on the student's Course of Study and proposed title and abstract for the Master's Project.

Area (A-E) requirement

Teaching and research in the Energy and Resources Group draws heavily on four academic traditions, as they are applied to the interactions of societies with resources and the natural environment:

Environmental science

Resource and environmental economics

Social science approaches to energy, resources and the environment

Engineering approaches to energy, resources and the environment

The ERG Master's curriculum ensures that each student is well acquainted with each of these academic spheres and also experiences how distinct approaches from these intellectual traditions are brought to bear in interdisciplinary resource analysis. Consequently, one of the cornerstone requirements of the ERG Master's curriculum is the A-E requirement. Students must complete at least one course in each of the A-E topics.

Alternate courses to those listed are allowed in Areas B-E with permission of the designated responsible faculty, but the alternate course must meet the intent and prerequisites of the area requirement. Attributes that would normally be considered minimum requirements for an alternative course to be acceptable are these: 3+ units, lecture or laboratory-based instruction (i.e., no seminar courses) with substantive intellectual content and topical relevance to the domain of ERG.

Students who have already taken a course similar to those listed in one of the areas are required to take an alternative course in the same area, preferably more advanced, subject to the approval of the designated responsible faculty. A student who has demonstrated a high level of mastery in a given area based on previous academic work may petition the responsible faculty to waive the need to complete a course in that area. For example, a high level of mastery in resource and environmental economics could be demonstrated by completion of an undergraduate degree in economics that included multiple courses in resource economics. In this case, a student could petition to have waived the requirement of completing an additional course in Area C.

A. Interdisciplinary Energy and Resource Analysis

- ER 200N – Energy and Society [Kammen, fall] (Prerequisites for ER 200N: at least one course in college physics or chemistry)
- ER 275 – Water and Development [Ray, fall] (Prerequisite for ER 275: at least one college level development-focused or water-focused course)

The purpose of these courses is to provide the interested entering graduate student sufficient background in the physical and social constructions of the relevant systems to enable them to understand key issues and to begin to conduct research in that area. This course should be taken during the first semester of Master's study, concurrently with ER 201.

B. Environmental Science

- ER 102 – Environmental Problem Solving [Harte, spring]

The purpose of this course is to provide the necessary concepts and analytical tools in environmental science expected of all ERG graduates.

Note: The prerequisites for this course are 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.

Responsible Faculty: Harte

C. Resource and Environmental Economics

The following courses meet this requirement:

- ERG C180 / EEP C180 – Ecological Economics in Historical Context [Norgaard; spring]
- ERG 280 – Energy Economics [Norgaard; spring]
- EEP C101 / Econ C125 – Environmental Economics [spring]
- EEP C102 / Econ C102 – Natural Resource Economics [fall]
- EEP C151 / Econ C171 – International Economic Development [fall]
- EEP 162 – Economics of Water Resources [spring]
- MBA 212 — Energy and Environmental Markets [fall, spring]

The purpose of this course is to provide the necessary concepts and analytical tools in economics expected of all ERG graduates. These courses all have intermediate microeconomics (Econ 100A or 101A, or EEP 100) as a prerequisite, as well as at least one semester of calculus.

Responsible Faculty: Norgaard

D. Social Science Approaches to Energy, Resources and the Environment

The following courses meet this requirement:

- ER 273 – Research Methods in Social Sciences [Ray, spring]
- ER 151 – Politics of Energy and Environmental Policy [staff, fall]
- ESPM 155 – Sociology of Natural Resources [Fortmann, fall]
- ESPM 161 – Environmental Philosophy and Ethics [Merchant, fall]
- ESPM 168 – Political Ecology [Peluso, spring]
- ESPM 169 – International Environmental Politics [O'Neill, fall]
- CRP 254 – Sustainable Communities [Duane]

The purpose of this course is to ground ERG students in a broad range of the methods, theories and policies that underpin the diverse social sciences, through methodological, political, sociological or philosophical approaches to natural resources and the environment. Reading seminars are not allowed, even if they are graduate-level courses, unless the student has already taken an upper division course in e.g. environmental politics, and is seeking to fulfill this area requirement through an advanced seminar on the same theme.

Note: These courses generally have as prerequisites undergraduate level courses in geography, sociology, anthropology or political science.

Responsible Faculty: Ray

E. Engineering Approaches to Energy, Resources and the Environment

The following courses meet this requirement:

- ER C226/MSE C226 – Photovoltaic Materials [Kammen and Haller, fall alternate years]
- CE 103 – Introduction to Hydrology (staff, fall)
- CE 111 – Environmental Engineering (Nazaroff, Alvarez-Cohen, fall & spring)
- CE 218A – Air Quality Engineering (Harley, Nazaroff, fall)
- CE 268E – Civil Systems and the Environment (Horvath, spring)
- ME C105B / BioE C105B – Thermodynamics and Biothermodynamics (Carey, F, S)

The purpose of this course is to provide all ERG students with exposure to and experience with the problem-solving, design-oriented approach of relevant engineering disciplines. Other courses may be allowed by petition, but must have substantive engineering content and topical relevance to the domain of ERG, and must be offered in the College of Engineering or in the Department of Chemical Engineering.

Note: These courses will have various prerequisites.

Responsible Faculty: Kammen

Sample Program of Study

(Note: Effective Fall 2007, the minimum enrollment requirement for all graduate students who are not yet advanced to doctoral candidacy is 12 units per semester, regardless of their employment status.)

1st Semester (Fall)

ER 200N (4) or ER 275 (3) — Area A requirement

ER 201 (4) — Interdisciplinary Analysis in Energy and Resources

Elective C-E — satisfy one of the Area C-E requirements

Total units: 11-12; students should consider a seminar if needed to reach the 12 unit minimum

Early December – submit proposed Course of Study form

2nd Semester (Spring)

ER 102 (4) — Area B requirement

ER 292C (2) – Master's seminar

ER 295 (1) — ERG colloquium

Elective Cluster — Cluster course no. 1

Total units: 10-11; students should consider enrolling in one additional elective course

Receive feedback on Course of Study

3rd Semester (Fall)

ER 292D (2) – Master's seminar

ER 295 (1) — ERG colloquium

Elective Cluster — Cluster course no. 2

Elective C-E — satisfy one of the Area C-E requirements

Total units: 9-11; students should enroll in one additional elective course

Early December – submit updated Course of Study and Title/Abstract for Master's Project

4th Semester (Spring)

ER 299 or XX 299 (2) — Master's Project (register with first reader)

Elective Cluster — Cluster course no. 3

Elective C-E — satisfy one of the Area C-E requirements

Total units: 8-10; students should enroll in one additional elective course

Receive feedback and approval of Course of Study and Title/Abstract for Master's Project

**Energy and Resources Group
Master's Program Course of Study**

(Note: This form is to be filled out, signed, and given to the staff Graduate Adviser by the last day of classes each fall semester.)

Name: _____ Date: _____

Fall – Year 1	Spring – Year 1
Fall – Year 2	Spring – Year 2

Course used to fulfill the Area A-E requirements:

- A. Interdisciplinary Resource Analysis: _____
- B. Environmental Science: _____
- C. Resource and Environmental Economics: _____
- D. Social Science Approaches: _____
- E. Engineering Approaches: _____

Three-course sequence used to fulfill the cluster requirement:

- 1. _____
- 2. _____
- 3. _____

Additional courses used to fulfill the requirement for 18 graduate units in the major subject

- 1. _____
- 2. _____
- 3. _____

Academic Adviser Signature: _____ **Date:** _____