Energy

Programs Offered

- Minor in Energy
- Area of Special Interest in Energy

The discovery, production, and use of energy in modern societies have profound and far-reaching economic, political, and environmental effects. As energy is one of CSM's core statutory missions, several CSM departments have come together to offer Minor and Area of Special Interest (ASI) programs related to Energy. The 18-credit Energy Minor adds value to any CSM undergraduate degree program by not only addressing the scientific and technical aspects of energy production and use but its broader social impacts as well. The Energy Minor program is intended to provide engineering students with a deeper understanding of the complex role energy technology plays in modern societies by meeting the following learning objectives:

1. Students will gain a broad understanding of the scientific, engineering, environmental, economic, and social aspects of the production, delivery, and utilization of energy as it relates to the support of current and future civilization both regional and worldwide.
2. Students will develop depth or breadth in their scientific and engineering understanding of energy technology.
3. Students will be able to apply their knowledge of energy science and technology to societal problems requiring economic, scientific, and technical analysis and innovation while working in a multidisciplinary environment and be able to communicate effectively the outcomes of their analyses in written and oral form.

General CSM Minor/ASI requirements can be found here (catalog.mines.edu/undergraduate/undergraduateinformation/minorasi).

Program Requirements

Minor in Energy

Minimum 18 hours required:

Required Courses (6 credit hours)

- ENGY200 INTRODUCTION TO ENERGY 3.0
- ENGY330 ENERGY ECONOMICS 3.0
  - or EBGN330 ENERGY ECONOMICS

Policy Course: Select at least one of the following (minimum 3 credit hours)

- HASS490 ENERGY AND SOCIETY 3.0
- HASS491 ENERGY POLITICS 3.0
- HASS492 ENERGY AND SECURITY POLICY 3.0

Select the remaining electives from the following:

  Social Sciences and Law
   - EBGN310 ENVIRONMENTAL AND RESOURCE ECONOMICS 3.0
   - EBGN340 ENERGY AND ENVIRONMENTAL POLICY 3.0
   - HASS419 ENVIRONMENTAL COMMUNICATION 3.0
   - HASS464 HISTORY OF ENERGY AND THE ENVIRONMENT 3.0
   - PEGN430 ENVIRONMENTAL LAW AND SUSTAINABILITY 3.0

  All Energy Sources
   - CBEN469 FUEL CELL SCIENCE AND TECHNOLOGY 3.0
     - or MTGN469 FUEL CELL SCIENCE AND TECHNOLOGY
     - or MEGN469 FUEL CELL SCIENCE AND TECHNOLOGY
   - CBEN472 INTRODUCTION TO ENERGY TECHNOLOGIES 3.0
   - EENG389 ANALYSIS AND DESIGN OF ADVANCED ENERGY SYSTEMS 3.0
   - EENG481 COMPUTATIONAL METHODS IN ENERGY SYSTEMS AND POWER ELECTRONICS 3.0
   - ENGY497 SUMMER PROGRAMS 1-6
   - ENGY498 SPECIAL TOPICS 1-6
   - GEOL315 SEDIMENTOLOGY AND STRATIGRAPHY 3.0

  Nuclear Energy
   - ENGY340 NUCLEAR ENERGY 3.0
   - NUGN506 NUCLEAR FUEL CYCLE 3.0
   - NUGN510 INTRODUCTION TO NUCLEAR REACTOR PHYSICS 3.0

  Sustainable Energy
   - ENGY320 INTRO TO RENEWABLE ENERGY 3.0
   - ENGY350 GEOThermal ENERGY 3.0
   - CEEN477 SUSTAINABLE ENGINEERING DESIGN 3.0
   - CHGN311 INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY 3.0
   - EENG390 ENERGY, ELECTRICITY, RENEWABLE ENERGY, AND ELECTRIC POWER GRID 3.0
   - EENG472 PRACTICAL DESIGN OF SMALL RENEWABLE ENERGY SYSTEMS 3.0
   - EENG589 DESIGN AND CONTROL OF WIND ENERGY SYSTEMS 3.0
   - PHGN419 PRINCIPLES OF SOLAR ENERGY SYSTEMS 3.0

  Fossil Fuels
   - PEGN102 INTRODUCTION TO PETROLEUM INDUSTRY 3.0
   - ENGY310 INTRO TO FOSSIL ENERGY 3.0
   - CBEN480 NATURAL GAS HYDRATES 3.0
   - MNGN438 GEOSTATISTICS 3.0
   - PEGN251 FLUID MECHANICS 3.0
   - PEGN305 COMPUTATIONAL METHODS IN PETROLEUM ENGINEERING 2.0
   - PEGN308 RESERVOIR ROCK PROPERTIES 3.0
   - PEGN450 ENERGY ENGINEERING 3.0
   - ENGYXXX Additional courses with energy content may be approved by the director or co-director of the energy minor.

The Area of Special Interest in Energy requires a minimum of 12 credit hours of acceptable course work:

- ENGY200 INTRODUCTION TO ENERGY 3.0
- EBGN330 ENERGY ECONOMICS 3.0
  - or ENGY330 ENERGY ECONOMICS
Two additional energy-related courses 6.0
Total Semester Hrs 12.0

ENGY200. INTRODUCTION TO ENERGY. 3.0 Semester Hrs.
Introduction to Energy. Survey of human-produced energy technologies including steam, hydro, fossil (petroleum, coal, and unconventional), geothermal, wind, solar, biofuels, nuclear, and fuel cells. Current and possible future energy transmission and efficiency. Evaluation of different energy sources in terms of a feasibility matrix of technical, economic, environmental, and political aspects. 3 hours lecture; 3 semester hours.

ENGY310. INTRO TO FOSSIL ENERGY. 3.0 Semester Hrs.
(I) Students will learn about conventional coal, oil, and gas energy sources across the full course of exploitation, from their geologic origin, through discovery, extraction, processing, processing, marketing, and finally to their end-use in society. Students will be introduced to the key technical concepts of flow through rock, the geothermal temperature and pressure gradients, hydrostatics, and structural statics as needed to understand the key technical challenges of mining, drilling, and production. Students will then be introduced to unconventional (emerging) fossil-based resources, noting the key drivers and hurdles associated with their development. Students will learn to quantify the societal cost and benefits of each fossil resource across the full course of exploitation and in a final project will propose or evaluate a national or global fossil energy strategy, supporting their arguments with quantitative technical analysis. 3 hours lecture; 3 semester hours.

ENGY320. INTRO TO RENEWABLE ENERGY. 3.0 Semester Hrs.
(I) Survey of renewable sources of energy. The basic science behind renewable forms of energy production, technologies for renewable energy storage, distribution, and utilization, production of alternative fuels, intermittency, natural resource utilization, efficiency and cost analysis and environmental impact. 3 hours lecture; 3 semester hours.

ENGY330. ENERGY ECONOMICS. 3.0 Semester Hrs.
Equivalent with EBGN330.
(I) Study of economic theories of optimal resource extraction, market power, market failure, regulation, deregulation, technological change and resource scarcity. Economic tools used to analyze OPEC energy mergers, natural gas price controls and deregulation, electric utility restructuring, energy taxes, environmental impacts of energy use, government R&D programs, and other energy topics. Prerequisites: EBGN201 or EBGN311. 3 hours lecture; 3 semester hours.

ENGY340. NUCLEAR ENERGY. 3.0 Semester Hrs.
(I) Survey of nuclear energy and the nuclear fuel cycle including the basic principles of nuclear fission and an introduction to basic nuclear reactor design and operation. Nuclear fuel, uranium resources, distribution, and fuel fabrication, conversion and breeding. Nuclear safety, nuclear waste, nuclear weapons and proliferation as well economic, environmental and political impacts of nuclear energy. 3 hours lecture; 3 semester hours.

ENGY350. GEOTHERMAL ENERGY. 3.0 Semester Hrs.
(I) Geothermal energy resources and their utilization, based on geoscience and engineering perspectives. Geoscience topics include worldwide occurrences of resources and their classification, heat and mass transfer, geothermal reservoirs, hydrothermal geochemistry, exploration methods, and resource assessment. Engineering topics include thermodynamics of water, power cycles, electricity generation, drilling and well measurements, reservoir/surface engineering, and direct utilization. Economic and environmental considerations and case studies are also presented. 3 hours lecture; 3 semester hours.

ENGY490. ENERGY AND SOCIETY. 3.0 Semester Hrs.
Equivalent with LAIS490, MNGN490.
(II) A transdisciplinary capstone seminar that explores a spectrum of approaches to the understanding, planning, and implementation of energy production and use, including those typical of diverse private and public (national and international) corporations, organizations, states, and agencies. Aspects of global energy policy that may be considered include the historical, social, cultural, economic, ethical, political, and environmental aspects of energy together with comparative methodologies and assessments of diverse forms of energy development. Prerequisites: ENGY330/EBGN330 and one of either ENGY310, ENGY320, or ENGY340. 3 hours lecture/seminar; 3 semester hours.

Professors
Reuben Collins, Department of Physics
Roderick G. Eggert, Division of Economics and Business, Interim Division Director
Ramona M. Graves, Dean of the College of Earth Resource Sciences and Engineering
Mark Jensen
Angus Rockett
P.K. Sen, Division of Engineering
Roel Snieder, Department of Geophysics, Keck Foundation Professor of Basic Exploration Science

Associate Professors
Linda Figueroa, Division of Environmental Science and Engineering
Kathleen Hancock, co-director, Division of Humanities, Arts, and Social Sciences
John Heilbrunn, Division of Humanities, Arts, and Social Sciences
Andrew M. Herring, Department of Chemical Engineering
Kathryn Johnson, Department of Mechanical Engineering
Masami Nakagawa, Department of Mining Engineering
Timothy R. Ohno, co-director
Marcelo Simoes, Division of Engineering
Neal Sullivan, Associate Professor

Assistant Professors
Eric Toberer, Department of Physics
Jeffrey C. King, Department of Metallurgical and Materials Engineering
Jennifer Wilcox
Jeramy Zimmerman

Teaching Professors
Linda Battalora, Department of Petroleum Engineering
Charles Stone, Department of Physics

Teaching Associate Professors
Joseph Horan, Division of Humanities, Arts, and Social Sciences
John M. Persichetti, Department of Chemical Engineering