PROPOSAL FOR A GRADUATE PROGRAM IN ENERGY LEADING TO M.S. AND PH.D. DEGREES OFFERED THROUGH AN ENERGY GRADUATE GROUP

Submitted: October 10, 2014
Revised: November 25, 2014
Revised: June 9, 2015

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Overview

This proposal is submitted to create an Energy Graduate Group (EGG) at UC Davis that awards M.S. and Ph.D. degrees in interdisciplinary energy studies. Degrees will be awarded in one of two tracks: (1) Energy Science & Technology, or (2) Energy Policy & Management. A large group of faculty members have contributed to the development of this proposal and are strongly committed to its success. The Energy Institute will provide classroom and meeting space in West Village, administrative services, and fundraising support to the EGG program. The Dean of Engineering will provide lead academic support. Substantial funding commitments have been made to the proposed EGG program by the College of Engineering, Office of Graduate Studies, and College of Agricultural and Environmental Sciences.
Section 1. Introduction

1.1. Aims and objectives of the program

The goals of the proposed Energy Graduate Group (EGG) are to:

1. Build the strongest interdisciplinary energy graduate program in the country based on synergies among world-leading energy centers and faculty specializing in energy research at UC Davis;

2. Leverage this interdisciplinary expertise and educational training to benefit energy decision-making in government and industry; and

3. Provide a supply of diverse and well-trained energy experts to industry, government, NGOs, academia, and research centers to meet an unmet demand in the job market.

The proposed EGG will be a degree granting graduate group operating under its own set of bylaws and degree requirements. This new program will be administered by and fully integrated with the UC Davis Energy Institute and its affiliated energy centers in ways that enhance the educational experience of students and result in increased job opportunities. Not only will students benefit directly from their participation in the program, but the EGG program will also generate synergies between energy research and education by providing a mechanism for faculty to collaborate and transfer skills and knowledge across disciplines and between colleges and departments.

This graduate program will provide skills and knowledge to meet the needs of a new generation of energy researchers and professionals. The proposed EGG program will provide an integrated program of graduate education in energy that will lead to M.S. and Ph.D. degrees in the two following areas of emphasis: (1) Energy Science & Technology, and (2) Energy Policy & Management. The program will address energy systems broadly, with a focus on renewable energy, transportation fuels, and energy efficiency. A lack of diversity among students in science, technology, engineering, and mathematics (STEM) field is now recognized as an impediment to creativity and ingenuity. Aside from the moral and ethical imperative to improve equity in the US, diverse groups are also likely to arrive at more creative solutions to complex problems. Thus both an interdisciplinary approach and the development of a more diverse graduate student body are priorities of the EGG program.

A key feature of the EGG program will be the promotion of interdisciplinary interaction among graduate students and faculty, and with energy and environmental professionals in industry and government. These interactions will uniquely qualify EGG graduates for the interdisciplinary energy industry of the 21st century. Our graduates will utilize training in engineering, physical sciences, economics, environmental sciences, management, and policy to interact effectively with policymakers, engineers, scientists, and academics. The energy industry in California and around the nation currently has an unmet demand for highly skilled employees with this type of interdisciplinary graduate training in energy, as indicated by letters of support for the EGG program in Appendix D. The program proposed herein has been designed specifically to address this unmet need and to produce graduates who will be leaders and experts in government, the private sector, and academia.

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1 The following institutes and research centers at UC Davis are affiliated with the Energy Institute: Institute of Transportation Studies (ITS); Energy Efficiency Center (EEC); Plug-in Hybrid and Electric Vehicle Research Center; National Center for Sustainable Transportation; Policy Institute for Energy, Environment, and the Economy; Western Cooling Efficiency Center; and the Center for Water Energy Efficiency.

The EGG program is expected to attract new students to campus who otherwise would not be likely to enroll in another graduate program at UC Davis. The only exception might be a few students interested in energy who have been enrolled in the Transportation Technology and Policy group, but who would prefer to enroll in the EGG program. The EGG program would be designed to attract students with the following profile:

(a) 2 to 5 years of career experience working on energy-related topics in industry, government, non-profit advocacy groups, or academia.

(b) For the Energy Science & Technology track, successful candidates would likely have received an undergraduate degree in Engineering or the Physical Sciences.

(c) For the Energy Policy & Management track, successful candidates would likely have received an undergraduate degree in the social sciences, Management, Environmental Science and Policy, or related fields.

(d) The Energy Institute will promote the EGG program broadly to attract a diverse profile of in-state, out-of-state, and international students, with a particular goal of building a student body that includes historically underrepresented groups in STEM fields. The program will set initial targets for entering graduate classes of 40% in-state, 40% out-of-state, and 20% international.

The EGG program will become a preeminent program, producing graduates who have a unique foundation in the energy sciences, engineering, policy, and management that will allow them to become leaders in industry, government, and academia. This program will be unique to the University of California system in its focus on energy and its reach across the energy-related disciplines. It will make UC Davis a recognized leader in interdisciplinary energy science, engineering, policy research, and education.

1.2. History of Energy Studies and How UC Davis is Well Positioned to be a Global Leader in Energy Education and Research

California, the United States, and the world are on the cusp of two energy revolutions. One revolution is the dramatic expansion of liquid and gaseous fossil fuel supplies. Only five years ago, imports of oil and natural gas were growing, costing the United States hundreds of billions of dollars a year and exacerbating national energy security risks. New technologies are allowing U.S. industries to extract significant new quantities of domestic fossil fuels. With it widely expected that oil imports will continue to shrink into the foreseeable future, the U.S. will soon become the largest global oil producer, and domestic natural gas will be exported. Moreover, this American fossil energy revolution is expected to spread around the world, with increased investment and production of fuels from oil sands, shale gas and oil, Arctic oil, and other more exotic sources.

The second revolution is motivated by growing concerns for climate change, and the resulting risks of extreme weather events, water shortages, wildfires, and rising sea levels. This revolution is realized through rapid expansion of renewable energy and increasing emphasis on energy efficiency.

The tension between these two revolutions, one based on fossil energy and the other on renewable energy, creates perhaps the most complex and far-reaching challenges facing this nation and the world, with profound effects on national security, economic growth, climate stabilization, healthy cities, lifestyles, and social equity. A fundamentally new approach to energy supply and usage is needed that addresses these many complex interactions. On the supply side, we need to mitigate the risks of fossil energy production while increasing the supply and competitiveness of low-carbon renewable sources. On the demand side, we have enormous opportunities to improve efficiency and change behaviors in ways that dramatically reduce energy
use and greenhouse gas (GHG) emissions. In both cases, the socioeconomic and environmental impacts of our choices must be carefully understood and considered.

The training of students for this rapidly changing world is of paramount importance. This training must be interdisciplinary. Engineering, science, and policy topics to be covered include more efficient lighting and cooling technologies, zero net energy buildings, electric and fuel cell cars, and innovative new mobile apps designed to change consumer behavior around energy usage. New methods of producing energy from plant matter and novel materials for solar power and other materials are also emerging. Even with fossil energy, new technologies are being developed to capture and store carbon. Significant energy transformations are underway.

From basic energy science to applied policy analysis, experts and leaders working on these energy transformations must draw upon a wide range of disciplines to advance the state of knowledge and to make informed decisions about these challenges. UC Davis seeks to fill this need by creating an interdisciplinary graduate degree program in energy.

The community of professors and researchers engaged in energy research and teaching at UC Davis (and who would be mentors and advisors of EGG students) is large and expanding.

The campus recruited 12 new energy faculty members at the end of the last decade through its “Energy for the Future” initiative (the highest rated faculty initiative on the campus at the time). These new faculty members are just now gaining tenure and are primed to assume greater leadership on campus. They join well over 100 existing Academic Senate faculty already studying and teaching energy science, technology, and policy. Together, they form a strong and committed faculty foundation for a world-leading interdisciplinary graduate program in energy, as evidenced by the enthusiastic letters of support from faculty and department chairs found in Appendix A.

In fact, the recruitment of “Energy for the Future” faculty in 2007-09 was the motivation for UC Davis to create a campus-wide Energy Institute to oversee and coordinate the many energy research and education activities on the campus. In 2013, the campus physically and administratively clustered the Energy Institute with a set of affiliated energy and transportation research centers. The campus co-located this set of centers and institutes (described below)—along with their offices, labs, and student workspace—at West Village, the largest zero net energy (ZNE) community in the US:

UC Davis West Village

*UC Davis West Village is home to the Energy Institute and several affiliated research centers whose offices, labs, and workspace are located on the first floor of the mixed-use buildings seen above.*
A map of the UC Davis campus showing the location of West Village at the intersection of Interstate 80 and Route 113.

Example of the shared student workspace in the West Village offices that will be available to EGG students. Note the break room, shared computer terminals, lockers, and small meeting rooms.
In addition to student workspace and meeting rooms, the room shown above (1605 Tilia Street, Room 1103) will be available to the EGG program for large student meetings and seminars.

This cluster of energy and transportation research centers is well funded with almost $20 million per year in extramural expenditures and close partnerships with a large array of energy-related companies and government agencies. The Energy Institute is co-located at West Village with the Institute of Transportation Studies; Energy Efficiency Center; Policy Institute for Energy, Environment, and the Economy; Western Cooling Efficiency Center; Center for Water-Energy Efficiency: Plug-in Hybrid and Electric Vehicle Research Center; China Center for Energy and Transportation; and the National Center for Sustainable Transportation. These research units share a strong administrative support staff, including fundraising and communications professionals. Additionally, the Institute of Transportation Studies already hosts another graduate program, the successful Transportation Technology and Policy (TTP) Graduate Group,3 which will share administrative resources with the EGG program. The experience of this existing administrative staff will make administering the EGG program more efficient.

A unique benefit of the Energy Institute is its proximity to Sacramento, given the State’s global policy leadership in energy efficiency, low-carbon vehicles and fuels, renewable energy, and grid storage. Our faculty and students are deeply engaged in all these initiatives and EGG students would be well positioned to take advantage of the opportunities that come with our proximity to California’s state capital.

In summary, UC Davis is uniquely situated intellectually, institutionally, culturally, and geographically to be a leader in educating the next generation of energy experts. Students in the EGG program will benefit from research funding at existing energy and transportation units at West Village and affiliated departments across the campus, and will also gain valuable access to job opportunities with the many partnered companies and government agencies already affiliated with the units operating out of West Village. In short, the EGG program builds upon UC Davis’s already large commitment to energy research and education.

3 The TTP has graduated 123 students (82 M.S., 26 Ph.D., and 15 M.S./Ph.D. alumni who received two degrees from TTP) since 1997. The first M.S. degree was awarded in 1997 and the first Ph.D. in 1999.
1.3. Desired Date of Implementation and Timetable for Development of the Energy Graduate Group

We propose to begin accepting applications for students as soon as possible, ideally in the 2015-16 admission window, with the first new students enrolling for the Fall Quarter in 2016. We will limit enrollment to 10 new students in year one and to 20 total students in year two (with 10 new students enrolled). We anticipate increasing enrollments thereafter. The final target enrollment for the EGG program will be a minimum of 40 students and a maximum of 80 students. Current queries from students both within and outside UC Davis regarding the availability of an interdisciplinary energy graduate program suggest that the target enrollment should be easily met, attracting new graduate students who would not otherwise have pursued a graduate degree here.

There are no enrollment restrictions for graduate programs at UC Davis that affect this or related graduate programs.

1.4. Relation of the proposed program to existing programs on campus and to the Campus Academic Plan

Creation of the EGG program is a very high priority for the campus, as demonstrated by strong letters of support from college deans and department chairs, as well as strong funding commitments by the deans of Engineering, Graduate Studies, and Agricultural and Environmental Sciences (see Appendix A.).

The EGG program will be hosted by the Energy Institute, which is co-located along with several affiliated energy and transportation research centers at UC Davis West Village. The co-location of these research units in West Village reflects the rapid expansion of energy research on the campus in the past 10 years, including the Energy Efficiency Center, Western Cooling Efficiency Center, Center for Water-Energy Efficiency, Plug-in Hybrid and Electric Vehicle Research Center, China Center for Energy and Transportation, and the National Center for Sustainable Transportation. Another large unit is the Institute of Transportation Studies, with 120 affiliated graduate students, about half focused on energy. Together these centers administer close to $20 million per year.

The energy and transportation research units co-located at West Village are strongly supported by government and industry. These research units receive substantial funding from most of the major oil and natural gas companies in the world, most of the major automotive companies in the world, and all the major electric and natural gas companies in California. They also receive substantial funding from the most important energy and transportation-focused government agencies in California and the US (and many other states), including the United States Departments of Energy and Transportation, the US Environmental Protection Agency, and California’s Air Resources Board, Energy Commission, and Department of Transportation, and the South Coast Air Quality Management District. These units also work closely with many environmental NGOs and other advocacy groups. Graduate students benefit enormously from the funding and ongoing interactions with these organizations, and the resulting access to job opportunities upon graduation.

The shared administrative staff supporting the energy and transportation units at West Village have strong experience hosting interdisciplinary graduate programs and they are prepared to support the EGG program upon its approval. The affiliated Institute of Transportation Studies already hosts the successful Transportation Technology and Policy (TTP) Graduate Group, with about 60 enrolled students (M.S. and Ph.D.). The existing shared administrative staff at West Village will support the EGG program, with some reorganization initially; as enrollments increase, another staff person will likely be added.

The energy and transportation research units at West Village provide research assistantships, fellowships, and thesis and dissertation opportunities for students. These units currently provide a
large number of graduate fellowships per year, some from dedicated corporate sponsorships and others from the National Center for Sustainable Transportation (funded by the US Department of Transportation, Caltrans, California Energy Commission, California Air Resources Board, and South Coast Air Quality Management District). EGG students will be eligible immediately for all of these fellowships. With the growing success of these research units at West Village, it is expected that the pool of research funding and graduate fellowships will continue to expand into the foreseeable future. Additionally, concerted efforts will be devoted to raising additional fellowship funds specifically for EGG students.

The EGG program is distinguished from other graduate programs at UC Davis in that it will provide broad educational coverage in energy with two unique interdisciplinary tracks: (1) Energy Science & Technology, and (2) Energy Policy & Management. While the program itself will be unique, the EGG program will continue a long history of interdisciplinary research and teaching at UC Davis. The campus currently hosts 47 interdisciplinary graduate groups organized to give students the intellectual freedom to transcend traditional academic disciplines and areas of research. The EGG program will continue in this tradition by emphasizing the value of shared research across disciplines, by focusing on interdisciplinary research challenges that transcend traditional departmental boundaries, and by retaining the flexibility as a program to embrace emerging areas of interdisciplinary inquiry related to energy.

A large number of disciplinary departments currently offer a broad selection of energy courses and host students focused on energy issues. But these courses and students tend to be intellectually narrow, adhering to the traditional disciplinary focus of their respective departments. Faculty from these departments are enthusiastic supporters of the EGG program (as indicated by the letters of support in Appendix B. from individual faculty spanning several colleges and more than a dozen departments) because it will create an interdisciplinary energy community on campus, allowing them to recruit students with a broader array of skills and facilitate interdisciplinary collaboration with faculty in other departments. Faculty recognize and embrace the need to pursue interdisciplinary research on energy topics—to bridge the material and plant sciences, engineering, management, and policy. Not only will the EGG program enable a richer education for its students, it will also leverage existing resources more efficiently and provide greater visibility for the existing academic and research strengths of the campus on energy and energy-related topics.

The most similar unit to the proposed EGG program is the Transportation Technology and Policy (TTP) Graduate Group hosted by the Institute of Transportation Studies. The proposed EGG program will be administered in parallel with TTP, as described above, and will have some overlapping faculty. Based on our experience with TTP, it is anticipated that a few students will join the EGG program who might have otherwise enrolled in TTP or one of the disciplinary departments. But the vast majority is expected to be students who would not have otherwise come to UC Davis (or even to the University of California).

The long history of energy research and professional engagement at UC Davis provides a strong foundation for the establishment of the EGG program. The proposal has received strong support from faculty and affiliated scientists, along with the campus and UC administration. The creation of this group will allow UC Davis to build upon its existing strengths in energy research and education to become an international leader of energy transformations for the 21st Century and beyond.

1.5. Interrelationship of the program with other University of California institutions

There exist a number of other energy-related programs and research centers within the UC system. The only significant interdisciplinary graduate degree program in energy, however, is the Energy and Resources Group (ERG) at UC Berkeley. ERG annually accepts < 10% of applicants with a focus on energy (about 10-12 students per year). ERG faculty recognizes that this demand far outstrips their capacity to admit students and, partly for this reason, they are supportive of the
establishment of the EGG program at UC Davis. They have offered to assist with the development of the EGG program (see the letter of support from ERG in Appendix C.).

1.6. Department or group that will administer the program

As indicated earlier, the EGG program will be a degree-granting graduate group organized under its own set of bylaws and will be administratively supported by the Energy Institute (leveraging the existing shared administrative staff that supports the energy and transportation research units at West Village) with the Dean of Engineering providing lead academic support and oversight. Nearly 200 faculty members are currently affiliated with the energy and transportation research units. These units have strong partnerships with academic departments and colleges, especially the colleges of Engineering, Letters and Science, Agricultural and Environmental Sciences, Division of Mathematical and Physical Sciences, and Graduate School of Management, as well as with additional faculty in other units. The EGG program would benefit from these existing partnerships and will contribute to UC Davis’s growing leadership in energy research.

The energy and transportation research units at West Village share a single administrative unit, which not only provides effective financial, personnel, and purchasing services, but also provides strong communications and fundraising capabilities. The fundraisers have proven effective at strengthening partnerships with industry and government and generating increasing funding for faculty and students. Likewise, the communications and conference staff have been highly effective at disseminating faculty and student research, and connecting faculty and students to the legislature, government agencies, and the general public. This coordinated support helps to foster research funding, internships, and job opportunities for students.

This collection of mission-specific administrative services at West Village has proved successful at supporting the preparation and management of large new center proposals in the past few years, including the recent launches of the Western Cooling Energy Center, Water-Energy Efficiency Center, and National Center for Sustainable Transportation. One of the goals of the EGG program will be to build more centers in the energy sciences, with increasing leadership from the outstanding young energy faculty hired 5 to 7 years ago through the “Energy for the Future” initiative, as described above.

The UC Davis Energy Institute, whose director reports to the Vice Chancellor of Research, will be the administrative home for the EGG program. The Chair of the EGG program will report to the Dean of Graduate Studies. This reporting relationship parallels that of the TTP Graduate Group and the Institute of Transportation Studies (ITS-Davis). The Dean of Engineering will provide lead academic support for this program and the Deans of Engineering, Agricultural and Environmental Sciences, and Graduate Studies have all committed significant financial resources to launching the program. These funding commitments are described in detail in the letters of support from these deans in Appendix A., and are summarized below:

- **College of Engineering:**
  - $20,000, $40,000, and $60,000 in years 1, 2, and 3 of the EGG program, respectively, for the support of EGG graduate students advised by faculty from the College of Engineering.
  - Matching funds for EGG administrative staff (up to 50% of the required amount) for the five years of the program to match the funding provided by the Office of Graduate Studies.

- **College of Agricultural and Environmental Sciences:**
  - $10,000 to support the EGG in the first year that it admits students and a commitment to re-evaluate continued funding needs thereafter.
Office of Graduate Studies:

- $30,000, $60,000, and $120,000 in years 1, 2, and 3 of the EGG program as "start-up transition funding" for the group to complement funding provided by the College of Engineering.
- Beginning in year 4, will provide an on-going Graduate Program Fellowship Allocation (formerly known as the Block Grant). Based on current rates, this would amount to at least $240,000 per year at the target program enrollment size.
- Administrative funding (minimum of $10,000 per year) based on enrollment.
- Up to $4,000 per year for a stipend for the Chair of the EGG based on experience and size of the group.

1.7. Plan for evaluation of the program

The program will be evaluated using the latest guidelines published by the Program Review Committee of the UC Davis Graduate Council. These guidelines for review of the program are summarized below.

History of the Program

A history of the program will be maintained that includes the following: (1) date the program was approved and date admissions were opened; (2) degree(s) offered; (3) name changes or mergers of the program; (4) revisions in bylaws and degree requirements; and (5) changes in mentoring guidelines. This information will be important for external evaluation of the program.

Program Standing

To date, the proposed graduate program is unique and most comparable to the ERG program at UC Berkeley. Comparison with the ERG program will be made for evaluation purposes.

Faculty and Research Areas

Membership in the EGG Program will be limited to faculty of the University of California and affiliated National Laboratories who are qualified according to the regulations of the University of California to guide candidates towards graduate degrees in Energy and who participate in the activities of the EGG program. Membership is based on disciplinary expertise and is independent of specific department appointment or Academic Senate membership. Faculty names, their department and college affiliation will be maintained for purposes of external review. Every three years a summary of quality of faculty members, such as research support, awards, prizes, election to fellow of a professional society, etc., and areas of research that this graduate program encompasses will be prepared and evaluated by the Executive Committee described in section 4. Collaboration of faculty members on research with others outside the program will be documented. The proposed EGG program bylaws included in Appendix E. provide additional information regarding faculty application, membership and evaluation for continued membership.

Courses and Curriculum

Modifications of the curriculum will be evaluated and submitted to Graduate Council for approval. New courses suitable for each program track will be added to lists of recommended courses on a yearly basis. Brief descriptions of required and recommended courses along with up-to-date copies of expanded course outlines from affiliated departments and programs will be maintained by the EGG program and will be made available through the Energy Institute and EGG websites.
Students

The following information will be reviewed at an annual meeting of the EGG program as required for all graduate groups at UC Davis: (1) total number of students; (2) number enrolled per year; (3) number who withdrew; (4) master’s and doctoral breakdown for domestic and international students; (5) time to degree, including the average and range; (6) summary of admissions and enrollment; (7) a summary of GPAs and standardized test scores of admitted students; (8) percentage of students with financial support (including sources); and (9) student representation and involvement in the graduate program and administrative committees. Information will be compared to similar programs on campus such as the Transportation Technology and Policy program to determine whether the trends in these markers indicate that changes are needed in the program.

Alumni

We will maintain a record on the placement of alumni, including professional positions and their participation in ongoing program projects (internships, guest lectures, etc.). Alumni will be contacted to seek their advice and input on the EGG program, and we will include information on alumni in review documents.

Advisory Board

Upon approval of the EGG program, an advisory board, consisting of members outside UC Davis, will be organized to evaluate the program every five years. Metrics of evaluation will be similar to those noted above under Faculty and Research Areas. Board members will include high ranking corporate executives, academics and other educators, government officials and staff, and principals of non-governmental organizations qualified by advanced education or experience to provide guidance and direction at the graduate level. The program is also subject to review by the Program Review Committee of the Graduate Council.
Section 2. Program

All students will be assigned a Major Professor upon enrollment in the Energy Graduate Group (EGG) program based on the student’s indicated area of research interest. During the student’s first quarter of study, the Major Professor will assist the student in the formulation and approval of a coherent program of study for achievement of the Masters of Science (M.S.) or Doctor of Philosophy (Ph.D.) in either Energy Science & Technology or Energy Policy & Management. It is expected that the Major Professor will oversee the EGG student’s research and progress during his/her program of study.

The entering EGG student will work with his/her Major Professor to develop a program of study that meets the degree requirements described in the remainder of this section. For more details about the degree requirements for EGG students, see Appendix F.

2.1. Undergraduate preparation for admission

The EGG program will be designed to accommodate persons of diverse backgrounds who have sound educational foundations in areas that may include engineering, science, policy, economics, planning, or management. All students will be expected to have completed at least one upper division college level course in statistics and two quarters of calculus prior to admission. For students pursuing a degree in the Energy Science and Technology track, an undergraduate degree in engineering or at least two undergraduate courses in chemistry or physics will be required. For students pursuing a degree in the Energy Policy and Management track, intermediate microeconomics will also be required.

Highly competitive applicants will have a GPA greater than a 3.6 in their prior programs and GRE verbal and quantitative scores greater than 60% and 90%, respectively. A minimum GPA of 3.0 in the undergraduate program and in any prior graduate program will be required for admission. The program will follow the policies of the UC Davis Graduate Council for evaluating international applicants and their test scores. For applicants who meet the admission requirements, the group will admit those who are academically outstanding and who demonstrate an interest in advanced energy systems, including technologies, policy, planning, and management in their applications.

2.2. Foreign language

There will be no foreign language requirement for the EGG program.

2.3. Program of study

2.3.a. Specific field(s) of emphasis

The EGG program will initially offer two tracks of study:

(1) Energy Science & Technology, and

(2) Energy Policy & Management.

Specific unit requirements will follow UC Davis Graduate Council standards for M.S. and Ph.D. degree programs. All students in M.S. degree programs (Plan I and Plan II) will be required to take the following three core courses: (1) EGG 200, Fundamentals of Energy Science and Technology, 4 units; (2) EGG 201, Life Cycle Analysis in Energy Systems, 4 units; and (3) EGG 202, Energy and Climate Policy, 3 units. All students will also be required to take a 1-unit EGG 290 Energy Seminar course that will meet weekly in the Fall Quarter. In addition to these courses, students in the Ph.D. program will also be required to take a course in research design (described in Section
2.3.d below). Draft course descriptions for EGG 200, EGG 201, EGG 202, and EGG 290 are included in Section 5.0 of this proposal.

In addition to these core requirements, students will also be required to take at least two foundation courses and to develop a specialization in consultation with their Major Professor as part of their program of study.

Students in the Energy Science and Technology track must take at least two foundation courses (minimum of six units) in one of the following two foundation areas:

(a) Engineering and Technology, or
(b) Energy Sciences.

Students in the Energy Policy and Management track must take at least two courses (minimum of six units) in the following foundation area:

(a) Policy and Management.

The remainder of the student’s program of study will include electives carefully selected in consultation with his/her faculty advisor to develop a specialization within the energy field. M.S. Plan I and Ph.D. students will also be required to take a sufficient number of EGG 299 research units to produce an acceptable thesis or dissertation, respectively.

2.3.b. Plan(s): Masters I or II; Doctorate B

At the Master’s level, the program will offer students the option of completing either a Plan I or Plan II Master’s Degree. The M.S. need not be a terminal degree, but can be part of the path to a Ph.D. The program will also offer the Plan B option for completing a Ph.D. For a more detailed review of the degree requirements, see Appendix F.

Master’s Plan I

The capstone requirement for the M.S. Degree, Plan I will be met by completing a minimum of 36 units in graduate and upper-division undergraduate courses, an acceptable thesis, a public presentation, and a minimum of three quarters of academic residence.

Master’s Plan II

The capstone requirement for the M.S. Degree, Plan II will be met by completing a minimum of 38 units in graduate and upper division undergraduate courses, satisfactory completion of a comprehensive written final examination to be taken in the candidate’s track, and a minimum of three quarters of academic residence.

Doctor of Philosophy Plan B

Formal requirements for the degree of Ph.D. will include passing an oral qualifying examination, completion of an acceptable dissertation, and a final oral presentation to serve as an exit seminar. In the qualifying examination, the student will be examined by a committee of faculty on the major (either the Energy Science & Technology track or Energy Policy & Management track) and minor fields defined in the student's approved program of study, which is described in detail under Sections 2.3.c-d and in Appendix F. The qualifying examination will be used to determine the adequacy of the student’s preparation to undertake the dissertation research prior to advancement to candidacy for the degree. The exit seminar will be open to the public and will be attended by the student’s faculty dissertation review committee members to provide the student recommendations for any necessary thesis revisions prior to approval.
2.3.c. Unit requirements

For a detailed review of the degree requirements for both the M.S. and Ph.D. degrees from the Energy Graduate Group, see Appendix F.

**M.S. Degree Requirements**

The M.S. Plan I degree will require 36 units of credit, of which at least 18 units must be graduate work in the major field. A minimum of 3 units and a maximum of 6 units of EGG 299 research units may count toward this 36 unit requirement for M.S. Plan I students. An acceptable thesis will be required for completion of the degree.

The M.S. Plan II degree will require 38 units of credit, of which at least 20 units must be graduate courses in the major field. A comprehensive final examination in the major subject is required of each M.S. Plan II candidate for completion of the degree. No thesis is required.

The remaining units needed for completion of the M.S. degree may be made up of upper-division courses or of other graduate courses exclusive of research and seminar courses. All graduate courses must be passed with a letter grade of “B” or higher, and a minimum of three quarters of academic residence is required.

**Ph.D. Degree Requirements**

For the Ph.D., the program will require at least 45 units of credit, of which at least 30 units must be graduate courses in the major field, exclusive of seminars and research, and an additional 15 units of upper-division or graduate courses. All required courses must be completed before taking the qualifying examination. Ph.D. students must take the same core and foundation course requirements described above. At least 24 units of the required total must be taken at UC Davis. In-depth knowledge can usually be obtained by completing about 30 units in upper division and graduate courses in the major field. These 30 units must be from courses listed in Appendix F. or as otherwise approved by the faculty advisor in development of the student’s course of study. Study in a minor field will not be expected to be as extensive as in the Ph.D. student's major field; it should, however, encompass the equivalent of 15 units or more in a particular field — typically 2 upper division and 3 graduate courses. Sample programs of study for each track are given in Section 2.11 below.

2.3.d. Required and recommended courses, including teaching requirement

To anchor the program, three core courses will be required for all students (M.S. and Ph.D.):

1. **EGG 200, Fundamentals of Energy Science and Technology**
2. **EGG 201, Life Cycle Analysis in Energy Systems**
3. **EGG 202, Energy and Climate Policy**
4. **EGG 290, Energy Seminar**

Detailed course descriptions for EGG 200, EGG 201, EGG 202, and EGG 290 are included in Section 5.0 of this proposal. EGG 200 will provide an introduction and overview of energy technologies and efficient management approaches. To achieve this breadth of training, we expect EGG 200 to be taught using a team-based approach under a rotating principal instructor (with Professors Bryan Jenkins and Jean VanderGheynst alternating) with several faculty in the graduate group each providing 2-3 weeks of instruction on a primary topic. EGG 201 will be offered by Alissa Kendall from Civil and Environmental Engineering. EGG 202 on Energy and Climate Policy will be taught by Daniel Sperling and Joan Ogden. Additional EGG core courses may be submitted following approval of this program. EGG 290 will be a 1-unit seminar course offered every fall.
EGG 200 Fundamentals of Energy Science and Technology, EGG 201 Life Cycle Analysis in Energy Systems, and EGG 202 Energy and Climate Policy will be modified slightly from existing courses to meet the needs of the EGG program and will be offered by EGG faculty members. The courses will be offered every fall and winter quarter, and students will be required to enroll in them during their first year of study. Additionally, the EGG 290 Energy Seminar course will be a one-unit course designed to promote interdisciplinary interaction among EGG students by exposing them to guest lectures on varied topics ranging from advances in basic energy sciences, to energy policy developments, to discussions of the engineering challenges facing renewable energy deployment.

In addition to these core requirements, all students (M.S. and Ph.D.) will be required to take at least two additional foundation courses in their designated degree track. For a preliminary list of courses eligible to fulfill this foundation requirement, see Appendix F.

**M.S. Degree Requirements**

All students in M.S. degree programs (Plan I and Plan II) will be required to take the following four core courses:

1. EGG 200, Fundamentals of Energy Science and Technology, 4 units;
2. EGG 201, Life Cycle Analysis in Energy Systems, 4 units;
3. EGG 202, Energy and Climate Policy, 3 units; and
4. EGG 290, Energy Seminar, 1 unit (x2).

All students in M.S. degree programs (Plan I and Plan II) will also be required to take at least two foundation courses (min. of 6 units) based on their chosen degree track. For Energy Science & Technology students, the courses may be either from the list of eligible courses for “Engineering and Technology” or for “Energy Sciences.” For Energy Policy & Management students, the courses must be from the list of eligible courses for “Policy & Management.” For a preliminary list of the courses eligible to meet this foundation requirement, see Appendix F.

**Ph.D. Degree Requirements**

In addition to the core and foundation courses outlined above for M.S. degree students, students in the Ph.D. program will also be required to take at least one course in research design. The courses that fulfill this requirement depend on whether the student is pursuing the Ph.D. in Energy Science & Technology or in Energy Policy & Management. The following courses satisfy this requirement for Energy Science & Technology candidates:

- STA 205, Statistical Methods for Research with SAS
- STA 233, Design of Experiments
- EBS 265, Design and Analysis of Engineering Experiments

The following courses satisfy this requirement for Energy Policy & Management candidates:

- STA 205, Statistical Methods for Research with SAS
- PSC 207, Survey and Questionnaire Research Methods

Additionally, Ph.D. students will be required to take EGG 290 in Year 3, as well as in Year 1 and Year 2.

**Teaching Requirements**

While both M.S. and Ph.D. students will be encouraged to take advantage of teaching opportunities on campus, there will be no teaching requirement for students in the EGG.

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4 See Appendix J. for the required Memoranda of Understanding between the faculty who have agreed to teach these core courses and the Chairs of their respective Departments.
2.3.e. Licensing or certification
No licensing or certification is associated with this program.

2.4. Field examinations — written and/or oral
No field examination is associated with this program.

2.5. Qualifying examinations — written and/or oral
Qualifying examinations will evaluate students on the breadth and depth of learning within the foundational area of emphasis (i.e., either Energy Science & Technology or Energy Policy & Management) and specialization or major, in addition to any minor fields defined in the program of study by the student and his/her Major Professor. Proficiency in the major field will need to be demonstrated along with a firm grasp of basic principles and their application in the minor field. Ability to correlate and integrate knowledge in these areas will be emphasized. The student’s Major Professor will not serve on the qualifying exam committee unless specifically approved with justification by formal petition to the EGG Executive Committee.

2.6. Thesis and/or dissertation
The Master’s thesis for Plan I students will demonstrate the student’s proficiency in research and scientific or policy analysis relative to the chosen area of specialization.

The doctoral dissertation must be an original and substantial contribution to knowledge appropriate to the chosen area of specialization. It must demonstrate the student’s ability to independently carry out a program of advanced research and to report the results in accordance with the standards of scientific journals.

2.7. Final examination or presentation
The final examination under the M.S. Plan II and the public presentations under the M.S. Plan I and Ph.D. Plan B are described above in section 2.3.b.

2.8. Explanation of special requirements over and above Graduate Division minimum requirements
There are no special requirements for this program.

2.9. Relationship of master’s and doctoral programs
The Master’s program is designed to provide fundamental training in energy to allow the student to work in industry, government, non-profit advocacy, or consulting upon completion of the degree. Students receiving the M.S. degree may apply to continue in the EGG Ph.D. program.

2.10. Special preparation for careers in teaching
This program does not provide special training for careers in teaching.

2.11. Sample programs
Example programs of study for the Energy Science and Technology track are given in Table 1 and Table 2 below for the M.S. Plan I and Ph.D., respectively.

The M.S. program includes three required core courses: (1) EGG 200, Fundamentals of Energy Science and Technology, (2) EGG 201, Life Cycle Analysis in Energy Systems, and (3) EGG 202, Energy and Climate Policy. This sample program also includes the required EGG 290 Energy
Seminar in the fall of Year 1 and Year 2.

This sample M.S. Plan I program features a student with an engineering foundation and courses in economics for breadth (Table 1 below). The sample program would be appropriate for a student interested in research in bioenergy using thermochemical conversion methods. Upper division and graduate courses emphasize reaction kinetics and combustion. Note that this student would also be required to take EGG 299 research units to complete an acceptable thesis.

**Table 1.** Sample program of study for a M.S. student in the Energy Science and Technology track. The example program would be appropriate for a student interested in energy engineering economics.

<table>
<thead>
<tr>
<th>COURSE TITLE</th>
<th>Prefix and Number</th>
<th>School</th>
<th>Term and Year</th>
<th>Undergrad Units</th>
<th>Grad Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Core Courses</strong></td>
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</tr>
<tr>
<td>Fundamentals of Energy Science and Technology</td>
<td>EGG 200</td>
<td>UCD</td>
<td>Fall yr1</td>
<td>4</td>
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<tr>
<td>Life Cycle Analysis in Energy Systems</td>
<td>EGG 201</td>
<td>UCD</td>
<td>Winter yr1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Energy and Climate Policy</td>
<td>EGG 202</td>
<td>UCD</td>
<td>Spring yr1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Energy Seminar</td>
<td>EGG 290</td>
<td>UCD</td>
<td>Fall yr1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Energy Seminar</td>
<td>EGG 290</td>
<td>UCD</td>
<td>Fall yr2</td>
<td>1</td>
<td></td>
</tr>
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<td><strong>Foundation:</strong> Engineering and Technology</td>
<td></td>
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<td></td>
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<tr>
<td>Combustion</td>
<td>MAE 217</td>
<td>UCD</td>
<td>Winter yr1</td>
<td>4</td>
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<td>Advanced Energy Systems</td>
<td>MAE 218</td>
<td>UCD</td>
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<td>4</td>
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<td><strong>Additional Graduate and Upper Division Courses</strong></td>
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<tr>
<td>Microeconomic Analysis I</td>
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<td>Spring yr1</td>
<td>4</td>
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<tr>
<td>Infrastructure Economics</td>
<td>ECI 268</td>
<td>UCD</td>
<td>Spring yr2</td>
<td>3</td>
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<tr>
<td><strong>TOTAL UNITS OF UPPER DIVISION AND GRADUATE COURSES</strong></td>
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<td></td>
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<td><strong>TOTAL UNITS OF GRADUATE COURSES</strong></td>
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<td></td>
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<td><strong>32</strong></td>
</tr>
</tbody>
</table>

| At least 19 units are required |
| At least 27 units (Plan I) or 32 units (Plan II) are required |
| At least 12 units are required |

The sample Ph.D. program of study is for a student interested in research in bioenergy production using biochemical conversion methods (Table 2 below). This program includes four required core courses: (1) EGG 200, Fundamentals of Energy Science and Technology, (2) EGG 201, Life Cycle Analysis in Energy Systems, (3) EGG 202, Energy and Climate Policy, and (4) STA 233, Design of Experiments. This sample program also includes the required EGG 290 Energy Seminar in the Fall
of Year 1, Year 2, and Year 3. It features a student with an energy sciences foundation and a specialization in bioenergy production using biochemical conversion methods with a minor in biotechnology. Note that this Ph.D. student would also be required to complete EGG 299 research units sufficient to produce an acceptable dissertation.

**Table 2.** Sample program of study for a Ph.D. student in the Energy Science and Technology track. The sample Ph.D. program of study is for a student interested in research in bioenergy production using biochemical conversion methods.

<table>
<thead>
<tr>
<th>COURSE TITLE</th>
<th>Prefix and Number</th>
<th>School</th>
<th>Term and Year</th>
<th>Non UCD Units</th>
<th>UCD Units</th>
<th>Undergrad Units</th>
<th>Grad Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Courses</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fundamentals of Energy Science, Technology, Policy and Management</td>
<td>EGG 200</td>
<td>UCD</td>
<td>Fall yr1</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life Cycle Analysis in Energy Systems</td>
<td>EGG 201</td>
<td>UCD</td>
<td>Winter yr1</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental Design</td>
<td>STA 233</td>
<td>UCD</td>
<td>Spring yr1/2</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Energy and Climate Policy</td>
<td>EGG 202</td>
<td>UCD</td>
<td>Winter yr1</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Energy Seminar</td>
<td>EGG 290</td>
<td>UCD</td>
<td>Fall yr1</td>
<td>1</td>
<td>1</td>
<td></td>
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<tr>
<td>Energy Seminar</td>
<td>EGG 290</td>
<td>UCD</td>
<td>Fall yr2</td>
<td>1</td>
<td>1</td>
<td></td>
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<tr>
<td>Energy Seminar</td>
<td>EGG 290</td>
<td>UCD</td>
<td>Fall yr3</td>
<td>1</td>
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**Foundation:** Energy Sciences

<table>
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<th>School</th>
<th>Term and Year</th>
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<th>UCD Units</th>
<th>Undergrad Units</th>
<th>Grad Units</th>
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<tr>
<td>Modeling and Analysis of Biological and Physical Systems</td>
<td>EBS 270</td>
<td>UCD</td>
<td>Spring yr1</td>
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<tr>
<td>Renewable Bioprocessing</td>
<td>EBS 267</td>
<td>UCD</td>
<td>Fall yr2</td>
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**Specialization:** Bioenergy

<table>
<thead>
<tr>
<th>COURSE TITLE</th>
<th>Prefix and Number</th>
<th>School</th>
<th>Term and Year</th>
<th>Non UCD Units</th>
<th>UCD Units</th>
<th>Undergrad Units</th>
<th>Grad Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Development, Cell Biology and Metabolism</td>
<td>PBI 200B</td>
<td>UCD</td>
<td>Winter yr1</td>
<td>5</td>
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<tr>
<td>Design and Analysis of Engineering Experiments</td>
<td>EBS 265</td>
<td>UCD</td>
<td>Spring yr1</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cell Walls</td>
<td>PBI 214</td>
<td>UCD</td>
<td>Fall yr2</td>
<td>3</td>
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**TOTAL UNITS FOR THE MAJOR (CORE, FOUNDATION, and SPECIALIZATION)*** 34

**Minor:** Biotechnology

<table>
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<tr>
<th>COURSE TITLE</th>
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<th>School</th>
<th>Term and Year</th>
<th>Non UCD Units</th>
<th>UCD Units</th>
<th>Undergrad Units</th>
<th>Grad Units</th>
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<tbody>
<tr>
<td>Biotechnology Fundamentals</td>
<td>MCB 263</td>
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<td>Winter yr2</td>
<td>2</td>
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<tr>
<td>Plant Molecular and Cellular Biology</td>
<td>PLB 113</td>
<td>UCD</td>
<td>Spring yr2</td>
<td>3</td>
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<tr>
<td>Biochemistry Laboratory</td>
<td>MCB 120L</td>
<td>UCD</td>
<td>Winter yr2</td>
<td>6</td>
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<tr>
<td>Biotech Facility Design</td>
<td>ECH 161C</td>
<td>UCD</td>
<td>Winter yr2</td>
<td>4</td>
<td>4</td>
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</table>
Example programs of study for the Energy Policy and Management track are given in Table 3 and Table 4 below for the M.S. Plan I and Ph.D., respectively.

The M.S. Plan I program includes three required core courses: (1) EGG 200, *Fundamentals of Energy Science and Technology*, (2) EGG 201, *Life Cycle Analysis in Energy Systems*, and (3) EGG 202, *Energy and Climate Policy*. This sample program also includes the required EGG 290 *Energy Seminar* in the fall of Year 1 and Year 2. The sample M.S. Plan I program features a student with a foundation in policy & management with a specialization in economics (Table 3). The example program would be suitable for a student interested in research in energy policy and economics. Upper division and graduate courses emphasize energy and environmental policy, economics and statistics. Note that the student would also be required to take sufficient EGG 299 research units to produce an acceptable thesis.

**Table 3.** Sample program of study for a M.S. Plan I student in the Energy Policy and Management track. The example program would be appropriate for a student interested in research in energy policy and economics.

<table>
<thead>
<tr>
<th>COURSE TITLE</th>
<th>Prefix and Number</th>
<th>School</th>
<th>Term and Year</th>
<th>Undergrad Units</th>
<th>Grad Units</th>
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<td><strong>Core Courses</strong></td>
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<tr>
<td>Fundamentals of Energy Science and Technology</td>
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<td>Life Cycle Analysis in Energy Systems</td>
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<td>Winter yr1</td>
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</tr>
<tr>
<td>Energy and Climate Policy</td>
<td>EGG 202</td>
<td>UCD</td>
<td>Spring yr1</td>
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</tr>
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<td>Energy Seminar</td>
<td>EGG 250</td>
<td>UCD</td>
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<tr>
<td>Energy Seminar</td>
<td>EGG 250</td>
<td>UCD</td>
<td>Fall yr2</td>
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<td><strong>Foundation:</strong></td>
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<td>Environmental Policy Process</td>
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<tr>
<td>Efficiency in Energy Markets</td>
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<tr>
<td><strong>TOTAL UNITS FOR THE CORE + FOUNDATION</strong></td>
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**Specialization:** Energy Economics and Policy
### Additional Graduate and Upper Division Courses

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<td>ESP 212B</td>
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<td>ESP 275</td>
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<td>STA 205</td>
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**TOTAL UNITS OF UPPER DIVISION AND GRADUATE COURSES**

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**TOTAL UNITS OF GRADUATE COURSES**

<table>
<thead>
<tr>
<th></th>
<th>33</th>
</tr>
</thead>
</table>

* a. At least 19 units required
* b. At least 27 or 32 units total required for Plan I and Plan II, respectively
* c. At least 12 units of graduate level courses required

The sample Ph.D. program of study is for a student interested in energy systems, with particular emphasis in life cycle analysis and economics as they relate to energy conversion and distribution (Table 4). This program includes four required core courses: (1) EGG 200, *Fundamentals of Energy Science and Technology*, (2) EGG 201, *Life Cycle Analysis in Energy Systems*, (3) EGG 202, *Energy and Climate Policy*, and (4) PSC 207, *Survey and Questionnaire Research Methods*. This sample program also includes the required EGG 290 *Energy Seminar* in the fall of Year 1, Year 2, and Year 3. Note that the Ph.D. student would also be required to take sufficient EGG 299 research units to complete an acceptable dissertation.

**Table 4. Sample program of study for a Ph.D. student in the Energy Policy and Management Track.** The example program would be appropriate for a student interested in research in management and energy economics analysis

<table>
<thead>
<tr>
<th>COURSE TITLE</th>
<th>Prefix and Number</th>
<th>School</th>
<th>Term and Year</th>
<th>Non UCD Units</th>
<th>UCD Units</th>
<th>Undergrad Units</th>
<th>Grad Units</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
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<tr>
<td>Fundamentals of Energy Science, Technology, Policy and Management</td>
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<tr>
<td>Life Cycle Analysis in Energy Systems</td>
<td>EGG 201</td>
<td>UCD</td>
<td>Winter yr1</td>
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<tr>
<td>Survey and Questionnaire Research Methods</td>
<td>PSC 207</td>
<td>UCD</td>
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<tr>
<td>Energy and Climate Policy</td>
<td>EGG 202</td>
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<tr>
<td>Energy Seminar</td>
<td>EGG 290</td>
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<td>Energy Seminar</td>
<td>EGG 290</td>
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<tr>
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**Foundation:** Policy and Management
Management of Innovation  
**MGT 251**  
UCD  
**Winter yr1**  
3  
3

Production and Operations Management  
**MGT 252**  
UCD  
**Spring yr2**  
3  
3

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<th>Specialization:</th>
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| Efficiency in Energy Markets  
**ECN 125**  
UCD  
**Spring yr2**  
4  
4
| Infrastructure Economics  
**ECI 268**  
UCD  
**Spring yr2**  
3  
3
| Engineering Economics  
**ENG 106**  
UCD  
**Spring yr1**  
3  
3

**TOTAL UNITS FOR THE MAJOR (CORE, FOUNDATION, and SPECIALIZATION)**

<table>
<thead>
<tr>
<th>MINOR:</th>
<th>Statistics</th>
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| Reliability  
**STA 142**  
UCD  
**Spring yr1**  
4  
4
| Statistical Methods for Research  
**STA 205**  
UCD  
**Spring yr1**  
4  
4
| Design of Experiments  
**STA 233**  
UCD  
**Spring yr2**  
3  
3
| Theory of Multivariate Analysis  
**STA 238**  
UCD  
**Winter yr2**  
4  
4

**TOTAL UNITS FOR THE MINOR**

| **TOTAL UNITS OF UPPER DIVISION AND GRADUATE COURSES** | 49 |
| **TOTAL UNITS OF GRADUATE COURSES** | 38 |
| **TOTAL UNITS AT UCD** | 49 |

**2.12. Normative time from matriculation to degree**

The normative time to degree for the M.S. program will be 2 years. Normative lengths of time for pre-candidacy will be three quarters, assuming the student has no deficiencies and is full-time. The normative time to degree will be five years for the Ph.D. program. Normative lengths of time for pre-candidacy will be 6 quarters, assuming the student has no deficiencies and is full-time.
**Section 3. Projected Need**

3.1. Student demand for the program

At present, there are few colleges and universities where students can receive advanced comprehensive graduate training across multiple areas in energy science, technology, policy, and management. Several of these programs are described in section 3.6. The program most comparable to the one proposed here is the Energy and Resources Group (ERG) at UC Berkeley. A detailed description of the ERG program and its required courses are provided in Appendix G. The ERG program emphasizes training in the following four areas: (1) environmental science, (2) resource and environmental economics, (3) social science approaches to energy, resources and the environment, and (4) engineering approaches to energy, resources and the environment.

According to the letter of support provided by ERG in Appendix C. for the Energy Graduate Group (EGG) at UC Davis, the ERG program at Berkeley admits roughly 20 students per year from 250 applicants. Last year, the ERG program admitted only 12 students out of 175 applicants who had indicated “energy” was their primary focus of study, indicating a substantial unmet demand for graduate training in this area. ERG faculty conveyed to the preparers of this proposal that the ERG applicant pool is easily strong enough to admit twice as many students annually without sacrificing the overall academic quality of the admitted class. So while there is some overlap between the proposed EGG program at UC Davis and the ERG program at UC Berkeley, this existing unmet demand from students in the UC system suggests that the EGG would be complementary to the ERG program and would, in fact, strengthen it by fostering new synergistic collaboration on topics in energy. Additionally, the EGG provides two possible degree tracks (Energy Science and Technology; Energy Policy and Management) and a greater focus on energy efficiency, renewable energy, and transportation energy that will distinguish it from the ERG program. The EGG would make UC Davis an international leader in interdisciplinary graduate training in energy, and would attract more outstanding students to our campus and to the UC System.

3.2. Opportunities for placement of graduates

Letters of support for the creation of the EGG program from industry and government leaders can be found in Appendix D. These letters, along with the results of a survey we conducted of a wide range of potential employers, indicate there is a large unmet demand in the current job market for highly trained employees with interdisciplinary graduate training in energy. Additionally, information provided to us by the ERG program at UC Berkeley about the placement of its graduates combined with market research we conducted provides more strong evidence of a robust market for future graduates of the EGG program.

Below are some key highlights that summarize our findings about opportunities for the placement of graduates from the EGG program:

- **Market interest in EGG:** In a survey of potential employers from government, industry, and NGOs, 86% of respondents indicated that they would find it valuable for new-hires to have an interdisciplinary graduate education in energy.

- **Overall growth of the sector:** Industry data suggests strong overall growth for the clean energy sector, reflecting a healthy career outlook for EGG graduates.

- **Strong letters of support for EGG:** Governor’s Office of Planning and Research (California); California Energy Commission; California Public Utilities Commission; Lawrence Livermore National Laboratory; Black & Veatch; and SunPower.

- **Academic job opportunities:** Recent academic job postings from 2013 and 2014 suggest strong interest in new faculty hires with a focus on interdisciplinary energy issues, including
faculty openings at the following universities: Yale University; Illinois State University; Virginia Tech; University of Wisconsin-Madison; Auburn University; Lehigh University; Northeastern University; and Florida State University.

**Survey of Government, Industry, and Non-Profit**

To determine the demand for EGG graduates beyond the letters of support found in Appendix D., we conducted an informal survey of executives, managers, and supervisors working in the energy sector to gauge their interest in hiring graduates from the EGG program. To review the full survey and responses, see Appendix I.

We surveyed leaders from some of the leading energy companies and government agencies in the nation. Executives, managers, or supervisors from the following organizations participated in our survey conducted in August-September 2014:

- **Federal Government:** Department of Energy (DOE), Environmental Protection Agency (EPA), U.S. Agency for International Development (USAID), Sandia National Laboratory, and Lawrence Livermore National Laboratory.

- **State Government:** California Energy Commission (CEC), California Public Utilities Commission (CPUC), California Air Resources Board (CARB), and California Environmental Protection Agency (CalEPA).

- **Utility Companies:** Pacific Gas & Electric (PG&E), Southern California Edison (SCE), and Sempra Energy / San Diego Gas & Electric (SDG&E).


- **Oil and Gas Companies:** ExxonMobil, Shell, Indian Oil Corporation, and BP.

- **Automotive:** BMW, Fiat Chrysler, GM, Toyota, Nissan, Daimler, and Ford.

- **Non-Profit:** Electric Power Research Institute (EPRI), Energy Foundation, Local Government Commission, New Buildings Institute, and the Alliance to Save Energy.

Of those surveyed, 86% of respondents indicated that they would find it valuable for a prospective new hire to have received an interdisciplinary graduate education in energy that included (a) an understanding of energy policy and economics, (b) a strong foundation in energy sciences and engineering, and (c) an ability to communicate clearly about complex energy topics with policymakers, engineers, academics, and scientists.

Furthermore, when presented with a list of eight (8) different graduate degrees that a prospective hire may possess, survey participants were asked to rank the relevancy of each degree to the work of their company or organization. The survey asked participants to rank the following degrees (displayed in random order): Basic Sciences (M.S. or Ph.D.), Civil Engineering (M.S. or Ph.D.), Electrical Engineering (M.S. or Ph.D.), Energy Science and Technology (M.S. or Ph.D.), Energy Policy and Management (M.S. or Ph.D.), Masters of Business Administration (M.B.A.), Masters of Public Policy (M.P.P.), Economics (M.S. or Ph.D.).

Of the degrees listed, 48% of participants selected one of the degrees proposed for the EGG program (M.S. or Ph.D. in either Energy Policy and Management or Energy Science and Technology) as their first choice – the two most selected choices of the eight degrees listed. Moreover, 65% of participants ranked the M.S. or Ph.D. in Energy Policy and Management among their Top 3 choices, while 46% of participants ranked the M.S. or Ph.D. in Energy Science and Technology among their Top 3 choices.

These informal survey results demonstrate a strong interest among leaders in the energy sector for prospective employees with the type of education that we propose here through the EGG program.
Overall Job Growth for the Energy Sector

Graduates from existing individual departmental programs who have specialized in energy have found employment in varied energy industry jobs. Clean-tech and green-tech markets including energy are some of the fastest growing in new investment, and well-trained individuals in all related fields are urgently needed to provide the level of expertise required to advance technology and policy to satisfy state, national, and international objectives for greater energy sustainability.

To quantify the growth of the clean energy industry, we look to the 2013 year in review “Clean Energy Works for Us” report published by Environmental Entrepreneurs (E2). E2 is a national non-partisan community of business leaders in the clean energy industry who promote sound environmental policies that build economic prosperity. This group’s members have been involved in the financing, funding, or development of more than 1,700 companies that have created over 500,000 jobs in the clean energy industry. E2’s members also manage billions of dollars in venture and private equity capital that is directed at this industry.

E2 found that more than 78,600 jobs were created in the clean energy and clean transportation sector in 2013. This growth was led by the solar power generation sector that added more than 21,000 jobs, followed by building efficiency (12,500 jobs) and public transportation (11,400). California led all states by adding 15,400 jobs in these industries.

Additionally, TIME Magazine recently reported that solar manufacturing and the green/sustainable building industry were among the Top Ten fastest growing job sectors in the United States. TIME reported the following annual growth rates for these industries over the last ten years (through 2012) and the projected future growth rate (through 2017):

- **Solar Manufacturing**
  - Average annual growth (2002-2012): 32.3%
  - Projected annual growth (2012-2017): 8.2%

- **Green and Sustainable Building Construction**
  - Average annual growth (2002-2012): 28.9%
  - Projected annual growth (2012-2017): 22.8%

We cite these numbers here from E2 and from TIME Magazine to demonstrate the robust growth of the clean energy industry at large. Graduates from the EGG program will be well positioned after graduation to pursue jobs in this rapidly growing industry.

Academic Job Prospects for EGG Ph.D. Graduates

Reflecting the growth of the energy industry generally, there is also emerging demand in academia for faculty with training and research interests in interdisciplinary energy topics. The following is a sample list of recent academic job postings compiled from 2013 and 2014 listings:

<table>
<thead>
<tr>
<th>Position</th>
<th>University (Department / Program)</th>
<th>Desired Qualifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assistant Professor</td>
<td>Yale University (Energy Sciences Institute)</td>
<td>- Creative teacher-scholar who will have a primary appointment in Chemistry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Must have Ph.D. in a relevant discipline, and an outstanding</td>
</tr>
</tbody>
</table>

8 Several of these job listings were provided to the UC Davis Energy Institute by the Council of Energy Research and Education Leaders (CEREL) of the National Council for Science and the Environment, while others were found posted on public websites.
record of research that demonstrates originality in addressing significant questions in the study of energy.

- Particularly interested in individuals with expertise in the conversion of solar energy into storable chemical energy.

### Assistant Professor, Renewable Energy
**Illinois State University**
*(Dept. of Technology)*

- Seeking tenure-track faculty to teach courses in Renewable Energy
- Doctorate in engineering, technology, or discipline closely related to renewable energy sources such as wind, solar, and bio-fuels.
- Creative teacher-scholars who will have a primary appointment in Chemistry
- Work experience with renewable energy firms is highly desirable.
- Expertise in renewable energy systems and/or sustainability and energy efficiency.
- Ability to teach in one or more of the department's other technical areas (e.g., engineering technology, automation systems, or technology management).

### Assistant Professor
**University of North Texas**
*(Dept. of Mechanical and Energy Engineering)*

- Particularly interested in candidates with strengths in areas related to computational thermo-fluid science and engineering.
- Desired candidates will have interests and background in computational fluid dynamics, sustainable engineering, alternative and renewable energy.
- Doctorate

### Professor
**Virginia Tech**
*(Dept. of Mechanical Engineering)*

- Applicants must hold a doctoral degree in engineering or closely related discipline.
- Position targeted at research related to Virginia Tech's Center for Intelligent Material Systems and Structures (CIMSS), which may include the Center directorship, and the Center for Energy Harvesting Materials and Systems (CEHMS).

### Assistant Professor
**UMass (Lowell)**
*(Dept. of Mechanical Engineering)*

- Seeking full-time/tenure track faculty in the field of Clean Energy.
- Successful candidates will conduct research, teach classes, collaborate with existing faculty, and advise students in the following areas:
  (a) Clean energy
  (b) Renewable energy generation
  (c) Energy conversion and storage
  (d) Sustainable design of energy systems
- Must possess Ph.D. in mechanical engineering or related field.

### Professor
**Texas A&M – Kingsville**
*(Dept. of Mechanical and Industrial Engineering)*

- Ph.D. in mechanical engineering or related field
- A successful candidate will:
  (a) Conduct multidisciplinary research in the broad range of energy, including sustainable systems.
  (b) Demonstrate significant evidence of engagement in energy-related research across the engineering and science disciplines.
  (c) Provide significant leadership for our proposed Ph.D. program in Sustainable Energy.

### Professor
**Ohio University**
*(College of Engineering and Technology)*

- Invites applications from innovative researchers in the field of Sustainable Energy conversion and transport systems.
- Candidate should have expertise in thermodynamics, transport phenomena, fuels conversion, development of
<table>
<thead>
<tr>
<th>Role</th>
<th>Institution</th>
<th>Requirements</th>
</tr>
</thead>
</table>
| Associate Professor      | Virginia Tech (Dept. of Electrical and Computer Engineering)       | • Seeks applicant for faculty position in power systems engineering.  
• Areas of interest include: energy system analysis, control, stability and protection; power system devices; energy storage; smart grid; integration, monitoring and protection of distributed renewable generation to the grid.  
• Candidate expected to be significant contributor to the Center for Power and Energy.  
• Ph.D. in electrical engineering or related field. |
| Professor                | Univ. of Wisconsin–Madison (College of Engineering)                | • Ph.D. and outstanding record of accomplishment in a biological, physical science or engineering discipline that is relevant to biodesign or biocatalysis for the production of biofuels.  
• Applicants with experience and interest in cross-disciplinary research strongly encouraged to apply.  
• Candidate expected to conduct research with the Wisconsin Energy Institute and the Great Lakes Bioenergy Research Center. |
| Professor                | Auburn University (College of Engineering)                         | • Candidate sought to enhance college’s focus on energy generation, conversion and storage.  
• Candidate will be expected to participate in large-scale, multidisciplinary team research efforts.  
• Candidate expected to teach courses in materials engineering and develop innovative, cross-disciplinary courses. |
| Anderson Endowed Faculty Chair | Lehigh University (Dept. of Chemical Engineering)                | • Seeks applications for endowed chair position in the broad field of Energy Sciences, including:  
(a) Energy systems  
(b) Chemical processing  
(c) Biocatalysis  
(d) Photovoltaics  
(e) Biofuels  
• Successful candidate will be expected to develop strong research program with significant interdisciplinary research.  
• Candidate expected to be a leader in campus-wide Energy and Environmental Initiative. |
| Associate Professor      | George Mason University (Dept. of Civil Environmental & Infrastructure Engineering) | • Ph.D. in civil engineering or closely aligned field  
• Search priority given to applicants with research programs in resilient systems and/or energy in the context of transportation |
| Professor, Resilient and Sustainable Energy Systems | Northeastern University (Dept. of Electrical and Computer Engineering) | • Seek exceptional candidates addressing problems in resilient and sustainable energy systems, with expertise broadly in one or more of the following areas:  
(a) Utility power systems  
(b) Power electronics and machine drives  
(c) Renewable energy and sustainable systems  
(d) Networks and cyber-physical systems  
(e) Large-scale system monitoring and control |
| Professor                | Florida State University (Campus-wide “Energy and Materials” 2020 hiring) | • FSU continuing its major interdisciplinary hiring initiative in Energy and Materials. During the 2013-14 academic year, FSU will recruit as many as nine new tenure-track faculty. |
Successful candidates expected to have synergistic impact on existing interdisciplinary research on campus.

- We invite applications from researchers active in the broadly-defined area of materials science and materials engineering, with an emphasis on materials for energy production, conversion, storage and utilization.
- Target research areas encompass theory, computation, synthesis, biomaterials, fundamental characterization, materials measurement science, device construction, and proof of concept and prototype.
- Open to all departments and disciplines.

Assistant Professor, Molecular Approaches to Renewable Energy

- Invitation for applications for an Assistant Professorship in Molecular Approaches to Renewable Energy.
- Appointment would be in the Chemistry Department, in the context of the newly established interdisciplinary Light to Chemical Energy Conversion Centre.

Assistant Professor

- Candidates sought with expertise in mechanics applied to Energy.
- Candidates with industrial research experience particularly encouraged to apply.
- Successful applicant will have earned a doctorate in either engineering or a related field.

Professor

- Inviting applications for tenure-track faculty position in the broad areas of electricity generation, transmission and distribution, and energy storage.
- Interest in these areas follows from a strategic investment that has been made over the past eight years in these areas.
- Excellent candidates will have technical expertise in electricity generation, transmission, and distribution.

This sampling of actual academic job listings suggests that graduates from the EGG Ph.D. program will find an emerging academic job market for faculty with interdisciplinary academic training in energy upon graduation. In addition to these specific job openings over the past year, the following list of academic Ph.D.-granting programs would also be prime targets for EGG Ph.D. graduates pursuing a faculty appointment:

1. Energy Resources Engineering (Stanford University)
2. Energy and Geo-Environmental Engineering (Penn State University)
3. Energy Systems Engineering (University of Michigan)
4. Energy and Resources Group (UC Berkeley)
5. Technology and Policy Program (MIT)
6. Energy and Earth Resources Program (University of Texas, Austin)
7. Engineering and Public Policy (Carnegie Mellon University)

Additionally, the ERG program at UC Berkeley – the most similar graduate program in California to the one we propose here – has found that approximately 50% of its recent Ph.D. graduates have accepted faculty appointments. Recent ERG graduates are now on the faculty at the Yale University School of Environmental Studies, the Nelson Institute at the University of Wisconsin, Stanford University, the University of Arizona, MIT, UCLA, and others.

3.3. Importance to the discipline

The EGG program is important in that it integrates scientific, technical, policy, and management applications within the broad field of energy, giving clear guidance and direction to students. The
development of a graduate program in energy will strengthen related existing research programs and provide greater opportunities for the campus to engage in developing much needed sustainable energy alternatives. The EGG program will also fill a critical gap in the energy industry by supplying the market with highly trained graduates conversant in a wide range of energy related disciplines, as opposed to disciplinary experts who possess a more narrow educational training and face communications barriers when navigating complex energy challenges with experts in other disciplines.

3.4. Ways in which the program will meet the needs of society

Energy transformations are happening, but they are not simple, straightforward, nor obvious. The energy challenges range from the most fundamental science questions to applied policy challenges. A fundamentally new approach to energy supply and use is needed. The training of students for this rapidly changing world is of paramount importance. This training must be interdisciplinary. From basic energy science to applied policy analysis, experts and leaders must draw upon a wide range of disciplinary knowledge to advance the state of knowledge and to make informed decisions about these energy challenges. A key feature of the EGG program will be the promotion of interdisciplinary interaction among graduate students and faculty, and with the energy and environmental professionals. These interactions will uniquely qualify EGG graduates for the interdisciplinary energy industry of the 21st Century, as they utilize their technology, science, economics, environmental, management, and policy training to interact effectively amongst policymakers, engineers, and scientists.

In its transition from a fossil-based energy system to a cleaner and more efficient renewable system, the rapidly growing energy sector is generating increasing demand for highly trained specialists in all sectors of engineering, industry, business, environmental management and government. The EGG program will provide the engineers, scientists and policy makers needed to meet this demand and to develop interdisciplinary solutions to the many challenges facing the energy sector and society.

3.5. Relationship of the program to research and/or professional interests of the faculty

The EGG program will be an integral component of the UC Davis Energy Institute and its affiliated energy and transportation research units co-located at West Village. The Institute was established as the umbrella energy organization on campus to help focus and coordinate energy research and education, and to facilitate interactions with other institutions. At present, the Energy Institute collaborates with the following successful, established energy and transportation research units located in West Village:

- Institute of Transportation Studies
- Energy Efficiency Center
- National Center for Sustainable Transportation
- China Center for Energy and Transportation
- Western Cooling Efficiency Center
- Water-Energy Center
- Plug-in Hybrid and Electric Vehicle Research Center

The proposed EGG program will be fully integrated with the Energy Institute and other energy centers in ways that enhance the educational experience of students and increase their job opportunities after graduation. A strong EGG program will generate synergies between energy research and education by providing a mechanism for faculty to collaborate and transfer skills and
knowledge across disciplines, and enhancing the quality and quantity of interdisciplinary energy research and education opportunities for students.

(See Table 8 below in Section 4.1 for an overview of the broad range of diverse energy-related research interests of inaugural EGG faculty members.)

3.6. Program Differentiation

The only existing program comparable to the one proposed here is the ERG program at UC Berkeley as discussed above in Section 3.1. A detailed description of this program and its required courses is provided in Appendix G. When compared to ERG, the unique features of the EGG program are its two areas of emphasis (Energy Science & Technology and Energy Policy & Management) and its flexibility in allowing students to design specialized programs of study. Moreover, the ERG program only admitted 12 students last year out of approximately 175 applicants who indicated a primary focus on energy, demonstrating a significant unmet demand for interdisciplinary graduate training in energy.

At present, there are few places where students can receive advanced comprehensive training in energy sciences, technology, engineering, and policy. Several selected programs are listed in Table 7. Existing programs that offer training in energy generally fall into two categories: (1) programs that emphasize training in engineering, with additional energy related courses that supplement this training; and (2) programs that are not science-based and offer M.A. degrees. The EGG program falls between these two categories, offering rigorous, science-based degrees without the restriction of a required engineering degree. In addition, the EGG program will offer several key advantages over other programs, including (1) healthy funding support for research in energy from industry, foundations, and federal and state funding agencies; (2) proximity to federal and state agencies, stakeholders and industries in the Sacramento and San Francisco Bay Areas as sources of expertise and potential employment in fields related to energy; (3) more than 100 faculty members engaged in energy research to mentor students in energy related fields; (4) UC Davis’s rich history and reputation for research in energy, policy and management; and (5) California’s leading role in shaping new energy and environmental policies around the world.

Table 7. Selected institutions offering graduate degrees in energy related areas.

<table>
<thead>
<tr>
<th>University</th>
<th>Program Name</th>
<th>Degrees Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC Berkeley</td>
<td>Energy and Resources Group</td>
<td>M.A., M.S., Ph.D.</td>
</tr>
<tr>
<td>Stanford</td>
<td>Energy Resources Engineering</td>
<td>M.S., Ph.D.</td>
</tr>
<tr>
<td>Penn State</td>
<td>Energy and Geo-Environmental Engineering</td>
<td>M.S., Ph.D.</td>
</tr>
<tr>
<td>University of Michigan</td>
<td>Energy Systems Engineering</td>
<td>M.Eng.</td>
</tr>
<tr>
<td>University of Delaware</td>
<td>Center for Energy and Environmental Policy</td>
<td>MEEP, Ph.D.</td>
</tr>
<tr>
<td>Boston University</td>
<td>Center for Energy and Environmental Studies</td>
<td>M.A.</td>
</tr>
<tr>
<td>Carnegie Mellon University</td>
<td>Engineering and Public Policy</td>
<td>M.S., Ph.D.</td>
</tr>
<tr>
<td>New York Institute of Technology</td>
<td>School of Engineering and Technology Program in Energy Management</td>
<td>M.S.</td>
</tr>
<tr>
<td>University of Massachusetts Lowell</td>
<td>Department of Energy Engineering</td>
<td>M.Eng., Ph.D.</td>
</tr>
</tbody>
</table>
Section 4. Faculty

4.1 Membership

The initial faculty members for this graduate group will consist of faculty recently hired under the Energy for the Future Initiative and faculty affiliated with the UC Davis Energy Institute who have expressed an interest in joining the Energy Graduate Group (EGG) based upon their research interest(s) in energy. Existing faculty who have expressed a desire to be among the initial membership for the EGG program are listed in Table 8 below, including an indication of the individual’s department affiliation and area(s) of research interest. For a listing of relevant energy-related publications from these faculty members, see the CVs provided in Appendix H.

Table 8. Initial EGG faculty members and area(s) energy research interest.

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Department/Affiliation</th>
<th>Area(s) of Energy Research Interest</th>
</tr>
</thead>
</table>
| Nina Amenta         | Chair           | Computer Science                                    | • Visualization  
|                     |                 |                                                     | • User interfaces  
|                     |                 |                                                     | • Smart grid       |
| Shota Atsumi        | Assistant Professor | Chemistry                  | • Biofuels                                                           |
| Louise Berben       | Associate Professor | Chemistry                       | • Solar fuels  
|                     |                 |                                                     | • CO₂ conversion  
|                     |                 |                                                     | • Hydrogen production          |
| James Bushnell      | Associate Professor | Economics                           | • Energy markets  
|                     |                 |                                                     | • Utility regulation  
|                     |                 |                                                     | • Climate change  
|                     |                 |                                                     | • Environmental regulation |
| J.P. Delplanque     | Professor / Director | Mechanical and Aerospace Engineering / California Small Hydro Collaborative | • Combustion  
|                     |                 |                                                     | • Hydropower  
|                     |                 |                                                     | • Modeling and simulation |
| Georgia Drakakaki   | Assistant Professor | Plant Sciences                             | • Biofuels  
|                     |                 |                                                     | • Cell wall  
|                     |                 |                                                     | • Algae  
|                     |                 |                                                     | • Biomass |
| Zhiliang (Julia) Fan| Assistant Professor | Biological and Agricultural Engineering | • Biofuels  
|                     |                 |                                                     | • Metabolic engineering  
|                     |                 |                                                     | • Fermentation  
|                     |                 |                                                     | • Process modeling |
| Annaliese Franz     | Associate Professor | Chemistry                             | • Biofuels  
|                     |                 |                                                     | • Catalysis  
<p>|                     |                 |                                                     | • Chemical transformations to produce biofuels |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Department/Center</th>
<th>Research Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrew Hargadon</td>
<td>Chair in Entrepreneurship</td>
<td>Graduate School of Management</td>
<td>Energy efficiency design and management</td>
</tr>
<tr>
<td>Bryan Jenkins</td>
<td>Chair / Director</td>
<td>Biological and Agricultural Engineering / California Renewable Energy Center</td>
<td>Energy systems, Optimization, Thermochemical conversion</td>
</tr>
<tr>
<td>Tina Jeoh</td>
<td>Assistant Professor</td>
<td>Biological and Agricultural Engineering</td>
<td>Cellulosic biofuels, Bioconversion</td>
</tr>
<tr>
<td>Alissa Kendall</td>
<td>Associate Professor</td>
<td>Civil and Environmental Engineering</td>
<td>Life cycle assessment, Renewable energy, Transportation energy</td>
</tr>
<tr>
<td>Sangtae Kim</td>
<td>Professor</td>
<td>Materials Science of Engineering</td>
<td>Nanomaterials, Energy storage, Fuel cells</td>
</tr>
<tr>
<td>Kirill Kovnir</td>
<td>Assistant Professor</td>
<td>Chemistry</td>
<td>Materials for energy, Thermoelectrics, Superconductors, Battery materials</td>
</tr>
<tr>
<td>John Labavitch</td>
<td>Professor Emeritus</td>
<td>Plant Sciences</td>
<td>Plant cell wall metabolism</td>
</tr>
<tr>
<td>Frank Loge</td>
<td>Professor</td>
<td>Civil and Environmental Engineering</td>
<td>Information technology, Water/Energy nexus, Conservation, Use efficiency</td>
</tr>
<tr>
<td>Mark Mascal</td>
<td>Professor</td>
<td>Chemistry</td>
<td>Integrated biorefinery, Renewable fuels and materials, Biomass valorization, Biomass-derived platform chemicals</td>
</tr>
<tr>
<td>Mark Modera</td>
<td>Professor / Director</td>
<td>Civil and Environmental Engineering &amp; Mechanical and Aerospace Engineering / Western Cooling Efficiency Center</td>
<td>End-use energy efficiency, Energy distribution systems, Building energy management</td>
</tr>
<tr>
<td>Adam Moule</td>
<td>Assistant Professor</td>
<td>Chemical Engineering and Material Sciences</td>
<td>Solar materials</td>
</tr>
<tr>
<td>Joan Ogden</td>
<td>Professor</td>
<td>Environmental Science and Policy</td>
<td>Alternative fuels, Energy transitions, Hydrogen and fuel cells</td>
</tr>
<tr>
<td>Name</td>
<td>Title/Position</td>
<td>Department</td>
<td>Research Interests</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------</td>
<td>-------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Frank Osterloh</td>
<td>Professor</td>
<td>Chemistry</td>
<td>Energy infrastructure, Solar energy, Photovoltaics, Photocatalytic water splitting, Hydrogen, Nanomaterials</td>
</tr>
<tr>
<td>Jae Wan Park</td>
<td>Associate Professor</td>
<td>Mechanical and Aerospace Engineering</td>
<td>Efficiency energy systems, Fuel cells, Batteries, Electric grid</td>
</tr>
<tr>
<td>David Rapson</td>
<td>Assistant Professor</td>
<td>Economics</td>
<td>Energy economics, Energy Markets</td>
</tr>
<tr>
<td>Pamela Ronald</td>
<td>Professor / Director</td>
<td>Plant Pathology / Grass Genetics, JBEI</td>
<td>Biofuels, Grass genetics, Cell wall biosynthesis</td>
</tr>
<tr>
<td>Chris Simmons</td>
<td>Assistant Professor</td>
<td>Food Science and Technology</td>
<td>Biofuels, Waste-to-energy, Water/Energy nexus</td>
</tr>
<tr>
<td>Daniel Sperling</td>
<td>Professor / Director</td>
<td>Civil and Environmental Engineering &amp; Environmental Science and Policy / Energy Institute</td>
<td>Transportation and energy systems, Transportation and energy policy</td>
</tr>
<tr>
<td>Pieter Stroeve</td>
<td>Distinguished Professor / Director</td>
<td>Chemical Engineering and Material Sciences / California Solar Energy Collaborative</td>
<td>Solar energy, Biofuels, Hybrid renewable energy systems, Thermoelectrics</td>
</tr>
<tr>
<td>Case van Dam</td>
<td>Chair</td>
<td>Mechanical and Aerospace Engineering</td>
<td>Wind energy</td>
</tr>
<tr>
<td>Jean VanderGheynst</td>
<td>Professor</td>
<td>Biological and Agricultural Engineering</td>
<td>Biofuels, Algae, Bioconversion</td>
</tr>
<tr>
<td>Sonia Yeh</td>
<td>Research Scientist</td>
<td>Institute of Transportation Studies</td>
<td>Energy modeling, Policy analysis, Sustainability, GHG emissions, Transportation fuels</td>
</tr>
<tr>
<td>Dong Yu</td>
<td>Associate Professor</td>
<td>Physics</td>
<td>Solar energy, Nanostructure solar cells</td>
</tr>
</tbody>
</table>
These faculty members have played a critical role in the development of this proposal (see Appendix H. for CVs with publications and Appendix B. for letters of support). Immediately upon approval of the program, we will solicit formal graduate group membership requests from Energy Institute faculty affiliates and other campus faculty who meet the requirements outlined in the EGG program bylaws (see Appendix E.).

4.2. Executive Committee

The administration of the EGG program and its activities shall be vested in an Executive Committee, pursuant to the draft EGG Bylaws found in Appendix E. The Executive Committee shall coordinate with the Chair in administering the program and oversee the modification of the program’s mentoring guidelines and application within the program. The number of members and the composition of the Executive Committee will be determined according to the draft EGG Bylaws (see Appendix E.). The Executive Committee will deal with issues of program curricula, student support, student appeals, and other group business.

4.3. Bylaws

A draft of the EGG Bylaws is included with this proposal in Appendix E. The content and approval of the bylaws will be consistent with campus and other University policy.
Section 5. Courses

In addition to the many existing courses relevant to the Energy Graduate Group (EGG) already offered by academic departments at UC Davis (see Appendix F. for the preliminary list of proposed EGG-eligible courses), we will modify three existing courses to be specifically tailored to the EGG to serve as core course requirements for the program.

Required core courses in the EGG program will be: (1) EGG 200, Fundamentals of Energy Science and Technology; (2) EGG 201, Life Cycle Analysis in Energy Systems; and (3) EGG 202, Energy and Climate Policy. All students will also be required to participate in a 1-unit EGG 290 Energy Seminar course that will meet weekly in the Fall quarter (M.S. and Ph.D. students will be required to take EGG 290 in the fall of both Year 1 and Year 2, while Ph.D. students will also be required to take the seminar in Year 3).

EGG 200 will be taught using a team-based approach under a rotating principal instructor (Professors Bryan Jenkins and Jean VanderGheynst alternating) with several faculty members in the graduate group each providing 2-3 weeks of instruction on a primary topic. Departments that hired new energy faculty through the Energy for the Future initiative have committed to allowing these faculty to teach in the EGG (see supporting letters from Department Chairs in Appendix A. and Section 6); providing rotating lectures as part of the required EGG 200 course would be one approach toward meeting that commitment in addition to the possibility of teaching new courses for the EGG. EGG 201 will be offered by Prof. Alissa Kendall, a recently tenured faculty member in Civil and Environmental Engineering who was hired under the Energy for the Future initiative with specific expertise in life cycle analysis. EGG 202 will be taught by Professors Joan Ogden and Dan Sperling. All are internationally recognized experts in energy and climate policy. The proposed EGG 290 Energy Seminar course will be a one-unit course designed to promote interdisciplinary interaction among EGG students by exposing them to guest lectures on varied topics ranging from advances in basic energy sciences, to energy policy developments, to discussions of the engineering challenges facing renewable energy deployment. Brief course descriptions for EGG 200, EGG 201, EGG 202, and the proposed EGG 250 are provided below.

<table>
<thead>
<tr>
<th>EGG 200: Fundamentals of Energy Science and Technology</th>
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<tr>
<td>Fall quarter (every year)</td>
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<tr>
<td>4 units (lecture – 4 hrs/week)</td>
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**Course Goals:** EGG 200 is designed to provide graduate students with a consistent and comprehensive background in energy science and technology. Students will learn fundamentals of energy science, including thermodynamics, mass-energy conservation, energy resources, energy conversion, and environmental impacts. They will be introduced to renewable and non-renewable energy resources and conversion technologies, and to research directions in new technology and sustainable resource development. In addition to lectures, the course will emphasize student directed team projects related to energy resources and conversion.

**Prerequisites:** Must be a graduate student in good standing.

**Grading:** Letter grade based on midterm exam (25%), a written project proposal (10%), a team report and oral presentation (40%), and final exam (25%). For the term project, the class will be divided into teams of approx. 4 students each to propose, describe and analyze an approach for the conversion of energy, using information available in the literature and based on resources, methods, techniques, approaches and concepts discussed in the class. Project proposals will be submitted and reviewed by the instructor(s) and returned with comments and suggestions. Each team will prepare a written project report and give an oral presentation on their findings to the class and instructors at the end of the quarter.
Instructors: Jenkins, VanderGheynst. Under the direction of a principal instructor (Jenkins and VanderGheynst alternating) the course will be taught by teams of faculty instructors that will alternate on a yearly basis. Other EGG faculty may serve as principal instructor depending on interest.

Lecture topics
- Energy science (thermodynamics, conservation laws, availability, nomenclature, energy sources)
- Renewable energy technologies (bioenergy, hydro, solar, wind, geothermal, ocean)
- Fossil and nuclear energy technologies
- Energy systems (poly-generation systems, combined heat and power, energy storage, transmission and distribution, distributed generation, infrastructure, environmental impacts)

Reference Texts (on Reserve at Library):
Lecture notes will be provided along with references to the literature.

EGG 201: Life Cycle Analysis in Energy Systems
Winter quarter (every year)
4 units (lecture – 4 hrs/week)

Course Goals: EGG 201 is designed to provide graduate students with training in life cycle analysis and its application to life cycle assessment of energy systems. Topics of study will include methodologies of life cycle analysis, software implementation, data bases, and applications. Case studies will be used to examine and quantify factors associated with different fuel production and energy conversion scenarios and energy efficiency and management. In addition to lectures, the course will emphasize student directed team projects related to energy production and efficiency.

Prerequisites: EGG 200. Must be a graduate student in good standing.

Grading: Letter grade based on a midterm exam (25%), a written project proposal (10%), a team (oral presentation and written report) (40%), and a final exam (25%). For the term project, the class will be divided into teams of approx. 4 students each to complete a life cycle analysis on production of energy from a selected resource, using information available in the literature, based on methods, techniques, approaches and concepts discussed in the class. Project proposals will be submitted and reviewed by the instructor(s) and returned with comments and suggestions. Each team will prepare a concise written report and oral presentation on their topic to the rest of the class and instructors toward the end of the quarter.

Instructors: Kendall. Other EGG faculty may serve as instructor depending on interest.

Lecture topics
- Life cycle analysis methodologies and standards
- Energy consumption and efficiency
- Software implementations
- Application of life cycle analysis to
  - Engineered systems, with a focus on energy production technologies
  - Accounting of greenhouse gas emissions in fuel production and electricity generation
- Review of current metrics used to analyze renewable energy production, including net energy ratio, life cycle cost, and payback time.
### Reference Texts:


### EGG 202: Energy and Climate Policy

<table>
<thead>
<tr>
<th>Spring quarter (every year)</th>
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<td>3 units (lecture – 2 hrs/week</td>
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</table>

**Course Goals:** EGG 202 provides a comprehensive understanding of energy and climate policy at the state, federal, and international levels. Students will examine the interplay of technology innovation, industry interests, and consumer behavior in the adoption of policies and regulations. Emphasis on renewable energy, energy efficiency, sustainable transportation, and smart grid, especially with regard to California’s leadership on energy and climate policies—which will be contrasted with Europe, Japan, China, and elsewhere.

**Prerequisites:** EGG 200. Must be a graduate student in good standing.

**Grading:** Letter grade based on a mid-term exam (25%), final exam (40%), and a policy paper (35%).

**Instructors:** Ogden, Sperling. Other EGG faculty may serve as instructor depending on interest.

**Lecture topics**

- Energy Supply
  - Fossil energy
  - Renewable energy
- Organizational structure and behavior of energy industries (electricity, coal, oil, gas, renewables)
- Markets for electricity and fuels
- Regulation of the electricity industry
- GHG and energy policies
- Regulation of fuels, vehicles, and buildings

**References:**


Other reading materials distributed via course packet.

### EGG 290: Energy Seminar

<table>
<thead>
<tr>
<th>Fall quarter (every year)</th>
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<tr>
<td>1 unit (Seminar – 1.5 hours/week)</td>
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</table>

**Course Goals:** EGG 290 is designed to provide an opportunity for regular interdisciplinary interaction amongst EGG students by exposing them to varied topics in energy by guest lecturers. Topics will vary annually and may cover science, engineering, policy, legal, or management issues related to energy.

**Prerequisites:** Must be a graduate student in good standing.
Grading:  S/U grading only. (Course may be repeated for credit.)
Instructors:  Sperling, Kendall. Guest lecturers weekly on varied topics.
Examples of seminar topics
• Advances in basic energy science research (potential presenters: research scientists from major energy companies, national labs, or universities)
• Selected discussion of energy policy developments at the state and federal level (potential presenters: academic faculty, policymakers from Sacramento or D.C.)
• Energy challenges facing the energy industry (potential presenters: engineers from utility companies or major energy development companies)
References:
Not applicable.
Section 6. Resource Requirements

6.1. FTE faculty

The Energy Graduate Group (EGG) will rely on faculty hired several years ago under the “Energy for the Future” initiative plus other existing campus faculty already engaged in energy research (see Table 8 in Section 4.1 for a listing of core EGG faculty). The Energy for the Future faculty positions are listed in Table 9 below. The faculty required to teach the core courses for the EGG are currently in place as described in Section 5.0 above.

Departments across campus have committed to allowing and encouraging their faculty members to teach in the EGG program as indicated in their letters of support (see Appendix A. for details). The Chair of Civil and Environmental Engineering, Sashi Kunnath, for instance, offered his support: “Several graduate courses already offered by our department could be cross-listed with the Energy Graduate Group, providing increased opportunity for our faculty to interact with EGG graduate students. Additionally, the department has already agreed to allow Professor Alissa Kendall to offer ECI 244 Life Cycle Assessment of Sustainable Engineering as a core course of study for the EGG program.” Additionally, the Chair of Biological and Agricultural Engineering noted that “several members of our faculty have very active research programs that relate to energy, and I expect that they will be strong participants in the new Energy Graduate Group.”

Table 9. below provides a summary of the faculty hired several years as part of the “Energy for the Future” initiative at UC Davis.

<table>
<thead>
<tr>
<th>Position</th>
<th>Department</th>
<th>Name</th>
</tr>
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<tbody>
<tr>
<td>Biofuels Engineer</td>
<td>BAE</td>
<td>Zhiliang (Julia) Fan</td>
</tr>
<tr>
<td>Bioconversion Engineer</td>
<td>BAE</td>
<td>Tina Jeoh-Zicari</td>
</tr>
<tr>
<td>Catalysis and PV Materials Engineer</td>
<td>CHMS</td>
<td>Adam Moule</td>
</tr>
<tr>
<td>Efficient Energy Systems Engineer</td>
<td>MAE</td>
<td>Jae Wan Park</td>
</tr>
<tr>
<td>Energy Lifecycle Analysis Engineer</td>
<td>CEE</td>
<td>Alissa Kendall</td>
</tr>
<tr>
<td>Plant Molecular Biologist</td>
<td>Plant Sciences</td>
<td>Georgia Drakakaki</td>
</tr>
<tr>
<td>Metalloenzyme Structure and Function</td>
<td>Chemistry</td>
<td>David Goodin</td>
</tr>
<tr>
<td>Synthetic Biology</td>
<td>Chemistry</td>
<td>Shota Atsumi</td>
</tr>
<tr>
<td>Solid State and Materials Chemistry</td>
<td>Chemistry</td>
<td>Kirill Kovnir</td>
</tr>
<tr>
<td>Inorganic Chemistry</td>
<td>Chemistry</td>
<td>Louise Berben</td>
</tr>
<tr>
<td>Experimental Condensed Matter Physicist</td>
<td>Physics</td>
<td>Dong Yu</td>
</tr>
<tr>
<td>Transportation Economist</td>
<td>Economics</td>
<td>David Rapson</td>
</tr>
</tbody>
</table>

6.2. Library acquisition

No additional library resources are required to support the EGG program. The UC libraries already have the vital journals and books readily available that are needed for this program. Over 850 journal titles of general relevance to energy are available electronically. There are approximately 70 journal titles available electronically that are directly related to energy science, 25 related to energy policy, 80 related to energy management, and 70 related to energy technology.
6.3. Computing costs
Computing costs for the EGG program will be covered by the UC Davis Energy Institute and participating departments. Administrative computing costs will be included within the operating budget provided by the Energy Institute. General student computing facilities and workspace will be made available by the Energy Institute to students in its West Village offices. Students may also rely on department equipment, such as that within the College of Engineering, when working on the main campus. The Energy Institute will also leverage its existing relationships with the National Laboratories to secure access to more highly specialized computing equipment as needed on an individual student basis. Students admitted to the program will be required to have a minimum computing capability, usually in the form of a laptop computer with commonly used software installed.

6.4. Equipment
No funding for equipment is requested. With sponsor approval, we will utilize funding opportunities arranged through the Energy Institute and other contractual and gift arrangements to purchase new equipment, if needed.

6.5. Space and other capital facilities
This program will share administrative space allocated for the UC Davis Energy Institute and will use general classroom space and affiliated laboratories at West Village. As indicated in the support letter (Appendix A.) from the Energy Institute Director, Daniel Sperling, the Energy Institute will provide office space, meeting rooms, and computing resources for EGG students, in addition to providing them access to a centralized administrative, communications, and fundraising unit that already operates out of the West Village offices. The Energy Institute has also committed to providing additional in-kind support, as needed, to ensure the success of the EGG program.

6.6. Other operating costs
The Deans of Engineering, Agricultural and Environmental Sciences, and Graduate Studies have each committed significant financial resources to the EGG program to ensure its success. Those commitments are summarized above in Section 1.6 and can be found in detail in the letters of support in Appendix A.

Additionally, the UC Davis Energy Institute has committed significant in-kind contributions that will also support the EGG program and provide students with a centralized workspace as discussed previously throughout this proposal.

The following annual expenses are expected to launch the EGG program in its first three years:
   a) **Graduate Group Chair Stipend:**
      a. **Year 1:** Up to $4,000 per year
      b. **Year 2:** Up to $4,000 per year
      c. **Year 3:** Up to $4,000 per year
   b) **Administrative Support:**
      a. **Year 1:** $36,000 to fund 50% of a Student Affairs Officer
      b. **Year 2:** $37,080 to fund 50% of a Student Affairs Officer
      c. **Year 3:** $38,192 to fund 50% of a Student Affairs Officer
c) **Recruitment:**

   a. **Year 1:** $25,000 to advertise the new program and recruit students
   
   b. **Year 2:** $15,000 to advertise the new program and recruit students
   
   c. **Year 3:** $15,000 to advertise the new program and recruit students

The funding commitments provided by the Deans of Engineering, Graduate Studies, and Agricultural and Environmental Sciences will cover a significant portion of these expected operating costs. To the extent that additional funding is required, the Energy Institute will engage the development and fundraising staff already working for the energy and transportation research centers at West Village to develop supplemental extramural funding sources. It is expected that the Energy Institute will raise sufficient funding to support the estimated budget described above and ensure the success of the EGG program.

Note that providing fellowship and research support for EGG students is another significant expense that is addressed separately in Section 7.0 below.
Section 7. Graduate Student Support

We expect the EGG program to be highly competitive and to attract academically outstanding students to UC Davis. Through the combination of existing campus financial commitments and significant extramural fundraising, it is expected that all EGG students will receive fellowship and research support.

The following summarizes the sources of expected support for EGG students:

- **Campus financial commitments**: Significant fellowship support committed by the Deans of Engineering, Graduate Studies, and Agricultural and Environmental Sciences.

- **Corporate support**: Development by the Energy Institute of corporate sponsorship of energy related research to support EGG students.

- **Existing fellowship opportunities**: EGG students studying transportation-related energy issues will be eligible to compete for existing fellowship opportunities.

- **Faculty grants**: Some EGG students may be funded on existing faculty research grants.

- **Extramural research funding**: The Energy Institute will aggressively pursue interdisciplinary energy research grants from federal and state agencies, and foundations.

**Campus Commitments.** Many incoming students will be eligible for external and campus fellowships including those funded by the commitments described in letters from the Deans of Engineering, Graduate Studies, and Agricultural and Environmental Sciences found in Appendix A. Fellowship funding committed by those deans totals $350,000 over the first three years of the EGG program, after which time the Office of Graduate Studies will support the program through the Graduate Program Fellowship Allocation (with funding of $240,000 per year on the basis of expected EGG enrollment beginning in Year 4).

**Corporate Support.** Additional fellowship support for EGG students is expected to be raised from extramural sources by the Energy Institute. One strategy will be for the Energy Institute to adopt the successful modeled developed by the Institute of Transportation Studies (ITS-Davis) that provides fellowship support through its Corporate Affiliate Program for students studying transportation issues. Through that program, affiliate members of ITS-Davis make major gifts to support core programs and include members such as: BMW, BP, ExxonMobil, Daimler, Nissan, Shell, Toyota, and PG&E. The Energy Institute will be able to leverage these corporate connections as it works with affiliated energy and transportation research centers co-located at West Village to raise new funding sources for EGG student fellowships.

**Existing Fellowship Opportunities.** Moreover, to the extent that any EGG students have research interests in transportation-related energy issues, they may also be eligible to apply for existing fellowships offered by ITS-Davis or by affiliated research centers, such as the National Center for Sustainable Transportation (NCST). NCST is co-located with the Energy Institute at West Village and is funded by the U.S. Department of Transportation (with match funding from the California Air Resources Board, California Department of Transportation, and California Energy Commission) at $11.2 million over four years.

**Faculty Grants.** Some EGG students will also likely be funded through existing faculty research grants focused on energy topics. In some instances, this may be to the exclusion of existing students in other departments on campus, but in others, faculty will likely be able to fund additional students due to the increased capabilities that EGG student researchers will provide. For more details about the extent to which faculty envision including EGG students on existing research grants, see the letters of support from EGG faculty in Appendix B.

**Extramural Research Funding.** The final source of expected funding for EGG students will come
from research grants to fund interdisciplinary energy research. The Energy Institute will aggressively identify and pursue targets external sources of research funding, such as research grants from federal and state agencies or from foundations. The sub-section below provides an overview of the federal and state energy research trends.

**Federal and State Energy Research Trends**

Because the availability of federal and state research grants is a significant potential source of funding for EGG students, this sub-section provides additional detail on the size of these funding opportunities and recent trends.

Federal and state agencies have significantly increased their commitment to advanced energy research—particularly in the basic sciences, renewable energy, and energy efficiency—in recent years. For instance, according to the American Association for the Advancement of Science (AAAS), an international non-profit organization dedicated to advancing science for the benefit of all people, the U.S. Department of Energy has increased its spending on research and development by 17.5% over the last decade.

Significantly, according to AAAS, R&D funding for energy efficiency and renewable energy has increased by a staggering 128.5% over the same period, with funding in 2014 set at $1.6 billion. What’s more, the President’s recently released 2015 budget proposal recommends increasing this funding even more next year—to $2.3 billion. Funding for basic energy sciences R&D has also increased more than 50% over the last decade.

The creation in 2007 by Congress of the Advanced Research Projects Agency-Energy (ARPA-E) is further evidence of the trend of increased federal spending on energy R&D in recent years. From its inaugural budget of $172.6 million in 2011, the budget for ARPA-E has already nearly doubled to $338.6 million in 2014. ARPA-E directs its R&D dollars at transformational energy technology projects.

At the state level, the California Public Utilities Commission (CPUC) recently created the Electric Program Investment Charge (EPIC), a new R&D program to replace the Public Good Charge’s R&D program funding. EPIC will be administered by the California Energy Commission (CEC) and the state’s three large investor-owned utilities (PG&E, SCE, and SDG&E). EPIC will fund innovative technologies, tools and approaches that provide benefits to electric ratepayers through greater reliability, lower costs, increased safety, and enhanced environmental sustainability.

The majority of EPIC funds will be administered by the CEC. As an example of the energy R&D funding available through this state program, EPIC solicitations from the CEC scheduled for 2014 alone are expected to make $332 million in energy-related research funding available. Additional funding in similar amounts is expected to continue in the coming years.

These trends in federal and state spending on energy research are significant because our energy faculty members are well positioned to secure funding in these areas and will be able to use the funds to support EGG students. It is also likely that the development of the EGG should bolster the ability of UC Davis faculty members to secure large center grant proposals from the Department of Energy and the CEC to pursue transformational interdisciplinary research in the areas of energy efficiency, renewable energy, and basic energy sciences, among others.

No teaching assistantships are so far proposed to be devoted to this program, but EGG students would be eligible for to seek TA appointments in the appropriate academic departments based on their academic backgrounds.
Section 8. Governance

The proposed Energy Graduate Group (EGG) will operate under its approved set of bylaws and will be administratively supported by the UC Davis Energy Institute with the Dean of Engineering providing lead academic support. The program will grant M.S. and Ph.D. degrees in either Energy Science & Technology or Energy Policy & Management.
Section 9. Changes in Senate Regulations

No changes are necessary in Senate Regulations or Academic Assembly.
Appendices

Appendix A. Letters of Support: Deans, Department Chairs, and UC Davis Energy Institute A1
Appendix B. Letters of Support: Initial EGG Faculty B1
Appendix C. Letters of Support: UC Berkeley Energy and Resources Group (ERG) C1
Appendix D. Letters of Support: Government and Industry D1
Appendix E. Draft Bylaws for the Energy Graduate Group E1
Appendix F. Required Courses for the Energy Graduate Group F1
Appendix G. Overview of the Energy and Resources Group at UC Berkeley G1
Appendix H. Curriculum Vitae of Initial EGG Faculty H1
Appendix I. Survey of Potential Employers I1
Appendix J. Required Memoranda of Understanding J1
Appendix A. Letters of Support: Deans, Department Chairs, and UC Davis Energy Institute
DAN SPERLING  
Professor, Civil and Environmental Engineering  
Director, UC Davis Energy Institute  

Re: Energy Graduate Group  

Dear Dan,

I am writing to convey my enthusiastic support for your proposal to establish an Energy Graduate Group (EGG) and its proposed degree programs. UC Davis, with its historical strength in renewable energy and environmental research coupled with extensive experience in interdisciplinary graduate training, is uniquely positioned to offer this type of forward-thinking graduate program. The proposed program will provide a structured graduate education and training component to the UC Davis Energy Institute and will facilitate research collaborations between faculty in the Energy Institute with other campus units focused on energy and environmental related research.

There is an urgent need for highly trained professionals with broad knowledge of the technical as well as the economic, global, environmental and policy issues surrounding the critical energy issues our world now faces. Without these scientific and policy leaders we will never be able to sustainably achieve the energy independence goals that our country has established. Given the current level of undergraduate and graduate student interest and participation in energy related research, I have no doubt that the proposed program will be attractive in recruiting top graduate students to our campus. It will not only allow new research and curricular collaborations with existing faculty and students in the college doing research in wind energy, hydrogen production, combustion, catalysis, fermentation, hydrogen fuel cells, photovoltaics, biofuels, transportation studies, lighting controls, and fusion energy sciences, but will expand those collaborations to include faculty from economics, social sciences, environmental sciences and business. To ensure the curricular components of the EGG are implemented, I will encourage department chairs to include EGG courses in their normal academic planning process and assign EGG courses as part of faculty’s normal teaching responsibilities as needed. In addition, if the College of Engineering serves as the lead for the EGG (which we would be happy to do) we will provide matching funds for the EGG administrative staff (50% of the determined amount required for administrative staff effort) for the first five years of the program to match the funding provided by the Office of Graduate Studies. If multiple lead deans are assigned we will provide our proportional fraction of the match. We anticipate there will likely be a ramp-up in the administrative support staff effort level required during the initial phases as the EGG is getting started and also hope that staffing within the Energy Institute can be leveraged when possible.

The EGG provides the intellectual focus in advancing energy knowledge and understanding on the Davis campus, and is the educational cornerstone of our Energy Institute. Our experience with faculty and graduate student researchers addressing challenges in energy has demonstrated that a graduate group specifically focused on energy is imperative for top-tier research and teaching. The faculty hired under the Energy for the Future Initiative represent an outstanding addition to our campus core efforts, and we are committed to supporting their efforts to recruit and fund talented energy-focused graduate
students. Their recent funding streams and the outstanding extramural funding of the Energy Institute highlights the excellence of our energy programs. We anticipate this substantial extramural funding to continue to be sufficient to support doctoral energy students. To address immediate needs, however, the College of Engineering will provide $20K, $40K, and $60K in years 1, 2, and 3, respectively, for the support of EGG graduate students advised by College of Engineering faculty. These funds will complement extramural funding and other campus support in those years for the new Energy Graduate Group. Beyond this, we anticipate that the EGG will be supported by campus on the basis of future enrollments in the same manner as other graduate groups.

I appreciate the leadership and effort you and your colleagues have put into this proposal and wish you the best as it proceeds through the campus and university approval process.

Yours sincerely,

Enrique J. Lavernia
Distinguished Professor
Dean, College of Engineering
October 13, 2014 (revised)

PROFESSOR DANIEL SPERLING
Civil and Environmental Engineering
Environmental Science and Policy

SUBJECT: Financial Support for the Proposed Energy Graduate Group

Dear Dan

The proposed Energy Graduate Group (EGG) has my full and enthusiastic support. I view this as a very timely new program that fits very well with the academic and research strengths of UC Davis. As you know, it is the outcome of careful and thoughtful planning by the faculty and the dean primarily from the College of Engineering. In addition, the proposed Energy Graduate Group benefits from significant campus investment in faculty hired under the Energy for the Future Initiative.

I am writing to provide a commitment of graduate student financial support for this proposed program. Specifically, I will allocate $30,000, $60,000 and $120,000 in years 1, 2 and 3 as start-up transition student support funding for the group. This funding will complement funding committed by the College of Engineering and other extramural funds secured by the group. Beginning in year 4, Graduate Studies will provide an on-going Graduate Program Fellowship Allocation (formerly known as the Block Grant). Based on current rates, this would amount to at least $240,000 per year at the target program size. All of the graduate student support funds provided to the group will be new and will not negatively impact other graduate programs. Consistent with current practice, Graduate Studies will provide 50% of the administrative support for the group (to be matched by the lead dean(s)), which will be a minimum $10,000 per year based on the projected enrollment of 40 students. Graduate Studies will also provide a customary stipend of $3,000-4,000 for the chair based on experience and group size.

We already know that there are many opportunities to raise additional private fellowship support in the area of energy technology, policy and management. My development officer and I have had numerous conversations with potential donors and firmly believe that approval of the Energy Graduate Group will catalyze several of them to make gifts to UC Davis to support the new group.

Sincerely,

Jeffery C. Gibeling
Vice Provost – Graduate Education and Dean – Graduate Studies

c: Dean Lavernia
   Associate Dean VanderGheynst
   Assistant Dean Lefkoff
   Chief Administrative Officer Martin-Ocampo
   Director Albrecht
   Graduate Policy Analyst Mendoza
DAN SPERLING  
UC Davis Energy Institute  

RE: Letter of Support for the Energy Graduate Group (EGG)  

Dear Dan:  

It is with great enthusiasm that my office supports the Energy Graduate Group proposal, as submitted to me this past June, 2014. I agree that wise energy use and policies are needed for a sustainable California and the world, and that our campus and college provides the basic sciences and engineering capacity to lead such an initiative through the Energy Institute.  

We agree with you that in addition to Science and Technology, Energy Policy must be a critical part of such a degree. Our campus is strategically well placed, with Davis in close proximity to the State capital, thus providing excellent opportunities for EGG students to engage with the state legislature and state agencies within the realm of environmental policy. Also, with existing strengths of our campus in the wide range of sciences and engineering, as well as through ongoing partnerships with the Institute of Transportation Studies and John Muir Institute of the Environment, the proposed interdisciplinary training will significantly add to the strength of our campus.  

Through internal discussions in my office, we reviewed existing Graduate Group/Program funding in my college, and used it as a benchmark, recognizing that startup funding will be required in addition. I will commit $10,000 for the first year after the EGG is receiving students, and be willing to re-evaluate continued funding needs, as the EGG program develops.  

Sincerely,  

Helene Dillard  
Dean  

cc: Mary Delany  
Jan Hopmans  
Tom Kaiser
September 25, 2014

From: Daniel Sperling, Professor and Director, UC Davis Energy Institute

Re: Energy Institute Commitment to Proposed Energy Graduate Group (EGG)

The UC Davis Energy Institute will provide the administrative home for the Energy Graduate Group (EGG) and will enthusiastically support the EGG in all ways. The faculty affiliates of the Energy Institute view the EGG as a premier activity of the Institute. Our commitment is substantial in space, administrative support, fundraising assistance, and communications. Our offer is made through the Energy Hub in West Village (UC Davis), a partnership of the following energy and transportation research centers: Energy Institute, Institute of Transportation Studies; Policy Institute for Energy, Environment, and the Economy; Energy Efficiency Center; and a number of other specialized energy centers. Together this Energy Cluster expends almost $20 million annually for research, education, and outreach (almost all of it extramural grants, contracts, and gifts).

This Energy Hub has one administrative unit, headed by Mr. Ernest Hoftyzer (who reports to me). This administrative unit includes three fundraisers and a communications team, as well as the traditional administrative functions. It also includes a staff person, Annemarie Schaaf, who administers our Transportation Technology and Policy Graduate Group. Ms. Schaaf currently works part-time, and will expand her hours to help launch the EGG. The existence of this Energy Hub and its strong administrative staff means that the cost of administering EGG will be manageable and that EGG students will benefit from a strong, experienced fundraising staff already in place.

The Energy Hub has offices and labs co-located at West Village, the largest zero net energy (ZNE) community in the US. EGG students will be provided office space, along with other department-based students employed at the Energy Hub.

The cluster of Energy Hub centers provides students with access to fellowships, research funding, office space, and access to job opportunities with the many companies and government agencies already affiliated with institutes and centers operating out of the Energy Hub. In short, the EGG builds upon and benefits from UC Davis’s already large commitment to energy research and education.

We will support the launch of the EGG alongside the College of Engineering (providing lead academic support). We have the administrative team in place and we have strong faculty commitment. We have strong support from administrative leaders of the campus (as evidenced by the letters of support from college deans and department chairs) and we have strong financial support. In addition to the significant levels of funding committed by the Deans of Engineering, Agricultural and Environmental Sciences, and Graduate Studies, the Energy Institute is committed to providing additional in-kind support for the EGG, as needed, to ensure its success.

On behalf of the Energy Institute, I offer my strongest support for the creation of the Energy Graduate Group and I commit the full resources of the Energy Institute to support the group and provide the group with an administrative home.

Sincerely,

Daniel Sperling
Director, Energy Institute
2014, June 19

Daniel Sperling  
Interim Director, Energy Institute  
Founding Director, Institute of Transportation Studies  
Faculty Director, Policy Institute for Energy, Environment and the Economy  
Professor of Transportation Engineering and Environmental Policy  
1715 Tilia St., #1109  
University of California, Davis

Dear Dr. Sperling,

Thank you for the information regarding the proposed Energy Graduate Group. I am aware that this proposal has been under discussion for quite a number of years and I am pleased to see it moving forward at this time. Given the current energy-related challenges, which range from technological to social, there is great need for the kind of interdisciplinary training that would be offered through this program. In the past, students interested in energy-related topics have had limited options especially when their interests were multidisciplinary.

In my view, the proposed program complements and does not compete with existing programs that have attracted in the past students interested in energy. As you know, several members of our faculty have very active research programs that relate to energy, and I expect that they will be strong participants in the new Energy Graduate Group.

I strongly support the establishment of the Energy Graduate Group.

Best regards,

Raul H. Piedrahita  
Professor and Chair

cc. Prof. Bryan Jenkins
Date: July 2, 2014

To: Director Daniel Sperling  
UC Davis Energy Institute  
1605 Tilia Street, Suite 100  
Davis, CA 95616

Fr: Sashi Kunnath, CEE Chair

Re: Letter in support of the Energy Graduate Group

The Department of Civil Engineering offers its strongest support for the creation of an Energy Graduate Group (EGG) to offer the MS and PhD degrees in Energy Science & Technology and in Energy Policy & Management.

Many of our faculty members are already engaged in research related to energy, as reflected in the courses offered through our department and in the areas of research focus of our faculty. Some of the most relevant courses already offered by the department include:

- Urban Systems and Sustainability (ECI 123)
- Building Energy Performance (ECI 125)
- Planning for Green Civil Systems (ECI 126)
- Design for Green Civil Systems (ECI 127)
- Green Engineering Design and Sustainability (ECI 143)
- Solid Waste Management (ECI 147)
- Air Pollution (ECI 149)
- Air Pollution Design (ECI 150)
- Deterministic Optimization and Design (ECI 153)
- Transportation Systems (ECI 161)
- Energy and Environmental Aspects of Transportation (ECI 163)
- Water Quality (ECI 240)
- Air Quality Modeling (ECI 241)
- Life Cycle Assessment for Sustainable Engineering (ECI 244)
- Sustainable Transportation Technology and Policy (ECI 252)
- Infrastructure Economics (ECI 268)

The Department of Civil Engineering believes strongly that our existing graduate students can work in collaboration with students in the proposed energy grad program to create new synergies that will ultimately benefit our department and the research of our faculty. It is our expectation that the EGG will facilitate this type of interdisciplinary collaboration and will result in increased funding for our department’s graduate students working on projects with EGG students.

Several graduate courses already offered by our department could be cross-listed with the Energy Graduate Group, providing increased opportunity for our faculty to interact with EGG graduate students. Additionally, the department has already agreed to allow Professor Alissa Kendall to offer ECI 244 Life Cycle Assessment for Sustainable Engineering as a core course of study for the EGG program.

I enthusiastically offer my support for the formation of an Energy Graduate Group.
Distinguished Professor Susan M. Kauzlarich  
Chair of Chemistry, ACS Fellow  
email: smkauzlarich@ucdavis.edu

Professor Dan Sperling  
Director, UC Davis Energy Institute University of California Davis

RE: Letter of Support for the Energy Graduate Group at UC-Davis

Dear Professor Sperling:

The Chemistry Department at UC Davis enthusiastically supports the creation of an Energy Graduate Group (EGG) that will supply the next generation of experts and leaders in this field to industry, government, academia, and research centers. The EGG would provide a rich, interdisciplinary education for students from the basic sciences to engineering and policy analysis. The Chemistry Department has multiple faculty that are interested to participate in the degree programs that EGG will offer. There will be M. Sc. and Ph.D. programs in two tracks: 1) Energy Science and Technology, and 2) Energy Policy and Management. Both of the tracks involve Chemistry and we have a number of new and existing courses that would fit within these programs.

We have a large number of faculty involved in Energy related research, such as myself (thermoelectrics, solar photovoltaics), Shota Atsumi (biofuels, metabolic engineering), Louise Berben (homogeneous catalysis), David Britt (photosynthesis, natural and artificial), Annalieze Franz (biofuels, catalysis), Kirill Kovnir (superconductors, battery, thermoelectrics), Mark Mascal (integrated biorefinery and renewable platform chemicals), Frank Osterloh (solar water splitting catalysis, photovoltaics) Adam Moulé (GPC, photovoltaics), and Philip Power (hydrogen conversion and storage).

There are a number of courses our faculty members teach including:

- Chemical Uses of Symmetry and Group Theory (CHE201)
- Symmetry, Spectroscopy, and Structure (CHE205)
- X-Ray Structure Determination (CHE217)
- Chemistry of Nanoparticles (CHE222)
- Principles of Transition Metal Chemistry (CHE226)
- Bio-inorganic Chemistry, Main Group Chemistry, Solid State Chemistry, Homogeneous Catalysis (CHE228A-D)
- Organic Synthesis: Methods and Strategies, Advanced Organic Synthesis (CHE231A, B)
- Physical Organic Chemistry (CHE233)
- Organometallic Chemistry in Organic Synthesis (CHE235)
- Advanced Analytical Chemistry (CHE240)
- Surface Analytical Chemistry, Laser and X-ray Spectroscopy (CHE241A, B)
- Chemical Biology for Energy and Environment (CHE 298)
– Industrial Chemistry (CHE221B)

In addition to the existing courses, the faculty involved in the EGG would develop a new core course “Chemistry of Materials for Energy” specifically for students in the Energy Science & Tech track that would cover topics of materials discovery and design ranging from the molecular level to extended solids and would be appropriate for both engineers and energy scientists.

We see the establishment of the EGG as an opportunity to strengthen the interdisciplinary nature of research in these areas and the Energy Institute will provide additional visibility to our efforts.

Sincerely,

Susan M. Kauzlarich
Dear Professor Sperling,

I am writing in enthusiastic support of the proposal to create an Energy Graduate Group. I believe that a PhD program in Energy will provide a framework for research and initiatives that are difficult to accommodate within existing structures at UC Davis. This program could follow the very successful model of the Transportation Studies Graduate Group and make space for the kind of vital interdisciplinary research that is such a challenge in academia but so necessary for the concurrent advancement of technology and public policy.

Power systems engineering is one area where this program could make a huge difference. Re-engineering our power generation system requires re-engineering the power distribution grid. This is one of the defining challenges our generation, but American academia is doing a terrible job of preparing the needed scientists, engineers and policy professionals. Over the last fifty years, power engineering fell out of favor within electrical engineering departments, who quite rightly saw integrated circuit design and communications technologies as their research frontiers. Meanwhile, power grid engineering has become much more complex, as real-time networked sensors, controls, and pricing introduce technical problems traditionally associated with the internet, and as varied new forms of electricity generation, with very different availability and distribution profiles, are brought online. At the same time, redesigning the power system is a vast political, economic and policy challenge. Useful technological research has to be informed by the social science context, and visa versa. As a generation of power engineers are moving into retirement, and the complexities of the job increase, there is a dearth of programs preparing the new generation.

Davis is luckily in a unique position to move into this vital, high-potential area. The electrical engineering department at nearby California State University, Sacramento, has one of the few active power engineering graduate programs in the country. Their Smart Grid Center is heavily supported by the California Energy Commission and their faculty, researchers and masters students have a vigorous research program. They would like to start offering PhD degrees, and for this, they need the cooperation of a UC campus. Cooperation would be a tremendous asset to us, since our work on power generation, storage, networking, policy, electric vehicle infrastructure, economics and consumer usage patterns would all benefit from contact and collaboration with a solid power engineering program. This is an opportunity to take a leadership role at an important national research frontier.

One current stumbling block to taking advantage of this terrific potential synergy is that power engineering does not fall within the traditional strengths of any of our existing graduate groups. Our electrical engineering group, like most, has strong expertise in integrated circuits and communications, and it could not provide enough advisors to enable a joint PhD program (Prof. Anna Scaglione is the only faculty member doing related research).
An interdisciplinary Energy Graduate Group, however, would be an ideal vehicle for UC Davis to move forward with this remarkable opportunity. By expanding the focus, it becomes possible to provide enough PhD advisors at Davis to handle a meaningful pipeline of students working on interdisciplinary projects. Some specific examples of potential PhD paths might be a student who writes an excellent MS thesis at Sacramento State and moves into a more interdisciplinary PhD project as part of the Energy PhD, or a student admitted directly into the Energy PhD program who takes one or more classes in classical power generation and the Smart Grid at Sacramento State, as part of a PhD focused in one of the physical or social sciences, computer or materials engineering, or even design.

Last fall, we had a joint workshop (sponsored by CITRIS and attended by faculty from other UCs and a representative of the CEC) with Sacramento State faculty on the potential for this joint PhD program. While it is clear that working out the administrative structure for a joint PhD program are not trivial, the potential for synergy was also very clear. Creating an Energy Graduate Group removes one of the main challenges we saw.

The State of California is deeply concerned with Smart Grid research, and will be a consistent source of funding in addition to federal and industry sources. As the Institute for Transportation Studies had demonstrated, having a well-defined interdisciplinary program with its own visible profile exactly addressing an issue of great importance to society is an excellent vehicle for bringing in research funding.

In summary, I am very enthusiastic about the opportunities created by the proposed Energy Graduate Group and I hope that it can move forward.

Very Sincerely,

Nina Amenta  
Bucher Family Professor  
Chair, Department of Computer Science  
Director, Center for Information Technology Research in the Interest of Society (CITRIS)  
University of California at Davis  

cc:
July 31, 2014

Daniel Sperling, Professor  
Interim Director UC Davis Energy Institute  
Davis Campus

Dear Dr. Sperling,

This letter is in strong support of the Energy Institute's proposal to create an Energy Graduate Group (EGG) at UC Davis. We think this is an excellent opportunity to build bridges across campus with increased interdisciplinary collaborations, especially for students; the Dept. of Design is extremely interested in working with the EGG through our existing California Lighting Technology Center (CLTC), with its focus on energy efficient lighting, and our newly forming industrial design area (funded through the Provost's Hiring Investment Program).

By connecting the prominent energy groups already in existence on the UC Davis campus, the EGG promises to provide a critical area of study and training for students who will become our future leaders in the field of energy. We look forward to working with you as you develop this important and significant graduate group.

Sincerely,

Susan Avila  
Professor and Chair, Dept. of Design
September 13, 2014

Professor Dan Sperling  
Interim Director, UC Davis Energy Institute  
University of California Davis

RE: Letter of Support for the Energy Graduate Group at UC Davis

The Department of Electrical and Computer Engineering (ECE) enthusiastically supports the creation of an Energy Graduate Group (EGG), which will offer M. Sc. and Ph.D. programs in two tracks: 1) Energy Science and Technology, and 2) Energy Policy and Management.

ECE is currently involved in various aspects of the science and technology of efficient energy production, storage, transmission, and consumption, and we have the prospect of adding two energy related faculty from AY 2014-15 recruiting. We would expect to have several ECE faculty members would be active in the EGG, and expect that the EGG would help connect ECE faculty with other energy-related researchers at UC Davis.

Existing research in ECE in the efficient energy production area includes work on photovoltaic devices based on vertically oriented micro/nano-pillars (Professor Islam), and methods for energy harvesting for ultra-low-power sensors (Professor Amirtharajah). Work in efficient storage includes research into more efficient lithium-ion batteries based on a silicon anode (Professor Islam). Work in transmission includes various aspect of the Smart Grid, including grid control and security (Professor Scaglione and a new faculty member). Work in efficient consumption includes ultra-low power circuits (Professor Amirtharajah), energy efficient computing (Professors Akella, Baas, and Ghiasi), energy efficient networking (Professors Yoo and Zhao), energy efficient lighting (Professor Hunt), and efficient power electronics (Professor Amirtharajah and new faculty hire).

ECE has various existing courses that would be applicable to the EGG, including Smart Grid, Power Electronics, Low Power Digital Integrated Circuit Design, and Advanced Semiconductor Devices.

In short, the ECE Department strongly endorses the proposed Energy Graduate Group. The EGG will be a catalyst that we can expect will broaden and deepen energy-related research at UC Davis.
Sincerely,

Kent Wilken
Professor and Chair
Dear Professor Sperling,

On behalf of the Graduate Group in Ecology (GGE /GECL), I am writing in support of the formation of a new Energy Graduate Group (EGG). The GGE Executive Committee recently reviewed and approved the proposal for the EGG.

The Graduate Group in Ecology has programmatic strengths in many areas that would synergize well with energy development and energy policy, including our Areas of Emphasis in Environmental Policy and Human Ecology, Conservation Ecology, Restoration Ecology, Agricultural Ecology and more. For example, many of our members are actively engaged in climate change research.

Comments regarding the EGG were strongly favorable. For example, our members opined that additional courses offered through the EGG could benefit the GGE students. Energy students enrolling in Ecology courses could bring different and valuable perspectives to the concepts and issues ecologists address. Interactions between our groups could provide networking opportunities, especially in the areas of climate research and environmental resource management.

We endorse the formation of an Energy Graduate Group. It is likely to raise the profile of UC Davis nationally and internationally. We look forward to productive interactions with the EGG faculty and students.

Best Regards,

Sharon P. Lawler
Chair, Graduate Group in Ecology
Professor of Entomology and Nematology

November 6, 2014
July 30, 2014

Dr. Daniel Sperling, Director
UC Davis Energy Institute
University of California, Davis
One Shields Ave.
Davis, CA 95616

Dear Dan:

I am pleased to write and offer my strong support for your efforts to establish a graduate group in Energy. Establishing such a group will provide valuable interdisciplinary opportunities for graduate students that seem perfect for our University given its strengths in applied science.

Many recent discussions in the Division of Social Science and the Department of Economics have included strong interest in partnering with science and engineering to provide students with broader training that will better prepare them to tackle difficult problems in research and public policy. Within economics, many of our graduate students pursue research agendas that touch on energy and environmental issues, reflecting the interest and strengths of several of our faculty members. A graduate group in Energy will allow additional opportunities for such students.

The Department of Economics, its students, and its scholarly reputation could both contribute to, and benefit from, such a group. The intersection of science and policy offered by a program of study developed by an Energy Graduate Group seems likely to be both academically rigorous and to attract research funding which will further benefit students, faculty and the University.

Sincerely,

Ann Huff Stevens
August 11, 2014

Professor Dan Sperling
Interim Director, UC Davis Energy Institute
University of California Davis

RE: Letter of Support for the Energy Graduate Group at UC-Davis

The Department of Environmental Science and Policy (ESP) strongly supports the creation of the Energy Graduate Group (EGG) offering M. Sc. and Ph.D. programs in two tracks: 1) Energy Science and Technology, and 2) Energy Policy and Management. ESP could contribute to and would benefit from the creation of the EGG.

Faculty members from ESP are engaged in research on a wide variety of pressing environmental problems. Our research spans the natural sciences and the social sciences, and our work has implications for both resource management and environmental policy. Several faculty members focus in whole or on part on questions related to energy and the environment, and nearly all touch on the direct or indirect implications of energy consumption for natural or man-made communities.

Courses taught by ESP faculty members that would be relevant to the EGG include:
- ARE/ESP 175: Natural Resource Economics
- ESP168 Energy and Environmental Aspects of Transportation
- ESP167 Energy Policy
- ESP212A Environmental Policy Process
- ESP212B Environmental Policy Evaluation
- ESP275 Economic Analysis of Resource and Environmental Policies
- ESP278 Research Methods in Environmental Policy

The Energy Graduate Group will strengthen interdisciplinary education and research on the environment at UC Davis. The Department of Environmental Science and Policy (ESP) strongly supports this proposal.

Sincerely,

Susan Handy
Chair
30 June 2014

Professor Daniel Sperling
Director of Institute of Transportation Studies
Professor of Environmental Science and Policy

Professor Sperling:

The Graduate School of Management (GSM) strongly supports the creation of an Energy Graduate Group (EGG) at UC Davis. The proposed program will produce graduates with a strong interdisciplinary background in energy who would be prepared to become leaders of industry and government.

In addition, the Energy Graduate Group will enhance the education of our existing GSM graduate students. In particular, the GSM is excited about the synergies that will develop through the collaboration of GSM and EGG students and faculty, pairing the business and entrepreneurial acumen of the former with the energy science and engineering expertise of the latter. The development of these synergistic relationships will allow the GSM and EGG to pursue new opportunities for funding and research that otherwise would have been unattainable.

Additionally, it is our expectation that several existing GSM courses will be offered to graduate students enrolled in the EGG program. These courses will provide EGG students—particularly those pursuing the MS or PhD in Energy Policy & Management—a solid foundation in management before they embark on careers in industry and government.

It is also worth noting that our students have a long track record of interest in energy and many have pursued careers in industry and government working on energy related issues, demonstrating market demand in the energy industry for graduates from interdisciplinary graduate programs such as the one proposed here. The following is a list of recent GSM alumni who have built careers in energy:

- Lead Project Engineer, Chevron Energy Solutions
- Director, Product and Process Engineering, Altergy Systems
- Energy Economist, PG&E
- Sr. Product Manager, SMUD
- Lead Principal, IT Governance, PG&E
- Sr. Enterprise Infrastructure Specialist, SMUD
- Director of Enterprise Risk Management, California ISO
- Manager, IDSM Core Products-Buildings, PG&E
On behalf of the Graduate School of Management, I am enthusiastically in support of the proposal to create a new Energy Graduate Group at UC Davis.

Best regards,

Steven C. Currall, Ph.D.
Dean and Professor of Management

SCC:nke
August 13, 2014

Professor Dan Sperling  
Interim Director, UC Davis Energy Institute  
University of California Davis  

RE: Letter of Support for the Energy Graduate Group at UC Davis  

The Department of Mechanical and Aerospace Engineering (MAE) is very pleased to support the creation of an Energy Graduate Group (EGG) which will offer Masters and Doctoral degrees in two tracks: 1) Energy Science and Technology, and 2) Energy Policy and Management.  

Energy is one of the four strategic areas of MAE and includes research in vehicles, fuel cells, renewable power, combustion, energy efficiency, and the environment. A significant number of our Department’s faculty are involved in energy related areas as reflected in the courses offered and research conducted. Pertinent undergraduate and graduate courses offered include:

- Thermo-fluid dynamics and heat transfer (ENG 103, ENG 105, EME 106, EME 165, MAE 210A, MAE 210B, MAE 211, MAE 216)
- Propulsion systems (EAE 138, EME 163, MAE 248)
- Advanced Energy Systems (MAE 218, MAE 268, MAE 269)

A sample of faculty members, among others in the Department, active in energy related research, development, and demonstration are Barbara Linke (energy efficiency in manufacturing), Raissa D’Souza (networks), Francis Assadian, Jae Wan Park and Paul Erickson (vehicles, fuel cells, alternative fuels), Tony Wexler (environmental), Roger Davis (gas turbines), Ben Shaw and Ralph Aldredge (combustion), Valeria La Saponara and Case van Dam (wind power).

MAE is committed to training future engineers in energy related technologies and consider that the EGG will create new synergies that will benefit the Department and graduate research and education in general. The EGG will facilitate a media for joint work and for multi-disciplinary proposals to support graduate students in fields of mutual interest. Also, this will make it easier to leverage resources in multiple units and apply for larger, multi-PI grants and contracts to support the graduate programs. Several graduate courses offered in MAE could be cross-listed with the EGG thereby facilitating student/faculty interactions in both programs.

On behalf of the Department, I strongly endorse this proposal and look forward to the creation of the Energy Graduate Group.

Sincerely,

C. P. van Dam  
Warren and Leta Giedt Endowed Professor  
Chair, Mechanical and Aerospace Engineering
August 1, 2014

Dan Sperling, Professor
Environmental Science and Policy
Davis Campus

Dear Dr. Sperling:

I am pleased on behalf of the Division of Mathematical and Physical Sciences (MPS) to offer my whole-hearted support for the proposal to create a new Energy Graduate Group at UC Davis. As Interim Dean of the Division, I can see how the intersections between Engineering, MPS disciplines, as well as others will provide a good basis for the educational goals of the proposed Group. In my opinion, this is an exciting time to be launching this effort and I am happy to convey my support.

Based on our recent meeting where you shared your vision and plans, it is my understanding the Energy Graduate Group will be related to the established Energy Institute and affiliated partners at West Village. Both of these projects have been leaders in the area of energy research and conservation. With the current momentum for energy work and new discoveries, the strong reputation of UC Davis in this arena, I anticipate this graduate group will draw some of the best students to campus. Further, I believe we have a number of faculty in MPS that would participate in the recruitment of these students and apply for faculty membership of the group as well. Therefore, the time is right in bringing the energy interests of prospective students together with the energy expertise of our UCD faculty.

We look forward to the next steps of your proposal. We want to work with you in establishing the group and making it a success.

Sincerely,

[Signature]
Alexandra Navrotsky, Interim Dean
Mathematical and Physical Sciences

AN:tl
June 23, 2014

Professor Dan Sperling
Interim Director, UC Davis Energy Institute
University of California Davis

RE: Letter of Support for the Energy Graduate Group at UC-Davis

The Department of Plant Sciences enthusiastically supports the creation of an Energy Graduate Group (EGG) which will offer M. Sc. and Ph.D. programs in two tracks: 1) Energy Science and Technology, and 2) Energy Policy and Management. Within these two tracks, sub-core categories are included in Environmental Science and Environmental Management. In particular these two sub-core categories are of special interest for the Department of Plant Sciences as they cover the core area of instruction and research activities.

Faculty members from the department of Plant Sciences are largely involved in the production of plant biomass to be used for feedstock. On campus, our department is the largest group who works on the large scale production of plant biomass and addresses environmental and sustainability issues related to its production. There are a number of courses our faculty members teach including:
- System Analysis in agriculture and natural resources (PLS121, PLS205, PLS206)
- Agroforestry (PLS160)
- Cropping Systems (PLS140, PLS150)
- Agriculture and the Environment and Production (PLS101, 110A, 100B, 100C)
- Plant breeding and genetics for crop improvement (PLS220, PLS222)

The department of Plant Sciences has a strong emphasis on the production of biomass that can be served as feedstock for the production of biofuel products. Activities in the area cover the entire continuum from the molecular and genetics, cellular, organisms, crop, and field level. A sample of faculty members, among numerous others in the department, who are active along this continuum in the area of feedstock and biofuel production are David Neale and Jorge Dubcovsky (molecular and genetics), John Labavitch, Georgia Drakakaki and Alison Berry (cellular and organisms), Dan Putnam (crop) and Steve Kaffka and Chris van Kessel (field).

The department of Plant Sciences is interested and fully committed in training future plant scientists who will become prominent in the generation of energy from biofuel crops. In particular we see great promise in designing biofuel crops that will lead to a higher energy conversion, coupled with a management strategy of a long-term sustainable production system.

Through the establishment of the Energy Graduate Group, the department also sees an opportunity to strengthen the interdisciplinary nature of the development and production of alternative energy sources through plant biomass. Through the formation of the Energy Graduate
Group, the application for interdisciplinary, multiple PI grants should be strengthened. Furthermore, the visibility of the newly established Energy Institute on campus will be vastly enhanced by the establishment of an Energy Graduate Group.

Several graduate courses offered by Horticulture and Agronomy and Plant Biology should be cross-listed with the EGG. The department revised its undergraduate courses and established the majors of Plant Sciences and Ecological Management and Restoration. A number of the upper division undergraduate courses would be most appropriate for graduate students in the sub-core categories of Environmental Science and Environmental Management.

In summary, the department of Plant Sciences strongly endorses the proposal for the establishment a new Graduate Group in Energy. It is most timely and highly relevant to have such a Graduate Group in Energy on campus.

Sincerely yours,

Chris van Kessel
Chair
5 August, 2014

Professor Dan Sperling  
Interim Director, UC Davis Energy Institute  
University of California, Davis

RE: Letter of Support for the Energy Graduate Group at UC-Davis

On behalf of the executive committee of the Transportation Technology and Policy Graduate Group I would like to express our enthusiastic support for the creation of an Energy Graduate Group (EGG).

Our understanding is that EGG will offer M. Sc. and Ph.D. programs in two tracks: 1) Energy Science and Technology, and 2) Energy Policy and Management. Within these two tracks, sub-core categories are included in Environmental Science and Environmental Management. This structure is very similar to the tracks of the TTP program, and complementary. While we expect some students who might have otherwise enrolled in the TTP program to study transportation and energy might in the future choose the EGG program, we believe that this is a positive expansion of the graduate education options at UCD and complementary to the TTP program. Students can now specialize in energy or transportation and we expect that this strong new program will add breadth of opportunity to TTP students to study the relationships of energy and transportation, and similarly EGG students who are interested in transportation will continue to take TTP classes while completing their EGG degree.

We believe that the establishment of the EGG program will add an educational focus to the wide ranging and growing research on campus associated with the Energy Institute and will become an important organizing center for interdisciplinary research that will be attractive to faculty in many departments and students from many disciplines. The close physical proximity of the two programs in the West Village is expected to facilitate further interdisciplinary communication. We expect the joint efforts of the EGG and TTP groups to strengthen proposals for research on transportation and energy, and to attract further attention to the capabilities of the campus to conduct world-leading research on important issues related to energy and transportation.

In summary, we offer our full support to the establishment of the Energy Graduate Group at UC Davis, and welcome any opportunity to help make this vision become a reality.

Sincerely yours,  

John Harvey  
Chair, Transportation Technology and Policy Graduate Group
Appendix B. Letters of Support: Initial EGG Faculty
University of California One Shields Avenue Davis, CA 95616

Dear Dr. Sperling,

I am writing in support of the formation of an Energy Graduate Group at UC Davis, and to indicate that I would like to be a member.

Computer visualization, my research area, can be applied to many different kinds of data. As part of the RISE program, I have been supervising a Masters student who has been working on visualizations for consumers of energy usage and carbon emissions in transportation, both air and automobile. Continuing with this kind of work would fit neatly into the graduate group.

As Director of the UC Davis Center for Information Technology in the Interest of Society, I have had a great opportunity to explore the research and education ecosystem here at Davis. While individual disciplines contribute to energy research in many ways, without a strong unifying structure useful synergies can be overlooked and opportunities can be missed. For instance, we have the opportunity in West Village and with the experimental houses to work with micro-grids, but because it does not fit neatly into existing disciplines it has difficult to get this going. This is even more true for educational opportunities than it is for research. Energy problems are social as well as technical, and cross-training students will make them into much more effective professionals.

Very Sincerely,

Nina Amenta
Bucher Family Professor
Chair, Department of Computer Science
University of California at Davis
August 29, 2014

Re: Application for an Energy Graduate Group at UC Davis

This letter is to confirm my enthusiastic support for and expected engagement with the proposed Energy Graduate Group (EGG) at UC Davis.

I am a faculty member in the Department of Chemistry and a member of the Chemistry graduate group, the Biochemistry, Molecular, Cellular and Developmental Biology graduate group, and the Microbiology graduate group. I was hired at UC Davis under the Energy for the Future initiative. The research in my group involves the intersection of principles and methods in science and engineering for bioenergy research. My research needs an integrated perspective of the important junctions and synergies connecting science and engineering. I believe that EGG will enhance the interdisciplinary approaches in my research group.

While bioenergy research is one of the major topics on which UC Davis focuses, there was not a related course on synthetic biology or metabolic engineering for bioenergy available on the campus. To fill the demand, I developed a teaching module about biosyntheses of valuable chemicals for a graduate course. This class (CHE298) launched in W’14. In W’14, a total of ten students (six from Chemistry, two from BMCDB, two from Microbiology) took this class. The class is designed to introduce graduate students to the basic concepts of renewable microbial synthesis of natural or non-natural chemicals such as biofuels, fragrances, solvents, and plastics. It addresses the gap in formal education created by the emerging field of microbial production of chemicals, by providing students with an understanding of how to apply basic chemical biology skills in order to construct an organism capable of producing renewable replacements for petroleum products. I designed this course so that students can become adept at identifying synthetic routes and enzymes useful for producing a target chemical, and develop the multi-disciplinary skills necessary for design and construction of biosynthetic pathways. I expect that this class will serve the interests and needs of EGG students.

My current research group includes six graduate students (five from Chemistry and one from Microbiology). I expect that when EGG is approved, my research group will grow and EGG students will comprise approximately one-third of my group. EGG students will expand engineering aspects in my research, which is important to deliver our technologies to market.

Sincerely,

Shota Atsumi
September 12, 2014

Re: Application for an Energy Graduate Group at UC Davis

This letter describes my enthusiastic support for and expected engagement with the proposed Energy Graduate Group (EGG) at UC Davis. I strongly support the implementation of this graduate group and plan to contribute to the teaching, advising and administration of the graduate group when it is approved.

I am a faculty member in the Department of Chemistry and a member of the Chemistry Graduate Group. I was hired at UC Davis under the Energy for the Future initiative as one of four hires in Chemistry for the initiative. This hire reflects my interest in the storage of renewable energy through synthesis of homogeneous electrocatalysts that mediate the production of liquid fuels from abundant substrates such as CO₂ and water.

My teaching focuses on Inorganic Chemistry at the lower division, upper division and graduate levels. These interests are reflected in courses taught such as CHE226 Transition Metal Chemistry, CHE124A Inorganic Chemistry: Fundamentals, CHE124C Transition Metal Chemistry, and CHE2C General Chemistry. In each of these classes (with the exception of CHE2C) the majority of students are chemistry majors and the remaining, roughly 10% of students, are drawn from environmental chemistry, agricultural, or engineering majors. The fundamental chemistry of the transition metals has broad application in many areas so I anticipate that the availability of the course to student interested in energy research may increase the enrolment in some of these courses.

My current research group includes graduate students from the chemistry graduate group. My lab currently hosts six graduate students, two postdoctoral associates and three undergraduate students. The research in my lab concerns fundamental chemistry of fuel reactions and so I expect that when EGG is approved, my research group may attract students who have a strong background in chemistry, but have an interest in energy and a wish to educate themselves on policy and engineering concerns of a transition to renewable systems.

Sincerely,

Louise Berben
September 1, 2014

To Whom It May Concern:

I write this letter to express my strong support for the proposal to establish an energy graduate group at UC Davis. I am an Associate Professor in Economics and have a deep background in energy economics and policy. Before coming to Davis I spent 18 years as the research director of the Energy Institute at UC Berkeley and an affiliate of the Energy and Resources Group there. I saw first-hand the advantages that ERG provided to the Berkeley energy community and I believe a program like this would be a great asset to the UC Davis campus.

I currently teach a course in energy economics, ECN 125, that we hope would become part of the EGG curriculum. This class is adapted from an MBA course on energy markets that I co-developed and is now a foundation of the energy focus at the Haas School at Berkeley. We also anticipate graduate students in the EGG who are inclined to do economics focused energy research would be encouraged to take the Industrial Organization sequence in economics, where three of our faculty work extensively on the energy industry topics.

I have participated in dissertation committees in several departments, including the Transportation Policy Program, and enjoy working with interdisciplinary oriented students with a predilection for economic analysis. I am currently advising two students in Agricultural and Resource Economics, both of whom have a focus on energy and environmental economics topics. Because of a strong and growing group of energy economists across both Econ and ARE, these programs are beginning to attract strong applications who are increasingly interested in working on energy focused research.
In short, I look forward to participating in an Energy Graduate Group program that has the potential to both solidify and broaden UC Davis’s standing as a leader in energy research.

Sincerely yours,

James B. Bushnell
September 10, 2014

RE: Energy Graduate Group

This is to express my strongest support for the proposed Energy Graduate Group at UC Davis. It is my intention to contribute actively to the administration, mentoring, and teaching activities of that much needed graduate group once it is approved.

I am a Professor in the Department of Mechanical and Aerospace Engineering. My main area of expertise is computational and theoretical fluid dynamics and transport phenomena with applications to emerging technologies, respiratory flow, combustion systems, and, small hydro powers. I have been teaching and conducting research in that area for about twenty years. I also serve as co-Director of the California Small Hydropower Collaborative (CSHC) which is part of the California Renewable Energy Center. I expect the activities of the CSHC to grow significantly in the coming years, but this will only be possible if we can attract graduate students interested in Energy Systems.

As former graduate adviser for admissions and then vice-chair for graduate studies in MAE, I have experienced first-hand, the challenges associated with recruiting to UC Davis graduate students who are interested in Energy systems. The inherent multidisciplinarity of the field makes it difficult to cover adequately within the existing structure. I have no doubt that, once approved, this new graduate group will enable us to attract these top students to our campus which will, in turn, increase our competitiveness for Energy-related research grants.

Sincerely,

Jean-Pierre Delplanque, PhD
Professor of Mechanical and Aerospace Engineering
delplanque@ucdavis.edu
Re: Application for an Energy Graduate Group at UC Davis

This letter describes my enthusiastic support for and expected engagement with the proposed Energy Graduate Group (EGG) at UC Davis. I strongly support the development of this graduate group and plan to contribute to the teaching and advising of the graduate group when it is approved.

I am a faculty member in the Department of Plant Sciences and a member of the Plant Biology (PBGG) and the Biochemistry, Molecular, Cellular and Developmental Biology (BMCDB) graduate groups. I was hired at UC Davis under the Energy for the Future initiative and was drawn to UC Davis in part because of its graduate group system, which allows for the interdisciplinary training and research which underpins my area of expertise in plant cell wall, and because today’s greatest energy challenges require an interdisciplinary approach in utilizing alternative energy recourses such as plant biomass.

One of the graduate courses that I teach, PBI214 – Plant Cell Walls can serve as a core course for EGG. During the past years students from several graduate groups, with research focused on several aspects of biofuels, have taken this course.

My current research group includes graduate students from the PBGG. I also serve as an advisor to a number of students from Biosystems Engineering and Plant pathology. I expect that when EGG is approved, my research group will grow, since more students will apply to this program at our campus instead of other ones across the nation.
I believe my research group will substantially benefit with the EGG approval and I strongly support its development.

Sincerely,

Georgia Drakakaki
Assistant Professor,
Hellman Fellow
Dept. of Plant Sciences
University of California
Davis, CA 95616
gdrakakaki@ucdavis.edu
530-752-1664
Re: Application for an Energy Graduate Group at UC Davis

I wrote this letter to offer my strong support to the development of the energy graduate group (EGG) and commit to contribute to the teaching, advising and administration of the graduate group if it is approved.

I am a faculty member in the Department of Biological and Agricultural Engineering (BAE) and a member of the department’s graduate group as well as the Microbiology graduate group. I was hired at UC Davis under the Energy for the Future initiative. My primary research interests are in advancing technologies for production of fuels and chemicals from renewable resources, including metabolic engineering and biocatalyst development; fermentation process development and modeling; biological and chemical process design and economic evaluation. Now I am working on projects related to ethanol and isobutanol production from cellulosic materials.

My current research group includes graduate students from both BAE (two students, one PhD and one MS) and Microbiology (one PhD). I see that the unique features of EGG will be able to attract students my current associated graduate groups could not attract. I am very excited to recruit and advise students from EGG when it is approved.

I am also committed to support the teaching in EGG. I developed an undergraduate course on kinetics and reactor design (EBS 161) and now this course is the only elective offered to BAE undergraduate students who are interested in the bioprocessing direction. I plan to develop a graduate level course along that line and co-list this course as one of the electives for the EGG. I expect that students from BAE, CHMS and EGG would be interested in this course.

I will be happy to serve on committees and participate in the administration of graduate group as needed.

I would like to offer my strong support for the EGG application and would appreciate you would give the EGG application a favorable consideration.

Sincerely,

Zhiliang Fan
Re: Application for an Energy Graduate Group at UC Davis

I am writing to provide my enthusiastic support for the proposed Energy Graduate Group (EGG) at UC Davis and I plan to support and contribute to the development and organization of this graduate group through teaching, student advising and other administrative contributions.

I am a faculty member in the Department of Chemistry and a member of the department's graduate group as well as the Agricultural and Environmental Chemistry Graduate Group, and the Graduate Group of Biochemistry, Molecular, Cellular and Developmental Biology. My active participation in these Graduate Groups, as well my participation in the Designated Emphasis for Biotechnology, demonstrate my strong support for interdisciplinary research and training for graduate students. The current courses that I teach have been focused in traditional areas of organic chemistry, but I have discussed the design of new courses with several colleagues and I always incorporate issues of energy and fuel in my CHE 8 and 128 courses.

My current research group includes one PhD student from BMCDB, who is focusing on energy-related research, and 9 students in Chemistry (8 PhD and one MS), of which one is currently focusing on energy-related research in the area of Bioorganic Chemistry. I have recently graduated two PhD students whose dissertation research was in the area of Analytical Chemistry with a focus on energy-related research. I also have several undergraduate students from engineering and chemistry who are also participating in various research projects in my laboratory.

I strongly believe that approval of the EGG will have a substantial impact on the recruitment of graduate students and the growth of research efforts and collaborations focused on energy-related research, which will continue to develop the role of UC Davis as a leader in the field of energy research.

Sincerely,

Annaliese Franz
Associate Professor
Department of Chemistry
University of California, Davis
September 2, 2014

Re: Application for an Energy Graduate Group at UC Davis

I am writing to communicate my strong enthusiasm for and expected engagement with the proposed Energy Graduate Group (EGG) at UC Davis. I support the development of this graduate group and expect to continue contributing to the teaching, advising and administration of the graduate group when it is approved.

I am a faculty member in the Graduate School of Management and have been involved with the Energy Institute, as well as the related Energy Efficiency Center and the Institute for Transportation Studies since 2004. Additionally, I have taught a number of students in my graduate courses: MGT251: Management of Innovation, MGT250: Technology Management, and MGT298: Business Development. These courses offer engineering and science students a set of perspectives and tools related to the management of innovation and entrepreneurship, and an understanding of how technology and policy shape and are shaped by processes of innovation. I look forward to teaching more such students.

Sincerely,

Andrew Hargadon, Ph.D.
Charles J. Soderquist Chair in Entrepreneurship
UC Davis Graduate School of Management
26 September 2014

Daniel Sperling, Professor
Director, UC Davis Energy Institute
University of California
Davis, CA  95616

Re: Energy Graduate Group

Dear Dan:

This is to indicate my strong support, both as participating instructional faculty and as the new chair of the Department of Biological and Agricultural Engineering, for the proposal to establish an energy graduate group at UC Davis. I am pleased to see this new proposal being advanced and look forward to having an active graduate group on the campus in this important area.

As you are aware, I had earlier committed to helping teach within the core of the EGG program and reaffirm that commitment here. I have taught both undergraduate and graduate courses in energy and energy-related topics since arriving as a member of the faculty on the campus, and have long observed the need and opportunity for a comprehensive multidisciplinary graduate program addressing the diverse nature of the field. My graduate level EBS 216 course on Energy Systems has over the years attracted students from a variety of backgrounds and disciplines who share a common interest in understanding how energy conversion and use, as essential elements of society, can be made more sustainable. Many of these students have expressed interest in taking an advanced degree in an energy-specific discipline and the potential to enroll in an energy graduate group has generated a substantial amount of excitement.

As department chair, I echo the support of our previous chair expressed in his letter regarding the Energy Graduate Group. The department is privileged to have two faculty hired under the Energy for the Future initiative who join other departmental faculty with research programs focused on energy related subjects, principally in bioenergy but extending to other areas as well including solar energy, energy efficiency, materials, and systems engineering. The Energy Graduate Group is an excellent complement to the education and training offered through the department and its affiliated Biological Systems Engineering graduate program and I believe both programs will prove mutually supportive in attracting excellent students.

Sincerely,

Bryan M. Jenkins
Professor and Chair

[Signature]
September 2, 2014

Re: Application for an Energy Graduate Group at UC Davis

I am writing to state my strong support and expected engagement with the proposed Energy Graduate Group at UC Davis.

I am an Assistant Professor in the Biological and Agricultural Engineering Department. I am a member of my department’s Biological Systems Engineering (EBS) Graduate Group and the Chemical Engineering and Materials Science (CHMS) Graduate Group. My primary area of research is in the bioconversion of cellulosic biomass for advanced (second generation) biofuels production.

I currently advise four Ph.D. students (3 EBS and 1 CHMS), three of whom joined my group to pursue bioenergy research. In the past 6 years, two other students graduated from my group with M.S. degrees, having conducted bioenergy research. While my group’s research has a strong engineering focus, we also conduct technical but non-engineering inquiries in our work (e.g. biochemical or molecular biology based inquiries). However, my current membership in engineering graduate groups limit my contact to applicants with a minimum of a B. S. in an engineering discipline. A major reason for my enthusiasm for the establishment of the Energy Graduate Group (EGG) is the anticipated diversification of my research program by opportunities to integrate graduate students with technical but non-engineering backgrounds. Bioenergy research is inherently multidisciplinary and will benefit from strong collaboration amongst students from various technical disciplines.

I teach four courses per two year cycle as is customary for the EBS major. One of the courses is an EBS graduate course in Polysaccharides Interfacial Interactions that was recently submitted for cross listing as a graduate course in the CHMS graduate program. Polysaccharides and carbohydrates are primarily feedstock for biochemically derived advanced biofuels, thus I anticipate that this is a course that can be cross-listed in the EGG as well.

In short, I am in strong support of the establishment of EGG and am eager to engage energy-minded graduate students.

Sincerely,

Tina Jeoh
Assistant Professor
Biological and Agricultural Engineering
UC Davis
Distinguished Professor Susan M. Kauzlarich  
Chair of Chemistry, ACS Fellow  
email: smkauzlarich@ucdavis.edu

Professor Dan Sperling  
Director, UC Davis Energy Institute University of California Davis

Re: Application for an Energy Graduate Group at UC Davis

Dear Professor Sperling:

This letter describes my enthusiastic support for and expected engagement with the proposed Energy Graduate Group (EGG) at UC Davis. As you will see in this letter I strongly support the development of this graduate group and plan to contribute to the teaching, advising and administration of the graduate group when it is approved.

I am a faculty member in the Chemistry Department and my research is in the area of sustainable energy. In particular, I am currently working on new materials for high efficiency thermoelectrics (direct heat to electrical energy conversion) and nanomaterial for solar energy conversion (photovoltaics). I have been involved in a number of collaborative and interdisciplinary proposals on critical materials for sustainability, a MRSEC on materials for emerging technologies, and Solar energy collaborative funded by NSF. While in my field, I have achieve significant recognition for my work in these fields in Chemistry, I believe that the Energy Institute would allow for even better development of new materials for Energy Sustainability.

I designed a course on Solid State Chemistry that could easily be adapted as a course course for the EGG. In this course, I present the materials requirements and design of new materials for energy and functional applications. I believe that some of my graduate students would be interested in the broader curriculum that the EGG would provide.

Sincerely,

Susan M. Kauzlarich
August 12, 2014

Re: Application for an Energy Graduate Group at UC Davis

This letter describes my enthusiastic support for and expected engagement with the proposed Energy Graduate Group (EGG) at UC Davis. As you will see in this letter I strongly support the development of this graduate group and plan to contribute to the teaching, advising and administration of the graduate group when it is approved.

I am a faculty member in the Department of Civil and Environmental Engineering (CEE) and a member of the department’s graduate group as well as the Transportation Technology and Policy (TTP) graduate group. I was hired at UC Davis under the Energy for the Future initiative and was drawn to UC Davis in part because of its graduate group system, which allows for the interdisciplinary training and research which underpins my area of expertise and research in the field of industrial ecology, and because today’s greatest challenges and potential innovations require an interdisciplinary approach.

My graduate course, ECI244 – Life Cycle Assessment for Sustainable Engineering, will serve as a core course for EGG (EGG 201). This course was designed with EGG in mind and already has a strong focus on energy and energy systems, and already draws students from a variety of graduate groups. The class benefits from the multi-disciplinary perspectives in the room, and will be enhanced by the addition of EGG students who will bring knowledge and enthusiasm about energy systems and policy to the class. This is one of three courses I teach each year. I am just transitioning to a new schedule of courses which will permit me to teach two graduate courses. This new teaching schedule will include a follow-up course to ECI244 that will be designed for multidisciplinary enrolment and will, I expect, serve the interests and needs of EGG students.

My current research group includes graduate students from both CEE (two students, one PhD and one MS) and TTP (three students, one PhD and two MS). I also serve as an advisor to a number of MS plan 2 students for CEE, who do not participate in research as part of their MS degree. I expect that when EGG is approved, my research group will grow and EGG will comprise approximately one half to two-thirds of my research group, making EGG my primary graduate group affiliation. Over my seven years at UC Davis I know with certainty that two of my graduate students would have applied to EGG if it was available to them, indicating that I might see a modest reduction in students from TTP and CEE.
However, at this time I have difficulty recruiting a sufficient number of students with the appropriate background and interests, in part because those interested in my research are not necessarily interested, nor do they have the appropriate background, for enrolling in the CEE or TTP graduate groups. Thus, I believe my research group will grow substantially when EGG is approved.

Sincerely,

Alissa Kendall, PhD
Associate Professor
Department of Civil and Environmental Engineering
University of California, Davis
One Shields Ave. Davis, CA 95616
Phone: (530) 752-5722 / Fax: (530) 752-7872
Email: amkendall@ucdavis.edu
This letter is in strong support of the Energy Graduate Group (EGG) proposed by Professor Daniel Sperling and his colleagues and to express my interest in participating in the program, if approved. I am a professor of Materials Science of Engineering (MSE) and currently also serving as an affiliate faculty member of the UC Davis Energy Institute, the Institute of Transportation Studies at UC Davis (ITS-UCD), Nanomaterials in the Environment, Agriculture, and Technology Organized Research Unit (NEAT-ORU), California Solar Energy Collaborative (CSEC), and Center for Information Technology Research in the Interest of Society (CITRIS).

My research centers on a mechanistic understanding of ion conduction in solids to be used in next-generation energy storage and production devices such as batteries, supercapacitors, and fuel cells. I have been actively serving on organization committees for various international meetings on energy research over the past decade and also as a reviewer or a speaker for DOE Annual Merit Review and Advanced Research Projects Agency-Energy (ARPA-E) meetings for solid oxide fuel cells.

I have been teaching both graduate- and undergraduate-level thermodynamics courses (EMS 260 and EMS 160) for the MSE students for many years. Furthermore, I created EMS 170 entitled “Sustainable Energy Technologies” and have been offering this course for the UCD Summer Abroad programs since last year. This course, offered in Seoul, South Korea during summer each year, consists of in-class lectures and technical excursions to major energy industries in Korea to provide the students from all UC campuses a unique opportunity learn future clean energy technologies. The course has been really well received by the students participated.

I strongly believe that I will be able to provide my research and teaching expertise in energy related topics to the Energy Graduate Group once established.

Thank you.

Sincerely,

Sangtae Kim
Professor
Department of Chemical Engineering and Materials Science
University of California, Davis
E-mail: chmkim@ucdavis.edu
Phone: 530-754-2254
August 30, 2014

Re: Application for an Energy Graduate Group at UC Davis

This letter describes my enthusiastic support for and expected engagement with the proposed Energy Graduate Group (EGG) at UC Davis. I strongly support the development of this graduate group and plan to contribute to the teaching when it is approved.

I am a faculty member in the Department of Chemistry and a member of the Chemistry graduate group. I was hired at UC Davis under the Energy for the Future initiative. I am teaching three courses each year. Materials Chemistry graduate course has an interdisciplinary nature and strong focus on materials for energy applications. This course may be embedded into EGG curriculum, as one of elective courses for natural science students.

My current research group includes graduate students (4) and postdocs (2) from Chemistry. All are involved in different projects dedicated to synthesize new energy materials with improved properties. I believe that graduate students from EGG may bring new perspectives in my research group.

Sincerely,

Dr. Kirill Kovnir
Assistant Professor

Department of Chemistry

University of California, Davis

Phone: (530) 752-5563
e-mail: kkovnir@ucdavis.edu
To: Dan Sperling / Adam Schultz  
Re: Proposed Energy Graduate Group (EGG)

Thank you for the opportunity to indicate my support for the proposed UC Davis Energy Graduate Group. On July 1, I retired from my position on the faculty of UCD's Plant Sciences Department after 38+ years. However, it is my intent to remain active in teaching and research, including bioenergy-related research that is based in my laboratory and in the labs of colleagues. My support for the EGG is based on (1) the success of the grad group model that I have experienced in my years at UCD, (2) my opinion that the challenges associated with development of energy sources that do not imperil the Earth's "health" demand insights and creativity that must blend the expertise of many disciplines, and (3) my sense that this blending will require researchers who can usefully think in and speak a shared language.

Because I am now Emeritus, I will most likely share the role of guiding students in their research with other formally active faculty and senior researchers. This is what I have done for the past few years, in anticipation of retirement and it has worked well. A good example is in the students I have worked with as a part of the "microalgae biofuels" project that is based in Prof. VanderGheynst's lab and mine, a project that has led to Ph.D. degrees for students in the Horticulture and Agronomy (HA) and Biological Systems Engineering programs. My primary grad programs will remain Plant Biology (PBGG) and HA. For several years I have led a core course in each of these grad groups and I will continue to teach in these courses. The Plant Biology core course (PBI200B) and the Plant Cell Wall course (PBI214, which I will also continue to teach; next in Fall, 2014) are listed in Table 2 of the EGG proposal (section 2.11, Table 2) as part of the Biological Sciences Sub-Core Area 2. Over the years, several students in Biological and Chemical Engineering have taken PBI214. I also will remain a member of the Plant Pathology grad group, but have not been officially connected to a student research guidance committee in Plant Path for the past 3-4 years. A PBGG Ph.D. student in my lab is now finishing his degree and I will be associated with a student who will begin her MS program in HA in the Fall. She will be continuing work on fruit-pathogen interactions that has been developed by several students over the past 6 years. I am also involved in guiding the research of 2 students for whom Prof. VanderGheynst serves as major professor. In my opinion, my involvement with the EGG program will not have any negative impact on my involvement with my other graduate programs; rather, I think my EGG involvement will enhance my contributions in other programs!

I see as the EGG's most important contribution, the training of young scientists (1) as specialists in various disciplines pertinent to today's interest in developing a more diverse sense of what tomorrow's energy should be (2) and who are capable of talking with each other on a common, creative ground. The EGG will accomplish this and I look forward to being a part of the effort.

Sincerely,

John M. Labavitch
Professor Emeritus
September 3, 2014

Re: Application for an Energy Graduate Group at UC Davis

I am writing this letter to express my enthusiastic support for the proposed Energy Graduate Group (EGG) at UC Davis. I am a faculty member in the Department of Civil and Environmental Engineering (CEE) and a member of the department’s graduate group as well as Transportation Technology and Policy (TTP) and Geography (GGG) graduate groups. My research lies at the interface of water and energy systems. I have found it a challenge to recruit students with interests congruent with mine into these existing graduate groups. Students interested in CEE, TTP, and GGG generally do not have an interest and/or technical background in water-energy systems. Additionally, the program requirements of these existing graduate groups represent a huge obstacle in tailoring programs of study for students with an interest in water-energy systems. I personally feel that EGG would not duplicate or compete with any existing graduate group at UC Davis. Additionally, I feel EGG would expand the breath and depth of energy related research and graduate education at UC Davis.

Sincerely,

Frank Loge, Ph.D., P.E.
Professor and CEE Graduate Advisor
Department of Civil and Environmental Engineering
University of California Davis
One Shields Avenue
Davis, CA 95616
530.754.2297
filoge@ucdavis.edu
September 5, 2014

Re: Application for an Energy Graduate Group at UC Davis

This letter is written in support of the proposal to constitute an Energy Graduate Group (EGG) at UC Davis. The global momentum in renewable energy is leading the top universities to organize and coordinate their efforts in this field, and UC Davis should be no exception, particularly taking into account its history as an innovator in the agricultural, environmental, and physical sciences.

My appointment is in Chemistry and at this time I am not a member of any other graduate groups, but I see the graduate group system as a substantial advantage both to faculty who benefit from the ability to recruit students from different disciplines, and to students whose research interests may not be confined to those of the faculty in their department.

I have co-developed and co-taught a relevant course (The Chemistry of Petroleum Alternatives) with my colleague Pieter Stroeve in the Chemical Engineering department which could form part of an initial offering for students in the EGG. Other core courses in organic chemistry (CHE 118 or 128/129 series), which are highly relevant to biorefinery research, could also be cross-listed. Finally, my graduate course on Industrial Chemistry (CHE 221B), which includes substantial material on petroleum and biomass-derived energy and products, alongside alternative energy sources, may also serve the needs of EGG students.

My research program spans fundamental chemistry, pharmaceutical chemistry, and renewable chemistry. The group currently consists of ten members, constituted from visiting professors, postdocs, graduate and undergraduate students. I have up to this point not had the opportunity to recruit outside my department, but would welcome the chance to mentor students in a future EEG, ideally in a collaborative, interdisciplinary arrangement with other EEG members with common interests.

In summary, I have volunteered myself to be an inaugural EGG faculty member and undertake to contribute to it both academically and in any organization/administrative role that may benefit from my expertise in this field. I believe the creation of an EGG would be highly beneficial to UC Davis, and I strongly support the approval of this application.

Sincerely,

Mark Mascal
Professor of Chemistry
August 29, 2014

Re: Application for an Energy Graduate Group at UC Davis

I am writing this letter to express my support for the proposed Energy Graduate Group (EGG) at UC Davis. I am a faculty member in the Department of Civil and Environmental Engineering (CEE) as well as the Department of Mechanical and Aerospace Engineering. I also hold the Sempra Energy Chair in Energy Efficiency, and am the Director of the UC Davis Western Cooling Efficiency Center (WCEC), which has 15 full-time staff and at least 15 students, all doing research on Energy Efficiency. As you might guess from the number of appointments that I have, my research is rather interdisciplinary, with the common thread being energy efficiency. Thus, the idea of forming an Energy Graduate Group makes a lot of sense to me, as it would reinforce the common thread, as well as foster more interactions between WCEC staff/students and other professors/students whose research is focused in the energy sector.

Currently I have 7 graduate students working in my research center, spanning three different departments at UC Davis: MAE, CEE and Sociology. The breath of their interests is quite large, ranging from understanding aerosol transport and deposition, to phase change materials, to ground-source heat pumps, to rainwater capture, to human behavior with respect to energy, with the common focus of their research being energy efficiency. I believe that these and future students would benefit from being members of the same graduate program, and that the proposed EGG would fit that need very nicely. For all the above reasons, I would encourage the creation of, and would be glad to join, an Energy Graduate Group at UC Davis.

Sincerely,

Mark Modera
Professor
Department of Civil and Environmental Engineering
Department of Mechanical and Aerospace Engineering
Director, Western Cooling Efficiency Center
Sempra Energy Chair in Energy Efficiency
Phone: (530) 754-7671 Email: mpmodera@ucdavis.edu
I am a faculty member in the Department of Chemical Engineering and Materials Science (CHMS) and a former member California Renewable Energy Collaborative (CREC). For CREC I served as the technical director for solar energy and in this role was responsible for collaborative research initiatives discussing the use of solar energy in California. I was hired at UC Davis under the Energy for the Future initiative specifically for solar energy devices based on organic materials. For my first five years at UC Davis organic photovoltaic devices were the main research subject from my group. I have graduated 4 PhD students and received tenure and continue to work on electronic polymers for energy applications.

For the technological development of PV and other light harvesting energy devices, I am able to get graduate students at UC Davis with fantastic credentials. UC Davis engineering students arrive with strong training and are able to fill all of the roles within my group necessary for the scientific parts of device work.

Unfortunately, (at least for me) the quality, cost and materials for PV devices does not limit their deployment worldwide. If this were the case, we would live in a world with mostly renewable power. Instead the power controlling systems, design of the electricity grid, the cost of changing technology bases, the political will power and the understanding of global warming limit the deployment of renewable energy. It is not enough to understand that using renewable energy is the right thing to do or even that given the current technology, that it is possible to convert all energy systems over to renewable energy; The process of adaption and the policy necessary to guide the change from fossil to renewable energy is in fact the sticking point for change. It will not be engineers that design this problem away, but rather individuals that have a broad understanding of energy policy and economics as well the engineering and technological aspects of renewable energy technologies.

The energy graduate group (EGG) seeks to fill this gap in graduate training by a combined course of economics, policy, and technical training. This new line of training is important because it would not be appropriate to expect traditionally trained engineers (for example) to learn this “non-engineering” information but to still be receiving an engineering degree. Examples include production cost modeling of PV projects, determination if whether a new product is safer or more efficient in-use than an another technology or determining the necessary changes in cost structure that make new technology affordable (or at least stop subsidizing old technologies) are really necessary parts of the energy studies equation that are not covered within any academic program at UC Davis.

It is for these reasons that I recommend approval of the EGG. I have, through CREC, been exposed to all of the Energy problems and decided that I will maintain research in engineering areas. If at some point in the future I become more interested in deployment of light harvesting devices (rather than
lab research on them) I would like to have the option of hiring students that are interested in these other areas and I would hire them through the Energy Graduate Group.

Yours sincerely,

Adam Moule

Prof. Adam J. Moule
Chemical Engineering & Materials Science
University of California, Davis
August 30, 2014

Re: Application for an Energy Graduate Group at UC Davis

I am writing in enthusiastic support of the recent application for forming an Energy Graduate Group at UC Davis. I strongly support the formation of the graduate group, as it aligns very well with my research and teaching interests.

I am a professor in the Department of Environmental Science and Policy, and a member of the Transportation Technology and Policy (TTP) and the Civil and Environmental Engineering (CEE) graduate groups. I have also served on graduate committees for students in Mechanical and Aerospace Engineering. I direct a $2 million/year interdisciplinary research program (the Sustainable Transportation Energy Pathways program) at the Institute of Transportation Studies, which focusses on the energy dimensions of transportation futures and involves about 20 graduate students from a variety of departments. My academic background is in physics (Ph.D. University of Maryland in theoretical plasma physics, 1977), and for the past 30 years I have worked in energy systems studies, especially in the areas of alternative fuels, energy transitions, renewable energy and technology assessment. I joined the faculty at UC Davis in 2003, in part because of its graduate group system, which allows for the interdisciplinary training and research so necessary in my field of research. The formation of an Energy Graduate Group at UC Davis would fit exactly with my research interests. I am excited about the prospect of attracting new, excellent energy graduate students to UC Davis.

If the EGG graduate group is approved, I would plan to take an active role in teaching courses, and advising students. I currently teach two advanced undergraduate/graduate courses ESP 167 (Energy Policy) and ESP 168a (Policy analysis) which would be of strong interest to students in EGG. In addition, the formation of the EGG would be a great opportunity to develop new graduate classes in the areas of energy systems modeling or technology assessment.

In summary, I am strongly supportive of the application and plan to contribute to the new EGG if it is approved.

Please do not hesitate to contact me, if I can provide more information.

Sincerely,

Dr. Joan M. Ogden
Professor of Environmental Science and Policy
University of California, Davis
Phone: 530 752-2768
jmogden@ucdavis.edu
Dear Dan and Adam,

Congratulations on putting together such a comprehensive proposal on the Energy Graduate Group (EGG) program. I enjoyed reading it and found it very convincing, in terms of need, execution, and growth potential. The EGG at UC Davis has been long overdue, considering the strong existing research on campus in the energy area, and the unique faculty and facilities that are available here. The development of Sustainable Energy technology and its implementation is key to the California economy and to the living quality in the State. It befits the University of California well to make Sustainable Energy a focus in the academic programs and in the daily operations of the campus. The UC Davis Energy Institute, West Village, the recycling and energy conservation programs on campus are beacons that promote the University nationally and internationally. Already now these initiatives help attract and inform the next generation of students for whom sustainable energy is more than just a dream. With the planned EGG these students now will receive a needed academic base, and a training ground that will prepare them for a professional career in sustainable energy.

As you point out, research activities in energy science have increased substantially over the past years, thankfully, due to increased funding from federal and state agencies, and private foundations. Already, now at least 16 faculty in the Chemistry Graduate group have active research programs on energy related topics. These individuals mentor approximately 75 graduate students, which qualifies them as potential mentors for students from the EGG and as potential instructors for EGG courses. Upon joining the EGG, these faculty would likely remain members of the Chemistry Graduate Group (GPC).

As a GPC member, my own research is also centered on sustainable energy, specifically, solar energy to fuel conversion. Currently, my group consists of 8 chemistry graduate students and 3 visiting students. I teach two podium courses every year, of which the graduate level course ‘Homogeneous Catalysis’ might be suitable for EGG students in the Energy Science and Technology track. As a future member of the EGG, I could also imagine to develop a graduate course on ‘Photoelectrochemistry and Photocatalysis’, a topic central to my research activities at UC Davis. I believe that EGG membership would enrich my experience as a faculty and teacher at UC Davis.

In summary, as a Chemistry faculty member and as the Chemistry Graduate Group Chair, I give my strongest support to the proposed Energy Graduate Group at UC Davis.

Sincerely yours,
September 16th, 2014

Re: Application for an Energy Graduate Group at UC Davis

Dear whom it may concern,

I am an associate professor in the department of mechanical and aerospace engineering. I am writing this letter to express my sincere endorsement for the Energy Graduate Group at UC Davis.

The issues of energy and environment are some of the most critical dilemmas we face in the twenty-first century. Research covers broad range of science and engineering requiring significant interdisciplinary efforts to achieve goals. For example, fuel cells and batteries are electro-chemical devices but are the core components of modern mechanical power-trains that my research group is working on. Due to limited knowledge and experience in electro-chemical fundamentals, my graduate students have been seeking relevant educations as well as collaborations with researchers in chemical, electrical and civil engineering areas.

With no doubt, graduate group will facilitate collaborations among students and faculties in different departments creating significant synergies. In turn, this will lead to a great success in research funding. The graduate group will also provide the students with higher degrees with well suited educations for the competitive job markets in energy area.

Overall, the Energy Graduate Group at UC Davis will benefit not only the students and faculties but also the University and Nation. I will actively collaborate with other researchers and willingly support this program in terms teaching and other academic services.

Sincerely,

[Signature]

Jae Wan Park, Ph.D.
Associate Professor
Mechanical and Aerospace Engineering
University of California, Davis
One Shields Avenue
Davis, California 95616
Tel: 530 752 5559
To whom it may concern:

I am writing to express my strong support for the formation of an Energy Graduate Group (EGG) at UC Davis. I am an Assistant Professor in Economics, and was an “energy initiative” hire in 2008. My entire research portfolio relates to energy and environmental markets, and the community of energy researchers at UC Davis has been a valuable source of ideas, feedback and support. An EGG will serve to strengthen the fabric of this research environment, and I will endeavor to support it in any way that I can.

The way that graduate students fit into the research “production function” in economics is somewhat different from that of most other disciplines. For example, graduate students in economics are accepted into a departmental pool, and funded primarily through teaching assistantships. It is rare for economists to accept and fund students as part of their individual laboratory, although perhaps one achievement of EGG will be to help facilitate the inclusion of economics students as a source of financial support. I anticipate that my main contribution to EGG will be via teaching and, when the opportunity presents itself, advising.

My contribution to EGG teaching will initially be through my energy economics class (ECN 125), which I developed from scratch in 2010. This class covers a wide range of topics spanning the theory of externalities and pollution markets to evaluating the performance of second-best climate change mitigation policies (e.g. Corporate Average Fuel Economy standards). The class is intended to bring students to the frontier of understanding environmental and energy policies. The vast majority of students taking ECN 125 are undergraduates majoring in Economics, Managerial Economics, or Environmental Science & Policy. However, it was designed with Transportation, Technology and Policy graduate students in mind, and I hope that it would fit seamlessly into the EGG curriculum.

In summary, I strongly support the formation of EGG and look forward to being an active contributor in whatever ways that I can. Please don’t hesitate to contact me if any additional information would be helpful.

Warm Regards,

David Rapson
Assistant Professor
Economics Department
Re: Application for an Energy Graduate Group at UC Davis

I am writing to support the proposed Energy Graduate Group (EGG) at UC Davis. I plan to contribute to the advising and mentoring of the graduate group students when it is approved.

I am a faculty member in the Department of Plant Pathology and the Genome Center and serve as Director of Grass Genetics and the Joint Bioenergy Institute in Emeryville.

My current research group includes graduate students from several graduate programs (Plant biology, IGG, MCB and Plant Pathology). I expect that when EGG is approved, I will recruit students from EGG with a particular focus on bioenergy crops.

Sincerely,

Pamela C. Ronald
Professor, Department of Plant Pathology and the Genome Center
The University of California, Davis
Director, Grass Genetics, JBEI
August 29, 2014

RE: Application for an Energy Graduate Group at UC Davis

I am pleased to submit this letter in support of establishing an Energy Graduate Group (EGG) at UC Davis. Once established, I look forward to contributing to the graduate group by mentoring graduate students and instructing courses within the group.

I joined the faculty of the Department of Food Science and Technology in 2013. My position was created via a unique agreement between the Department of Food Science and the Energy Efficiency Center at UC Davis to address a need for energy efficiency and sustainable energy in food processing. Currently, I am a member of the Food Science graduate group and Biological Systems Engineering graduate group. Having earned my PhD in the Biological Systems Engineering graduate group at UC Davis, I have had the unique opportunity of being on both sides of the graduate group system at UC Davis. As a result, I am keenly aware of the power of graduate groups to bring together people and resources across disciplines to facilitate high-impact research. As such, the Energy Graduate Group is necessary to best train the next generation of leading scientists and engineers at UC Davis to tackle energy-related issues.

As my faculty appointment is relatively new, I have the opportunity to develop new courses going forward. The first graduate course I intend to create in the food science curriculum is “Sustainable Food Processing.” This course will capture many concepts relevant to the EGG, such as combined heat and power, waste heat capture, and generation of bioenergy from waste biomass. I expect EGG students will find value in this course for its applied science approach to an essential industry. Currently, I teach one course, Physical Principles of Food Processing (FST 110). As I enter the second year of my faculty position, this will grow to two courses each year. I expect my proposed sustainable food processing graduate course to become the third I teach.

I currently mentor four PhD students across the two graduate groups I participate in. I would expect this number to grow via participation in the EGG. Specifically, I see students from the EGG comprising approximately one quarter to one third of my lab, comparable to representation from the biological systems engineering graduate group. Furthermore, I see EGG students as the best avenue to conduct research related to process modeling and technoeconomic analysis of energy use in food processing pipelines – an area where I currently have trouble recruiting students from existing graduate groups. While my primary graduate group affiliation will be in Food Science and Technology, I see participation in the EGG as a critical element to advancing energy efficiency and renewable energy research in my field. I strongly support and encourage enactment of the Energy Graduate Group.
Sincerely,

Christopher W. Simmons, PhD
Assistant Professor
Department of Food Science and Technology
University of California, Davis
One Shields Avenue, Davis, CA 95616
Phone: 530-752-2109
Email: cwsimmons@ucdavis.edu
Re: Application for an Energy Graduate Group (EGG) at UC Davis

I give my strongest support to the establishment of an “Energy Graduate Group” at UC Davis. I expect to participate in this group in terms of teaching, advising, research and administration.

I am a Distinguished Professor of Chemical Engineering and Materials Science at the University of California Davis (UC Davis). I have worked as a professor at the Department of Chemical Engineering and Materials Science, UC Davis for over 32 years. Previously, I worked 4 years as an Assistant and Associate Professor at the Department of Chemical Engineering, State University of New York in Buffalo. I obtained my bachelor’s degree in Chemical Engineering at the University of California Berkeley, and my masters and doctoral degrees in Chemical Engineering at the Massachusetts Institute of Technology, Cambridge, MA. I have published approximately 260 scientific papers. My research work is in solar energy, biomass conversion to fuels, nanotechnology, colloid science, biotechnology, separations and electrochemical engineering. I am a Fellow of the American Institute of Chemical Engineers and a member of the American Chemical Society. I am also the Director of the California Solar Energy Collaborative at UC Davis. I am a member of the graduate group in Electrical and Computer Engineering and the Graduate Group in Transportation Technology and Policy.

My research in the energy area has increased significantly in the last few years and the demand by graduate students to obtain a PhD in the energy area has increased correspondingly. I have collaborated with several faculty members at UC Davis and with others in the States and abroad. It is clear that interdisciplinary research in energy is of utmost importance since many energy systems or new energy developments are very complex. I have worked extensively in both the solar energy area and in biomass conversion to liquid fuels. Currently, I have 4 PhD students and 3 postdocs. Several undergraduate students are doing senior honor studies with me. In the last four years, I have had several students from other Departments (Mechanical and Aerospace Engineering, Electrical and Computer Engineering, and the Institute of Transportation) work with me on energy research. In addition to energy; I work in several other areas as indicated above. The existence of an EGG would be beneficial to students and postdocs involved in energy research. My students would be able to interact, within an EGG framework, with the many students that work on energy on the UC Davis Campus.

I teach courses that are important in the energy field such as thermodynamics, heat transfer, fluid mechanics, mass transfer and engineering mathematics. I have won many teaching awards at UC Davis. Currently I teach 3 courses with large enrollments. Some of these courses could be cross-listed with EGG. It is obvious to me that an integrated group of courses in EGG could help graduate students in their research and their future. For example, a graduate level course in thermodynamics with a strong focus on energy systems is of great importance. The laws of thermodynamics are of fundamental importance in analyzing energy processes and energy systems.
I see numerous benefits in an EGG at the UC Davis campus in: teaching, collaborative research, opportunities for funding, participation in campus conferences, and the recruitment of students by academia, industry and government.

Regards,

Pieter Stroeve
Distinguished Professor of Chemical Engineering and Materials Science
Co-Director of the California Solar Energy Collaborative
Department of Chemical Engineering and Materials Science
University of California Davis
1 Shields Ave.
Davis, CA 95616
Phone: 530-752-8778
Fax: 530-752-1031
Web sites:
http://www.chems.ucdavis.edu/faculty/stroeve/contact.html
http://solar.ucdavis.edu
August 31, 2014

Dear Dan,

It is my pleasure to enthusiastically support your proposal to establish a graduate program in Energy. Listed below are my responses to questions posed by the Graduate Council and Office of Graduate Studies.

1. Will the proposed program be your primary graduate program affiliation?
   I expect my affiliation to be split equally between the Biological Systems Engineering graduate program and the Energy Graduate Group.

2. Will you teach a course in the proposed program and what course?
   I plan to offer two courses to students in the program: Mass Transfer and Kinetics in Biological Systems Engineering (EBS 127), and Renewable Bioprocessing (EBS 267).

3. How many graduate programs are you currently a member of?
   I am a member of the Biological Systems Engineering graduate program.

4. How many courses do you currently teach?
   I currently teach EBS 267, EBS 127 and Introduction to Engineering Design (ENG 11).

5. How many graduate students are you currently mentoring?
   I am the major professor for four PhD students and one MS student. I am on the thesis and dissertation committees of several other students. I also direct the Renewable Energy Systems Opportunity for Unified Research Collaboration and Education (RESOURCE) NSF-GK12 graduate training program. In this role I annually provide financial support and advising to 10-12 graduate fellows pursuing research in the area of renewable energy.

6. How will participation in EGG affect your participation in other graduate programs?
   Participation in EGG will not affect my participation in the Biological Systems Engineering graduate program.

Thank you for your leadership in this important education and training effort for our campus. I look forward to working with you on future developments in this program.

Best regards,

Jean VanderGheynst
Professor
August 30, 2014

Re: Application for an Energy Graduate Group at UC Davis

I would like to express my enthusiastic and strong support advocating for the creation of an Energy Graduate Group at UC Davis. Given the vast number of undergraduate and graduate students, research staff, faculty members, and research centers currently engage in the studying, teaching and research of energy topics, I personally think that this is a high priority that UC Davis should address to fill this gaping hole in order to attract future pools of talented students and faculty, create a strong and coordinated curriculum, and attract funding for high impacts research.

I am a researcher at the Institute of Transportation Studies (ITS), a faculty member at the Graduate Groups in Ecology (GGE) and Transportation Technology and Policy (TTP), and an adjunct professor at the Department of Engineering and Public Policy, Carnegie Mellon University. My primary research interest is to advance the understanding of future energy systems and their environmental and social impacts, and to seek solutions that improve the societal process of making decisions toward a low-carbon energy system. My expertise is in energy market economics and modeling, lifecycle analysis of greenhouse gas emissions, alternative transportation energy use and modeling, sustainability standards for biofuels, and technological change induced by government policy. I lead research programs in Best Policy and Incentive Strategies for Technical Assistance & Analysis funded by the California Energy Commission and the Integrated Scenario Analysis within the Sustainable Transportation Energy Pathways Program (STEPS). Between 2007-2013, I co-led the UC research teams with UC Davis and UC Berkeley in supporting the implementation of California's Low Carbon Fuel Standard and was the co-director of the National Low Carbon Fuel Standard Project.

Energy (across all economic sectors, not just the transportation) and sustainability are the cores of my research, which has allowed me to make significant impacts in policy, academic research and among the industry and NGOs, and attracted large funding to support research in energy. In 2013, alone with our head of the Institute, Prof. Daniel Sperling, I was honored to be named the “Policy Shapers of the Water-Energy-Food Landscape” by The Global Leadership and Technology Exchange (GLTE), a partnership project between Royal Dutch Shell, Xyntéo and Unilever and received the Academic Federation Award for Excellence in Research from UC Davis in 2014.

I am extremely impressed for the student pools and the supporting research environment we have at UC Davis campus, most of which are due to the resources and visions led by the Institute of Transportation Studies and its five research centers, including the newly established National Center for Sustainable Transportation. However, I also see major gaps in education when comparing with other top-tier universities such as UC Berkeley and Stanford, particularly due to the lack of an Energy Graduate Program that perspective students interested in energy study can identify themselves.
with, and a lack of academic curriculum that students can follow. In 2013, I taught a graduate course on Energy Modeling for Policy Analysis. The course attracted graduate students across campus including the Graduate Groups in Ecology (GGE) and Transportation Technology and Policy (TTP), Department of Civil and Environmental Engineering. I have also supervised master and PhD students from these departments and graduate groups, as well as the Geography Graduate Group (GGG). Therefore, I see the creation of an Energy Graduate Group will only strengthen the existing tight linkages between energy education and research and these other graduate groups and departments.

Sincerely,

Sonia Yeh
Research Scientist
Institute of Transportation Studies
1605 Tilia Street, Suite 100
University of California, Davis CA 95616
Phone: (530) 830-2544
Fax: (530) 752-6572
Email: slyeh@ucdavis.edu
http://steps.ucdavis.edu/People/slyeh
Re: Application for an Energy Graduate Group at UC Davis

I strongly support the proposed Energy Graduate Group (EGG) at UC Davis. This letter is to confirm my commitment to this proposed interdisciplinary program.

I am a faculty member in the Department of Physics. I was hired at UC Davis under the Energy for the Future initiative. A significant part of my research interest is on energy related materials, particularly semiconductor nanowires and quantum dots for cost-effective solar energy applications.

My graduate course entitled "Introduction to Nanoscale Science" (PHY 250) has a strong focus on energy related nanomaterials. This is one of the three courses I teach each year. This interdisciplinary course has already drawn students from several different departments including Chemistry, Chemical Engineering and Material Science, and Electrical and Computer Engineering.

My current research group includes two Ph.D. students and one postdoctoral fellow from Physics Department. But I would like to recruit more graduate students, particularly with interest in energy science. At this time, I have difficulty recruiting a sufficient number students from the physics department. I expect that when EGG is approved, my research group will grow and EGG may comprise up to one half of my research group, which makes it possibly my primary graduate group affiliation.

Sincerely,

Dong Yu, Ph.D.
Associate Professor
Department of Physics
University of California, Davis
1 Shields Ave, Davis, CA 95616
Phone: 530-554-1630
yu@physics.ucdavis.edu
September 25, 2014

Re: Application for an Energy Graduate Group at UC Davis

I am writing this letter to provide my enthusiastic support for and expected engagement with the proposed Energy Graduate Group (EGG) at UC Davis. I strongly support the development of this graduate group and plan to contribute to the teaching and advising of graduate students in the EGG group when it is approved.

I am a faculty member in the Department of Biological and Agricultural Engineering (BAE) and a member of the department’s graduate group as well as the International Agricultural Development (IAD) graduate group. My expertise lies in the areas of bioenergy and biofuels and waste to energy technologies. I have advised many graduate students who had strong interest in energy systems and renewable energy production. Currently I have seven graduate students and all of them are pursuing PhD studies and have Bioenergy as the major focus area. My graduate course, EBS245 – Waste Management in Biological Systems is largely focused on waste to energy conversion technologies and will be a useful course for EGG students. I will be interested in providing lectures to other EGG courses and advising EGG students in their graduate training. I strongly believe that the EGG will expand our capacity and allow us to provide more interdisciplinary teaching and research training to the graduate students.

Sincerely,

Ruichong Zhang, PhD
Professor
rhzhang@ucdavis.edu
Appendix C. Letters of Support: UC Berkeley Energy and Resources Group (ERG)
September 16, 2014

Professor Daniel Sperling  
Director, UC Davis Energy Institute  
1605 Tilia Street, Suite 100  
Davis, CA 95616

Dear Dr. Sperling,

As faculty members of the Energy and Resources Group at the University of California, Berkeley, we are writing this letter in support of UC Davis’ initiative to create a graduate energy group. The experience at Berkeley and the structure of the ERG group may be of use in designing a program that works well at Davis. While ERG has existed as a unique interdisciplinary program since the early 1970s, other programs now exist at Berkeley where advanced training exists in energy, including the traditional departmental routes (a variety of engineering departments, both Economics and Resource Economics, to name just a few). Berkeley also collaborates closely with Lawrence Berkeley National Laboratory with many students working and receiving mentorship with LBNL employees.

Our overall conclusion from the assessment below is clear: there is significant unmet demand for advanced graduate training in energy and resource analysis. The University of California, Davis, has a very strong record of training and placing students whose research interests are in this area. The combination of these two facts makes a graduate ‘EGG’, or Energy Graduate Group, a promising enterprise that we are happy to support.

**Background:** Energy and Resources Group (ERG) at UC Berkeley is perhaps the most similar program within the UC system to the one proposed. ERG is a graduate group that emphasizes interdisciplinary approaches to understanding and solving problems related to energy and the environment. We were founded in 1973, have over 400 graduates, 6 core faculty with some portion of their tenure line at ERG, and over 100 affiliates throughout campus in engineering, social sciences and humanities, as well as professional schools (public policy, public health, law, business). Though “energy” is the first word in our title, our faculty and students work on a broad set of environmental problems; we typically bin our research efforts into environmental science, climate, water and energy. There is a strong international component to much of our work. Though ERG is interdisciplinary, we require our PhD students to develop at least one expertise that is comparable to what students enrolled in a disciplinary program would develop. This puts our students on equal footing with those from other programs.
**Degree programs:** We have two graduate degree categories: a MA/MS in Energy and Resources, and PhD in Energy and Resources. ERG also offers an undergraduate minor in Energy and Resources.

**Masters Degree:** 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. A joint masters degree program also exists with the Goldman School of Public Policy were typically three students or less gain admission to both programs and receive both degrees in three years.

**Ph.D. Degree:** The admission requirement for the PhD is based on 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 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 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 advisor and subject to the approval of the Graduate Dean. The final requirement for the PhD is completion of the dissertation to the satisfaction of a committee consisting of three faculty advisors/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.

The energy research community at the University of California, Davis, has great strengths in transportation and energy, biomass energy, wind energy, and energy economics, hydrology and energy, to name a few clusters. EGG would ideally coordinate and bring together these faculty and student strengths into an intellectual and professional community. Degrees currently offered at Davis via ITS, its departmental affiliations, and in economics and engineering degree programs (to name only a few) could be well served and integrated by the formation the Energy Graduate Group.

**Admissions:** Each year, we admit roughly 20 students from 250 applications, and roughly 75% of those admitted matriculate to the program. Last year, 175 students indicated that “energy” was their intended area of study, and we admitted 12 of those students.

**Placement:** Approximately half of our students take positions in academia upon graduation. Recent graduates are on the faculty in the Yale University School of Environmental Studies, the Nelson Institute
at the University of Wisconsin, Stanford University, the University of Arizona, MIT, UCLA, and other universities. Of the remaining group, roughly 20 percent take jobs at government labs, 20 percent take jobs at non-profits, and the remaining 10 percent take positions in the private sector.

We hope that this information on the structure of the ERG program, its research and teaching dimensions is valuable to design of graduate energy initiatives at the University of California, Davis. The wider University of California, Davis, energy research community is well poised to capture the diverse energy research hubs across campus and bring both methodological coherence and dialog, and also fundraising and job placement benefits to the students and faculty on campus. We are pleased to endorse the plan for an energy graduate group.

Sincerely,

Dan Kammen  
Class of 1935 Professor of Energy  
kammen@berkeley.edu

Duncan Callaway  
Assistant Professor  
dcal@berkeley.edu

Sincerely,

Harrison Fraker, Chair  
Energy and Resources Group  
fraker@berkeley.edu
Appendix D. Letters of Support: Government and Industry
September 12, 2014

Subject: Support for University of California Davis Energy Institute Proposal for Energy Graduate Group

To Whom It May Concern:

The Governor's Office of Planning and Research is pleased to support the UC Davis Energy Institute proposal for an Energy Graduate Group and graduate degree in energy at UC Davis. Now is a critical time for this effort in light of the energy challenges faced by the state, nation, and world with the backdrop of climate change and carbon pollution. In California, we are moving inexorably to a renewable energy future, but the technical and policies challenges are many, varied, and often daunting. These challenges must be confronted and addressed over the next few decades. We need critical thinkers with excellent academic training more than ever.

The Office of Planning and Research (OPR) is California's comprehensive state planning agency and serves the Governor and his Cabinet as staff for long-range planning and research. As such, OPR is working extensively on energy and energy-related issues, from siting and infrastructure challenges related to electric vehicle charging to land use decisions connected to vehicle miles traveled to smart grid integration and impacts of transmission and beyond. In addition, I am a senior advisor on energy and environmental issues to Governor Brown. I see the need, every day, for a talented, trained, motivated work force, both in the public and private sector, to solve complex energy and energy-related issues. California continues to lead the world's response to climate change, and our energy conversion is the central piece of that effort. The UC Davis Energy Graduate Group would help continue that leadership.

Please let me know if I can provide additional information or support for this worthwhile effort.

Sincerely,

Ken Alex  
Director

1400 10th Street  P.O. Box 3044  Sacramento, California 95812-3044  
(916) 445-0613  FAX (916) 323-3018  www.opr.ca.gov
September 29, 2014

Professor Daniel Sperling  
Director, Energy Institute  
University of California, Davis  
1605 Tilia Street, Suite 100  
Davis, CA 95616

RE: California Energy Commission Letter of Support for Establishing an Energy Graduate Group, hosted by the UC Davis Energy Institute, at the University of California, Davis

Dear Dr. Sperling:

The California Energy Commission supports your proposal to establish an Energy Graduate Group under the UC Davis Energy Institute at the University of California, Davis.

We agree with and support your proposal to create a graduate group dedicated to the interdisciplinary study of energy science, engineering, economics, and policy. California is a national and world leader in energy policy, and there is a clear need for future experts and leaders with a deep understanding of the technology, history, economics, and politics that influence the way we generate and consume energy. The graduate group would complement energy centers and graduate programs at other California institutions, further supporting California’s leadership position. We believe the students and graduates from the Energy Graduate Group will be in high demand throughout the state, country, and world for internships and employment.

We at the California Energy Commission look forward to the establishment of the Energy Graduate Group at UC Davis, and to the opportunity to work with and possibly hire future students and graduates from the program.

Sincerely,

Robert P. Oglesby  
Executive Director
November 24, 2014

Director Daniel Sperling
UC Davis Energy Institute
Davis, CA 95616

Dear Director Sperling:

On behalf of the California Independent System Operator Corporation (ISO), I submit this letter of support for the proposed Energy Graduate Group at UC Davis. Over the last 9 years, the ISO has considered UC Davis a key resource in developing our future talent through student internships. This proposed interdisciplinary graduate training comprised of basic sciences, engineering and policy analysis promises to build a pool of talent we need, and will continue to need, in our industry to help us lead the way to tomorrow’s energy network.

The ISO provides open and non-discriminatory access to one of the largest power grids in the world. The vast network of high-voltage transmission power lines we operate is supported by a competitive energy market and comprehensive grid planning. Partnering with more than one hundred clients, we are a nonprofit public benefit corporation dedicated to the continual development and reliable operation of a modern grid that operates for the benefit of consumers. Recognizing the importance of the global climate challenge, we are at the forefront of integrating renewable power and advanced technologies that will help provide a sustainable, efficient and clean energy future. Toward that goal, the ISO recently launched an energy imbalance market (EIM) in partnership with Portland-based PacifiCorp. By developing an EIM between the balancing authorities, a broad array of resources can be shared and economically dispatched through the ISO’s five-minute market. This real-time market is the first of its kind in the West.

The electric industry is experiencing a historic, global transformation brought on by far-reaching environmental policies, regulatory changes, economics, customer demands and the availability of advanced technologies. The ISO needs employees who understand the interdependencies and dynamics of this change and are ready to bring multidisciplinary training and innovative thinking to the challenges at hand. The ISO sees tremendous potential value in the proposed Energy Graduate Group and we would welcome its students and graduates to apply for internships and consider career opportunities with the California ISO.

Best regards,

[Signature]

Stephen Berberich
President and CEO
California Independent System Operator Corporation
September 19, 2014

Daniel Sperling
Director, Energy Institute
University of California, Davis
Davis, CA 95616

Director Sperling:

On behalf of the California Public Utilities Commission (CPUC), I submit this letter to offer my enthusiastic support for the creation of an Energy Graduate Group at UC Davis. The proposed program would produce graduates with a strong interdisciplinary education in energy issues that, I believe, would make them ideal future employees of the CPUC.

The CPUC regulates privately owned electric and natural gas companies in the state. Our five Governor-appointed Commissioners, as well as our staff of 1,000 employees, are dedicated to ensuring that consumers have safe, reliable utility service at reasonable rates, protecting against fraud, and promoting the health of California’s economy. In addition, the CPUC also plays a key role in making California an international leader in clean energy.

We require a highly trained staff of specialists to fulfill our mission, and the proposed energy graduate program at UC Davis has been designed to provide the type of interdisciplinary training that would allow one to excel in a staff position in the CPUC’s Energy Division, the Office of Ratepayer Advocates, or as an advisor in a Commissioner’s office. The Commission is constantly seeking prospective employees with advanced academic training in a broad range of energy issues, from energy technology to engineering to policy, who can communicate effectively with staff from other agencies, regulated industry, and the public about energy related issues and policies.

Graduates from the proposed graduate program in energy at UC Davis would be well-suited to contribute to the CPUC’s mission. We look forward to discussing the potential to set up an intern program to give these students real-world experience in the energy sector, and we invite future graduates of this program to apply for full-time employment at the CPUC.

Respectfully,

Michael R. Peevey
President
October 6th, 2014

Professor Daniel Sperling
Director, Energy Institute
University of California, Davis
Davis, CA 95616

Professor Sperling:

On behalf of Pacific Gas & Electric Company (PG&E), I write to offer my strongest support for the creation of an interdisciplinary graduate degree program in energy science, technology, engineering, policy, and management at UC Davis.

PG&E is a utility company operating in northern and central California which generates revenues primarily through the sale and delivery of electricity and natural gas to our customers. As of 2013, PG&E served more than 5 million electricity distribution customers and over 4 million natural gas distribution customers. To serve these customers, PG&E maintains a workforce in the state of over 19,000 employees.

As one might expect, PG&E regularly seeks to hire new employees with advanced training in energy issues. The type of interdisciplinary educational training proposed through the new energy graduate program at UC Davis would serve prospective PG&E employees well. As the electric and natural gas industries continue to evolve rapidly, it will be critical to PG&E’s success to retain a highly trained and agile workforce with a broad understanding of energy sector issues and the ability to communicate about these issues across our company.

The type of interdisciplinary program in energy studies proposed at UC Davis is precisely the type of graduate training program that could benefit not only future PG&E employees, but also future employees working elsewhere in California’s energy industry and in state government. We would also be happy to discuss the possibility of developing a rotational internship or fellowship program at PG&E to give students in this program invaluable real-world experience in the industry. It is with enthusiasm that PG&E submits this letter of support.

Sincerely,

Laura Butler
Vice President and Chief Diversity Officer
Talent Management & Inclusion
245 Market Street
San Francisco, CA 94105

Mailing Address
Mail Code N2F
P.O. Box 770000
San Francisco, CA 94117
October 6, 2014

Director Daniel Sperling
UC Davis Energy Institute
Davis, CA 95616

Dear Director Sperling:

On behalf of Southern California Edison (SCE), I submit this letter of support for the proposed Energy Graduate Group at UC Davis that would award graduate degrees in Energy Science & Technology or Energy Policy & Management. Our constantly evolving company has a continued need for a better trained and more flexible workforce at all levels that can address the industry's challenges of tomorrow as well as those we face today. For this reason, the type of interdisciplinary graduate training in energy that UC Davis proposes with this program could provide an excellent foundation for those seeking employment at SCE.

SCE is one of the largest electric utilities in the United States and a longtime leader in renewable energy and energy efficiency. With headquarters in Rosemead, California, SCE serves more than 14 million people in a 50,000 square-mile area of central, coastal and Southern California. SCE has provided electric service in the region for more than 125 years. We're about cleaner energy, smarter electricity grids, and helping people manage energy more efficiently. We encourage bright and dedicated people to join our team which is currently over 14,000 employees strong. Our workplaces are diverse and inclusive by design. At SCE, we believe that diversity encourages innovation, creativity, and collaboration. From entry-level analysts to senior managers, our teams represent a broad array of cultures, ethnicities, genders, sexual orientations, generations, and life experiences. We're particularly proud that SCE ranks as #1 in the nation for diversity practices in HispanicBusiness.com's 2014 Annual Diversity Report.

SCE sees a lot of value in the type of interdisciplinary training that is being proposed. If the program is approved, we would be interested in evaluating the graduate students in this program for potential internship opportunities at SCE. Now more than ever, our industry needs new employees who understand the complex world of providing safe and reliable utility service to customers while navigating rapidly evolving policies and technologies. Southern California Edison supports the creation of the Energy Graduate Group at UC Davis.

Regards,

Gary A. Stern
Director, Regulatory Policy

P.O. Box 800
2244 Walnut Grove Ave.
Rosemead, CA 91770
September 19, 2014

Professor Daniel Sperling
Director, UC Davis Energy Institute
University of California, Davis
Davis, California 95616

Dear Professor Sperling,

It is with great pleasure that I offer this letter in support of your proposal to create an Energy Graduate Group at UC Davis. The combination of dual track themes of Energy Science & Technology and Energy Policy & Management along with a rich interdisciplinary educational foundation delivers exactly the skills and experiences needed to solve the energy challenges of the 21st Century. This would place UC Davis at the cutting edge of energy research and education.

Lawrence Livermore National Laboratory (LLNL) is a world leader in developing and applying science and technology to ensure our national security. As a Department of Energy laboratory, LLNL’s 7000 employees are advancing and integrating science and technology across physics, chemistry, materials, and biological sciences into engineering solutions to many of our nation’s most important challenges. A critical component of national security is ensuring the security of our local, regional, and national energy systems. In the face of ongoing climate change and increasing energy demand, we must develop new energy technologies that reduce greenhouse gas emissions and deliver reliable, cost-effective power all within the context of a complex network of local, regional, and national regulations and policies. This national need and complex landscape requires exactly the type of dual-track students, faculty, and educational organization that the UC Davis Energy Graduate Group will produce.

At LLNL, our energy program addresses a broad spectrum of energy technologies, but we have especially focused on advancing the incredible opportunities offered by natural gas, improving the efficiency and grid integration of geothermal, wind and solar, developing a next generation smartgrid system, and seeking adaptation solutions to local and regional climate change. To accomplish our goals, LLNL has strong interest in students, graduate students, and post-doctorate fellows who possess the interdisciplinary education and optimal mix of technology expertise and policy understanding to deliver science and engineering solutions to these national needs. LLNL would like to explore a cooperative arrangement with the Energy Graduate Group at UC Davis towards pursuing joint research activities and involvement of UCD students and staff in LLNL’s energy activities. Our Livermore Scholar Program, which provides up to four years of support for PhD students, would be available to students in this new Graduate Group.

We support your proposal for creating an Energy Graduate Group at UC Davis and LLNL looks forward to working closely with Graduate Group students and faculty in educating our future national energy leaders and delivering solutions to our national energy needs and security.

Sincerely,

Doug Rotman
Energy & Environmental Program Director
September 19, 2014

Adam Schultz  
Program Manager  
UC Davis Energy Institute  
One Shields Avenue  
Davis, CA 95616

Subject: Energy Graduate Group Support

Dear Mr. Schultz:

The purpose of this letter is to express support for an Energy Graduate Group (EGG), sponsored by the UC Davis Energy Institute, to supply the next generation of experts and leaders to industry government, NGOs, academia, and research centers. We understand the EGG would provide a rich, interdisciplinary education for students from the basic sciences to engineering and policy analysis, as well as economics and finance.

Black & Veatch is an employee-owned, global leader in building Critical Human Infrastructure in Energy, Water, Telecommunications and Government Services. Since 1915, we have helped our clients improve the lives of people in over 100 countries through consulting, engineering, construction, operations and program management. Our revenue in 2013 was $3.6 billion (USD).

At Black & Veatch, our global clients face rapidly changing business and regulatory environments. To meet these needs, they rely on the leading solutions we provide in customized planning, and conceptual and detailed engineering. We also offer procurement, construction and construction management, startup and commissioning. We excel in both program management and asset optimization.

We cover the entire range of energy needs from power generation, power delivery, and oil and gas facilities. We work closely with clients to deliver solutions to their most complex projects through our commitment to execution excellence, quality, and integrity of service.

The company is committed to sustainability – meeting the needs of the present generation while improving the ability of future generations to meet their own needs. We see beyond the here and now and help clients plan far into the future. Our passion is creatively providing tailored solutions through our diverse, global teams. Furthermore, we complete projects on time and on budget.

Behind the large pieces of equipment and heavy machinery, this is a people business. Our success and our clients’ successes are very much interconnected. Our global professionals are committed to building close relationships beyond the project. We consistently deliver quality, performance, safety, schedule certainty and sustained value.
To do these things Black & Veatch, first and foremost needs and wants engineers with solid technical training and skills. However, today’s projects are complex technically, politically, environmentally, economically and socially. This means we need integrators, people with rich interdisciplinary backgrounds and experiences. Public policy and community benefits, environmental licensing and permitting, project finance, economics, marketing, management, legal and other skills and experience are as important to us as technology. We can’t design it and build it without people that are able to pull diverse disciplines together into teams that communicate effectively with an understanding of the role each other plays. This why we, as a company, need interdisciplinary integrators.

We welcome the opportunity to participate in the formation and planning of the EGG and the potential to explore internships for EGG students that will provide them with real-world experience in the energy industry. Our team would be willing to participate with guest lectures and work with our clients to seek local project site visits as appropriate. Please keep us informed as your proposal proceeds, we fully support its objectives.

If you have any questions, please feel free to contact me directly at Tel: (913) 458-9868 or e-mail PletkaRJ@bv.com.

Very truly yours,

BLACK & VEATCH

[Signature]

Ryan Pletka
Associate Vice President

SMS
Enclosure
Dear Adam:

As a member of the Davis area energy community and as an employee of SunPower Corporation, I want to commend you on your efforts to implement an Energy Graduate Group at the UC Davis Energy Institute. The program represents a forward-thinking, practical approach to energy education that will produce professionals that are equipped to make an immediate and powerful impact on the energy industry.

By way of background, SunPower is a multinational, diversified solar energy based in San Jose, CA, with offices all over the world including one in Davis. With some of the most efficient solar cells, we provide cutting-edge solar technology to residential, commercial and utility-scale customers worldwide. We have over 6,000 employees working to change the way the world is powered. These employees share a common passion for solar energy, and many share an interdisciplinary background similar to that which the Energy Graduate Group aims to provide.

Speaking from personal experience, our company values individuals that have a deep and diverse understanding of the energy industry, and in particular solar energy. From project and business development to technology innovation, there are opportunities for professionals to utilize traditional engineering skills complemented by softer skills such as communications and economics. Your emphasis on training students across disciplines an important aspect of the program for this purpose. This curriculum, taught in the setting of UCD’s West Village net zero community, should make for outstanding results.

I am supportive of and excited about this program, and wish you the best of luck in getting it started!

Sincerely,

Kyle Cobb
Product Manager
Appendix E. Draft Bylaws for the Energy Graduate Group
ARTICLE I. Objective
The Energy Graduate Group (EGG) is a campus-wide graduate program offering the M.S. (Plan I and Plan II) and Ph.D. degrees in Energy. The mission of the EGG is to provide an integrated program of graduate education in energy and related fields that will lead to M.S. and Ph.D. degrees in one of the two following disciplines: (1) Energy Science and Technology, and (2) Energy Policy and Management. Distinctive features of the program will be a focus on renewable energy systems, transportation fuels, and energy efficiency with general training in energy, leading to improved environmental and economic performance and sustainable design.

ARTICLE II. Membership
A. Criteria for Membership in the Energy Graduate Group

1. Disciplinary expertise, research area and accomplishments:

Eligibility for membership in the EGG is governed by the UC Davis Graduate Council’s “Policy on Membership in Graduate Programs” [GC1998-02 (rev. 03, May 16, 2014)]. The current Graduate Council policy can be found online at the following URL: http://gradstudies.ucdavis.edu/sites/default/files/upload/files/grad-council/gc1998-02-membership-in-graduate-programs.pdf

Membership in the EGG will be limited to faculty of the University of California and affiliated National Laboratories who are qualified under University regulations to guide candidates towards graduate degrees in Energy and who participate in the activities of the EGG. Membership is based on disciplinary expertise and is independent of specific department appointment or Academic Senate membership.

Members must hold an appropriate academic title, such as but not necessarily limited to:

(a) A member of the Academic Senate of the University of California (includes Professors, Lecturers with Security of Employment, Professors in Residence, Professors of Clinical “__”, Professors Emeritus/a, and Research Professors),

(b) Adjunct Professor,

(c) Lecturer (without Security of Employment), or

(d) Lecturer Without Salary.

Academic staff with primary appointments as Cooperative Extension Specialists or in the Professional Research series are not eligible to be members of graduate programs unless they also hold an appropriate instructional title (normally Lecturer Without Salary).

2. Active Research:
Members must be engaged in active research in an area related to energy science, engineering, technology, policy, law, or management.

3. Voting Rights:
All active members are eligible to vote.

B. Application for Membership

1. Process:
A faculty member wishing to join the EGG may apply directly for membership or may be nominated by a current EGG member. The Membership Committee will evaluate each candidate as per the guidelines stated in Article II.B.2 of the EGG Bylaws. The Membership Committee’s evaluation of the faculty application, the faculty applicant’s curriculum vitae, and a ballot will be sent to all active members of the EGG. Nominees will be deemed elected upon receiving a 2/3 majority vote of all members voting. Upon the election of a new member, said person will be sent a letter of invitation by the Graduate Program Chair and will be considered a member only in the event of an affirmative reply.

2. Evaluation Criteria:
The following criteria will be used to determine the appropriateness of an applicant’s membership in the EGG:

(a) The relevance of the applicant’s research program to the fields of either (1) Energy Science and Technology or (2) Energy Policy and Management.

(b) The ability of the applicant to serve effectively as a major professor in the fields of either (1) Energy Science and Technology or (2) Energy Policy and Management under the regulations of the University of California.

(c) The applicant’s scholarly expertise and activity in the fields of either (1) Energy Science and Technology or (2) Energy Policy and Management.

C. Emeritus Status
UC Davis faculty members are eligible to apply for membership in the EGG under the criteria set forth in Article II.B.2. of the EGG Bylaws. Status as an active member of the EGG does not continue automatically upon attaining faculty emeritus status but requires an application for renewal of membership and approval by a 2/3 majority vote of the active EGG membership.

D. Review of Membership
Continuation of active EGG membership is based on the same criteria set forth in Article II.B.2. of the EGG Bylaws as criteria for initial membership in the EGG. The EGG will conduct reviews of membership on a three-year cycle with one third of the membership reviewed each year. Membership in the EGG may be reconsidered in the event that an individual no longer satisfies the criteria for initial membership as set forth in Article II.B.2. of the EGG Bylaws. Membership in the EGG may then be discontinued by a simple majority vote of all members voting.

E. Membership Appeal Process
A denial of membership pursuant to Article II.B.1. of the EGG Bylaws or a discontinuation of membership pursuant to Article II.D. of the EGG Bylaws may be appealed to the Graduate Program Chair in writing and will be considered by the Graduate Affairs Committee. A written statement containing a rebuttal of the reasons for denial must accompany the appeal within 30 days of written notice of the denial or discontinuation of membership in the EGG. Applicants may make a final appeal of the denial or discontinuation to the Dean of Graduate Studies.
ARTICLE III. Administration
The administration of the EGG program and its activities are vested in the Graduate Program Chair and an Executive Committee.

ARTICLE IV. Graduate Program Chair
A. Chair Appointment Process
The Graduate Program Chair (or Chair) will be appointed in accordance with the Academic Personnel Manual policy UCD-245 B and the policies and procedures of the Graduate Council and the Office of Graduate Studies.

A Nominating Committee will be named by the Executive Committee to solicit, from active faculty and graduate student members of the group, names of nominees for the position of Graduate Program Chair. Those nominated will then be contacted regarding their willingness to serve. The names of the nominees who have indicated a willingness to serve will then be submitted to faculty and graduate student members of the EGG for comment. All comments will remain confidential.

The Nominating Committee will forward two names to the Dean of Graduate Studies along with all comments received on the nominees. All comments solicited from faculty and students of the EGG will be treated as confidential information by the Group’s Nominating Committee and the Office of Graduate Studies.

The Group may express a preference for Chair and, if it does, should indicate the basis for determining that preference. After interviewing the nominees, the Dean of Graduate Studies will forward his/her recommendation to the Chancellor. The normal term of the Chair’s appointment is three years, however the Dean of Graduate Studies may recommend a shorter term based on the nominee’s willingness to serve.

B. Duties of the Chair
The duties of the Chair are to:

1. Provide overall academic leadership for the program;
2. Oversee, develop and implement policies for the program;
3. Represent the interests of the program to the campus and University administrators;
4. Call and preside at meetings of the program;
5. In consultation with the Executive Committee appoint such standing and ad hoc committees as deemed necessary to properly administer the activities of the Program, with standing committees normally to include the Graduate Affairs, Student Admissions, and Membership Committees;
6. Coordinate all administrative matters with the Office of Graduate Studies;
7. Manage the budgets of the program;
8. Submit course change or approval forms, and
9. Be responsible for the accuracy of all publications related to the program including web pages and catalog copy.

ARTICLE V. Committees
1. Executive Committee:
The administration of the EGG program and its activities will be vested in an Executive Committee. The committee will coordinate with the Chair in administering the EGG program and oversee the modification of the EGG program’s mentoring guidelines and application within the program. The committee will consist of the Graduate Advisor, the Graduate Admissions Advisor, and a third member appointed by the Chair. The Graduate Advisor will serve as the Chair of the Executive Committee. The Graduate Staff Coordinator will be a non-voting member of the Executive Committee. Unless otherwise serving as an active member of the Executive Committee, the Director of the UC Davis Energy Institute will serve as an ex-officio member of the Executive Committee.

The principal responsibilities of the Executive Committee are to:

(a) Administer the graduate program, including the approval of all individual programs of study (POS) and graduate course approval forms;

(b) Nominate Thesis Committee (M.S. Plan I) membership (to include three members, including the Major Professor as Chair, will be recommended by the student) to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy;

(c) Appoint Comprehensive Examination Committees (M.S. Plan II);

(d) Nominate Qualifying Examination Committee (Ph.D.) membership (to include five faculty members and not to be chaired by the student’s Major Professor) to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy;

(e) Nominate Dissertation Reading Committee (Ph.D.) membership (to include three faculty members and typically Chaired by the student’s Major Professor) to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy;

(f) In consultation with the Chair of the EGG program, appoint such standing and ad hoc committees as deemed necessary to properly administer the activities of the Program; and

(g) Make decisions regarding financial support of students including decisions concerning the allocation of fellowship funding.

Standing committees normally include the Graduate Affairs, Student Admissions, and Membership Committees:

2. Graduate Affairs Committee:

The Graduate Affairs Committee will be chaired by the Graduate Advisor. The committee will consist of four members, including a graduate student representative, and will have the following responsibilities:

(a) To prepare recommendations, as needed, regarding minimum requirements for graduate degrees and other programmatic proposals for consideration by the members of the EGG Program;

(b) To review and recommend revision to the membership, as needed, of the Energy Graduate Group curriculum;

(c) To review petitions from graduate students; and

(d) To assist in the recruitment of graduate students.
Recommended revisions to the EGG Program curriculum must be approved by simple majority vote of the membership.

3. Student Admissions and Membership Committee:

This committee will consist of four members appointed by the Executive Committee and will be chaired by the Graduate Admissions Advisor. The committee will be responsible for the recruitment of graduate students to the EGG program, the evaluation of their applications, and making admissions recommendations. In addition, the Student Admissions and Membership Committee will be responsible for screening applications for membership in the EGG Program and for reviewing membership in the EGG Program.

ARTICLE VI. Student Representatives

Any graduate student enrolled in the Energy Graduate Group is eligible for membership in the Energy Graduate Student Organization (EGSO). In consultation with the EGSO, the Chair will appoint one graduate student representative to the Graduate Affairs Committee. Student representatives will serve a one-year renewable term and may vote on issues when deemed appropriate by the Chair.

The Chair of any committee with student members must excuse the student representatives from meetings during discussions about other students, personnel actions, disciplinary issues relating to faculty or students, or during rankings of existing students for funding.

ARTICLE VII. Program Advisors

Program Advisors are appointed in compliance with the policies of procedures of the Graduate Council and the Office of Graduate Studies. If possible, a student’s thesis/dissertation advisor should not serve as their Program Advisor. Program Advisors are appointed for two years, in compliance with the policies and procedures of the Graduate Council and the Office of Graduate Studies. The Chair nominates advisors to the Office of Graduate Studies. There will be at least two Program Advisors for the Energy Graduate Group: one serving as Graduate Advisor, the other serving as Graduate Admissions Advisor.

The Program Advisors will serve as representatives of the EGG Program in its dealings with graduate students in the program, with the following specific duties:

1. Graduate Advisor:
   (a) Chair the Graduate Affairs Committee;
   (b) Keep track of the progress of each graduate student in the EGG Program;
   (c) Provide advice, in consultation with the thesis advisor, on how the student may best complete the requirements of the EGG Program;
   (d) Determine whether and how graduate student work satisfies the EGG Program requirements;
   (e) Administer required examinations; and
   (f) Communicate to students their standing in the EGG Program.

2. Graduate Admissions Advisor:
   (a) Chair the Student Admissions and Membership Committee;
   (b) Manage student recruitment activities for the EGG Program; and
ARTICLE VIII. Meetings
The Energy Graduate Program will have one annual meeting in Fall quarter. The Chair will call regular and special meetings of the program as deemed necessary or desirable. Faculty members can petition the Chair for additional meetings. Petitions to which three or more members are signatories will automatically generate a call to the membership for a special meeting. Notification of any meeting will be emailed at least two weeks before the meeting. Members not on campus may participate by conference call or other virtual interaction (e.g. video link or webcast) in which the member’s direct participation can be officially recorded.

ARTICLE IX. Quorum
A quorum for the purpose of amending the bylaws, establishing graduate program membership, or establishing graduate program policy must be greater than 50% of the members who are eligible to vote. Balloting can be done either in a meeting of the group, by e-mail, or by another commonly accepted method of online balloting if previously approved by the Executive Committee. If balloting by e-mail or by other method of online balloting, at least seven calendar days will be allowed for expression of opinions about the proposal and formal vote.

ARTICLE X. Order of Business for Meetings
The program does not have a set format for meetings.

ARTICLE XI. Amendments
Amendments to the EGG Bylaws may be proposed by any active faculty member of the Energy Graduate Group program. The EGG Bylaws may be amended by the approval of a simple majority of the members who are eligible to vote. Written notice of a proposed amendment will be sent to each active member of the EGG Program at least ten (10) calendar days prior to a meeting at which the proposed amendment is to be discussed. All amendments and revisions to the EGG Bylaws must be submitted to Graduate Council for review and approval. Changes in the EGG Bylaws will become effective upon approval by Graduate Council.
Appendix F. Degree Requirements
ENERGY GRADUATE GROUP
M.S. AND Ph.D. DEGREE REQUIREMENTS
Submitted: November 25, 2014
Graduate Council Approval: __________

Master’s Degree Requirements

1) Admissions requirements:
Admissions decisions will be made on a case-by-case basis according to the following timeline:

Priority Deadline: January 1 (priority given for fellowships)
General Deadline: March 15
Final Deadline: May 31 (space permitting)

Applicants will be notified of admissions decisions within approximately 30 to 45 days after the application deadline. Meeting some or all of the admissions criteria outlined below does not guarantee admission, but merely confirms eligibility. The decision to recommend admission to the Dean of Graduate Studies will be made by the Student Admissions and Membership Committee of the Energy Graduate Group on the basis of available space and the competitiveness of applicants.

All applicants must complete the current “UC Davis Graduate Application” available online through the UC Davis Office of Graduate Studies and submit the required application fee. That online application will require applicants to provide:

- Basic Information
- Personal Information
- Plans for Graduate Study
- U.S. Citizens and Permanent Residents
- Academic History
- Other Information
- Test Scores
- Statement of Purpose / Personal History Statement
- Data Verification
- Recommendations

In addition to completing the “UC Davis Graduate Application” online, the following criteria are required for admission to the Energy Graduate Group:

Undergraduate Degree. Consideration for program admission requires a bachelor’s degree from an accredited institution. Strong applicants to the program who intend to pursue a degree in Energy Science & Technology will likely have received an undergraduate degree in engineering, mathematics, the physical sciences, or a related field. Strong applicants to the program who intend to pursue a degree in Energy Policy & Management will likely have received an undergraduate degree in economics, political science, policy, planning, management, or a related field.

Minimum GPA. A minimum GPA of 3.0 in the applicant’s undergraduate program and in any prior graduate program is required.

Letters of Recommendation. Applicants will be required to submit three letters of recommendation through the online “UC Davis Graduate Application.” Applicants are
encouraged to submit professional letters of recommendation, but at least one letter
should be from a professor who can assess your potential for advanced academic work.

**Official Transcripts.** Applicants will be required to submit official transcripts from any
previous institution of higher education attended. This requirement is in addition to
reporting degrees awarded and GPA attained on the online “UC Davis Graduate
Application.”

**Resume (optional).** Applicants are encouraged to submit a current resume that reflects
work experience, academic track record, and any other relevant information.

**Statement of Purpose.** All applicants are required to complete the Statement of
Purpose required on the online “UC Davis Graduate Application.”

**Personal History Statement.** All applicants are required to complete the Personal
History Statement required on the online “UC Davis Graduate Application.”

**GRE Scores.** Applicants will be required to submit official GRE General Test scores
from within the last 5 years. This requirement is in addition to self-reporting GRE test
scores on the online “UC Davis Graduate Application.” Competitive applicants will report
strong overall GRE scores. For the Energy Science & Technology degree track, most
successful applicants will have a very strong GRE Quantitative Reasoning score. For the
Energy Policy & Management degree track, most successful applicants will have a very
strong GRE Verbal Reasoning score.

**Application and Fee.** All applicants will be required to complete the Office of Graduate
Studies online “UC Davis Graduate Application” application and to remit the
accompanying application fee by the stated admission deadline.

**Research Interests.** Applicants are required to list three areas of potential research
interest within the energy field. Please use only one to five words to describe each
interest.

**Faculty Mentor.** Applicants are required to list three potential faculty mentors on the
basis of his/her research interests. Applicants are strongly encouraged to communicate
with potential research advisors (Major Professors) prior to admission to the Energy
Graduate Group. Ideally, this process of communicating with potential Major Professors
should begin no later than in the Fall prior to anticipated enrollment. Applicants should
take the initiative to inquire about future research directions of specific faculty at UC
Davis, exchange research ideas with potential Major Professors, and make an effort to
identify viable possibilities. To assist applicants, the UC Davis Energy Institute will
maintain a website that identifies faculty affiliated with the Energy Graduate Group and
notes their area(s) of expertise.

**TOEFL/IELTS Requirements.** The program will follow the policies of the UC Davis
Graduate Council for evaluation of international applicants. TOEFL or IELTS scores
must be submitted to demonstrate English language proficiency for international
applicants who have not studied at an institution where the language of instruction was
in English. International applicants must meet the Office of Graduate Studies minimum
score requirement.

a) **Prerequisites:**

In addition to the admission requirements stated above, applicants are expected to
have passed the equivalent of the following UC Davis courses:

*All EGG students, regardless of track, must have completed at least one of the
following courses in upper division Statistics (or its equivalent) and must have
completed the following two courses in Calculus (or their equivalent):*

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA 102</td>
<td>Introduction to Probability Modeling and Inference</td>
<td>4</td>
</tr>
<tr>
<td>STA 103</td>
<td>Applied Statistics for Business and Economics</td>
<td>4</td>
</tr>
</tbody>
</table>
STA 104 Applied Statistical Methods: Nonparametric Stats 4 units
STA 106 Applied Statistical Methods: Analysis of Variance 4 units
STA 108 Applied Statistical Methods: Regression Analysis 4 units
MAT 21A Calculus 4 units
MAT 21B Calculus 4 units

For the Energy Science & Technology track, applicants must have an undergraduate or graduate degree in Engineering from an accredited institution, or have completed at least two of the following courses (or their equivalent):
CHE 110A Physical Chemistry: Introduction 4 units
CHE 124A Inorganic Chemistry: Fundamentals 4 units
CHE 128A Organic Chemistry 4 units
PHY 110A Electricity and Magnetism 4 units
PHY 140A Introduction to Solid State Physics 4 units

For the Energy Policy & Management track, applicants must have completed the following course (or its equivalent):
ECN 100 Intermediate Microeconomic Theory 4 units

b) Deficiencies:
Pre-requisite coursework deficiencies must be taken for a letter-grade and are expected to be completed by the time the student files for advancement to candidacy.

2) M.S. Plan I or Plan II
At the Master’s level, the Energy Graduate Group will offer students the option of completing either a Plan I or Plan II Master’s Degree. The M.S. need not be a terminal degree, but can be part of the path to a Ph.D. The program will offer the Plan B option for completing a Ph.D.

Students will pursue one of the following plans for fulfillment of the requirements for the Master’s degree. Students will identify in coordination with the Major Professor which plan they intend to pursue upon enrollment in the program.

Plan I (Thesis). This plan requires a minimum of 36 units of graduate and upper division courses (the 100 and 200 series only), of which at least 18 of the 36 units must be graduate work in the major field. All graduate courses must be passed with a letter grade of “B” or higher. In addition, a thesis or a project in lieu of a thesis is required. This research thesis or project will serve as the capstone requirement for the degree. A minimum of 3 units and a maximum of 6 units of EGG 299 research units may count toward this 36 unit requirement for the degree for M.S. Plan I students. The student is subject to guidance by the major program regarding the distribution of his or her work.

A minimum of three quarters of academic residence is required.
This Plan requires more units than the UC Davis minimum, which are: 30 units of graduate and upper division courses (the 100 and 200 series only), at least 12 of which must be graduate work in the major field.

Plan II (Comprehensive Examination). This plan requires a minimum of 38 units of graduate and upper division courses (the 100 and 200 series only), of which at least 20 units must be graduate courses in the major field. All graduate courses must be passed with a letter grade of “B” or higher. A comprehensive final examination in the major subject, of such nature and conducted in such manner as may be determined by the program concerned, is required of each candidate. No thesis is required. The capstone requirement is fulfilled by the candidate’s successful completion of the comprehensive examination.
A minimum of three quarters of academic residence is required.

This Plan requires more units than the UC Davis minimum M.S. Plan II, which are: 36 units of graduate and upper division courses (the 100 and 200 series only), at least 18 of which must be graduate courses in the major field. Not more than 9 units of research (299 or equivalent) may be used to satisfy the 18 unit requirement.

3) Course Requirements – Core, Sub-Core, and Electives (minimum of 36 units)

M.S. students will be required to complete four Core Courses, and will be required to enroll in EGG 290 Energy Seminar in the Fall Quarter of their first and second years of the program. Additionally, M.S. students will be required to take an additional two courses (minimum of 6 units) from among a list of pre-approved Sub-Core Courses designed to give the student a strong foundation in their chosen degree track (either Energy Science & Technology, or Energy Policy & Management). The remaining units required for the student to achieve the minimum of 36 units required for the degree will be determined by a course of study developed by the student in coordination with their Major Professor that is designed to provide the student with a specialization within the energy field. Sufficient EGG 299 research units must also be taken so that an M.S. Plan I student can write an acceptable thesis.

a) **Core Courses (13 units)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGG 200</td>
<td>Introduction to Energy Science and Technology</td>
<td>4</td>
</tr>
<tr>
<td>EGG 201</td>
<td>Life-Cycle Analysis of Energy Systems</td>
<td>4</td>
</tr>
<tr>
<td>EGG 202</td>
<td>Energy and Climate Policy</td>
<td>3</td>
</tr>
<tr>
<td>EGG 290</td>
<td>Energy Seminar</td>
<td>1 (x2)</td>
</tr>
</tbody>
</table>

b) **Sub-Core Foundation Courses (6 to 8 units)**

In addition to the “Core Requirements” above, all students will be required to take at least two courses (minimum 6 units) in a foundation area. At least one course (minimum 3 units) taken to fulfill the Sub-Core foundation requirement must be taken at the graduate level, while the other may be upper division. Students in the Energy Science & Technology track will be required to take courses in either (a) Engineering and Technology or (b) Energy Sciences to fulfill this requirement. Students in the Energy Policy & Management track will be required to take courses in Policy & Management to fulfill this requirement.

**Engineering and Technology**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>DES 136A</td>
<td>Lighting Technology and Design</td>
<td>4</td>
</tr>
<tr>
<td>EBS 218</td>
<td>Solar Thermal Engineering</td>
<td>4</td>
</tr>
<tr>
<td>EBS 265</td>
<td>Design and Analysis of Engineering Experiments</td>
<td>5</td>
</tr>
<tr>
<td>ECE 216</td>
<td>Low Power Digital Integrated Circuit Design</td>
<td>3</td>
</tr>
<tr>
<td>ECE 284</td>
<td>Design and Optimization of Embedded Computing Sys.</td>
<td>4</td>
</tr>
<tr>
<td>ECI 125</td>
<td>Building Energy Performance</td>
<td>4</td>
</tr>
<tr>
<td>ECI 143</td>
<td>Green Engineering Design and Sustainability</td>
<td>4</td>
</tr>
<tr>
<td>ECI 268</td>
<td>Infrastructure Economics</td>
<td>3</td>
</tr>
<tr>
<td>EME 106</td>
<td>Thermo-Fluid Dynamics</td>
<td>4</td>
</tr>
<tr>
<td>EME 163</td>
<td>Internal Combustion Engines and Future Alternatives</td>
<td>4</td>
</tr>
<tr>
<td>EMS 170</td>
<td>Sustainable Energy Technology: Batteries, Fuel Cell, PV</td>
<td>4</td>
</tr>
<tr>
<td>ENG 160</td>
<td>Environmental Physics and Society</td>
<td>3</td>
</tr>
<tr>
<td>MAE 216</td>
<td>Advanced Thermodynamics</td>
<td>4</td>
</tr>
<tr>
<td>MAE 217</td>
<td>Combustion</td>
<td>4</td>
</tr>
<tr>
<td>MAE 218</td>
<td>Advanced Energy Systems</td>
<td>4</td>
</tr>
<tr>
<td>MAE 258</td>
<td>Hybrid Electric Vehicle System Theory and Design</td>
<td>4</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Units</td>
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<tr>
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<td>--------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>MAE 268</td>
<td>Wind Power Engineering</td>
<td>4</td>
</tr>
<tr>
<td>MAE 269</td>
<td>Fuel Cell Systems</td>
<td>4</td>
</tr>
<tr>
<td>MAE 271</td>
<td>Advanced Modeling and Simulation of Mechatronic Sys.</td>
<td>4</td>
</tr>
<tr>
<td>MAE 272</td>
<td>Theory and Design of Control Systems</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>Energy Sciences</strong></td>
<td></td>
</tr>
<tr>
<td>ATM 116</td>
<td>Climate Change</td>
<td>4</td>
</tr>
<tr>
<td>ATM 149</td>
<td>Air Pollution (same as ECI 149)</td>
<td>4</td>
</tr>
<tr>
<td>CHE 205</td>
<td>Symmetry, Spectroscopy, and Structure</td>
<td>3</td>
</tr>
<tr>
<td>CHE 226</td>
<td>Principles of Transition Metal Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHE 228C</td>
<td>Solid-State Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHE 228D</td>
<td>Homogenous Catalysis</td>
<td>3</td>
</tr>
<tr>
<td>CHE 241D</td>
<td>Electroanalytical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>EBS 267</td>
<td>Renewable Bioprocessing</td>
<td>3</td>
</tr>
<tr>
<td>EBS 270</td>
<td>Modeling and Analysis of Biological and Physical Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECI 241</td>
<td>Environmental Reactive Chemical Transport Modeling</td>
<td>4</td>
</tr>
<tr>
<td>ETX 203</td>
<td>Environmental Toxicants</td>
<td>4</td>
</tr>
<tr>
<td>FST 205</td>
<td>Industrial Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>MCB 214</td>
<td>Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td>MCB 263</td>
<td>Biotechnology Fundamentals and Application</td>
<td>2</td>
</tr>
<tr>
<td>PHY 200A</td>
<td>Theory of Mechanics and Electromagnetics</td>
<td>4</td>
</tr>
<tr>
<td>PHY 200B</td>
<td>Theory of Mechanics and Electromagnetics</td>
<td>4</td>
</tr>
<tr>
<td>PHY 200C</td>
<td>Theory of Mechanics and Electromagnetics</td>
<td>4</td>
</tr>
<tr>
<td>PHY 210</td>
<td>Computational Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHY 241</td>
<td>Advanced Topics in Magnetism</td>
<td>3</td>
</tr>
<tr>
<td>PHY 242</td>
<td>Advanced Topics in Superconductivity</td>
<td>3</td>
</tr>
<tr>
<td>SSC 222</td>
<td>Global Carbon Cycle</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Policy and Management</strong></td>
<td></td>
</tr>
<tr>
<td>ARE 147</td>
<td>Resource and Environmental Policy Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CRD 245</td>
<td>Political Economy of Urban and Regional Development</td>
<td>4</td>
</tr>
<tr>
<td>ECI 268</td>
<td>Infrastructure Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECN 125</td>
<td>Efficiency in Energy Markets</td>
<td>4</td>
</tr>
<tr>
<td>ECN 215D</td>
<td>Environment and Economic Development</td>
<td>4</td>
</tr>
<tr>
<td>ESP 163</td>
<td>Energy and Environmental Aspects of Transportation</td>
<td>4</td>
</tr>
<tr>
<td>ESP 212A</td>
<td>Environmental Policy Process</td>
<td>4</td>
</tr>
<tr>
<td>ESP 212B</td>
<td>Environmental Policy Evaluation</td>
<td>4</td>
</tr>
<tr>
<td>ESP 275</td>
<td>Economic Analysis of Resource and Environmental Policy</td>
<td>4</td>
</tr>
<tr>
<td>LAW 235</td>
<td>Administrative Law</td>
<td>3</td>
</tr>
<tr>
<td>LAW 282</td>
<td>Energy Law Seminar</td>
<td>2</td>
</tr>
<tr>
<td>LAW 282AT</td>
<td>Renewable Energy Seminar</td>
<td>2</td>
</tr>
<tr>
<td>LAW 285A</td>
<td>California Environmental Issues</td>
<td>2</td>
</tr>
<tr>
<td>LAW 285E</td>
<td>Climate Change Law and Policy</td>
<td>3</td>
</tr>
<tr>
<td>LDA 201</td>
<td>Theory and Philosophy of the Designed Environment</td>
<td>4</td>
</tr>
<tr>
<td>MGT 206</td>
<td>Decision Making and Management Science</td>
<td>3</td>
</tr>
<tr>
<td>MGT 241</td>
<td>New Product Development</td>
<td>3</td>
</tr>
</tbody>
</table>
MGT 250  Technology, Competition, and Strategy  3 units
MGT 251  Management of Innovation  3 units
MGT 413  Sustainable Business Ventures: Business and Energy  1 unit
POL 171  The Politics of Energy  4 units
POL 208  Policy Analysis  4 units
c) **Elective Courses (minimum of 17 units)**
M.S. students will develop a coherent course of study with their Major Professor by the end of the student’s first quarter of study. This course of study will be designed so that the student can develop a specialization within the energy field through electives. Students may enroll in any of the courses listed above as eligible for the foundation requirement as electives to fulfill their degree requirements, or the student may enroll in other electives subject to the approval of their Major Professor.

Allowing for this flexibility in the course of study will allow the student and their Major Professor to design tailored courses of study that will result in specializations most relevant to the particular student and his/her career objectives. The following are a few examples of the types of specializations within the field that may be expected from EGG students:

- Building energy efficiency; Biomass conversion; Fuel cell engineering; Sustainable transportation policy; Energy economics; Biofuels; Nanosolar manufacturing; Energy systems analysis; among others.

As a result of the diversity of specializations expected within the EGG program, EGG faculty members have chosen not to pre-identify a list of eligible or preferred electives. As the program matures, however, the Executive Committee of the EGG may consider requiring additional specific courses as certain specializations become more common.

d) **Summary:**

M.S. Plan I students will be required to complete a minimum of 36 units to graduate, at least 18 of which must be at the graduate level in the major field. M.S. Plan II students will be required to complete a minimum of 38 units to graduate, at least 20 of which must be at the graduate level in the major field. All M.S. students will be required to complete 13 units of core coursework, and will be required to complete a minimum of 6 units of additional sub-core coursework to develop a foundation within the student’s chosen degree track (either Energy Science & Technology, or Energy Policy & Management). M.S. students will develop a coherent program of study with their Major Professor by the end of the student’s first quarter of study. This program of study will be designed so that the student can develop a specialization within the energy field through electives.

Full-time students must enroll for 12 units per quarter including research, academic and seminar units. Courses that fulfill any of the program course requirements may not be taken S/U unless the course is normally graded S/U (such as EGG 290 *Energy Seminar*). Once course requirements are completed, students can take additional classes as needed. Per UC regulations students cannot enroll in more than 12 units of graduate level courses (200) or more than 16 units of combined undergraduate and graduate level (100, 200, 300) courses per quarter.

Students must maintain a GPA of 3.0 overall, and a grade of “C” or higher is required in all graduate courses that fulfill the M.S. Degree course requirements. If the GPA falls below the 3.0 minimum, the student is placed on academic probation. If a student is on academic probation for more than two quarters, the student is subject to disqualification upon recommendation by the Graduate Advisor to the Dean of Graduate Studies.
4) **Special requirements:** None.

5) **Committees:**

a) **Executive Committee:**

The administration of the EGG program and its activities will be vested in an Executive Committee. The committee will coordinate with the Chair in administering the EGG program and oversee the modification of the EGG program’s mentoring guidelines and application within the program. The committee will consist of the Graduate Advisor, the Graduate Admissions Advisor, and a third member appointed by the Chair. The Graduate Advisor will serve as the Chair of the Executive Committee. The Graduate Staff Coordinator will be a non-voting member of the Executive Committee. Unless otherwise serving as an active member of the Executive Committee, the Director of the UC Davis Energy Institute will serve as an ex-officio member of the Executive Committee.

The principal responsibilities of the Executive Committee are to:

1. Administer the graduate program, including the approval of all individual programs of study (POS) and graduate course approval forms;
2. Nominate Thesis Committee (M.S. Plan I) membership (to include three members, including the Major Professor as Chair, as recommended by the student) to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy;
3. Appoint Comprehensive Examination Committees (M.S. Plan II);
4. Nominate Qualifying Examination Committee (Ph.D.) membership (to include five faculty members and not to be chaired by the student’s Major Professor) to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy;
5. Nominate Dissertation Reading Committee (Ph.D.) membership (to include three faculty members and typically Chaired by the student’s Major Professor) to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy;
6. In consultation with the Chair of the EGG program, appoint such standing and ad hoc committees as deemed necessary to properly administer the activities of the Program; and
7. Make decisions regarding financial support of students including decisions concerning the allocation of fellowship funding.

b) **Thesis Committee (M.S. Plan I)**

The student, in consultation with the Major Professor and the Graduate Adviser, recommends three faculty members to the Executive Committee to serve on their Thesis Committee. The Major Professor serves as the Chair of the Thesis Committee and must be a faculty member of the Energy Graduate Group. The Executive Committee nominates the Thesis Committee to the Office of Graduate Studies for formal appointment in accordance with Graduate Council Policy. Only members of the Academic Senate or the EGG program have automatic eligibility to serve as members of advanced degree committees.

Members of the Academic Senate who are *not* members of the EGG program can seek exception to serve as Chair of an advanced degree committee; the petition to do so can be obtained from the Office of Graduate Studies.
Individuals who are not members of the Academic Senate or the EGG program can serve on advanced degree committees with written recommendation from the student and approval by the Graduate Adviser and the Office of Graduate Studies; the petition to do so can be obtained from the Office of Graduate Studies. Nomination of an individual who is neither a member of the Academic Senate nor a member of the EGG program to serve as the Chair of an advanced degree committee is approved by the Executive Committee only in the most exceptional circumstances.

c) **Comprehensive Examination Committee (M.S. Plan II)**

The student, in consultation with the Major Professor and the Graduate Adviser, recommends three faculty members to the Executive Committee to review the capstone project and serve on the Comprehensive Examination Committee. The Major Professor serves as Chair of the Comprehensive Examination Committee and must be a faculty member of the EGG program.

d) **Graduate Affairs Committee**

The Graduate Affairs Committee will be chaired by the Graduate Advisor. The committee will consist of four members, including one graduate student representative, and shall have the following responsibilities:

- (a) To prepare recommendations, as needed, regarding minimum requirements for graduate degrees and other programmatic proposals for consideration by the members of the EGG Program;
- (b) To review and recommend revision to the membership, as needed, of the Energy Graduate Group curriculum;
- (c) To review petitions from graduate students; and
- (d) To assist in the recruitment of graduate students.

Recommended revisions to the EGG Program curriculum must be approved by simple majority vote of the membership.

e) **Student Admissions and Membership Committee**

Once the completed application for admission, all supporting material (as described above), and the application fee have been received, the application will be submitted to the Student Admissions and Membership Committee. The Student Admissions and Membership Committee consists of four faculty members. Based on a review of the entire application, a recommendation is made to accept or decline an applicant's request for admission. That recommendation is forwarded to the Dean of Graduate Studies for final approval of admission. Notification of admissions decisions will be sent by the Office of Graduate Studies. Applications are accepted through January 1 of the year of anticipated enrollment for priority admission; through March 15 for general admission; and through May 31 if space is still available for the upcoming fall class. Admissions decisions will be announced within approximately 30 to 45 days after the admissions deadline.

6) **Advising Structure and Mentoring:**

The Major Professor is the faculty member who supervises the student's research and thesis (M.S. Plan I) or comprehensive examination (M.S. Plan II) and helps the student to develop his/her detailed plan of study designed to result in a specialization within the energy field; this person also serves as the Chair of the student's Thesis or Comprehensive Examination Committee. The Major Professor also advises the student on course selection each quarter. Students are required to submit a proposed Program of Study which lists the quarter’s registration plan (must include at least 12 units per quarter,
and may include research and seminar units). The Major Professor is required to review and sign off on the proposed Program of Study each quarter. The approved Program of Study will be filed with the student’s official record in the Graduate Program Staff’s office. Any changes to the Program of Study must similarly be approved by the Major Professor.

The Graduate Advisor, who is appointed by the Office of Graduate Studies, is a resource for information on academic requirements, policies and procedures, and registration information until the Graduate Affairs Committee of the EGG is formed. The Graduate Program Coordinator (staff) assists students with identifying a major professor, identifying appointments and fellowship opportunities, and assists with general university policies. The Mentoring Guidelines can be found in the graduate student handbook produced by Graduate Council and can be found online at the following address:


7) **Advancement to Candidacy:**

Every student must file an official application for Candidacy for the Degree of Master of Science and pay the Candidacy Fee after completing one-half of their course requirements and at least one quarter before completing all degree requirements; the student is expected to complete all degree requirements by the end of the Spring Quarter of the student’s second year of study. The Candidacy for the Degree of Master of Science form can be found online at: http://www.gradstudies.ucdavis.edu/forms/. A completed form includes a list of courses the student will take to complete degree requirements. If changes must be made to the student’s course plan after s/he has advanced to candidacy, the Graduate Advisor must recommend these changes to the Office of Graduate Studies. Students must have their Graduate Advisor and committee Chair sign the candidacy form before it can be submitted to Graduate Studies. If the candidacy is approved, the Office of Graduate Studies will send a copy to: the appropriate Graduate Program Coordinator and the student; the Thesis Committee Chair will also receive a copy, if applicable. If the Office of Graduate Studies determines that a student is not eligible for advancement, the program and the student will be told the reasons for the application’s deferral. Some reasons for deferring an application include: grade point average below 3.0, outstanding “I” grades in required courses, or insufficient units.

8) **Comprehensive Examination and/or Thesis Requirements:**

a) **Thesis Requirements (M.S. Plan I):**

**Thesis Committee:** M.S. Plan I students, in coordination with their Major Professor, are expected to form their thesis committee (minimum of three members, including the Major Professor, who will serve as Chair) by the end of their first quarter of study. The candidate and Major Professor should meet at least once a year with the other members of the thesis committee to discuss progress and any changes in research objectives.

**Thesis:** Research for the Master’s thesis is to be carried out under the supervision of a faculty member of the program and must represent an original contribution to knowledge in the field. The thesis research must be conducted while the student is enrolled in the program. The thesis is submitted to the thesis committee at least one month before the student plans to make requested revisions. All committee members must approve the thesis and sign the title page before the thesis is submitted to the Office of Graduate Studies for final approval. Should the thesis committee determine that the thesis is unacceptable, even with substantial revision, the thesis committee may make a recommendation to disqualify the student from the program to the Dean of Graduate Studies.

The thesis must be filed in a quarter in which the student is registered or on filing fee. Instructions on preparation of the thesis and a schedule of dates for filing the thesis in
final form are available from the Office of Graduate Studies; the dates are also printed in the UC Davis General Catalog and in the Class Schedule and Registration Guide issued each quarter. A student must have a GPA of 3.0 or higher for the M.S. degree to be awarded.

b) **Comprehensive Examination (M.S. Plan II):**

Fulfillment of the Comprehensive Examination is the last requirement of the M.S. Plan II. A student may take the comprehensive examination once they have advanced to candidacy. However, it is important that the capstone requirement be completed at or near the end of the coursework for the Master’s degree. Consistent with the policy of Graduate Council, most students will sit for the exam at the end of the 5th quarter of study (the end of Winter Quarter in the second year).

The comprehensive examination requirement includes both the submission of a written technical report to the Comprehensive Examination Committee and passing a one-hour oral exam administered by that same committee. The technical report is to be written under the direction of a faculty mentor, who must be a member of the graduate program. The written capstone project report is generally expected to have the scope and quality of a refereed journal paper, without the need to be an original contribution to the field. The student must have the report approved by the Comprehensive Examination Committee; the report constitutes the written portion of the examination.

In addition, an oral presentation and or oral exam may be required as the discretion of the Chair of the Comprehensive Examination Committee. The format of the presentation and/or oral exam is established by the Chair of the Comprehensive Examination Committee. The scope of the oral exam is the candidate’s coursework as well as the project work. Typically, the three members of the Comprehensive Examination Committee meet with the student for one hour and ask questions related to the report and/or to any courses the student completed to fulfill the M.S. Degree course requirements.

Upon completion of the Comprehensive Examination, the Chair of the Committee must notify the Graduate Coordinator, indicating the following:

(a) When the student took the Comprehensive Examination;

(b) The members of the Comprehensive Examination Committee; and,

(c) The recommendation to pass or not pass.

The Exam committee’s unanimous vote is required to pass a student on the exam. If a student does not pass the exam, the committee may recommend that the student be reexamined a second time, but only if the Graduate Advisor concurs with the committee. The second exam must take place within one quarter of the first exam. The format of the second exam is the same as that of the first exam and may include the submission of an amended version of the report. The examination may not be taken more than twice. A student who does not pass on the second attempt is subject to disqualification from further graduate work in the program.

Once passed, the Master’s Report Form is signed by the Program Graduate Advisor and then forwarded to the Office of Graduate Studies. The deadlines for completing this requirement are listed each quarter in the campus General Catalog (available online at the website of the Office of the Registrar). A candidate must be a registered student or in Filing Fee status at the time the program submits the form, with the exception of the summer period between the end of the Spring Quarter and the beginning of Fall Quarter. The program must file the report with the Office of Graduate
Studies within one week of the end of the quarter in which the student’s degree will be conferred.

9) **Normative Time to Degree:**
Normative time is the elapsed time (calculated to the near academic quarter) that a student would need to complete all requirements for the degree, assuming that they are engaged in full-time study and making adequate progress. For the Master of Science degree from the Energy Graduate Group, the normative time to advancement to candidacy is 3 quarters and the normative time to advancement to degree is 6 quarters.

10) **Typical Time Line and Sequence of Events:**
The following table provides an example of a study plan for an M.S. Plan I student focused on energy economics and policy. This student has demonstrated fulfillment of the pre-requisite for STA 102, but not for ECN 100. As such, this student addresses this deficiency by taking ECN 100 in the Fall quarter of the first year of study.

For example:

<table>
<thead>
<tr>
<th>Year One</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring (advancement to M.S. candidacy)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EGG 290: Energy Seminar (1)</td>
<td>ARE204A: Microeconomic Analysis I (4)</td>
<td>ECI 268: Infrastructure Economics (3)</td>
<td></td>
</tr>
<tr>
<td>ECN 100: Intro to Microeconomic Theory (4)</td>
<td>EGG 299: Research (4)</td>
<td>LAW 282: Energy Law Seminar (2)</td>
<td></td>
</tr>
<tr>
<td>EGG 299: Research (3)</td>
<td>EGG 299: Research (4)</td>
<td>EGG 299: Research (4)</td>
<td></td>
</tr>
<tr>
<td><strong>Total Units:</strong></td>
<td><strong>8 units (course work)</strong></td>
<td><strong>8 units (course work)</strong></td>
<td><strong>6 units (course work)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1 unit (seminar)</strong></td>
<td><strong>4 units (research)</strong></td>
<td><strong>2 units (seminar)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>3 units (research):</strong></td>
<td><strong>12 units</strong></td>
<td><strong>4 units (research):</strong></td>
</tr>
<tr>
<td></td>
<td><strong>12 units</strong></td>
<td><strong>12 units</strong></td>
<td><strong>12 units</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year Two</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring (Thesis completed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EGG 290: Energy Seminar (1)</td>
<td>ECN 256: Applied Econometrics (4)</td>
<td>ESP 212B: Environmental Policy Evaluation (4)</td>
<td></td>
</tr>
<tr>
<td>ECN 125: Efficiency in Energy Markets (4)</td>
<td>EGG 299: Research (4)</td>
<td>EGG 299: Research (4)</td>
<td></td>
</tr>
<tr>
<td>EGG 299: Research (3)</td>
<td>EGG 299: Research (3)</td>
<td>EGG 299: Research (3)</td>
<td></td>
</tr>
<tr>
<td><strong>Total Units:</strong></td>
<td><strong>7 units (course work)</strong></td>
<td><strong>8 units (course work)</strong></td>
<td><strong>8 units (course work)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1 unit (seminar)</strong></td>
<td><strong>4 units (research)</strong></td>
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<td></td>
<td><strong>4 units (research):</strong></td>
<td><strong>12 units</strong></td>
<td><strong>12 units</strong></td>
</tr>
<tr>
<td></td>
<td><strong>12 units</strong></td>
<td><strong>12 units</strong></td>
<td><strong>12 units</strong></td>
</tr>
</tbody>
</table>

11) **Sources of funding.**
We expect the EGG program to be highly competitive and to attract academically outstanding students to UC Davis. Through the combination of existing campus financial commitments and significant extramural fundraising, it is expected that all EGG students will receive fellowships.
and/or research appointments.

The following summarizes the sources of expected support for EGG students:

- **Campus financial commitments:** Significant fellowship support committed by the Deans of Engineering, Graduate Studies, and Agricultural and Environmental Sciences.

- **Corporate support:** The Energy Institute will pursue corporate sponsorships of energy related research to support EGG students, beyond those already available through other energy-related centers in the Energy Hub.

- **Existing fellowship opportunities:** EGG students studying transportation-related energy issues will be eligible to compete for substantial existing fellowship opportunities.

- **Faculty grants:** Some EGG students may be funded on existing faculty research grants.

- **Extramural research funding:** The Energy Institute will aggressively pursue interdisciplinary energy research grants from federal and state agencies, and foundations.

**Campus Commitments.** Many incoming students will be eligible for external and campus fellowships including those funded by the commitments described in letters from the Deans of Engineering, Graduate Studies, and Agricultural and Environmental Sciences found in Appendix A. Fellowship funding committed by those deans totals $350,000 over the first three years of the EGG program, after which time the Office of Graduate Studies will support the program through the Graduate Program Fellowship Allocation (with funding of $240,000 per year on the basis of expected EGG enrollment beginning in Year 4).

**Corporate Support.** Additional fellowship support for EGG students is expected to be raised from extramural sources by the Energy Institute. One strategy will be for the Energy Institute to adopt the successful modeled developed by the Institute of Transportation Studies (ITS-Davis) that provides fellowship support through its Corporate Affiliate Program for students studying transportation issues. Through that program, affiliate members of ITS-Davis make major gifts to support core programs; current members are BMW, BP, ExxonMobil, Daimler, Nissan, Shell, Toyota, and PG&E. The Energy Institute will be able to leverage these corporate connections as it works with affiliated research centers in the Energy Hub to raise new funding sources for EGG student fellowships.

**Existing Fellowship Opportunities.** Moreover, to the extent that any EGG students have research interests in transportation-related energy issues, they may also be eligible to apply for existing fellowships offered by ITS-Davis or by affiliated research centers, such as the National Center for Sustainable Transportation (NCST). NCST is co-located with the Energy Institute at the Energy Hub at West Village and is funded by the U.S. Department of Transportation (with match funding from the California Air Resources Board, California Department of Transportation, and California Energy Commission) at a minimum of $11.2 million over four years (roughly half of which is dedicated to UC Davis).

**Faculty Grants.** Some EGG students will also likely be funded through existing faculty research grants focused on energy topics. In some instances, this may be to the exclusion of existing students in other departments on campus, but in others, faculty will likely be able to fund additional students due to the increased capabilities that EGG student researchers will provide. For more details about the extent to which faculty envision including EGG students on existing research grants, see the letters of support from EGG faculty in Appendix B.

**Extramural Research Funding.** The final source of expected funding for EGG students will come from research grants to fund interdisciplinary energy research. The Energy Institute will aggressively identify and pursue targets external sources of research funding, such as research grants from federal and state agencies or from foundations. The sub-section below provides an overview of the federal and state energy research trends.

Funding decisions related to fellowships are generally made by either the Graduate Program
Committee or Graduate Studies, depending on the source of funding for the fellowship. Not all fellowship funding decisions are made by either the Graduate Program Committee or Graduate Studies; as examples, graduate students may also seek fellowship funding directly from the US Environmental Protection Agency, National Science Foundation, US Department of Energy, foundations, and a range of other agencies and organizations. Funding decisions related to Research Assistantships are made by the Principal Investigator of the source of funding.

12) **PELP, In Absentia and Filing Fee status.**

Information about PELP (Planned Educational Leave), In Absentia (reduced fees when researching out of state), and Filing Fee status can be found in the Graduate Student Guide: [http://www.gradstudies.ucdavis.edu/publications/](http://www.gradstudies.ucdavis.edu/publications/)
Ph.D. DEGREE REQUIREMENTS

1) Admissions Requirements:
Admissions decisions will be made on a case-by-case basis according to the following timeline:

- **Priority Deadline:** January 1 (priority given for fellowships)
- **General Deadline:** March 15
- **Final Deadline:** May 31 (space permitting)

Applicants will be notified of admissions decisions within approximately 30 to 45 days after the application deadline. Meeting some or all of the admissions criteria outlined below does not guarantee admission, but merely confirms eligibility. The decision to recommend admission to the Dean of Graduate Studies will be made by the Student Admissions and Membership Committee of the Energy Graduate Group on the basis of available space and the competitiveness of applicants.

All applicants must complete the current “UC Davis Graduate Application” available online through the UC Davis Office of Graduate Studies and submit the required application fee. That online application will require applicants to provide:

- **Basic Information**
- **Personal Information**
- **Plans for Graduate Study**
- **U.S. Citizens and Permanent Residents**
- **Academic History**
- **Other Information**
- **Test Scores**
- **Statement of Purpose / Personal History Statement**
- **Data Verification**
- **Recommendations**

In addition to completing the “UC Davis Graduate Application” online, the following criteria are required for admission to the Energy Graduate Group:

- **Undergraduate Degree.** Consideration for program admission requires a bachelor’s degree from an accredited institution. Strong applicants to the program who intend to pursue a degree in Energy Science & Technology will likely have received an undergraduate degree in engineering, mathematics, the physical sciences, or a related field. Strong applicants to the program who intend to pursue a degree in Energy Policy & Management will likely have received an undergraduate degree in economics, political science, policy, planning, management, or a related field.

- **Minimum GPA.** A minimum GPA of 3.0 in the applicant’s undergraduate program and in any prior graduate program is required.

- **Letters of Recommendation.** Applicants will be required to submit three letters of recommendation through the online “UC Davis Graduate Application.” Applicants are encouraged to submit professional letters of recommendation, but at least one letter should be from a professor who can assess your potential for advanced academic work.

- **Official Transcripts.** Applicants will be required to submit official transcripts from any previous institution of higher education attended. This requirement is in addition to reporting degrees awarded and GPA attained on the online “UC Davis Graduate Application.”
Resume (optional). Applicants are encouraged to submit a current resume that reflects work experience, academic track record, and any other relevant information.

Statement of Purpose. All applicants are required to complete the Statement of Purpose required on the online “UC Davis Graduate Application.”

Personal History Statement. All applicants are required to complete the Personal History Statement required on the online “UC Davis Graduate Application.”

GRE Scores. Applicants will be required to submit official GRE General Test scores from within the last 5 years. This requirement is in addition to self-reporting GRE test scores on the online “UC Davis Graduate Application.” Competitive applicants will report strong overall GRE scores. For the Energy Science & Technology degree track, most successful applicants will have a very strong GRE Quantitative Reasoning score. For the Energy Policy & Management degree track, most successful applicants will have a very strong GRE Verbal Reasoning score.

Application and Fee. All applicants will be required to complete the Office of Graduate Studies online “UC Davis Graduate Application” application and to remit the accompanying application fee by the stated admission deadline.

Research Interests. Applicants are required to list three areas of potential research interest within the energy field. Please use only one to five words to describe each interest.

Faculty Mentor. Applicants are required to list three potential faculty mentors identified by the applicant on the basis of his/her research interests. Applicants are strongly encouraged to communicate with potential research advisors (Major Professors) prior to admission to the Energy Graduate Group. Ideally, this process of communicating with potential Major Professors should begin no later than in the Fall prior to anticipated enrollment. Applicants should take the initiative to inquire about future research directions of specific faculty at UC Davis, exchange research ideas with potential Major Professors, and make an effort to identify viable possibilities. To assist applicants, the UC Davis Energy Institute will maintain a website that identifies faculty affiliated with the Energy Graduate Group and notes their area(s) of expertise.

TOEFL/IELTS Requirements. The program will follow the policies of the UC Davis Graduate Council for evaluation of international applicants. TOEFL or IELTS scores must be submitted to demonstrate English language proficiency for international applicants who have not studied at an institution where the language of instruction was in English. International applicants must meet the Office of Graduate Studies minimum score requirement.

a) Prerequisites:

In addition to the admission requirements stated above, applicants are expected to have passed the equivalent of the following UC Davis courses:

All EGG students, regardless of track, must have completed at least one of the following courses in upper division Statistics (or its equivalent) and must have completed the following two courses in Calculus (or its equivalent):

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA 102</td>
<td>Introduction to Probability Modeling and Inference</td>
<td>4</td>
</tr>
<tr>
<td>STA 103</td>
<td>Applied Statistics for Business and Economics</td>
<td>4</td>
</tr>
<tr>
<td>STA 104</td>
<td>Applied Statistical Methods: Nonparametric Stats</td>
<td>4</td>
</tr>
<tr>
<td>STA 106</td>
<td>Applied Statistical Methods: Analysis of Variance</td>
<td>4</td>
</tr>
<tr>
<td>STA 108</td>
<td>Applied Statistical Methods: Regression Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MAT 21A</td>
<td>Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MAT 21B</td>
<td>Calculus</td>
<td>4</td>
</tr>
</tbody>
</table>
For the Energy Science & Technology track, applicants must have an undergraduate or graduate degree in Engineering from an accredited institution, or have completed at least two of the following courses (or their equivalent):

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 110A</td>
<td>Physical Chemistry: Introduction</td>
<td>4</td>
</tr>
<tr>
<td>CHE 124A</td>
<td>Inorganic Chemistry: Fundamentals</td>
<td>4</td>
</tr>
<tr>
<td>CHE 128A</td>
<td>Organic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>PHY 110A</td>
<td>Electricity and Magnetism</td>
<td>4</td>
</tr>
<tr>
<td>PHY 140A</td>
<td>Introduction to Solid State Physics</td>
<td>4</td>
</tr>
</tbody>
</table>

For the Energy Policy & Management track, applicants must have completed the following course (or its equivalent):

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECN 100</td>
<td>Intermediate Microeconomic Theory</td>
<td>4</td>
</tr>
</tbody>
</table>

b) **Deficiencies:**

Pre-requisite coursework deficiencies must be taken for a letter-grade and are expected to be completed by the time the student files for advancement to candidacy.

2) **Dissertation Plan:**

The Energy Graduate Group will offer the Ph.D. Plan B. This plan is described in detail under Section 519(D)(2) of the Davis Division Academic Senate Regulations, and described in greater detail in Section 8 below.

Pursuant to those rules, and consistent with the bylaws of the Energy Graduate Group, the student will nominate to the Executive Committee of the EGG a Dissertation Committee consisting of at least three faculty members, with the candidate’s Major Professor serving as Chair. The Executive Committee will formally recommend the Dissertation Committee to Graduate Council for final appointment.

Formal requirements for the degree of Ph.D. will include passing an oral Qualifying Examination (QE), completion of an acceptable dissertation, and a final oral presentation to serve as an exit seminar. These steps are described in greater detail in Section 8 below. In the QE, the student will be examined by a committee of faculty on the major (either the Energy Science & Technology track or Energy Policy & Management track) and any minor fields of study as identified in the student’s approved Program of Study. The QE will be used to determine the adequacy of the student’s preparation to undertake the dissertation research prior to advancement to candidacy for the degree. The exit seminar will be open to the public and will be attended by the student’s faculty dissertation review committee members to provide the student recommendations for any necessary thesis revisions prior to approval.

The Energy Graduate Group will not offer the C.Phil. degree for students who are advanced to candidacy for the Ph.D. but have not yet received that degree.

3) **Course Requirements – Core, Sub-Core, and Electives (minimum of 45 units)**

Ph.D. students will be required to take at least 45 units, of which 30 units must be graduate level courses in the major, exclusive of seminars and research units, and an additional 15 units of upper division or graduate courses. All required courses must be completed before taking the qualifying examination. At least 24 of these required units must be taken at UC Davis. In-depth knowledge in the major field can typically be obtained by completing approximately 30 units in upper division and graduate courses.

Ph.D. students will be required to complete four Core Courses, and will be required to enroll in EGG 290 Energy Seminar in the Fall Quarter of their first, second, and third years of the program. Ph.D. students will also be required to take at least one course in research design. Additionally, Ph.D. students will be required to take an additional two courses (minimum of 6 units) from among a list of pre-approved Sub-Core Courses designed to give the student a
strong foundation in their chosen degree track (either Energy Science & Technology, or Energy Policy & Management).

The remaining units required for the student to achieve the minimum of 45 units required for the degree will be determined by a program of study developed by the student in coordination with their Major Professor that is designed to provide the student with a specialization within the energy field. Ph.D. students will also be expected to take EGG 299 research units each quarter as they work toward completing their dissertation.

a) **Core Courses (13 units)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGG 200</td>
<td>Introduction to Energy Science and Technology</td>
<td>4</td>
</tr>
<tr>
<td>EGG 201</td>
<td>Life-Cycle Analysis of Energy Systems</td>
<td>4</td>
</tr>
<tr>
<td>EGG 202</td>
<td>Energy and Climate Policy</td>
<td>3</td>
</tr>
<tr>
<td>EGG 290</td>
<td>Energy Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

b) **Research Design Requirement (minimum of 3 units)**

In addition to the core courses outlined above, students in the Ph.D. program will also be required to take at least one course (minimum of 3 units) in research design. The courses that fulfill this requirement depend on whether the student is pursuing the Ph.D. in Energy Science & Technology, or in Energy Policy & Management.

The following courses satisfy this requirement for Ph.D. candidates on the Energy Science & Technology track:

- STA 205 Statistical Methods for Research with SAS 4 units
- STA 233 Design of Experiments 3 units
- EBS 265 Design and Analysis of Engineering Experiments 5 units

The following courses satisfy this requirement for Ph.D. candidates on the Energy Policy & Management track:

- STA 205 Statistical Methods for Research with SAS 4 units
- PSC 207 Survey and Questionnaire Research Methods 4 units

c) **Sub-Core Foundation Courses (6 to 8 units)**

In addition to the “Core Requirements” above, all students will be required to take at least two courses (minimum 6 units) in a foundation area. At least one course (minimum 3 units) taken to fulfill the Sub-Core foundation requirement must be taken at the graduate level, while the other may be upper division. Students in the Energy Science & Technology track will be required to take courses in either (a) Engineering and Technology or (b) Energy Sciences to fulfill this requirement. Students in the Energy Policy & Management track will be required to take courses in Policy & Management to fulfill this requirement.

**Engineering and Technology**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>DES 136A</td>
<td>Lighting Technology and Design</td>
<td>4</td>
</tr>
<tr>
<td>EBS 218</td>
<td>Solar Thermal Engineering</td>
<td>4</td>
</tr>
<tr>
<td>EBS 265</td>
<td>Design and Analysis of Engineering Experiments</td>
<td>5</td>
</tr>
<tr>
<td>ECE 216</td>
<td>Low Power Digital Integrated Circuit Design</td>
<td>3</td>
</tr>
<tr>
<td>ECE 284</td>
<td>Design and Optimization of Embedded Computing Sys.</td>
<td>4</td>
</tr>
<tr>
<td>ECI 125</td>
<td>Building Energy Performance</td>
<td>4</td>
</tr>
<tr>
<td>ECI 143</td>
<td>Green Engineering Design and Sustainability</td>
<td>4</td>
</tr>
<tr>
<td>ECI 268</td>
<td>Infrastructure Economics</td>
<td>3</td>
</tr>
<tr>
<td>EME 106</td>
<td>Thermo-Fluid Dynamics</td>
<td>4</td>
</tr>
<tr>
<td>EME 163</td>
<td>Internal Combustion Engines and Future Alternatives</td>
<td>4</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Units</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------------------------------------------------------</td>
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</tr>
<tr>
<td>EMS 170</td>
<td>Sustainable Energy Technology: Batteries, Fuel Cell, PV</td>
<td>4</td>
</tr>
<tr>
<td>ENG 160</td>
<td>Environmental Physics and Society</td>
<td>3</td>
</tr>
<tr>
<td>MAE 216</td>
<td>Advanced Thermodynamics</td>
<td>4</td>
</tr>
<tr>
<td>MAE 217</td>
<td>Combustion</td>
<td>4</td>
</tr>
<tr>
<td>MAE 218</td>
<td>Advanced Energy Systems</td>
<td>4</td>
</tr>
<tr>
<td>MAE 258</td>
<td>Hybrid Electric Vehicle System Theory and Design</td>
<td>4</td>
</tr>
<tr>
<td>MAE 268</td>
<td>Wind Power Engineering</td>
<td>4</td>
</tr>
<tr>
<td>MAE 269</td>
<td>Fuel Cell Systems</td>
<td>4</td>
</tr>
<tr>
<td>MAE 271</td>
<td>Advanced Modeling and Simulation of Mechatronic Sys.</td>
<td>4</td>
</tr>
<tr>
<td>MAE 272</td>
<td>Theory and Design of Control Systems</td>
<td>4</td>
</tr>
</tbody>
</table>

**Energy Sciences**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATM 116</td>
<td>Climate Change</td>
<td>4</td>
</tr>
<tr>
<td>ATM 149</td>
<td>Air Pollution (same as ECI 149)</td>
<td>4</td>
</tr>
<tr>
<td>CHE 205</td>
<td>Symmetry, Spectroscopy, and Structure</td>
<td>3</td>
</tr>
<tr>
<td>CHE 226</td>
<td>Principles of Transition Metal Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHE 228C</td>
<td>Solid-State Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHE 228D</td>
<td>Homogenous Catalysis</td>
<td>3</td>
</tr>
<tr>
<td>CHE 241D</td>
<td>Electroanalytical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>EBS 267</td>
<td>Renewable Bioprocessing</td>
<td>3</td>
</tr>
<tr>
<td>EBS 270</td>
<td>Modeling and Analysis of Biological and Physical Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECI 241</td>
<td>Environmental Reactive Chemical Transport Modeling</td>
<td>4</td>
</tr>
<tr>
<td>ETX 203</td>
<td>Environmental Toxicants</td>
<td>4</td>
</tr>
<tr>
<td>FST 205</td>
<td>Industrial Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>MCB 214</td>
<td>Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td>MCB 263</td>
<td>Biotechnology Fundamentals and Application</td>
<td>2</td>
</tr>
<tr>
<td>PHY 200A</td>
<td>Theory of Mechanics and Electromagnetics</td>
<td>4</td>
</tr>
<tr>
<td>PHY 200B</td>
<td>Theory of Mechanics and Electromagnetics</td>
<td>4</td>
</tr>
<tr>
<td>PHY 200C</td>
<td>Theory of Mechanics and Electromagnetics</td>
<td>4</td>
</tr>
<tr>
<td>PHY 210</td>
<td>Computational Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHY 241</td>
<td>Advanced Topics in Magnetism</td>
<td>3</td>
</tr>
<tr>
<td>PHY 242</td>
<td>Advanced Topics in Superconductivity</td>
<td>3</td>
</tr>
<tr>
<td>SSC 222</td>
<td>Global Carbon Cycle</td>
<td>3</td>
</tr>
</tbody>
</table>

**Policy and Management**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARE 147</td>
<td>Resource and Environmental Policy Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CRD 245</td>
<td>Political Economy of Urban and Regional Development</td>
<td>4</td>
</tr>
<tr>
<td>ECI 268</td>
<td>Infrastructure Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECN 125</td>
<td>Efficiency in Energy Markets</td>
<td>4</td>
</tr>
<tr>
<td>ECN 215D</td>
<td>Environment and Economic Development</td>
<td>4</td>
</tr>
<tr>
<td>ESP 163</td>
<td>Energy and Environmental Aspects of Transportation</td>
<td>4</td>
</tr>
<tr>
<td>ESP 212A</td>
<td>Environmental Policy Process</td>
<td>4</td>
</tr>
<tr>
<td>ESP 212B</td>
<td>Environmental Policy Evaluation</td>
<td>4</td>
</tr>
<tr>
<td>ESP 275</td>
<td>Economic Analysis of Resource and Environmental Policy</td>
<td>4</td>
</tr>
<tr>
<td>LAW 235</td>
<td>Administrative Law</td>
<td>3</td>
</tr>
<tr>
<td>LAW 282</td>
<td>Energy Law Seminar</td>
<td>2</td>
</tr>
</tbody>
</table>
d) **Elective Courses (minimum of 23 units)**

Ph.D. students will develop a coherent program of study with their Major Professor by the end of the student’s first quarter of study. This program of study will be designed so that the student can develop a specialization within the energy field through electives. Students may enroll in any of the courses listed above as eligible for the foundation requirement as electives to fulfill their degree requirements, or the student may enroll in other electives subject to the approval of their Major Professor.

Allowing for this flexibility in the course of study will allow the student and their Major Professor to design tailored programs of study that will result in specializations most relevant to the particular student and his/her career objectives. The following are a few examples of the types of specializations within the field that may be expected from EGG students:

- Building energy efficiency; Biomass conversion; Fuel cell engineering; Sustainable transportation policy; Energy economics; Biofuels; Nanosolar manufacturing; Energy systems analysis; among others.

As a result of the diversity of specializations expected within the EGG program, EGG faculty members have chosen not to pre-identify a list of eligible or preferred electives. As the program matures, however, the Executive Committee of the EGG may consider requiring additional specific courses as certain specializations become more common.

e) **Summary:**

Ph.D. students will be required to complete a minimum of 45 units to graduate, at least 30 of which must be at the graduate level in the major field. Of those units, all Ph.D. students will be required to complete 13 units of core coursework, and will be required to complete a minimum of 6 units of additional sub-core coursework to develop a foundation within the student’s chosen degree track (either Energy Science & Technology, or Energy Policy & Management). Ph.D. students will also be required to take at least one course in research design. Ph.D. students will then develop a coherent program of study with their Major Professor by the end of the student’s first quarter of study. This program of study will be designed so that the student can develop a specialization within the energy field through electives.

Full-time students must enroll for 12 units per quarter including research, academic and seminar units. Courses that fulfill any of the program course requirements may not be taken S/U unless the course is normally graded S/U (such as EGG 290 Energy Seminar). Once course requirements are completed, students can take additional classes as needed. Per UC regulations students cannot enroll in more than 12 units of graduate level courses (200) or more than 16 units of combined undergraduate and graduate level (100, 200, 300) courses per quarter.
Students must maintain a GPA of 3.0 overall, and a grade of “C” or higher is required in all graduate courses that fulfill the M.S. Degree course requirements. If the GPA falls below the 3.0 minimum, the student is placed on academic probation. If a student is on academic probation for more than two quarters, the student is subject to disqualification upon recommendation by the Graduate Advisor to the Dean of Graduate Studies.

4) Special Requirements: After passing the Qualifying Examination, all Ph.D. students are expected to give a seminar presentation on their dissertation progress at least once annually.

5) Committees:

a) Executive Committee:

The administration of the EGG program and its activities will be vested in an Executive Committee. The committee will coordinate with the Chair in administering the EGG program and oversee the modification of the EGG program’s mentoring guidelines and application within the program. The committee will consist of the Graduate Advisor, the Graduate Admissions Advisor, and a third member appointed by the Chair. The Graduate Advisor will serve as the Chair of the Executive Committee. The Graduate Staff Coordinator will be a non-voting member of the Executive Committee. Unless otherwise serving as an active member of the Executive Committee, the Director of the UC Davis Energy Institute will serve as an ex-officio member of the Executive Committee.

The principal responsibilities of the Executive Committee are to:

(1) Administer the graduate program, including the approval of all individual programs of study (POS) and graduate course approval forms;

(2) Nominate Thesis Committee (M.S. Plan I) membership (to include three members, including the Major Professor as Chair, as recommended by the student) to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy;

(3) Appoint Comprehensive Examination Committees (M.S. Plan II);

(4) Nominate Qualifying Examination Committee (Ph.D.) membership (to include five faculty members and not to be chaired by the student’s Major Professor) to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy;

(5) Nominate Dissertation Reading Committee (Ph.D.) membership (to include three faculty members and typically Chaired by the student’s Major Professor) to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy;

(6) In consultation with the Chair of the EGG program, appoint such standing and ad hoc committees as deemed necessary to properly administer the activities of the Program; and

(7) Make decisions regarding financial support of students including decisions concerning the allocation of fellowship funding.

b) Qualifying Examination Committee (Ph.D.)

The student, in consultation with the Major Professor and the Graduate Adviser, recommends five faculty members to the Executive Committee to serve on their Qualifying Examination (QE) Committee. The QE Committee conducts the exam and submits the results to the Office of Graduate Studies. The Major Professor is not to
serve as the Chair of the QE Committee. The Executive Committee nominates the QE Committee to the Office of Graduate Studies for formal appointment in accordance with Graduate Council Policy. Only members of the Academic Senate or the EGG program have automatic eligibility to serve as members of advanced degree committees.

Members of the Academic Senate who are *not* members of the EGG program can seek exception to serve as Chair of an advanced degree committee; the petition to do so can be obtained from the Office of Graduate Studies.

Individual who are not members of the Academic Senate or the EGG program can serve on advanced degree committees with written recommendation from the student and approval by the Graduate Adviser and the Office of Graduate Studies; the petition to do so can be obtained from the Office of Graduate Studies. Nomination of an individual who is neither a member of the Academic Senate nor a member of the EGG program to serve as the Chair of an advanced degree committee is approved by the Executive Committee only in the most exceptional circumstances.

c) **Dissertation Reading Committee (Ph.D.)**

The Dissertation Committee is a three-member committee identified by the student, in consultation with the Major Professor. The majority of the committee should be from faculty members of the EGG program. The composition of the dissertation committee is entered on the Advancement to Candidacy Form and submitted by the group’s Executive Committee to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy.

The role of the Dissertation Committee is to advise the doctoral student on the research topic and methods, and then to review the final completed dissertation for acceptance. The Committee Chair (usually the Major Professor) should determine the desires of the individual members regarding assistance with the research and dissertation review at the time the dissertation committee is constituted. Students are expected to meet with the Chair of their dissertation committee regularly. Dissertation committee members are expected to read and comment on a dissertation within four weeks from its submission. This time limit policy does not apply to summer periods for faculty holding nine-month appointments. The student and faculty will coordinate a timeline for the student to present the thesis to the dissertation committee. This timeline must allow all dissertation committee members enough time to fulfill their responsibilities within the four-week deadline.

d) **Graduate Affairs Committee**

The Graduate Affairs Committee will be chaired by the Graduate Advisor. The committee will consist of four members, including one graduate student representative, and shall have the following responsibilities:

(e) To prepare recommendations, as needed, regarding minimum requirements for graduate degrees and other programmatic proposals for consideration by the members of the EGG Program;

(f) To review and recommend revision to the membership, as needed, of the Energy Graduate Group curriculum;

(g) To review petitions from graduate students; and

(h) To assist in the recruitment of graduate students.

Recommended revisions to the EGG Program curriculum must be approved by simple majority vote of the membership.

e) **Student Admissions and Membership Committee**
Once the completed application for admission, all supporting material (as described above), and the application fee have been received, the application will be submitted to the Student Admissions and Membership Committee. The Student Admissions and Membership Committee consists of four faculty members. Based on a review of the entire application, a recommendation is made to accept or decline an applicant’s request for admission. That recommendation is forwarded to the Dean of Graduate Studies for final approval of admission. Notification of admissions decisions will be sent by the Office of Graduate Studies. Applications are accepted through January 1 of the year of anticipated enrollment for priority admission; through March 15 for general admission; and through May 31 if space is still available for the upcoming fall class. Admissions decisions will be announced within approximately 30 to 45 days after the admissions deadline.

6) Advising Structure and Mentoring:

The Major Professor is the faculty member who supervises the student’s research and dissertation and helps the student to develop his/her detailed program of study designed to result in a specialization within the energy field; this person also serves as the Chair of the student’s Dissertation Reading Committee. The Major Professor is not, however, permitted to Chair the Qualifying Examination Committee. The Major Professor also advises the student on course selection each quarter. Students are required to submit a proposed program of study which lists the quarter’s registration plan (must include at least 12 units per quarter, and may include research and seminar units). The Major Professor is required to review and sign off on the proposed program of study each quarter. The approved program of study will be filed with the student's official record in the Graduate Program Staff’s office. Any changes to the program of study must similarly be approved by the Major Professor.

The Graduate Advisor, who is appointed by the Office of Graduate Studies, is a resource for information on academic requirements, policies and procedures, and registration information until the Graduate Affairs Committee of the EGG is formed. The Graduate Program Coordinator (staff) assists students with identifying a Major Professor, identifying appointments and fellowship opportunities, and assists with general university policies. The Mentoring Guidelines can be found in the graduate student handbook produced by Graduate Council and can be found online at the following address:

7) Advancement to Candidacy:

Before advancing to candidacy for a doctoral degree, a student must have satisfied all requirements set by the graduate program, must have maintained a minimum GPA of 3.0 in all course work undertaken (except those courses graded S or U), and must have passed a Qualifying Examination before a committee appointed to administer that examination in accordance with Graduate Council policy. Normally, students advance by the end of the 9th quarter of study. The student must file the appropriate paperwork with the Office of Graduate Studies and pay the Candidacy Fee in order to be officially promoted to Ph.D. Candidacy. Refer to the Graduate Council website for additional details regarding the Doctoral Qualifying Examination at http://gradstudies.ucdavis.edu/gradcouncil/policiesall.html.

8) Preliminary Examination, Qualifying Examination and Dissertation requirements:

a) Preliminary Examination
   The Ph.D. program does not have a preliminary examination.

b) Qualifying Examination
   1. General Information
All students will complete all course requirements before taking their Qualifying Examination (QE). Passing the QE exam makes the student eligible for advancement to candidacy. The QE should be taken by no later than the end of the 9th quarter after admission to the Ph.D. program. According to university policy, graduate students cannot hold an academic title (e.g., GSR, TA) for more than nine quarters before passing their QE.

The primary purpose of the QE is to validate that the student is academically qualified to conceptualize a research topic, undertake scholarly research and successfully produce the dissertation required for a doctoral degree. The QE must evaluate the student’s command of the field, ensuring that the student has both breadth and depth of knowledge, and must not focus solely on the proposed dissertation research. In addition, the QE provides an opportunity for the committee to provide important guidance to the student regarding his or her chosen research topic.

The QE will consist of both written and oral examinations.

2. Written Portion of the Qualifying Exam – Dissertation Prospectus

At a minimum, the written portion of the QE consists of a research proposal called the Dissertation Prospectus. The Prospectus should be provided to members of the QE committee at least 10 days before the oral portion of the QE.

The Prospectus is an independently prepared proposal of 5-10 pages describing the student's dissertation-specific research aims, hypotheses, progress to date, and experimental approach. Concepts within the research proposal can be discussed with others (such as the student's Major Professor and peers), but the writing of the proposal should be solely the student's work (i.e., no editorial assistance is allowed) as the proposal will serve as evidence of the student's proficiency in scientific writing.

The QE committee will be responsible for assessing that the student's writing proficiency is satisfactory before advancement to candidacy. Furthermore, the Prospectus will provide information that may be discussed during the oral portion of the QE.

3. Oral Portion of the Qualifying Exam

The oral portion of the QE will be 2-3 hours in length and is intended to demonstrate the student's critical thinking ability, powers of imagination and synthesis, and broad knowledge of the field of study.

The QE committee will evaluate the student's general qualifications for a respected position as an educator or leader as well as the student's preparation in a special area of study based upon relevant portions of the student's previous academic record, performance on specific parts of the examination, and the student's potential for scholarly research as indicated during the examination.

4. Outcome of the Qualifying Exam

The QE committee will reach a decision on the student’s performance immediately after the oral portion of the QE exam. The QE committee, having reached a unanimous decision, shall inform the student of its decision to:

- “Pass” (no conditions may be appended to this decision),
- “Not Pass” (the Chair’s report should specify whether the student is required to retake all or part of the examination, list any additional
requirements, and state the exact timeline for completion of requirements to achieve a “Pass”), or

- “Fail.”

If a unanimous decision takes the form of “Not Pass” or “Fail”, the Chair of the QE committee must include in its report a specific statement, agreed to by all members of the committee, explaining its decision and must inform the student of its decision. Having received a “Not Pass,” the student may retake the QE one additional time; the QE report must identify and list the specific conditions and timing for the second exam. After a second examination, a vote of “Not Pass” is unacceptable; only “Pass” or “Fail” is recognized. Only one retake of the QE is allowed. Should the student receive a “Fail” on the first or second attempt at the exam, the student will be recommended for disqualification from the program to the Dean of Graduate Studies.

Note that to address any deficiencies identified during the oral portion of the QE exam, additional work, as determined by the QE committee, may be required of the student in order to pass the QE on second attempt.

c) The Dissertation

1. Exit Seminar
The dissertation follows Plan B with a required exit seminar. Satisfaction of this requirement must be verified by the Dissertation Committee Chair. The Exit Seminar is a formal public presentation of the student’s research before the program faculty and students. It is recommended that this presentation take place during the final quarter of the program. The Dissertation Committee will not sign the Dissertation until after the exit seminar has taken place. Adequate scheduling of the exit seminar is the responsibility of the student.

2. Dissertation: General Requirements
Filing of a Ph.D. dissertation with the Office of Graduate Studies is normally the last requirement satisfied by the candidate. The deadlines for completing this requirement are listed each quarter in the campus General Catalog (available online at the website of the Office of the Registrar or from the Bookstore) and are available from the Office of Graduate Studies. A candidate must be a registered student or in Filing Fee status at the time of filing a dissertation, with the exception of the summer period between the end of the Spring Quarter and the beginning of Fall Quarter. The PhD. Dissertation will be prepared, submitted, and filed according to regulations instituted by the Office of Graduate Studies http://gradstudies.ucdavis.edu/students/filing.html Satisfaction of this requirement must be verified by the Dissertation Committee Chair.

3. Dissertation:
The research conducted by the student must be of such character as to show ability to pursue independent research. The dissertation reports a scholarly piece of work of publishable quality that solves a significant scientific problem in the field and is carried out under the supervision of a member of program while the student is enrolled in the program. The chair of the Dissertation Committee must be a member of the EGG program and must be immediately involved with the planning and execution of the experimental work done to formulate the dissertation. The Major Professor’s laboratory is the setting for most of the student’s research activities, unless an alternative site and immediate supervisor are approved in advance by the Executive Committee.

Students should meet regularly with their Dissertation Committee. The dissertation must be submitted to each member of the dissertation committee at least one month before the student expects to make requested revisions; committee
members are expected to respond within 4 weeks, not including summer months for nine month faculty. Informing committee members of progress as writing proceeds helps the members to plan to read the dissertation and provide feedback within this time frame. The dissertation must be approved and signed by the dissertation committee before it is submitted to the Office of Graduate Studies for final approval.

9) **Normative Time to Degree**

Normative time is the elapsed time (calculated to the near academic quarter) that a student would need to complete all requirements for the degree, assuming that they are engaged in full-time study and making adequate progress. For the Ph.D. degree from the Energy Graduate Group, the normative time to advancement to candidacy is 9 quarters (three years of full-time academic enrollment).

For Ph.D. students, measured from the time a student begins graduate study, the normative time in candidacy to complete the dissertation and earn the degree is approximately 5 years. For a student entering the Ph.D. program already having an M.S. degree in the field, the normative time in candidacy to complete the dissertation and earn the Ph.D. degree is approximately 3 years.

10) **Typical Time Line and Sequence of Events**

This section provides two timelines. The first table illustrates the expected timeline for full-time Ph.D. to meet broad objectives within the program. The second table presents an example of a study plan for a Ph.D. student focused on energy engineering.

<table>
<thead>
<tr>
<th>Action Item</th>
<th>Expected Quarter of Completion After Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select a Major Professor</td>
<td>1</td>
</tr>
<tr>
<td>Submit Graduate Student Study List</td>
<td>1 / 2 / 3</td>
</tr>
<tr>
<td>Select Program of Study Committee</td>
<td>1</td>
</tr>
<tr>
<td>Submit Graduate Student Annual Progress Report</td>
<td>3 / 6 / 9 / 12 / 15</td>
</tr>
<tr>
<td>Submit Preliminary Program of Study</td>
<td>2</td>
</tr>
<tr>
<td>Establish Dissertation Committee</td>
<td>3</td>
</tr>
<tr>
<td>Submit final Program of Study</td>
<td>6</td>
</tr>
<tr>
<td>Submit Application for Qualifying Exam</td>
<td>6</td>
</tr>
<tr>
<td>Take initial Qualifying Exam</td>
<td>6</td>
</tr>
<tr>
<td>Retake Qualifying Exam (if necessary)</td>
<td>9</td>
</tr>
<tr>
<td>Submit Application for Advancement to Candidacy</td>
<td>6 / 9</td>
</tr>
<tr>
<td>File Dissertation and Present Exit Seminar</td>
<td>15</td>
</tr>
</tbody>
</table>

The following table presents an example of a study plan for a Ph.D. student focused on energy engineering and economic modeling of energy systems. This student will have entered the EGG program with an undergraduate degree in Engineering and thus has fulfilled all pre-requisites.

<table>
<thead>
<tr>
<th>Year One</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>EGG 200</strong>: Fundamentals of Energy Science and Technology (4)</td>
<td><strong>EGG 201</strong>: Life Cycle Analysis in Energy Systems (4)</td>
<td><strong>EGG 202</strong>: Energy and Climate Policy (3)</td>
</tr>
<tr>
<td>Year Two</td>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------------------------</td>
<td>---------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Total Units:</td>
<td>8 units (course work)</td>
<td>8 units (course work)</td>
<td>8 units (course work)</td>
</tr>
<tr>
<td></td>
<td>1 unit (seminar)</td>
<td>4 units (research)</td>
<td>4 units (research)</td>
</tr>
<tr>
<td></td>
<td>3 units (research):</td>
<td>8 units (course work)</td>
<td>8 units (course work)</td>
</tr>
<tr>
<td></td>
<td>12 units</td>
<td>12 units</td>
<td>12 units</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year Three</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECI 250: ECI 250: Civil EGG 299: Research (3)</td>
<td>ECI 250: Civil Infrastructure System EGG 299: Research (3)</td>
<td>ECI 250: Civil Infrastructure System Optimization and EGG 299: Research (3)</td>
<td>ECI 250: Civil Infrastructure System Optimization and Identification (4)</td>
</tr>
<tr>
<td>Total Units:</td>
<td>8 units (course work)</td>
<td>8 units (research)</td>
<td>8 units (research)</td>
</tr>
<tr>
<td></td>
<td>1 unit (seminar)</td>
<td>12 units</td>
<td>12 units</td>
</tr>
<tr>
<td></td>
<td>3 units (research):</td>
<td>12 units</td>
<td>12 units</td>
</tr>
</tbody>
</table>

The student will take predominantly EGG 299 research units in years four and five of study as the student completes the research needed for the dissertation. The student may take additional graduate or upper-division courses during this time as determined to be appropriate by the Major Professor.

11) Sources of funding.

We expect the EGG program to be highly competitive and to attract academically outstanding students to UC Davis. Through the combination of existing campus financial commitments and significant extramural fundraising, it is expected that all EGG students will receive fellowship and research support.

The following summarizes the sources of expected support for EGG students:
- **Campus financial commitments:** Significant fellowship support committed by the Deans of Engineering, Graduate Studies, and Agricultural and Environmental Sciences.

- **Corporate support:** Development by the Energy Institute of corporate sponsorship of energy related research to support EGG students.

- **Existing fellowship opportunities:** EGG students studying transportation-related energy issues will be eligible to compete for existing fellowship opportunities.

- **Faculty grants:** Some EGG students may be funded on existing faculty research grants.

- **Extramural research funding:** The Energy Institute will aggressively pursue interdisciplinary energy research grants from federal and state agencies, and foundations.

**Campus Commitments.** Many incoming students will be eligible for external and campus fellowships including those funded by the commitments described in letters from the Deans of Engineering, Graduate Studies, and Agricultural and Environmental Sciences found in Appendix A. Fellowship funding committed by those deans totals $350,000 over the first three years of the EGG program, after which time the Office of Graduate Studies will support the program through the Graduate Program Fellowship Allocation (with funding of $240,000 per year on the basis of expected EGG enrollment beginning in Year 4).

**Corporate Support.** Additional fellowship support for EGG students is expected to be raised from extramural sources by the Energy Institute. One strategy will be for the Energy Institute to adopt the successful modeled developed by the Institute of Transportation Studies (ITS-Davis) that provides fellowship support through its Corporate Affiliate Program for students studying transportation issues. Through that program, affiliate members of ITS-Davis make major gifts to support core programs and include members such as: BMW, BP, ExxonMobil, Daimler, Nissan, Shell, Toyota, and PG&E. The Energy Institute will be able to leverage these corporate connections as it works with affiliated research centers in the Energy Hub to raise new funding sources for EGG student fellowships.

**Existing Fellowship Opportunities.** Moreover, to the extent that any EGG students have research interests in transportation-related energy issues, they may also be eligible to apply for existing fellowships offered by ITS-Davis or by affiliated research centers, such as the National Center for Sustainable Transportation (NCST). NCST is co-located with the Energy Institute at the Energy Hub at West Village and is funded by the U.S. Department of Transportation (with match funding from the California Air Resources Board, California Department of Transportation, and California Energy Commission) at $11.2 million over four years.

**Faculty Grants.** Some EGG students will also likely be funded through existing faculty research grants focused on energy topics. In some instances, this may be to the exclusion of existing students in other departments on campus, but in others, faculty will likely be able to fund additional students due to the increased capabilities that EGG student researchers will provide. For more details about the extent to which faculty envision including EGG students on existing research grants, see the letters of support from EGG faculty in Appendix B.

**Extramural Research Funding.** The final source of expected funding for EGG students will come from research grants to fund interdisciplinary energy research. The Energy Institute will aggressively identify and pursue targets external sources of research funding, such as research grants from federal and state agencies or from foundations. The sub-section below provides an overview of the federal and state energy research trends.

Funding decisions related to fellowships are generally made by either the Graduate Program Committee or Graduate Studies, depending on the source of funding for the fellowship. Not all fellowship funding decisions are made by either the Graduate Program Committee or Graduate Studies; as examples, graduate students may also seek fellowship funding directly from the US Environmental Protection Agency, National Science Foundation, US Department of Energy,
foundations, and a range of other agencies and organizations. Funding decisions related to Research Assistantships are made by the Principal Investigator of the source of funding.

12) **PELP, In Absentia and Filing Fee status.**

   Information about PELP (Planned Educational Leave), In Absentia (reduced fees when researching out of state), and Filing Fee status can be found in the Graduate Student Guide: [http://www.gradstudies.ucdavis.edu/publications/](http://www.gradstudies.ucdavis.edu/publications/)

13) **Leaving the Program Prior to Completion of the Ph.D. Requirements.**

   Should a student leave the program prior to completing the requirements for the Ph.D., they may still be eligible to receive the M.S. degree if they have fulfilled all the requirements necessary for that degree (see M.S. degree requirements section). Students can use the Change of Degree Objective form available from the Registrar’s Office to initiate this process: [http://registrar.ucdavis.edu/local_resources/forms/D065-graduate-major-degree-change.pdf](http://registrar.ucdavis.edu/local_resources/forms/D065-graduate-major-degree-change.pdf).
Appendix G. Overview of the Energy and Resources Group at UC Berkeley
The Energy and Resources Group (ERG) is a collaborative community of graduate students, core faculty, over 100 affiliated faculty and researchers across the campus, and over 300 alumni across the globe. ERG offers M.A., M.S., and Ph.D. degrees to students working across disciplines and departments to create a transformative knowledge for the planet and its people. ERG is a world-renowned program with a 45-year history of outstanding research, education, and outreach to government, industry, and civil society at the state, national, and international levels.

The online application for Fall 2015 admission to ERG’s graduate programs will be available September 2, 2014. The deadline for filing applications is Friday, December 5, 2014. Applications for the concurrent degree programs with the Goldman School of Public Policy are due Tuesday, December 2, 2014. Admissions decisions will be announced by March 1, 2015. ERG accepts students only in the Fall term. You can learn more about the graduate programs at UC Berkeley and access the application on the Graduate Division website here. For more information on ERG Admissions for Prospective Students, see here.

ERG students and faculty work across disciplines and departments to create transformative knowledge for the planet and its people. Forty years of ERG research has advanced the fields of global change ecology, renewable energy deployment, efficient energy systems, ecological economics, and equitable and affordable access to water and energy. Donate now to support ERG’s unique culture of interdisciplinary research and teaching for a sustainable environment and a just society.

Donate Now

'The United States is finally willing to walk its climate talk.' Dr. Mallik Ranganathan (MS’00, PhD’10), Assistant Professor at American University.

Watch White House scientists, including Dr. Cyrus Wadia (ERG MS’06, Ph.D’08), talk about the White House’s shift toward renewables.

Go to Spotlight Archive
ABOUT

ABOUT ERG

Mission
The mission of the Energy and Resources Group is education and research for a sustainable environment and a just society.

Overview
With its four-decade history of transformative teaching and research, the Energy and Resources Group (ERG) has reframed ecological and social problems in terms that borrow from, and yet can be understood across, many traditionally separate disciplinary cultures. The ERG model combines a rigorous core curriculum, a shared learning environment, and the freedom to access the entire Berkeley faculty. The core curriculum provides students with relevant analytical tools from ecology, economics, engineering and the social sciences. ERG research is strongly evidence-based and hypothesis-driven; its interdisciplinary culture equally encourages student- and faculty-led research. The value of such a culture is hard to quantify: it has evolved through the commitment to systemic thinking, and the vision of a just and sustainable planet, over generations of ERGees.

A Brief History
For thirty years, the Energy and Resources Group (ERG) at the University of California, Berkeley has provided its outstanding graduate students and exceptional faculty the scholarly conditions in which to:

- study the environmental sciences,
- analyze the social causes of our energy and environmental problems,
- undertake field research in a variety of ecosystems,
- engage in cross-cultural learning, and
- devise technical and policy alternatives to unsustainable energy and resource use patterns.

The Berkeley Campus offers exceptional opportunities to learn from outstanding scholars in many disciplines. ERG facilitates the placement of specialized knowledge into the larger integrated perspective. Students and faculty incorporating one another’s insights, work on alternative energy technologies, ecological economics, terrestrial ecology, environmental justice, resource conflicts, and society and technology. ERG and the term ‘activist-scholar’ are closely associated. Faculty and students alike are motivated by current and foreseeable problems and are encouraged to take what they learn into the full range of educational, political, and policy processes. In this highly interactive academic environment, feasible paths to social justice, appropriate technologies and ecological integrity begin to emerge.

ERG traces its origins to the Committee on Energy and Resources, which was established in November 1972 under the chairmanship of electrical engineering professor C. K. Birdsall as an Advisory Committee to the then Vice-Chancellor Mark N. Christensen. The Committee laid the groundwork for an Interdisciplinary program of teaching and research in energy and resources and secured for this purpose the first regular faculty position in Berkeley’s history to reside entirely in an interdisciplinary unit.

John P. Holden (emeritus) was appointed to fill that position, as Assistant Professor in the Energy, and Resources Program, in summer 1973. The program attained degree-granting status as a Graduate Group in late 1974, and admitted its first graduate students in 1975.
PROGRAMS OFFERED AT ERG

- Master's Degree in Energy and Resources (MA or MS)
- Master's/Ph.D. Track
- ERG Concurrent Degree Programs (MPP/MA or MPP/MS)
- Matriculation from the Master's or Track to the Ph.D.
- Ph.D. in Energy and Resources
- Undergraduate Minor in Energy and Resources

Master's Degree 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.

Click here for more information on the Master's Degree Curriculum Requirements (MA or MS).

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Master's/Ph.D. Track

A small number of highly qualified applicants will be selected for the Master's/Ph.D. Track. The Track is both an indication of your intent to continue to the Ph.D. 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 Ph.D. Candidates admitted into the joint Master's/Ph.D. Track will be expected to complete all the requirements of the ERG Master's Degree before continuing.

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

The Energy and Resources Group (ERG) and 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).

Click for more details on the concurrent degree program.

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Matriculation from the Master's or Track to Ph.D.

Students who begin on the Master's/Ph.D. 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 Ph.D. during the third semester of the two-year Master's program.

To officially matriculate into the Ph.D. 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 Ph.D. advisor and an assessment of the types of projects the student could work on during Ph.D. 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 Ph.D. program.

Ph.D. Degree 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 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 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 advisor and subject to the approval of the Graduate Dean.
MASTER'S DEGREE CURRICULUM REQUIREMENTS (MA OR MS)

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 broad and deep, stressing analytic, methodological, theoretical, and practical approaches to problems in energy, resources, and the environment.

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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
- Complete the ERG Masters Degree Series:
  - ER 201 — Interdisciplinary Analysis in Energy and Resources (3 units)
  - ER 292B — Master's Research Skills and Project Development (2 units)
  - ER 292C — Masters Project Development (2 units)
  - 292D — Masters Project Presentation (2 units)
  - ER 295 — ERG Colloquium (2 units) Two semesters are required to ensure exposure to a broad array of topics and approaches.
- Six additional units of approved graduate-level courses
- Complete one course from each of the A-E Requirements listed below.
- 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 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:
  - A maximum of 4 units of 299 (individual research) credits can be counted.
  - 299 units (group study) cannot be counted.

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 classes 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 student's ERG core faculty advisor. The course of study may change as a student's interests and plans change. At the end of the second and third semesters, students are expected to submit a revised course of study. The final course of study must be approved early in the student's final semester to meet the requirements for graduation.

At the end of the third semester, students also are required to submit their proposed Master's Project title and abstract to their ERG core faculty advisor, who will provide feedback. Each student, in collaboration with the first faculty reader and 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 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. The ERG core faculty advisor makes a final determination of the appropriateness of the MA/MS selection.
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 for a grade (not pass/fail) 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 maturity in a given area based on previous academic work may petition the responsible faculty to waive the requirement in that area. For example, a high level of maturity 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.

Please note that course offerings change each semester, and not all courses are offered each term. Please consult the online Schedule of Classes at http://schedule.berkeley.edu/ for current course offerings. The following is not a comprehensive list; please consult with the area responsible faculty advisor about proposed alternative courses to satisfy the requirements.

A. Interdisciplinary Energy and Resource Analysis

Responsible Faculty: Isha Ray

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.

The following courses meet this requirement:
- ER C200 – Energy and Society (Prerequisite: at least one course in college physics or chemistry)
- ER 275 – Water and Development (Prerequisite: at least one college-level development-focused or water-focused course)

B. Environmental Science

Responsible Faculty: John Korte

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

All Master’s students must take this class (no substitutions):
- ER 102 – Quantitative Aspects of Global Environmental Problems (Prerequisites: calculus (Math 1A-1B or 16A-16B), or physics (7A-7B or 8A-8B), or chemistry (1A or 4A), or biology (1B or 11), or consent of instructor)

C. Resource and Environmental Economics

Responsible Faculty: David Anthoff

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 106) as a prerequisite, as well as at least one semester of calculus.

Some of the courses that meet this requirement:
- ER C180 / EEP C180/280 – Ecological Economics in Historical Context
- ARE 212 – Econometrics
- EEP 100/AERE 241 – Microeconomics Theory
- EP C101 / Econ C120 – Environmental Economics
- EEP C102 / Econ C102 – Natural Resource Economics
- EEP C151 / Econ C171 – International Economic Development
- EEP Y92 – Economics of Water Resources
- MBA 212 – Energy and Environmental Markets
D. Social Science Approaches to Energy, Resources and the Environment

Responsible Faculty: Isha Ray

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.

Some of the courses that meet this requirement:
- ER 273 – Research Methods in Social Sciences
- ER 151 – Politics of Energy and Environmental Policy
- ESPR 155 – Sociology of Natural Resources
- ESPR 161 – Environmental Philosophy and Ethics
- ESPR 108 – Political Ecology
- ESPR 159 – International Environmental Politics
- CRP 204 – Sustainable Communities
- ESPR 260 – Governance of Global Production
- GEOG 215 – Seminar in Comparative and International Development

E. Engineering Approaches to Energy, Resources and the Environment

Responsible Faculty: Duncan Callaway

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.

Some of the courses that meet this requirement:
- ER 226/MSE 226 – Photovoltaic Materials
- ER 254 – Electric Power Systems
- CEE 103 – Introduction to Hydrology
- CEE 111 – Environmental Engineering
- CEE 218A – Air Quality Engineering
- CEE 266E – CNH Systems and the Environment

The ERG Master’s Degree Seminar Series

Semester I – Fall
- ER 201 – Interdisciplinary Analysis in Energy and Resources
  3 units, graded. Required for all Masters students in their first semester. Introduction to the Masters final project process; survey of previous Masters final projects; survey of energy and resources classic texts; external funding searches and proposal writing skills; introduction of ERG faculty research topics, interactive group research projects.
- ER 292A – Tools of the Trade
  2 units, S/U. Recommended for all new Masters students who want to refresh their quantitative skills; students with substantial remedial needs may need to take some undergraduate coursework. Quantitative methods for energy and resource analysis. Topics include linear algebra, differential equations, statistical methods, chemical equilibrium theory and thermodynamics.

Semester II – Spring
- ER 292B – Master’s Seminar: Research Skills
  2 units, graded. Critical reading and analysis of research papers; development and discussion of project ideas. Students begin to identify and solicit faculty readers for their projects. Human subject research issues, ethics and protocols introduced.

Semester III – Fall
- ER 292C – Master’s Seminar: Research Project Development
  2 units, graded. Final development of research project ideas; final solicitation of faculty readers; critical feedback from cohort on projects.

Semester IV – Spring
- ER 292D – Master’s Seminar: Final Project Presentations
  2 units, graded. Students meet as needed with faculty readers and advisors; following Spring Break students meet as a group for practice presentations. End of semester all students do a final 15-minute presentation of their project.
Sample Program of Study

Note: the minimum enrollment requirement for all graduate students who are not yet advanced to doctoral candidacy is 12 units per semester.

1st Semester (Fall)
- ER 201 (4 units) or ER 275 (3 units) — Area A requirement
- ER 201 (3 units) — Interdisciplinary Analysis in Energy and Resources
- Elective C-E — satisfy one of the Area C-E requirements
- ER 292A — Tools of the Trade (2 units)
- Early December — submit proposed Course of Study form

2nd Semester (Spring)
- ER 102 (4 units) — Area B requirement
- ER 292C (2 units) — Master’s seminar
- ER 295 (1 unit) — ERG colloquium
- Elective Cluster — Cluster course no. 1
- Early May — Submit revised Course of Study

3rd Semester (Fall)
- ER 292D (2 units) — Master’s seminar
- ER 295 (1 unit) — ERG colloquium
- Elective Cluster — Cluster course no. 2
- Elective C-E — satisfy one of the Area C-E requirements
- Additional Elective
- Early December — submit updated Course of Study and Title/Abstract for Master’s Project

4th Semester (Spring)
- ER 292D (2 units) — Master’s Project
- Elective Cluster — Cluster course no. 3
- Elective C-E — satisfy one of the Area C-E requirements
- Additional elective course
- Receive feedback and approval of Course of Study and Title/Abstract for Master’s Project
ACADEMICS

ADMISSIONS

PROGRAM

COURSES

Please note: This is a full list of ERG course offerings, not all courses are offered each term. For current course offerings, please refer to the online Schedule of Classes.

ER 98/198 — Energy DeCal
Daniel Kammen (Instructor of Record), class conducted by undergraduate students
Introduction to energy: topics and explore the social, environmental, and economic consequences of our carbon-based economy.
Includes guest speakers, article presentations, projects, discussions, and films to explore the energy cycle, tracing its origins, distribution, consumption and waste.

ER C100/C200 — Energy and Society
Daniel Kammen
You will develop an understanding – and a real working knowledge – of our energy technologies, policies and options. This will include analysis of the different opportunities and impacts of energy systems that exist within and between groups defined by national, regional, household, ethnic, and gender distinctions. Analysis of the range of current and future energy choices will be stressed, as well as the role of energy in determining local environmental conditions and the global climate. ER C100 is open to undergraduates. ER C200 is open to graduate students. Cross-listed with Pub Pol C184/C264.

ER 101 — Ecology and Society
John Harte
Introduction 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, eutrophication, the evolution of cooperation in ecosystems, industrial ecology, and the population biology of ecology. Prerequisites: One college level course, or high school Advanced Placement, in either physics of biology. Introductory calculus.

ER 102 — Quantitative Aspects of Global Environmental Problems
John Harte
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.

ER 175/275 — Water and Development
Isha Ray
Introduction 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.” ER 175 is open to undergraduates; 275 is open to graduate students.

ER 290 — 901 — Climate Change Economics
David Anthoff
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.

ER C180/C280 — Ecological Economics in Historical Context
Isha Ray (Instructor of Record) and Jael Sager
Cross-listed with Environmental Economics & Policy C180.
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.

ER 201 — Interdisciplinary Analysis in Energy and Resources
ERG Faculty
Required for and limited to new ERG Master’s students. Introduction to interdisciplinary analysis as it is practiced in the Energy and Resources Group (ERG). Most of the course consists of important perspectives on energy and resources 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 and practical knowledge and skills necessary to successfully complete graduate school in an interdisciplinary program.

ER 264 — Electric Power Systems
Duncan Callaway
Three hours of lecture per week. Prerequisites: Physics 7B or 8B or equivalent.
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, and end-use efficiency, and new technologies.
ERG Courses:

**ER 273 – Social Science Methods**
Isha Ray
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.

**ER C283 – Information and Communications Technology for Development**
Isha Ray and Anna Lee Saxenian
A review of 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. Cross-listed with School of Information INFO 283.

**ER 280 – Alternative Transportation Fuels (Crosslisted with CEE 290 F)**
Timothy Lipman
Limited to senior undergraduates and graduate students.
This graduate seminar will provide background information on science, and adaptation and mitigation components of climate change research, the magnitude of increase in temperature under different emission scenarios, identify energy technologies and forest sector options to reduce emissions, describe the barriers and challenges to marketing the above options, and discuss the role of policies to speed up the deployment of above options in order to limit the temperature increase to 2°C. The class will provide a forum for the development of original written material that challenges current hypotheses, and, ideally, presents alternative theories.

**ER 250 – Assessing Building Energy Use and Indoor Environmental Quality (Crosslisted with Arch 245)**
Stefano Schiavon and Duncan Gallaway
This course will revolve around the energy and indoor environmental quality assessment of buildings on the UC Berkeley campus, using energy use field measurements, data analysis, and surveys. Includes a mix of lectures and field trips to buildings. Topics include heating, cooling, ventilation, energy benchmarking, indirect energy modeling, post occupancy evaluation, indoor environmental quality assessment, and basic economic modeling tools. Evaluation based on framework assignments and one final group project. Limited to senior undergraduates and graduate students. Prereq Arch 140, ERG 250 or equivalent, plus graduate standing or consent of instructor.

**ER 280 – 005 – Climate Change Adaptation and Mitigation: Global Analysis and Regional Response**
Larry Dale, Jayant Sathaye and Scott McCreary
This graduate seminar will provide background information on science, adaptation and mitigation components of climate change research, explore the magnitude of increase in temperature under different emission scenarios, identify energy technologies and forest sector options to reduce emissions, explore the challenges to marketing and advancing these options in the local, state, federal, and international policy arenas to address and respond to climate change. Course modules will address both local issues, including San Francisco Bay and the State’s food and wine industry, and international challenges, including India, China and the role of negotiation in shaping climate change policy and intervention. Ideally, the class will provide a forum for the development of original written material that challenges current hypotheses and suggests alternative theories.

**ER 252 A – Master’s Seminar: Tools of the Trade**
John Harte (Instructor of Record)
Recommended for Energy and Resources Master’s students in the fall of their first year. Limited to ERG graduate students. Quantitative methods for energy and resource analysis. Topics include linear algebra, differential equations, statistical methods, chemical equilibrium theory and thermodynamics.

**ER 252 B – Master’s Seminar**
Required for, and limited to, Energy and Resources Master’s candidates in the spring of their first year. Topics include research skills, critical reading and analysis of research papers, development of Master’s project ideas. Human subject research issues, ethics and protocols introduced.

**ER 252 C – Master’s Seminar**
Required of, and limited to, first-year Energy and Resources Master’s students in the fall of their second year. Topics include the adoption of a research project, research design, presentation of work, statistical analyses. Students will apply the interdisciplinary methods, approaches and perspectives learned in the core curriculum.

**ER 252 D – Master’s Seminar**
Required of and limited to second-year Energy and Resources Master’s students in the spring of their second year. Topics include the adoption of a research project, research design, presentation of work, statistical analyses. Students will apply the interdisciplinary methods, approaches and perspectives learned in the core curriculum. Sequence begins spring each year.

**ER 255 – ERG Colloquium: Special Topics in Energy and Resources**
Duncan Gallaway with guest speakers
Presentations of research in energy issues by faculty, students, and visiting lecturers. Master’s degree students required to enroll for two semesters.

**ER 256 – Doctoral Seminar**
Isha Ray with guest speakers
Presentations of current Ph.D. research. Limited to ERG graduate students.

**ER 299 – Independent Research**
For information on Independent research units with individual faculty members please contact the department at erggrad@berkeley.edu.
Appendix H. Curriculum Vitae of Initial EGG Faculty
Nina Amenta  
Professor and Chair, Department of Computer Science  
The University of California at Davis, 95616

EDUCATION:

University of California at Berkeley, Computer Science Ph.D., 1993.

PROFESSIONAL HISTORY:

2013–present Chair, Computer Science Department, University of California at Davis  
2007 – present Professor, Computer Science Department, University of California at Davis  
2002–2007 Associate Professor, Computer Science Department, University of California at Davis  
1997–2002 Assistant Professor, Computer Sciences Department, University of Texas at Austin.  
1995–1997 Post-doctoral Researcher, Xerox Palo Alto Research Center  
1982–1987 Software Engineer and Project Manager, Ultrasound Division, Diasonics Inc.

RELEVANT PUBLICATIONS:


Lance Simons, Stewart He and Nina Amenta. Point-based rendering of forest LiDAR, Submitted to Workshop on Visualisation in Environmental Sciences, Eurographics, 2014.


OTHER PUBLICATIONS:


SYNERGISTIC ACTIVITIES:

**Director**
Center for Information Technology Research in the Interest of Society (CITRIS) at UC Davis, 2011–present.

**Steering Committee**

**Selected Program Committees**

**Freely Distributed Software**
Landmark editor, 3D landmark placement and morphometric tools, used by paleontologists, [http://graphics.idav.ucdavis.edu/research/EvoMorph](http://graphics.idav.ucdavis.edu/research/EvoMorph)
Phylogeny visualization software: Tree-set visualization module for Mesquite, used by evolutionary biologists, [http://comet.lehman.cuny.edu/treeviz/](http://comet.lehman.cuny.edu/treeviz/)
Power crust software for surface reconstruction, used in science and engineering, [http://www.cs.utexas.edu/users/amenta/powercrust/](http://www.cs.utexas.edu/users/amenta/powercrust/)
Kali, an interactive visualization of planar symmetry, used with middle school students, [http://www.geom.umn.edu/software/download/kali.html](http://www.geom.umn.edu/software/download/kali.html)
CURRICULUM VITAE

Shota Atsumi
Assistant Professor
Department of Chemistry
University of California-Davis

Work Address: One Shields Ave, Davis, CA 95616
Phone: 530-752-6595
Fax: 530-752-8995
Email: satsumi@ucdavis.edu

Education
1992-1996 School of Science Kyoto University, Kyoto, Japan, BS, Science
1996-1998 School of Science Kyoto University, Kyoto, Japan, MS, Science
1998-2002 School of Science Kyoto University, Kyoto, Japan, Ph.D, Chemistry

Employment
2002-2006 Department Biochemistry & Molecular Biophysics, University Arizona, Postdoc
2006-2009 Department of Chemical & Biomolecular Engineering, University of California, Los Angeles, Postdoc
2009-present University of California, Davis, Assistant Professor

Honors & Awards
2010 Presidential Green Chemistry Challenge Award (United States Environmental Protection Agency) “Recycling Carbon Dioxide to Biosynthesize Higher Alcohols” I received a certificate for significant contributions to development of the award-winning technology and was the only person to be awarded a certificate other than Professor James C. Liao.
2012 Hellman fellow
2014 NSF CAREER Award

Selected Publications

Synergistic Activities

**Editorial and Advisory Boards**

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<tr>
<th>Year</th>
<th>Position</th>
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<td>2014-present</td>
<td>Associate Editor: Frontiers in Synthetic Biology.</td>
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**Teaching**

**Student Advising**

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**Thesis Committees**

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<tr>
<td>2011-2014</td>
<td>Lisa Adele Anderson, Member, Ph.D., In Progress</td>
</tr>
<tr>
<td>2011-2014</td>
<td>Gabriel Manuel Rodriguez, Chair, Ph.D., In Progress</td>
</tr>
<tr>
<td>2012-2012</td>
<td>Edna Lamsen, Chair, Masters, Awarded, Senior Learning Skills Counselor (UC Davis)</td>
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<tr>
<td>2012-2014</td>
<td>John William Kidder Oliver, Chair, Ph.D., In Progress</td>
</tr>
<tr>
<td>2012-2015</td>
<td>Jordan McEwen, Chair, Ph.D., In Progress</td>
</tr>
<tr>
<td>2012-2015</td>
<td>Amanda Hildebrand, Member, Ph.D., In Progress</td>
</tr>
<tr>
<td>2013-2016</td>
<td>Shuchi Desai, Chair, Ph.D., In Progress</td>
</tr>
<tr>
<td>2013-2016</td>
<td>Alexander Gulevich, Member, Ph.D., In Progress</td>
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<td>2014-2017</td>
<td>Nicole Nozzi, Chair, Ph.D., In Progress</td>
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**Trainees**

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<tr>
<td>2011-present</td>
<td>Christine A. Rabinovich-Deere, Post-doctoral researcher</td>
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<tr>
<td>2012-present</td>
<td>Yohei Tashiro, Post-doctoral researcher</td>
</tr>
<tr>
<td>2011-2013</td>
<td>Iara M.P. Machado, Post-doctoral researcher</td>
</tr>
<tr>
<td>2010-2011</td>
<td>Michael R. Connor, Post-doctoral researcher</td>
</tr>
<tr>
<td>2011-2013</td>
<td>Hisanari Yoneda, Visiting researcher</td>
</tr>
</tbody>
</table>
Appendix 1. Biographical Sketch  Louise A. Berben

Education and Training
University of New South Wales  Pure and Applied Chemistry  B.Sc. (Hons)  2000
University of California Berkeley  Chemistry  Ph.D.  2005

Professional History
07/2014 – present  Associate Professor  Department of Chemistry, University of California Davis
07/2009 – 06/2014  Assistant Professor  Department of Chemistry, University of California Davis

Awards
2014  Organometallics Young Investigator Fellow
2014  Young Investigator featured in Inorganic Chemistry
2014  Rising Star Award, WCC, American Chemical Society
2013  Chemical Communications Emerging Investigator Lectureship
2012  Alfred P. Sloan Foundation Fellow
2011  CAREER Award, National Science Foundation
2006  Dow Chemical Company Postdoctoral Fellow
2003  Outstanding Graduate Student Instructor Award, UC Berkeley

Selected Recent Publications


**Synergetic Activities**


2012-present Service for Chemical Communications. Editorial Advisory Board and Guest Editor for 2 Special Issues: "Small Molecule Activation" and "Non-Innocent Ligands".

2013-2014 Research mentor for undergraduates student in MURPPS and UC LEADS programs (UC programs for students from economically disadvantaged backgrounds). For ACS and NSF-REU programs.

2009-present Reviewer: mail and panel for NSF-CHE(CAT) and NSF ENG(CBET) programs. Ad hoc for NSF, DOE GRFP, Research Corp, ACSPRF

2012 Session Chair at an NSF-sponsored Sustainable Chemistry (SusCHEM) Workshop.

**Selected Recent Invited Talks**

1. 248th National Meeting of the American Chemical Society, Symposium for Organometallics Young Investigator Fellows, San Francisco, CA; August 2014.
4. University of California Los Angeles, CA; June 2014.
5. University of California Irvine, CA; June 2014.
6. Texas A&M University, College Station, TX; April 2014.
7. 247th National Meeting of the American Chemical Society, Symposium for Rising Star Award Women Chemists Committee, Dallas, TX; March 2014.
8. 247th National Meeting of the American Chemical Society, Symposium on Molecular Inorganic Chemistry at the Frontiers of Energy Research, Dallas, TX; March 2014.
James B. Bushnell

Contact Info: University of California, Davis, Department of Economics, 1 Shields Ave., Davis CA 95616
Phone: (530) 752-3129; email: JBBushnell@ucdavis.edu

Education:

University of California at Berkeley Ph. D. Operations Research, December 1993
University of California at Berkeley M.S. Operations Research, May 1990
University of Wisconsin - Madison B.S. Economics and Industrial Engineering, May 1989

Academic Appointments:

2011 - Present  University of California, Davis
Associate Professor, Economics Department.
2007 - Present  National Bureau of Economic Research
Research Associate (Faculty Research Fellow 2007-2009)
2009 – 2011  Iowa State University
Associate Professor, Cargill Chair in Energy Economics. Economics Department.
Director, Biobased Industry Center.
1993-2009  University of California, Berkeley
Research Scientist, Director of Research. UC Energy Institute
Lecturer, Haas School of Business

Professional Activities:

2002 - Present  California Independent System Operator
Member, Market Surveillance Committee
2009 – 2013  California Air Resources Board
Member, Economic Assessment and Allocation Committee (EAAC): 2009-2011.
Member, Emissions Market Assessment Committee (EMAC) 2012-2013.
1999 – 2000  California Power Exchange
Member and Chair, Market Monitoring Committee
2006-  Associate Editor (for Energy and Resources), Operations Research.

Selected Related Journal Publications:


Book Chapters (last 5 years):


Regulatory and Public Policy Reports:


Research Funding


JEAN-PIERRE DELPLANQUE

Education
ENSEEIHT, France     Fluid Mechanics and Energy Systems   Diploma   1987
INP Toulouse, France  Theoretical and Applied Mechanics   DEA*    1987
University of California, Irvine Mechanical Engineering   M.Sc.    1989
University of California, Irvine Mechanical & Aerospace Eng. Ph.D.  1993
*equivalent to M.Sc.

Academic Experience:
Associate Dean, College of Engineering Undergraduate Studies, 2014-present
Vice-Chair, Mechanical and Aerospace Engineering, UC Davis, 2010-2014
Professor, Mechanical and Aerospace Engineering, UC Davis, 2009-present
Associate Professor, Mechanical and Aeronautical Engineering, UC Davis, 2004-2009
Associate Professor, Engineering Division, Colorado School of Mines, 2002-2004
Assistant Professor, Engineering Division, Colorado School of Mines, 1998-2002
Assistant Researcher, Mechanical and Aerospace Engineering and Chemical Engineering and Materials Science, UC Irvine, 1997-1998
Assistant Specialist and Lecturer, MAE & CBMES, UC Irvine, 1994-1997

Non-Academic Experience:
Technical Monitor and Research Specialist, Combustion Devices Department, Société Européenne de Propulsion (SEP), France, 1993-1994

Professional Organizations
American Physical Society
American Society of Mechanical Engineers
Combustion Institute
Institute of Liquid Atomization and Spray Systems
Society for Advancement of Chicanos and Native Americans in Science

Honors and Awards
Faculty Career Development Award from U.C. Irvine, CA, 1996-97
Faculty Career Development Award from U.C. Irvine, CA, 1995-96
Graduate fellowship from Société Européenne de Propulsion, Vernon, France, 1995-96
Lavoisier Scholarship from the French government, 1988

Service Activities
Graduate Council (Academic Senate Cmt., member) AY 2012-2013
GC Academic Planning and Development committee (Chair) January-August 2013
GC Program Review committee AY 2012-2013
UC Davis CTSC T32 PhD Selection Committee Winter 2012, Winter 2013
Judge for graduate presentations at the 2011 SACNAS National
Conference, San Francisco, CA, .................................................................2011
Key Reader for Metallurgical and Materials Transactions A, ..........................2008-present
Publications Chair, Executive Committee of the Western States Section
of the Combustion Institute, ................................................................. 2005-2011
Chair, Committee on Fire and Combustion (K-11), Heat Transfer Division, ASME, ... 2003-2007
MAE Department Vice-Chair, ........................................................................ 2010-2014
MAE Graduate Program Chair Delegate, ......................................................... 2009-2014
MAE Faculty Adviser for Continuing Graduate Students, ................................ 2009-2010
Campus E-mail Review Committee, .................................................................. 2007
MAE Graduate Study Committee, ................................................................. 2005-present
Teaching Assistant Selection Committee, ....................................................... 2005-present
MAE Faculty Adviser for Graduate Students (Admissions), .............................. 2005-present
MAE Budget Advisory committee, ................................................................. 2009

Journal Reviewer:
AIAA Journal; Atomization and Sprays; Combustion and Flame; Combustion Science and
Technology; Computers and Fluids; Metallurgical and Materials Transactions

Selected Publications
“Influence of Mechanically Milled Powder and High Pressure on Spark Plasma Sintering of Mg-

“Investigation of Atypical Molten Pool Dynamics in Tungsten Carbide-Cobalt During Laser
Deposition using In-Situ Thermal Imaging,” Applied Physics Letters, 100(3):034101.

Bumatay, A., Chan, R., Lauher, K., Kwan, A. M., Stoltz, T., Delplanque, J.-P., Kenyon, N. J.,

Barrot, C. and Delplanque, J-P (2010) “Liquid microflows: Particularities and modeling”. In


Dispersed Water Mist on the Suppression of Laminar Premixed Hydrogen-, Methane-, and

Parallel Stream Configuration: Parametric Study," Proceedings of the Combustion Institute,
23:887-894.
Georgia Drakakaki

Curriculum vitae

Department of Plant Sciences
University of California Davis
One Shields Avenue Davis 95616

Phone: (530)-752-1664
Fax: (530)-752-9659
E-mail gdrakakaki@ucdavis.edu

Professional Preparation

Aristotle University of Thessaloniki, Greece Plant Physiology BSc 1995
Mediterranean Agronomic Inst. of Chania, Greece Plant Molecular Biology MS 1997
University of East Anglia/ John Innes Center, UK Plant Biology PhD 2002
University of California, Riverside Cell Biology Post-Doctoral Fellow 2002-2007
University of California, Riverside Cell Biology Visiting Researcher 2007-2008
University of California, Riverside Cell Biology Assistant Specialist 2008-2009

Appointments

2010- present Assistant Professor, Department of Plant Sciences, University of California
Davis, One Shields Avenue, Davis 95616

Fellowships and awards

2012 University of California Davis Hellman Fellowship
2014 Excellence in Education Award, finalist for the College of Agricultural and
Environmental Sciences

Core Teaching

PBI214 Plant Cell Wall (FQ)
PLS100AL Plant Metabolic Processes Laboratory (FQ)
PBI200B Cell/Developmental Biology (WQ)
PLS012/SAS12 Plants and Society (WQ)

Selected Publications (10/23)


Synergistic Activities


Member of Hellenic Quality Assurance Agency of Higher Education and external evaluator of University Departments in Greece (2010-present).

Advisor for two post docs, two graduate students, 23 undergraduate students and 3 international visiting scholars.

Serving as a trainer in the NSF CREATE- REU (Research Experience for Undergraduates) training grant (2010-2012), the NSF CREATE IGERT grant and the Designated Emphasis in Biotechnology. Member of Plant Biology (PBGG) and the Biochemistry, Molecular, Cellular and Developmental Biology (BMCDB) graduate groups.

Member of the UC Davis Energy Institute and Member of the American Society of Plant Biologists. Secretary/treasurer of the Western Section of American Society of Plant Biologists (2013-2014).
Biographical Sketch

BIOGRAPHICAL SKETCH ---Zhiliang Fan

EDUCATION

Zhejiang University  Biochemical Engineering  B.E.  1993
Iowa State University  Chemical Engineering  M.S.  1999
Dartmouth College  Engineering Management  M.S.  2004
Dartmouth College  Chemical and Biochemical Engineering  Ph.D.  2004

PROFESSIONAL EXPERIENCE

Oct. 07 to present.  Assistant Professor, Biological and Agricultural Engineering Department,
University of California, Davis, CA 95616
Aug. 05 to Sept. 07.  Assistant Professor, Biological Systems Engineering Department,
Virginia Polytechnic Institute and State University, Blacksburg VA

HONORS

2011  University of California, Davis, Hellman Fellow
2009 to now  Member, Gamma Sigma Delta Honor Society for Agriculture
2004  Receipt of the John C. Woodhouse Environmental Engineering Prize, Thayer School
of Engineering, Dartmouth College

PROFESSIONAL SERVICE

Section Chair - Non-fuel Product and Production System from Sustainable Resources, 2006 AICHE annual
meeting, San Francisco, CA
Session Chair- The Emergent Fermentation and Separation Technology Session at the 2008 ASABE
meeting, Minneapolis, MN, 2007
Member - American Chemical Society (ACS)
Member-American Society of Engineering Education (ASEE)
Member - American Institute of Chemical Engineers (AICHE)
Journal Reviewer - “Biotechnology and Bioengineering”, “Bioresource Technology”, “Biochemical
Technology and Management”, and “Environmental Science and Technology”, “Bioprocess and Biosystems
Engineering”, “Enzyme and Microbial technology”
NSF Panel Reviewer, 2009
Section co-chair – Advances in pretreatment and hydrolysis, 2011 ACS annual meeting, Anaheim, CA

SELECTED PUBLICATIONS

Wu, W., Kasuga, T., Xiong, X., Ma, D., and Fan, Z. (2013) Location and contribution of individual beta
glucosidases from Neurospora crassa to total beta-glucosidase activity Archives of Microbiology, 195: 823-829


Wu, W., Hildebrand, A., Kasuga, T., Xiong, X., and Fan, Z. (2013) Direct cellobiose production from
cellulose using sextuple beta-glucosidase gene deletion Neurospora crassa mutants, Enzyme and Microbial
Technology, 52, 184-189


**PATENT**


**PATENT APPLICATIONS**


Fan , Z. “a new biochemical platform for fuels and chemicals production from biomass” US patent Application No. 13/318,340

**SYNERGISTIC ACTIVITIES**

Serve as the trainer in the area of biofuels and biorefinery for the Collaborative Research and Education in Agricultural Technologies and Engineering (CREATE) IGERT program sponsored by NSF at UC Davis. Serve as a faculty mentor for the campus wide Renewable Energy Systems Opportunity for Unified Research Collaboration and Education (RESOURCE) program sponsored by NSF, which will train graduate fellows who will partner with 50 sixth grade school teachers in seven elementary schools to create an innovative curriculum and educational tools that promote interest in renewable energy technologies and associated STEM disciplines. Serve as the trainer for the summer REU program sponsored by NSF from 2010-2013.

**LIST OF CONFLICTS OF INTEREST**

**Co-Authors:** Peter J. Reilly, Lee R. Lynd, John McBride, Colin South, Kimberly Lyford, Peter. van Walsum, Willem H. van Zyl, Jeffery Munsie, Gbekeloluwa B. Oguntimein, Naresh Budhavaram, Takao Kasuga, Ruifu Zhang, Edyta Szewczyk, Weihua Wu, Xiaochao Xiong, Amanda Hildebrand

**Collaborators:** Zhiyou Wen, Clark Ford, Jactone Arogo, Foster Agblevor, Michael Thelen, Takao Kasuga, Rebecca Parales, Jean VanderGhynst, Ruihong Zhang, Byran Jenkins, Joan Ogden, Shota Atsumi, Charles Wyman

**Advisors/Advisees:** Peter J. Reilly, Lee R. Lynd, Somayesaday Badieyan, Ravi Sankara Varma Nadimpalli, Naresh Budhavaram, Weihua Wu, Xiaochao Xiong, Ruifu Zhang, Edyta Szewczyk, Amanda Hildebrand, Di Ma, Shuangyan Han, Yujia Mao, Yaqin Sun
ANNALIESE K. FRANZ
Associate Professor
Department of Chemistry

Education
Ph.D., Organic Chemistry, University of California, Irvine 2002
B.S. in Chemistry, magna cum laude, Trinity University, San Antonio, TX 1996

Research and Professional Experience
Associate Professor, Department of Chemistry, UC Davis 2013 to present
Assistant Professor, Department of Chemistry, UC Davis 2007 to 2013

Research Topics: Catalysis, Synthesis, Biofuels

NIH Postdoctoral Fellow (Stuart L. Schreiber) Harvard University 2002-2007
Research Topics: Synthesis of Biologically-Active Molecules, Chemical Genetic Screening

Graduate Research Associate (Keith A. Woerpel) UC Irvine 1996-2002
Research Topics: Synthetic Methodology, Catalysis and Mechanism

Graduate Groups and Graduate Student Training at UC Davis
Chemistry Graduate Group
Agricultural and Environmental Chemistry Graduate Group
Graduate Group in Biochemistry, Molecular, Cellular and Developmental Biology (BMCDB)
Designated Emphasis in Biotechnology
Bioenergy Research Center

Honors & Awards (in past 5 years)
Outstanding Mentor Award, Consortium for Women & Research, UC Davis 2013
Faculty Development Award, UC Davis 2012
American Chemical Society, WCC Rising Star Award 2012
American Chemical Society, Division of Organic, Young Investigator Symposium 2012
Thieme Chemistry Journal Award 2010
ASUCD Excellence in Education Award Finalist, UC Davis 2010-11
3M Non-tenured Faculty Award 2009-12
NSF CAREER Award 2009-14

Service, Outreach, University and Professional Activities (Selected examples)
Director, GAANN Fellows Program, Department of Education, 2013-present
Executive committee, Beckman Scholars Foundation, 2013-present
Executive committee, NIH Training Grant in Biomolecular Technology, UC Davis
“Elements of Life” Chemistry Plaza Project (Art/Science Fusion & Science Education), Co-Designer and Scientific Consultant, 2012
Co-Director, GAANN Fellows Program, Department of Education, 2009-2012
Advisory Panel Member, Beckman Scholars Foundation, 2010, 2012
Faculty Mentor for ACS Project SEED (high school student), UC Davis, 2011, 2012
Faculty Mentor for Young Scholars Program (high school students), UC Davis, 2009-2011
Advisor and faculty participant for Chemistry Club, UC Davis, 2007-present
Women in Science and Engineering (WISE), Faculty Panel & Mentor, 2009-2014
Selected Publications


Education
Ph.D. in Organizational Behavior, Department of Industrial Engineering and Engineering Management, Stanford University, 1998.

Academic Positions
2010 - present  Charles J. Soderquist Chair in Entrepreneurship
2009 - present  Professor of Technology Management, Graduate School of Management, University of California, Davis.
2007 - present  Associate Director, Energy Efficiency Center
University of California, Davis.
2006 - present  (Founding) Director, Center for Entrepreneurship
(now Child Family Institute for Innovation & Entrepreneurship)
Graduate School of Management, University of California, Davis.
2006 - 2007  (Founding) Director, Energy Efficiency Center
University of California, Davis.
2005 - 2010  Chancellor’s Fellow, University of California, Davis
2004 - 2009  Visiting Professor, Imperial College
2003 - 2009  Associate Professor of Technology Management, Graduate School of Management, University of California, Davis.
Director, Technology Management Programs,
Graduate School of Management, University of California, Davis.
2001 - 2003  Assistant Professor of Technology Management, Graduate School of Management, University of California, Davis.
1998 - 2001  Assistant Professor of Management, Department of Management, Warrington College of Business Administration, University of Florida.
1997 - 1998  Instructor, Department of Industrial Engineering and Engineering Management, Stanford University.
1992 - 1994  Instructor, Department of Mechanical Engineering, Stanford University.

Publications

Program, Research, and Teaching Grants
1. Sacramento Region Clean AgTech Innovation Center Development Project ($1M)
   Economic Development Agency’s i6 Challenge grant, funding clean agtech innovation development.
2. Co-PI (With Kurt Kornbluth), Program on International Energy Technologies ($47.5k)
   Developed and implemented a 2-course curriculum on the design, development and selective implementation of energy solutions for developing communities.
3. Co-PI (With Dan Chang), Superfund Business Development Intensive ($49.9k)
   Developed and implemented a custom Business Development intensive for Superfund researchers in 2007.
4. Principal Investigator, West Village Energy Efficiency Study ($40k)
   Organized a series of workshop and studies to develop and compare alternative technical, financial, and organizational solutions for the UC Davis campus housing project (West Village)
5. Principal Investigator, Green Technology Entrepreneurship Academy 2007 ($120k)
   One-week intensive in the development of business models for launching science and engineering green tech based start-ups.
6. Co-PI (with Dan Sperling), UC Davis Energy Efficiency Center ($25M)
   $1M grant from CalCEF to establish Energy Efficiency Center. In the first five years, it has received approximately $20M in total funding.
# Professional Preparation

<table>
<thead>
<tr>
<th>Institution</th>
<th>Discipline</th>
<th>Degree</th>
<th>Year</th>
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<tbody>
<tr>
<td>College of William and Mary</td>
<td>Chemistry</td>
<td>B.S.</td>
<td>1980</td>
</tr>
<tr>
<td>Michigan State University</td>
<td>Chemistry</td>
<td>Ph.D.</td>
<td>1985</td>
</tr>
<tr>
<td>Iowa State University</td>
<td>Chemistry</td>
<td>Postdoctoral</td>
<td>1985-1987</td>
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## Appointments

<table>
<thead>
<tr>
<th>Year</th>
<th>Position</th>
<th>Institution</th>
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<tbody>
<tr>
<td>2013 – present</td>
<td>Chair, Department of Chemistry, University of California, Davis</td>
<td></td>
</tr>
<tr>
<td>2010 – 2013</td>
<td>Faculty Assistant to the Dean of Mathematic and Physical Sciences, University of California, Davis.</td>
<td></td>
</tr>
<tr>
<td>1996 – present</td>
<td>Professor, Department of Chemistry, University of California, Davis.</td>
<td></td>
</tr>
<tr>
<td>1992 – 1996</td>
<td>Associate Professor, Department of Chemistry, University of California, Davis.</td>
<td></td>
</tr>
<tr>
<td>1987 – 1992</td>
<td>Assistant Professor, Department of Chemistry, University of California, Davis.</td>
<td></td>
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## Awards and Honors

**2013**
- Francis P. Garvan-John M. Olin Medal
- Elected ACS Fellow

**2011**
- Patrick Lecturer, Kansas State
- IUPAC Distinguished Women in Chemistry/Chemical Engineering
- Iota Sigma Pi National Honorary Member Award
- Elected AAAS Fellow
- The U.S. Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring

**2008**
- NSF-DMR0600742: Creativity Extension
- Editor, *Chemistry of Materials*
- NASA Tech Brief Award NPO 42627 High Efficiency of Yb$_3$MnSb$_{11}$ For Thermoelectric Power Generation
- UC Davis Distinguished Graduate Mentoring Award
- Outstanding Mentor Award, UCDavis Consortium for Women and Research
- Maria Goepert Mayer Distinguished Scholar Award, Argonne National Laboratory

## Products

### 5 Publications Most Related, Previous 5 Years

#### 2014
- Julia V. Zaikina, Elayaraja Muthuswamy, Kristina I. Lilova, Zachary M. Gibbs, Michael Zeilinger, G. Jeffrey Snyder, Thomas F. Fässler, Alexandra Navrotsky, and Susan M. Kauzlarich “Thermochemistry, Morphology, and Optical Characterization of Germanium Allotropes” *Chemistry of Materials*, 26 (10), 3263-3271. [http://dx.doi.org/10.1021/cm5010467](http://dx.doi.org/10.1021/cm5010467)

#### 2013
- Elayaraja Muthuswamy, Jing Zhao, Katayoun Tabatabaei, Marlene M. Amador, Michael A. Holmes, Frank E. Osterloh, and Susan M. Kauzlarich “Thiol-Capped Germanium Nanocrystals: Preparation and Evidence for Quantum Size Effects” *Chemistry of Materials*, 26 (6), 2138-2146. [http://dx.doi.org/10.1021/cm4042154](http://dx.doi.org/10.1021/cm4042154)

#### 2014
- Shreyashi Ganguly, Nasrin Kazem, Danielle Carter, and Susan M. Kauzlarich “Colloidal Synthesis of an Exotic Phase of Silicon: The BC8 Structure” *Journal of the American Chemical Society*, 136 (4), 1296-1299. [http://dx.doi.org/10.1021/ja412213q](http://dx.doi.org/10.1021/ja412213q)

#### 2013

#### 2013
5 Other Publications

2014  Roudedush, John H.; Grebenkemper, Jason; Hu, Yufei; Kazem, Nasrin; Abdusalyamova, M. N.; Kauzlarich, Susan M. "Yb_{1-x}T_{x}MnSb_{11} (0<x<0.5): Structure and magnetic properties” Journal of Solid State Chemistry, 211, 206-211. DOI: 10.1016/j.jssc.2013.12.023

2014  Nasrin Kazem, Weiwei Xie, Saneyuki Ohno, Alexandra Zevalkink, Gordon J. Miller, G. Jeffrey Snyder, and Susan M. Kauzlarich “High-Temperature Thermoelectric Properties of the Solid-Solution Zintl Phase Eu_{1-x}Cd_{x}Sb_{12-x}As_{x} (x < 3)” Chemistry of Materials, 26 (3), 1393-1403. http://dx.doi.org/10.1021/cm403345a

2013  Oliver Janka; Baumbach, Ryan E.; (Thompson, Joe D.; Bauer, Eric D.; Kauzlarich, Susan M. “Crystal structure, magnetism and transport properties of Ce_{3}Ni_{25.75}Ru_{3.16}Al_{4}B_{10}” Journal of Solid State Chemistry, 205, 154-159. DOI: 10.1016/j.jssc.2013.05.041

2013  Yi, Tanghong; Zhang, Gaigong; Tsuji, Naohito; Fleurial, Jean-Pierre; Zevalkink, Alex; Snyder, G. Jeffrey; Gronbech-Jensen, Niels; Kauzlarich, Susan M., “Phase Characterization, Thermal Stability, High-Temperature Transport Properties, and Electronic Structure of Rare-Earth Zintl Phosphides Eu_{x}M_{x}P_{y} (M = Ga, In),” Inorganic Chemistry, 52(7): 3787-3794. DOI: 10.1021/ic302400q

2012  Yi, Tanghong; Chen, Shaoping; Li, Shawn; Yang, Hao; Bux, Sabah; Bian, Zhixi; Katcho, Nebil A.; Shakouri, Ali; Mingo, Natalio; Fleurial, Jean-Pierre; Browning, Nigel D.; Kauzlarich, Susan M., “Synthesis and characterization of Mg2Si/Si nanocomposites prepared from MgH2 and silicon, and their thermoelectric properties” Journal of Materials Chemistry, 22 (47): 24805-24813. DOI: 10.1039/c2jm35257e

Synergistic Activities

Editorial Advisory Board, Handbook on the Physics and Chemistry of Rare Earths, 2002- present
Advisory Board, Women in Science and Engineering, UC Davis campus, 2008-2012
Vice Chair, Chair of the Solid State and Materials Chemistry Gordon Research Conference, 2012-2014
CAMPOS (the Center for Advancing Multicultural Perspectives on Science) Initiative Advisory Committee member, 2012-2013

Collaborators and Co-Editors: G. Galli (UCD); Sue Carter (UCSC); M.N. Abdusalyamova, Tajikistan; E. D. Bauer, LANL; Z. Bian, UCSC; N. Browning, PNNL; S. Bux, JPL; B. C. Chakounakos, ORNL; S. Chen, Taiyuan University, China; N. Curro, UCD; Z. Fisk, UCI; J.-P. Fleurial, JPL; G. Galli, UCD; B. B. Iversen, Aarhus University, Denmark; P. Klavins, UCD; D. Larsen, UCD; A. Louie, UCD; K. Meerholz, U. Cologne; N. Mingo, LITEN, CEA-Grenoble; A. Navrotsky, UCD; G. Nolas, FSU; S. Sen, UCD; A. Shakouri, Purdue; J. Snyder, Cal Tech;

Doctoral Research: Professor Bruce Averill, State Department
Postdoctoral Research: Professor John D. Corbett, ISU, deceased

Thesis Advisor and Postdoctoral-Scholar Sponsors: I have graduated 31 Ph.D. students and 5 M.S. students, 15 postdoctoral scholars

Postdoctoral Scholars from the past 5 years (affiliation): Shreya Ganguly (U. Minn.), Oliver Janka (Habilitation at Westfälische Wilhelms-Universität), Mani Singh (Gelest); Xuchu Ma (Provo, Utah, Cosmas); Andrea Goforth (Portland State U); Xiaoming Zhang (Glenn Research); Doinita Neiner (PNNL).

Graduate Students (affiliation; graduated in the past 5 years): (35) Tonya Atkins (Chevron), Tanghong Yi (LBNL), John Roudedush (Princeton), Catherine Uvarov (UC Davis), Julia, Wang (Tyco Industries), Japheth Rauscher (Portland State, Adjunct Assistant Professor), Cathie Condon, Ray Carter. Hsiang Wei Chiu, Jing Zou, Jiong Jiang, Chris Chervin, Sung-jin Cho, Katherine Pettigrew, Hyungrak Kim, Aaron Holm, Julia Y. Chan, Daniel Mayeri, Boyd Taylor, Rick Bley, Chung-Sung Yang, Tadashi Ozawa, Amy Payne, Stephanie Brock, Dianna Young, Joe Sunstrom, Gerald Roberts, Ned Stetson, Debra O’Dink, Tracy Kuromoto, Kang Song, (Ph.D.); Susan Verberne (M.S.), Shih-Chieh Yin (M.S.), Mary Wang (M.S.), Shawnna Brown (M. S.), Kyung Park (M.S.)

Current Ph.D Students: (9) Jason Grebenkemper, Fan Sui, Nasrin Kazem, Bradley Nolan, Alexandra Holm, Yufei Hu, Katayoun Tabatabaei, Joya Cooley, John Uhrig

Current Undergraduates Engaged in Research: (4), Marlene Amador, Antonio Hurtado, Eric Chan, Mai Vue

Current Postdoctoral Fellows: (2) Elayara Muthuswamy, Julia Zaikina
Curriculum Vitae
ALISSA KENDALL

Department of Civil and Environmental Engineering
University of California
3167 Ghausi Hall
One Shields Avenue
Davis, CA 95616

Phone: (530) 752-5722
Fax: (530) 752-7872
E-mail: amkendall@ucdavis.edu

EDUCATION
University of Michigan, Ann Arbor: Ph.D. School of Natural Resources & Environment and Department of Civil & Environmental Engineering (jointly conferred), 2007
University of Michigan, Ann Arbor: M.S. Natural Resource Policy, 2004
University of Michigan, Ann Arbor: Certificate in Industrial Ecology, 2004
Duke University: B.S. Environmental Engineering, 2000

POSITIONS HELD
2013-Present, Associate Professor, Department of Civil and Environmental Engineering, University of California, Davis, CA
2007-2013, Assistant Professor, Department of Civil and Environmental Engineering, University of California, Davis, CA

UC Davis Affiliations: Institute of Transportation Studies (Faculty Member), Energy Institute (Faculty Member), Agricultural Sustainability Institute (Faculty Fellow)

2002-2007, Research Assistant, Center for Sustainable Systems, University of Michigan, Ann Arbor, MI

HONORS AND AWARDS
Laudise Young Researcher Prize from the International Society of Industrial Ecology – 2013
National Academy of Engineering’s Frontiers in Engineering Education – 2012
UC Davis Hellman Fellow – 2009-2010
3M Award for Industrial Ecology from University of Michigan – 2005

SELECTED PEER-REVIEWED PUBLICATIONS
Murphy, C.W., Kendall, A., (2013) Life cycle inventory development for corn and stover production systems under different allocation methods. Biomass and Bioenergy. 58: 67-75. DOI:10.1016/j.biombioe.2013.08.008
Curriculum Vitae

ALISSA KENDALL


Sangtae Kim

Professional Preparation:
Sogang University, Seoul, Korea  Chemistry (Physics minor)  BSc, 1988
Sogang University, Seoul, Korea  Chemistry  MSc, 1990
University of Houston, Houston, TX  Chemistry  PhD, 1999
Max Planck Institute, Stuttgart, Germany  Solid State Ionics  2000-2004

Appointments:
2013-present  Professor, Chemical Engineering & Materials Science, UC Davis
2008-2013  Associate Professor, Chemical Engineering & Materials Science, UC Davis
2004-2008  Assistant Professor, Chemical Engineering & Materials Science, UC Davis

Selected Publications:
S.K. Kim, M.J. Shin, J. Rufner, K. van Benthem, J.H. Yu, S. Kim, (2014) “Sr0.95Fe0.5Co0.5O3-d-Ce0.9Gd0.1O2-δ dual-phase membrane: Oxygen permeability, phase stability, and chemical compatibility”, J. Membr. Sci., 462, 153
S. Kim, S. Khodorov, C.-T. Chen, S. Kim, I. Lubomirsky (2013), "How to interpret current-voltage relations of blocking grain boundaries in oxygen ionic conductors?", PCCP, 15, 8716-8721
**Collaborators**


**Synergistic Activities:**


3. **Board Membership:** Board member of International Society for Solid State Ionics (2011 – 2015), International Advisory Board Member of the 16th International Conference for Solid State Ionics (SSI-16)

**Collaborators and Other Affiliations**

**Collaborators and Co-Editors:** Mark Asta (UC Berkeley), Nigel Browning (UC Davis), Kyu-Tae Kim (Korea University, Korea), Igor Lubomirsky (Weizmann Institute, Israel), Manfred Martin (RWTH Aachen University, Germany), Zuhair Munir (UC Davis), Alexandra Navrotsky (UC Davis), Sabyasachi Sen (UC Davis), Yayoi Takamura, (UC Davis), Kirill Kovnir (UC Davis)

**Graduate Advisors and Postdoctoral Sponsors:** Graduate Advisor: Professor Allan J. Jacobson, University of Houston, Houston; Postdoctoral Advisor: Professor Joachim Maier, Max Plank Institute for Solid State Research, Germany

**Thesis Advisor and Postgraduate-Scholar Sponsor:** Hugo J. Avila (PhD), Chien-Ting Chen (PhD), Kwanghoon Choi (Postdoc), Seong Kim (PhD), Edmund Mills (PhD), Alex Kon (PhD), Maxwell Marple (PHD), Matthew Ibotson (MS) Jong Soo Lee (Postdoc), Hee Jung Park (Postdoc), John Wall (PhD), Shizhong Wang (Postdoc)
## Biographical sketch

**Kirill Kovnir**

*Department of Chemistry*  
*University of California, Davis*  
*Davis, CA 95616*  
*530-752-5563 (phone)*  
*530-752-8995 (fax)*  
*kkovnir@ucdavis.edu*

## Education and Training

<table>
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<tr>
<th>Institution</th>
<th>Degree Program</th>
<th>Degree</th>
<th>Year</th>
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<tbody>
<tr>
<td>Moscow State University</td>
<td>Chemistry (Honors)</td>
<td>B.S./M.S.</td>
<td>2001</td>
</tr>
<tr>
<td>Moscow State University</td>
<td>Materials Chemistry</td>
<td>Ph.D.</td>
<td>2004</td>
</tr>
<tr>
<td>Max-Planck-Institute for Chemical Physics of Solids</td>
<td>Intermetallic compounds</td>
<td>Postdoctoral</td>
<td>2005-2007</td>
</tr>
<tr>
<td>Fritz-Haber-Institute of Max-Planck Society</td>
<td>Heterogeneous Catalysis</td>
<td>Postdoctoral</td>
<td>2007-2008</td>
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<tr>
<td>Florida State University</td>
<td>Magnetochemistry</td>
<td>Postdoctoral</td>
<td>2008-2011</td>
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## Research and Professional Experience

- Assistant Professor of Chemistry, UC Davis  
  2011-present

## Honors and Awards

- ACS YCC Leadership Development Award  
  2013
- NSF REU Chemistry Leadership Group Award  
  2013
- ACS Chemistry Ambassador  
  2013

## Scholarly and professional activities

- Chair of faculty advisory committee for UC Davis Undergraduate Chemistry Club  
  2011-present
- Organizer of First Northern California College/University Chemistry Club Conference  
  2013
- Faculty instructor at California Summer School for Mathematics and Science (COSMOS) for students from public or private high schools  
  2012-present
- Faculty host for the ACS Project SEED: Summer Research Internship Program for Economically Disadvantaged High School Students  
  2012-present
- Faculty host for UC Davis Young Scholar Program  
  2014-present
- Faculty host for UCD-Mexico REU program  
  2014-present

## Ad hoc Reviewer Service

- National Science Foundation (NSF) Department of Materials Science (DMR)
Department of Energy (DOE) Graduate Fellowship Program
Natural Sciences and Engineering Research Council of Canada
UC Davis Research Grants

Selected Publications, 71 total, h-index = 21 (ISI).

UC Davis undergraduate student authors are highlighted with bold underline.


JOHN M. LABAVITCH
Professor and Pomologist
Plant Sciences Department
Plant Reproductive Biology Building
University of California
Davis, CA 95616
e-mail: jmlabavitch@ucdavis.edu

PROFESSIONAL PREPARATION
Wabash College Zoology/Botany B.A., 1965
Stanford University Biology/Plant Development Ph.D., 1973
University of Colorado Chemistry Postdoctoral 1973-1976

APPOINTMENTS
2014 Professor Emeritus
2010-2014 Chair, Agricultural Plan Biology Section, Plant Sciences Dept.
1986 - present Professor, Department of Pomology, University of California (Davis)
1996 - 2000 Chairman, Plant Biology Graduate Group
1980-1986 Associate Professor, Department of Pomology, UC (Davis)
1976-1980 Assistant Professor, Department of Pomology, UC (Davis)
1973-1976 NIH Postdoctoral Associate, Department of Chemistry, University of Colorado (Advisor: Peter Albersheim)

SELECTED RECENT PUBLICATIONS (of 150 reviewed papers)

Bioenergy-related
FRANK J. LOGE

Professional Preparation:

<table>
<thead>
<tr>
<th>University</th>
<th>Field</th>
<th>Degree, year</th>
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<tr>
<td>University of California Davis</td>
<td>Civil and Environmental Engineering</td>
<td>Ph.D., 1998</td>
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<tr>
<td>University of California Davis</td>
<td>Civil and Environmental Engineering</td>
<td>M.S., 1994</td>
</tr>
<tr>
<td>University of California Davis</td>
<td>Civil Engineering</td>
<td>B.S., 1993</td>
</tr>
</tbody>
</table>

Appointments:

Director, Center for Water–Energy Efficiency, Davis, CA 2009–
Associate Director, Energy Efficiency Center, Davis, CA 2009–
Professor, Department of Civil and Environmental Engineering, Davis, CA 2009–
Associate Professor, Department of Civil and Environmental Engineering, Davis, CA 2004–2009
Assistant Professor, Department of Civil and Environmental Engineering, Pullman, WA 1999–2004
Program Director, Water–Wastewater Treatment and Reuse, State of Washington Water Research Center, Pullman, WA 2002–2004
Post Graduate Research Assistant, Department of Civil and Environmental Engineering, Davis, CA 1993–1999
Civil Engineer, Wallace Kuhl and Associates, West Sacramento, CA 1993–1994

Products:

Five most closely related to the proposed project –

Five additional significant products –


**Synergistic Activities:**


2. Participant in the Water Energy Team of the Climate Action Team, and the Water Energy Coalition, CA organizations focused on advancing the water-energy nexus. Vice-Chair, Sustainable Water Systems Committee, University of California Office of the President. This group develops UC system-wide policy for sustainable water resources management.

3. Committee Chair, Sustainable Learning Laboratory Task Force. This committee is charged with planning a 65-acre mixed-use sustainable development on the UC Davis campus that would be designed and largely built by students in classes taught in a range of departments and colleges across campus. The development would embody highly innovative concepts of sustainability, including zero net water and zero net energy.

4. Faculty Advisor for three student groups competing in the US EPA sponsored design competition entitled “People, Prosperity, Planet”, 2010–Present.


**Collaborators and Other Affiliations**

**Collaborators and Co-Editors:** Mary Arkoosh, NOAA Fisheries NWFSC; Mark Borchardt, USDA-ARS; Tracy Collier, NOAA Fisheries; Joseph Dietrich, NOAA Fisheries; Robert Emerick, Stantec; Allen Evans, Realtime Research; Derek Fryer, US Army Corps Engineers; Timothy Ginn, Dept. of Civil and Environmental Engineering, UC Davis; Richard Hess, Idaho National Environmental Engineering Laboratory; Lyndal Johnson; NOAA Fisheries NWFSC; Steve Juhnke, US Army Corps Engineers; James Quinn, UC Davis; Nathaniel Scholz, NOAA Fisheries NWFSC; Sue Spenser, Marshfield Medical Research Foundation; David Thompson, Idaho National Environmental Engineering Laboratory; Joshua Viers, UC Davis; Michael Wolcott, Washington State University.

**Graduate Advisors and Postdoctoral Sponsors:** Jeannie Darby, Dept. of Civil and Env. Eng., UC Davis; George Tchobanoglos, Dep’t. of Civil and Env. Eng., UC Davis; Edward Schroeder, Dep’t. of Civil and Env. Eng., UC Davis

**Thesis Advisor and Postgraduate-Scholar Sponsor:** Mary Kay Anuskiewicz, University of Pacific; Mary Chen, UC Davis; Chad Crain, US Navy; Kai Eder, UC Davis; Aaron King, UC Davis; Elisabetta Lambertini, University of Maryland; Hsin-Ying Liu, HDR Engineering; Erik Loboschesky, CA Dep’t. of Water Resources; Arash Massoudieh, Catholic University; Sarah Miller, UC Davis; Muammar Al-Najjar, CH2M HILL; Kendra Olmos, UC Davis; Christopher Pierce, UC Davis Reed Thayer, UC Davis; Eda Tuna, UC Davis.; Total Graduate Students = 44. Total Post-Docs = 12
Curriculum Vitae – Mark Mascal

Professional preparation

B.S. Chemistry, 1983, Western Illinois University

M.S. Organic Chemistry, 1985, University of Illinois at Urbana-Champaign

Ph.D. Organic Chemistry, 1988, Imperial College of Science, Technology and Medicine, University of London, U.K.

Postdoctoral research, 1988-1990, Université Louis Pasteur, Strasbourg, France (with Jean-Marie Lehn)

Appointments

Professor, 2011 - present, Department of Chemistry, University of California Davis

Associate Professor, 2007 - 2011, Department of Chemistry, University of California Davis

Assistant Professor, 2003 - 2007, Department of Chemistry, University of California Davis

Donald J. Cram Teacher-Scholar and Visiting Assistant Professor, 2000 - 2003, Department of Chemistry and Biochemistry, University of California Los Angeles

Lecturer, 1992 - 1999, School of Chemistry, University of Nottingham, Nottingham, U.K.


Honors and awards

NSF Career Award

ConocoPhillips 50k Energy Prize

International Advisory Board, ChemSusChem

2012-13 Fulbright Distinguished Chair in Alternative Energy at Chalmers University of Technology, Gothenburg, Sweden

Significant recent publications past five years (2010-2014)


Funding past five years (2010-2014)

<table>
<thead>
<tr>
<th>Current</th>
<th>Completed</th>
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<tbody>
<tr>
<td>PI: Mascal</td>
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</tr>
<tr>
<td>Source of support: NSF CBET</td>
<td>Co-PI: none</td>
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<tr>
<td>Award amount: $317,744</td>
<td>Source of support: NSF Chemistry</td>
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<tr>
<td>Dates: 08/01/13 - 07/31/16</td>
<td>Award amount: $150,000</td>
</tr>
<tr>
<td>PI: Mascal</td>
<td>Dates: 09/01/13 - 08/31/14</td>
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<tr>
<td>Source of support: Micromidas, Inc.</td>
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<tr>
<td>Award amount: $223,820</td>
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<td>Dates: 01/10/13 - 09/30/14</td>
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<tr>
<td>PI: Mascal</td>
<td>PI: Mascal</td>
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<tr>
<td>Source of support: NSF Chem</td>
<td>Co-PI: none</td>
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<tr>
<td>Award amount: $450,000+$60,209 AGEP</td>
<td>Source of support: NSF Chemistry</td>
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<tr>
<td>Dates: 07/01/14 - 06/30/16</td>
<td>Award amount: $400,000</td>
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<tr>
<td>PI: Adam Moule</td>
<td>Dates: 02/01/10 - 01/31/13</td>
</tr>
<tr>
<td>Co-PI: Mascal</td>
<td></td>
</tr>
<tr>
<td>Source of support: DOE-BES</td>
<td></td>
</tr>
<tr>
<td>Award amount:$514,036</td>
<td></td>
</tr>
<tr>
<td>Dates: 09/01/13 - 08/31/16</td>
<td></td>
</tr>
</tbody>
</table>

Dates: 09/01/13 - 08/31/16 Award amount:$514,036
Mark Modera, Professor

EDUCATION
Ph.D. Mechanical Engineering 1989 Royal Institute of Tech., Stockholm
M.S. Mechanical Engineering 1980 UC Berkeley
B.S. Mechanical Engineering 1978 Cooper Union, New York

ACADEMIC EXPERIENCE
University of California, Davis
Professor 2009- (25%)
Civil & Environmental Engineering
Mechanical and Aerospace Engineering 2011- (25%)
Adjunct Professor
Mechanical & Aerospace Engineering 2008-2011
Sempra Energy Chair in Energy Efficiency 2008-present
Director, Western Cooling Efficiency Center 2008-present (50%)

PROFESSIONAL EXPERIENCE
Vice President, Carrier-Aeroseal 2001-2007
Founder, President of Aeroseal Inc 1997-2001
Staff Scientist, Lawrence Berkeley Lab 1980-2001

NON-ACADEMIC EXPERIENCE - Patents
U.S. Patent No. 4,635,469, Methods and Apparatus for Measuring the Tightness of Enclosures
U.S. Patent No. 5,522,930, Method and Device for Producing and Delivering an Aerosol for Remote Sealing and Coating
U.S. Patent No. 5,980,984, Method for Sealing Remote Leaks in an Enclosure Using an Aerosol
U.S. Patent No. 6,923,072, Method and Device for Measuring Airflows through HVAC Grilles
U.S. Patent No. 7,156,320, Method and Apparatus for Duct Sealing Using a Clog-Resistant Insertable Injector

CERTIFICATIONS OR PROFESSIONAL REGISTRATIONS
California Professional Mechanical Engineer License # M23823

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS
Fellow, American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

HONORS AND AWARDS
Sempra Energy Chair in Energy Efficiency, 2009
Sempra Energy Distinguished Scholar in Energy Efficiency, 2008
Lawrence Berkeley National Laboratory Technology Transfer Award, 2003
DOE Energy100 Award and DOE Energy@23 Award, 2000

SERVICE ACTIVITIES
INSTITUTIONAL SERVICE
Associate Director – Energy Efficiency Center
Search Committees – Energy Efficiency Faculty Director; Arthur Rosenfeld Chair in Energy Efficiency; Food-Science/Energy Efficiency Junior Faculty
PROFESSIONAL SERVICE
  Board of Directors, Aeroseal, LLC
  Board of Advisors, California Clean Energy Fund
  Proposal and Publication Reviewer: AAAS, ASHRAE, DOE-ARPA-E, EERE

RECENT PUBLICATIONS AND PRESENTATIONS


MODELING AND DESIGN ANALYSIS OF A REGENERATIVE INDIRECT EVAPORATIVE HEAT EXCHANGER USING AN EFFECTIVENESS METHOD, Zhijun Liu, William Allen, Mark Modera, ASHRAE Transactions 119(2) (2013)


ADVANCING DEVELOPMENT OF HYBRID ROOFTOP PACKAGED AIR CONDITIONERS: TEST PROTOCOL AND PERFORMANCE CRITERIA FOR THE WESTERN COOLING CHALLENGE, J.M. Woolley and M.P. Modera, ASHRAE Trans. 117(I) 2011


PROFESSIONAL DEVELOPMENT ACTIVITIES

A Principal Investigator at LBNL on many research projects, including developing a new research program focused on thermal energy distribution in buildings; developed an aerosol-based duct sealing process, subsequently established Aeroseal, Inc., then sold it to Carrier Corporation. Current research projects encompass (i) HVAC-equipment efficiency improvement; (ii) alternative cooling technologies, (iii) thermal energy distribution, (iv) water management technologies and strategies, (v) aerosol particle production and application to sealing. Research sponsors include: California Energy Commission, Southern California Edison, Pacific Gas and Electric, Sempra Utilities, Sacramento Municipal Utility District, US Department of Energy, and Lawrence Berkeley National Laboratory, along with a host of corporate affiliates.
ADAM J. MOULÉ

Professional Preparation:
University of Oregon  Chemistry  B.S.  1998
University of California, Berkeley  Physical Chemistry  PhD.  2003
University of Cologne  Device Physics  Postdoc  2004-2007

Appointments:
2007-present  Assistant Professor, Chemical Engineering and Materials Science, UC Davis
2005-2007  Project Leader, Physical Chemistry Institute, University of Cologne, Germany
2004-2006  Alexander von Humboldt Postdoctoral Fellow, University of Cologne

Selected Relevant Publications: 1-10

Other Recent Publications

Synergistic Activities:
Courses Developed – I developed and taught a new course EMS 272 Advanced Optical, Electrical and Magnetic Properties of Materials for graduate students in Fall 2008+09+10+11. I also re-developed ECM6 Computational Methods for Chemical Engineers taught using the programming language MATLAB in spring 2010+12+13+14.
I have reviewed proposals or served on review panels for NSF, DOE, USDA, UC Discovery Grants, the France-Berkeley Fund, and the Canadian research agency and reviewed articles for
I am the technical director of Solar Energy for the California Renewable Energy Collaborative. A significant part of our mission is solar policy, public outreach and providing technical training for a California Solar workforce. Through this position I have written three policy white papers for the California Energy Commission, taught 2 weeks of an Electrical Engineering course EES298 on photovoltaics and regularly provide free consulting to CA businesses about solar energy.

I am an active member of the Chemistry Graduate Group. As a result of this membership I advise a chemistry graduate student, I teach a lecture section of General Chemistry every-other-year, and I participate in physical-chemistry qualifying exams and recruitment, etc.

Collaborators & Other Affiliations:

Collaborators and Co-Editors: Christoph Brabec, (Erlangen, Germany); Richard Friend, (Cambridge, UK); Michael Graetzel, (Institut de Chimie Physique, EPFL, Switzerland); Klaus Meerholz, (University of Cologne, Germany); Ulrich Scherf, (University of Wuppertal, Germany); Markus Scharber, (Konarka Inc., Germany); Henry Snaith, (Oxford, UK); Delmar Larson, (Davis, CA); Roland Faller, (Davis, CA); Olle Inganas, (Linkoping, Sweden); David Huang, (Adelaide, Australia); John Grey, (U. New Mexico), Stephan Friedrich (LLNL), Frank Osterloh (Davis, CA)

Graduate Advisor: Alexander Pines, University of California, Berkeley

Postdoctoral Sponsor: Klaus Meerholz, University of Cologne, Germany

Postgraduate-Scholars: Total Number of Postgraduate-Scholars Advised: 3
Dr. David Huang – Faculty - University of Adelaide, Australia, Dr. Daniella La Grange – CEO of TEM instrumentation start-up, Dr. Sook Yoon (finished April 2011)

Graduate Students: Total Number of Graduate Students Advised: 8
Dr. Chris Rochester (13 - Intel), Dr. Scott Mauger (13 – NREL postdoc), Dr. John Roehling (13 – UCD postdoc), Dr. Lilian Chang (13 – searching), Ian Jacobs (current), Varuni Dantnarayana (current), Jun Li (current), and Joseph Sitt (current)

Undergraduate Researchers: Total Number of Undergraduate Researchers Advised: 27

International and domestic visitors: Total Advised: 5 students + 3 Professors
Masaya Toba (NAIST, Japan) , Cristian Heredia (LLNL, USA), Benjamin Commoult (U. Nantes, France), Woohung Chung (NAIST, Japan), Prof. Yong Ku Kwan (Inha University, Korea), Rong Ziqin (Tsinghua, China), Prof. Bayram Kilic (Yalova University, Turkey), and Prof. Ozge Tuzun (Düzce University, Turkey)
BIOGRAPHICAL SKETCH

Dr. Joan M. Ogden
Professor of Environmental Science and Policy
Director, Sustainable Transportation Energy Pathways Program
Institute of Transportation Studies
University of California
Davis, CA  95616
EMAIL: jmogden@ucdavis.edu
Phone (530)752-2768

EDUCATION:
B.S. with high honors, mathematics, University of Illinois, Champaign-Urbana, 1970.


EXPERIENCE:
Department of Environmental Science and Policy and Institute of Transportation Studies, University of California, Davis
       Professor, July 2006-present
       Associate Professor, September 2003-June 2006,
       Director, Hydrogen Pathways Program September 2003-2006
       Director, Sustainable Transportation Energy Pathways Program Jan 2007-present

Center for Energy & Environmental Studies, Princeton Environmental Institute, Princeton University
       Research scientist July 1993-August 2003
       Research staff, July 1987-June 1993; Hewlett Fellow, September 1986-June 1987;
       NSF Visiting Professor, September 1985-August 1986

David Sarnoff Research Center, RCA, Princeton, NJ
       Member of the Technical Staff, September 1984-September 1985.

Research Interests: Technical and economic assessment of new energy technologies, especially in the areas of alternative fuels, fuel cells, renewable energy and energy conservation. Ogden is Director of the Sustainable Transportation Energy Pathways Program at UC Davis, a team of 15 faculty and 20 graduate students, who are developing new and innovative tools to better understand the technological, economic, social and environmental characteristics of sustainable transportation energy systems. The research is funded by a consortium of 23 industry and government sponsors. Over 30 graduate students in the have received degrees under this program. Ogden has directly advised 15 of these students.
Publications: Ogden has written extensively on energy topics, including two books, 27 book chapters, and 43 peer-reviewed journal articles, as well as numerous reports and conference papers.

Five key papers (2008-2012):

Joan Ogden was a member of the NRC committee and primary author of Chapter 6, October 2008.


Professional Awards and Honors: She received R&D Excellence Awards from the US Department of Energy in 2005 and 2006. In 2007, she received an award from the University of California, for distinguished public service, and from the Transportation Research Board for the best paper on Transportation and Energy Policy.

Public Service: Joan Ogden has served on a number of high-level committees and working groups convened by the U.S. Department of Energy on future energy technologies and strategies. In 2007-8, she served on a National Academies Panel that assessed research needs for hydrogen and fuel cell technologies and in 2009-2010 on a National Academies panel assessing these needs for plug-in hybrid electric vehicles. In 2007-2009, she served on a California state panel to advise the state on implementing its greenhouse gas law AB32, the DOE’s Hydrogen Technical Advisory Committee, and is a lead author for the Intergovernmental Panel on Climate Change 2011 Special Report on Renewable Energy, examining the future role of renewable energy.
Frank E. Osterloh

University of California
Department of Chemistry
One Shields Avenue, Davis, CA 95616

Phone (530) 754-6242
Fax (530) 752-8995
osterloh@chem.ucdavis.edu

(A) PROFESSIONAL PREPARATION
1994 Diploma (M.S.) in Chemistry, Department of Chemistry, Carl von Ossietzky Universität, Oldenburg, Germany
1997 Ph.D. in Chemistry (summa cum laude), Department of Chemistry, Carl von Ossietzky Universität, Oldenburg, Germany Thesis title: Synthesis and Characterization of novel Fe- and Ni-Complexes as Model Compounds for the Active Sites of NiFe-Hydrogenase and Ni-CO-Dehydrogenase
1997 – 2000 Postdoctoral Fellow in Chemistry, Department of Chemistry and Chemical Biology, Harvard University, Cambridge, MA

(B) APPOINTMENTS
2011 – Professor, Department of Chemistry, UC Davis, CA.
2006 – 2010 Associate Professor, Department of Chemistry, UC Davis, CA.
2000 – 2005 Assistant Professor, Department of Chemistry, UC Davis, CA.
1997 – 2000 Postdoctoral Research Assistant, Department of Chemistry and Chemical Biology, Harvard University, Cambridge, MA.
1994 – 1997 Teaching Assistant, Department of Chemistry, Carl von Ossietzky University, Oldenburg, Germany

(C) AWARDS AND FELLOWSHIPS
1997–1999 Deutsche Forschungsgemeinschaft (DFG) Postdoctoral Fellowship
2010 Division of Inorganic Chemistry Inorganic Nanoscience Award by the American Chemical Society (ACS)
2010 DAAD Research Visit Fellowship
2012/13 Research Corporation Scialog Collaborative Innovation Award
Member: German Chemical Society (GDCh), American Chemical Society (ACS), Electrochemical Society (ECS)

(D) PROFESSIONAL ACTIVITIES
2014 – Associate Editor for Journal of Materials Chemistry A (RSC)
2013 – Chair, ACS Division of Inorganic Chemistry, Nanoscience Subdivision
2012 – Chair, Chemistry Graduate Group, UC Davis; Vice Chair, Chemistry Department
2011 – Member, Editorial Advisory Board of Chemistry of Materials (ACS)
2009 Chair, Solar Hydrogen and Nanotechnology Symposium, SPIE, San Diego, CA.
2003 – Member, Chemistry Club Advisory Committee (http://chemgroups.ucdavis.edu/~osterloh/chemclub/home.htm),
C. Frank Osterloh, Department of Chemistry, University of California, Davis


(E) GRADUATE AND POSTDOCTORAL ADVISORS
Graduate: Dr. Siegfried Pohl (deceased 1996), Department of Chemistry, Carl von Ossietzky Universität, Oldenburg, Germany
Postdoctoral: Dr. Richard Holm, Department of Chemistry and Chemical Biology, Harvard University, Cambridge, MA

(F) RECENT PUBLICATIONS
Jae Wan Park, Ph.D.  

Biographical Sketch

**Education and Training**

Pohang University of Science and Technology  Mechanical Engineering  B.S.  1997  
Pohang University of Science and Technology  Mechanical Engineering  M.S.  1999  
Pohang University of Science and Technology  Mechanical Engineering  Ph.D.  2004  

**Professional Experience**

*Associate Professor,*  
Department of Mechanical and Aerospace Engineering,  University of California, Davis  
2014 - present  

*Assistant Professor,*  
Department of Mechanical and Aerospace Engineering,  University of California, Davis  
2008 - 2014  

*Lecturer,*  
Department of Mechanical engineering  
University of Waterloo, Waterloo, Canada  
2007 - 2008  

*Post Doctoral Research Associate,*  
Green Energy Laboratory  
University of Waterloo, Waterloo, Canada  
2005 - 2008  

*Graduate Student Researcher,*  
Pohang University of Science and Technology  
Pohang, Korea  
1997-2004  

**Recent Critical Publications**


**Synergistic Activities**

**Recent Collaborators**

- **Local:** Adam Weber, Vincent Battaglia (P. I. at Lawrence Berkeley National Laboratory), Andrew Frank (Professor, UC Davis), Robert Flochini (Director, UCD McClellan Nuclear Research Center), Paul Moller (CEO, Moller international)

- **International:** W. C. Yang (Senior V. P. at Hyundai Kia Motor Company, South Korea), C. B. Lee (Senior director, Korea Automotive Technology Institute), Simon Farrington (Senior Researcher, Automotive Fuel Cell Cooperation Corp., Canada), Woonbong Hwang (Professor, Pohang University of Science and Technology, South Korea), Xianguo Li (Professor, University of Waterloo, Canada), Y. J. Sohn (Senior Researcher, Korea Institute of Energy Research)

**Academic Service**


- **Director:** UC Davis Formula SAE Team Hybrid (http://mae.ucdavis.edu/jwpark/Hybrid.html), UC Davis Green Transportation Laboratory (http://mae.ucdavis.edu/jwpark/Hybrid.html), Korea Automotive Research Center at ITS-Davis

- **Faculty of Institute of Transportation Study, Davis (ITS-Davis)**

- **Instructor of California State Summer School for Mathematics & Science (COSMOS)**

- **Member of SAE and ASME**

- **Thesis Advisor (as of 2014 Sept.):** Anthony Santamaria (Post doc.), Shijie Tong (Post doc.), Matthew Klein (Ph.D., 4th year), Maxwell Becton (M.D, 2nd year), Nathaniel Cooper (Ph.D., 3rd year), Tzu Fung (Ph. D., 2nd), Dong IL Shin (Ph. D., 2nd year), Travis Smith (Ph. D. 4th year)
APPOINTMENTS:
2008-Present: Assistant Professor of Economics, UC Davis
2008-Present: Faculty Affiliate, Energy Efficiency Center, UC Davis
2008-Present: Faculty Affiliate, Institute of Transportation Studies, UC Davis
2014-Present: Faculty Affiliate, The E2e Project
2012-13: Visiting Researcher, UC Energy Institute, UC Berkeley

PROFESSIONAL SERVICE:

EDUCATION
Ph.D., Economics, Boston University, Boston MA, June 2008
M.A., Economics, Queen’s University, Kingston ON, Canada, 2003
A.B., Economics, Dartmouth College, Hanover NH, 1999

RESEARCH INTERESTS
Energy & Environmental Economics, Industrial Organization

PUBLICATIONS


**WORKING PAPERS**


**GRANTS**

Principal Investigator, *California Air Resources Board* (with T. Turrentine (co-PI), G. Tal), 2014. $300,000.
Principal Investigator, *California Air Resources Board* (with P. Mokhtarian (co-PI), K. Gillingham, C. Knittel), 2012. $300,000.
Investigator, *UC Davis Research Investments in the Sciences and Engineering* (with K. Levitt, Ho-Chen, George Barnett, J. Bushnell, A. Scaglioni, and Nicole Woolsey-Biggert), 2012. $840,000.
Investigator, *National Science Foundation* (with G. Kesisidis (PI), K. Levitt (PI), D.J. Miller, J. Rowe, J. Bushnell, A. Scaglioni), 2012. $240,000 (Rapson share).
Principal Investigator, *UC Energy and Environmental Economics Program* (with K. Jessoe (co-PI)), 2012. $17,000.
Principal Investigator, *UC Energy and Environmental Economics Program* (with K. Jessoe (co-PI)), 2010. $17,000.
Principal Investigator, *UC Davis Sustainable Transportation Center*, 2008

**TEACHING**

Graduate Empirical Industrial Organization, UC Davis (2009-present)
Undergraduate Industrial Organization, UC Davis (2009-present)
Energy Economics, UC Davis (2012-present)
Intermediate Microeconomics, Boston University (2006)

**REFEREE SERVICES**


**CITIZENSHIP:** CANADA
**RESIDENCY:** UNITED STATES (Green Card)
Pamela C. Ronald  
Tel. (530) 752-1654 / Fax (530) 754-6940 / Email: pcronald@ucdavis.edu

**Professional Preparation:**
University of Strasbourg, France, French Language Studies, Diploma 1981.
Reed College, Portland, Oregon, Biology, B.A. 1982.
Stanford University, Biology, M.A. 1984.
UC Berkeley, Molecular and Physiological Plant Biology, Ph.D. 1990.

**Appointments:**
2011-present  Faculty, UC Davis Genome Center
2008-2011    Vice-President, Feedstocks, Joint Bioenergy Institute
2007-present  Director, Grass Genetics, Joint Bioenergy Institute
2007-present  Bio Sci Faculty, Physical Biosciences Division at Lawrence Berkeley National Laboratory
2004-2007    Faculty Assistant to the Provost
2004-2007    Director, Grass Genetics, Joint Bioenergy Institute
2004-2008    Chair, UCD Plant Genomics Program
2002-present  Professor, Department of Plant Pathology, UC Davis
1997-2002    Associate Professor, Department of Plant Pathology, UC Davis
1992-1997    Assistant Professor, Department of Plant Pathology, UC Davis
1990-1992 Postdoctoral Fellow, Department of Plant Breeding, Cornell University

**Other experience and professional service:**
2013-2014  Founding Member, National Plant Science Council
2013-2016  Member, Scientific Advisory Board of the Donald Danforth Plant Science Center
2012-present Member, Board of Directors and the Scientific Advisory Board, Boyce Thompson Institute for Plant Biology
2010    NIH review panel, HIBP Study Section
2004-2007  Chair, American Society of Plant Biology Public Affairs Committee
1995-1996  USDA Plant Pathology Review Panels

**Honors:**
2014    Director’s Award for Exceptional Achievement in the area of Societal Impact, Lawrence Berkeley National Laboratory
2013-2016 Biofortified.org nominated for the National Academies of Science Kleck Communication award
2013 "Tomorrow’s Table" selected as the North Carolina State Common Reading text.
2013 The Bifen Lecture, John Innes Institute
2013 31st Arthur G. Rempel Lecture, Whitman College
2013 Recommended as one of 10 women scientists to follow on twitter
2013 Mary Snow Lecture, University of Oxford Department of Plant Sciences
2012 Louis Malassis International Scientific Prize for Agriculture and Food.
2012 The 2012 Tech Award - Honors 12 international laureates who are using innovative technology to benefit humanity.
2011 Elected Fellow of the World Technology Network
2011 Selected as 1 of 100 most creative people in business by Fast Company Magazine.
2011 2011 Riley lecturer; selected by representatives from AAAS, the US National Academies, the World Food Prize Committee and the Riley Foundation
2010-2013 Professor as International Scholar, Ministry of Education, Science and Technology, Korea, Kyung Hee University
2010 The 2012 Fulbright-Tocqueville Distinguished Chair
2009 Winner of the 2009 Science in Society Journalism Award, sponsored by the National Association of Science Writers
2008 USDA National Research Initiative Discovery Award
2008 “Tomorrow’s Table” selected as Outstanding Book of the year (Seed Magazine)
2007 CGIAR Science Award for Outstanding Scientific Article
2007-2008 Fellow, Japan Society for the Promotion of Science
2006 Fellow, American Association for the Advancement of Science
2002-2005 Honorary Scientist at the National Institute of Ag Biotechnology, Korea
1999-2000 John Simon Guggenheim Fellow

Publications most closely related to proposed project:
Bart, Rebecca, Mawsheng Chern, Miguel Vega-Sanchez, Patrick Canlas and P.C.Ronald. 2010. Rice Snl6, a Cinnamoyl-CoA Reductase-like Gene Family Member, is Required for NH1-Mediated Immunity to Xanthomonas oryzae pv. oryzae. Plos Genetics. 6(9): e1001123.
Chern MS, Canlas PE and Ronald PC. Strong Suppression of SAR by NRR is Dependent on its Ability to interact with NPR1 and a putative repression domain. 2008. Molecular Plant. 1:552-559.

Five other significant publications:

Synergistic activities:
1. Benefit Sharing: Established the UCD Genetic Resources Recognition Fund to equitably share benefits derived from developing nation germplasm
2. Transfer of knowledge: Organizer of symposia on Plant Microbe interactions and Rice Functional Genomics (2001-2010); Leader of multi-institutional Rice oligoarray consortium (2003). Establishment of phylogenomic databases (2006-2010); co-authored Tomorrow’s Table: Organic Farming Genetics and the Future of Food
3. Public Education: Speaker (20 presentations/yr) to non-scientific audiences on agricultural biotechnology. Examples include: Oregon State University “Food for Thought” Distinguished lecture series; Established K-12 science-through-art program in Davis elementary schools (2003-present) and Poptech lecture.
4. Professional service: History of professional service to USDA, NSF and NIH peer review panels, service on 3 major editorial boards. Chair of ASPB Public Affairs committee.
Biographical sketch – Christopher Simmons

Christopher W. Simmons
Assistant Professor, Department of Food Science and Technology
University of California, Davis, One Shields Avenue, Davis, CA 95616
Tel: 530-752-2109, Fax: 530-752-4759, Email: cwsimmons@ucdavis.edu

Education and Training:
2005 University of California, Davis B.S. Biological Systems Engineering
2007 University of California, Davis M.S. Biological Systems Engineering
2011 University of California, Davis Ph.D. Biological Systems Engineering
2013 University of California, Davis Postdoctoral Biological Systems Engineering
2013 Joint BioEnergy Institute Postdoctoral Microbial Communities

Professional Experience:
2013-presents Assistant Professor, Dept. of Food Science & Technology, UC Davis
2013-present Affiliated faculty, Energy Efficiency Center, UC Davis

Synergistic Activities:
2013- Editorial board member, Advanced Science, Engineering and Medicine
2013- Member, Institute of Food Technologists
2008- Mentor for the Biotech Academy at Sheldon High School (Sacramento, CA).
2007- Graduate student representative to the UC Davis Graduate Council.
2007- Departmental representative to the UC Davis Graduate Student Association.
2006- Member, American Chemical Society

Honors and Awards:
2011 Nominated by students for the University of California, Davis Outstanding Teaching Assistant Award
2009- The Honor Society of Agriculture, Gamma Sigma Delta, member
2008- NSF CREATE-IGERT Fellowship, recipient
2007- International Fuel Ethanol Workshop (FEW) Scholarship, recipient
2005- UC Davis Biological and Agricultural Engineering Departmental Citation for Undergraduate Achievement, recipient
2004- President’s Undergraduate Fellowship, recipient

Select relevant publications (last 5 years):


*these authors contributed equally to this work


Biographical Sketch of Daniel Sperling
Professor and Director, Institute of Transportation Studies, University of California, Davis
+1 530.752.7434, dsperling@ucdavis.edu

A. Professional Preparation
Cornell University  Civil and Environmental Engineering  BS 1973
University of California, Berkeley  Transportation Engineering (minors in economics and energy resources)  MS 1979  PhD 1982

B. Academic and Professional Appointments
2014-2015  Vice Chair and Chair, Transportation Research Board (National Academies)
2013-present  Interim Director, Energy Institute, UC Davis
2012-2013  Chairman (and Vice Chair), California Fuel Cell Partnership (public-private entity)
2011-present  Faculty Director, Policy Institute for Energy, Environment, and Economy, UC Davis
2007-present  Board Member, California Air Resources Board
2007-2009  Acting Director, Energy Efficiency Center, University of California, Davis
1991-present  Founding Director, Institute of Transportation Studies, University of California, Davis
1991-present  Professor, University of California, Davis. Joint appointment in Department of Civil & Environmental Engineering and Department of Environmental Science & Policy.
1982-1991  Assistant and Associate Professor, University of California, Davis
1976-1977  Environmental Planner, U.S. Environmental Protection Agency

C. Major Awards
- Blue Planet Prize for being “a pioneer in opening up new fields of study to create more efficient, low-carbon, and environmentally beneficial transportation systems” (Asahi Glass Foundation), 2013
- Heinz Award for “achievements in the research of alternative transportation fuels and responsibility for the adoption of cleaner transportation policies in California and across the United States,” 2010
- Robert M. Zweig Public Education Award of the National Hydrogen Association, 2009
- Barry McNutt TRB Award for Best Paper in Energy, 2008 (Jon Hughes, Chris Knittel, and D. Sperling)
- Lifetime National Associate, National Academies, 2004
- Carl Moyer Memorial Award for Scientific Leadership and Technical Excellence, Coalition for Clean Air, 2002
- Clean Air Award, American Lung Association, Sacramento, California, 1997
- Distinguished Public Service Award, University of California, Davis, 1996
- Juror, Electric Vehicle and the American Community: National Planning and Design Competition, 1993

D. Key Leadership Activities (since 2009)
- IPCC (Intergovernmental Panel on Climate Change), Lead author, transportation chapter, WG III, 2006-07 (4th Assessment), 2011-14 (5th Assessment)
- US Transportation Research Board Committees (National Academies):
  - Vice Chair and Chairman, 2014-15
  - Member, Standing Committees on Transportation and Sustainability, Transportation Energy, Alternative Transportation Energy, New Transportation Systems and Technology, and Task Force on Climate Cha
- Brunei National Energy Research Institute, International Advisory Committee, 2013+
- King Abdullah Petroleum Research Center (KAPSARC, Saudi Arabia), International Advisory Committee, 2010+
- Chair, California Fuel Cell Partnership, 2013 (member of Executive Committee, 2012+)
Chair, Council on Future of Transportation, Davos World Economic Forum, 2008-09  
Board member, California Air Resources Board, 2007+  
Royal Dutch Shell External Review Committee for Sustainability, Member, 2010-13  
Nissan Environmental Advisory Committee, Member, 2005+

At UC Davis….  
Founded Institute of Transportation Studies at UC Davis in 1991.  
Founded a highly successful biennial conference on transportation and energy policy in 1988 under the auspices of the US Transportation Research Board of the National Research Council.  
Founded first university-based energy efficiency center in the US in 2006.

E. Selected Publications (out of 250 technical papers, books, reports)


PIETER STROEVE

Address
Department of Chemical Engineering and Materials Science,
University of California Davis,
1 one Shields Ave
Davis, CA 95616
Tel: 530-304-9748

Academic Preparation
Postdoc Physiology, Radboud University of Nijmegen, Netherlands 1974-1977
Postdoc Colloid Science, Weizmann Institute of Science, Rehovot, Israel 1973-1974, 1977
Sc.D. Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA 1973
M.S. Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA 1969
B.S. Chemical Engineering with Honors, University of California, Berkeley, CA 1967

Professional History
1977-1980 Assistant Professor of Chemical Engineering, State University of New York at Buffalo, NY
1980-1981 Associate Professor of Chemical Engineering, State University of New York at Buffalo, NY
1982-1984 Associate Professor of Chemical Engineering, University of California Davis
1984-2010 Professor of Chemical Engineering, University of California Davis
2010-present Distinguished Professor of Chemical Engineering, University of California Davis.
1988-1989 Paul J. Flory Sabbatical Fellow at the IBM Almaden Research Center, San Jose, CA
Spring-Summer 1996 Visiting Professor at the Max-Planck Institute of Polymer Research, Mainz, Germany
2003-2004 FRONTIS Visiting Professor of Nanotechnology at Wageningen University, the Netherlands
Spring 2010 Visiting Professor at the Department of Chemistry, Valencia Polytechnic University

Recent publications (Total 261)


Synergistic activities
Supervision of undergraduate and graduate research.
In the past six years five students have received PhD degrees under my supervision. In addition five students completed their Masters degree. In addition, I often have several undergraduates participating in my research projects.
Reviews of manuscripts and grant proposals
Each year I review about 30 scientific articles and approximately 10 proposals.
Recent collaborators (last 5 years): Dr. Marek Majewski, LANL; Dr. Alexander Noy, Dr. Joseph Tringe, Dr. Sonia Letant, LLNL; Prof. Y.C. Ke National Petroleum University (NPU), Beijing; Prof. Young Soo Kang, Pukyong National University, Korea; Prof. Salvador Mafe, University of Valencia, Spain; Prof. Patricio Ramirez, Universidad Politecnica de Valencia, Spain; Prof. Takahiko Nakaoki, Ryokoku University, Shiga, Japan; and Prof. Wendy Chiu, Taiwan National University, Taiwan; Prof. Guoqu Zheng, Zhejian University of Technology, China; Prof. Morteza Mahmoudi, Shariff University, Iran. Prof. Ramon Martinez, Universidad Polytechnica de Valencia, Spain.
Tina Jeoh
Assistant Professor, Biological and Agricultural Engineering, University of California, Davis. 2044 Bainer Hall, One Shields Drive, Davis, CA 95616. Tel: (530) 752-1020, Fax: (530) 752-2460.

Education and Training
1996 Virginia Tech B.S. Biological Systems Engineering
1999 Virginia Tech M.S., Biological Systems Engineering
2004 Cornell University Ph.D., Biological and Environmental Engineering

Research and Professional Experience
2008-present Assistant Professor, Biological and Agricultural Engineering, UC Davis
2007-2008 Research Scientist, Geosynfuels, LLC, Golden, CO
2003-2006 Post-Doctoral Researcher, National Renewable Energy Laboratory

Honors and Awards:
National Science Foundation CAREER Award, 2011-2016.
UC Davis ADVANCE Scholar Award, 2014

Synergistic activities
Discussion Leader, Gordon Conference of Cellulosomes, Cellulases, and other Carbohydrate Modifying Enzymes, Proctor Academy, Andover, NH, August 2013. Conference Chair: Harry Brumer.
Session Chair, Advances in the Molecular Level Understanding of Enzyme Mechanisms, 33\textsuperscript{rd} Symposium on Biotechnology for Fuels and Chemicals, Seattle, WA, May 2011.
Organizer, STEM for Girls, Annual UC Davis outreach event to engage 50-60 middle school girls in STEM.
Faculty advisor, UC Davis Women in Science and Engineering (WISE), 2008-present.

Representative Publications (Full List here: Publications)


**Patents**

Jean Suzanne VanderGheynst

Education

1997 Cornell University, College of Agriculture and Life Sciences and College of Engineering, Ithaca, NY
Doctor of Philosophy in Agricultural and Biological Engineering with minors in Environmental and Soil and Water Engineering.

1994 Cornell University, College of Agriculture and Life Sciences and College of Engineering, Ithaca, NY
Master of Science in Agricultural and Biological Engineering

1991 Syracuse University, College of Engineering, Syracuse, NY
Bachelor of Science in Chemical Engineering, with Distinction

Professional Experience

2013-present Associate Dean for Research and Graduate Study, University of California, College of Engineering, Davis, CA

2009-2013 Associate Dean for Undergraduate Study, University of California, College of Engineering, Davis, CA

2010-present Director, Renewable Energy Systems Opportunity for Unified Research, Collaboration and Education (RESOURCE), Davis, CA

1996-present Professor (2007), Associate Professor (2002) and Assistant Professor (1996) of Biological and Agricultural Engineering, University of California, Department of Biological and Agricultural Engineering, Davis, CA

2006-present Staff Research Scientist, Joint BioEnergy Institute, Emeryville, CA

2007-2009 Graduate Advisor, Biological Systems Engineering Graduate Program, Davis, CA

1992-1996 Graduate Research Assistant, Cornell University, Ithaca, NY

1991 Environmental Consultant, Galson Incorporated, East Syracuse, NY

1990 Manufacturing Engineer, Dow Corning Corporation, Midland, MI

1989 Process Engineer, Dow Corning Corporation, Midland, MI

Selected Professional Activities

Editorial Board Member of Compost Science and Utilization. 1997-present
Editorial Board Member of Industrial Biotechnology. 2005-present
Associate Editor of Biological Engineering. 2006-2010
California Biomass Collaborative. Board Member. 2006-2010
UC Davis Energy Institute. Steering Committee. 2007-2011
ASABE Farrall Young Educator Award Committee. 2005-2009
Society for Industrial Microbiology. Member

Awards

Nona Sall Award. Awarded by the CSUS/UCD MESA Center for promoting CA K-12 STEM education, 2011.

Outstanding Project Award. Awarded by the National Science Foundation GK-12 program. 2011.

Farrall Young Educator Award. Awarded by ASABE for outstanding teaching. 2005.

Outstanding Mentor Award. Awarded by the Consortium for Women and Research Advisory Board for mentoring women’s research at UC Davis. 2003.

California Resource Recovery Association award for leadership, commitment and dedication to education and advocacy to organic recycling in California. 1999.

U.S. Environmental Protection Agency Graduate Fellowship. 1995-1996.

Alice H. Cook and Constance E. Cook award for efforts on improving the status of women at Cornell. 1995.

Member of Tau Beta Pi Engineering Honor Society. 1989-present.
Selected Peer Reviewed Publications


Sonia Yeh
Institute of Transportation Studies, University of California
1605 Tilia Street, Davis California, 95616
slyeh@ucdavis.edu; http://steps.ucdavis.edu/People/slyeh

Current Positions
Research Scientist, Institute of Transportation Studies, University of California, Davis (2007-present)
Lecturer, Department of Environmental Science and Policy, College of Agricultural and Environmental Sciences, University of California, Davis (2012-present)
Faculty affiliate, UC Davis Graduate Group in Ecology (GGE) (2014-present)
Faculty member, UC Davis Graduate Group in Transportation Technology and Policy (TTP) (2008-present)
Adjunct faculty, Department of Engineering and Public Policy, Carnegie Mellon University (2004-present)

Education
M.S. Harvard School of Public Health, Boston, MA (1997) Environmental Health
B.S. Tunghai University, Taichung, Taiwan (1995) Environmental Science

Previous Experience
• Research Director, Carolina Transportation Program, University of North Carolina at Chapel Hill (2005-2007)
• Fellow, National Risk Management Research Laboratory, U.S. Environmental Protection Agency (2004-2007)
• Post-Doctoral Research Fellow, Department of Engineering and Public Policy, Carnegie Mellon University (2001-2003)

Research Management and Leadership
• Organizer and founder of California Climate Policy Modeling Dialog, a collaboration between UC Davis, California Air Resources Board, California Energy Commission, Stanford University, UC Berkeley, and LBNL (2013-present)
• Co-task leader, Best Policy and Incentive Strategies for Technical Assistance & Analysis, research program funded by California Energy Commission, Institute of Transportation Studies, University of California Davis (2013-2014)
• Track leader, Integrated Scenario Analysis, Sustainable Transportation Energy Pathways Program (STEPS), University of California, Davis (2007-present)
Award and Recognition

- Academic Federation Award for Excellence in Research, University of California, Davis, 2014.
- Named as the “Policy Shapers of the Water-Energy-Food Landscape” by The Global Leadership and Technology Exchange (GLTE), a partnership project between Royal Dutch Shell, Xyntéo and Unilever, 2013.

Journal Publications

5. Yui, S.; Yeh, S., Land use change emissions from oil palm expansion in Pará, Brazil depend on proper policy enforcement on deforested lands. Environmental Research Letters 2013, 8 (4), 044031 (9pp).


**Trade Magazine Articles (Invited)**


**Book Chapters**


Research Reports and Policy Briefs


Legislative Briefings

1. "A National Low Carbon Fuel Policy," Congressional briefings at U.S. Senate hosted by International Food Policy Research; Green Design Institute of Carnegie Mellon University; Department of Agricultural and Consumer Economics/Energy Biosciences Institute, University of Illinois, Urbana-Champaign; Oak Ridge National Laboratory; Institute of Transportation Studies, University of California, Davis; Margaret Chase Smith Policy Center, and School of Economics, University of Maine. Washington DC (July 19, 2012).
2. "A National Low Carbon Fuel Policy," Congressional briefings at U.S. House hosted by International Food Policy Research; Green Design Institute of Carnegie Mellon University; Department of Agricultural and Consumer Economics/Energy Biosciences Institute, University of Illinois, Urbana-Champaign; Oak Ridge National Laboratory; Institute of Transportation Studies, University of California, Davis; Margaret Chase Smith Policy Center, and School of Economics, University of Maine. Washington DC (July 20, 2012).


Professional Activities and Service

Committee Membership (and Chair)
California Air Resources Board Low Carbon Fuel Standard Expert Workgroup on Indirect Land Use Change (March-December 2010) – Chair of Emission Factors Subgroup.
California Air Resources Board Low Carbon Fuel Standard Expert Workgroup on Sustainability (March 2010-present).

Editorial Boards of Journal
Associate Editor, Frontiers in Energy Systems and Policy (2013-present)

Conference/Workshop Organizer

Reviewer

Books, Reports and Others:

First-order draft of the Working Group 3 contribution to the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC, 2006).


Journals:


Reviews of proposals and models (compensated):

- Canadian Government Networks of Centers of Excellence (NCE) program, Carbon Management Canada (2010 and 2011)

Teaching

TTP 289A-002 Energy Modeling for Policy Analysis (Winter Quarter 2013)

Students Mentoring at UC Davis

Postdoctoral researchers:

- Nicholas P Lutsey; Julie Witcover; David Ricardo Heres

Ph.D. students (by discipline/department):

- Transportation Technology and Policy (TTP): David McCollum, Juhong Yuan, Jacob Teter, Kalai Ramea, Jeff Kessler, Geoffery Morrison, Saleh Zakeri, Kate Tiedeman, Anqi Zhao, Gouri Shankar Mishra
- Geography Group: Peter Tittman
- Ecology Group: Jeffery Mason Earles

Master students (by discipline/department):

- Transportation Technology and Policy: Gouri Shakar Mishra, Pu Chen, Sahoko Yui, Shengmao Mu, Kate Tiedeman
- Geography Group: Eric Winford

International exchange students:

- Moonmoon Hiloidhari, Doctoral research candidate, Fulbright-Nehru (USA-INDIA) Fellowship, Department of Energy, Tezpur University

Awards Earned by Mentored Students

Sonia Yeh
• Santa Fe Complex Systems Summer School 2014 (Kalai Ramea)
• Precourt Energy Efficiency Center Student Fellow for Behavior, Energy and Climate Change Conference (Kalai Ramea)
• National Science Foundation (NSF) Renewable Energy Systems Opportunity for Unified Research Collaboration and Education (RESOURCE) program fellowship (Jeff Kessler and Jacob Teter)
• Young Scientists Summer Program (YSSP) Fellowship, International Institute for Applied Systems Analysis (IIASA), Laxenburg Austria (David McCollum, Jacob Teter and Kalai Ramea)
• International Energy Agency, Paris, summer internship (Jacob Teter and Geoff Morrison)
• Eno Leadership Development Conference, Washington, DC (Jacob Teter)
• EPA STAR graduate fellowship (Jeffery Mason Earles)
• UK Energy Research Centre Summer School (Kalai Ramea)
• Graduate Climate Conference scholarship awarded by Massachusetts Institute of Technology (MIT) Program in Atmospheres, Oceans, and Climate. Woods Hole Oceanographic Institution, Woods Hole, Cape Cod, MA, (Sahoko Yui)
• Outstanding Student of the Year for the UC Davis Sustainable Transportation Center (David McCollum, Gouri Shankar Mishra);
• Honorable Mention, Environment and Ecology, AAAS Student Poster Competition (Gouri Shankar Mishra);
• First place, Joe Beaton Poster Award competition for graduate students, California Geographical Society 67th Annual Conference Cal Poly San Luis Obispo, 2013 (Sahoko Yui)

Media (Twitter (@Sonia_yeh; @NLCFS); Google+ (Sonia Yeh))

Blogs

Moving forward with the Low Carbon Fuel Standard (7/11/2014)
UC Davis climate modeling: we can cut carbon by 2030, in sync with state goals (6/03/2014)

News Stories Based on Journal Publications

"Time, place and how wood is used are factors in carbon emissions from deforestation," Science Daily, May 13, 2012.

Professional Associations

• International Association of Energy Economics (IAEE) and US Association of Energy Economics (USAEE) (2004-present)
Extramural Grants and Contracts Since 2007

  - $150,000

  - $20,000

  - $20,000

  - $114,680

- **PI.** "Congressional Briefing of A National Low Carbon Fuel Standard.” July 2012
  - $10,000

  - $227,000

  - $300,000

  - $211,859

  - €7000

  - $100,000

  - $75,000

  - $114,680

  - $95,000

  - $124,000

  - $100,000

  - $1,000,000

  - $278,356


Presentations
12. "Long-Term Shifts in Transportation Energy Use and Demand," The Association for the Study of Peak Oil and Gas -USA 2012 Conference, University of Texas at Austin, Austin, TX (Nov 30, 2012) (invited).
DONG YU

Education and Training:
Univ. of Sci. & Tech. of China (USTC) Materials Science B.Sc. 2000
University of Chicago Physics Ph.D. 2005
Harvard University Physics Postdoc 2005-2008

Research and Professional Experience:
2008-2014: Assistant Professor, Physics Department, U. C. Davis
2014-Current: Associate Professor, Physics Department, U. C. Davis

Ten Publications Most Closely Related to This Project:
(1) Five publications most closely related:


(2) Five other significant publications:


Synergistic Activities:

- Reviewer for user proposals to DOE funded The Molecular Foundry (TMF). Member of the User Executive Committee (UEC) at TMF. Co-organizer for the Annual User Meeting (AUM) at TMF.
- Reviewer for National Science Foundation (NSF).
- Developed a new graduate course “Introduction to Nanoscale Science” at UC Davis.

Identification of Potential Conflicts of Interest or Bias in Selection of Reviewers

Collaborators and Co-Editors (in last 48 months):

- Ilke Arslan, Pacific Northwest National Laboratory
- Fachun Lai, Fujian Normal University, China
- Matt Law, University of California, Irvine
- Eunsoon Oh, Chungnam National University, Korea
- David Seidman, Northwestern University
- Junqiao Wu, University of California, Berkeley

Graduate Advisors and Postdoctoral Sponsors:

- **Graduate Advisor:** Philippe Guyot-Sionnest, University of Chicago
- **Postdoc Sponsor:** Hongkun Park, Harvard University

Thesis Advisor and Postgraduate-Scholar Sponsor:

- **Ph.D. Students:** Graduated (5):
  - Hengkui Wu (Phonone, Inc.),
  - Chris Miller (Postdoc at Insight Data Science)
  - Rion Graham, Tyler Otto, J. Kaszpurenko
- **Current (3):** Y. Yang, X. Peng, M. Triplett, U.C. Davis

Awards and Honors:

- 2010 Hellman Fellowship, University of California, Davis
- 2005 Second Prize, James Frank Institute Annual Symposium, University of Chicago
- 2001 Robert G. Sachs Fellowship, University of Chicago
- 1999 Guo Moruo Prize, USTC
Dr. Ruihong Zhang is Professor in Department of Biological and Agricultural Engineering at the University of California, Davis. She is a leading expert in anaerobic digestion and other waste treatment technologies. She has over 20 years of research, teaching, and engineering experiences with bioenergy production, waste treatment, organic residual management, and bioconversion technologies. Her current research is focused on conversion of organic residuals to biofuels and biobased products, wastewater treatment, and air quality control. Dr. Zhang has more than 200 scientific publications and seven patents. She is the director for UC Davis Biogas Energy Project, which is sponsored by an alliance between UC Davis and private industry. She is very successful in transferring and commercializing new technologies.

EDUCATION

Ph.D. 1992 University of Illinois at Urbana-Champaign, Illinois
M.S. 1986 Northeast Agricultural University, China
B.S. 1983 Inner Mongolia Engineering College, China

PROFESSIONAL EXPERIENCE

7/2004-Present Professor, University of California, Davis
7/1999-6/2004 Associate Professor, University of California, Davis
10/1995 - 6/1999 Assistant Professor, University of California, Davis
8/1993 - 9/1995 Assistant Professor, Iowa State University
4/1992 - 8/1993 Postdoctoral Research Associate, University of Illinois at Urbana-Champaign (UIUC)

AWARDS AND HONORS

Achievement Award, California Bioresources Alliance, 2013
Innovator Award, College of Engineering, University of California, Davis, 2013
AOCABE Distinguished Career Award, 2010
EPA Environmental Award, 2007
ASAE New Holland Young Researcher Award, 2003
ASAE Superior Paper Award, 2000
ASAE Superior Paper Award, 1998

SELECTED PUBLICATIONS


Appendix I. Survey of Potential Employers
The following survey (hosted by SurveyMonkey) was distributed via e-mail to existing industry and government contacts of the UC Davis Energy Hub. The screenshots below show the actual survey as it appeared online. Screenshots of the actual survey responses follow.

**Note:** The options listed in Q4 were displayed in random order for each survey participant.
**Note:** Degree options listed in Q5 were displayed in random order for each survey participant.

### UC Davis - Energy Graduate Group
Graduates from the UC Davis EGG Program

<table>
<thead>
<tr>
<th>Rank</th>
<th>Degree Option</th>
<th>Subject Areas</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>M.B.A. -- Masters of Business Administration</td>
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</tr>
<tr>
<td>2</td>
<td>M.P.P. -- Masters of Public Policy</td>
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<tr>
<td>3</td>
<td>M.S. or Ph.D. -- Basic sciences (chemistry, physics, biology, etc.)</td>
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</tr>
<tr>
<td>4</td>
<td>M.S. or Ph.D. -- Civil Engineering</td>
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</tr>
<tr>
<td>5</td>
<td>M.S. or Ph.D. -- Economics</td>
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</tr>
<tr>
<td>6</td>
<td>M.S. or Ph.D. -- Electrical Engineering</td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>M.S. or Ph.D. -- Energy Policy &amp; Management</td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td>M.S. or Ph.D. -- Energy Science &amp; Technology</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*6. If you were looking to hire a new employee to work in the energy field, which of the following advanced academic degrees would be the most relevant to the work of your company or organization? Please rank accordingly (1 = most relevant):*

---

**Final question!**

*6. If you were going to hire a new employee to work in the energy sector, would you find it valuable for that individual to have had an interdisciplinary graduate education in energy? For instance, the candidate would have: (a) an understanding of energy policy and economics; (b) a strong foundation in energy sciences and engineering; and (c) an ability to communicate clearly about complex energy topics with policymakers, engineers, academics, and scientists.*

- Yes -- Our company or organization has demand for more employees with an interdisciplinary understanding of the energy sector.
- No -- Our company or organization has demand for employees with different skills.
- Maybe

7. *(Optional)* Please use this box to provide us with any additional comments about the types of qualities you would like to see prospective hires gain from a graduate education in energy.

---

Powered by SurveyMonkey
Survey Results:
The following screenshot provides a summary of the survey results, the number of participants, and when the participants took the survey:
Note: The e-mail addresses provided in response to Q1 have been redacted to protect the privacy of individuals who participated in the survey.
Note: Some names are redacted in circumstances where the name of the company would reveal the specific individual who participated in the survey.
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<th>Organization</th>
<th>Date</th>
<th>Time</th>
<th>View Respondent's Answers</th>
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<td></td>
</tr>
<tr>
<td>TOTAL Marketing &amp; Services</td>
<td>8/25/2014 12:21 AM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>Ford Motor Company</td>
<td>8/24/2014 3:28 AM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>CA Energy Commission</td>
<td>8/21/2014 8:29 AM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>Ford Motor Company</td>
<td>8/20/2014 9:57 AM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>Department of Energy</td>
<td>8/19/2014 8:05 PM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>Westport</td>
<td>8/19/2014 4:57 PM</td>
<td>View respondent's answers</td>
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</tr>
<tr>
<td>Clean Energy</td>
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</tr>
<tr>
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</tr>
<tr>
<td>General Motors</td>
<td>8/19/2014 7:11 AM</td>
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</tr>
<tr>
<td>GE</td>
<td>8/19/2014 6:12 AM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>Royal Dutch Shell</td>
<td>8/19/2014 2:06 AM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>Company/Media</td>
<td>Date/Time</td>
<td>View respondent's answers</td>
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<tr>
<td>--------------</td>
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<td></td>
</tr>
<tr>
<td>Shell</td>
<td>8/19/2014 1:35 AM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>Daimler</td>
<td>8/19/2014 1:13 AM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>Technology Planning Department, Nissan Motor Co., Ltd.</td>
<td>8/18/2014 10:35 PM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>Westport</td>
<td>8/18/2014 3:23 PM</td>
<td>View respondent's answers</td>
<td></td>
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<tr>
<td>California Environmental Protection Agency</td>
<td>8/18/2014 3:16 PM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>California Energy Commission</td>
<td>8/18/2014 2:46 PM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>Toyota Motor North America, Inc.</td>
<td>8/18/2014 2:39 PM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>Alliance to Save Energy</td>
<td>8/18/2014 2:33 PM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>EDP Renovables North America LLC</td>
<td>8/18/2014 2:19 PM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>EDP Renewables North America LLC</td>
<td>8/18/2014 2:17 PM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>Ontario Ministry of the Environment and Climate Change</td>
<td>8/18/2014 10:40 AM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>ExxonMobil Corp</td>
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<td>View respondent's answers</td>
<td></td>
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<tr>
<td>General Motors Company</td>
<td>8/18/2014 7:40 AM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>IndianOil Corporation Ltd</td>
<td>8/15/2014 10:11 AM</td>
<td>View respondent's answers</td>
<td></td>
</tr>
<tr>
<td>Company</td>
<td>Date</td>
<td>Time</td>
<td>View Respondent's Answers</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------</td>
<td>---------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>Fiat Chrysler Automobile</td>
<td>8/15/2014</td>
<td>10:11 AM</td>
<td>View respondent's answers</td>
</tr>
<tr>
<td>Citigroup</td>
<td>8/15/2014</td>
<td>10:05 AM</td>
<td>View respondent's answers</td>
</tr>
<tr>
<td>California Energy Commission</td>
<td>8/14/2014</td>
<td>1:49 PM</td>
<td>View respondent's answers</td>
</tr>
<tr>
<td>BP</td>
<td>8/14/2014</td>
<td>11:19 AM</td>
<td>View respondent's answers</td>
</tr>
<tr>
<td>BP</td>
<td>8/14/2014</td>
<td>1:10 AM</td>
<td>View respondent's answers</td>
</tr>
<tr>
<td>BMW Group Munich</td>
<td>8/13/2014</td>
<td>10:38 PM</td>
<td>View respondent's answers</td>
</tr>
</tbody>
</table>
Which of the following best describes your role within the organization, company, or agency?

Answered: 83  Skipped: 0

<table>
<thead>
<tr>
<th>Answer Choices</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive</td>
<td>36.14%</td>
</tr>
<tr>
<td>Supervisor / Manager</td>
<td>43.37%</td>
</tr>
<tr>
<td>Analyst / Engineer</td>
<td>7.23%</td>
</tr>
<tr>
<td>HR / Admin</td>
<td>0.00%</td>
</tr>
<tr>
<td>Other</td>
<td>13.25%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>83</strong></td>
</tr>
</tbody>
</table>
If you were looking to hire a new employee to work in the energy field, which of the following attributes, qualities, educational training, or experiences would be most valuable for the prospective hire to demonstrate? Please rank accordingly (1 = most valuable):

<table>
<thead>
<tr>
<th>Attribute</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Total</th>
<th>Average Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COMMUNICATION:</strong> Ability to communicate about complex energy topics among various types of professionals (e.g., engineers, policymakers, academics, scientists, managers, etc.).</td>
<td>15.79%</td>
<td>23.68%</td>
<td>15.73%</td>
<td>17.11%</td>
<td>13.16%</td>
<td>7.09%</td>
<td>6.58%</td>
<td>76</td>
<td>4.82</td>
</tr>
<tr>
<td><strong>POLICY:</strong> Understanding of energy and climate policy at the state, federal, and international levels.</td>
<td>19.74%</td>
<td>11.34%</td>
<td>19.74%</td>
<td>13.16%</td>
<td>13.16%</td>
<td>17.11%</td>
<td>5.26%</td>
<td>76</td>
<td>4.39</td>
</tr>
<tr>
<td><strong>REAL-WORLD EXPERIENCE:</strong> Experience working on real-world, applied energy questions from fellowships or internships with energy companies, national labs, or state and federal agencies.</td>
<td>32.89%</td>
<td>14.47%</td>
<td>13.16%</td>
<td>14.47%</td>
<td>10.53%</td>
<td>6.58%</td>
<td>7.89%</td>
<td>76</td>
<td>4.93</td>
</tr>
<tr>
<td><strong>ECONOMIC:</strong> Understanding of energy markets and economics.</td>
<td>5.26%</td>
<td>17.11%</td>
<td>22.37%</td>
<td>21.05%</td>
<td>10.53%</td>
<td>10.53%</td>
<td>13.16%</td>
<td>76</td>
<td>4.01</td>
</tr>
<tr>
<td><strong>ENGINEERING:</strong> Knowledge of power engineering, including generation technologies and transmission &amp; distribution infrastructure.</td>
<td>9.21%</td>
<td>14.47%</td>
<td>9.21%</td>
<td>19.74%</td>
<td>10.53%</td>
<td>27.03%</td>
<td>9.21%</td>
<td>76</td>
<td>3.72</td>
</tr>
<tr>
<td><strong>MODELING:</strong> Advanced modeling skills (including economic, financial, resource potential, etc.) that can be used to evaluate the impacts of policy changes or industry actions on the energy sector.</td>
<td>10.53%</td>
<td>10.53%</td>
<td>14.47%</td>
<td>7.89%</td>
<td>34.21%</td>
<td>9.21%</td>
<td>13.16%</td>
<td>76</td>
<td>3.75</td>
</tr>
<tr>
<td><strong>SCIENCES:</strong> Advanced training in the basic energy sciences (physics, chemistry, biology, etc.).</td>
<td>6.58%</td>
<td>7.89%</td>
<td>8.26%</td>
<td>6.58%</td>
<td>7.89%</td>
<td>21.05%</td>
<td>44.74%</td>
<td>76</td>
<td>2.57</td>
</tr>
</tbody>
</table>
If you were looking to hire a new employee to work in the energy field, which of the following advanced academic degrees would be the most relevant to the work of your company or organization? Please rank accordingly (1 = most relevant):

<table>
<thead>
<tr>
<th>Degree Type</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Total</th>
<th>Average Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.S. or Ph.D. - Basic sciences (chemistry, physics, biology, etc.)</td>
<td>6.58%</td>
<td>17.11%</td>
<td>11.84%</td>
<td>5.26%</td>
<td>13.16%</td>
<td>18.42%</td>
<td>13.16%</td>
<td>14.47%</td>
<td>76</td>
<td>4.18</td>
</tr>
<tr>
<td>M.S. or Ph.D. - Civil Engineering</td>
<td>7.89%</td>
<td>16.68%</td>
<td>10.53%</td>
<td>11.84%</td>
<td>9.21%</td>
<td>9.21%</td>
<td>13.16%</td>
<td>32.89%</td>
<td>76</td>
<td>3.00</td>
</tr>
<tr>
<td>M.S. or Ph.D. - Electrical Engineering</td>
<td>17.11%</td>
<td>10.53%</td>
<td>18.42%</td>
<td>21.65%</td>
<td>8.16%</td>
<td>14.47%</td>
<td>5.26%</td>
<td>5.26%</td>
<td>7.89%</td>
<td>76</td>
</tr>
<tr>
<td>M.S. or Ph.D. - Energy Science &amp; Technology</td>
<td>17.11%</td>
<td>10.53%</td>
<td>18.42%</td>
<td>21.65%</td>
<td>8.16%</td>
<td>14.47%</td>
<td>5.26%</td>
<td>5.26%</td>
<td>7.89%</td>
<td>76</td>
</tr>
<tr>
<td>M.S. or Ph.D. - Energy Policy &amp; Management</td>
<td>17.11%</td>
<td>10.53%</td>
<td>14.47%</td>
<td>15.79%</td>
<td>13.16%</td>
<td>13.16%</td>
<td>9.21%</td>
<td>7.89%</td>
<td>76</td>
<td>5.83</td>
</tr>
<tr>
<td>M.B.A. - Masters of Business Administration</td>
<td>17.11%</td>
<td>10.53%</td>
<td>14.47%</td>
<td>15.79%</td>
<td>13.16%</td>
<td>13.16%</td>
<td>9.21%</td>
<td>7.89%</td>
<td>76</td>
<td>4.84</td>
</tr>
<tr>
<td>M.P.P. - Masters of Public Policy</td>
<td>14.47%</td>
<td>22.37%</td>
<td>11.84%</td>
<td>3.96%</td>
<td>11.84%</td>
<td>10.53%</td>
<td>11.84%</td>
<td>4.79%</td>
<td>76</td>
<td>4.29</td>
</tr>
<tr>
<td>M.S. or Ph.D. - Economics</td>
<td>3.96%</td>
<td>10.53%</td>
<td>10.53%</td>
<td>15.74%</td>
<td>22.37%</td>
<td>18.79%</td>
<td>7.89%</td>
<td>9.21%</td>
<td>76</td>
<td>4.29</td>
</tr>
</tbody>
</table>
If you were going to hire a new employee to work in the energy sector, would you find it valuable for that individual to have had an interdisciplinary graduate education in energy? For instance, the candidate would have: (a) an understanding of energy policy and economics; (b) a strong foundation in energy sciences and engineering; and (c) an ability to communicate clearly about complex energy topics with policymakers, engineers, academics, and scientists.

Answered: 71   Skipped: 12

<table>
<thead>
<tr>
<th>Answer Choices</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes -- Our company or organization has demand for more employees with an interdisciplinary understanding of the energy sector.</td>
<td>87.32% 82</td>
</tr>
<tr>
<td>No -- Our company or organization has demand for employees with different skills.</td>
<td>4.23% 3</td>
</tr>
<tr>
<td>Maybe</td>
<td>8.45% 6</td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
</tr>
</tbody>
</table>
(Optional) Please use this box to provide us with any additional comments about the types of qualities you would like to see prospective hires gain from a graduate education in energy.

Answered: 33    Skipped: 50

Showing 33 responses

Ability to write well.
9/16/2014 7:23 PM    View respondent's answers

We would benefit from a graduate having knowledge in the technology, business and policy issues of the various sectors of bioenergy. Bioenergy would also fit in well with UC Davis's agricultural expertise.

9/10/2014 10:55 AM    View respondent's answers

Note that my comments are biased in that I would be hiring an energy professional for policy rather than program work. The people who would fit best in my field would be scientists with strong analytical backgrounds in particular fields, but some generalist tendencies that make them good communicators. While I think the questions on page 2 are useful, the choices are not inclusive of all that I might look for in a hiring process.

9/9/2014 12:21 PM    View respondent's answers

An understanding of the nuts and bolts of energy (e.g., specific technologies, engineering, specific policies etc.) is great and necessary. But so far, and judging from my brief time in the private sector and my last year in the public sector, I consider the ability to see the big picture essential and something that I am continually trying to grasp. What I consider "the big picture" includes supply/demand, transmission & distribution, and energy markets; evolution of the electric grid; and the economics behind technologies and how they contribute to our changing grid. These topics were relatively new to me and were not discussed, even in my energy specific classes at UMD. I think that anyone entering the energy industry should have a strong grasp of these concepts.

9/9/2014 9:02 AM    View respondent's answers

Detailed understanding of project fundamentals across functions. How deals are done, projects are built and how the contracts/documents around those processes are drafted. Putting work into context right away would be helpful.

9/8/2014 10:44 PM    View respondent's answers

A demonstrated ability to collaborate with people who have a variety of perspectives, experience and training. Thanks for providing the opportunity to provide feedback.

9/5/2014 6:31 PM    View respondent's answers
The most useful skills that come out of graduate school are (a) those that are gained in the real world, (b) quantitative skills (less modeling and more analysis of data and ability to use excel etc.), and (c) strong writing/presentation skills.

9/2/2014 8:54 PM  View respondent's answers

Note- I tried not to answer question 2. It would be helpful to focus on the various motivations of each stakeholder.

9/2/2014 4:16 PM  View respondent's answers

A diverse knowledge of both commercial and policy elements are important attributes.

9/2/2014 8:33 AM  View respondent's answers

Mechanical Engineer was not listed on Q5 - that is more relevant for Efficiency Orgs but Elect. Engineer for Energy Cos. Also, the emphasis on new employee creates the question of expectation regarding their years of experience. Fresh from grad school with little time in field or new to our org but with a lot of previous years creates a diff. expectation. I took 'new' to be newer to the industry as well and where should the focus have been through a program such as you are proposing. Love the idea. Attrition in our field is acute with an aging boomer group!

8/29/2014 2:14 PM  View respondent's answers

My answers are focused on hiring into our engineering and development teams, not our policy or financial teams.

8/28/2014 9:54 AM  View respondent's answers

Strong leadership skills, including building consensus among internal and external stakeholders, leading large teams, managing conflict and devising strategy for external engagement.

8/27/2014 5:48 PM  View respondent's answers

Understanding of the CA regulatory environment

8/27/2014 4:30 PM  View respondent's answers

Communication, drive, open-mindedness, work ethic, etc. far more important than particular degree or background training.

8/27/2014 4:26 PM  View respondent's answers

I answered your survey as if I were still program / line manager at SNL.

8/27/2014 3:10 PM  View respondent's answers
A clear understanding of the challenges and pathways toward solutions with translating energy policy across social and economic levels.
8/27/2014 2:05 PM  View respondent's answers

n/a
8/27/2014 2:01 PM  View respondent's answers

Creativity. The ability to look at an open-ended question and be able to answer it creatively. Whether that’s changing the nature of the question, using data in unique ways, or developing novel methods.
8/27/2014 1:50 PM  View respondent's answers

Open minded, flexible
8/25/2014 12:29 AM  View respondent's answers

Have the ability to effectively communicate in written form and orally
8/19/2014 8:09 PM  View respondent's answers

Add a good understanding of technology deployment life cycle
8/19/2014 5:01 PM  View respondent's answers

We have a Senior Public Policy and Regulatory Affairs position open right now and it can be found on our website. Thanks!
8/19/2014 2:49 PM  View respondent's answers

Balance between a solid skills set (immediately applicable) and core competencies set (future development potential). The ideal is to have subject matter experts in depth as well as width, but not 'boxed in' thinking, combined with managerial and excellent communication skills at policy level.
8/19/2014 1:45 AM  View respondent's answers

I appreciate someone who can take a sober look at emerging technologies and get beyond an uncritical enthusiasm.
8/18/2013 3:24 PM  View respondent's answers

The actual skill is far more important than the topics, categories, and degrees.
8/18/2014 2:44 PM  View respondent's answers

Strong written and verbal communications skills; real-world work experience
8/18/2014 2:36 PM  View respondent's answers

Difficult to complete this survey since our company hires across many disciplines.
8/18/2014 10:35 AM  View respondent's answers
Showing 33 responses

Difficult to complete this survey since our company hires across many disciplines.
8/18/2014 10:35 AM  View respondent's answers

Industry experience is key because employers may go to what they know best: petroleum engineering schools, international relations etc; where these graduates might also have a wider set of choices. Hence, having the industry experience, either internships or industry collaborative work, would be important because (1) they would get to know the sector, do relevant research and differentiate themselves vs. graduates from other programs; (2) industry people who see how good these students are and would consider hiring. A rather critical element is whether the program wants students to enter the private/public sector or wants them to stay in academia. I came from a PhD program that encourages students to do stay in academia and do research, but entering the private sector is not the preferred option. As we know, what other similar graduate programs out there do should shed light on the program structure and outcome. Good luck!
8/15/2014 10:11 AM  View respondent's answers

We would like to see more well-rounded candidates for prospective hires combining good quantitative skills (math, economics, statistics and engineering) with abilities to develop depth of knowledge in technology/understand the factors and potential for technology change, and understand how government intervention (laws, policies, regulations and incentives) can drive change. Our new candidates will need to be project facilitators in terms of problem solving and seeking project financing too.
8/14/2014 2:02 PM  View respondent's answers

My personal background is in social sciences and I also have an MPA. At this moment I work for BP in a commercial role as a Competitor Analyst. For commercial roles within BP a strong understanding of Finance/Economics is important and was key for me to get hired. Having said this, it is difficult to make generalisations for a large company like BP, as it has so many different departments with different skills needs - from science to engineering to public policy. So please interpret my answers only from the view of commercial operations within a large energy company.
8/14/2014 1:21 AM  View respondent's answers

My responses are made under the impression of the various very far reaching changes in direction of German Energy policies and the resulting need to rethink the power supply strategy of our company, under an environment like this, interdisciplinary qualification is clearly needed.
8/13/2014 10:45 PM  View respondents answers

For us, it is critical that new candidates have both a fundamental engineering/science background and understanding of energy economics.
8/1/2014 10:18 AM  View respondent's answers

Real-world experience through an internship, hands-on experience at collaboration, partnerships
7/21/2014 12:26 PM  View respondent's answers
Appendix J. Required Memoranda of Understanding
Memorandum of Understanding

Instruction of Core Courses

Department of Biological and Agricultural Engineering and
Energy Graduate Group

As chair of the Department of Biological and Agricultural Engineering, I agree to offer, every year except when on approved leave or sabbatical, a core graduate course (EGG 200) for students interested in energy systems. The course will be primarily listed in the Biological Systems Engineering program as EBS 216 but may be cross-listed in the Energy Graduate Group program as EGG 200. Attempts will be made to schedule the course at times to minimize conflicts with other EBS courses taken by Biological Systems Engineering students.

This MOU and its effectiveness will be evaluated during program reviews, and may be renewed as needed after evaluation. This agreement shall remain in force until otherwise agreed by all parties, with the expectation that it will be continued, or a replacement instructor found. It is understood that if substantial program cuts are made due to budget or other situations, EBS teaching loads may be reassigned. At the current time, the course is expected to be offered indefinitely.

Signed:

Bryan M. Jenkins
Professor and Chair
Biological and Agricultural Engineering
Sept. 30, 2014

Memorandum of Understanding  
Instruction of Core Courses

Civil and Environmental Engineering Program, College of Engineering  
and  
Energy Graduate Program

As Chair of the Civil & Environmental Engineering Program, I hereby agree that Professor Alissa Kendall of our program will continue to offer, every year except when she is on approved leave or sabbatical, a core graduate course for students interested in life cycle analysis of energy systems. It is expected that this course, with some minor modification anticipated by Prof. Kendall, will be appropriate for graduate students in the Energy Graduate Program. The course will be primarily listed in Civil & Environmental Engineering (ECI) but may be cross-listed in the Energy Graduate Program (EGG 201). The course will be scheduled at a time that does not conflict with other ECI courses that our Civil & Environmental Engineering graduate students take. Prof. Kendall agrees to this arrangement.

This MOU and its effectiveness will be evaluated during program reviews, and may be renewed as needed after evaluation. This agreement shall remain in force until otherwise agreed by all parties, with the expectation that it will be continued, or a replacement for Prof. Kendall will be found. It is understood that if draconian program cuts are made due to the budget situation, the Chair of ECI will use his/her option to re-assign teaching loads, including Prof. Kendall’s, to protect the core mission of the Civil & Environmental Engineering Program. At the current time, we expect that Prof. Kendall will be able to offer her graduate Life Cycle Analysis course each year indefinitely.

Sashi Kunnath
Chair  
Civil & Environmental Engineering

Alissa Kendall
Professor  
Civil & Environmental Engineering
April 2, 2014

Memorandum of Understanding
Instruction of Core Courses

Environmental Science & Policy, College of Agricultural and Environmental Sciences
and
Energy Graduate Group

As Chair of the Environmental Science & Policy Program, I hereby agree that Professor Daniel Sperling of our program will continue to offer, every year except when he is on approved leave or sabbatical, a core graduate course for students interested in energy and climate policy. It is expected that this course, adapted from the existing course ESP 252 with some modification by Prof. Sperling, will be appropriate for graduate students in the Energy Graduate Program. The course may be cross-listed in the Energy Graduate Program as EGG 202. Prof. Sperling agrees to this arrangement.

This MOU and its effectiveness will be evaluated during program reviews, and may be renewed as needed after evaluation. This agreement shall remain in force until otherwise agreed by all parties, with the expectation that it will be continued, or a replacement for Prof. Sperling will be found. We expect that Prof. Sperling will be able to offer his graduate Energy and Climate Policy course each year indefinitely.

Susan Handy
Chair
Environmental Science & Policy

Daniel Sperling
Acting Chair
Energy Graduate Program

Daniel Sperling
Professor
Environmental Science & Policy