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 Mines core statutory missions, several Mines 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 Mines 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, 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.

The Mines guidelines for Minor/ASI can be found in the Undergraduate Information section of the Mines Catalog.

Program Requirements

Minor in Energy

Minimum 18 credits required:

Required Courses (6 credits)

ENGY200	INTRODUCTION TO ENERGY	3.0
EBGN330	ENERGY ECONOMICS	3.0

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

HASS490	ENERGY AND SOCIETY	3.0
HASS491	ENERGY TRANSITION: POLITICS AND 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	
or MTGN469	FUEL CELL SCIENCE AND TECHNOLOGY	
CBEN472	INTRODUCTION TO ENERGY TECHNOLOGIES	3.0
EENG389	FUNDAMENTALS OF ELECTRIC MACHINERY	4.0
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
CEEN493	SUSTAINABLE ENGINEERING DESIGN	3.0
CHGN311	INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY	3.0
EENG475	INTERCONNECTION OF RENEWABLE ENERGY	3.0
EENG589	DESIGN AND CONTROL OF WIND ENERGY SYSTEMS	3.0
PHGN419	PRINCIPLES OF SOLAR ENERGY SYSTEMS	3.0
Fossil Fuels		
PEGN201	PETROLEUM ENGINEERING FUNDAMENTALS	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
ENGY	Additional courses with energy content may be approved by the director or co-director of the energy minor.	

Area of Special Interest in Energy

Minimum of 12 credits of acceptable course work:

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

Courses

ENGY200. INTRODUCTION TO ENERGY. 3.0 Semester Hrs.
Introduction to Energy. Survey of human-produced energy technologies including steam, hydro, fossil (petroleum, coal, and unconventionals), 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.
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.
Course Learning Outcomes

- no change

ENGY320. INTRO TO RENEWABLE ENERGY. 3.0 Semester Hrs.
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.
Course Learning Outcomes

- no change

ENGY340. NUCLEAR ENERGY. 3.0 Semester Hrs.
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.
Course Learning Outcomes

- no change

ENGY350. GEOTHERMAL ENERGY. 3.0 Semester Hrs.
Geothermal energy resources and their utilization, based on geoscience and engineering perspectives. Geoscience topics include world wide 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.
Course Learning Outcomes

- no change

Emeritus Professor

Ramona M. Graves, Petroleum Engineering

Professors

Linda Figueroa, Civil and Environmental Engineering

Andrew Herring, Chemical and Biological Engineering

Mark Jensen, Chemistry

Kathryn Johnson, Electrical Engineering

Jeffrey C. King, Metallurgical and Materials Engineering

Angus Rockett, Metallurgical and Materials Engineering

Roel Snieder, Geophysics

Associate Professors

Kathleen Hancock, Director, Humanities, Arts and Social Sciences

Masami Nakagawa, Mining Engineering

Timothy R. Ohno, Physics

Neal Sullivan, Mechanical Engineering

Teaching Professors

Linda Battalora, Petroleum Engineering

Joseph Horan, Humanities, Arts and Social Sciences

Teaching Associate Professor

John Persichetti, Engineering, Design and Society

Research Professor

Roderick G. Eggert, Economics and Business

Visiting Professor

Angeline Letourneau, Humanities, Arts and Social Sciences